

## Original Article

# An Approach Method to Calibrate the Autocollimator with Small Angle Measurement Range

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## Abstract

A new method to calibrate the autocollimator with small angle measurement range has been developed. This method used a system based on rotary encoder for angle measurements with self-calibration function (SelfA47). The SelfA47 has 18,000 graduation lines with angle interval of  $0.02^\circ$ , corresponds to 72 arcsec. Thereby this system cannot be used to calibrate the autocollimator with measurement range  $<72$  arcsec. On the other hand, SelfA47 can be used to calibrate an electronic level. The deviation of electronic level shaped linear gradient. Therefore a small nominal gradient of electronic level can be approximated by interpolation. Since the gradient of a curve corresponds to the angle quantities, it is feasible to calibrate the autocollimator with nominal angle  $<72$  arcsec using SelfA47 and an electronic level. In this proposed method, SelfA47 is placed horizontally on the same plane with electronic level and mirror reflector position. The electronic level value that have been corrected by SelfA47 is used as a reference. This reference value was converted to the angle, thus the angle deviation of autocollimator can be determined. The prominent uncertainty of angle measurement using this new technique derived from the uncertainty of electronic level and rotary encoder. Using this method, the expanded uncertainty of 0.36 arcsec is obtained from calibration of autocollimator with measuring range of  $\pm 20$  arcsec and it is consistent statistically with the manufacturer calibration result shown by  $E_n$  value is  $<1$ . In conclusion, this approach method can be applied to calibrate the autocollimator with a resolution smaller than SelfA47 as standard, but it is not recommended for the calibration of highly accurate autocollimator.

# Keywords

Dissemination; Traceability; Electronic level; Angle deviation; Rotary encoder