ROUNDNESS/CYLINDRICITY MEASUREMENT
ROUNTEST RA-2200 SERIES

OFFERING THE 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.

**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.

The detector-unit holder can be stopped at a position sufficiently higher than the workpiece along the Z-axis, and then lowered and positioned to make measurements. Furthermore, internal/external diameters can be easily measured with the continuous internal/external diameter measurement function*2.

**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.

**Wide variety of models available to suit any application**

- RA-2200AS/AH models are supplied as standard with an automatic centering and leveling turntable*1, freeing the operator from the centering and leveling task.
- RA-2200DS/DH models are supplied as standard with a navigation function*1 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 11.8” (300mm), and are available with a column drive height of 19.7” (500mm) (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*3.

**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.

*1: See page 3 for details about the turntable.
*2: See page 3 for details about the continuous ID and OD measuring function.
*3: Isolation Table, Monitor Arm and Printer Table are optional accessories.
Equipped with a highly accurate turntable that enables simple and accurate centering and leveling of the workpiece

The table provides high rotational accuracy (radial 0.02+3.5H/10000 μm; axial 0.02+3.5X/10000 μm), enabling the system to measure flatness and other characteristics, in addition to roundness/cylindricity, at a level that suits any application. For centering and leveling support, you can select either the A.A.T. (Automatic Adjustment Table) or D.A.T. (Digimatic Adjustment Table).

**High accuracy even at high positioning speeds**
Continual development has resulted in the highest drive speed within the class.
- Vertical direction (Z-axis column): Max. 50 mm/s
- Radial direction: Max. 30 mm/s

**Continuous OD/ID measurement function**
Patent registered in Japan, USA, Germany, UK, France
Continuous internal/external diameter measurement is possible without changing the detector position.

**Spiral Measurement/Analysis**
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.

**Highly accurate repeat measurements**
Mitutoyo's linear scales are 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.

**Partial circle measurement function**
Even if a workpiece cannot be measured by physically rotating it by a full turn due to some obstruction (projection), segments of the circumference can be measured.

**Measurement through X-axis tracking**
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>Order No.</td>
<td>211-511A</td>
<td>211-514A</td>
<td>211-512A</td>
<td>211-516A</td>
</tr>
</tbody>
</table>

#### Turntable Unit

<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>Order No.</td>
<td>211-511A</td>
<td>211-514A</td>
<td>211-512A</td>
<td>211-516A</td>
</tr>
</tbody>
</table>

#### Vertical Drive Unit (Z-axis)

<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>Order No.</td>
<td>211-511A</td>
<td>211-514A</td>
<td>211-512A</td>
<td>211-516A</td>
</tr>
</tbody>
</table>

#### Radial Drive Unit (X-axis)

<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>Order No.</td>
<td>211-511A</td>
<td>211-514A</td>
<td>211-512A</td>
<td>211-516A</td>
</tr>
</tbody>
</table>

#### Detector

<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>Order No.</td>
<td>211-511A</td>
<td>211-514A</td>
<td>211-512A</td>
<td>211-516A</td>
</tr>
</tbody>
</table>

#### Other

<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>Order No.</td>
<td>211-511A</td>
<td>211-514A</td>
<td>211-512A</td>
<td>211-516A</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Type</th>
<th>Standard (Standard accessory)</th>
<th>Notch</th>
<th>Deep groove</th>
<th>Corner</th>
<th>Cutter mark</th>
</tr>
</thead>
<tbody>
<tr>
<td>Order No.</td>
<td>12AAAL021</td>
<td>12AAAL022</td>
<td>12AAAL023</td>
<td>12AAAL024</td>
<td>12AAAL025</td>
</tr>
<tr>
<td>Stylus tip</td>
<td>ø1.6 mm tungsten carbide</td>
<td>ø1.6 mm tungsten carbide</td>
<td>ø1.6 mm tungsten carbide</td>
<td>ø1.6 mm tungsten carbide</td>
<td></td>
</tr>
<tr>
<td>Dimensions (mm)</td>
<td>ø4.5</td>
<td>ø4.5</td>
<td>ø4.5</td>
<td>ø4.5</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Type</th>
<th>Small hole (ø 0.8)</th>
<th>Small hole (ø 1.0)</th>
<th>Small hole (ø 1.0)</th>
<th>Extra small hole (Depth 3 mm)</th>
<th>ø1.6 mm ball</th>
</tr>
</thead>
<tbody>
<tr>
<td>Order No.</td>
<td>12AAAL026</td>
<td>12AAAL027</td>
<td>12AAAL028</td>
<td>12AAAL029</td>
<td>12AAAL030</td>
</tr>
<tr>
<td>Stylus tip</td>
<td>ø1.6 mm tungsten carbide</td>
<td>ø1.6 mm tungsten carbide</td>
<td>ø1.6 mm tungsten carbide</td>
<td>ø1.6 mm tungsten carbide</td>
<td></td>
</tr>
<tr>
<td>Dimensions (mm)</td>
<td>ø4.5</td>
<td>ø4.5</td>
<td>ø4.5</td>
<td>ø4.5</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Type</th>
<th>Disk</th>
<th>Crank (ø 0.5)</th>
<th>Crank (ø 1.0)</th>
<th>Flat surface</th>
<th>2X-long type *1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Order No.</td>
<td>12AAAL031</td>
<td>12AAAL032</td>
<td>12AAAL033</td>
<td>12AAAL034</td>
<td>12AAAL035</td>
</tr>
<tr>
<td>Stylus tip</td>
<td>ø1.2 mm tungsten carbide</td>
<td>ø1.2 mm tungsten carbide</td>
<td>ø1.2 mm tungsten carbide</td>
<td>ø1.2 mm tungsten carbide</td>
<td>ø1.2 mm tungsten carbide</td>
</tr>
<tr>
<td>Dimensions (mm)</td>
<td>ø4.5</td>
<td>ø4.5</td>
<td>ø4.5</td>
<td>ø4.5</td>
<td>ø4.5</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Type</th>
<th>2X-long type notch *2</th>
<th>2X-long type deep groove *2</th>
<th>2X-long type corner *2</th>
<th>2X-long type cutter mark *2</th>
<th>2X-long type Small hole *2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Order No.</td>
<td>12AAAL036</td>
<td>12AAAL037</td>
<td>12AAAL038</td>
<td>12AAAL039</td>
<td>12AAAL040</td>
</tr>
<tr>
<td>Stylus tip</td>
<td>ø3 mm tungsten carbide</td>
<td>ø3 mm tungsten carbide</td>
<td>ø3 mm tungsten carbide</td>
<td>ø1 mm tungsten carbide</td>
<td>ø1 mm tungsten carbide</td>
</tr>
<tr>
<td>Dimensions (mm)</td>
<td>ø4.5</td>
<td>ø4.5</td>
<td>ø4.5</td>
<td>ø4.5</td>
<td>ø4.5</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Type</th>
<th>3X-long type</th>
<th>3X-long type deep groove *2</th>
<th>Stylus shank</th>
<th>Stylus shank (standard groove)</th>
<th>Stylus shank (2X-long groove) *2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Order No.</td>
<td>12AAAL041</td>
<td>12AAAL042</td>
<td>12AAAL043</td>
<td>12AAAL044</td>
<td>12AAAL045</td>
</tr>
<tr>
<td>Stylus tip</td>
<td>ø1.6 mm tungsten carbide</td>
<td>ø1.6 mm tungsten carbide</td>
<td>ø1.6 mm tungsten carbide</td>
<td>ø1.6 mm tungsten carbide</td>
<td>ø1.6 mm tungsten carbide</td>
</tr>
<tr>
<td>Dimensions (mm)</td>
<td>ø4.5</td>
<td>ø4.5</td>
<td>ø4.5</td>
<td>ø4.5</td>
<td>ø4.5</td>
</tr>
</tbody>
</table>

*1: Measuring is only possible in the vertical direction.

*2: Customized special interchangeable styl are available on request. Please contact any Mitutoyo office for more information.
**ROUNDTEST EXTREME RA-2200CNC**

**Detector unit orientation programmable for CNC measurement**

This function controls the orientation of the arm holding the detector unit (between vertical and horizontal) and the detector unit rotation mechanism (between 0 and 360 degrees in 1-degree increments), making it possible to continuously and automatically measure internal/external diameters as well as top/bottom surfaces. Additionally, a full-featured offline teaching function simplifies the creation of part programs.

**Simple and accurate centering and leveling of the workpiece**

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.

<table>
<thead>
<tr>
<th>A.A.T. (Automatic Adjustment Table)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Incorporating an Automatic Adjustment Table (A.A.T.), the top-of-the-line RA-2200CNC models relieve the operator of workpiece centering and leveling.</td>
</tr>
<tr>
<td><img src="image" alt="Diagram" /></td>
</tr>
</tbody>
</table>

- Turntable axis
- Workpiece
- Initial misalignment of axes
- Centering range: ±3 mm
- Leveling range: ±1º

**Highly accurate turntable**

The table provides high rotational accuracy (radial 0.02+3.5H/10000 μm; axial 0.02+3.5X/10000 μm), enabling the system to measure flatness and other characteristics, in addition to roundness/cylindricity, at a level that suits any application.

**Space-saving design**

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.

**Highly accurate positioning sensor**

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.

**Roughness detector unit support**

When an optional roughness detector unit is incorporated into the system it can measure workpiece surface roughness in the circumferential direction around the θ-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-2200CNC

<table>
<thead>
<tr>
<th>Model No.</th>
<th>RA-22005CNC</th>
<th>RA-2200H CNC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Order No.</td>
<td>211-517A</td>
<td>211-518A</td>
</tr>
</tbody>
</table>

### Turntable unit
- Z-axis: Rotational accuracy: ±(0.02+3.5H/10000) µm; Axial direction: ±(0.02+3.5X/10000) µm; X: distance from rotational center (mm)
- Rotating speed: 2, 4, 6, 10 rpm
- Table effective diameter: ø9.25" (235 mm)
- Centering/leveling adjustment: ±0.12" (3 mm)
- Leveling adjustment range: ±1 °

### Vertical drive unit (Z-axis)
- Straightness accuracy: 0.10µm / 100 mm (c2.5); 0.15µm / 300 mm (c2.5)
- Traverse speed: Max. 50 mm/s (measurement: 0.5 / 1.0 / 2.0 / 5.0 mm/s)
- Max. probing OD: 11.8" (300 mm)
- Max. probing ID: 11.8" (300 mm)

### Radial drive unit (X-axis)
- Straightness accuracy: 0.7µm / 150 mm (c2.5)
- Travel amount: 6.9" (175 mm) (from rotation center -25mm~+150 mm)
- 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: ø1.6mm tungsten carbide
- Measuring range: Standard ±400µm / ±40µm / ±4µm; Follow ±5 mm
- Other: Rotating mechanism (within the range 0˚ to 290˚, in increments of 1˚)

### Other
- Power supply: 100 V - 240 V
- Air pressure: 0.39 MPa
- Air consumption: 30 L/min (standard state)
- Weight (measurement main unit): 397lbs (180 kg); 441lbs (200 kg)

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

<table>
<thead>
<tr>
<th>Type</th>
<th>Deep groove</th>
<th>Flat surface</th>
<th>Standard</th>
<th>Notch</th>
<th>Deep hole A</th>
</tr>
</thead>
<tbody>
<tr>
<td>Order No.</td>
<td>12AAE310</td>
<td>12AAE302</td>
<td>12AAE301</td>
<td>12AAE309</td>
<td>12AAE306</td>
</tr>
<tr>
<td>Styli type</td>
<td>ø1.6mm ball</td>
<td>ø0.8mm ball</td>
<td>ø0.5mm ball</td>
<td>ø1.6mm ball</td>
<td>ø1.6mm ball</td>
</tr>
<tr>
<td>Dimensions (mm)</td>
<td>ø4.4</td>
<td>ø4.2</td>
<td>ø4.1</td>
<td>ø4.8</td>
<td>ø4.8</td>
</tr>
</tbody>
</table>

### Options common to the RA-2200AS/DS/AH/DH, RA-2200CNC
- **Centering chuck (key operated)** 211-014
  - Suitable for holding longer parts and those requiring a relatively powerful clamp.
  - Holding capacity: Internal jaws: OD = ø2 - ø25mm, ID = ø25 - ø68mm
  - External jaws: OD = ø35 - ø78mm
  - External dimensions: ø157 x 70.6mm
  - Mass: 3.8kg
- **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 - ø99mm
  - External dimensions: ø118 x 41mm
  - Mass: 1.2kg
- **Micro-chuck** 211-031
  - Used for clamping a workpiece (less than ø1 mm dia.) that the centering chuck cannot handle.
  - Holding capacity: ø0.1 - ø1.5mm
  - External dimensions: ø118 x 41mm
  - Mass: 0.6kg
- **Magnification calibration gage** 211-045
  - Used for normalizing detector magnification by calibrating detector travel against displacement of a micrometer spindle.
  - Maximum calibration range: 400μm
  - Graduation: 0.2μm
  - External dimensions: 235 (max) x 185 x 70mm
  - Mass: 4kg
- **Vibration isolator** 12AAK110
- **Monitor arm** 12AAK120
- **Side table** 12AAL019
- **Surface Roughness Detector Holder for non-CNC** 12AAF353

### Specifications
- Magnification calibration gage
  - RA-2200S CNC
  - RA-2200H CNC
  - Order No.
  - Z-axis: Rotational accuracy: ±(0.02+3.5H/10000) µm; Axial direction: ±(0.02+3.5X/10000) µm; X: distance from rotational center (mm)
  - Rotating speed: 2, 4, 6, 10 rpm
- Maximum calibration range: 400µm
- Graduation: 0.2µm
- External dimensions: 235 (max) x 185 x 70mm
- Mass: 4kg
Roundness/Cylindricity measurement/Analysis software

ROUNDPAK

ROUNDPAK provides simple manipulation using a mouse and icons.

**Simple operations even with a full set of parameters and analysis functions**

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.

**Freedom in laying out the graphics and data obtained from measurements**

The customer can create reports in custom formats by specifying how the analysis results will be displayed, as well as the sizes and positions of graphics. The analysis result window can be directly utilized as a layout window. Since the measurement procedure, including the layout information, is saved, the entire process, from measurement start, calculation, result saving, and finally to printing, can be automatically executed.

**A wide variety of graphics functions**

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

- Normal display
- Wire-frame display
- Surface-map display
- Shading display

**Off-line measurement procedure programming function**

Patent registered in Japan, USA
Patent pending in Europe

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.
Whatever your challenges are, Mitutoyo supports you from start to finish.

Mitutoyo is not only a manufacturer of top quality measuring products but one that also offers qualified support for the lifetime of the equipment, backed up by comprehensive services that ensure your staff can make the very best use of the investment.

Apart from the basics of calibration and repair, Mitutoyo offers product and metrology training, as well as IT support for the sophisticated software used in modern measuring technology. We can also design, build, test and deliver measuring solutions and even, if deemed cost-effective, take your critical measurement challenges in-house on a sub-contract basis.