

## CNC Roundness/Cylindricity Measuring System ROUNDTRACER EXTREME



ROUNDTRACER EXTREME

# 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  $\theta$  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

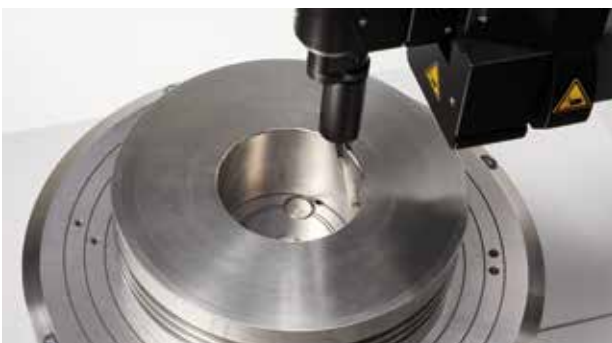
Newly developed motorized sliding axis, detector, and detector holder help avoid workpiece interference while enabling continuous automatic measurement

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

Detectors



### 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.



### 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

Dramatically improved measurement throughput by reduced positioning times

Best in class maximum X, Z, and  $\theta$  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  $0^\circ$  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  $0^\circ$  position in curvilinear measurements reduce the positioning time by about 40% compared with conventional models (in-house comparison), dramatically improving the performance.

## $\theta$ axis drive speed



# 3 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.



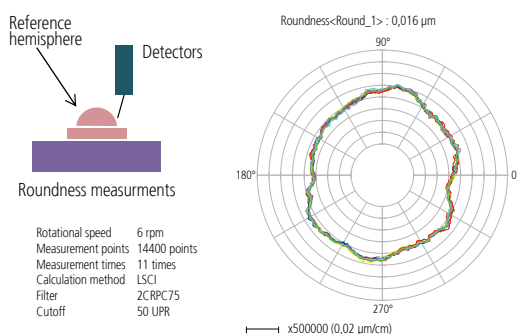
## Internal architecture of the Z-axis slider

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.

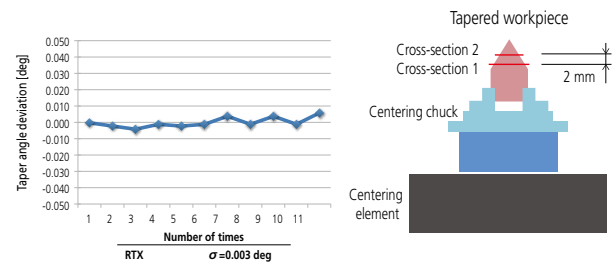
## Internal architecture of the table

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



### Repeatability of tapered workpiece measurement



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



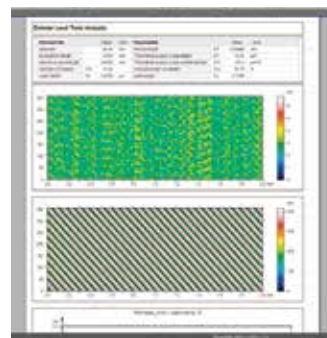
### Form / contour

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.



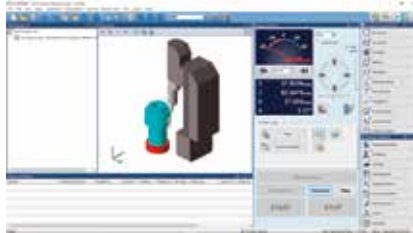
Video available here

## ROUNDPAK

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



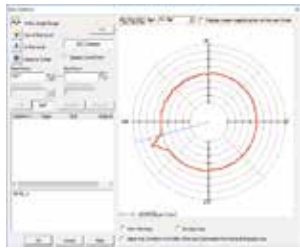
Allows for switching to measurement-only screen (run-only measurement screen), where operators are only allowed to run part programs.



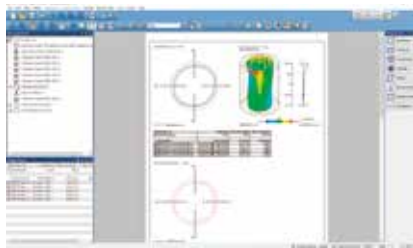
Equipped with an offline teaching function, part programs can be created without even having actual measurement workpieces, and measurements can be virtually run in the 3D workpiece view window. Warnings regarding risk of collision can also be displayed.



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.

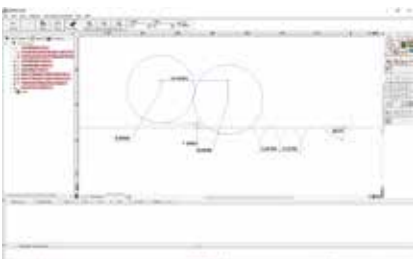


The customer can create measurement reports in custom formats by specifying how the analysis results will be displayed, as well as the sizes and positions of graphics.

## FORMTRACEPAK-AP

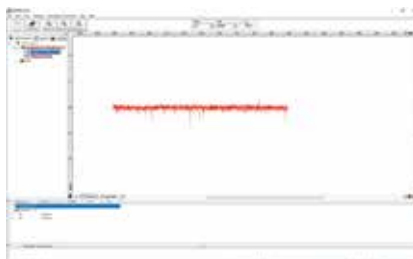
Contour analysis, surface roughness analysis and the creation of inspection certificates are included as standard features.

### Contour analysis



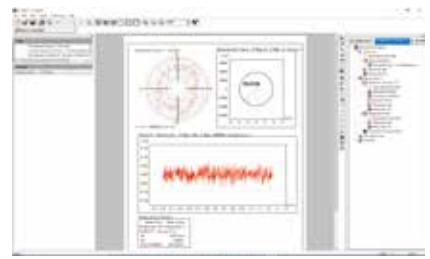
Provides not only a range of basic commands for analyzing points (10 types), lines (6 types), and circles (6 types), but also a wide variety of commands to calculate angles formed by a combination of items, pitches, distances, etc. Standard features include contour matching and design value generation.

### 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

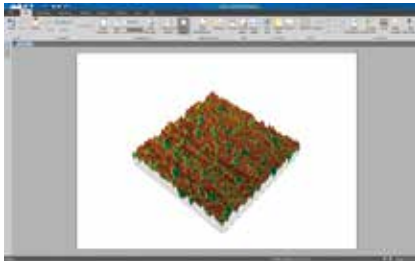


Allows for layout of contour, surface roughness, and/or roundness measurement results and graphics on a single sheet of paper by using simple operations. Furthermore, support for pasting from specified saved files allows results to be pasted from multiple files.

## MCubeMap

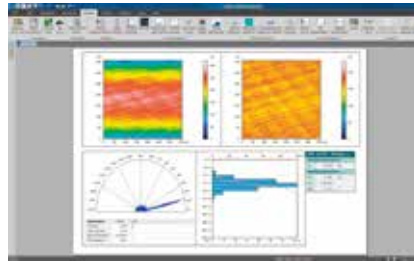
Visualizes analyzed surface roughness and contour by using a wide variety of graphic technologies.

Wide variety of data operation functions



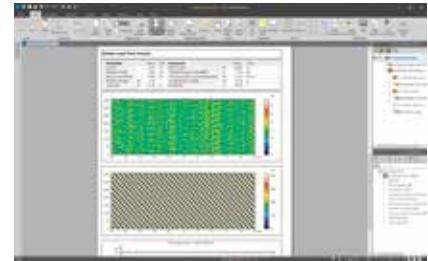
Allows for visualizing the measurement target in a 3D graphics view, as well as showing a section view at an arbitrary point.

3D parameter analysis



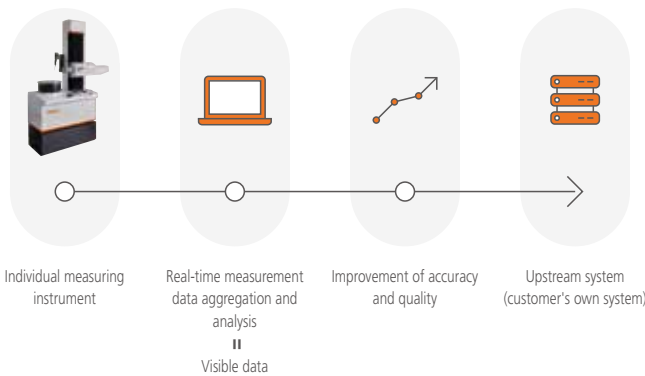
Supports the latest ISO 25178 3D surface texture parameter specifications. Allows for easy creation of reports with freely laid out results of analyses related to not only vertical directions, such as Sa and Sq, but also spaces, compounds, features, and graphics.

Lead (twist) analysis



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

## MeasurLink



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

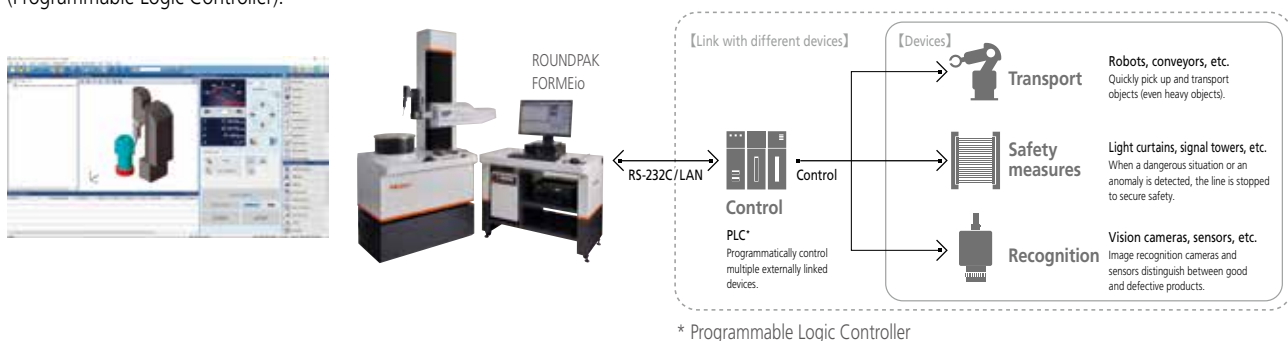
Measurement results enable various statistical processing operations. Furthermore, displaying the control chart in real-time enables early detection of possible future failures (cutting tool wear, damage, etc.). In addition, connecting this program to an upstream network environment as a terminal enables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



## 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

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### 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

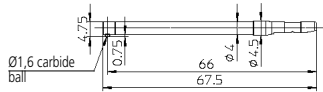


The rotating X-axis tracking measurement function enables all-round measurement and assessment\* of splines exceeding the measuring range of the detector.

\* Subject to tracking angle limitation of the stylus for contour measurement.

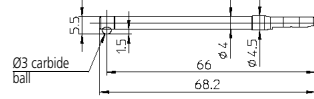
## Styli for roundness measurement

### Standard stylus - D1,6 mm



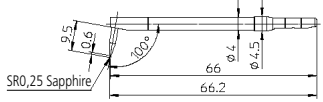
Order No. **12AAV342**  
 Stylus tip S Ø1,6 mm  
 Material Carbide-tipped  
 ID measuring range ID Ø7 mm or more  
 Depth less than 50 mm  
 Remarks Standard accessory

### Stylus for notched workpieces



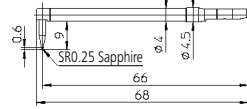
Order No. **12AAV387**  
 Stylus tip S Ø3,0 mm  
 Material Carbide-tipped  
 ID measuring range ID Ø8 mm or more  
 Depth less than 50 mm

### Stylus A for deep groove



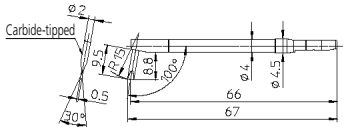
Order No. **12AAV388**  
 Stylus tip SR0,25 mm  
 Material Sapphire  
 ID measuring range ID Ø14 mm or more  
 Depth less than 50 mm

### Stylus B for deep groove



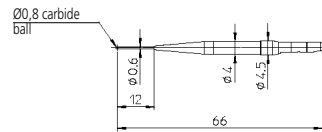
Order No. **12AAV389**  
 Stylus tip SR0,25 mm  
 Material Sapphire  
 ID measuring range ID Ø15 mm or more  
 Depth less than 50 mm

### Stylus for removing cutter mark



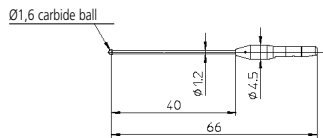
Order No. **12AAV390**  
 Stylus tip R15 mm  
 Material Carbide-tipped  
 ID measuring range ID Ø15 mm or more  
 Depth less than 50 mm  
 Remarks Vertical position

### Stylus for small holes (Ø0,8)



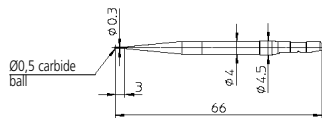
Order No. **12AAV391**  
 Stylus tip S Ø0,8 mm  
 Material Carbide-tipped  
 ID measuring range ID Ø1,5 mm or more  
 Depth less than 10 mm  
 ID Ø8 mm or more  
 Depth less than 50 mm

### Stylus for small holes (Ø1,6)



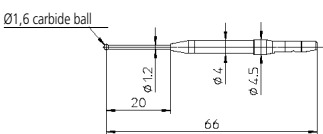
Order No. **12AAV392**  
 Stylus tip S Ø1,6 mm  
 Material Carbide-tipped  
 ID measuring range ID Ø3 mm or more  
 Depth less than 38 mm  
 ID Ø8 mm or more  
 Depth less than 50 mm

### Stylus for ultra-small hole (Ø0,5)



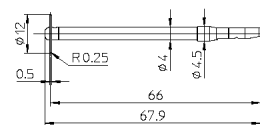
Order No. **12AAV393**  
 Stylus tip S Ø0,5 mm  
 Material Carbide-tipped  
 ID measuring range ID Ø1 mm or more  
 Depth less than 2,5 mm  
 ID Ø8 mm or more  
 Depth less than 50 mm

### Ø1,6 mm ball stylus



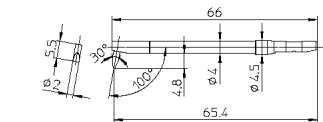
Order No. **12AAV394**  
 Stylus tip S Ø1,6 mm  
 Material Carbide-tipped  
 ID measuring range ID Ø3 mm or more  
 Depth less than 18 mm  
 ID Ø8 mm or more  
 Depth less than 50 mm

### Disk stylus



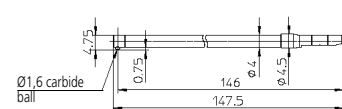
Order No. **12AAV395**  
 Stylus tip R0,25 mm  
 Material Carbide-tipped  
 ID measuring range ID Ø14 mm or more  
 Depth less than 50 mm

### Stylus for flat surface



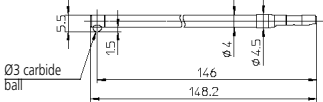
Order No. **12AAV396**  
 Stylus tip R1,0 mm  
 Material Carbide-tipped  
 ID measuring range —  
 Remarks Horizontal position  
 (Upper and lower surface measurements only)

### 2X-long type



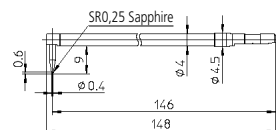
Order No. **12AAV397**  
 Stylus tip S Ø1,6 mm  
 Material Carbide-tipped  
 ID measuring range ID Ø7 mm or more  
 Depth less than 130 mm  
 Remarks Vertical position

### 2X-long stylus for notched workpiece



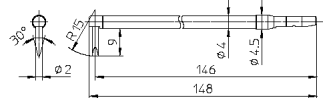
Order No. **12AAV398**  
 Stylus tip S Ø3,0 mm  
 Material Carbide-tipped  
 ID measuring range ID Ø8 mm or more  
 Depth less than 130 mm  
 Remarks Vertical position

### 2X-long stylus for deep groove



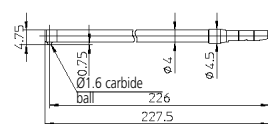
Order No. **12AAV399**  
 Stylus tip SR0,25 mm  
 Material Sapphire  
 ID measuring range ID Ø12 mm or more  
 Depth less than 130 mm  
 Remarks Vertical position

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



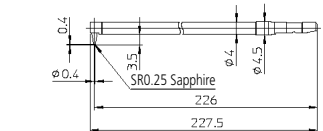
Order No. **12AAV400**  
 Stylus tip R15 mm  
 Material Carbide-tipped  
 ID measuring range ID Ø13 mm or more  
 Depth less than 130 mm  
 Remarks Vertical position

### 3X-long type



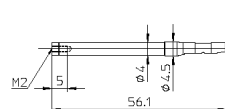
Order No. **12AAV401**  
 Stylus tip S Ø1,6 mm  
 Material Carbide-tipped  
 ID measuring range ID Ø7 mm or more  
 Depth less than 130 mm  
 Remarks Vertical position

### 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

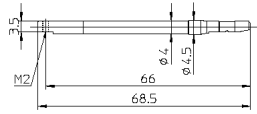
### M2 stylus shank



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

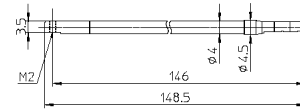
Styli for roundness measurement

M2 stylus shank (for groove)



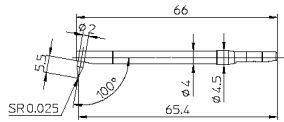
Order No. **12AAV404**  
 Stylus tip —  
 Material —  
 ID measuring range —  
 Remarks Compatible with CMM stylus

2X-long type M2 stylus shank (for groove)



Order No. **12AAV405**  
 Stylus tip —  
 Material —  
 ID measuring range —  
 Remarks Compatible with CMM stylus

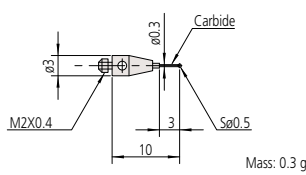
Contour stylus (cone 30° H5.5)



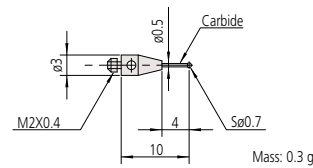
Order No. **12AAV406**  
 Stylus tip SR0.025 mm  
 Material Carbide-tipped  
 ID measuring range —

Using a stylus shank for roundness measurement described above enables the mounting of coordinate measuring machine (CMM) styli.

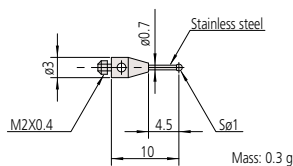
Styli for CMMs\*



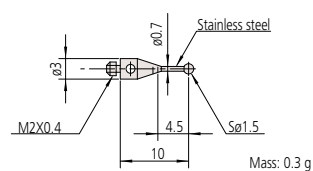
Order No. **K651276**  
 Name MS2-0.5R3  
 Material Ruby



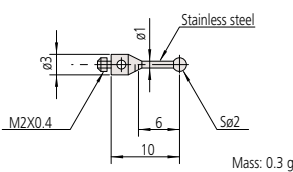
Order No. **K651236**  
 Name MS2-0.7R4  
 Material Ruby



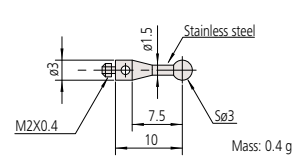
Order No. **K651012**  
 Name MS2-1R4.5  
 Material Ruby



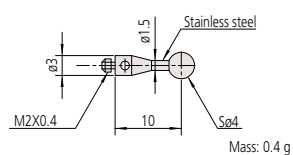
Order No. **K651013**  
 Name MS2-1.5R4.5  
 Material Ruby



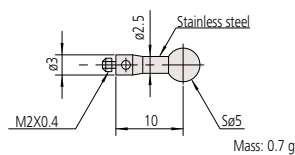
Order No. **K651014**  
 Name MS2-2R6  
 Material Ruby



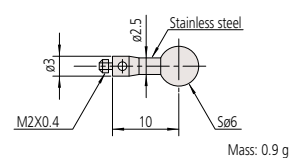
Order No. **K651016**  
 Name MS2-3R7.5  
 Material Ruby



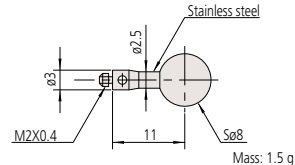
Order No. **K651017**  
 Name MS2-4R10  
 Material Ruby



Order No. **K651018**  
 Name MS2-5R10  
 Material Ruby



Order No. **K651024**  
 Name MS2-6R10  
 Material Ruby

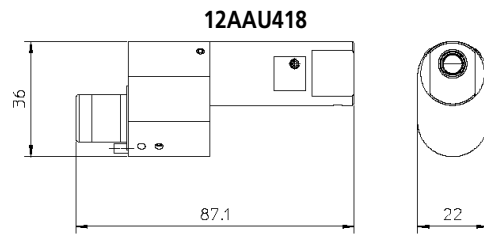


Order No. **K651025**  
 Name MS2-8R11  
 Material Ruby

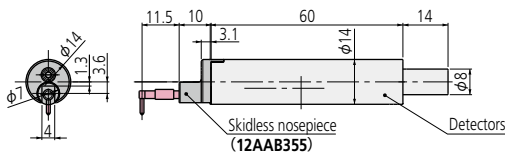
\* **12AAV404** (stylus shank <standard groove>) or **12AAV405** (stylus shank <2X-long groove>) required separately.

## Roughness detector adapter

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



## For Surface Roughness Measuring | Detectors



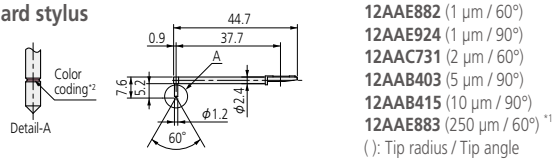
Order No.      Measuring force

**178-396-2**      0,75 mN

**178-397-2**      4 mN

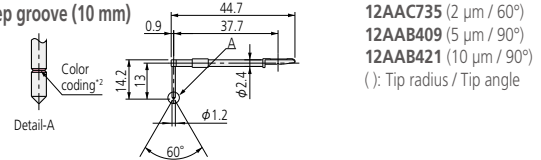
## For Surface Roughness Measuring | Styli

### Standard stylus



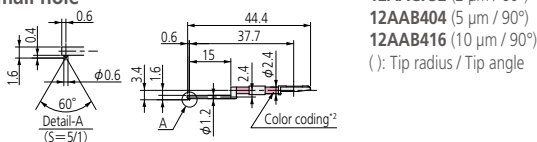
**12AAE882** (1 μm / 60°)  
**12AAE924** (1 μm / 90°)  
**12AAC731** (2 μm / 60°)  
**12AAB403** (5 μm / 90°)  
**12AAB415** (10 μm / 90°)  
**12AAE883** (250 μm / 60°)\*1  
 ( ): Tip radius / Tip angle

### For deep groove (10 mm)



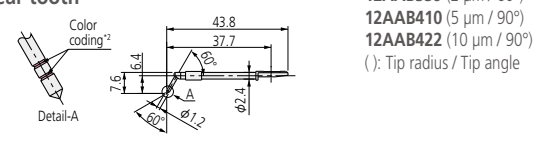
**12AAC735** (2 μm / 60°)  
**12AAB409** (5 μm / 90°)  
**12AAB421** (10 μm / 90°)  
 ( ): Tip radius / Tip angle

### For small hole



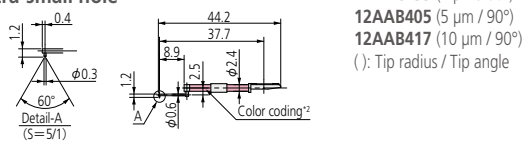
**12AAC732** (2 μm / 60°)  
**12AAB404** (5 μm / 90°)  
**12AAB416** (10 μm / 90°)  
 ( ): Tip radius / Tip angle

### For gear tooth



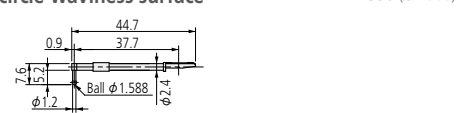
**12AAB339** (2 μm / 60°)  
**12AAB410** (5 μm / 90°)  
**12AAB422** (10 μm / 90°)  
 ( ): Tip radius / Tip angle

### For extra-small hole



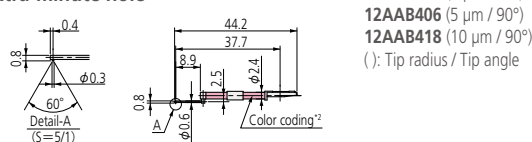
**12AAC733** (2 μm / 60°)  
**12AAB405** (5 μm / 90°)  
**12AAB417** (10 μm / 90°)  
 ( ): Tip radius / Tip angle

### For rolling circle waviness surface\*3



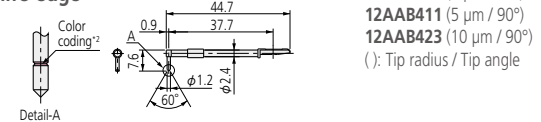
**12AAB338** (Ø1.588)

### For extra-minute hole



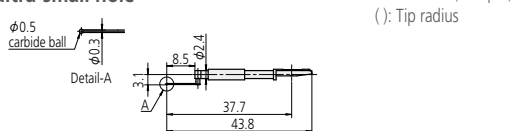
**12AAC734** (2 μm / 60°)  
**12AAB406** (5 μm / 90°)  
**12AAB418** (10 μm / 90°)  
 ( ): Tip radius / Tip angle

### For knife-edge



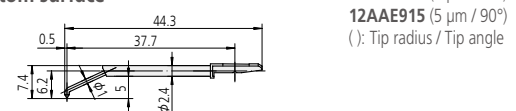
**12AAC738** (2 μm / 60°)  
**12AAB411** (5 μm / 90°)  
**12AAB423** (10 μm / 90°)  
 ( ): Tip radius / Tip angle

### For ultra-small hole\*3



**12AAJ662** (250 μm)  
 ( ): Tip radius

### For bottom surface



**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 (DxH): Ø157x70,6 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 (DxH): Ø118x41 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 (DxH): Ø107x48,5 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 (WxDxH): 235 (max.)x185x70 mm
- Mass: 4 kg

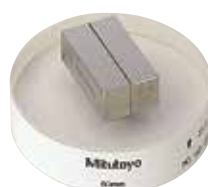
Cylindrical square

350850

- Straightness: 1 µm
- Cylindricity: 2 µm
- External size (DxH): Ø70x250 mm
- Mass: 7,5 kg

Gauge block set for calibration

997090



Auxiliary stage for a short workpiece

356038



Side table

12AAV541

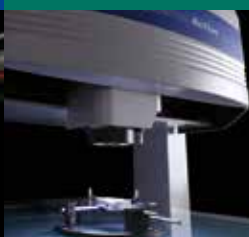


The side table, designed to match the main unit, can house the controller supplied with the main unit, a PC, and a front feed/output printer.

Coordinate Measuring Machines



Vision Measuring Systems



Form Measurement



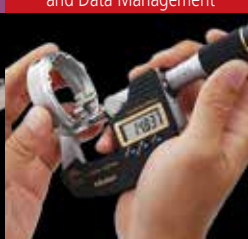
Optical Measuring



Sensor Systems

Test Equipment  
and Seismometers

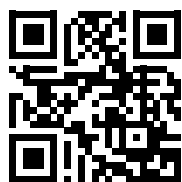
Digital Scale and DRO Systems

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.

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