Mitutoyo

Compact Roundness Measurement
ROUNDTEST RA-10

FORM MEASUREMENT

PRE1410(3)

We have a compelling reason to introduce you the roundness measuring machines for your business.

The verification of geometrical tolerances, including roundness, is essential in today's quality-conscious environment.

Roundness measuring machines, equipped with the capability to perform product verification in accordance with ISO, JIS, and other standards, are indispensable for any quality control system aiming to achieve high-grade quality assurance. An increased focus on production quality and superior goods will contribute to enhancing your corporate image among the buying public.

Attempting roundness verification using basic measuring tools involves the following drawbacks:

- Measurement is not conducted using a radius method that conforms to the standards, which requires a reference axis.
- It is not possible to perform measurement verification that meets the accuracy requirements stated in the drawings.
- Obtaining recorded profiles is not possible

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

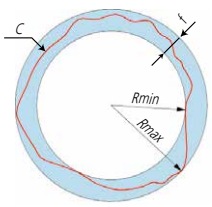
The three-point method, which utilizes an indicator and V-block, offers better resolution but is not sensitive to common lobing conditions.

Once roundness measuring machines are introduced into quality control:

- The reduction of nonconforming parts will lead to lower overall manufacturing costs.
- Product quality will improve, and the time-to-market for new products will be reduced.
- The corporate image will be enhanced.

Definition of Roundness

The roundness of a profile or contour (C) is defined as the difference in radius (f) between two concentric circles that enclose C when the separation of these circles is minimized. It 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, making it easy to view and understand.
- One-shot setup recall function: Complex setups are stored in advance, ready for recall with a single key operation.
- Zero-setting function: The detector's level can be easily set to zero (0) with a single key press, relieving the user from meticulous positioning.
- The operation handles for vertical direction (Z axis) and radial direction (X axis) adjustments are conveniently positioned on the slider for optimal operability.

High accuracy even though a low-end machine

Although being a low-priced model, the turntable with air bearings offers rotational accuracy as high as (0.04+6H/10000) µm, ensuring precision comparable to high-end models.

Large LCD Panel and built-in thermal printer:

- The large LCD panel displays measurement results and recorded profiles in an easy-to-view manner.
- The built-in thermal printer prints out measurement results and recorded profiles on demand.

Compact design means small installation space

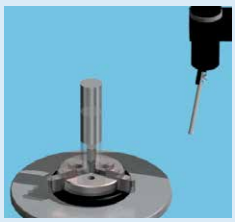
It's compact body integrates the measuring unit, electronics, and printer, requiring only a small installation space.

Options that further enhance usability

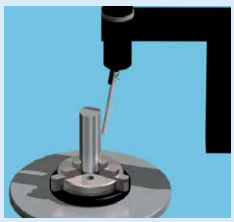
Use of a part setting jig exactly fitting the object being measured eliminates the need for the centering and leveling adjustments which would otherwise be required prior to measurement. An X-axis stop in the radial direction allows for easy positioning of the detector according to the object to be measured,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

* 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 even higher efficiency when measuring identical workpieces 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
Enables easy positioning of the workpiece with its wide measuring range of ±1000 µm.

Part setting jig (Optional)
Can be selected to best suit the workpiece, enabling clamping/releasing in a single action. High re-gripping accuracy eliminates the need for centering and leveling.

High-precision air bearings
Achieves the highest accuracy (0.04+6H/10000) µm.

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 conveniently positioned for X- and Z-axis stylus position adjustment.

Large LCD panel
Clearly displays measurement results and recorded profiles.

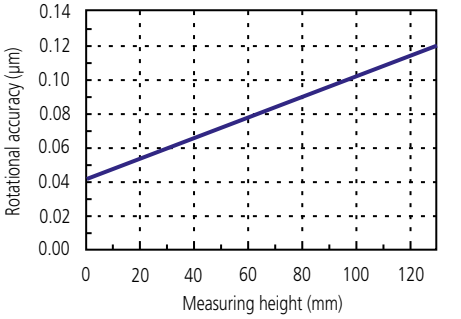
Simple operation panel
Large-sized buttons allow easy recall of stored measurement setups and help prevent input errors.

Space-saving design
The compact body integrates the measuring unit, electronics, and printer, making installation hassle-free.

High-precision air bearings highly accurate measurement

Turntable axis stability is the most critical specification of a roundness measuring machine, as this axis serves as the reference for measuring stylus deflection in all types of analysis. To ensure high-precision measurements, the RA-10 is equipped with specially designed air bearings that provide exceptional rotational accuracy. These air bearings are inherently non-contacting, eliminating any degradation commonly associated with regular use. As a result, the machine maintains high accuracy even when used continuously over an extended period of time.

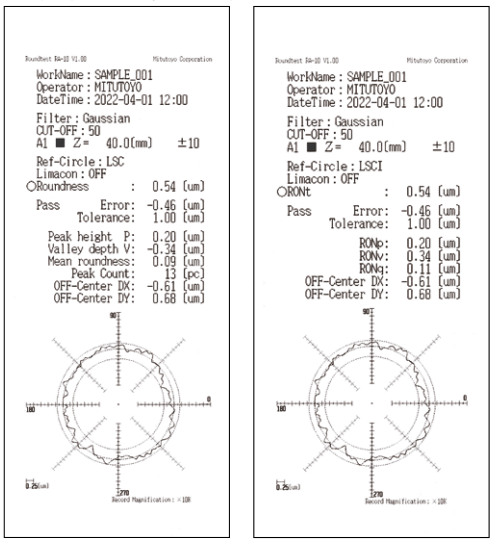
Graph of rotational accuracy versus height above table surface.



Measurement results can be printed or exported for external processing and storage

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

Sample printout 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.

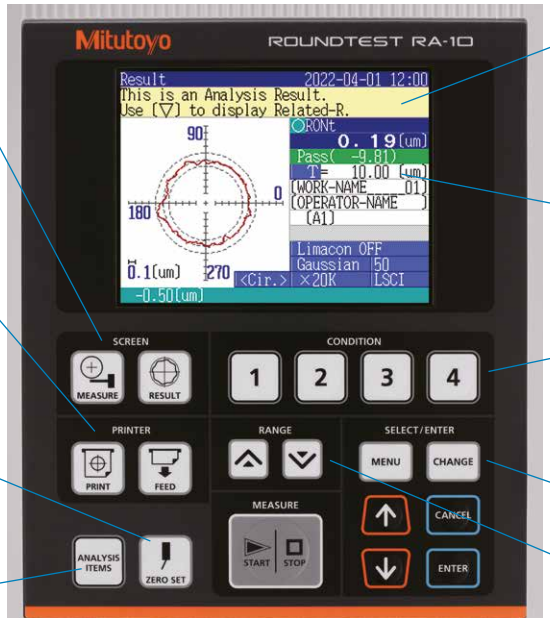
Printer control

While automatic printing is available, settings can also be adjusted to print only the desired results, thus, saving paper.

Zero Set button

A potent tool for establishing optimal 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

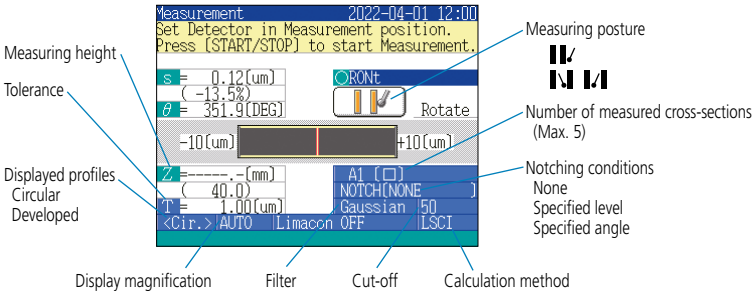
Frequently used measurement setups can be stored in advance, ready to be accessed with a single touch of a button.

Setup definition

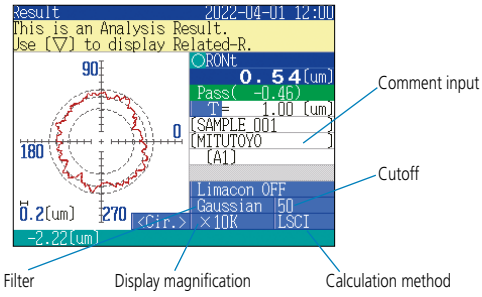
Measuring range switching

USB communication program for ROUNDTEST RA-10

The Roundtest RA-10 has a USB interface, allowing easy data transfer to a spreadsheet or other software.



Sample Measurement Screen



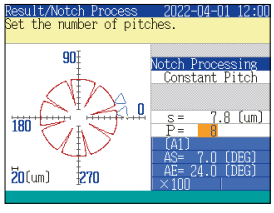
Sample Result Screen (Roundness)

Useful functions help setting up prior to measurement

In cases where high-resolution range measurement is required, demanding accurate positioning, the Zero Set button allows the detector to be set at the optimal position.

Measurement data editing function

The measurement data editing function offers the ability to exclude specific parts of a profile from the calculation. This means that any undesired elements, such as notches or data generated by scratches, can be automatically removed from the measurement data. By observing the recorded profiles on the screen, you have the flexibility to ignore unwanted features and ensure accurate and precise results.



Limaçon function compensates for eccentricity

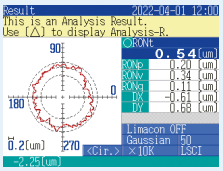
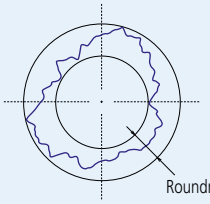
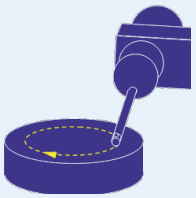
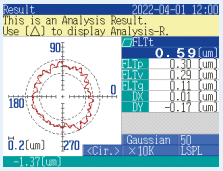
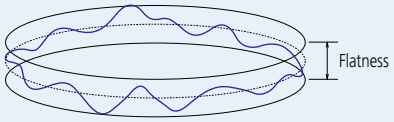
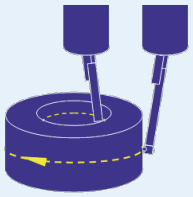
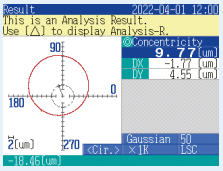
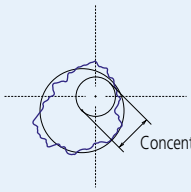
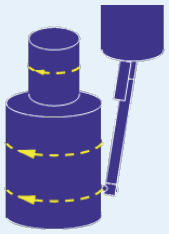
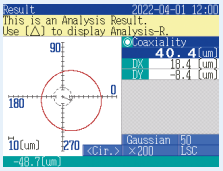
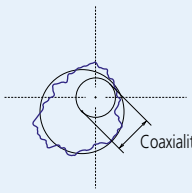
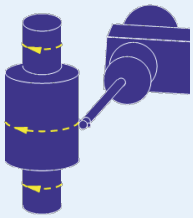
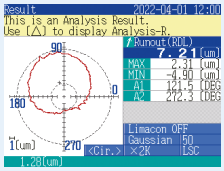
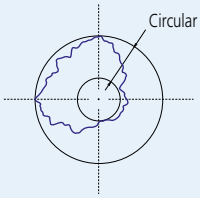
A displacement offset between the turntable axis and the axis of the part being measured can lead to distortions in the measured form, known as limaçon errors. These errors can lead to inaccuracies in the calculated roundness value.
The RA-10 supports accurate measurements by offering a limaçon error correction function. This ensures accurate and reliable measurements even in the presence of eccentricity.

Notes:

1. The limaçon error correction is effective only when measuring a workpiece of larger diameter than the tip of the probe.
2. If the limaçon error correction function does not provide sufficient results, the optional alignment table (available for separate purchase only) can be used to achieve precise centering of the workpiece.

Types of Analysis with the RA-10

MiCAT
Mitutoyo Intelligent Computer Aided Technology
the standard in world metrology software
FORM

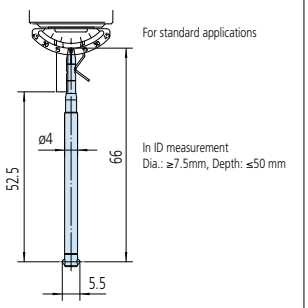
Feature Characteristic	Characteristic Symbol	Measurement Method	Sample Result Screen	Explanation
Form	Roundness ○			 Roundness (MZC) Roundness (MZC definition) of a profile is the difference in radius of two concentric circles that enclose the profile, with the separation between these circles being minimized.
	Flatness ▱			 Flatness Flatness of a profile defined as the distance between two planes that enclose the profile when this distance is minimized.
Location	Concentricity ◎			 Concentricity Concentricity of a profile is calculated as twice the shortest distance between the center of the profile and the datum.
	Coaxiality ◎			 Coaxiality Coaxiality refers to the alignment of the axis of a profiled surface. It is determined as twice the shortest radial distance between the axis and the datum at the measured positions.
Runout	Circular runout (radial) ↗			 Circular runout Circular runout of a profile is the radial distance between two circles that enclose the profile and the datum, with this distance being minimized.

Optional Accessories

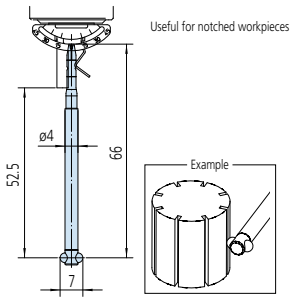
Interchangeable Styli*

Unit: mm

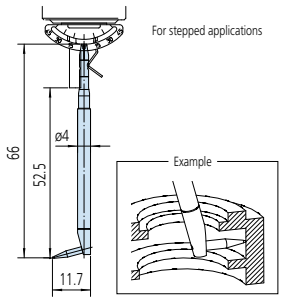
12AAL021 Standard accessory
Standard stylus (stylus tip: ø1.6 carbide ball)



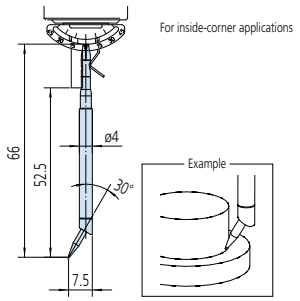
12AAL022
Stylus for notched workpieces (stylus tip: ø3 carbide ball)



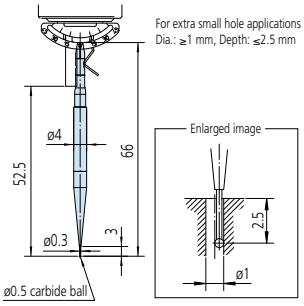
12AAL023
Stylus for grooves (stylus tip: R0.25 sapphire)



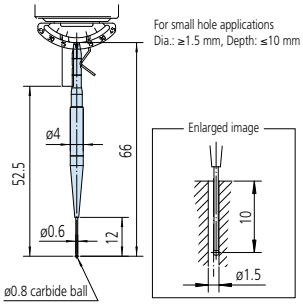
12AAL024
Stylus for corners (stylus tip: R0.25 sapphire)



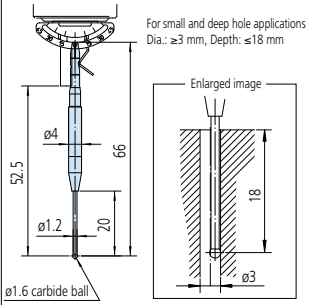
12AAL029
Stylus for extra small holes (stylus tip: ø0.5 carbide ball)



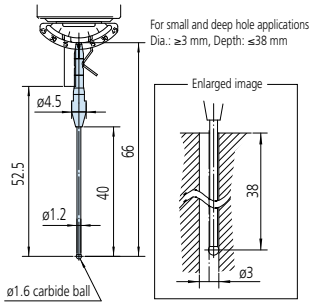
12AAL026
Stylus for small holes (stylus tip: ø0.8 carbide ball)



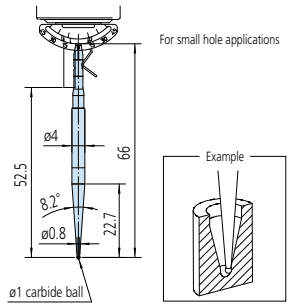
12AAL030
Stylus for small and deep holes (stylus tip: ø1.6 carbide ball)



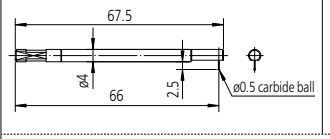
12AAL028
Stylus for small and deep holes (stylus tip: ø1.6 carbide ball, L=40)



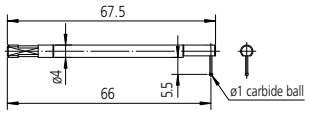
12AAL027
Stylus for small holes (stylus tip: ø1 carbide ball)

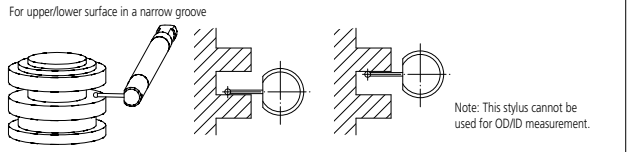


12AAL032
Cranked stylus (stylus tip: ø0.5 carbide ball)

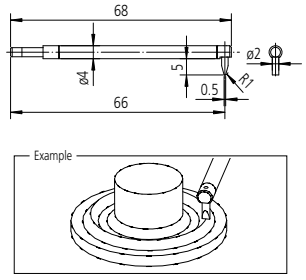


12AAL033
Cranked stylus (stylus tip: ø1 carbide ball)

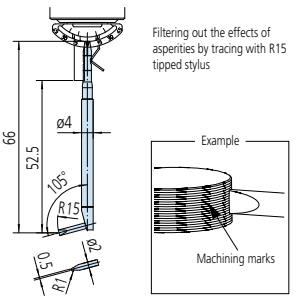




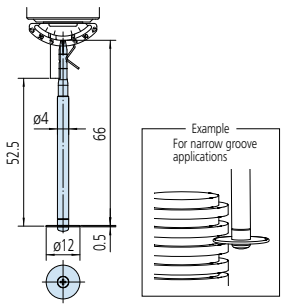
12AAL034
Stylus for flat surface



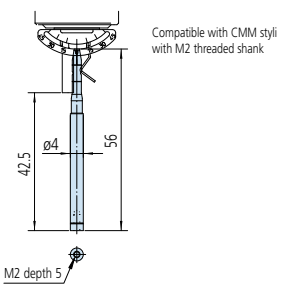
12AAL025
Cutter mark stylus - R15 mm



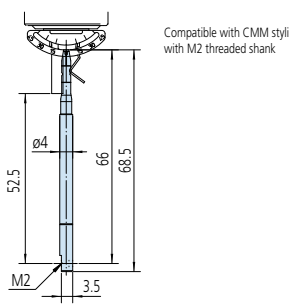
12AAL031
Disc stylus D12 mm



12AAL043
Stylus shank for mounting M2-CMM



12AAL044
Groove stylus shank for mounting M2-CMM



*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

Quick chuck

When measuring a small-sized workpiece, the chuck offers excellent operability, and the knurled ring enables easy clamping of the workpiece.

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 specifically designed to match the required diameter range of the workpiece, ensuring precise and reliable measurements.

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 A (screw clamp)

The cylindrical surface of the workpiece is positioned against the V-block and firmly secured using the screw-type clamp. This semi-custom-made product (ø10 to ø100 mm) is adjusted to fit the workpiece size prior to shipping. With this jig, workpieces of the same size can be measured without the need for centering each piece.

211-053: for ø50 mm

V-block B (spring clamp)

The V-block securely holds and clamps the cylindrical surface of the workpiece using a spring-type clamp. This semi-custom-made product (ø10 to ø100 mm) is adjusted to fit the workpiece size before shipping. With this jig, workpieces of the same size can be measured without the need for individual centering.

211-054: for ø50 mm

Spigot/Socket fixture

These jigs are specifically designed to position the plain sections of a workpiece, allowing for quick loading and unloading. The initial centering operation on the jig automatically provides workpiece centering, enabling measurement to commence immediately after loading the workpiece onto the jig. No clamping is required; however, the workpiece must be sufficiently heavy to ensure stability during measurement. Please note that a separate Spigot/Socket Fixture master mating part, matching the workpiece diameter, is required and can be ordered separately (up to a maximum diameter of ø30 mm).

211-055: for ø10mm

Alignment table with D.A.T.*

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

*** D.A.T. = Digital Adjustment Table**

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

Options available for installation on the alignment table:

Quick chuck (knurled ring operated)

Designed for measuring small-diameter workpieces. 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

Micro chuck

Specifically designed for clamping small workpieces with a diameter of 1 mm or less. It is ideal for securing workpieces 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 stopper

Enables the user to quickly and easily return the detector to a fixed position on the X-axis.

Order No.	12AAH320
Mass	65 g

Z-axis scale unit

Provides accurate positioning of the slider in the Z-axis direction using an ABS scale.

Order No.	12AAH318
Mass	450 g

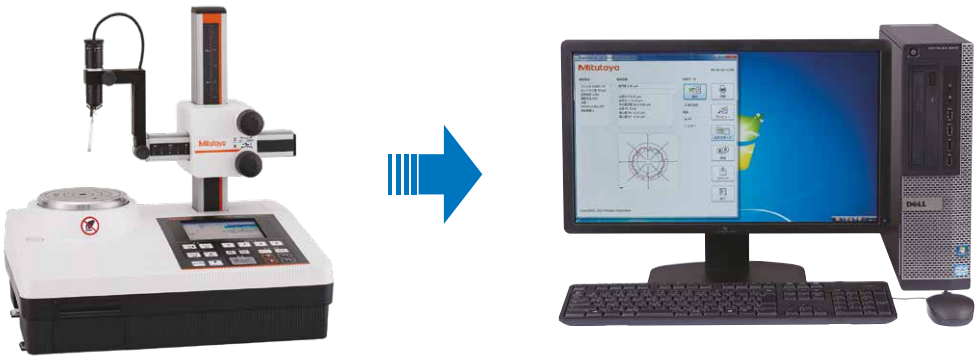
* Shipped with the RA-10 machine, or installed on-site by Mitutoyo service personnel.

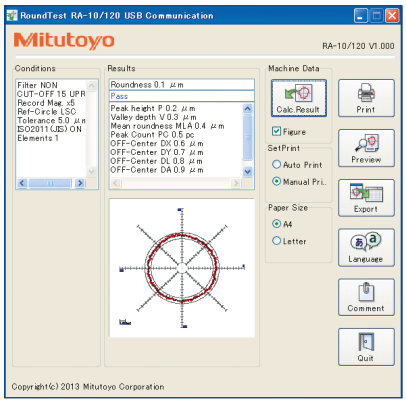
Vibration damping stand

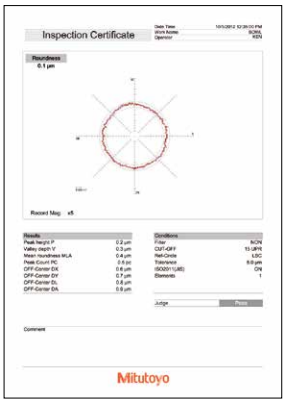
Order No.	211-013
Vibration damping system	Diaphragm type air spring
External size	615 × 515 × 51 mm
Max. loading	150 kg

• USB Communication Program for ROUNDTEST RA-10

The Roundtest RA-10 features a USB interface, allowing easy data transfer to spreadsheets or other software.
Additionally, we offer a program that enables the creation of 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 (Order No. **12AAH490)** is required.

Commercial item: Equivalent to USB Type A to B cable.

This program is available for FREE download from the Mitutoyo website at:
https://mitutoyo.eu/en_us/downloads/software-and-updates

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
	Maximum workpiece diameter	ø320 mm
Vertical column (Z axis))	Vertical travel	117 mm ·Buttom position: Approx 35 mm from the turntable top*2 ·Top position: Approx. 152 mm*1 from the turntable top*2
	Maximum probing height	152 mm from the turntable top
	Maximum probing depth	100 mm (minimum ID: ø30 mm) using the standard stylus
Horizontal arm (X axis)	Horizontal travel	–25 mm to 50 mm
Detector	Measuring force	100 mN (±30 %)
	Standard stylus (**12AAL021**)	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 x 88.4 mm
	Printer	Thermal line printer
	Display languages	Japanese, English, German, French, Italian, Spanish, Portuguese, Korean, Traditional Chinese, Simplified Chinese, Czech, Polish, Hungarian, Turkish, Swedish, Dutch
Others	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
350366	Magnification adjusting film	2 pcs.
611755-04	Gauge block (35 mm, JIS Grade 2)	1 pc.
11BAB941	Level	1 pc.
12AAL021	Standard stylus	1 pc.
12BAJ340	Printer paper*	2 rolls
—	Receptacle	1 pc.
—	Hose band	1 pc.
—	Power cable	1 pc.
—	Leveling spanner	1 pc.
—	Philips 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

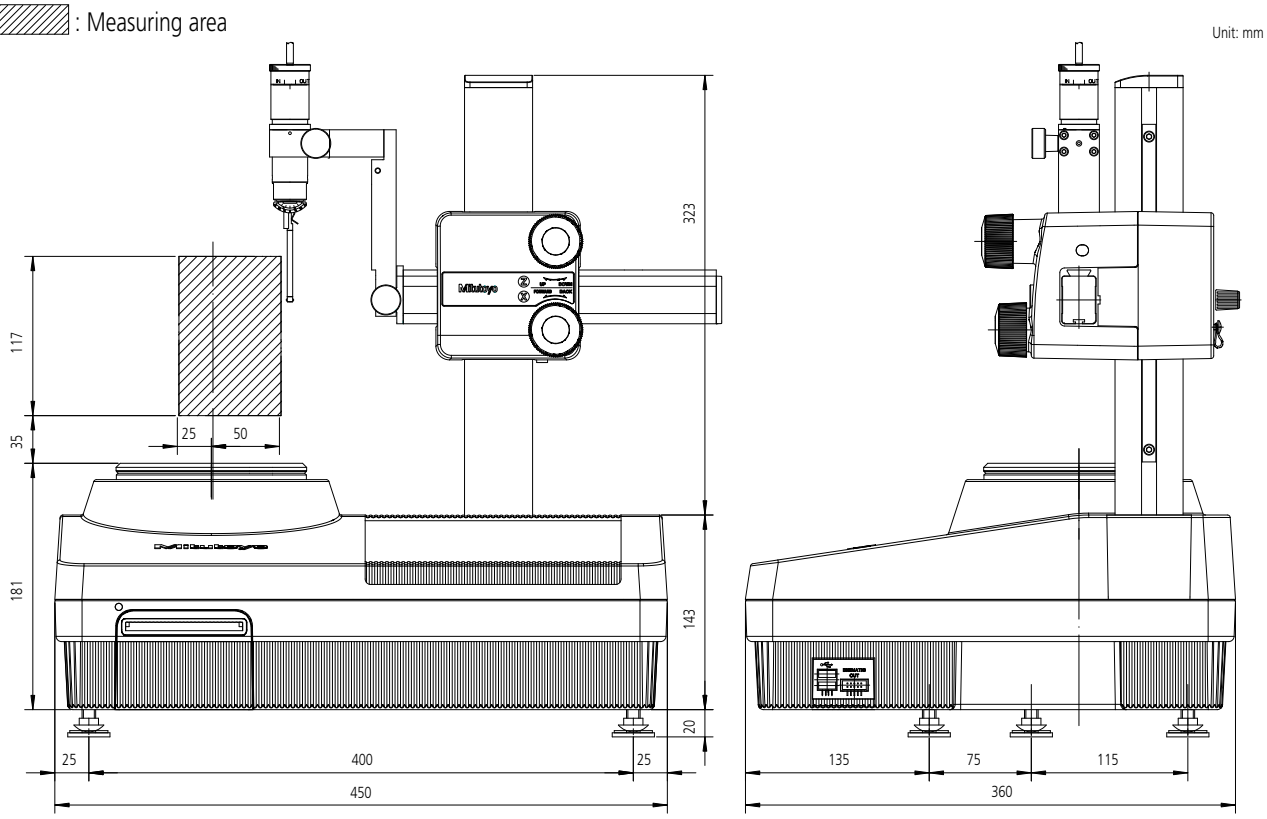
***12AAH181**: Optional printer paper set (10 rolls)

Dimensions

■ External dimensions –

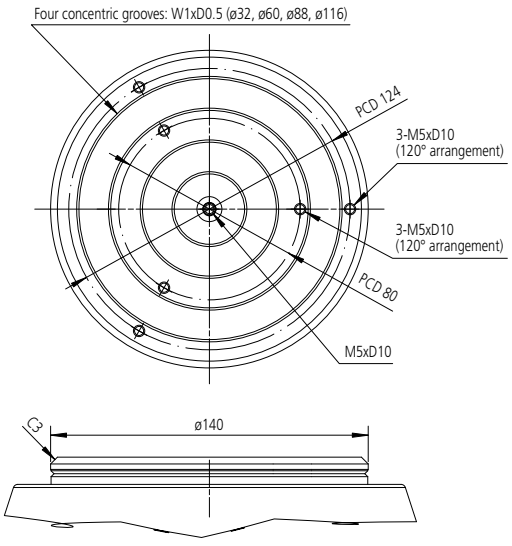
: Measuring area

Unit: mm



■ Turntable top view

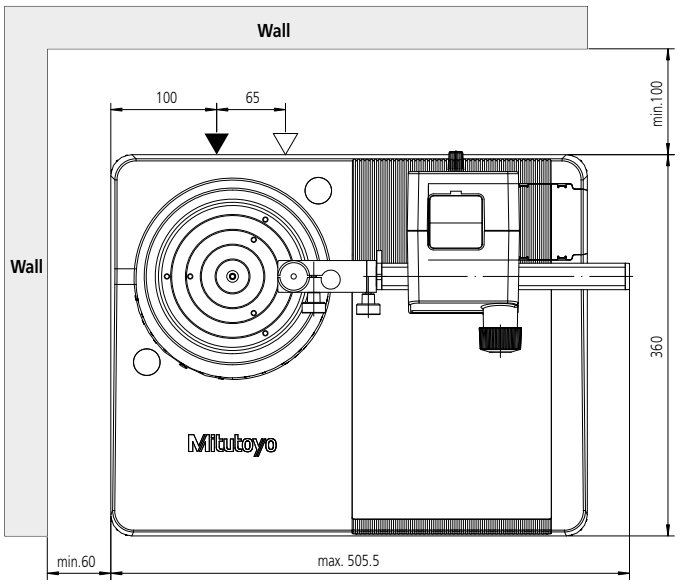
Unit: mm



■ Installation floor plan

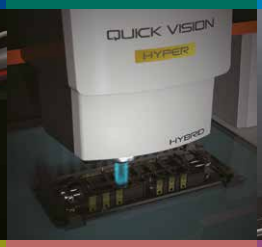
▼: Power inlet
▽: Air inlet

Unit: mm



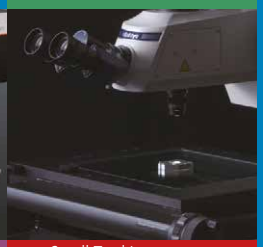
Coordinate Measuring Machines

Vision Measuring Systems



Form Measurement

Optical Measuring

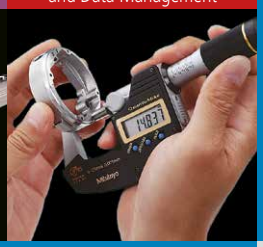


Sensor Systems

Test Equipment

Digital Scale and DRO Systems

Small Tool Instruments and Data Management



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 complete catalog here.

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