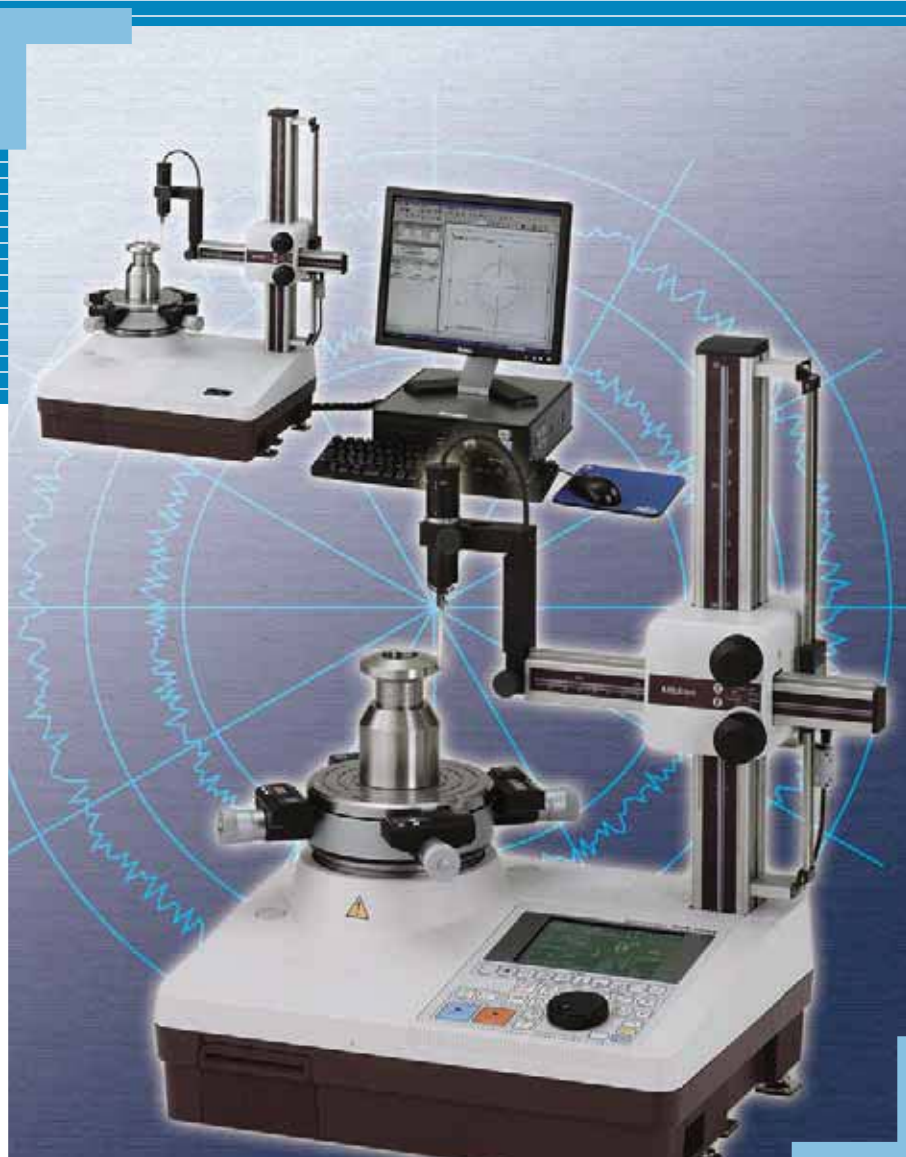


# Compact Roundness Measurement ROUNDTEST RA-120/120P

Bulletin No. 1949



Compact roundness tester equipped with a wide range of analysis features and capable of accommodating a variety of workpieces

**Mitutoyo**

# Roundtest RA-120

- Fine adjustment on both X- and Z-axes
- Multiple analyses through simple operation
- D.A.T. function \*except for 211-621
- Scaled Z-axis
- Continuous ID and OD measurement
- High-precision air bearing
- Wide-range detector
- Store and implement measuring conditions and results

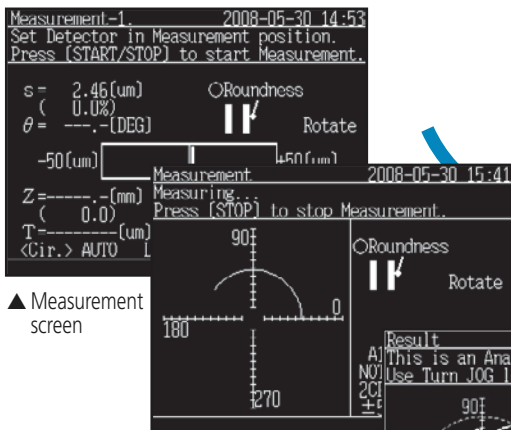


## Simple, interactive display screen

The large LCD screen with backlight shows easy-to-understand measurement results and graphs. Forms can be checked and notch processing can be set while observing the displayed graphs.

### Measurement screen

- Set the position of the detector and measurement conditions here
- During measurement, graphs are displayed in real time

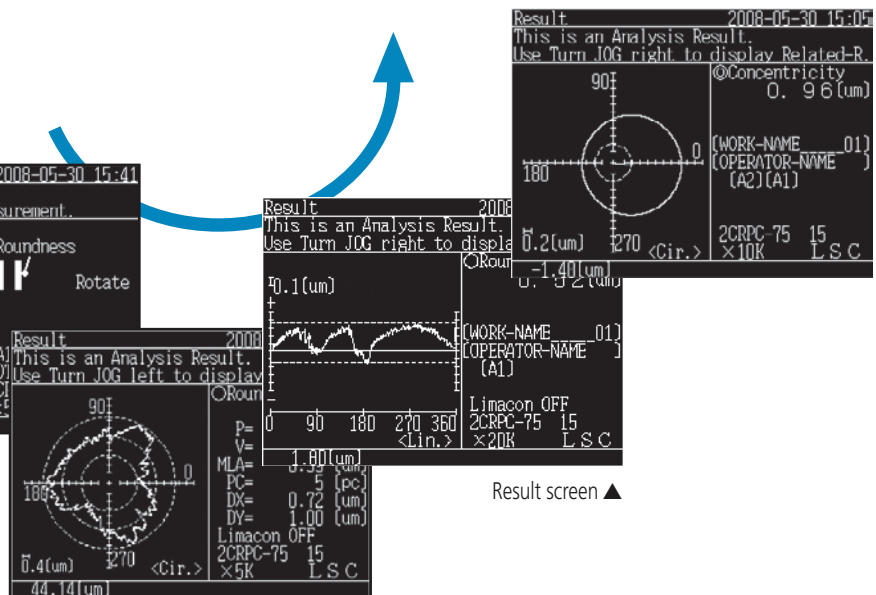


▲ Measurement screen

▲ Measurement in progress screen

### Measurement results

- Filter, display magnification, etc., can be altered
- Besides circles, development views can also be displayed



▲ Result screen

Assuming on-the-job use, this compact roundness measuring machine is provided with numerous user-friendly features aimed at prioritizing usability, such as a wider range for the detector, an easy-to-understand operation panel with large LCD, a DAT function that powerfully supports centering and leveling adjustments, and so on.

## Operating panel that is read at a glance

### Supports 10 languages

- Japanese, English, German
- French, Italian, Spanish
- Portuguese, Chinese (Traditional characters)
- Korean, Chinese (Simplified characters)

### Analysis type

Selection buttons provide access to a wide variety of analysis types

### Switching screen modes

Switch the display at the touch of a button, providing access to the [Calibration], [Centering and Leveling], [Measurement], and [Result] screens.

### Zero-setting button

No fine adjustment necessary for setting the measurement position



### Simple setup

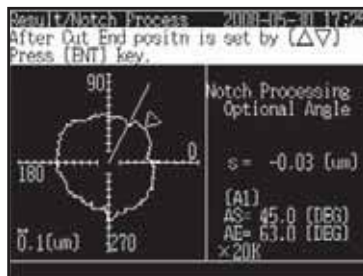
Apply measurement conditions on one step  
Simple operation and prevention of operational errors

### Jog dial

Make detailed changes to conditions and other operations

## Notch processing

Unwanted data, such as that produced by notches or scratches, can be excluded from the analysis if desired. Select between [Automatic setting] and [Arbitrary setting].



## File save

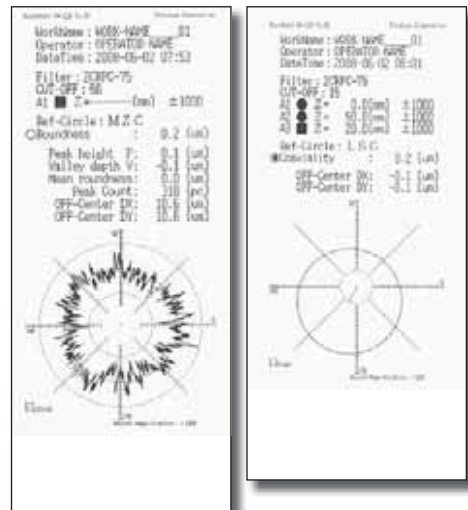
Save and access [Measurement files] and [Result files] in USB memory. Data can also be totaled using the data output function with commercial tabulation software.

[Measurement file] [Measurement data (Data output)]  
[Result file] [Result data (Data output)]

## High-grade thermal printer

Print measurement conditions, computation results, result graphs, comments, etc., to the thermal printer. Change development graphs and output items as desired.

### ■ Sample prints



Recording paper set (optional set of 10 rolls)

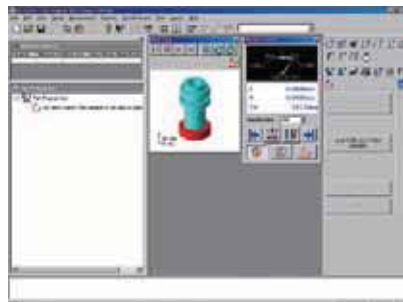
# Roundtest RA-120P

- Fine adjustment on both X- and Z-axes
- Multiple analyses through simple operation
- D.A.T. function \*except for 211-625
- Scaled Z-axis
- Continuous ID and OD measurement
- Display function for diverse graphs
- High-precision air bearing
- Wide-range detector



## Windows graphical interface

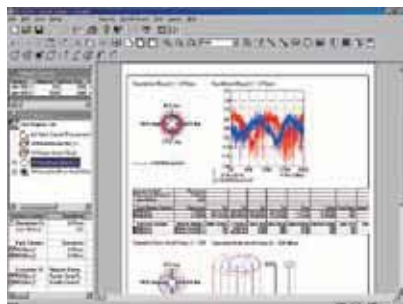
By using a mouse and buttons, identified by corresponding icons, to control the machine, the Roundtest RA-120P's interface provides excellent usability. Functions such as recalculation and graph reading are handled swiftly with easy-to-understand operations.



▲ Main screen



▲ Measurement setup screen



▲ Result screen

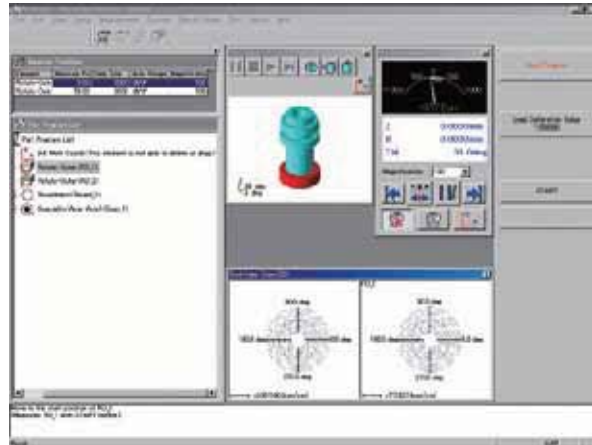


▲ Measurement in progress screen



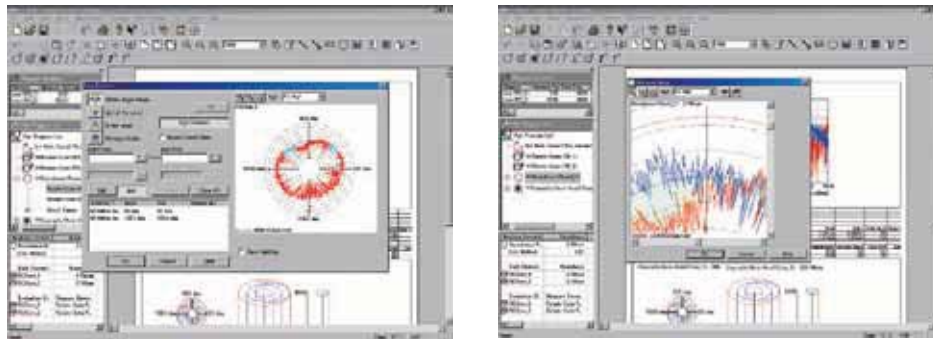
This entry-level desktop tester incorporates the ROUNDPAK multi-analysis evaluation program, which provides it with analytical power close to that of more elaborate models. This is, therefore, a highly functional multi-analysis roundness measuring machine that is suitable for use not only in measurement rooms, but also in research and development sections.

**Measurement screen makes ample use of graphs**



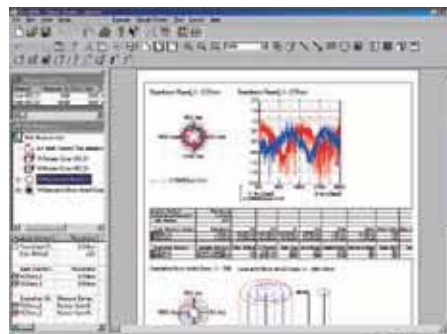
**Multi-analysis function**

Complete with a wide range of functions including partial enlargement, auxiliary line setup, color-change, displacement/angular difference of data between two points, and so on. Also equipped with notch processing and graph reading functions, which make the machine useful in research departments. Recalculation can also be performed when the filter and evaluation method is changed.

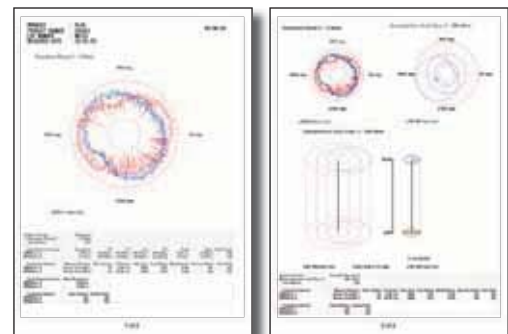


**Simplified layout function**

Computation results for multiple items can be laid out in multiple forms on a single sheet and printed. This function also supports output to a color printer (optional). Printer cable (optional, 2m long):



■ Layout setting screen



■ Sample print outputs

# Functions that implement greater efficiency of measurement and range of analysis types

## D.A.T. function (patented) \*except for 211-621 and 211-625

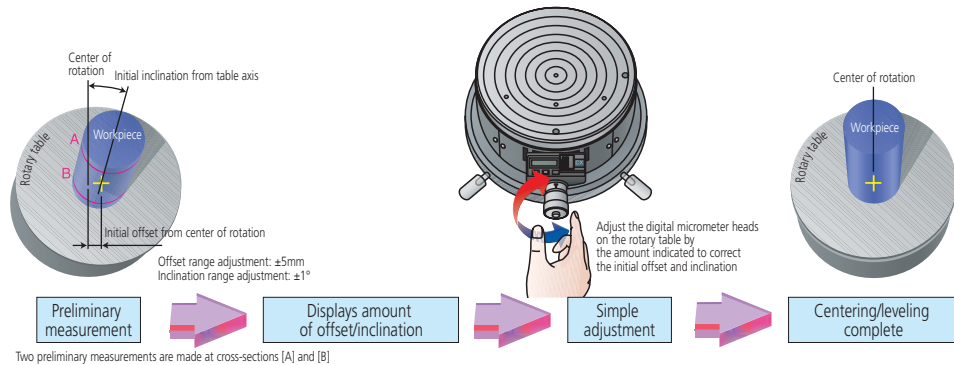
This instrument uses the DAT (Digital Adjustment Table) function available on higher-end models, and this provides powerful support for centering and leveling operations. To perform such operations, the operator need only adjust the digital micrometer heads attached to the rotary table by the amounts indicated by the display. This function also supports notched workpieces.



**RA-120**

Mode selection → Preliminary setup → Centering → Leveling

**RA-120P**



## Continuous ID and OD measuring function (patented)

This function comes in very handy when outside diameter and inside diameter surfaces need to be measured repeatedly, for example, with respect to coaxiality, deviation in wall thickness, etc. The inner surface can be measured and calculated with the detector, maintaining the same measuring position for the outside diameter without changing its orientation, as illustrated on the right. Inside diameters down to 50mm can be measured.



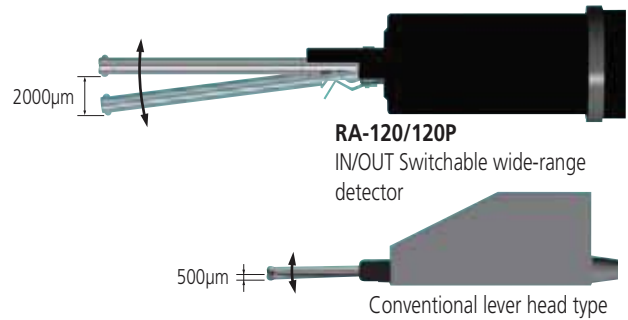
## Z-axis scale

This scale is useful when the measuring height position needs to be entered, such as when measuring coaxiality, etc. The machine uses an ABS Digimatic scale unit to provide an effective means for repetitive measurement and position setting.



## IN/OUT switchable wide-range detector

The range of this detector has been extended from that of a conventional lever head by as much as four times, and is now wider than ever before. The detector can provide sufficient margin for centering and leveling jobs, or when measuring large differences. Moreover, the measuring direction can be switched between inside and outside diameters with a single touch of a button.



## Types of Analysis

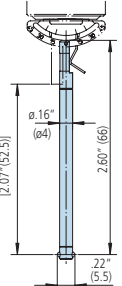
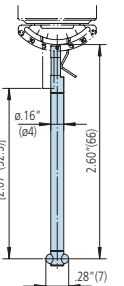
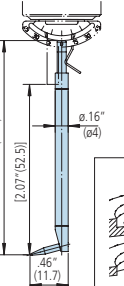
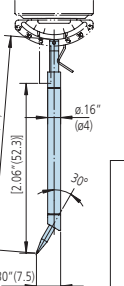
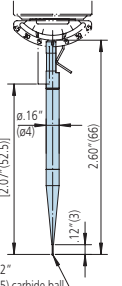
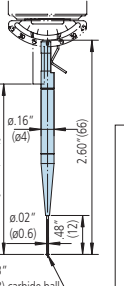
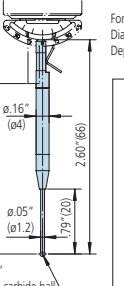
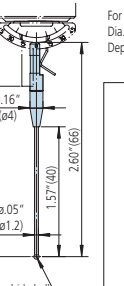
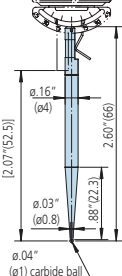
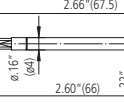
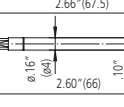
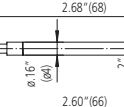
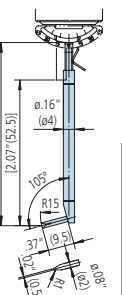
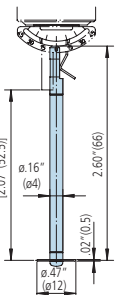
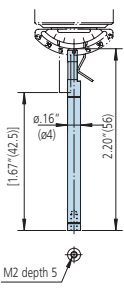
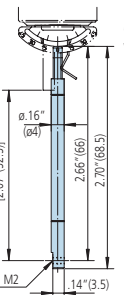
Type of Analysis	Measurement mode	Evaluation diagram	RA-120	RA-120P
Roundness			✓	✓
Flatness			✓	✓
Squareness	Relative to Axis		✓	✓
	Relative to Plane		✓	✓
Concentricity			✓	✓
Coaxiality	Of section		✓	✓
	Of axis		—	✓

Type of Analysis	Measurement mode	Evaluation diagram	RA-120	RA-120P
Parallelism			✓	✓
Thickness variation	Radial		✓	✓
	Axial		✓	✓
Circular run-out	Radial		✓	✓
	Axial		✓	✓
Power spectrum			—	✓

# Optional Accessories

## Interchangeable Styli

Unit: inch(mm)

<b>12AAB681</b> Standard stylus *Standard accessory (stylus tip: $\phi 0.06''(\phi 1.6)$ carbide ball)	<b>12AAB682</b> Stylus for notched workpieces (stylus tip: $\phi 0.12''(\phi 3)$ carbide ball)	<b>12AAB683</b> Stylus for grooves (stylus tip: R0.01"(.25) sapphire)	<b>12AAB684</b> Stylus for corners (stylus tip: R0.01"(.25) sapphire)
 <p>For standard applications</p> <p>In ID measurement                      Dia.: <math>\geq 0.30''(7.5\text{mm})</math>,                      Depth: <math>\leq 1.97''(50\text{mm})</math></p> <p>Dimensions: <math>\phi 0.16''(\phi 4)</math>, <math>2.60''(66)</math>, <math>2.07''(52.5)</math>, <math>22''(5.5)</math></p>	 <p>Useful for notched workpieces</p> <p>Example</p> <p>Dimensions: <math>\phi 0.16''(\phi 4)</math>, <math>2.60''(66)</math>, <math>2.07''(52.5)</math>, <math>28''(7)</math></p>	 <p>For stepped applications</p> <p>Example</p> <p>Dimensions: <math>2.65''(66.7)</math>, <math>\phi 0.16''(\phi 4)</math>, <math>2.07''(52.5)</math>, <math>46''(11.7)</math></p>	 <p>For inside-corner applications</p> <p>Example</p> <p>Dimensions: <math>2.60''(66)</math>, <math>\phi 0.16''(\phi 4)</math>, <math>2.07''(52.5)</math>, <math>30''(7.5)</math></p>
<b>12AAB687</b> Stylus for extra small holes (stylus tip: $\phi 0.02''(\phi 0.5)$ carbide ball)	<b>12AAE859</b> Stylus for small holes (stylus tip: $\phi 0.03''(\phi 0.8)$ carbide ball)	<b>12AAB674</b> Stylus for small and deep holes (stylus tip: $\phi 0.06''(\phi 1.6)$ carbide ball)	<b>12AAE855</b> Stylus for small and deep holes (stylus tip: $\phi 0.06''(\phi 1.6)$ carbide ball)
 <p>For extra small hole applications                      Dia.: <math>\geq 0.04''(1\text{mm})</math>,                      Depth: <math>\leq 1.0''(25\text{mm})</math></p> <p>Enlarged image</p> <p>Dimensions: <math>\phi 0.16''(\phi 4)</math>, <math>2.60''(66)</math>, <math>2.07''(52.5)</math>, <math>12''(3)</math>, <math>\phi 0.02''(\phi 0.5)</math> carbide ball, <math>10''(2.5)</math>, <math>0.04''(\phi 1)</math></p>	 <p>For small hole applications                      Dia.: <math>\geq 0.06''(1.5\text{mm})</math>,                      Depth: <math>\leq 0.39''(10\text{mm})</math></p> <p>Enlarged image</p> <p>Dimensions: <math>\phi 0.16''(\phi 4)</math>, <math>2.60''(66)</math>, <math>2.07''(52.5)</math>, <math>48''(12)</math>, <math>\phi 0.03''(\phi 0.8)</math> carbide ball, <math>0.06''(\phi 1.5)</math></p>	 <p>For small and deep hole application                      Dia.: <math>\geq 0.12''(3\text{mm})</math>,                      Depth: <math>\leq 0.71''(18\text{mm})</math></p> <p>Enlarged image</p> <p>Dimensions: <math>\phi 0.16''(\phi 4)</math>, <math>2.60''(66)</math>, <math>2.07''(52.5)</math>, <math>79''(20)</math>, <math>\phi 0.05''(\phi 1.2)</math> carbide ball, <math>71''(18)</math>, <math>\phi 0.12''(\phi 3)</math></p>	 <p>For small and deep hole application                      Dia.: <math>\geq 0.12''(3\text{mm})</math>,                      Depth: <math>\leq 1.50''(38\text{mm})</math></p> <p>Enlarged image</p> <p>Dimensions: <math>\phi 0.16''(\phi 4)</math>, <math>2.60''(66)</math>, <math>2.07''(52.5)</math>, <math>157''(40)</math>, <math>\phi 0.05''(\phi 1.2)</math> carbide ball, <math>150''(38)</math>, <math>\phi 0.12''(\phi 3)</math></p>
<b>12AAB686</b> Stylus for small holes (stylus tip: $\phi 0.04''(\phi 1)$ carbide ball)	<b>12AAB696</b> Cranked stylus (stylus tip: $\phi 0.02''(\phi 0.5)$ carbide ball)	<b>12AAB695</b> Cranked stylus (stylus tip: $\phi 0.02''(\phi 0.5)$ carbide ball)	<b>12AAE856</b> Stylus for flat surface
 <p>For small hole applications</p> <p>Example</p> <p>Dimensions: <math>\phi 0.16''(\phi 4)</math>, <math>2.60''(66)</math>, <math>2.07''(52.5)</math>, <math>88''(22.3)</math>, <math>\phi 0.03''(\phi 0.8)</math> carbide ball, <math>\phi 0.04''(\phi 1)</math> carbide ball</p>	 <p>Dimensions: <math>2.66''(67.5)</math>, <math>\phi 0.16''(\phi 4)</math>, <math>2.60''(66)</math>, <math>27''(5.5)</math>, <math>\phi 0.04''(\phi 1)</math> carbide ball</p> <p>For upper/lower surface in a narrow groove</p> <p>Note: This stylus cannot be used for OD/ID measurement.</p>	 <p>Dimensions: <math>2.66''(67.5)</math>, <math>\phi 0.16''(\phi 4)</math>, <math>2.60''(66)</math>, <math>10''(2.5)</math>, <math>\phi 0.02''(\phi 0.5)</math> carbide ball</p>	 <p>Dimensions: <math>2.68''(68)</math>, <math>\phi 0.16''(\phi 4)</math>, <math>2.60''(66)</math>, <math>2''(5)</math>, <math>\phi 0.02''(\phi 0.5)</math> carbide ball, <math>\phi 0.08''(\phi 2)</math></p> <p>Example</p>
<b>12AAB685</b> Stylus for filtering asperities (machining marks)	<b>12AAB694</b> Disk stylus	<b>12AAB676</b> M2 tapped shank for CMM styli	<b>12AAE857</b> M2 tapped shank for CMM styli
 <p>Filtering out the effects of asperities by tracing with R15 tipped stylus</p> <p>Example</p> <p>Cutter mark</p> <p>Dimensions: <math>2.60''(66)</math>, <math>\phi 0.16''(\phi 4)</math>, <math>2.07''(52.5)</math>, <math>105''(26.7)</math>, <math>R15</math>, <math>37''(9.5)</math>, <math>18''(4.5)</math>, <math>100''(25.4)</math>, <math>80''(20.3)</math></p>	 <p>Example</p> <p>For narrow groove applications</p> <p>Dimensions: <math>2.07''(52.5)</math>, <math>\phi 0.16''(\phi 4)</math>, <math>2.60''(66)</math>, <math>10''(2.5)</math>, <math>\phi 0.47''(\phi 12)</math></p>	 <p>Compatible with CMM styli with M2 threaded shank</p> <p>M2 depth 5</p> <p>Dimensions: <math>1.67''(42.5)</math>, <math>\phi 0.16''(\phi 4)</math>, <math>2.20''(56)</math></p>	 <p>Compatible with CMM styli with M2 threaded shank</p> <p>Dimensions: <math>2.07''(52.5)</math>, <math>\phi 0.16''(\phi 4)</math>, <math>2.66''(66)</math>, <math>2.70''(68.5)</math>, <math>14''(3.5)</math></p>

\*  $\square$  portion shows stylus except for the cranked stylus and stylus for flat surface.  
 \* [ ] dimension shows a distance from the tip end of stylus or the center of tip ball to the connecting surface of detector.  
 \* Customized special interchangeable styli are available on request. Please contact any Mitutoyo office for more information.



### Centering chuck (knurled ring operated)

Provides good operability when measuring a small-diameter workpiece. The knurled ring allows the workpiece to be clamped easily.



<b>Order No.</b>	<b>211-032</b>
Holding range	OD with internal jaws 11–36 mm ID with internal jaws 16–69 mm OD with internal jaws 25–79 mm
External size (D x H)	ø 4.65" x 1.6" (118 x 41 mm)
Mass	2.6 lbs (1.2 kg)

### Three-jaw chuck (key operated)

Useful where it is necessary to apply a higher clamping force to the workpiece than can be applied with the centering chuck.



<b>Order No.</b>	<b>211-014</b>
Holding range	OD with internal jaws 12–26 mm ID with internal jaws 25–68 mm OD with internal jaws 35–78 mm
External size (D x H)	ø 6.18" x 2.78" (157 x 70.6 mm)
Mass	8.4 lbs (3.8 kg)

### Microchuck

For clamping a small workpiece, 1 mm or less in diameter, that cannot be held in the centering chuck.



<b>Order No.</b>	<b>211-031</b>
Holding range	OD: up to 1.5 mm
External size (D x H)	ø4.65" x 1.9" (118 x 48.5 mm)
Mass	1.32 lbs (0.6 kg)

### Collet chuck

Provides high clamping repeatability due to the use of optional precision collets. (See table at right.)



<b>Order No.</b>	<b>211-051</b>
Part holding range	ø0.5–10 mm* <sup>2</sup>
Centering error	Within 50 μm* <sup>3</sup>
Mass	3 lbs (1.4 kg)

\*<sup>2</sup>: Collets to match the workpiece size range are required for use with this chuck.

\*<sup>3</sup>: When measured with ø5 mm pin gauge at measuring height of 30 mm.

### SD scale for Z axis\*

Scale unit for accurate positioning of the slider in the Z-axis direction (ABS scale used).



<b>Order No.</b>	<b>12AAH433</b>
Mass	.99 lbs (450g)

\* Shipped out attached to the RA-10 machine, or will be installed on site by Mitutoyo service personnel.

### X-axis stop

Allows the user to return the detector rapidly and easily to a fixed position in the X axis.



<b>Order No.</b>	<b>12AAH320</b>
Mass	.14 lbs (65 g)

### Individual collets\*<sup>4</sup>

These collets are for use with the collet chuck shown at left and are acquired to match the workpiece diameter range required.

Order No.	Part Holding Range (O.D.)
12AAH402	ø0.02" – 0.04" (0.5–1.0mm)
12AAH403	ø0.04" – 0.06" (1.0–1.5mm)
12AAH404	ø0.06" – 0.08" (1.5–2.0mm)
12AAH405	ø0.08" – 0.1" (2.0–2.5mm)
12AAH406	ø0.1" – 0.12" (2.5–3.0mm)
12AAH407	ø0.12" – 0.138" (3.0–3.5mm)
12AAH408	ø0.138" – 0.157" (3.5–4.0mm)
12AAH409	ø0.157" – 0.197" (4.0–5.0mm)
12AAH410	ø0.197" – 0.236" (5.0–6.0mm)
12AAH411	ø0.236" – 0.275" (6.0–7.0mm)
12AAH412	ø0.275" – 0.315" (7.0–8.0mm)
12AAH413	ø0.315" – 0.354" (8.0–9.0mm)
12AAH414	ø0.354" – 0.394" (9.0–10.0mm)

\*<sup>4</sup>: A collet cannot be mounted on the rotary table without a collet chuck.

\*<sup>4</sup>: YCC10-\*\* Class AA, made by Yukiwa Seiko Inc. or its equivalent.

### Auxiliary stage for a short workpiece

Order No. 356038



### Reference hemisphere

Order No. 211-016



### Magnification checking gage

Order No. 211-045

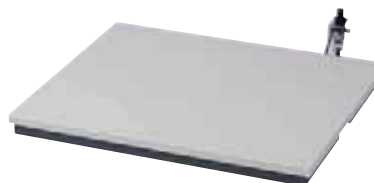


### Gage block set for calibration

Order No. 997090



### Vibration-damping stand



<b>Order No.</b>	<b>950-990</b>
Vibration damping system	Pneumatic type w/ self-leveling
External size	25" x 20" x 2" 610 x 508 x 51mm
Max. loading mass	175 lbs (80 kg)

# Specifications

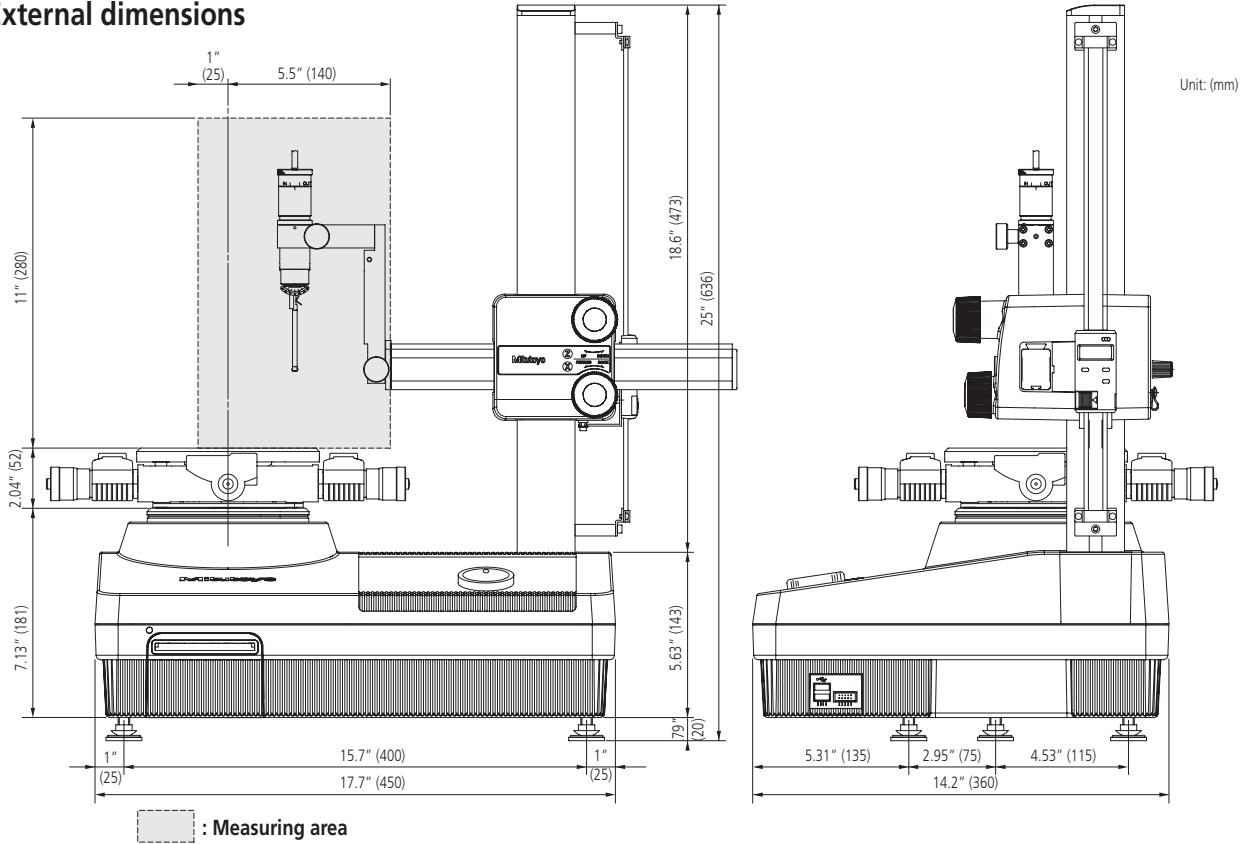
## Main unit

Model		RA-120		RA-120P		
Order No.*		211-621A	211-623A	211-625A	211-627A	
Turntable	Rotational accuracy	Radial	(0.04+6H/10000)μm H: Probing height (mm) JISB7451-1997			
		Axial	(0.04+6X/10000)μm X: Probing radius (mm)			
	Rotation speed	6rpm				
	Effective table diameter	ø6" (150mm)				
	Centering range adjustment	±.118" (3mm)				
	Leveling range adjustment	±1°				
	Centering/leveling device (micrometer head)	Mechanical head	Digital head (inch/mm)	Mechanical head	Digital head (inch/mm)	
	Maximum probing diameter	±11" (280mm) (±15" (380mm) in a reverse and vertical detector position)				
	Maximum workpiece diameter	17.32" (440mm)				
Maximum turntable loading	55 lbs (25kg)					
Vertical column (Z-axis)	Vertical travel	11.02" (280mm) from the turntable top				
	Maximum probing height	280mm from the turntable top (18.9" (480mm) in the reverse and vertical detector configuration)				
	Maximum probing depth	3.94" (100mm) [(minimum ID: ø1.12" (30mm)]				
Horizontal arm (X-axis)	Horizontal travel	6.5" (165mm) (Including a protrusion of 1" (25mm) from the turntable rotation center)				
Detector	Measuring direction	Two directional (IN/OUT switchable)				
	Measuring range	±1000μm				
	Measuring force	70 to 100mN (±30%)				
	Standard stylus ( <b>12AAB681</b> )	Carbide ball, ø1.6mm (.06")				
Electronic unit	Measuring range	±1000 ±500 ±200 ±100 ±50 ±20 ±10 ±5μm (8 steps)				
	Magnification	X5 to X200,000		X1 to X500,000		
	Filter type	Phase corrected: Gaussian, 2CRPC75, 2CRPC50		Not phase corrected: 2CR75, 2CR50 Filter OFF		
	Cutoff value	15upr, 50upr, 150upr, 500upr 15-150upr, 15-500upr, 50-500upr		15upr, 50upr, 150upr, 500upr, Manual 15-150upr, 15-500upr, 50-500upr, Manual		
	Number of measuring sections	Maximum 5		Maximum 100		
	Evaluation type	Roundness, coaxiality, concentricity, flatness, circular run-out (radial/axial), squareness (relative to axis/plane), thickness deviation, parallelism				
	Reference circle for evaluation	LSC, MZC, MIC, MCC				
	Adjusting centering/leveling	D.A..T function (circular/multi-point switchable)				
	Functions	Notched measurement, re-calculation, limaçon error correction, continuous ID and OD measurement		Notched measurement, re-calculation, limaçon error correction, remarkable point analysis (gear), harmonic analysis, continuous ID and OD measurement		
	Printer	Thermal line printer (external printer port available)		Windows compatible ink-jet printer		
	Data output	USB stick memory	Calculation result, measurement data			
		RS-232C	Calculation result, measurement data			
		SPC	Calculation result			
Others	Power supply	AC 100 – 240V				
	Power consumption	40W		30W (excluding PC system)		
	Air pressure	390kPa				
	Air consumption	30L/min (minimum)				
	Mass	Main unit: 70.5 lbs (32kg) Air filter: 4.4 lbs (2kg)				

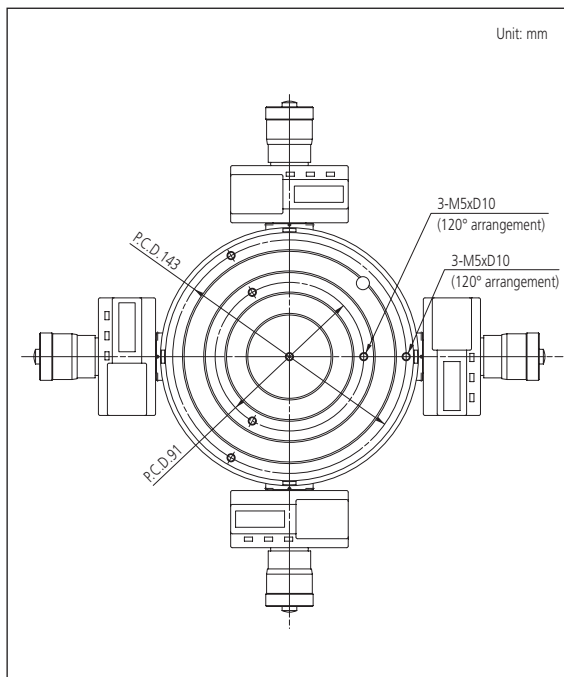
Optional replacement elements for the air filter: **358592** (for filter), **358593** (filter regulator)

# Dimensions

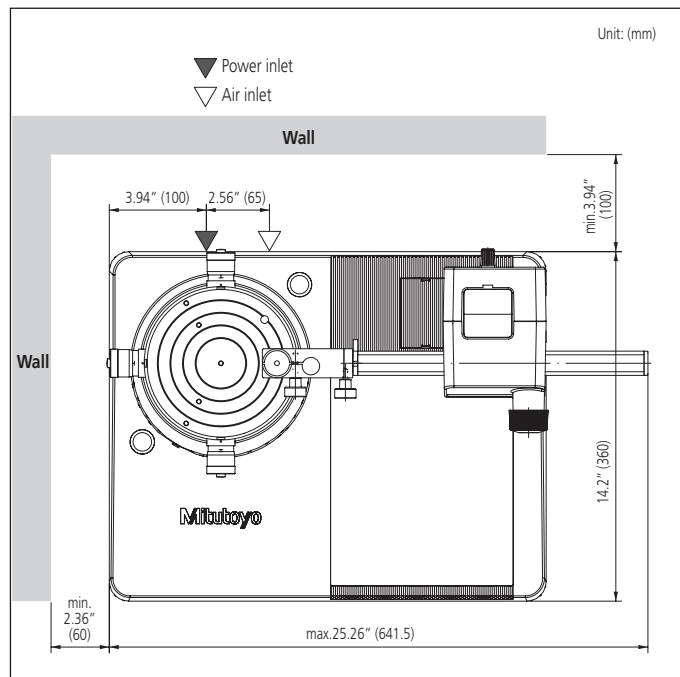
## External dimensions



## Turntable top view



## Installation floor plan





- Coordinate Measuring Machines
- Vision Measuring Systems
- Form Measurement
- Optical Measuring
- Sensor Systems
- Testing Equipment and Seismometer
- Digital Scale and DRO Systems
- Small Tool Instruments and Data Management

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