Autocollimators
Photoelectric Autocollimator 2

Problems that made previous autocollimators difficult to use are eliminated in the Nikon Photoelectric Autocollimator 2. This instrument can measure to 0.1 second of arc over a range of 20 minutes of arc. Direct digital readout on the display counter eliminates the need for visual and manual alignment with a micrometer during measurement.

Features
- Wide range of analog output power, switchable in 3 steps. Continuous measurements possible by connecting the autocollimator to a commercially available analog recorder.
- Built-in memory function permits measurement even if the light path is momentarily blocked by an obstacle while measuring.
- Direct digital readout system improves operational efficiency during measurement by eliminating the need for measurement with a micrometer.
- Fluctuations in readings caused by air currents are eliminated by a smoothing function.
- High resolving power (minimum reading: 0.1 second of arc) over a wide measuring range (20 minutes of arc).
- Easy alignment using an audible signal that sounds when the target reticle is within range of the CCD sensor. When the mirror is more than 5 meters away, just extend the eyepiece and the Photoelectric Autocollimator becomes a telescope for easy alignment.

Specifications

<table>
<thead>
<tr>
<th>Feature</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimum reading</td>
<td>0.1 second of arc</td>
</tr>
<tr>
<td>Measuring accuracy</td>
<td>0.5 second of arc within a measuring range of 1 minute of arc, 1.0 second in 5 minute range, 1.5 seconds in 10 minute range, 2.0 seconds in 20 minute range</td>
</tr>
<tr>
<td>Repeatability</td>
<td>±0.2 second of arc (3σ)</td>
</tr>
<tr>
<td>Measuring range</td>
<td>20 minutes of arc</td>
</tr>
<tr>
<td>Analog output</td>
<td>3 levels (±10 minutes, ±1 minute, ±5 seconds); Response time: 15 ms in normal mode, 15 ms in smooth mode</td>
</tr>
<tr>
<td>External output</td>
<td>BCD</td>
</tr>
<tr>
<td>Telescope magnification</td>
<td>14.3x</td>
</tr>
<tr>
<td>Objective</td>
<td>f=430mm, effective aperture: 45 mm</td>
</tr>
<tr>
<td>Viewfield</td>
<td>Dark-field type</td>
</tr>
<tr>
<td>Effective working distance</td>
<td>20 m (under good conditions)</td>
</tr>
<tr>
<td>Remote control box</td>
<td>Reset and Send buttons provided</td>
</tr>
<tr>
<td>Buzzer</td>
<td>Intermittent sound when within measuring range</td>
</tr>
<tr>
<td>Operating temperature</td>
<td>Accuracy guaranteed: 20 ± 1°C Storage temperature: 0°C to 40°C</td>
</tr>
<tr>
<td>Light source</td>
<td>6V, 1.1A special bulb (voltage variable: 3.5 - 5.7V, high-intensity fiber-optic illuminator available as option)</td>
</tr>
<tr>
<td>Power supply</td>
<td>AC100V, 120V, 220V, 240V, 50/60Hz Consumption: approx. 18 W</td>
</tr>
<tr>
<td>Dimensions</td>
<td>Main body: outer diameter of lens barrel 56.0mm, overall length approx. 441 mm Controller: 280(W) × 340(D) × 105(H)mm</td>
</tr>
<tr>
<td>Weight</td>
<td>Main body: approx. 7.2 kg Controller: approx. 6 kg</td>
</tr>
</tbody>
</table>
**Typical Examples of Use**

**Check the angular accuracy of rotary tables**

Measure the accuracy of rotary tables or dividing heads using polygon mirrors. The octahedral mirror measures in units of 45°, and the dodecahedral mirror in units of 30°.

**Check the deflection of elastic or springy materials**

Affix the mirror to the specimen and read the angular deflection using the autocollimator. Small vibrations may also be detected in this manner.

**Check the parallelism of end surfaces**

Compare the difference between the crosshair images reflected from the surface of the specimen and from a standard surface.

**Check the angle of workpieces**

Measure the difference between the crosshair images reflected from the end surface of the workpiece and from a standard angle block.

**Check the squareness of rectangular pieces**

Compare the reading difference between the standard reflecting surface and the surface of the specimen using the Pentapris.

**Check for straightness of movement**

Attach a plane mirror, either directly or on a stand, to the moving part and read the deviation from the reflection.

**Check the squareness of surfaces**

Compare the readings taken from plane mirror 'a' on surface 'A' to those from plane mirror 'b' on surface 'B' through the Pentapris.

---

**WARNING**

TO ENSURE CORRECT USAGE, READ MANUALS CAREFULLY BEFORE USING YOUR EQUIPMENT.

Specifications and equipment are subject to change without any notice or obligation on the part of the manufacturer.

September 1998
©1989 NIKON CORPORATION

NIKON CORPORATION
9-16, Ohts 3-chome, Shinagawa-ku, Tokyo 140-8505, Japan
Tel: +81-3-3773-8122 Telefax: +81-3-3773-8115
http://www.nikon.co.jp

NIKON CANADA INC.
CANADA Tel: +1-905-625-9899 Telefax: +1-905-625-0100

NIKON FRANCE S.A.
FRANCE Tel: +33-1-45-16-60-00 Telefax: +33-1-45-16-60-03

NIKON GmbH
GERMANY Tel: +49-211-91414-0 Telefax: +49-211-91414-222

NIKON INSTRUMENTS S.p.A.
ITALY Tel: +39-55-3009601 Telefax: +39-55-300960

NIKON SINGAPORE PTE. LTD.
SINGAPORE Tel: +65-8219412 Telefax: +65-8219461

NIKON AG
SWITZERLAND Tel: +41-1-913-36-01 Telefax: +41-1-913-36-63

NIKON UK LTD.
UNITED KINGDOM Tel: +44-181-541-4440 Telefax: +44-181-541-4584

NIKON EUROPE B.V.
P.O. Box 221, 1170 AE Badhoevedorp, The Netherlands
Tel: +31-20-44-96-222 Telefax: +31-20-44-96-298

NIKON INC.
Sciences and Technology Group
Instrument Division
1300 Walt Whitman Road, Melville, NY, 11747-3064, U.S.A.
Tel: +1-516-547-8500 Telefax: +1-516-547-0306

Printed in Japan Code No. 2CE-1YO-1 (9809-02)K
Accessories for Photoelectric Autocollimators 2 and 3

High-intensity Fiber-optic Illuminator

Enables measurement with mirrors with small effective reflecting surfaces or small reflection factors. It uses the transformer, lamp and cord for Nikon stereoscopic microscopes.

Stand C Adapter

Necessary when using Photoelectric Autocollimator 2 with the stand for Autocollimators 6B and 6D.
Accessories

**Plane Mirror B**

Large, extremely accurate reflecting mirror. Since both front and rear surfaces are reflective, the measuring distance can be doubled. A permanent magnet makes it very effective for measuring the squareness and straightness of iron materials.

Effective aperture of reflecting surface (both sides): 70 mm
Distance between legs of mirror stand: 100 mm
Permanent magnet: removable, provided with on/off knob
Wooden case provided

**Plane Mirror D**

General-purpose plane mirror. Base and both sides of the stand serve as guides for measuring straightness and flatness. The mirror can also be removed from the stand and placed on the surface to be measured.

Effective aperture of reflecting surface: 42 mm
Distance between legs of mirror stand: 100 mm
Wooden case provided

**Pentaprism**

Turns the optical axis of the autocollimator exactly 90° for use as an optical square to measure the squareness of two surfaces.

Guaranteed accuracy (optical right angle): 2 seconds of arc
Dimensions: 65 x 65 x 45 mm
Metal frame and wooden case provided

**8-sided Polygon Mirror**

Precisely divides 360° into 8 equal parts to check for eccentricity and errors in goniometers and other angle gauges.

Guaranteed accuracy: 1 second of arc for compensated values
Outer diameter: 117 mm
Diameter of center hole: 20 mm
Thickness: 46 mm
Wooden case provided

**12-sided Polygon Mirror**

Accurately divides 360° into 12 equal parts to check for eccentricity and errors in goniometers and other angle gauges.

Guaranteed accuracy: 1 second of arc for compensated values
Outer diameter: 117 mm
Diameter of center hole: 20 mm
Thickness: 46 mm
Wooden case provided

**Plane Mirror C**

Both sides are perfectly parallel, permitting its use as a reference for non-reflective surface. Also useful for measuring extremely small angles where a smaller mirror is desirable.

Outer diameter: 30 mm
Thickness: 12 mm
Parallelism: 2 seconds of arc
Wooden case provided

**Plane Mirror E**

Large-type flat mirror. Leg span is adjustable. Effective for measuring squareness and flatness.

Effective aperture of reflecting surface: 70 mm
Distance between legs: 50 - 200 mm

**Mirror Adapter Set**

 Raises height of plane mirrors (type B is ideal) to measure straightness and flatness. The set includes three pitch values (50, 100 and 200 mm), so you can choose the desired pitch.

When the Nikon Photoelectric Autocollimator is used with plane mirror B, use this set to adjust heights.
Specifications

<table>
<thead>
<tr>
<th>Specification</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Telescope magnification</td>
<td>38x</td>
</tr>
<tr>
<td>Objective</td>
<td>1000 mm; effective aperture: 70 mm</td>
</tr>
<tr>
<td>Measuring range</td>
<td>30 minutes of arc (both vertical and horizontal axes)</td>
</tr>
<tr>
<td>Minimum reading</td>
<td>0.5 second of arc</td>
</tr>
<tr>
<td>Readout system</td>
<td>Adjustment in viewfield and reading on micrometer</td>
</tr>
<tr>
<td>Measuring accuracy</td>
<td>0.5 second of arc within a range of 5 minutes of arc</td>
</tr>
<tr>
<td></td>
<td>1 second of arc within a range of 30 minutes of arc</td>
</tr>
<tr>
<td>Viewfield</td>
<td>6B: bright-field, 6D: dark-field</td>
</tr>
<tr>
<td>Light source</td>
<td>6V 15W special bulb</td>
</tr>
<tr>
<td>Power supply</td>
<td>AC 100V 50/60 Hz</td>
</tr>
<tr>
<td>Dimensions of main body</td>
<td>Outer diameter of lens barrel support: 68 mm</td>
</tr>
<tr>
<td></td>
<td>Overall length: approx. 490 mm</td>
</tr>
<tr>
<td>Weight (including stand)</td>
<td>Approx. 30 kg</td>
</tr>
</tbody>
</table>

Dimensions

Photoelectric Autocollimators 2 and 3

Autocollimators 6B and 6D
The Nikon Autocollimators 6B and 6D both employ 70mm aperture lenses to produce clear reflected images. They also feature extremely accurate double line reticles for improved detection. Both give readings of angular displacement to 0.5 second of arc using an easy-to-read large-diameter micrometer drum. Model 6B is a bright viewfield type, while 6D is a dark viewfield type. Model 6D is very effective when measuring with a small plane mirror or a low-reflective plane surface.

Features

- Accurate measurement possible at any distance between the objective lenses and mirror within maximum measurement distance.
- Efficient measurement because the autocollimator needs only the setting of a target mirror and collects reflected light rays.
- Vertical and horizontal axis values can be measured simultaneously.
The Photoelectric Autocollimator 3 from Nikon enables you to make extremely accurate measurements of straightness, flatness, and angular spacing for both horizontal and vertical axes in much less time. It can read as little as 0.05 second of arc, and measure over a range of 10 minutes of arc. It can measure the horizontal and vertical axes simultaneously, with readout on a digital display counter to minimize errors.

**Features**
- Simultaneous two-axis readout capability
- Direct digital readout improves operational efficiency
- High resolving power (minimum reading: 0.05 second of arc) over a wide measuring range (10 minutes of arc)
- Continuous measurement possible by connecting the autocollimator to a commercially available analog recorder
- Built-in memory function enables uninterrupted measurement even when the light path from the reflector mirror is temporarily obstructed
- Easy alignment by audible signal. Eyepiece extends for telescopic alignment.
- Fluctuations caused by air currents diminished by smoothing function
- Built-in printer
- Optionally available interfaces (GP-IB and RS-232C)

**Specifications**

<table>
<thead>
<tr>
<th>Feature</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimum reading</td>
<td>0.05 second of arc</td>
</tr>
<tr>
<td>Measuring accuracy</td>
<td>0.5 second within a measuring range of 1 minute,</td>
</tr>
<tr>
<td></td>
<td>1.0 second in 5 minute range,</td>
</tr>
<tr>
<td></td>
<td>1.5 seconds in 10 minute range.</td>
</tr>
<tr>
<td>Repeatability</td>
<td>±0.2 second of arc (5x)</td>
</tr>
<tr>
<td>Measuring range</td>
<td>10 minutes of arc</td>
</tr>
<tr>
<td>Analog output</td>
<td>2 levels (±0.5 minutes, ±30 seconds); Response time: 15 ms in normal mode,</td>
</tr>
<tr>
<td></td>
<td>15 ms in smooth mode</td>
</tr>
<tr>
<td>External output (option)</td>
<td>GP-IB or RS-232C</td>
</tr>
<tr>
<td>Telescope magnification</td>
<td>14.3x</td>
</tr>
<tr>
<td>Objective</td>
<td>f=430 mm; effective aperture: 45 mm</td>
</tr>
<tr>
<td>Viewfield</td>
<td>Dark-field type</td>
</tr>
<tr>
<td>Effective working distance</td>
<td>5 m (under good conditions)</td>
</tr>
<tr>
<td>Remote control box</td>
<td>Reset and Send buttons provided; Cord length: 10 m</td>
</tr>
<tr>
<td>Buzzer</td>
<td>Intermittent sound when within measuring range</td>
</tr>
<tr>
<td>Operating temperature</td>
<td>Accuracy guaranteed: 20 ± 1°C</td>
</tr>
<tr>
<td></td>
<td>Storage temperature: 0°C ~ +40°C</td>
</tr>
<tr>
<td>Light source</td>
<td>6V, 1.1A special bulb (voltage variable: 3.5 ~ 5.7 V, high-intensity</td>
</tr>
<tr>
<td></td>
<td>fiber-optic illuminator available as option)</td>
</tr>
<tr>
<td>Power supply</td>
<td>AC100V, 120V, 220V, 240V, 50/60Hz; Consumption: approx. 18VA</td>
</tr>
<tr>
<td>Dimensions</td>
<td>Main body: outer diameter of lens barrel 58.0 mm, overall length approx. 441</td>
</tr>
<tr>
<td></td>
<td>Controller: 280(W) × 340(D) × 105(H) mm</td>
</tr>
<tr>
<td>Weight</td>
<td>Main body: approx. 7.2 kg; Controller: approx. 7.3 kg</td>
</tr>
</tbody>
</table>