Magnescale

2018 精密工学会 技術賞受賞 The Japan Society for Precision Engineering

New angle calibration system

Presented by Magnescale

Self-calibrating Rotary encoder system

SET-HD100

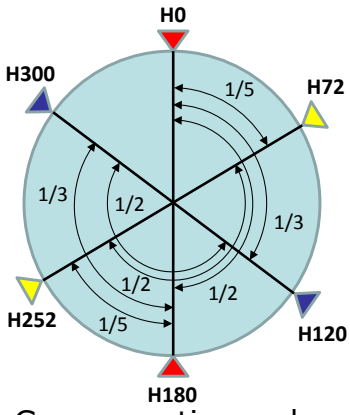
High angular accuracy	±0.2 [arcsec] achieved by original algorithm developed by MGS at 0.0012 [arcsec] resolution
Traceability of accuracy	Calibrated to the national primary standard by AIST(National Inst. Of Advanced Industrial Science & Technology)
High reproducibility	Non contact structure enables accuracy measurement unaffected by installation
Easy installation	Only 15 minutes from installation to measurement
Handy measuring kit	Compact and easy to carry

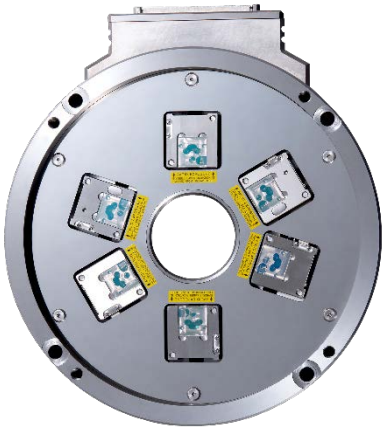
Magnescale Co., Ltd.

Self-compensating algorithm for angle accuracy

Intelligent encoder can Compensate its own errors. MGS original self-calibration algorithm “VEDA-method” *1 enables higher order correction with less heads, achieving up to 30th order compensation with only 6 heads at world-class high accuracy.

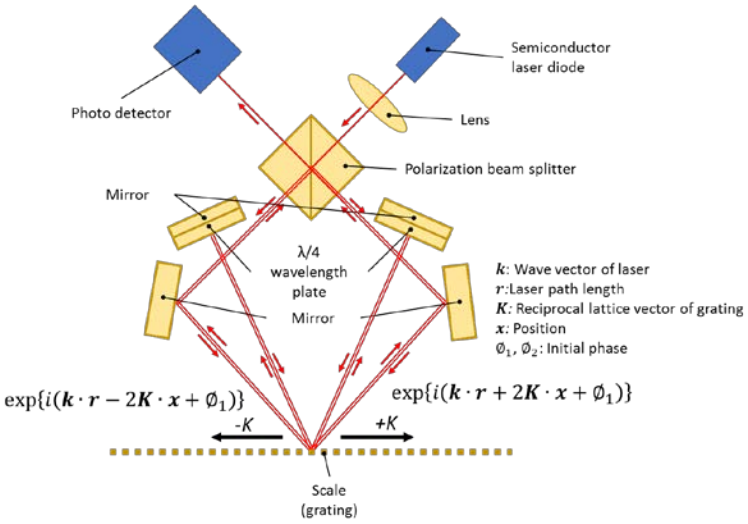
*1 Patent application No.6386368





Compensation order :
2×3×5=30th

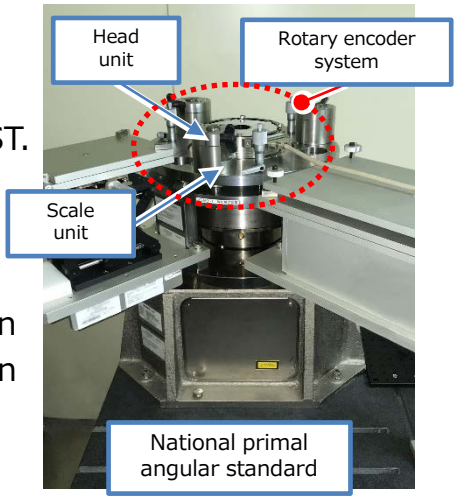
High resolution and stability by Laserscale

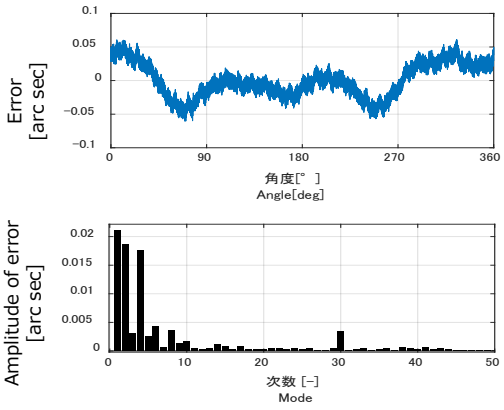


Laserscale allows high stability against environmental change e.g. pressure and temperature with the combination of high resolution, volume hologram diffraction grating and a sensor head with symmetric optical path. Signal wavelength of 1.24”=6.0μrad (250nm on the circle of ∅42 scale) is electrically interpolated to the resolution of 0.0012”=5.9nrad (0.25nm on ∅42) at the low noise level.

High accuracy and traceability

Accuracy is qualified against the primal national standard at AIST. MGS also offers angle calibration service with compliance to JCSS method after registration as an external calibration agent.





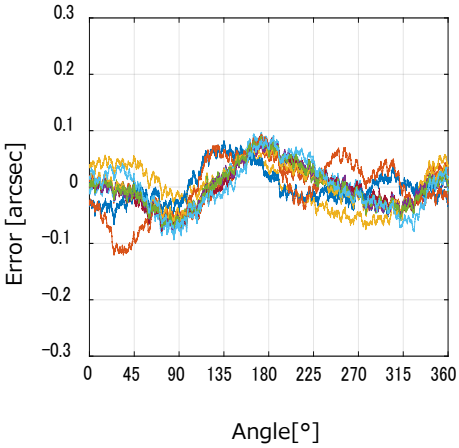
Example of accuracy measurement against national primal standard : ±0.061 [arcsec]

High reproducibility on the machine

Non-contact design almost eliminates the effect from the encoder onto rotating axis of the target during measurement. Self compensation after installation also minimize the change of accuracy at the installation and realize high repeatability. In particular, the system enables repeatable measurements even for horizontal rotation axis affected by gravity.

Mounting tolerance for guaranteed accuracy

Item	Max value
Circular run-out against rotation axis	0.010 [mm]
Total run-out on the mounting surface for the scale	0.010 [mm]
Circular run-out for the mounting surface for the head unit	0.050 [mm]
Concentricity of head unit with respect to scale unit	0.040 [mm]
Distance between reference surfaces for the scale and the head unit	1.503 ±0.020 [mm]
Axial run-out of the stage	<0.010 [mm]



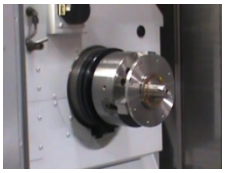
Example of repeatability of accuracy within mounting tolerance

Easy installation

15 minutes from installation to measurement

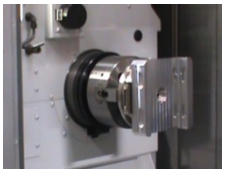
remark: act. time depends on mounting conditions at customer site

Example of installation onto a horizontal machine



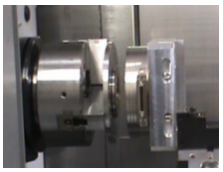
①Mount scale unit
Match the eccentricity of a scale and rotation axis
Insert positioning shaft

②Mount head unit
Adjust and mount the head to mechanical reference of inner diameter of a scale



③Mount attachment & fix to outer part
Install an attachment to fix the head unit onto the outer part

④Remove positioning shaft
Slide the head unit then remove a positioning shaft



⑤Adjust clearance
Adjust a clearance by moving a head unit toward the scale

Easy operation

No complex process needed for self - compensation. Interpolator applies compensated value automatically and output accurate angular position by pressing a single switch. Dedicated software generates angular data on a display and saves measured data.

Example of display by dedicated soft ware during measurement

Functions available by MGS software

- Real time data display
- Storage of measured data (TIME mode)
  - Measurement at constant sampling of 20kHz
  - Suitable for servo vibration analysis and speed jitter evaluation
- Storage of measured data(CONSTANT mode)
  - Data acquired at constant angle for accuracy measurement and saving compensation data

Portable measurement kit

Carry-on case is included to a standard package, which makes transportation easy and secures performance as an angular calibration system.

Head unit BH300

Scale unit BE300

Interpolator unit BD350

Recognition on outstanding technology

Mangescale won “2018 JSPE technology award” by Japan Society for Precision Engineering for introduction of the rotary system with original, self-compensation algorism. Several research papers to explain the principle and development of the algorism were also published in journals of JSPE as well as Advanced Mechanical Design, Systems and Manufacturing.

(1) N. Ishii, K. Taniguchi, K. Yamazaki and H. Aoyama: Development of super-accurate angular encoder system with multi-detecting heads using VEDA method, Journal of Advanced Mechanical Design, Systems, and Manufacturing, **12** (2018).

(2) N. Ishii, K. Taniguchi, K. Yamazaki and H. Aoyama: Super-Accurate Angular Encoder System with Multi-Detecting Heads Using VEDA Method, Journal of the Japan Society for Precision Engineering, **84** (2018). 717-723.

Specifications

Item	Specification	Item	Specification
Detecting radius	41.723 mm	Number of sensor	6 sensors / unit
Maximum rotary response speed	10 min^{-1}	Light source	Semiconductor laser × 6
Number of source signals	2^{20} (1,048,576) / revolution		Wave length790 nm, 5 mW or less / sensor
Source signal resolution	1.236” arcsec	Radiation power	EN60825: class 3B, JIS: class 3B, DHHS: class IIIb
Accuracy	±0.2” arcsec	Operating temperature range	+10 to +30 ℃ (no condensation)
Reference point position	1 point	Storage temperature range	0 to +50 ℃ (no condensation)
Output format	USB interface	Power supply	DC 20 to 24 V / 5 A (Max. 8 A)
Number of interpolations	2^{10} (1,024) / revolution	Dimension/Mass	Scale unit: Φ100×H8.5 mm / 300 g or less
Number of output divisions	2^{30} (1,073,741,824) / revolution		Head unit: Φ180×H46 mm / 3.8 kg or less
Output resolution	0.0012” arcsec		Interpolator unit: 298×210×110 mm / 5kg or less

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