

## Compact Roundness Measurement ROUNDTTEST RA-10



# We have a reason for proposing you introduce roundness measuring machines to your business.

Verification of geometrical tolerances, including roundness, is a must in today's quality-conscious environment.

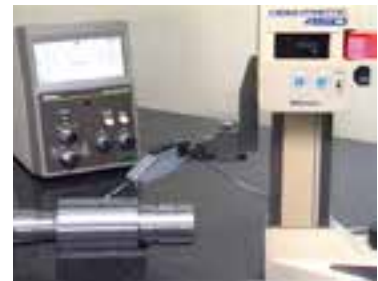
Roundness measuring machines with the ability to perform product verification in conformity with ISO, JIS and other standards are indispensable to any quality control system that aspires to implementing high-grade quality assurance. Heightened awareness of production quality and higher quality goods will help enhance your corporate image with the buying public.

## Roundness verification attempted using basic measuring tools involves the following drawbacks:

- Measurement is not conducted by a radius method conforming to the standards, for which a reference axis is necessary.
- Measurement verification that meets the accuracy required by the drawings cannot be performed.
- Recorded profiles cannot be obtained.



Diameter measurement using a micrometer cannot detect an odd-number lobing condition and resolution is marginal.



Three-point method using an indicator and V-block has better resolution but is not sensitive to common lobing conditions.

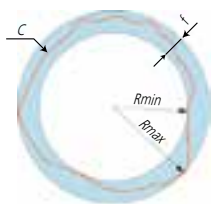


## Once roundness measuring machines are introduced into quality control:

- Reduction of nonconforming parts will translate into lower overall cost of manufacture.
- Product quality will improve and the time-to-market for new product will be reduced.
- Corporate image will be enhanced.

### Definition of Roundness

Roundness of a profile or contour (C) is the difference in radius (f) of two concentric circles that enclose C when the separation of these circles is a minimum, and is indicated as 'roundness xx mm' or 'roundness xx μm'.



# High-Precision Roundness Measurement

## Simple, beginner-friendly operation

- The key layout is large and simple so is easy to view and easy to understand.
- One-shot setup recall function: Complex setups are stored in advance, ready for recall when required by one-key operation.
- Zero-setting function: The detector's level can be set to zero (0) with one single key press. This relieves the user from the chore of meticulously positioning the detector.
- The operation handles for vertical direction (Z axis) and radial direction (X axis) adjustments have been positioned on the slider for best operability.
- Because setups can only be altered in administrator mode, the machine operator can be prevented from inadvertently changing settings.

## High accuracy even though a low-end machine

Despite being a low-priced model, the turntable with air bearings offers rotational accuracy as high as  $(0.04+6 H/10000) \mu\text{m}$ , thus assuring a precision that compares well to that of high-end models.

## Large LCD panel displays measurement results and recorded profiles in an easy-to-view fashion

## The built-in high-grade thermal printer prints out measurement results and recorded profiles on demand

## Compact design means small installation space

The machine calls for only a small installation space as its compact body integrates the measuring unit, electronics and printer.

## Options that further enhance usability

Use of a part setting jig exactly fitting the object being measured eliminates the need for the centering and leveling adjustments which would otherwise be required prior to measurement. An X-axis stop in the radial direction allows the detector to be positioned easily according to the object to be measured, eliminating the task of fine positioning when measurement is repeated.

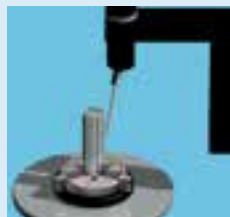
\* For details on the options, see pages 3 and 8.



## Four easy steps to measurement



**Clamp the workpiece to the jig.**



**Bring the detector into contact with the workpiece.**

\*Combined use of the zero-setting function and X-axis stop (Optional) will result in securing even higher efficiency when identical workpieces are measured repetitively.



**Press the [CONDITION (setup recall)] button, as needed.**

\*If measurement is always conducted using the last setup, there is no need to recall this because the machine always starts up with the same settings that were effective immediately before the machine was powered down last time.



**Press the [START] button.**

# Main Measuring Unit

## Detector

Allows simple positioning of the workpiece due to its wide measuring range of  $\pm 1000 \mu\text{m}$ .

## Part setting jig (Optional)

Can be selected to best suit the workpiece, which can be clamped/released in a single action. High re-gripping accuracy eliminates the need for centering and leveling.

## High-precision air bearings

The highest accuracy in its class,  $(0.04+6H/10000) \mu\text{m}$ , has been achieved.

## Built-in printer

Prints measurement results.



## Z-axis ABS scale (Optional)

When the ABS scale is fitted, positioning in the Z-axis (vertical) direction is performed with higher accuracy.

## Slider

Carries the manual operation knobs positioned together for convenient X- and Z-axis stylus position adjustment.

## Large LCD panel

Clearly displays measurement results and recorded profiles.

## Simple operation panel

Large-sized buttons allow easy recall of stored measurement setups and help prevent input errors.

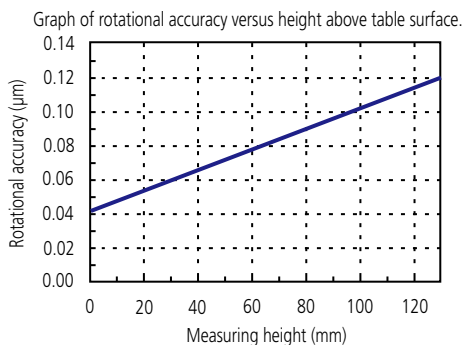
## Space-saving design

The compact body integrating the measuring unit, electronics and printer poses no problem in installing the machine.

## High-precision air bearings provide highly accurate measurement

Turntable axis stability is the most critical specification of a roundness measuring machine since this axis provides the datum from which the stylus deflection is measured for every type of analysis. For this reason the RA-10 is equipped with specially designed air bearings that assure high rotational accuracy to guarantee high-precision measurements.

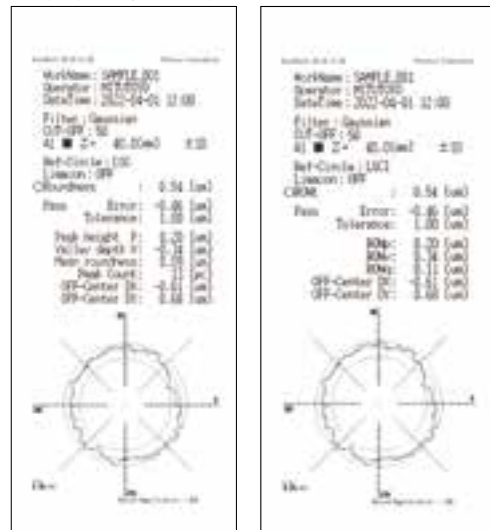
As these bearings are inherently non-contacting they are free of any degradation arising from normal use, so the machine retains high accuracy even when used for an extended period of time.



## Measurement results can be sent to the built-in printer or exported for external processing and storage

Measurement results and recorded profiles can be sent to the high-grade built-in thermal printer or exported via the SPC and RS-232C output functions or text file output function to USB memory.

Sample print by built-in printer



# Control Panel

## Measurement screen / Result screen switching

Switches between measurement screen and analysis result screen at one touch of a button.

## Printer control

While automatic print is available, setting can also be made to print desired results only, thus resulting in the saving of paper resources.

## Zero Set button

A potent tool for establishing optimum positioning of the detector.

## Setup button



## Supports 16 languages

Japanese, English, German, French, Italian, Spanish, Portuguese, Korean, Traditional Chinese, Simplified Chinese, Czech, Polish, Hungarian, Turkish, Swedish, Dutch

## Large LCD screen

Displays measurement results and recorded profiles in an easy-to-understand manner.

## Setup Recall

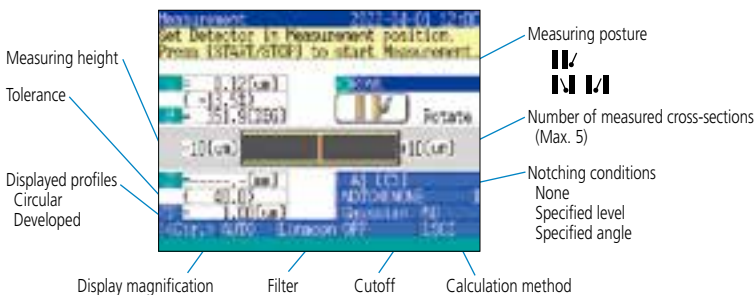
Frequently used measurement setups can be stored in advance, ready to be called up by one touch of a button.

## Setup definition

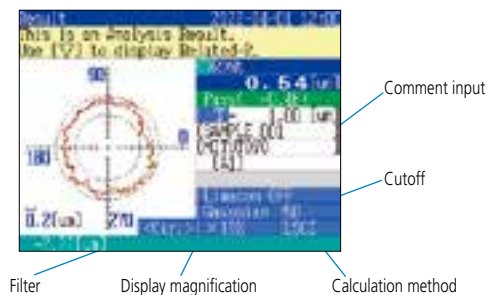
## Measuring range switching

## Simplified communication program for ROUNDTEST RA-10

The Roundtest RA-10 has a USB interface, enabling data to be transferred to a spreadsheet or other software.



Sample Measurement Screen



Sample Result Screen (Roundness)

## Useful functions help setting up prior to measurement

When a high-resolution range measurement is needed, for which accurate positioning is required, the Zero Set button allows the detector to be set at the optimum position. The machine delivers the measurement results for a workpiece after automatically correcting for eccentricity and inclination.

## Measurement data editing function

Any part of a profile that is not to be included in the calculation can be automatically excluded from the measurement data. Therefore notches in the profile can be ignored, or data produced by scratches can be deleted while observing recorded profiles on the screen.



## Limaçon function compensates for eccentricity

A displacement offset between the turntable axis and that of the part under measurement results in distortion of the measured form (limaçon error) and consequentially produces an error in the calculated roundness value. The larger the eccentricity, the larger is the error in calculated roundness.




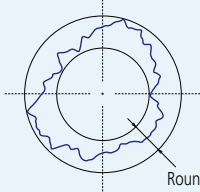


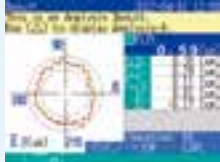
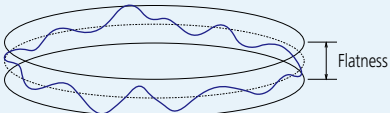

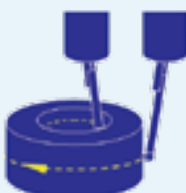

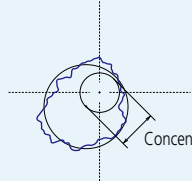

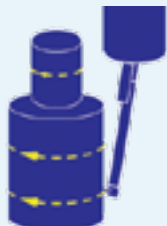

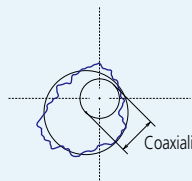



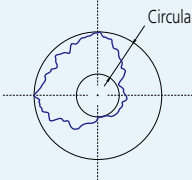
The RA-10 supports accurate measurement with a limaçon error correction function, which is provided to correct such errors arising from eccentricity.

### Notes:

1. The limaçon error correction is effective only when measuring a workpiece of larger diameter than that of the tip of the probe.
2. If the effect obtained with the limaçon error correction function is not sufficient, use the optional alignment table (to be purchased separately) to establish precise centering of the workpiece.



# Types of Analysis with the RA-10

Feature Characteristic	Characteristic Symbol	Measurement Method	Sample Result Screen	Explanation
Form	Roundness 			 Roundness (MZC) Roundness (MZC definition) of a profile is the difference in radius of two concentric circles that enclose the profile when the separation of these circles is a minimum.
	Flatness 			 Flatness Flatness of a profile is the distance between two planes enclosing the profile when this distance is a minimum.
Location	Concentricity 			 Concentricity Concentricity of a profile is twice the shortest distance between the center of the profile and the datum.
	Coaxiality 			 Coaxiality Coaxiality of the axis of a profiled surface is twice the shortest radial distance between the axis and the datum at the measured positions.
Runout	Circular runout (radial) 			 Circular runout Circular runout (radial) of a profile is the radial distance between two circles enclosing the profile and concentric with the datum when this distance is a minimum.

# Optional Accessories

## Interchangeable Styli

Unit: mm

<p><b>12AAL021</b> Standard stylus *Standard accessory (stylus tip: <math>\phi 1.6</math> carbide ball)</p> <p>For standard applications</p> <p>In ID measurement Dia.: <math>\geq 7.5</math> mm, Depth: <math>\leq 50</math> mm</p>	<p><b>12AAL022</b> Stylus for notched workpieces (stylus tip: <math>\phi 3</math> carbide ball)</p> <p>Useful for notched workpieces</p> <p>Example</p>	<p><b>12AAL023</b> Stylus for grooves (stylus tip: R0.25 sapphire)</p> <p>For stepped applications</p> <p>Example</p>	<p><b>12AAL024</b> Stylus for corners (stylus tip: R0.25 sapphire)</p> <p>For inside-corner applications</p> <p>Example</p>
<p><b>12AAL029</b> Stylus for extra small holes (stylus tip: <math>\phi 0.5</math> carbide ball)</p> <p>For extra small hole applications Dia.: <math>\geq 1</math> mm, Depth: <math>\leq 2.5</math> mm</p> <p>Enlarged image</p> <p><math>\phi 0.5</math> carbide ball</p>	<p><b>12AAL026</b> Stylus for small holes (stylus tip: <math>\phi 0.8</math> carbide ball)</p> <p>For small hole applications Dia.: <math>\geq 1.5</math> mm, Depth: <math>\leq 10</math> mm</p> <p>Enlarged image</p> <p><math>\phi 0.8</math> carbide ball</p>	<p><b>12AAL030</b> Stylus for small and deep holes (stylus tip: <math>\phi 1.6</math> carbide ball)</p> <p>For small and deep hole applications Dia.: <math>\geq 3</math> mm, Depth: <math>\leq 18</math> mm</p> <p>Enlarged image</p> <p><math>\phi 1.6</math> carbide ball</p>	<p><b>12AAL028</b> Stylus for small and deep holes (stylus tip: <math>\phi 1.6</math> carbide ball, L=40)</p> <p>For small and deep hole applications Dia.: <math>\geq 3</math> mm, Depth: <math>\leq 38</math> mm</p> <p>Enlarged image</p> <p><math>\phi 1.6</math> carbide ball</p>
<p><b>12AAL027</b> Stylus for small holes (stylus tip: <math>\phi 1</math> carbide ball)</p> <p>For small hole applications</p> <p>Example</p> <p><math>\phi 1</math> carbide ball</p>	<p><b>12AAL032</b> Cranked stylus (stylus tip: <math>\phi 0.5</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><b>12AAL033</b> Cranked stylus (stylus tip: <math>\phi 1</math> carbide ball)</p>	<p><b>12AAL034</b> Stylus for flat surface</p> <p>Example</p>
<p><b>12AAL025</b> Stylus for filtering asperities (machining marks)</p> <p>Filtering out the effects of asperities by tracing with R15 tipped stylus</p> <p>Example</p> <p>Machining marks</p>	<p><b>12AAL031</b> Disk stylus</p> <p>Example For narrow groove applications</p>	<p><b>12AAL043</b> M2 tapped shank for CMM styli</p> <p>Compatible with CMM styli with M2 threaded shank</p> <p>M2 depth 5</p>	<p><b>12AAL044</b> M2 tapped shank for CMM styli</p> <p>Compatible with CMM styli with M2 threaded shank</p> <p>M2 depth 3.5</p>

\* portion shows stylus except for the cranked stylus and stylus for flat surface.

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

# Optional Accessories

## Various Clamping Jigs

For direct mounting on the turntable

### Centering chuck

When measuring a small-sized workpiece, the chuck provides good operability and the knurled ring allows the workpiece to be clamped easily.



Order No.	211-052
Part holding range	O.D. (Internal jaws) 1–36 mm O.D. (External jaws) 25–79 mm I.D. (Internal jaws) 16–69 mm
Centering error	Within 150 μm*1
Mass	2.5 kg

\*1: When measured with ø10 mm pin gauge at measuring height of 30 mm.

### Collet chuck

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



Order No.	211-051
Part holding range	O.D. ø0.5–10 mm*2
Centering error	Within 50 μm*3
Mass	1.4 kg

\*2: Optional collets to match the workpiece size range are required.  
\*3: When measured with ø5 mm pin gauge at measuring height of 30 mm.

### Individual collets\*4

These collets are acquired to match the workpiece diameter range required.



Order No.	Part Holding Range (O.D.)
12AAH402	ø0.5–1.0 mm
12AAH403	ø1.0–1.5 mm
12AAH404	ø1.5–2.0 mm
12AAH405	ø2.0–2.5 mm
12AAH406	ø2.5–3.0 mm
12AAH407	ø3.0–3.5 mm
12AAH408	ø3.5–4.0 mm
12AAH409	ø4.0–5.0 mm
12AAH410	ø5.0–6.0 mm
12AAH411	ø6.0–7.0 mm
12AAH412	ø7.0–8.0 mm
12AAH413	ø8.0–9.0 mm
12AAH414	ø9.0–10.0 mm

\*4: A collet cannot be mounted on the turntable without a collet chuck.

### V-block jig A [Semi-custom product]

The cylindrical surface of the workpiece is held against the V-block and secured with the screw-type clamp. This is a semi-custom-made product (ø10 to ø100 mm) that is shipped out after adjusting the position of the V-block according to the workpiece size. This jig allows workpieces of the same size to be measured without having to center each one.



211-053: for ø50 mm

### V-block jig B [Semi-custom product]

The cylindrical surface of the workpiece is held against the V-block and secured with the screw-type clamp. This is a semi-custom-made product (ø10 to ø100 mm) that is shipped out after adjusting the position of the V-block according to the workpiece size. This jig allows workpieces of the same size to be measured without having to center each one.



211-054: for ø50 mm

### OD/ID mating jig [Semi-custom product]

These jigs are specially made to locate plain sections of a workpiece so that loading/unloading is very quick. Workpiece centering is automatically provided by just one initial centering operation on the jig, when first installed, so measurement can be started as soon as the jig is loaded with a workpiece. No clamping is used so the workpiece must be heavy enough to remain stable during measurement.

\*An OD/ID master mating part to match the workpiece diameter is required separately [(available to special order (max. ø30 mm)].



211-055: for ø10mm

### Alignment table

When installed on the turntable, this accessory enables the user to efficiently perform centering and leveling adjustments in synchronization with the adjustment Navi DAT.



Order No.	12AAH425	12AAH426
Centering adjustment range	±3 mm	±3 mm/.12"
Leveling adjustment range	±1 °	±1 °
Maximum loading	3 kg	3 kg
Mass	7 kg	7 kg

\*With mechanical micrometer head type (12AAH427) is available.

### Options that can be installed on the alignment table

#### Centering chuck (knurled ring operated)

When measuring a small-diameter workpiece, the chuck provides good operability and the knurled ring allows the workpiece to be clamped easily.



Order No.	211-032
Holding range	O.D. with internal jaws ø1–ø36 mm I.D. with internal jaws ø16–ø69 mm O.D. with internal jaws ø25–ø79 mm
External size (D x H)	ø118 x 41 mm
Mass	1.2 kg

#### Microchuck

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



Order No.	211-031
Holding range	O.D.: ø0.1–ø1.5 mm
External size (D x H)	ø107 x 48.5 mm
Mass	0.6 kg



• Other accessories

**X-axis stop**

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



<b>Order No.</b>	<b>12AAH320</b>
Mass	65 g

**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>12AAH318</b>
Mass	450 g

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

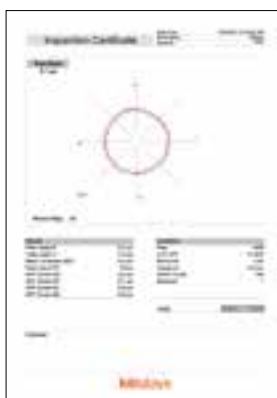
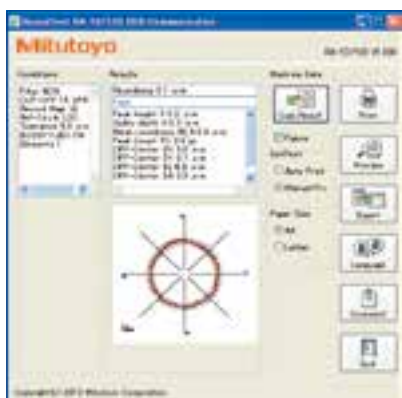
**Vibration damping stand**



<b>Order No.</b>	<b>211-013</b>
Vibration damping system	Diaphragm type air spring
External size	615 x 515 x 51 mm
Max. loading	150 kg

• Simplified communication program for ROUNDTEST RA-10

The Roundtest RA-10 has a USB interface, enabling data to be transferred to a spreadsheet or other software. We also provide a program that lets you create inspection record tables using a Microsoft Excel\* macro.



**Required environment:**

- OS: Windows XP-SP3  
Windows VISTA  
Windows 7 (32bit/64bit)  
Windows 10
  - Spreadsheet software: Microsoft Excel 2010, Microsoft Excel 2016
- Note: Windows OS and Microsoft Excel are products of Microsoft Corporation.

**The optional USB cable is also required.**

- USB cable for RA-10 series  
Order No. **12AAH490**  
Commercial item: Equivalent to USB Type A to B cable

This program can be downloaded for FREE from the Mitutoyo website.  
<https://www.mitutoyo.co.jp/eng/>

# Specifications

## Main unit

Model		RA-10
Turntable	Bearing type	Air bearing
	Rotational accuracy (radial)	(0.04+6H/10000) μm H: Probing height (mm) JISB7451-1997
	Rotational accuracy (axial)	(0.04+6X/10000) μm X: Distance from the center of rotation (mm)
	Rotation speed	6 rpm
	Table diameter	ø150 mm
	Maximum turntable loading	10 kg
	Maximum probing diameter	ø100 mm
Vertical column (Z axis)	Maximum workpiece diameter	ø320 mm
	Vertical travel	117 mm ·Bottom position: Approx 35 mm from the turntable top* <sup>2</sup> ·Top position: Approx. 152 mm* <sup>1</sup> from the turntable top* <sup>2</sup>
	Maximum probing height	152 mm from the turntable top
Horizontal arm (X axis)	Maximum probing depth	100 mm (minimum ID: ø30 mm) using the standard stylus
	Horizontal travel	-25 mm to 50 mm
Detector	Measuring force	100 mN (±30 %)
	Standard stylus ( <b>12AAL021</b> )	Stylus tip: ø1.6 mm carbide ball (Refer to page 7 for detailed information.)
	Measuring range	±1000 μm
	Measuring direction	Two directional (IN/OUT switchable)
Electronic unit	Measuring range	±1000 μm, ±100 μm, ±10 μm
	Magnification	×5, ×10, ×20, ×50, ×100, ×200, ×500, ×1,000, ×2,000, ×5,000, ×10,000, ×20,000, ×50,000, ×100,000, ×200,000
	Filter type	Phase corrected: 2CRPC75, 2CRPC50 Not phase corrected: 2CR75, 2CR50 Gaussion, filter OFF
	Cutoff value	15 upr, 50 upr, 150 upr, 500 upr 15-150 upr, 15-500 upr, 50-500 upr
	Number of measuring sections	1-section to 5-section: Roundness, Coaxiality, Flatness 1-section to 3-section: Circular runout (radial) 2-section: Concentricity
	Reference circle for evaluation	LSCI, MZCI, MICI, MCCI
	Evaluation capability	Roundness, Coaxiality, Concentricity, Flatness, Circular runout (radial)
	Data output	RS-232C I/F, SPC, USB stick memory
	Display	LCD 117.2 × 88.4 mm
	Printer	Thermal line printer, optional external printer
Others	Display languages	Japanese, English, German, French, Italian, Spanish, Portuguese, Korean, Traditional Chinese, Simplified Chinese, Czech, Polish, Hungarian, Turkish, Swedish, Dutch
	Power supply	AC100 to 240 V, 50/60 Hz
	Power consumption	32-36 W
	Air pressure	0.39 MPa
	Air consumption	30 L/min (minimum)
	Mass	26 kg

\*1: Top position will vary depending on any attachments installed.

\*2: No attachments installed.

## Standard accessories

Order No.	Name	Quantity
<b>350366</b>	Magnification adjusting film	2 pcs.
<b>611755-04</b>	Gauge block (35 mm, JIS Grade 2)	1 pc.
<b>11BAB941</b>	Level	1 pc.
<b>12AAL021</b>	Standard stylus	1 pc.
<b>12BAJ340</b>	Printer paper*	2 rolls
—	Receptacle	1 pc.
—	Hose band	1 pc.
—	Power cable	1 pc.
—	Leveling spanner	1 pc.
—	Phillips screwdriver	1 pc.
—	Key wrench 0.9, 2 and 4	1 pc. (0.9), 2 pcs. (2), 1 pc. (4)
—	Machine cover	1 pc.
—	User's manual	1 copy

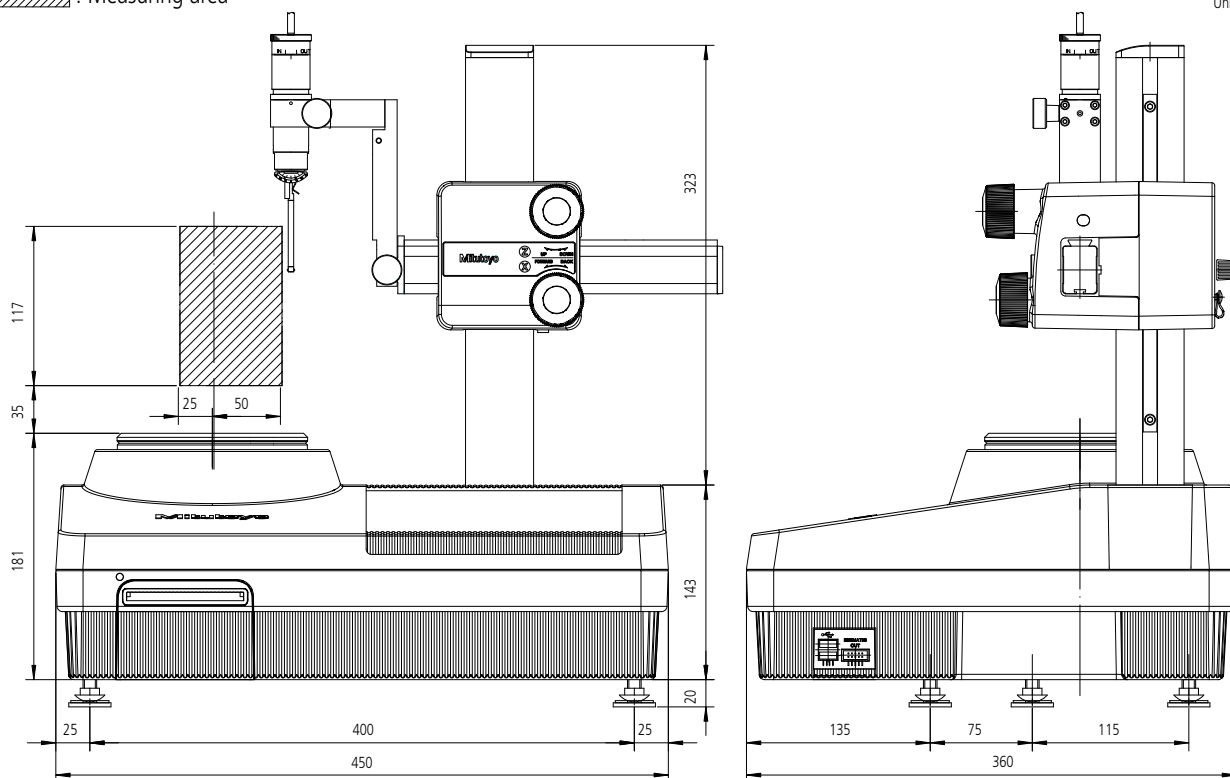
\*12AAH181: Optional printer paper set (10 rolls)

# Dimensions

## External dimensions

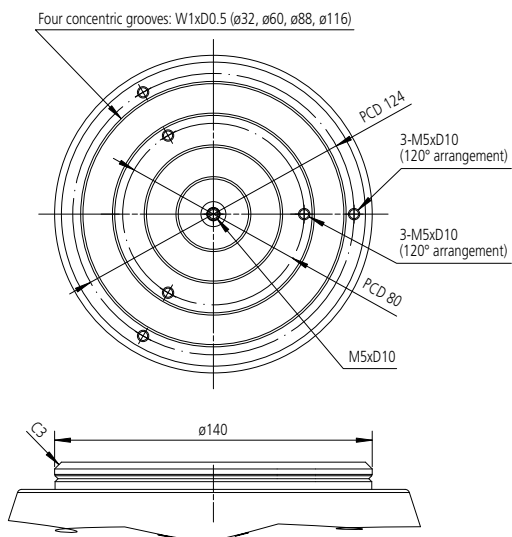
 : Measuring area

Unit: mm



## Turtable top view

Unit: mm

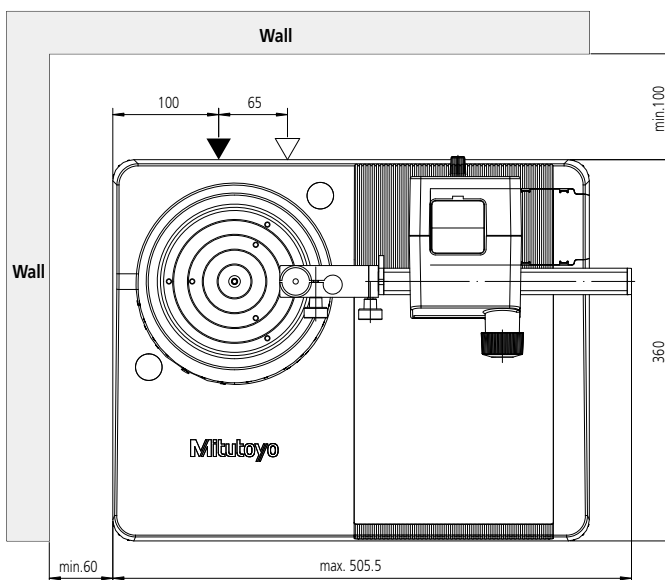


## Installation floor plan

▼: Power inlet

▽: Air inlet

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.



Find additional product literature and our product catalogue

<https://www.mitutoyo.co.jp/global.html>

**Our products are classified as regulated items under Japanese Foreign Exchange and Foreign Trade Law. Please consult us in advance if you wish to export our products to any other country. If the purchased product is exported, even though it is not a regulated item (Catch-All controls item), the customer service available for that product may be affected. If you have any questions, please consult your local Mitutoyo sales office.**

Note: Product illustrations are without obligation. Product descriptions, in particular any and all technical specifications, are only binding when explicitly agreed upon. MITUTOYO and MICAT are either registered trademarks or trademarks of Mitutoyo Corp. in Japan and/or other countries/regions. Other product, company and brand names mentioned herein are for identification purposes only and may be the trademarks of their respective holders.

# Mitutoyo

### Mitutoyo Corporation

20-1, Sakado 1-Chome,  
Takatsu-ku, Kawasaki-shi,  
Kanagawa 213-8533, Japan  
T +81 (0) 44 813-8230  
F +81 (0) 44 813-8231  
<https://www.mitutoyo.co.jp>