Roundness/Cylindricity Measurement

ROUNDTEST RA-2200 Series

Roundness/Cylindricity measuring system offering highest precision level in its class, exceptional ease-of-use, and multifunction analysis capability.
Integrating the system vibration-damping platform has reduced the installation space by approximately 20-40% compared to Mitutoyo's earlier installation platforms. Additionally, a design with increased layout freedom greatly improves the measurement room utilization rate and measurement efficiency.

**Wide variety of models available to suit any application**
- RA-2200AS/AH models are supplied as standard with an automatic centering and leveling turntable, freeing the operator from the centering and leveling task.
- RA-2200DS/DH models are supplied as standard with a navigation function that quickly and simply guides the operator through the centering and leveling task, as though the task were being performed by an expert.
- RA-2200AS/DS models have a column drive height of 300 mm, and are available with a column drive height of 500 mm (RA-2200AH/DH) for handling taller workpieces.
- All models can be combined with the basic, side-table system vibration-damping platform or the monitor-arm system vibration-damping platform.

**Space-saving design**
Integrating the system vibration-damping platform has reduced the installation space by approximately 20-40% compared to Mitutoyo's earlier installation platforms. Additionally, a design with increased layout freedom greatly improves the measurement room utilization rate and measurement efficiency.

**Sliding detector-unit holder provided as a standard feature**
The detector-unit holder is equipped with a sliding mechanism, enabling one-touch measurement of a workpiece with a deep hole having a thick wall, which has been difficult with the conventional standard arm.

**Safety mechanism provided as a standard feature**
A safety mechanism is incorporated into the detector unit area. A collision-sensing function has been added to the detector unit (when it is in the vertical orientation) to prevent collision in the Z-axis direction. Additionally, an accidental collision prevention function, which stops the system when the detector unit displacement exceeds its range, has been added. When an accidental touch is detected, the dedicated analysis software (ROUNDPAK) senses the error and automatically stops the system.

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*1: See page 3 for details about the turntable.
*2: See page 3 for details about the continuous ID and OD measuring function.
*3: Printer table is a special Accessory.
The spiral-mode measurement function combines table rotation and rectilinear action allowing cylindricity, coaxiality, and other data to be loaded as a continuous data set.

Measurement while tracing is possible through a built-in linear scale in the X-axis. This type of measurement is useful when displacement due to form variation exceeds the measuring range of the sensor, and X-axis motion is necessary to maintain contact with the workpiece surface.
## Specifications

### RA-2200AS/DS/AH/DH

<table>
<thead>
<tr>
<th>Model No.</th>
<th>RA-2200AS</th>
<th>RA-2200DS</th>
<th>RA-2200AH</th>
<th>RA-2200DH</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rotational accuracy</td>
<td>Radial direction</td>
<td>0.02+3.5H+100000um</td>
<td>H: probing height (mm)</td>
<td>0.02+3.5X+100000um</td>
</tr>
<tr>
<td>Rotating speed</td>
<td>2, 4, 6, 10 rpm</td>
<td>2, 4, 6, 10 rpm</td>
<td>2, 4, 6, 10 rpm</td>
<td>2, 4, 6, 10 rpm</td>
</tr>
<tr>
<td>Table effective diameter</td>
<td>ø 90 mm</td>
<td>ø 120 mm</td>
<td>ø 90 mm</td>
<td>ø 120 mm</td>
</tr>
<tr>
<td>Centering adjustment range</td>
<td>± 3 mm</td>
<td>± 5 mm</td>
<td>± 3 mm</td>
<td>± 5 mm</td>
</tr>
</tbody>
</table>

### Vertical drive unit (Z-axis)

<table>
<thead>
<tr>
<th>Type</th>
<th>Order No.</th>
<th>Stylus tip</th>
<th>Dimensions (mm)</th>
<th>Material</th>
<th>Measuring range</th>
<th>Measuring accuracy</th>
<th>Max. probing depth</th>
</tr>
</thead>
<tbody>
<tr>
<td>Notch</td>
<td>12AAL01</td>
<td>ø1.6mm tungsten carbide/SR0.25mm sapphire</td>
<td>ø1.6mm/5mm</td>
<td>tungsten carbide</td>
<td>± 0.10μm/100mm (Ax2.5)</td>
<td>± 0.25μm/500mm (Ax2.5)</td>
<td>ø 580 mm</td>
</tr>
<tr>
<td>Corner</td>
<td>12AAL02</td>
<td>ø3mm tungsten carbide/SR0.25mm sapphire</td>
<td>ø3mm/10mm</td>
<td>tungsten carbide</td>
<td>± 0.15μm/300mm (Ax2.5)</td>
<td>± 0.75μm/1500mm (Ax2.5)</td>
<td>ø 300 mm</td>
</tr>
<tr>
<td>Cutter mark</td>
<td>12AAL03</td>
<td>ø1.6mm tungsten carbide</td>
<td>ø1.6mm/5mm</td>
<td>tungsten carbide</td>
<td>± 0.10μm/100mm (Ax2.5)</td>
<td>± 0.25μm/500mm (Ax2.5)</td>
<td>ø 580 mm</td>
</tr>
<tr>
<td>Extra small hole (Depth 3mm)</td>
<td>12AAL04</td>
<td>ø1.6mm tungsten carbide</td>
<td>ø1.6mm/5mm</td>
<td>tungsten carbide</td>
<td>± 0.10μm/100mm (Ax2.5)</td>
<td>± 0.25μm/500mm (Ax2.5)</td>
<td>ø 580 mm</td>
</tr>
</tbody>
</table>

### Radial drive unit (X-axis)

<table>
<thead>
<tr>
<th>Type</th>
<th>Order No.</th>
<th>Stylus tip</th>
<th>Dimensions (mm)</th>
<th>Material</th>
<th>Measuring range</th>
<th>Measuring accuracy</th>
<th>Max. probing depth</th>
<th>Max. probing weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Small hole (ø 0.8)</td>
<td>12AAL05</td>
<td>ø1.6mm tungsten carbide</td>
<td>ø1.6mm/5mm</td>
<td>tungsten carbide</td>
<td>± 0.10μm/100mm (Ax2.5)</td>
<td>± 0.25μm/500mm (Ax2.5)</td>
<td>ø 580 mm</td>
<td></td>
</tr>
<tr>
<td>Small hole (ø 1.0)</td>
<td>12AAL06</td>
<td>ø3mm tungsten carbide</td>
<td>ø3mm/10mm</td>
<td>tungsten carbide</td>
<td>± 0.15μm/300mm (Ax2.5)</td>
<td>± 0.75μm/1500mm (Ax2.5)</td>
<td>ø 300 mm</td>
<td></td>
</tr>
<tr>
<td>Small hole (ø 1.6)</td>
<td>12AAL07</td>
<td>ø1.6mm tungsten carbide</td>
<td>ø1.6mm/5mm</td>
<td>tungsten carbide</td>
<td>± 0.10μm/100mm (Ax2.5)</td>
<td>± 0.25μm/500mm (Ax2.5)</td>
<td>ø 580 mm</td>
<td></td>
</tr>
</tbody>
</table>

### Detector

<table>
<thead>
<tr>
<th>Type</th>
<th>Order No.</th>
<th>Stylus tip</th>
<th>Dimensions (mm)</th>
<th>Measuring type</th>
<th>Accuracy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Radial (ø 0.5)</td>
<td>12AAL09</td>
<td>ø4mm tungsten carbide</td>
<td>ø4mm/10mm</td>
<td>Radial</td>
<td>± 0.10μm/100mm (Ax2.5)</td>
</tr>
<tr>
<td>Crank (ø 1.0)</td>
<td>12AAL10</td>
<td>ø4mm tungsten carbide</td>
<td>ø4mm/10mm</td>
<td>Crank</td>
<td>± 0.10μm/100mm (Ax2.5)</td>
</tr>
<tr>
<td>Flat surface</td>
<td>12AAL11</td>
<td>ø4mm tungsten carbide</td>
<td>ø4mm/10mm</td>
<td>Flat surface</td>
<td>± 0.10μm/100mm (Ax2.5)</td>
</tr>
</tbody>
</table>

### Other

- Power supply: 100V ~ 240V
- Air pressure: 0.39MPa
- Air consumption: 30L/min (standard state)
- Weight: 180kg (measurement main unit) 200kg

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### Styli for RA-2200AS/DS/AH/DH (Option)

**Type** | **Standard (Standard accessories)** | **Notch** | **Deep groove** | **Corner** | **Cutter mark** |
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Order No.</td>
<td>12AAL01</td>
<td>12AAL02</td>
<td>12AAL03</td>
<td>12AAL04</td>
<td>12AAL05</td>
</tr>
<tr>
<td>Stylus tip</td>
<td>ø 1.6mm tungsten carbide</td>
<td>ø3mm tungsten carbide</td>
<td>SRO 25mm sapphire</td>
<td>SRO 25mm sapphire</td>
<td>tungsten carbide</td>
</tr>
<tr>
<td>Dimensions (mm)</td>
<td>ø4/10mm</td>
<td>ø4/10mm</td>
<td>ø4/10mm</td>
<td>ø4/10mm</td>
<td>ø4/10mm</td>
</tr>
</tbody>
</table>

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### Notes

1. Measuring is only possible in the vertical direction.
2. Customized special interchangeable stylus are available on request. Please contact any Mitutoyo office for more information.
The system comes standard with the A.A.T. (Automatic Adjustment Table) positioning and leveling function, freeing the operator from the task of centering and leveling the workpiece. The table provides high rotational accuracy (radial $0.02+3.5H/10000 \mu m$; axial $0.02+3.5X/10000 \mu m$), enabling the system to measure flatness and other characteristics, in addition to roundness/cylindricity, at a level that suits any application.

Integrating the system vibration-damping platform has significantly reduced the installation space requirements. Additionally, any layout can be achieved by combining the system with a PC table.

A Mitutoyo linear scale is incorporated into the X-axis positioning sensor, directly sensing the displacement of the drive unit to achieve highly accurate positioning, which is essential for repeat measurements. Furthermore, continual development has resulted in the highest drive speed within the class while achieving high accuracy even at high positioning speeds.

When an optional roughness detector unit is incorporated into the system it can measure workpiece surface roughness in the circumferential direction around the $\phi$-axis, as well as roughness in the direct-drive directions along the X- and Z-axes with the table stopped.

The photo shows RA-2200CNC vibration isolator with side table.
Specifications

- **RA-2200 CNC**

<table>
<thead>
<tr>
<th>Model No.</th>
<th>RA-2200 CNC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Z-axis</td>
<td>Standard column</td>
</tr>
<tr>
<td>Rotational accuracy</td>
<td>Radial direction: (0.02±3.5H/100000) μm</td>
</tr>
<tr>
<td></td>
<td>Axial direction: (0.02±3.5X/100000) μm</td>
</tr>
<tr>
<td>Rotating speed</td>
<td>2, 4, 6, 10 rpm</td>
</tr>
<tr>
<td>Table effective diameter</td>
<td>ø235 mm</td>
</tr>
<tr>
<td>Centering/leveling adjustment</td>
<td>A,A</td>
</tr>
<tr>
<td>Centering adjustment range</td>
<td>±3 mm</td>
</tr>
<tr>
<td>Leveling adjustment range</td>
<td>±1°</td>
</tr>
<tr>
<td>Max. lording weight</td>
<td>30 kg</td>
</tr>
<tr>
<td>Max. probing diameter</td>
<td>ø256 mm</td>
</tr>
<tr>
<td>Max. lording diameter</td>
<td>ø580 mm</td>
</tr>
</tbody>
</table>

- **Turntable unit**

  - Maximum calibration range: 400 μm
  - Graduation: 0.2 μm
  - External dimensions: 235 (max) x 185 x 70 mm
  - Mass: 4 kg

- **Vertical drive unit (Z-axis)**

  - Straightness accuracy: 0.10 μm /100mm (E<sub>c2.5</sub>) 0.15 μm /300mm (E<sub>c2.5</sub>) 0.10 μm /100mm (E<sub>c2.5</sub>) 0.25 μm /500mm (E<sub>c2.5</sub>)
  - Straightness: 0.5 μm
  - Cylindricity: 2 μm
  - External dimensions: ø70 x 250 mm
  - Mass: 7.5 kg

- **Radial drive unit (X-axis)**

  - Straightness accuracy: 0.7 μm /150mm (E<sub>c2.5</sub>)
  - Horizontal to rotation center: 1.0 μm /150mm (Referential generatrix line)
  - Travel amount: 175 mm (from rotation center -25mm ~+150mm)
  - Travel speed: Max. 30 mm/s (measurement: 0.5 /1.0/ 2.0/ 5.0 mm/s)

- **Detector**

  - Measuring force: 40 mN
  - Stylus design, material: ø1.6 mm tungsten carbide
  - Measuring range: ±400 μm
  - Follow: ±5 mm
  - Other: Rotating mechanism (within the range 0° to 270°, in increments of 1°)

- **Other**

  - Power supply: 100V ~ 240V
  - Air pressure: 0.39 MPa
  - Air consumption: 30 L/min (standard state)
  - Weight (measurement main unit): 180 kg 200 kg

- **Styli for RA-2200 CNC (Option)**

<table>
<thead>
<tr>
<th>Type</th>
<th>Order No.</th>
<th>Rat surface</th>
<th>Standard</th>
<th>Notch</th>
<th>Deep hole</th>
</tr>
</thead>
<tbody>
<tr>
<td>Deep groove</td>
<td>12AAE310</td>
<td>ø1.6mm tungsten carbide</td>
<td>ø1.6mm tungsten carbide</td>
<td>ø1.6mm tungsten carbide</td>
<td>ø1.6mm tungsten carbide</td>
</tr>
<tr>
<td>Flat surface</td>
<td>12AAE302</td>
<td>ø1.6mm tungsten carbide</td>
<td>ø1.6mm tungsten carbide</td>
<td>ø1.6mm tungsten carbide</td>
<td>ø1.6mm tungsten carbide</td>
</tr>
<tr>
<td>Standard</td>
<td>12AAE303</td>
<td>ø1.6mm tungsten carbide</td>
<td>ø1.6mm tungsten carbide</td>
<td>ø1.6mm tungsten carbide</td>
<td>ø1.6mm tungsten carbide</td>
</tr>
<tr>
<td>Notch</td>
<td>12AAE304</td>
<td>ø1.6mm tungsten carbide</td>
<td>ø1.6mm tungsten carbide</td>
<td>ø1.6mm tungsten carbide</td>
<td>ø1.6mm tungsten carbide</td>
</tr>
<tr>
<td>Deep hole A</td>
<td>12AAE305</td>
<td>ø1.6mm tungsten carbide</td>
<td>ø1.6mm tungsten carbide</td>
<td>ø1.6mm tungsten carbide</td>
<td>ø1.6mm tungsten carbide</td>
</tr>
<tr>
<td>Deep hole B</td>
<td>12AAE306</td>
<td>ø1.6mm tungsten carbide</td>
<td>ø1.6mm tungsten carbide</td>
<td>ø1.6mm tungsten carbide</td>
<td>ø1.6mm tungsten carbide</td>
</tr>
</tbody>
</table>

- **Options common to the RA-2200AS/DS/AH/DH, RA-2200CNC**

- **Cylindrical square**
  - 350850
  - Straightness: 0.5 μm
  - Cylindricity: 2 μm
  - Internal dimensions: ø70 x 250 mm
  - Mass: 7.5 kg

- **Centering chuck (key operated)**
  - 211-014
  - Suitable for holding longer parts and those requiring a relatively powerful clamp.
  - Holding capacity: Internal jaws: OD = ø2 - ø35mm, ID = ø25 - ø68mm
  - External dimensions: ø157 x 70.6 mm
  - Mass: 3.8 kg

- **Micro-chuck**
  - 211-031
  - Used for clamping a workpiece (less than ø1 mm dia.) that the centering chuck cannot handle.
  - Holding capacity: ø0.1 - ø1.5 mm
  - External dimensions: ø118 x 48.5 mm
  - Mass: 0.6 kg

- **Magnification calibration gage**
  - 211-045
  - Used for normalizing detector magnification by calibrating detector travel against displacement of a micrometer spindle.
  - Maximum calibration range: 400 μm
  - Graduation: 0.2 μm
  - External dimensions: 235 (max) x 185 x 70 mm
  - Mass: 4 kg

- **Centering chuck (ring operated)**
  - 211-032
  - Suitable for holding small parts with easy-to-operate knurled-ring clamping.
  - Holding capacity: Internal jaws: OD = ø1 - ø36mm, ID = ø16 - ø69mm
  - External jaws: OD = ø25 - ø79mm
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A wide variety of parameters including those for roundness/cylindricity, as well as flatness and parallelism, are provided as standard features. You can visually select these parameters using icons.

ROUNDPAK also comes with specialized functions, such as the design value best-fit analysis function, the harmonic analysis function, and a function for recording the peak or trough points on a circumference. Data that has already been collected can be easily used for re-calculation, or deleted.

An offline teaching function is provided to create a part program (measurement procedure) without an actual measurement target, enabling the user to virtually execute the measurement operation in a 3D simulation window. You can also display warnings* about the risk of collision on the simulation window.

*This function is for RA-2200CNC only.

Analysis results such as cylindricity and coaxiality can be visually expressed in 3D graphics.
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Dimensions

RA-2200 AS/DS/AH/DH
Unit: mm

RA-2200 CNC
Unit: mm

RA-2200 AS/DS/AH/DH

RA-2200 CNC

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