Mitutoyo

CNC Roundness/Cylindricity Measuring System
ROUNDTRACER EXTREME

NEW Products

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All-In-One

A high-end machine that integrates roundness, contour, and surface roughness measuring functions all in one.

This measuring machine not only delivers speed, accuracy , and operability at the highest level but also supports the measurement of workpieces of various shapes, such as camshafts and bearings.

Equipped with roundness, contour and surface roughness measuring functions the ROUNDTRACER EXTREME is a triple-role Measuring System that consolidates processes to save you time and improve your productivity.

High-throughput roundness measurement

Higher reproducibility and best in class θ axis drive speed through increased turntable rigidity.

High-accuracy contour measuring

Dramatically improved contour measuring accuracy as a result of the guaranteed X and Z axes indication accuracy and support for stylus radius compensation.

Even more advanced surface roughness measurement

Increased maximum measuring diameter and support for 3D surface texture measurement and lead (twist) analysis.

1 Improved Flexibility

Newly developed motorized sliding axis, detector, and detector holder help avoid workpiece interference while enabling continuous automatic measurement

A motorized sliding axis, and a detector, and detector holder capable of changing the stylus angle (0°, 10°) have been newly developed to enable measurement while avoiding workpiece interference.

Motorized sliding axis
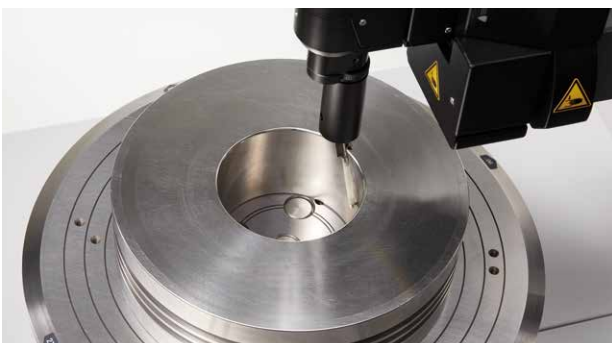
Easy measurement of inside diameter for thick workpieces

A 3-step motorized sliding axis enables easy inside diameter measurement of thick workpieces by avoiding interference, without having to replace the stylus as in conventional models. Furthermore, it allows for continuous automatic measurement of squareness, runout, etc. by combining inside diameter and upper surface measurements.

Detectors

Continuous small hole and outside diameter measurement

Allowing the stylus angle to take 2 states, 0° or 10° enables continuous, combined measurement of small holes and outside diameters while avoiding workpiece interference. Furthermore, measurements can be conducted with the workpiece remaining in the same position when measuring repeatedly while changing the stylus angle since changes in stylus tip position are automatically recognized by ROUNDPAK.

2 Improved Drive Speed

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Dramatically improved measurement throughput by reduced positioning times

Best in class maximum X, Z, and θ axes drive speed. Greatly reduced positioning times compared with conventional models. Moreover, throughput has dramatically increased for curvilinear measurements since data can now be acquired independently of the turntable 0° position.

X and Z axes drive speed

Best-in-class maximum of 100 mm/sec. With improved positioning accuracy and greatly reduced positioning times compared with conventional models.

Best-in-class maximum of 30 rpm. The ability to acquire measurement data without waiting for the 0° position in curvilinear measurements reduce the positioning time by about 40% compared with conventional models (in-house comparison), dramatically improving the performance.

θ axis drive speed

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Improved Repeatability and Reproducibility

Highly reproducible measurement as a result of new centering table architecture

The new centering table architecture reduces positional changes of the workpiece during measurement. Improved positioning accuracy of X and Z axes greatly increases measurement reproducibility compared with conventional models.

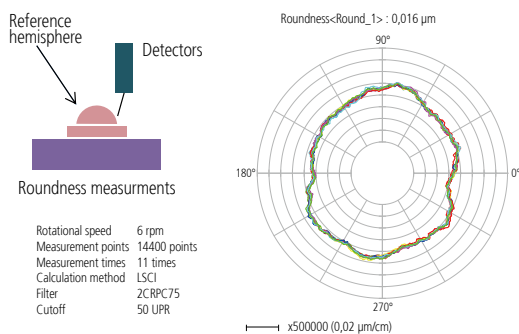### Internal architecture of the Z-axis slider

In the Z-axis, a hybrid guide comprising of a friction guide and air bearings is used.
The Z-axis slider is resistant to vibration and requires few positional changes.

Internal architecture of the table

Reduced positional changes of the workpiece have been achieved by replacing all guides in the centering table with rolling guides.

Result of repeating roundness measurement 11 times on reference hemisphere

Reference hemisphere

Detectors

Roundness measurments

Rotational speed	6 rpm
Measurement points	14400 points
Measurement times	11 times
Calculation method	LSCI
Filter	2CRPC75
Cutoff	50 UPR

Roundness<Round_1> : 0,016 μm

90°

180°   0°

270°

x500000 (0,02 μm/cm)

Repeatability of tapered workpiece measurement

Taper angle deviation [deg]

0.050
0.040
0.030
0.020
0.010
0.000
-0.010
-0.020
-0.030
-0.040
-0.050

1 2 3 4 5 6 7 8 9 10 11

Number of times

| RTX | σ =0.003 deg |

Tapered workpiece

Cross-section 2
Cross-section 1

2 mm

Centering chuck

Centering element
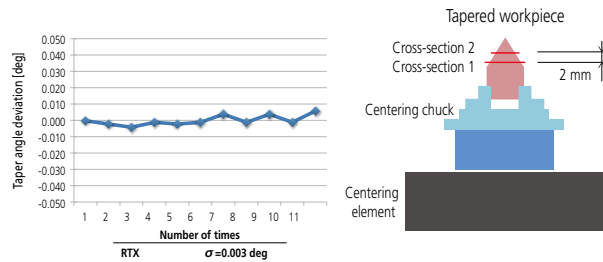
Note: The measurement data above is for reference only, it is not a guarantee of the measuring machine accuracy.

4 Rich Additional Features

Pursuing functionality

from the viewpoint of users

Design delivering both usability and innovation. The ergonomic remote box enhances the user's experience with clearly laid out buttons and controls.

Remote box

Provides excellent operability as a result of newly added features, such as the override control that enables drive speed adjustment in real-time, and the part program key that assists the creation of part programs.

- Outside diameter measuring position key
- Slide top position measuring position key
- Detector replacement key
- Curvilinear measurement item key
- Rectilinear measurement item key
- Auto-set key

Additional measuring functions

Form / contour

Guaranteed X and Z axes indication accuracy and support for stylus radius compensation resulting in improved form / contour measuring accuracy.

Surface roughness

High-precision surface roughness measurement is enabled by a drive noise lower than 0,1 µm in Rz for rectilinear surface roughness measurement by X and Z axes, and curvilinear surface roughness measurement by θ axis.
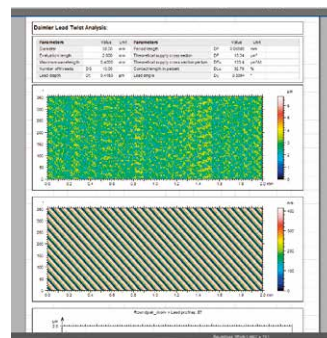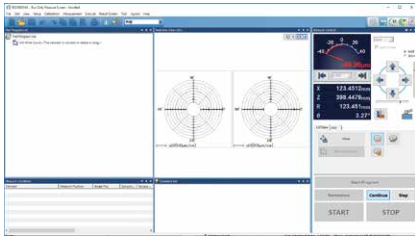
Lead (twist) analysis

Improved θ axis positioning accuracy enables lead (twist) analysis used for assessing the sealing performance.

Video available here

ROUNDPAK

Provides a wide variety of parameters as standard features, including those for roundness/cylindricity, as well as flatness and parallelism.


Allows for switching to measurement-only screen (run-only measurement screen), where operators are only allowed to run part programs.
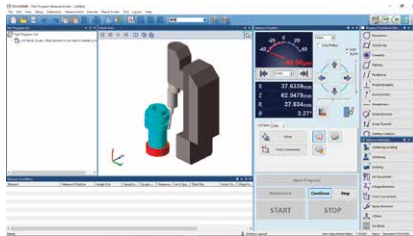

Equipped with an offline teaching function, part programs can be created without even having actual measurement workpieces, and measurements can be virtually run in the 3D workpiece view window. Warnings regarding risk of collision can also be displayed.
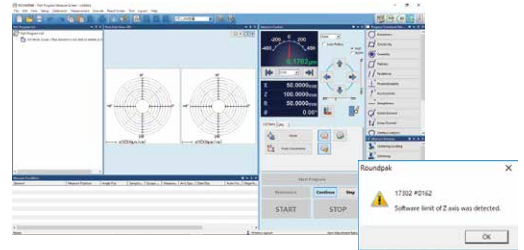
Allows for setting of X and Z axes travel ranges to prevent collisions with workpieces as a result of operational errors. Travel ranges can be grasped at a glance by displaying the software limit information bar on the measurement control screen.
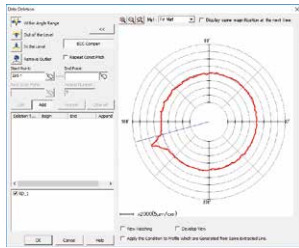
Allows for removing abnormal data in the measurement data (by mouse operation) due to scratches, dust, or other contamination on the workpiece, which affects the analysis results. In addition, there is also a function to automatically remove abnormal points based on set thresholds.
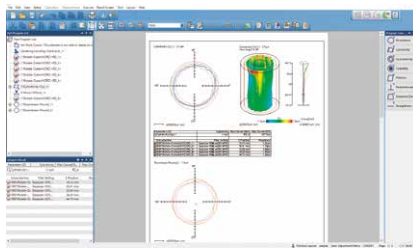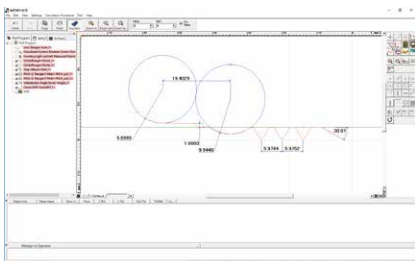

The customer can create measurement reports in custom formats by specifying how the analysis results will be displayed, as well as the sizes and positions of graphics.

FORMTRACEPAK-AP

Contour analysis, surface roughness analysis and the creation of inspection certificates are included as standard features.

Contour analysis

Provides not only a range of basic commands for analyzing points (10 types), lines (6 types), and circles (6 types), but also a wide variety of commands to calculate angles formed by a combination of items, pitches, distances, etc. Standard features include contour matching and design value generation.

Surface roughness analysis
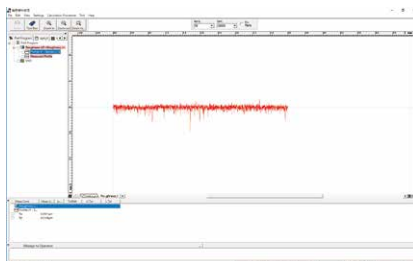
Allows for surface roughness analysis according to standards, such as ISO, JIS, ANSI, VDA, etc. Provides a wide variety of functions not only for calculating parameters but also for analyzing various graphs, removing (compensating) shapes such as slopes and curves, removing data, etc.

Layout
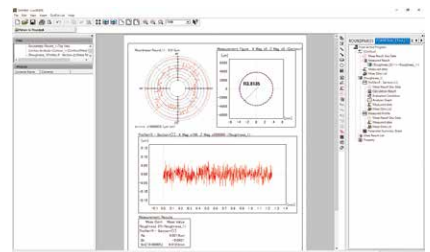
Allows for layout of contour, surface roughness, and/or roundness measurement results and graphics on a single sheet of paper by using simple operations. Furthermore, support for pasting from specified saved files allows results to be pasted from multiple files.
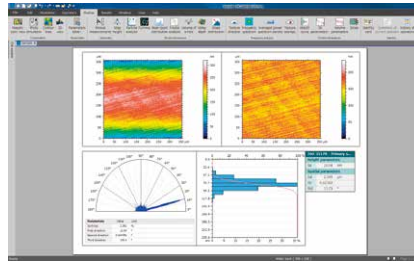
MCubeMap

Visualizes analyzed surface roughness and contour by using a wide variety of graphic technologies.

### Wide variety of data operation functions
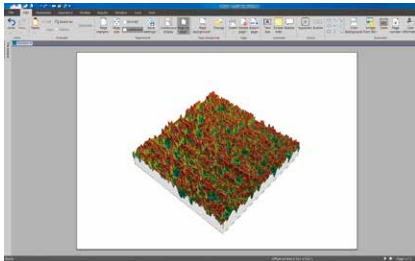
Allows for visualizing the measurement target in a 3D graphics view, as well as showing a section view at an arbitrary point.
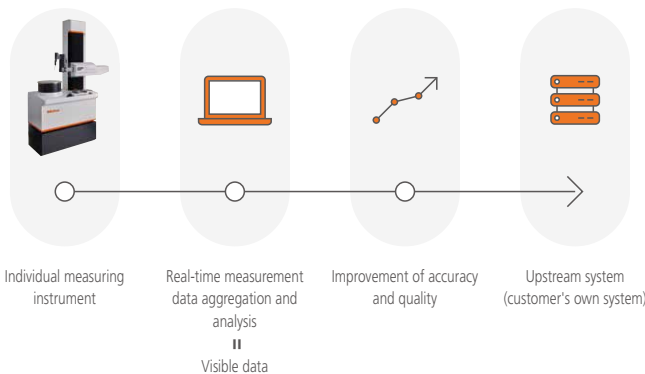
3D parameter analysis

Supports the latest ISO 25178 3D surface texture parameter specifications. Allows for easy creation of reports with freely laid out results of analyses related to not only vertical directions, such as Sa and Sq, but also spaces, compounds, features, and graphics.

Lead (twist) analysis
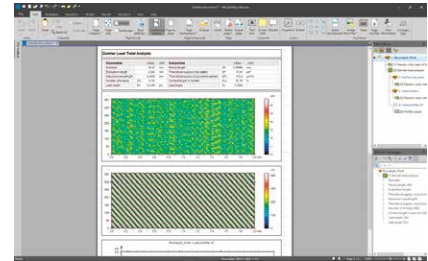
Supports the lead (twist) analysis used for assessing the sealing performance of shafts.

MeasurLink

Individual measuring instrument

Real-time measurement data aggregation and analysis
=
Visible data

Improvement of accuracy and quality

Upstream system (customer's own system)

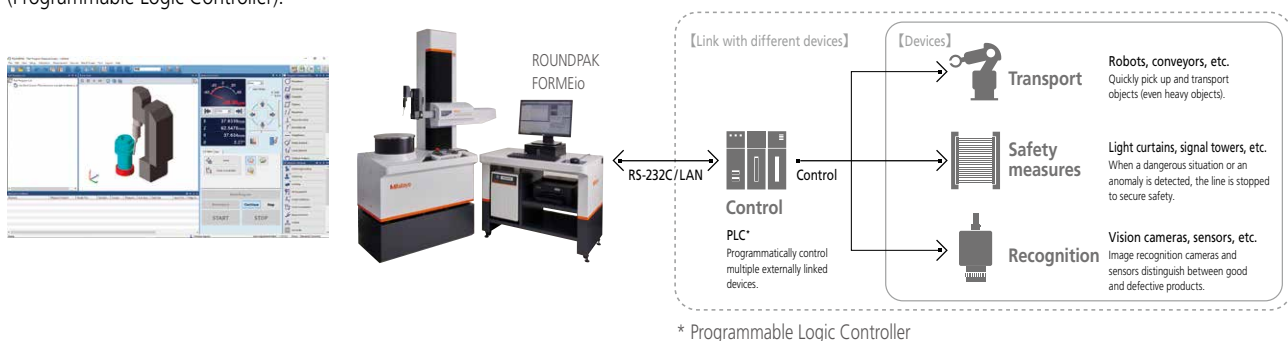## Reduction of defective products with "visualize product quality"

Measurement results enable various statistical processing operations. Furthermore, displaying the control chart in real-time enables early detection of possible future failures (cutting tool wear, damage, etc.). In addition, connecting this program to an upstream network environment as a terminal enables the construction of a system for centralized management.

FORMEio

This is optional software for installing the external control function in the measuring instrument.

Remote status monitoring and control

With this function, it is possible to monitor and control the measuring instrument conditions via RS-232C/LAN communication from the PLC (Programmable Logic Controller).

ROUNDPAK
FORMEio

【Link with different devices】

【Devices】

RS-232C/LAN

Control

Control

PLC*
Programmatically control multiple externally linked devices.

Transport
Robots, conveyors, etc.
Quickly pick up and transport objects (even heavy objects).

Safety measures
Light curtains, signal towers, etc.
When a dangerous situation or an anomaly is detected, the line is stopped to secure safety.

Recognition
Vision cameras, sensors, etc.
Image recognition cameras and sensors distinguish between good and defective products.

* Programmable Logic Controller

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Efficient precision measurement for practically any workpiece

ROUNDTRACER EXTREME has applications supporting measurements for a wide variety of workpieces. It delivers efficient, high-precision measurements, such as continuous measurement of inside diameter and the upper surface of thick workpieces owing to the motorized sliding axis, or automatic recognition of the stylus tip position during continuous measurement of inside and outside diameters of small holes.

APPLICATION

Camshaft

Camshafts require high-precision measurement because they control the opening and closing of inlet/outlet valves that improve the combustion efficiency of engines. Measurement of cam shape, surface roughness, and roundness, which previously required multiple measuring instruments and setup, can now be efficiently conducted using a single measuring machine.

Tool holder

The tapered portion of tool holders requires high-precision measurement since it needs to pair with the main axis of machine tools. High-precision positioning by the newly developed centering element and Z-axis slider enables highly reproducible measurements.

Bearing

The surface roughness of bearings requires high-precision measurement since it has a direct impact on the coefficient of friction. A single ROUNDTRACER EXTREME can not only efficiently measure roundness, but also surface roughness with high accuracy.

Pulley-based CVT

Automotive parts such as continuously variable transmissions (CVTs) directly relate to fuel efficiency and smoothness of travel, requiring extensive QA processes. Measurement of surface roughness of the tapered portion, roundness, and contour. This previously required multiple measuring instruments and setup but can now be efficiently conducted using a single measuring machine.

Electric motor cores

Motor cores, which are the base of motor assemblies, require high machining accuracy. ROUNDTRACER EXTREME allows for efficient, high-precision workpiece setup for rectilinear contour measurement at multiple points.

Spline

The rotating X-axis tracking measurement function enables all-round measurement and assessment* of splines exceeding the measuring range of the detector.
* Subject to tracking angle limitation of the stylus for contour measurement.

Styli for roundness measurement

Standard stylus - D1,6 mm
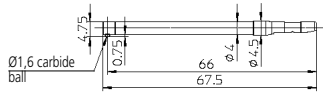
|	
Order No.	**12AAV342**
Stylus tip	S Ø1,6 mm
Material	Carbide-tipped
ID measuring range	ID Ø7 mm or more Depth less than 50 mm
Remarks	Standard accessory

Stylus for notched workpieces
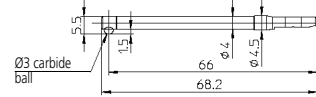
Order No.	**12AAV387**
Stylus tip	S Ø3,0 mm
Material	Carbide-tipped
ID measuring range	ID Ø8 mm or more Depth less than 50 mm

Stylus A for deep groove
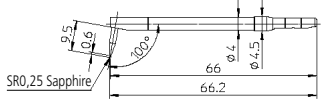
Order No.	**12AAV388**
Stylus tip	SR0,25 mm
Material	Sapphire
ID measuring range	ID Ø14 mm or more Depth less than 50 mm

Stylus B for deep groove
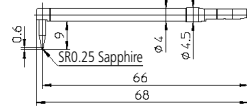
Order No.	**12AAV389**
Stylus tip	SR0,25 mm
Material	Sapphire
ID measuring range	ID Ø15 mm or more Depth less than 50 mm

Stylus for removing cutter mark
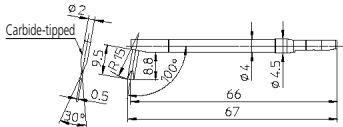
Order No.	**12AAV390**
Stylus tip	R15 mm
Material	Carbide-tipped
ID measuring range	ID Ø15 mm or more Depth less than 50 mm
Remarks	Vertical position

Stylus for small holes (Ø0,8)
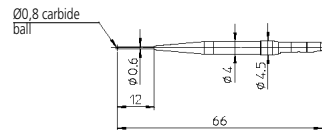
Order No.	**12AAV391**
Stylus tip	S Ø0,8 mm
Material	Carbide-tipped
ID measuring range	ID Ø1,5 mm or more Depth less than 10 mm ID Ø8 mm or more Depth less than 50 mm

Stylus for small holes (Ø1,6)
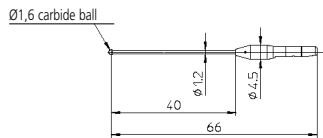
Order No.	**12AAV392**
Stylus tip	S Ø1,6 mm
Material	Carbide-tipped
ID measuring range	ID Ø3 mm or more Depth less than 38 mm ID Ø8 mm or more Depth less than 50 mm

Stylus for ultra-small hole (Ø0,5)
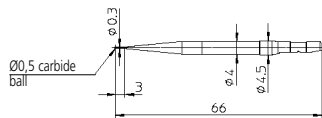
Order No.	**12AAV393**
Stylus tip	S Ø0,5 mm
Material	Carbide-tipped
ID measuring range	ID Ø1 mm or more Depth less than 2,5 mm ID Ø8 mm or more Depth less than 50 mm

Ø1,6 mm ball stylus
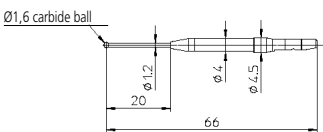
Order No.	**12AAV394**
Stylus tip	S Ø1,6 mm
Material	Carbide-tipped
ID measuring range	ID Ø3 mm or more Depth less than 18 mm ID Ø8 mm or more Depth less than 50 mm

Disk stylus
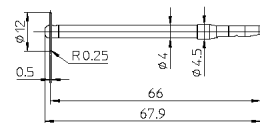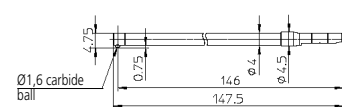
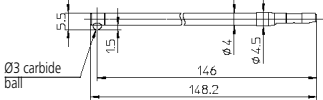|	
Order No.	**12AAV395**
Stylus tip	R0,25 mm
Material	Carbide-tipped
ID measuring range	ID Ø14 mm or more Depth less than 50 mm

Stylus for flat surface
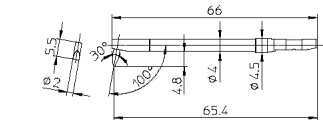
|	
Order No.	**12AAV396**
Stylus tip	R1,0 mm
Material	Carbide-tipped
ID measuring range	——
Remarks	Horizontal position (Upper and lower surface measurements only)

2X-long type

Order No.	**12AAV397**
Stylus tip	S Ø1,6 mm
Material	Carbide-tipped
ID measuring range	ID Ø7 mm or more Depth less than 130 mm
Remarks	Vertical position

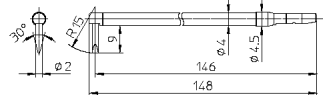### 2X-long stylus for notched workpiece

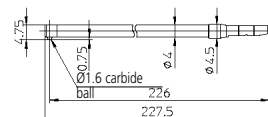|	
Order No.	**12AAV398**
Stylus tip	S Ø3,0 mm
Material	Carbide-tipped
ID measuring range	ID Ø8 mm or more Depth less than 130 mm
Remarks	Vertical position

2X-long stylus for deep groove
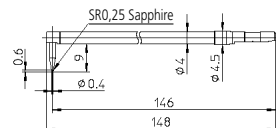
Order No.	**12AAV399**
Stylus tip	SR0,25 mm
Material	Sapphire
ID measuring range	ID Ø12 mm or more Depth less than 130 mm
Remarks	Vertical position

### 2X-long stylus for removing cutter mark

Order No.	**12AAV400**
Stylus tip	R15 mm
Material	Carbide-tipped
ID measuring range	ID Ø13 mm or more Depth less than 130 mm
Remarks	Vertical position

3X-long type

Order No.	**12AAV401**
Stylus tip	S Ø1,6 mm
Material	Carbide-tipped
ID measuring range	ID Ø7 mm or more Depth less than 210 mm
Remarks	Vertical position

3X-long stylus for deep groove
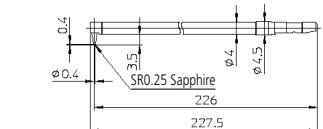
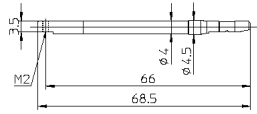|	
Order No.	**12AAV402**
Stylus tip	SR0,25 mm
Material	Sapphire
ID measuring range	ID Ø12 mm or more Depth less than 210 mm
Remarks	Vertical position

M2 stylus shank
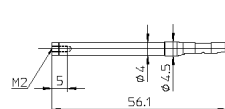
Order No.	**12AAV403**
Stylus tip	——
Material	——
ID measuring range	——
Remarks	Compatible with CMM stylus

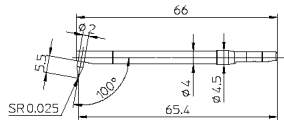## Styli for roundness measurement

M2 stylus shank (for groove)

Order No.	**12AAV404**
Stylus tip	——
Material	——
ID measuring range	——
Remarks	Compatible with CMM stylus

2X-long type M2 stylus shank (for groove)
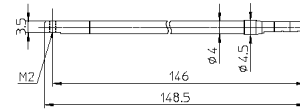
Order No.	**12AAV405**
Stylus tip	——
Material	——
ID measuring range	——
Remarks	Compatible with CMM stylus

Contour stylus (cone 30° H5.5)

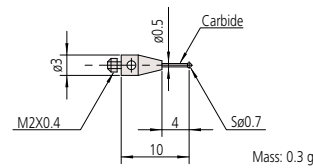|	
Order No.	**12AAV406**
Stylus tip	SR0,025 mm
Material	Carbide-tipped
ID measuring range	——

Using a stylus shank for roundness measurement described above enables the mounting of coordinate measuring machine (CMM) styli.
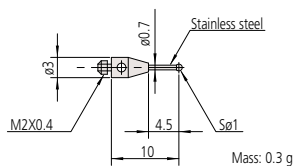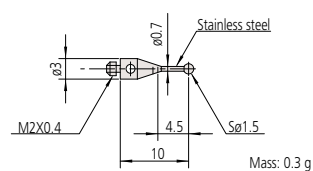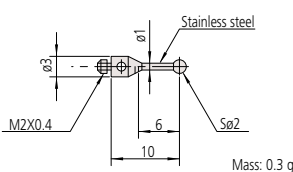
Styli for CMMs*
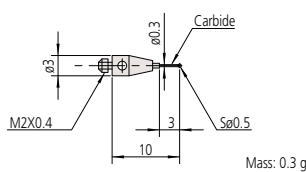
Order No.	Name	Material	Mass
K651276	MS2-0.5R3	Ruby	0.3 g
K651236	MS2-0.7R4	Ruby	0.3 g
K651012	MS2-1R4.5	Ruby	0.3 g
K651013	MS2-1.5R4.5	Ruby	0.3 g
K651014	MS2-2R6	Ruby	0.3 g
K651016	MS2-3R7.5	Ruby	0.4 g
K651017	MS2-4R10	Ruby	0.4 g
K651018	MS2-5R10	Ruby	0.7 g
K651024	MS2-6R10	Ruby	0.9 g
K651025	MS2-8R11	Ruby	1.5 g
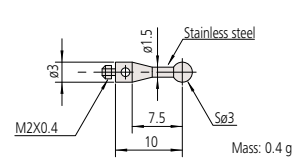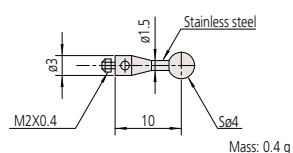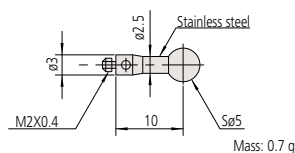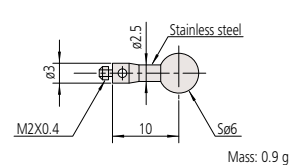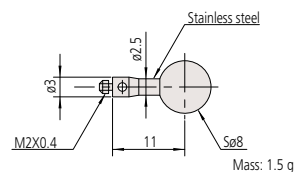
* **12AAV404** (stylus shank <standard groove>) or **12AAV405** (stylus shank <2X-long groove>) required separately.

13

Mitutoyo

Roughness detector adapter

This product enables the mounting of a roughness
detector (**178-396-2** or **178-397-2**)
to ROUNDTRACER EXTREME.

12AAU418

36 / 87.1 / 22
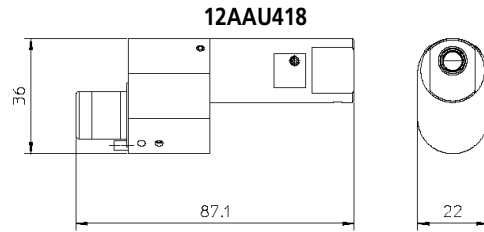
For Surface Roughness Measuring | Detectors

11.5 / 10 / 60 / 14 / φ14 / 3.1 / φ14 / φ8 / φ7 / 1.3 / 3.6 / 4

Skidless nosepiece
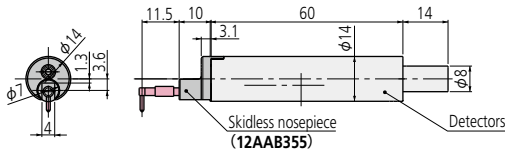(**12AAB355**)

Detectors

Order No.	Measuring force
178-396-2	0,75 mN
178-397-2	4 mN

For Surface Roughness Measuring | Styli

Standard stylus

Color coding*2 / Detail-A / 44.7 / 37.7 / 0.9 / 7.6 / 5.2 / φ2.4 / A / φ1.2 / 60°

12AAE882 (1 µm / 60°)
12AAE924 (1 µm / 90°)
12AAC731 (2 µm / 60°)
12AAB403 (5 µm / 90°)
12AAB415 (10 µm / 90°)
12AAE883 (250 µm / 60°) *1
( ): Tip radius / Tip angle

For deep groove (10 mm)

Color coding*2 / Detail-A / 44.7 / 37.7 / 0.9 / 14.2 / 1.3 / A / φ2.4 / φ1.2 / 60°

12AAC735 (2 µm / 60°)
12AAB409 (5 µm / 90°)
12AAB421 (10 µm / 90°)
( ): Tip radius / Tip angle

For small hole

0.6 / 0.4 / 1.6 / φ0.6 / 60° / Detail-A (S=5/1) / 44.4 / 37.7 / 0.6 / 15 / 3.4 / 1.6 / 2.4 / φ2.4 / A / φ1.2 / Color coding*2

12AAC732 (2 µm / 60°)
12AAB404 (5 µm / 90°)
12AAB416 (10 µm / 90°)
( ): Tip radius / Tip angle

For gear tooth

Color coding*2 / Detail-A / 43.8 / 37.7 / 7.6 / 6.4 / 60° / A / φ2.4 / 60° / φ1.2

12AAB339 (2 µm / 60°)
12AAB410 (5 µm / 90°)
12AAB422 (10 µm / 90°)
( ): Tip radius / Tip angle

For extra-small hole

0.4 / 1.2 / φ0.3 / 60° / Detail-A (S=5/1) / 44.2 / 37.7 / 8.9 / 1.2 / 2.5 / φ2.4 / A / φ0.6 / Color coding*2

12AAC733 (2 µm / 60°)
12AAB405 (5 µm / 90°)
12AAB417 (10 µm / 90°)
( ): Tip radius / Tip angle

For rolling circle waviness surface*3
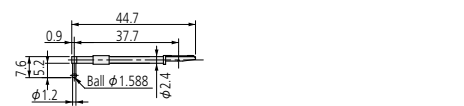
44.7 / 37.7 / 0.9 / 7.6 / 5.2 / Ball φ1.588 / φ2.4 / φ1.2

12AAB338 (Ø1.588)

For extra-minute hole

0.4 / 0.8 / φ0.3 / 60° / Detail-A (S=5/1) / 44.2 / 37.7 / 8.9 / 0.8 / 2.5 / φ2.4 / A / φ0.6 / Color coding*2

12AAC734 (2 µm / 60°)
12AAB406 (5 µm / 90°)
12AAB418 (10 µm / 90°)
( ): Tip radius / Tip angle

For knife-edge

Color coding*2 / Detail-A / 44.7 / 37.7 / A / 0.9 / 7.6 / φ2.4 / φ1.2 / 60°

12AAC738 (2 µm / 60°)
12AAB411 (5 µm / 90°)
12AAB423 (10 µm / 90°)
( ): Tip radius / Tip angle

For ultra-small hole*3

φ0.5 carbide ball / φ0.3 / Detail-A / 8.5 / φ2.4 / 3.1 / A / 37.7 / 43.8

12AAJ662 (250 µm)
( ): Tip radius

For bottom surface

44.3 / 0.5 / 37.7 / 7.4 / 6.2 / 5 / φ2.4
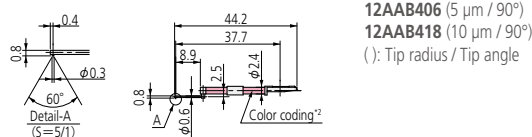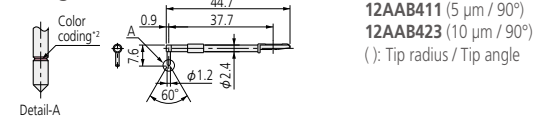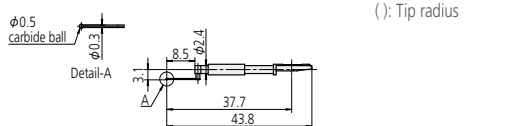
12AAE899 (2 µm / 60°)
12AAE915 (5 µm / 90°)
( ): Tip radius / Tip angle
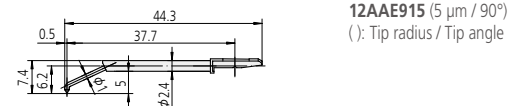
Tip radius	1 µm	2 µm	5 µm	10 µm	250 µm
Color coding	White	Black	No color	Yellow	No notch or color

*1 Used for calibration, a standard step gauge (**178-611**, optional) is also required.

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

Three-jaw chuck (key operated)   **211-014**

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

• Holding capacity:
  Internal jaws: OD=Ø2-Ø35 mm
                 ID=Ø25-Ø68 mm
  External jaws: OD=Ø35-Ø78 mm
• External size (D×H): Ø157×70,6 mm
• Mass: 3,8 kg

Centering chuck (knurled ring operated)   **211-032**

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

• Holding capacity:
  Internal jaws: OD=Ø1-Ø36 mm
                 ID=Ø16-Ø69 mm
  External jaws: OD=Ø25-Ø79 mm
• External size (D×H): Ø118×41 mm
• Mass: 1,2 kg

Micro chuck   **211-031**

Used for clamping a workpiece (less than Ø1 mm dia.) that the centering chuck cannot handle.

• Holding capacity: OD=Ø0,2-Ø1,5 mm
• External size (D×H): Ø107×48.5 mm
• Mass: 0,6 kg

Magnification calibration gauge   **211-045**

Used for normalizing detector magnification by calibrating detector travel against the displacement of a micrometer spindle.

• Maximum calibration
  range: 400 µm
• Graduation: 0,2 µm
• External size (W×D×H):
  235 (max.)×185×70 mm
• Mass: 4 kg

Cylindrical square   **350850**

• Straightness: 1 µm
• Cylindricity: 2 µm
• External size (D×H): Ø70×250 mm
• Mass: 7,5 kg

Gauge block set for calibration   **997090**

Auxiliary stage for a short workpiece   **356038**
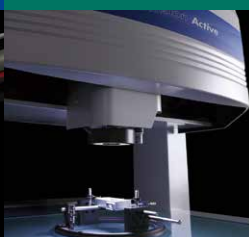
Side table   **12AAV541**

The side table, designed to match the main unit, can house the controller supplied with the main unit, a PC, and a front feed/output printer.
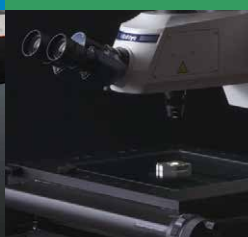
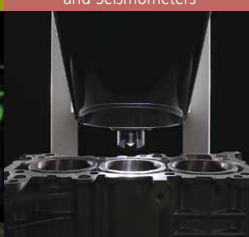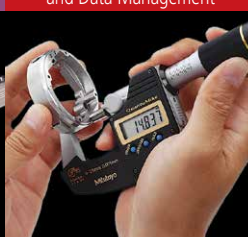| Coordinate Measuring Machines	Vision Measuring Systems	Form Measurement	Optical Measuring

Sensor Systems	Test Equipment and Seismometers	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, ensuring 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 bespoke measuring solutions and even, if deemed cost-effective, take your critical measurement challenges in-house on a sub-contract basis.
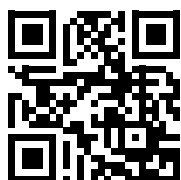
Find additional product literature and our complete catalog here.

www.mitutoyo.eu

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