In-house angular calibration capability

metrology-lab-setup

SHANGHAI MICROCRE OPTICS-MECH TECH CO.,LTD

Telephone: 400-812-7833 | 021-58391850

Address: 1478 Nanfeng Road, Fengcheng Town, Fengxian District, Shanghai, China | Postal code: 201411

Contact email: shanghai@yr17.net

Service email: rockwei@yr17.net

Application template; not a claim of a completed customer project.

Scope

Build internal calibration for autocollimators, electronic levels and angle standards, including equipment, environment and uncertainty budget.

Equipment and configuration guidance

• Reference autocollimator and small-angle tester

• Polygon or angle blocks

• Temperature-controlled room and isolation

Principle and calculation

The budget covers standard, repeatability, eccentricity, environment and resolution; combine in quadrature and apply the coverage factor.

On-site checklist

• Traceability complete

• Continuous environment records

• Budget reproducible

• Interim check criteria

Limitations

Formal accreditation follows local metrology authority requirements; site content does not replace assessment.

Detailed teaching example

Worked uncertainty budget for an angle standard

Scenario and task

Teaching example: an autocollimator with a polygon prism; five components are combined and expanded. Numbers are illustrative, not a formal laboratory budget.

Preparation and measurement steps

01. Define items, range and target uncertainty.

02. Select standards and support equipment along the traceability chain.

03. Set up environmental monitoring, equipment files and interim checks.

04. Write the procedure, record template and uncertainty budget.

Teaching example readings

• Components in arc-seconds: reference 0.05, repeatability 0.02, mounting eccentricity 0.03, environment 0.02, resolution 0.01.

• Combined standard uncertainty 0.0656″.

• Expanded uncertainty (k=2) 0.131″.

Calculation procedure

$u_c = \sqrt{(0.05^2+0.02^2+0.03^2+0.02^2+0.01^2)} = 0.0656''$; $U = 2u_c = 0.131''$. Correlated components need covariance terms.

Example result and interpretation

The set-up gives about 0.131″ at k=2; a tolerance below three times that value cannot be supported by the measurement.

Example verification checklist

• The budget must match the procedure; a new mounting needs a new budget.

• The repeatability term needs enough independent repeats.

• Certificate values are not automatically uncertainty components.

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