

## Roundness/Cylindricity Measuring System ROUNDTTEST RA-1600



# Powerful Analysis Performance in a Compact Form

## ROUNDTTEST RA-1600

# High-level functions promote greater efficiency

**Can measure a wide variety of workpieces**

- Realizes a wide measuring range in a compact form
- Max. probing diameter: 280 mm
- Vertical travel: 300 mm
- Max. table loading: 25 kg

**Multi-functional analysis system**

- Incorporates flexible data analysis software ROUNDPAK
- Measurement results displayed in a graphics window
- Easy to operate thanks to a simplified measurement mode
- Can simulate a part program

**High accuracy**

- Compact, but with top-end precision
- Rotational accuracy (Radial):  $(0.02+6H/10000) \mu\text{m}$
- Rotational accuracy (Axial):  $(0.02+6X/10000) \mu\text{m}$
- Accuracy assurance: Z axis (Straightness, Parallelism), X axis (Straightness, Squareness)

**High Functionality**

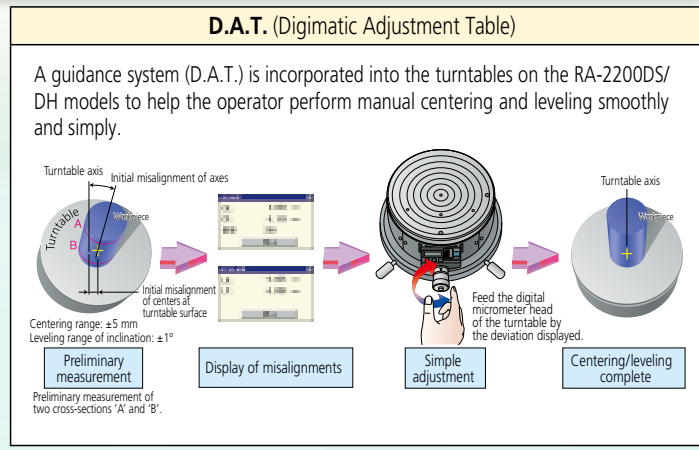
- Includes a detector to prevent damaging collisions in the z axis
- High-precision power column unit can evaluate straightness as well as cylindricity
- Equipped with D.A.T. mechanism to boost measurement efficiency
- Includes a remote control box for easy operation



### Equipped with a highly accurate turntable that enables simple and accurate centering and leveling of the workpiece

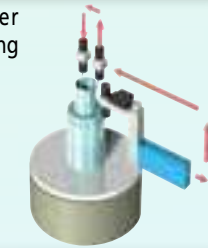
The table provides high rotational accuracy (radial  $0.02+6H / 10000 \mu\text{m}$ ; axial  $0.02+6X/10000 \mu\text{m}$ ), enabling the system to measure flatness and other characteristics, in addition to roundness/cylindricity, at a level that suits any application. The RA-1600 has also inherited the D.A.T. (Digital Adjustment Table) mechanism used in top-end devices to make workpiece centering and leveling quick and easy. The operator simply has to manipulate the digital micrometer heads of the turntable to match the adjustment values displayed on the monitor. Even notched workpieces can be measured accurately. Centering and leveling operations carried out by using the D.A.T.\* can also be incorporated into the measurement procedure (part program). This prevents human errors when performing centering and leveling, and helps standardize measurement operations executed by the part program.

\*Centering and leveling is a manual process guided by the display.



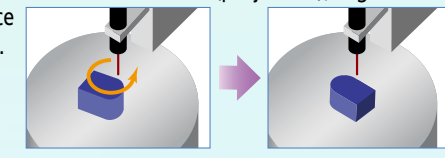
### Continuous OD/ID measurement function

Continuous internal/external diameter measurement is possible without changing the detector position.



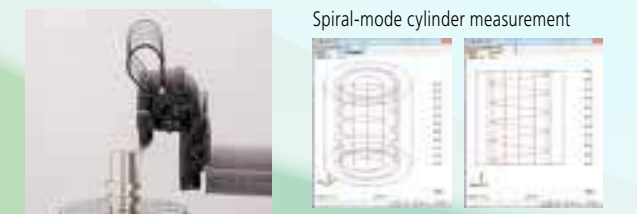
### Partial circle measurement function

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.



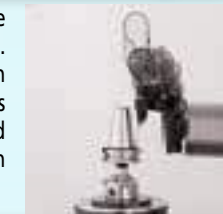
### Spiral Measurement/Analysis

The spiral-mode measurement function combines table rotation and rectilinear action allowing cylindricity, coaxiality, and other measurement data to be loaded as a continuous data set.



### 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 detector, and X-axis motion is necessary to maintain contact with the workpiece surface.



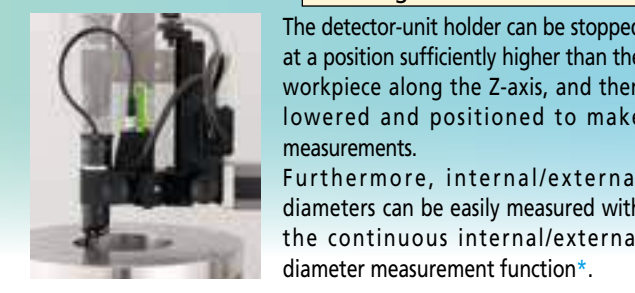
### Safety mechanism provided as a standard feature

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 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.



### Sliding detector-unit holder (Option)

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.



\* See this page for details about the continuous ID and OD measuring function.



# Roundness/Cylindricity measurement/Analysis software

## ROUNDPAK

ROUNDPAK provides simple manipulation using a mouse and icons

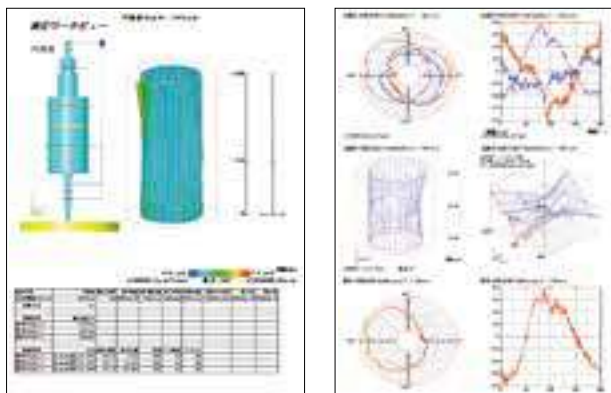
### Simple operations even with a full set of parameters and analysis functions

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.



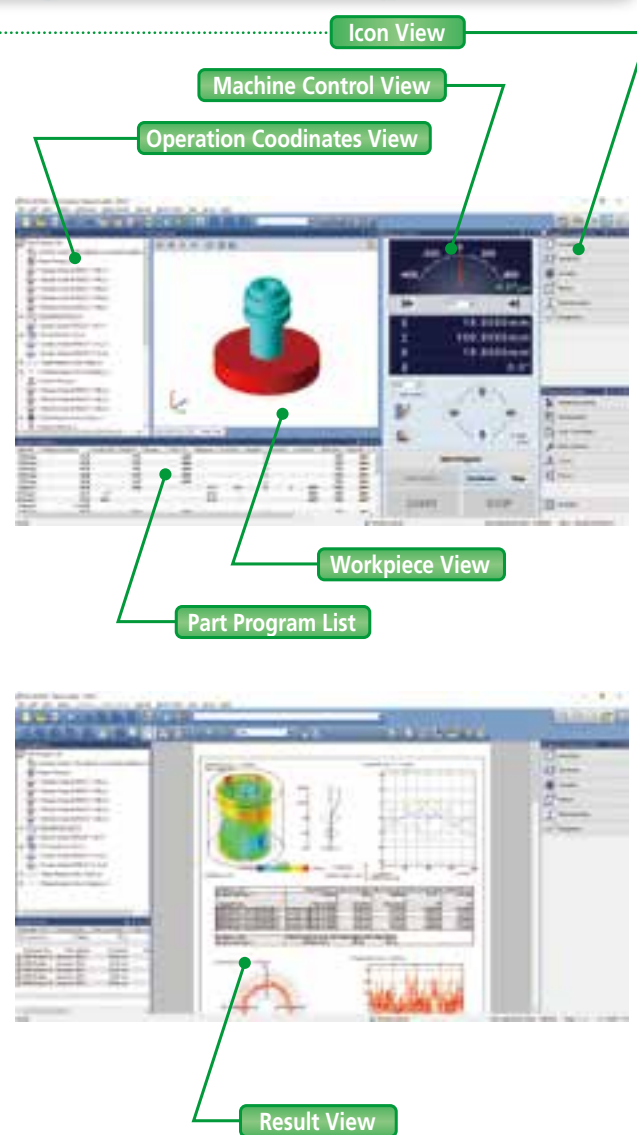
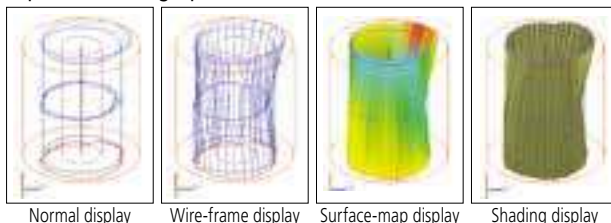
### Freedom in laying out the graphics and data obtained from measurements

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.

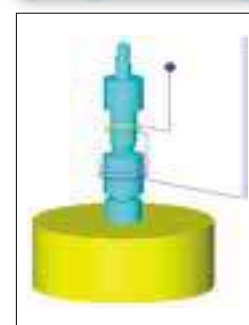


### A wide variety of graphics functions

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



### 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.

## Optional Accessories

### Styli for RA-1600 (Option)

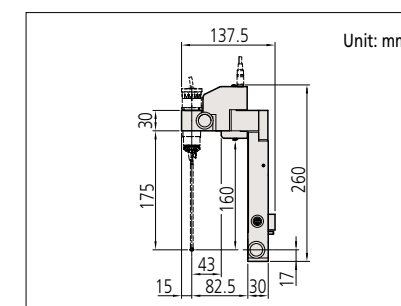
Type	Standard (Standard accessory)	Notch	Deep groove	Corner	Cutter mark
Order No.	12AAL021	12AAL022	12AAL023	12AAL024	12AAL025
Stylus tip	ø 1.6 mm tungsten carbide	ø 3 mm tungsten carbide	SR0.25 mm sapphire	SR0.25 mm sapphire	tungsten carbide
Dimensions (mm)					
Type	Small hole (ø 0.8)	Small hole (ø 1.0)	Small hole (ø 1.6)	Extra small hole (Depth 3 mm)	ø 1.6 mm ball
Order No.	12AAL026	12AAL027	12AAL028	12AAL029	12AAL030
Stylus tip	ø 0.8 mm tungsten carbide	ø 1 mm tungsten carbide	ø 1.6 mm tungsten carbide	ø 0.5 mm tungsten carbide	ø 1.6 mm tungsten carbide
Dimensions (mm)					
Type	Disk	Crank (ø 0.5)	Crank (ø 1.0)	Flat surface	2X-long type *1
Order No.	12AAL031	12AAL032	12AAL033	12AAL034	12AAL035
Stylus tip	ø 1.2 mm tungsten carbide	ø 0.5 mm tungsten carbide (Depth 2.5 mm)	ø 1 mm tungsten carbide (Depth 5.5 mm)	tungsten carbide	ø 1.6 mm tungsten carbide
Dimensions (mm)					
Type	2X-long type notch *1	2X-long type deep groove *1	2X-long type corner *1	2X-long type cutter mark *1	2X-long type Small hole *1
Order No.	12AAL036	12AAL037	12AAL038	12AAL039	12AAL040
Stylus tip	ø 3 mm tungsten carbide	SR0.25 mm sapphire	SR0.25 mm sapphire	tungsten carbide	ø 1 mm tungsten carbide
Dimensions (mm)					
Type	3X-long type *1	3X-long type deep groove *1	Stylus shank	Stylus shank(standard groove)	Stylus shank(2X-long groove)*1
Order No.	12AAL041	12AAL042	12AAL043	12AAL044	12AAL045
Stylus tip	ø 1.6 mm tungsten carbide	SR0.25 mm sapphire	For mounting CMM stylus (mounting thread M2)	For mounting CMM stylus (mounting thread M2)	For mounting CMM stylus (mounting thread M2)
Dimensions (mm)					

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

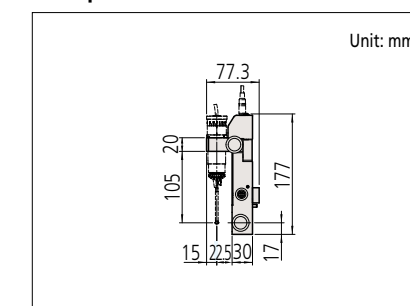
\*2: Customized special interchangeable styli are available on request. Please contact any Mitutoyo office for more information.

### Detector holders

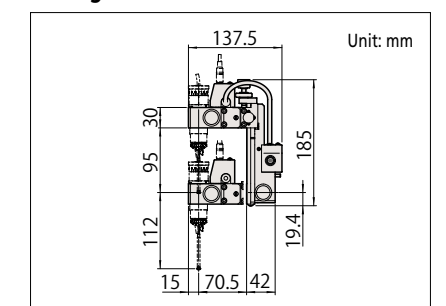
2X extension holder: 12AAF203



Auxiliary holder for a large-diameter workpiece: 12AAF204



Sliding detector holder: 12AAL090



# Optional Accessories



### Centering chuck (key operated)

**211-014**

Suitable for holding longer parts and those requiring a relatively powerful clamp.

- Holding capacity: Internal jaws: OD =  $\phi 2$  -  $\phi 35$  mm, ID =  $\phi 25$  -  $\phi 68$  mm External jaws: OD =  $\phi 35$  -  $\phi 78$  mm
- External dimensions (DxH):  $\phi 157 \times 70.6$  mm
- Mass: 3.8 kg



### Centering chuck (ring operated)

**211-032**

Suitable for holding small parts with easy-to-operate knurled-ring clamping.

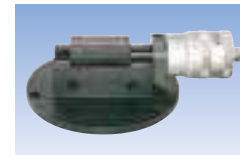
- Holding capacity: Internal jaws: OD =  $\phi 1$  -  $\phi 36$  mm, ID =  $\phi 16$  -  $\phi 69$  mm External jaws: OD =  $\phi 25$  -  $\phi 79$  mm
- External dimensions (DxH):  $\phi 118 \times 41$  mm
- Mass: 1.2 kg



### Micro-chuck 211-031

Used for clamping a workpiece (less than  $\phi 1$  mm dia.) that the centering chuck cannot handle.

- Holding capacity:  $\phi 0.2$  -  $\phi 1.5$  mm
- External dimensions (DxH):  $\phi 107 \times 48.5$  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  $\mu$ m
- Graduation: 0.2  $\mu$ m
- External dimensions (WxDxH): 235 (max) x 185 x 70 mm
- Mass: 4 kg

### Cylindrical square 350850

- Straightness: 1  $\mu$ m
- Cylindricity: 2  $\mu$ m
- External dimensions (DxH):  $\phi 70 \times 250$  mm
- Mass: 7.5 kg

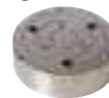
### Optical flat and gage block set 997090



### Reference hemisphere 211-016\*



### Auxiliary stage 356038



\* Standard accessory for RA-1600

## Vibration isolator

When measuring roundness and cylindricity, the measurement results can be significantly affected by environmental disturbances such as vibration. To prevent this, we invite you to choose either a desktop-type or desk-type vibration isolator which is to be used in combination with a monitor arm and a side table.

### Desktop type\*

**178-025**



\*Measuring unit and controller not included.

### Desk type

- Vibration isolator (integrated stand and air suspension system) **178-188**
- Monitor arm **12AAK120**\*1
- Side table **178-181**\*1



Example combination\*2: with a monitor arm but no side table\*3

Example combination\*2: with a side table but no monitor arm Side table\*1 **178-181**

\*1: Used together with vibration isolator (**178-188**)

\*2: Measuring unit, controller and analysis system not included.

\*3: User to provide a printer rack.

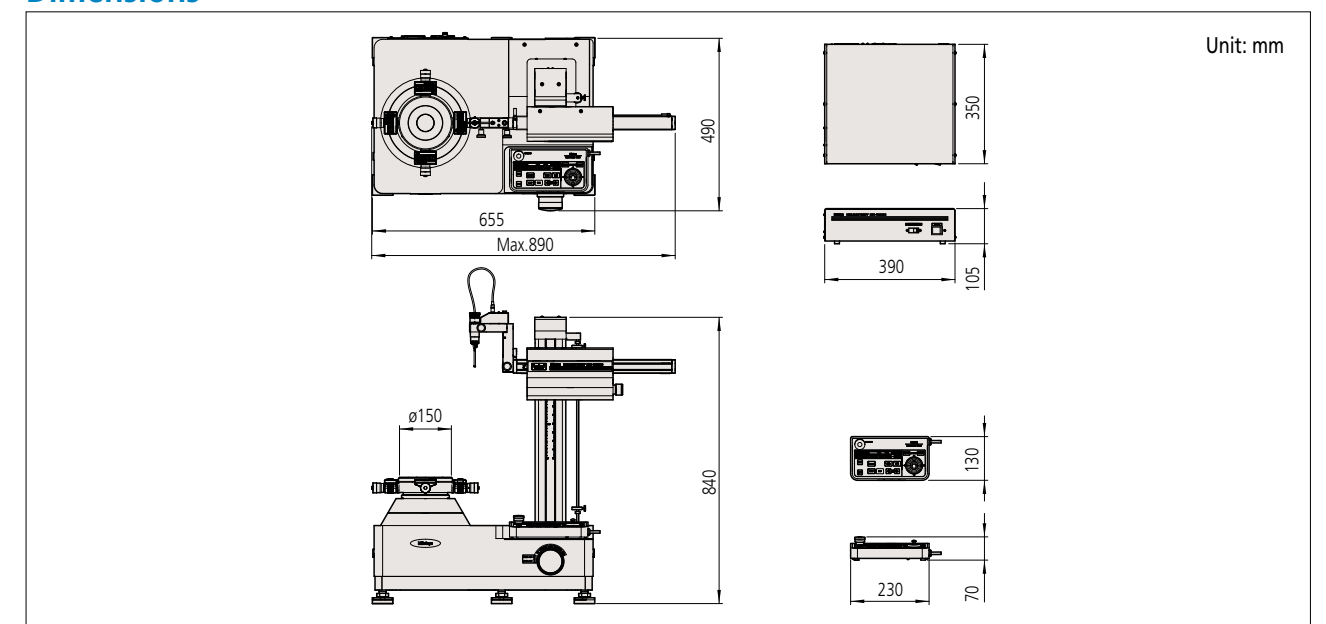
# Specifications

## Specifications

Model No.		RA-1600	
Turntable unit	Rotational accuracy	Radial direction	(0.02+6H / 10000) $\mu$ m H: Probing height (mm) JIS B7451-1997
		Axial direction	(0.02+6X / 10000) $\mu$ m X: Distance from the center of rotation (mm)
	Rotational speed	4, 6, 10 rpm	
	Table diameter	$\phi 150$ mm	
	Centering / leveling adjustment	D.A.T.	
	Centering adjustment range	$\pm 3$ mm	
	Leveling adjustment range	$\pm 1^\circ$	
	Maximum loading	25 kg	
	Maximum probing diameter	$\phi 280$ mm	
	Maximum workpiece diameter	$\phi 560$ mm	
Vertical drive unit (Z-axis column unit)	Straightness of drive	Narrow range	0.20 $\mu$ m / 100 mm
		Wide range	0.30 $\mu$ m / 300 mm
	Parallelism with turntable axis	1.5 $\mu$ m / 300 mm	
	Traverse speed	Max. 15 mm/s (Measurement: 0.5, 1, 2, 5 mm/s)	
Radial drive unit (X-axis arm unit)	Maximum probing height (ID / OD)	300 mm <sup>1</sup>	
	Maximum probing depth	over $\phi 32$	91 mm (with standard stylus)
		over $\phi 7$	50 mm (with standard stylus)
Detector	Straightness of drive	2.7 $\mu$ m / 140 mm	
		Perpendicularity to turntable axis 1.6 $\mu$ m / 140 mm	
	Measuring force	165 mm (From table axis -25 mm ~ +140 mm)	
		Max. 8 mm/s (measurement: 0.5, 1, 2, 5 mm/s)	
Other	Measuring range	Standard	10 ~ 50 mN (5 level switching) (ID/OD measuring position with standard stylus)
	Tracking	$\pm 400 \mu$ m / $\pm 40 \mu$ m / $\pm 4 \mu$ m	
		$\pm 5$ mm	
Tip shape, material	$\phi 1.6$ mm tungsten carbide		
Other	IN/OUT one-touch switching, Stylus angle scale markings ( $\pm 45^\circ$ ), Z-axis collision detection function		
Other	Power supply	100 V ~ 240 V	
	Power consumption	80 W	
	Air pressure	0.39 MPa	
	Air consumption	22 L/min (standard state)	
Mass of main unit (NET)	170 kg		

\*1: Use an optional auxiliary stage for measuring a workpiece whose height is 20 mm or less.

## Dimensions



Unit: mm



### 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.



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