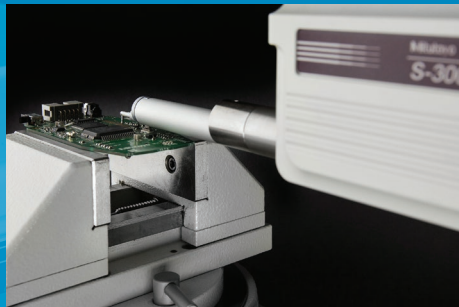


# FORM MEASUREMENT



## Surftest



## Formtracer



## Contracer



## Roundtest



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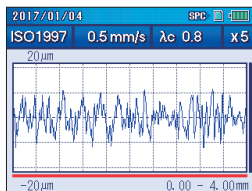
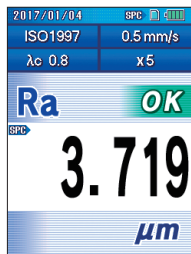
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# Surftest SJ-210

## SERIES 178 – Portable Surface Roughness Tester

- The 2.4-inch colour graphic LCD provides excellent readability and an intuitive display that is easy to navigate. The LCD also includes a backlight for improved visibility in dark environments.
- The Surftest SJ-210 can be operated easily using the buttons on the front of the unit and under the sliding cover.
- Up to 10 setups and one measured profile can be stored in the internal memory.
- An optional memory card can be used as an extended memory to store large quantities of measured profiles and conditions.
- Access to each feature can be password-protected, which prevents unintended operations and enables established settings to be protected.
- The display interface supports 16 languages, which can be freely switched.
- An alarm warns when the cumulative measurement distance exceeds a preset limit so the stylus can be replaced in good time.
- The Surftest SJ-210 complies with the following standards: JIS (JIS-B0601-2001, JIS-B0601-1994, JIS B0601-1982), VDA, ISO-1997, and ANSI.
- In addition to calculation results, the Surftest SJ-210 can display sectional calculation results and assessed profiles, load curves, and amplitude distribution curves.



Surftest SJ-210

### Technical Data

X axis (drive unit)	
Measuring range:	17.5, 5.6 mm (Transverse tracing drive unit type)
Measuring speed:	0.25, 0.5, 0.75 mm/s (returning: 1 mm/s)
Detector	
Range:	360 µm (-200 µm to +160 µm)
Measuring method:	Skidded
Measuring force:	0.75 mN or 4 mN
Stylus tip:	Diamond, 90° / R5 µm (60° / R2 µm)
Skid radius of curvature:	40 mm
Skid force:	Less than 400 mN
Type:	Differential inductance
Power supply:	Two-way power supply: battery (rechargeable Ni-MH battery) and AC adapter
Charging time:	About 4 hours (may vary due to ambient temperature)
Endurance:	About 1000 measurements (differs slightly due to use conditions/ environment)
External I/O:	USB I / F, digimatic output, printer output, RS-232C I / F, foot SW I / F
Data storage:	Memory card (option <b>12AAL069</b> )
Dimensions (WxDxH)	
Display unit:	52.1 x 65.8 x 160 mm
Drive unit:	115 x 23 x 26 mm
Mass:	About 0.5 kg (display unit + drive unit + standard detector)

### Evaluation Capability

Applicable standards:	JIS'82, JIS'94, JIS'01, ISO'97, ANSI, VDA
Assessed profiles:	Primary profile, Roughness profile, DF profile, Roughness profile-Motif
Evaluation parameters:	Ra, Rc, Ry, Rz, Rq, Rt, Rmax, Rp, Rv, R3z, Rsk, Rku, Rc, R <sub>PC</sub> , R <sub>sm</sub> , R <sub>z1max</sub> , S, HSC, Rz <sub>JIS</sub> , R <sub>ppi</sub> , R <sub>Δa</sub> , R <sub>Δq</sub> , R <sub>lr</sub> , R <sub>mr</sub> , R <sub>mr(c)</sub> , R <sub>dc</sub> , R <sub>k</sub> , R <sub>pk</sub> , R <sub>vk</sub> , Mr1, Mr2, A1, A2, Vo, R <sub>pm</sub> , tp, Htp, R, Rx, AR, possible to customize
Analysis graphs:	Bearing Area Curve (BAC), Amplitude Distribution Curve (ADC)
Digital filters:	Gaussian, 2CR75, PC75
Cutoff length:	lc: 0.08, 0.25, 0.8, 2.5 mm ls: 2.5, 8 µm
Sampling length:	0.08, 0.25, 0.8, 2.5 mm
Number of sampling lengths (x n):	x1, x2, x3, x4, x5, x6, x7, x8, x9, x10 arbitrary length (0.3 to 16 mm: 0.01 mm interval) x1, x2, x3, x4, x5, x6, x7, x8, x9, x10 arbitrary length (0.3 to 5.6 mm: 0.01 mm interval)*

\*Only for Transverse tracing drive unit type

### Specifications / Configuration

Model	SJ-210					
Code No. (inch/mm)	178-561-01E	178-561-02E	178-563-01E	178-563-02E	178-565-01E	178-565-02E
Drive unit	Standard type (178-230-2)		Retractable type (178-235)		Transverse tracing type (178-233-2)	
Detector	0.75 mN type (178-296)	4 mN type (178-390)	0.75 mN type (178-296)	4 mN type (178-390)	0.75 mN type (178-387)	4 mN type (178-386)
Display unit	Compact type (178-253*)					
Detector: Conical taper angle	60°	90°	60°	90°	60°	90°
Stylus tip radius	2 µm	5 µm	2 µm	5 µm	2 µm	5 µm
Detector measuring force	0.75 mN	4 mN	0.75 mN	4 mN	0.75 mN	4 mN
Price	£1480.00	£1480.00	£1750.00	£1750.00	£2740.00	£2740.00

## Functions

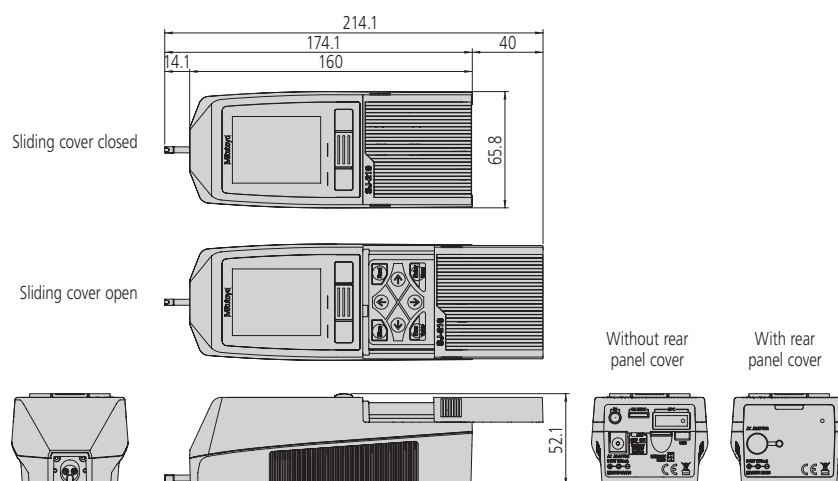
Customization:	Desired parameters can be selected for calculation and display.
GO/NG judgement:	By max value / 16% / standard deviation
Storage of setups:	Save the setup at power OFF
Storage	
Internal memory:	Setups (10 sets), Measured profile (1 set)
Memory card (option):	500 setups, 10000 measured profiles, 500 display images, text file (setups / measured profile / assessed profile / bearing area curve / amplitude distribution curve)
Calibration:	Auto-calibration with the entry of numerical value / average calibration with multiple measurement (max.5 times) is available

## Dimensions

### Drive unit stored inside display unit

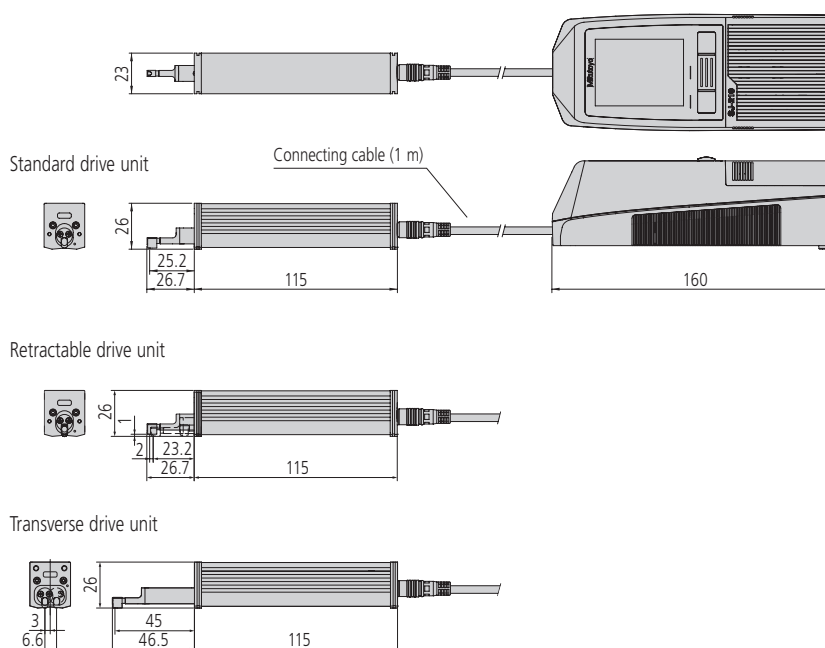
(Standard detector installed in drive unit) SJ-210 series

Unit: mm



### Drive unit not stored inside display unit

(Standard detector installed in drive unit) SJ-210 series





# Surftest SJ-310

## SERIES 178 – Portable Surface Roughness Tester

- The handheld data processing unit and the 5.7-inch colour graphic LCD touch-panel provide superior readability and operability. The LCD also includes a backlight for improved visibility in dark environments.
- The excellent user interface provides intuitive and easy-to-understand operability.
- Complies with the following standards: JIS (JIS-B0601-2001, JIS-B0601-1994, JIS B0601-1982), VDA, ISO- 1997, and ANSI.
- The Measure-Start and other frequently used buttons are strengthened to resist wear and the detrimental effects of workshop contaminants.
- Equipped with a large-capacity battery allowing approximately 1500 measurements when fully charged.
- Includes convenient carrying case for protection in the field.
- A high-speed printer is built into the main unit. Either landscape or portfolio mode can be selected according to the application. Paper saving mode is supported.
- The display interface supports 16 languages, which can be freely switched.
- 10 setups can be saved in the measurement unit. An optional memory card can save setups and the measured profile.



Surftest SJ-310

### Specifications/Configuration

Model	SJ-310					
Code No. (inch/mm)	178-571-01E	178-571-02E	178-573-01E	178-573-02E	178-575-01E	178-575-02E
Drive unit	Standard type (178-230-2)		Retractable type (178-235)		Transverse tracing type (178-233-2)	
Detector	0.75 mN type (178-296)	4 mN type (178-390)	0.75 mN type (178-296)	4 mN type (178-390)	0.75 mN type (178-387)	4 mN type (178-386)
Display unit	Standard type with printer					
Detector: Conical taper angle	60°	90°	60°	90°	60°	90°
Stylus tip radius	2 μm	5 μm	2 μm	5 μm	2 μm	5 μm
Detector measuring force	0.75 mN	4 mN	0.75 mN	4 mN	0.75 mN	4 mN
Price	£2850.00	£2850.00	£2990.00	£2990.00	£4200.00	£4200.00

### Technical Data

X axis (drive unit)	
Measuring range:	17.5, 5.6 mm (Transverse tracing drive unit type)
Measuring speed:	0.25, 0.5, 0.75 mm/s (returning: 1 mm/s)
Detector	
Range:	360 μm (-200 μm to +160 μm)
Measuring method:	Skidded
Measuring force:	0.75 mN or 4 mN
Stylus tip:	Diamond, 90° / R5 μm (60° / R2 μm)
Skid radius of curvature:	40 mm
Skid force:	Less than 400 mN
Type:	Differential inductance
Power supply:	Two-way power supply: battery (rechargeable Ni-MH battery) and AC adapter
Battery	
Charging time:	4 hours maximum
Recharge cycles:	Approximately 1500 times (slightly varies with the usage and environmental conditions)
External I/O:	USB I/F, digimatic output, RS-232C I/F, external SW I/F
Data storage:	Memory card (option 12AAL069)
Dimensions (WxDxH)	
Control unit:	275 x 109 x 198 mm
Drive unit:	115 x 23 x 26 mm
Mass	
Display unit:	Approx. 1.7 kg
Drive unit:	0.2 kg

### Evaluation Capability

Applicable standards:	JIS'82, JIS'94, JIS'01, ISO'97, ANSI, VDA
Assessed profiles:	P (primary profile), R (roughness profile), DIN4776, roughness motif, waviness motif
Evaluation parameters:	Ra, Ry, Rz, Rt, Rp, Rq, Rv, Rsk, Rku, Rc, RSm, S, Rpc, R3z, Rmr (c), Rpk, Rvk, Rdc, Rk, Mr1, Mr2, Lo, Rppi, R, AR, Rx, A1, A2, Vo, HSC, Rmr, SK, Ku, RΔa, RΔq, Rlr, λa, λq, Rpm, RzJIS (JIS'01), tp (ANSI), Htp (ANSI), Wte, Wx, W, AW, Rz1max (ISO), Rmax (VDA, ANSI, JIS'82), possible to customize
Analysis graphs:	Bearing area curve, amplitude distribution curve
Digital filter:	2CR, PC75, Gaussian
Cutoff length:	lc: 0.08, 0.25, 0.8, 2.5, 8 mm ls: 2.5, 8 μm
Sampling length:	0.08, 0.25, 0.8, 2.5, 8 mm
Number of sampling lengths (x n):	x1, x2, x3, x4, x5, x6, x7, x8, x9, x10 arbitrary length (0.3 to 16.0 mm: 0.01 mm interval) x1, x2, x3, x4, x5, x6, x7, x8, x9, x10 arbitrary length (0.3 to 5.6 mm: 0.01 mm interval)*
Printer:	Thermal type
Printing width:	48 mm (paper width: 58 mm)
Recording magnification	
Vertical:	10X to 100,000X, auto
Horizontal:	1X to 1,000X, auto

\* Only for Transverse tracing drive unit type.

## Functions

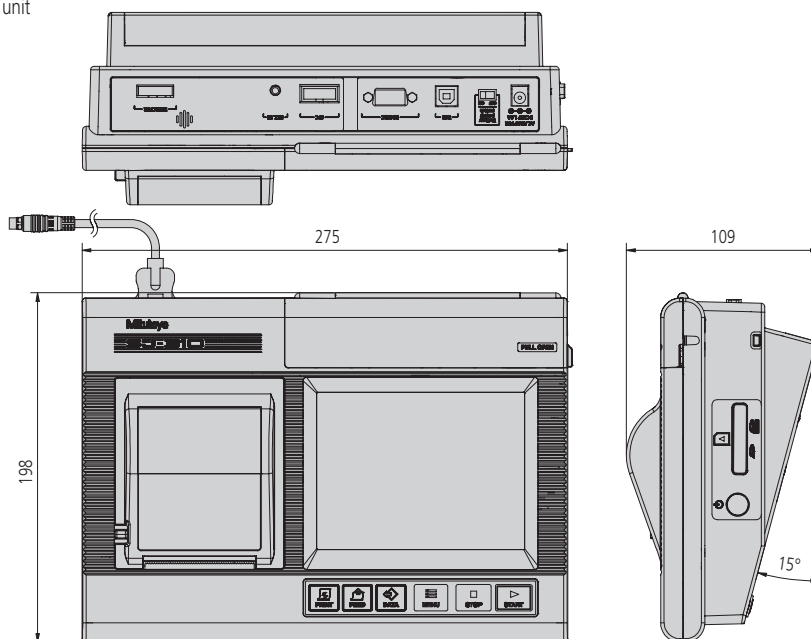
- Customization:** Desired parameters can be selected for calculation and display.
- Statistical processing:** Maximum value, minimum value, mean value, standard deviation, pass rate, histogram of each parameter
- GO/NG judgement:** Maximum value rule, 16% rule, average value rule, standard deviation ( $1\sigma$ ,  $2\sigma$ ,  $3\sigma$ )
- Storage**
- Internal memory: Setups (10 sets)
  - Memory card (option): 500 setups, 10000 measured profiles, 500 display images, text file (setups / measured profile / assessed profile / bearing area curve / amplitude distribution curve), 500 statistical data, etc.
- Calibration:** Auto-calibration with the entry of numerical value / average calibration with multiple measurement (max. 12 times) is available.
- Power saving function:** Auto-sleep-function, auto shutdown of backlight by ECO mode.



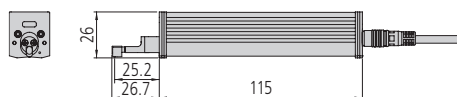
## Dimensions

Unit: mm

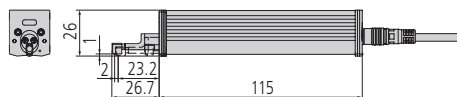
Display unit



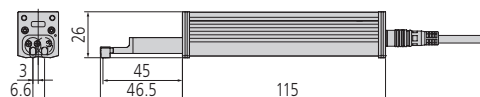
Standard drive unit



Retractable drive unit



Transverse drive unit



## For Surftest SJ-210 and SJ-310

## Standard detectors

### Small hole detectors

### Extra small hole detectors

## Gear-tooth surface detectors

[illegible]

## Deep groove detectors

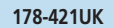
### Setting Attachments (for standard and retractable drive units only)

Code No.	Description	Price
<b>178-033</b>	V-type for measuring in the cylinder axis direction	<b>£2180.00</b>
<b>178-034</b>	Magnetic slider type	<b>£1670.00</b>
<b>178-035</b>	Inside diameter type	<b>£1960.00</b>



- Applicable diameter:  $\varnothing 75$  -  $\varnothing 95$  mm
- Accessible depth: 30 - 135 mm

- Power supply can be selected. (AC adapter or optional battery pack).
- Printable items: Setups, calculation results, assessed profile, bearing area curve (BAC), amplitude distribution curve (ADC), and environment settings.



DP-1VR

It is possible to process Digimatic data output from the Surftest SJ series with the DP-1VR. This compact, hand-held device can provide printouts of measurement data and various statistical analyses results such as histograms, D-charts, and X-bar R control charts. With optional output cables, DP-1VR is also capable of RS-232C output of measurement data to a PC (cable **09EAA084**) and GO/NG judgement output (cable **965516**).



**Mitutoyo**

## Optional Software

### SJ-Tools

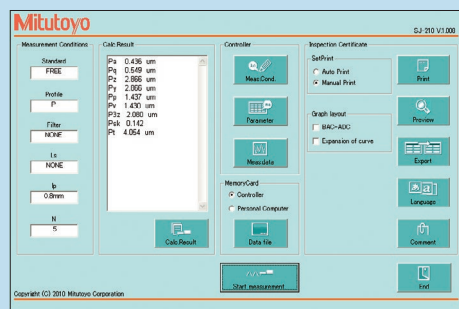
Output software based on Microsoft Excel\* for controlling instruments and reproducing and storing measurement data. Complete with exclusive accessories.

- Measurement device control.
- Definition of measurement variables.
- Graphic representation of the profile.
- Storage of measurement records.
- Documentation of measurement results.
- Connecting cable.

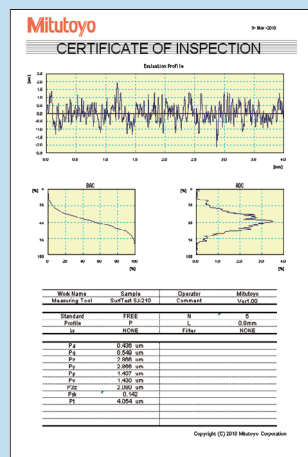
\*Microsoft Excel is not included. To be supplied by the customer.

Cables required:

Code No.	Description	Price
<b>12AAL068</b>	USB PC connecting cable (USB cable) for SJ-210	<b>£26.40</b>
<b>12AAD510</b>	USB PC connecting cable (USB cable) for SJ-310	<b>£45.50</b>
<b>12AAL067</b>	RS-232C cable for SJ-210	<b>£62.70</b>
<b>12AAA882D</b>	RS-232C cable for SJ-310	<b>£56.10</b>



SJ-Tools input mask for Surftest SJ series.

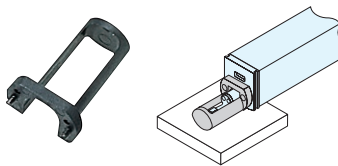


SJ-Tools output record from MS-Excel (This program can be downloaded for free from the Mitutoyo website [www.mitutoyo.co.uk](http://www.mitutoyo.co.uk)).

## Attachments

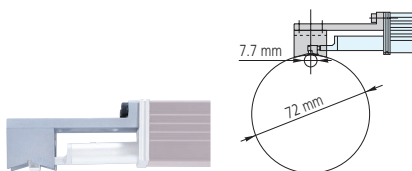
### Nosepiece for flat surfaces

- SJ-310 standard accessory. (Not for transverse tracing type.)



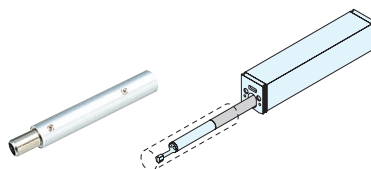
### V-type adapter

- SJ-310 Transverse tracing type standard accessory.



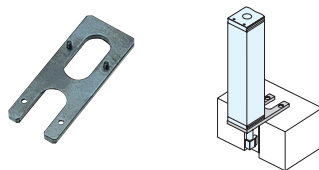
### Extension rod (50 mm)

- Not available for the transverse tracing drive unit. (Note: Only one rod can be used.)

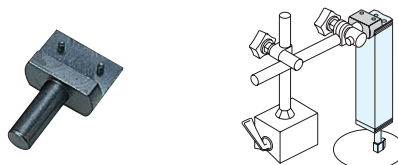


### Vertical positioning adapter

- Not available for the transverse tracing drive unit.

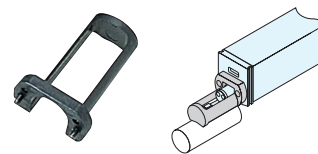


### Magnetic stand adapter



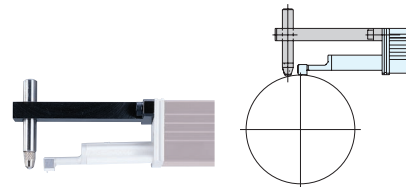
### Nosepiece for cylindrical surfaces

- SJ-310 standard accessory. (Not for transverse tracing type.)



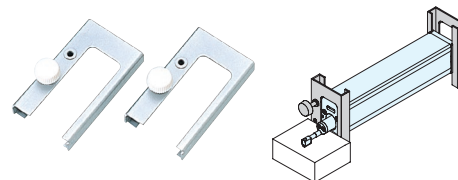
### Point-contact adapter

- SJ-310 Transverse tracing type standard accessory.

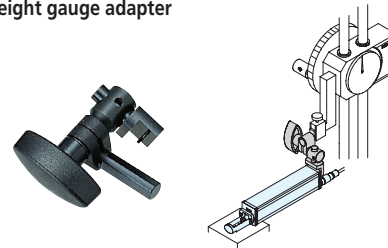


### Support feet set

- SJ-301/301R standard accessory.
- Not available for the detector end of the transverse tracing drive unit.



### Height gauge adapter



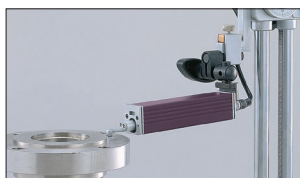
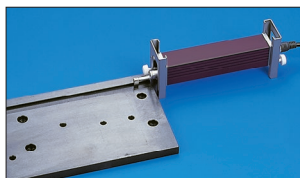
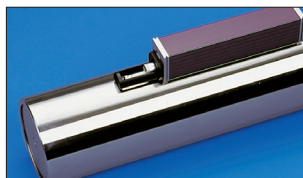
### Extension cable (1 m)

- Only one cable can be used.



Code No.	Description	Price
<b>12AAA210</b>	Extension rod (50 mm)	<b>£122.00</b>
<b>12AAA216</b>	Support feet set	<b>£77.90</b>
<b>12AAA217</b>	Nosepiece for flat surfaces	<b>£77.90</b>
<b>12AAA218</b>	Nosepiece for cylindrical surfaces	<b>£77.90</b>
<b>12AAA219</b>	Vertical positioning adapter	<b>£24.90</b>
<b>12BAA220</b>	Magnetic stand adapter (ø9.5 mm)	<b>£28.00</b>

Code No.	Description	Price
<b>12AAA221</b>	Magnetic stand adapter (ø8 mm)	<b>£28.00</b>
<b>12AAA222</b>	Height gauge adapter (9 x 9 mm)	<b>£44.90</b>
<b>12AAA223</b>	Height gauge adapter (1/4 x 1/2")	<b>£54.90</b>
<b>12AAE643</b>	Point-contact adapter	<b>£125.00</b>
<b>12AAE644</b>	V-type adapter	<b>£135.00</b>
<b>12BAA303</b>	Extension cable (1 m)	<b>£56.50</b>

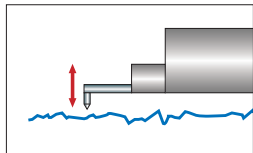




# Surftest SJ-410

## SERIES 178 – Portable Surface Roughness Tester

- Skidded and skidless measurements are both possible with this series. Measures 46 roughness parameters that conform to the latest ISO, DIN, ANSI, and JIS standards.
- A wide-range, high-resolution detector and efficient drive unit provide superior high-accuracy measurement.
- A skidless detector and a curved surface compensation function provide efficient evaluation of cylinder surface roughness.
- Ultra-fine steps, straightness and waviness can be measured by using the skidless measurement function.
- The handheld data processing unit and the 5.7-inch colour graphic LCD touch-panel provides superior readability and operability. The LCD also includes a backlight for improved visibility in dark environments.
- The excellent user interface provides intuitive and easy-to-understand operability.
- Measured data can be output to a PC with an optional RS-232C or USB cable.
- Digital filter function for accurate roughness profiles.
- GO/NG judgement function.
- Auto-calibration function.
- The display interface supports 16 languages, which can be freely switched.
- Simplified contour analysis function supports four types of measurement: step, level change, area and coordinate difference.
- Access to each feature can be password protected, which prevents unintended operations and enables established settings to be protected.
- The optional attachments for mounting on a column stand significantly increase the operability.



Skidless measurement.



Surftest SJ-411

### Specifications

Model		SJ-411		SJ-412	
Code No. (inch/mm)		178-581-01E	178-581-02E	178-583-01E	178-583-02E
Measuring range		25 mm		50 mm	
Speed		Measuring: 0.05, 0.1, 0.2, 0.5, 1.0 mm/s, returning: 0.5, 1, 2, 5 mm/s			
Range/resolution		800 μm/0.0125 μm, 80 μm/0.00125 μm, 8 μm/0.000125 μm (up to 2400 μm with an optional stylus)			
Measurement method		Skidless/skidded			
Stylus tip	Angle	60°	90°	60°	90°
	Radius	2 μm	5 μm	2 μm	5 μm
Detector measuring force		0.75 mN	4 mN	0.75 mN	4 mN
Assessed profiles		P (primary profile), R (roughness profile), DF (DF profile), W (filtered waviness profile), roughness motif, waviness motif			
Evaluation parameters		Ra, Rq, Rz, Ry, Rp, Rv, Rt, R3z, Rsk, Rku, Rc, R <sub>Pc</sub> , R <sub>Sm</sub> , R <sub>max</sub> (VDA, ANSI), R <sub>z1max</sub> (ISO'97), S, HSC, R <sub>zJIS</sub> (JIS'01), R <sub>ppi</sub> , R <sub>Δa</sub> , R <sub>Δq</sub> , R <sub>lr</sub> , R <sub>mr</sub> , R <sub>mr</sub> (c), R <sub>Δc</sub> , Rk, R <sub>pk</sub> , R <sub>vk</sub> , Mr1, Mr2, A1, A2, Vo, δq, Lo, R <sub>pm</sub> , tp(ANSI), H <sub>tp</sub> (ANSI), R, Rx, AR, AW, Wx, W <sub>te</sub>			
Analysis graphs		Bearing Area Curve (BAC), Amplitude Distribution Curve (ADC)			
Power supply		Via AC adapter or rechargeable battery			
Rechargeable battery		Recharge time: 4 hours (for a maximum 1000 measurements without printing)			
Price		£5920.00	£5920.00	£7110.00	£7110.00

### Technical Data

X axis (drive unit)	
Traverse direction:	Backward
Traverse straightness:	0.3 µm/25 mm (SJ-411), 0.5 µm/50 mm (SJ-412)
Positioning:	±1.5° (tilting), 10 mm (up/down)
Detector	
Skid radius of curvature:	40 mm
Type:	Differential inductance
Storage	
Internal memory:	Setups (10 sets)
Memory card (option):	500 setups, 10000 measured profiles, 500 display images, text file (setups / measured profile / assessed profile / bearing area curve / amplitude distribution curve), 500 statistical data, etc.
Dimensions (WxDxH)	
Display unit:	275 x 109 x 198 mm
Height-tilt adjustment unit:	131 x 63 x 99 mm
Drive unit:	128 x 36 x 47 mm (SJ-411), 155 x 36 x 47 mm (SJ-412)
Control unit mass:	Approx. 1.7 kg
Height-tilt adjustment unit:	Approx. 0.4 kg
Drive unit:	0.6 kg (SJ-411), 0.7 kg (SJ-412)

### Evaluation Capability

Applicable standards:	JIS'82, JIS'94, JIS'01, ISO'97, ANSI, VDA, Free
Digital filter:	2CR, PC75, Gaussian
Cutoff length:	λc: 0.08, 0.25, 0.8, 2.5, 8 mm λs: 2.5, 8, 25 µm (availability of switching depends on the selected standard.)
Sampling length:	0.08, 0.25, 0.8, 2.5, 8, 25*mm; or arbitrary length in range 0.1 to 25 mm (0.1 to 50 mm: SJ-412) in 0.01 mm increments
Number of sampling lengths:	1, 2, 3, ~20 (limited by traverse range)
Printer:	Thermal type
Printing width:	48 mm (paper width: 58 mm)
Recording magnification	
Vertical:	10X to 100,000X, auto
Horizontal:	1X to 1,000X, auto
Function	
Customize:	Selection of display/evaluation parameter
Data compensation:	R-surface, tilt compensation
Ruler function:	Step, level change, area and coordinate difference
DAT function:	Helps to level workpiece prior to skidless measurement. Displacement detection mode enables the stylus displacement to be input while the drive unit is stopped.
Statistical processing:	Max. value, min. value, mean value, standard deviation (s), pass ratio, histogram
GO/NG judgement:	Maximum value rule, 16% rule, average value rule, standard deviation (1σ, 2σ, 3σ)
Calibration:	Auto-calibration with the entry of numerical value/average calibration with multiple measurement (max. 12 times) is available.
Power saving function:	Auto-sleep-function, auto shutdown of backlight by ECO mode.

\*Only for SJ-412.

## Optional Software

### SJ-Tools

Output software based on Microsoft Excel\* for controlling instruments and reproducing and storing measurement data. Complete with exclusive accessories.

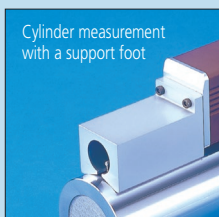
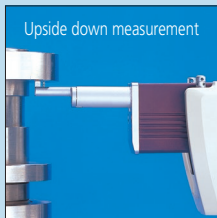
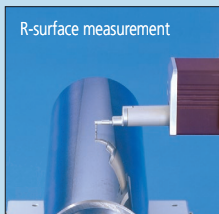
- Measurement device control
- Definition of measurement variables
- Graphic representation of the profile
- Storage of measurement records
- Documentation of measurement results
- Connecting cable

\*Microsoft Excel is not included. To be supplied by the customer.

Cables required:

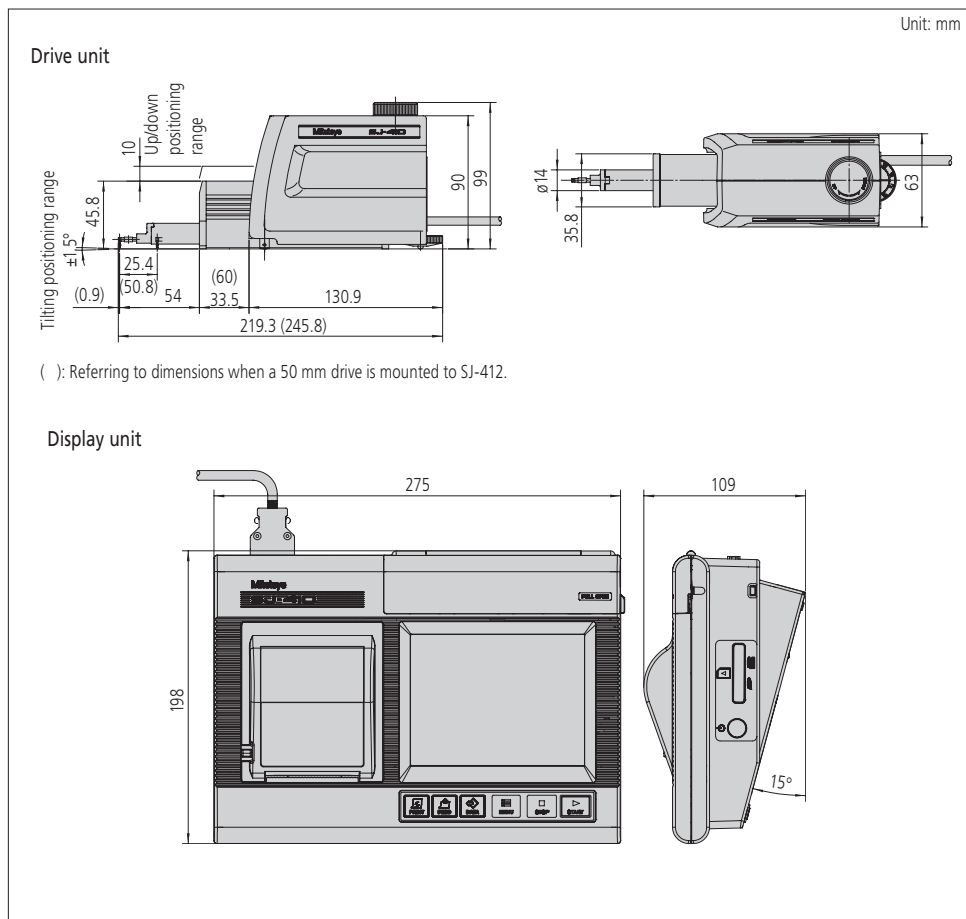
Code No.	Description	Price
<b>12AAD510</b>	USB PC connecting cable (USB cable)	<b>£45.50</b>
<b>2AAA882D</b>	RS-232C cable	<b>£56.10</b>

## Measurement Applications



With optional accessories.

## Dimensions



## Optional Accessories

Code No.	Description	Price
<b>178-611</b>	Reference step specimen (mm)	<b>£391.00</b>
<b>178-612</b>	Reference step specimen (mm/inch)	<b>£396.00</b>
<b>178-610</b>	Step gauge (step: 1 µm, 2 µm, 5 µm, 10 µm)	<b>£397.00</b>
<b>12AAM556</b>	Height/tilt adjustment unit for SJ-410	<b>£455.00</b>
<b>178-039</b>	Manual column stand (granite base, vertical travel: 250 mm)	<b>£500.00</b>
<b>178-010</b>	Auto-set unit for 178-039	<b>£2210.00</b>
<b>178-020</b>	X-axis adjustment unit for 178-039	<b>£1140.00</b>
<b>178-030</b>	Tilting adjustment unit (Inclination adjustment unit) for 178-039	<b>£1740.00</b>
<b>12AAB358</b>	Cylindrical surface adapter (workpiece ø15 - 60 mm)	<b>£133.00</b>
<b>178-016</b>	Levelling table (tilting: ±1.5°, max. loading: 15 kg)	<b>£631.00</b>
<b>178-048</b>	Levelling table with DAT function (mm) (tilting: ±1.5°, max. loading: 15 kg)	<b>£1330.00</b>
<b>178-058</b>	Levelling table with DAT function (inch) (tilting: ±1.5°, max. loading: 15 kg)	<b>£1330.00</b>
<b>178-043-1</b>	XY levelling table (25 x 25 mm) (tilting: ±1.5°, max. loading: 15 kg, swivelling: ±3°)	<b>£2370.00</b>
<b>178-053-1</b>	XY levelling table (1 x 1") (tilting: ±1.5°, max. loading: 15 kg, swivelling: ±3°)	<b>£2030.00</b>
<b>178-042-1</b>	Digital XY levelling table (25 x 25 mm) (tilting: ±1.5°, max. loading: 15 kg, swivelling: ±3°)	<b>£3070.00</b>
<b>178-052-1</b>	Digital XY levelling table (1 x 1") (tilting: ±1.5°, max. loading: 15 kg, swivelling: ±3°)	<b>£2280.00</b>
<b>178-049</b>	Digital XY levelling table (25 x 25 mm) (max. loading: 15 kg)	<b>£1400.00</b>
<b>178-059</b>	Digimatic XY levelling table (1 x 1") (max. loading: 15 kg)	<b>£1320.00</b>
<b>178-019</b>	Precision vice for XY levelling table (jaw opening: 36 mm)	<b>£700.00</b>
<b>998291</b>	Precision V-block for XY levelling table workpiece ø1 - ø160 mm)	<b>£639.00</b>
<b>12AAL069</b>	Memory card	<b>£27.50</b>
<b>12AAD510</b>	USB PC connecting cable (USB cable)	<b>£45.50</b>
<b>12AAA882D</b>	PC connecting cable (RS-232C cable)	<b>£56.10</b>
<b>965014</b>	SPC cable (2 m)	<b>£45.00</b>
<b>264-016</b>	Input tool (USB type)	<b>£220.00</b>
<b>264-504-5E</b>	DP-1VR	<b>£394.00</b>

### Consumable spares

<b>270732</b>	Durable printer paper (25 m, 5 rolls/set)	<b>£19.70</b>
<b>12AAJ088</b>	Footswitch	<b>£244.00</b>
<b>12AAN040</b>	LCD protective sheet (10 sheets/set)	<b>£153.00</b>
<b>12AAN046</b>	Replacement battery	<b>£143.00</b>

# Surftest SJ-500

## SERIES 178 – Surface Roughness Tester with Dedicated Control/Display Unit

- High-precision/performance surface roughness tester with a dedicated control unit, achieving user-friendly display and simple operation.
- Equipped with a 7.5-inch, colour TFT LCD with backlight, large colour icons and touch panel buttons for easy control of machine function.
- Feed-knobs on the main unit allow fine positioning of a small stylus for measuring small holes.
- Simple setup for surface roughness measuring conditions.
- A simple input function is used to calculate according to ISO/JIS roughness standard drawing instruction symbols. Complicated setups can easily be entered by selecting a drawing instruction symbol from the surface roughness menu.
- Built-in thermal printer.

Surftest SJ-500



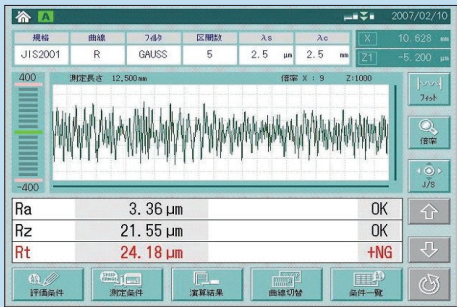
### Specifications

Model	SJ-500	
Code No. (mm)	178-532-01E	178-532-02E
Code No. (inch/mm)	178-533-01E	178-533-02E
Measuring range	50 mm	
Resolution	0.05 µm	
Scale	Linear encoder	
Drive speed	0-20 mm/s	
Measuring speed	0.02-5 mm/s	
Traverse direction	Backward	
Traverse straightness	0.2 µm/50 mm	
Positioning	±1.5° (tilting, with DAT function) 30 mm (up/down)	
Detector range/resolution	800 µm/0.01 µm, 80 µm/0.001 µm, 8 µm/0.0001 µm	
Measurement method	Skidless/skidded	
Stylus tip	Angle	60°
	Radius	2 µm
Detector measuring force	0.75 mN	4 mN
Skid radius of curvature	40 mm	
Detector type	Differential inductance	
Drive unit control	Joystick operation with manual adjustment knob	
Display magnification	Horizontal: X0.5 to X10,000 auto, vertical: X10 to X500,000 auto	
Mass	6.7 kg (drive unit: 2.7 kg, control unit: 4 kg)	

### Evaluation Capability

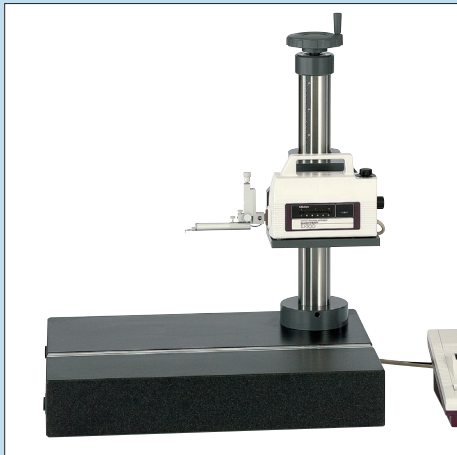
Assessed profiles:	P (primary profile), R (roughness profile), WC, WCA, WE, WEA, envelope residual profile, roughness motif, waviness motif
Evaluation parameters:	Ra, Rc, Ry, Rz, Rq, Rt, Rmax, Rp, Rv, R3z, Sm, S, Pc, mr(c), δc, mr, tp, Htp, Lo, Ir, Ppi, HSC, Δa, Δq, Ku, Sk, Rpk, Rvk, Rk, Mr1, Mr2, A1, A2, Vo, λa, λq
Roughness motif parameters:	R, AR, Rx
Waviness motif parameters:	W, AW, Wx, Wte
Analysis graphs:	ADC, BAC, power spectrum chart
Digital filter:	2CR-75%, PC-75%, gaussian, robust spline
Cutoff length:	λs: 0.25, 0.8, 2.5, 8, 25, 80, 250 µm, no filter λc*: 0.025, 0.08, 0.25, 0.8, 2.5, 8, 25 mm λf: 0.08, 0.25, 0.8, 2.5, 8, 25 mm, no filter
Sampling length*:	0.025, 0.08, 0.25, 0.8, 2.5, 8, 25 mm
Data compensation functions:	Parabola compensation, hyperbola compensation, ellipse compensation, R-plane (curved surface) compensation, conic compensation, tilt compensation

\*An arbitrary length can also be specified in the range from 0.025 mm to the maximum traverse length.



### Optional Accessory

Code No.	Description	Price
270732	Durable printer paper (25 m, 5 rolls/set)	£19.70



The SJ-500 can also be mounted on a manual column stand.

## Evaluation Capability: FORMTRACEPAK

Assessed profiles: P (primary profile), R (roughness profile), WC, WCA, WE, WEA, DIN4776 profile, envelope residual profile, roughness motif, waviness motif

Evaluation parameters: Ra, Rq, Rz, Ry, Rz(JIS), Ry(DIN), Rc, Rp, Rpm, Rpi, Rv, Rvmax, Rvi, Rt, Rti, R3z, R3zi, R3y, S, Pc (Ppi), Sm, HSC, mr,  $\delta c$ , plateau ratio, mrd, Rk, Rpk, Rvk, Mr1, Mr2,  $\Delta a$ ,  $\Delta q$ ,  $\lambda a$ ,  $\lambda q$ , Sk, Ku, Lo, Lr, A1, A2

Roughness motif parameters: Rx, R, AR, SR, SAR, NR, NCRX, CPM

Waviness motif parameters: Wte, Wx, W, AW, SW, SAW, NW

Analysis graphs: ADC, BAC1, BAC2, power spectrum chart, autocorrelation chart, Walsh power spectrum chart, Walsh auto-correlation chart, slope distribution chart, local peak distribution chart, parameter distribution chart, digital filter 2CR-75%, 2CR-50%, 2CR-75% (phase corrected), 2CR-50% (phase corrected), gaussian-50%

Cutoff length\*:  $\lambda c$ : 0.025, 0.08, 0.25, 0.8, 2.5, 8, 25 mm

Sampling length\*: fl: 0.08, 0.25, 0.8, 2.5, 8, 25 mm

Data compensation functions: fh: 0.08, 0.25, 0.8, 2.5, 8, 25 mm

Tilt compensation, R-plane (curved surface) compensation, ellipse compensation, parabola compensation, hyperbola compensation, quadric curve automatic compensation, polynomial compensation, polynomial automatic compensation

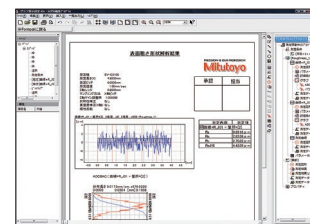
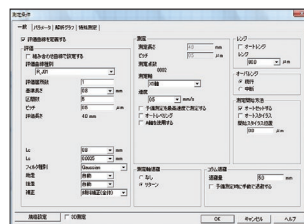
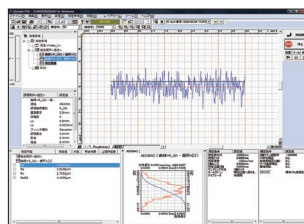
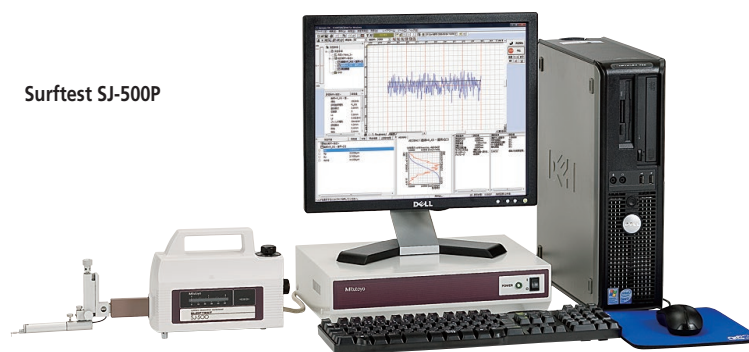
\*An arbitrary length can also be specified in the range from 0.025 mm to the maximum traverse length.

# Surftest SJ-500P

## SERIES 178 – Surface Roughness Tester with PC

- High-precision/performance surface roughness tester that runs under the FORMTRACEPAK sophisticated analysis software package.
- Software icons enable easy control of machine function.
- Feed-knobs on the main unit allow fine positioning of a small stylus for measuring small holes.
- Simple setup for surface roughness measuring conditions.
- A simple input function is used to calculate according to ISO/JIS roughness standard drawing instruction symbols. Complicated setups can easily be entered by selecting a drawing instruction symbol from the surface roughness menu.

Surftest SJ-500P



## Specifications

Model	SJ-500P	
Code No. (mm)	178-530-01E	178-530-02E
Code No. (inch/mm)	178-531-01E	178-531-02E
Measuring range	50 mm	
Resolution	0.05 $\mu$ m	
Scale	Linear encoder	
Drive speed	0 - 20 mm/s	
Measuring speed	0.02 - 5 mm/s	
Traverse direction	Backward	
Traverse straightness	0.2 $\mu$ m/50 mm	
Positioning	$\pm 1.5^\circ$ (tilting, with DAT function) 30 mm (up/down)	
Detector range/resolution	800 $\mu$ m/0.01 $\mu$ m, 80 $\mu$ m/0.001 $\mu$ m, 8 $\mu$ m/0.0001 $\mu$ m	
Measurement method	Skidless/skidded	
Stylus tip	Angle	60°
	Radius	2 $\mu$ m
Detector measuring force	0.75 mN	4 mN
Skid radius of curvature	40 mm	
Detector type	Differential inductance	
Drive unit control	PC	
Display magnification	Horizontal: X0.5 to X10,000 auto, vertical: X10 to X500,000 auto	
Mass	6.5 kg (main unit 2.7 kg; PC I/F unit 3.8 kg)	



# Surftest SV-2100

## SERIES 178 – Surface Roughness Tester with Dedicated Control/Display Unit

- High-precision/performance surface roughness tester with a dedicated control unit, achieving user-friendly display and simple operation.
- Equipped with a 7.5-inch, colour TFT LCD with backlight, large colour icons and touch panel buttons for easy control of machine function.
- A feed-knob on the main unit allows fine positioning of a small stylus for measuring small holes.
- Simple setup for surface roughness measuring conditions.
- A simple input function is used to calculate according to ISO/JIS roughness standard drawing instruction symbols. Complicated setups can easily be entered by selecting a drawing instruction symbol from the surface roughness menu.
- Built-in thermal printer.



### Specifications

Model	SV-2100M4		SV-2100S4	
Code No. (mm)	178-636-01E	178-636-02E	178-680-01E	178-680-02E
Code No. (inch/mm)	178-637-01E	178-637-02E	178-681-01E	178-681-02E
Measuring range	100 mm			
Stylus tip	Angle	60°	90°	60°
	Radius	2 µm	5 µm	2 µm
Detector measuring force	0.75 mN	4 mN	0.75 mN	4 mN
Vertical travel	350 mm manual column			
Granite base size (WxD)	600x450 mm			
Dimensions (main unit, WxDxH)	716 x 450 x 863 mm		766 x 482 x 966 mm	
Mass	144 kg		147 kg	

Model	SV-2100H4		SV-2100W4	
Code No. (mm)	178-682-01E	178-682-02E	178-684-01E	178-684-02E
Code No. (inch/mm)	178-683-01E	178-683-02E	178-685-01E	178-685-02E
Measuring range	100 mm			
Stylus tip	Angle	60°	90°	60°
	Radius	2 µm	5 µm	2 µm
Detector measuring force	0.75 mN	4 mN	0.75 mN	4 mN
Vertical travel	550 mm manual column			
Granite base size (WxD)	600x450 mm		1000x450 mm	
Dimensions (main unit, WxDxH)	766 x 482 x 1166 mm		1166 x 482 x 1176 mm	
Mass	157 kg		227 kg	

### Technical Data

X1 axis (drive unit)	
Resolution:	0.05 µm
Scale:	Linear encoder
Drive speed:	0-40 mm/s
Measuring speed:	0.02-5 mm/s
Traverse direction:	Backward
Traverse straightness:	0.15 µm/100 mm
Z2 axis (column)	
Type:	Manual operation or power drive
Resolution*:	1 µm
Scale type*:	Rotary encoder
Drive speed*:	0-20 mm/s
*Only for power drive type	
Detector	
Range / resolution:	800 µm/0.01 µm, 80 µm/0.001 µm, 8 µm/0.0001 µm
Measurement method:	Skidless
Type:	Differential inductance
Control unit	
Magnification:	Horizontal: X0.5 to X10,000, auto Vertical: X10 to X500,000, auto
Drive unit control:	Joystick operation with manual adjustment knob

### Evaluation Capability

Assessed profiles:	P (primary profile), R (roughness profile), WC, WCA, WE, WEA, envelope residual profile, roughness motif, waviness motif
Evaluation parameters:	Ra, Rc, Ry, Rz, Rq, Rt, Rmax, Rp, Rv, R3z, Sm, S, Pc, mr(c), δc, mr, tp, Htp, Lo, Ir, Ppi, HSC, Δa, Δq, Ku, Sk, Rpk, Rvk, Rk, Mr1, Mr2, A1, A2, Vo, λa, λq
Roughness motif parameters:	R, AR, Rx
Waviness motif parameters:	W, AW, Wx, Wte
Analysis graphs:	ADC, BAC, power spectrum chart
Digital filter:	2CR-75%, PC-75%, Gaussian, Robust Spline
Cutoff length:	λs: 0.25, 0.8, 2.5, 8, 25, 80, 250 µm, no filter λc*: 0.025, 0.08, 0.25, 0.8, 2.5, 8, 25, 80 mm λf: 0.08, 0.25, 0.8, 2.5, 8, 25, 80 mm, no filter
Sampling length*:	0.025, 0.08, 0.25, 0.8, 2.5, 8, 25, 80 mm
Data compensation functions:	Parabola compensation, hyperbola compensation, ellipse compensation, R-plane (curved surface) compensation, conic compensation, tilt compensation
*An arbitrary length can also be specified in the range from 0.025 mm to the maximum traverse length.	

### Optional Accessory

Code No.	Description	Price
270732	Durable printer paper (25 m, 5 rolls/set)	£19.70

## Technical Data

### X1 axis (drive unit)

Resolution:	0.05 $\mu\text{m}$
Scale:	Linear encoder
Drive speed:	0 - 40 mm/s
Measuring speed:	0.02 - 5 mm/s
Traverse direction:	Backward
Traverse straightness:	0.15 $\mu\text{m}/100\text{ mm}$

### Z2 axis (column)

Type:	Manual operation
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### Detector

Range / resolution:	800 $\mu\text{m}/0.01\text{ }\mu\text{m}$ , 80 $\mu\text{m}/0.001\text{ }\mu\text{m}$ , 8 $\mu\text{m}/0.0001\text{ }\mu\text{m}$
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### Measurement

method:	Skidless/skidded
Type:	Differential inductance
Drive unit control:	PC

**MiCAT**

Mitutoyo Intelligent Computer Aided Technology

the standard in world  
metrology software  
**FORM**

## Evaluation Capability: FORMTRACEPAK

### Assessed profiles:

P (primary profile), R (roughness profile), WC, WCA, WE, WEA, DIN4776 profile, envelope residual profile, roughness motif, waviness motif

### Evaluation parameters:

Ra, Rq, Rz, Ry, Rz(JIS), Ry(DIN), Rc, Rp, Rpmx, Rpi, Rv, Rvmx, Rvi, Rt, Rti, R3z, R3zi, R3y, S, Pc (Ppi), Sm, HSC, mr,  $\delta c$ , plateau ratio, mrd, Rk, Rpk, Rvk, Mr1, Mr2,  $\Delta a$ ,  $\Delta q$ ,  $\lambda a$ ,  $\lambda q$ , Sk, Ku, Lo, Lr, A1, A2

### Roughness motif

parameters: Rx, R, AR, SR, SAR, NR, NCRX, CPM

### Waviness motif

parameters:

Analysis graphs:

Wte, Wx, W, AW, SW, SAW, NW ADC, BAC1, BAC2, power spectrum chart, autocorrelation chart, Walsh power spectrum chart, Walsh auto-correlation chart, slope distribution chart, local peak distribution chart, parameter distribution chart

### Digital filter:

2CR-75%, 2CR-50%, 2CR-75% (phase corrected), 2CR-50% (phase corrected), Gaussian-50%

### Cutoff length\*:

$\lambda c$ : 0.025, 0.08, 0.25, 0.8, 2.5, 8, 25 mm

fl: 0.08, 0.25, 0.8, 2.5, 8, 25 mm

fh: 0.08, 0.25, 0.8, 2.5, 8 mm

### Sampling length\*:

0.025, 0.08, 0.25, 0.8, 2.5, 8, 25 mm

### Data compensation

functions:

Tilt compensation, R-plane (curved surface) compensation, ellipse compensation, parabola compensation, hyperbola compensation, quadric curve automatic compensation, polynomial compensation, polynomial automatic compensation

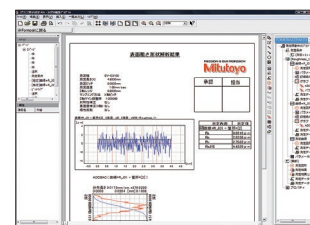
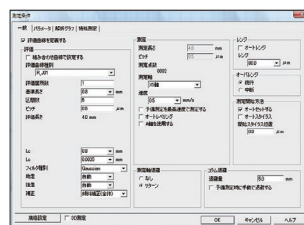
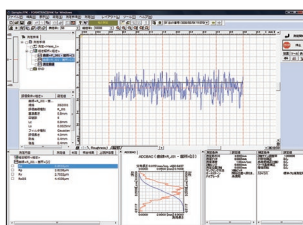
\*An arbitrary length can also be specified in the range from 0.025 mm to the maximum traverse length.

## SERIES 178 – Surface Roughness Tester with PC

- High-precision/performance surface roughness tester that runs under the FORMTRACEPAK sophisticated analysis software package.
- Software icons enable easy control of machine function.
- A feed-knob on the main unit allows fine positioning of a small stylus for measuring small holes.
- Simple setup for surface roughness measuring conditions.
- A simple input function is used to calculate according to ISO/JIS roughness standard drawing instruction symbols. Complicated setups can easily be entered by selecting a drawing instruction symbol from the surface roughness menu.



Surftest SV-2100M4 (PC type)



## Specifications

Model		SV-2100M4 (PC type)	
Code No. (mm)		178-634-01E	178-634-02E
Code No. (inch/mm)		178-635-01E	178-635-02E
Measuring range		100 mm	
Stylus tip	Angle	60°	90°
	Radius	2 $\mu\text{m}$	5 $\mu\text{m}$
Detector measuring force		0.75 mN	4 mN
Vertical travel		350 mm manual column	
Granite base size (WxD)		600x450 mm	
Dimensions (main unit, WxDxH)		716x450x863 mm	
Mass		144 kg (main unit 140 kg; PC I/F unit 3.8 kg)	

# Surftest SV-3200

## SERIES 178 – Surface Roughness Tester

- Mitutoyo's Surftest SV-3200 Series provides highly accurate, high level, multi-functional analysis and measurement of fine contour, as well as conventional surface roughness measurement.
- Peripheral devices such as the auto-levelling table are available to enhance operability and enable automatic measurement.
- Includes FORMTRACERPAK data analysis software. FORMTRACERPAK provides data management in a consistent format, from the work site to the laboratory.
- The X1-axis drive unit guide is made of superbly anti-abrasive ceramic and provides a choice of traverse distance of 100 or 200 mm, according to model. No lubrication is required.
- High-accuracy glass scales, built-in on the X1 axis (resolution: 0.05 µm) and Z2 axis (column, resolution: 1 µm) ensure high-accuracy positioning. The SV-3200 series produces highly reliable measurement, particularly in horizontal roughness parameters (S, Sm) that require high-accuracy X1-axis travel.
- Equipped with a highly accurate detector for which optional holders are available that enable manual change of detector orientation for measurement applications such as crankshaft journals (or similar workpiece features) in the axial direction, or the upper and lower surfaces of deep holes at one setup.
- Capabilities include a *straightness compensation* function, which improves the straightness of the X1-axis; a *circular compensation* function for the vertical movement of the stylus; and a *stylus-tip-radius compensation* function.
- The stylus and the skid are easily replaced. Optional styli and skids are available for a wide variety of roughness measurement applications, such as measurement of small holes, deep holes, etc.
- Comes with an easy-to-operate remote box independent of the main unit allowing positioning, measurement start/stop, retraction, and other operations to be performed remotely. The Drive Unit up/down position and the X1-axis traverse can be finely controlled manually.

Surftest SV-3200H4 with PC



S-3000CR holder enables upward detector orientation (optional accessory).

### Technical Data

X1 axis (drive unit)	
Resolution:	0.05 µm
Scale:	Linear encoder
Drive speed:	0 - 80 mm/s
Measuring speed:	0.02 - 5 mm/s
Inclination range:	±45° (with X1-axis inclination unit)
Z2 axis (column)	
Resolution:	1 µm
Scale:	ABSOLUTE linear encoder
Drive speed:	0 - 20 mm/s
Detector	
Range/resolution:	800 µm/0.01 µm, 80 µm/0.001 µm, 8 µm/0.0001 µm (up to 2400 µm with an optional stylus)
Measurement method: Skidless/skidded	
Type: Differential inductance	

### Optional Accessories

Code No.	Description	Price
178-611	Step gauge (2 µm, 10 µm)	£391.00
178-612	Step gauge (2 µm, 10 µm, 79 µinch, 394 µinch)	£396.00
178-610	Metric 4-step gauge (1 µm, 2 µm, 5 µm, 10 µm)	£397.00
178-047	Three-axis adjustment table (998291 is included)	£3650.00
178-016	Levelling table	£631.00
178-042-1	Digimatic XY levelling table (25 x 25 mm)	£3070.00
178-052-1	Digimatic XY levelling table (1 x 1")	£2280.00
178-043-1	XY levelling table (25 x 25 mm)	£2370.00
178-053-1	XY levelling table (1 x 1")	£2030.00
178-019	Precision vice*	£700.00
998291	Precision V-block*	£639.00
181-902-10	V-block set with clamp (max. workpiece ø25 mm)	£160.00
181-901-10	V-block set with clamp (max. workpiece ø1")	£160.00
178-023	Vibration isolator	£2910.00
178-024	Stand for vibration isolator	£744.00
218-007	Workbench	£1200.00
166-215	Workbench (with drawers)	£1790.00
218-010	Auxiliary desk	£667.00
218-008	Auxiliary desk	£575.00
178-074	S-3000C detector holder (crank orientation)	POA
178-075	S-3000CR detector holder (crank and upward/downward orientation)	POA
178-076	S-3000MR detector holder (upward/downward orientation, 100mm longer reach)	POA

\* Use with an XY levelling table.

### Evaluation Capability: FORMTRACEPAK

Conformable standards: JIS1982/JIS1994/JIS2001/ISO1997/  
ANSI/VDA

Assessed profiles: Primary profile, roughness profile,  
envelope residual curve, filtered  
waviness curve, band pass waviness  
curve, waviness curve, rolling circle  
waviness curve, roughness motif,  
waviness motif, DIN4776 curve

Parameters: Ra, Rq, Sk, Ku, Rp, Rv, Ry, RyDIN,  
RzDIN, Rt, Rc, Rz, R3z, R3y, S, Δa, Δq,  
λa, λq, Lo, Ir, Rk, Rpk, Rvk, Mr1, Mr2,  
A1, A2, Sm, Pc, HSC, mr, mrd, δc, Vo,  
Rx, AR, R, NR, NCRX, CPM, SR, SAR,  
Wx, AW, W, Wte, NW, SW, SAW

Graphs: Amplitude distribution graphs, BAC1,  
BAC2, power spectrum curve, auto  
correlation curve, inclination angle  
distribution curve, peak point height  
distribution curve, parameter  
distribution curve

Waviness motif  
parameters:

Analysis graphs: Wte, Wx, W, AW, SW, SAW, NW  
ADC, BAC1, BAC2, power spectrum  
chart, autocorrelation chart, Walsh  
power spectrum chart, Walsh  
auto-correlation chart, slope  
distribution chart, local peak  
distribution chart, parameter  
distribution chart

Digital filter: 2CR-75%, 2CR-50%, 2CR-75% (phase  
corrected), 2CR-50% (phase corrected),  
Gaussian-50%

Data compensation: Tilt compensation, R-surface  
compensation, ellipse compensation,  
parabola compensation, hyperbolic  
compensation, polynomial  
compensation, conic automatic  
compensation

Filters: Gaussian filter, 2CRPC75, 2CRPC50,  
2CR75, 2CR50, robust spline filter

Cutoff length: λc: 0.025, 0.08, 0.25, 0.8, 2.5, 8, 25,  
80 mm arbitrary  
λs: 0.8, 2.5, 8, 25, 80, 250, 800 μm  
arbitrary

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

### Specifications

Model		SV-3200S4		SV-3200H4	
Without X-axis tilting mechanism	Code No. (mm)	178-414-11E	178-414-12E	178-415-11E	178-415-12E
	Code No. (inch)	178-424-11E	178-424-12E	178-425-11E	178-425-12E
With X-axis tilting mechanism	Code No. (mm)	178-434-11E	178-434-12E	178-435-11E	178-435-12E
	Code No. (inch)	178-444-11E	178-444-12E	178-445-11E	178-445-12E
Stylus tip	Angle	60°	90°	60°	90°
	Radius	2 μm	5 μm	2 μm	5 μm
Detector measuring force		0.75 mN	4 mN	0.75 mN	4 mN
X1-axis measuring range		100 mm			
X1-axis traverse straightness*		(0.05+1L/1000) μm L = measured length (mm)			
Dimensions (main unit, WxDxH)		1016x575x966 mm		1016x575x1166 mm	
Mass (main unit)		140 kg		150 kg	

Model		SV-3200W4		SV-C3200L4	
Without X-axis tilting mechanism	Code No. (mm)	178-416-11E	178-416-12E	178-454-11E	178-454-12E
	Code No. (inch)	178-426-11E	178-426-12E	178-464-11E	178-464-12E
With X-axis tilting mechanism	Code No. (mm)	178-436-11E	178-436-12E	178-474-11E	178-474-12E
	Code No. (inch)	178-446-11E	178-446-12E	178-484-11E	178-484-12E
Stylus tip	Angle	60°	90°	60°	90°
	Radius	2 μm	5 μm	2 μm	5 μm
Detector measuring force		0.75 mN	4 mN	0.75 mN	4 mN
X1-axis measuring range		100 mm			
X1-axis traverse straightness*		(0.05+1L/1000) μm L = measured length (mm)			
Dimensions (main unit, WxDxH)		1416x575x1176 mm		1416x575x1436 mm	
Mass (main unit)		220 kg		270 kg	

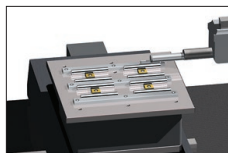
Model		SV-3200S8		SV-3200H8	
Without X-axis tilting mechanism	Code No. (mm)	178-417-11E	178-417-12E	178-418-11E	178-418-12E
	Code No. (inch)	178-427-11E	178-427-12E	178-428-11E	178-428-12E
With X-axis tilting mechanism	Code No. (mm)	178-437-11E	178-437-12E	178-438-11E	178-438-12E
	Code No. (inch)	178-447-11E	178-447-12E	178-448-11E	178-448-12E
Stylus tip	Angle	60°	90°	60°	90°
	Radius	2 μm	5 μm	2 μm	5 μm
Detector measuring force		0.75 mN	4 mN	0.75 mN	4 mN
X1-axis measuring range		200 mm			
X1-axis traverse straightness*		(0.1+2L/1000) μm L = measured length (mm)			
Dimensions (main unit, WxDxH)		1026x575x966 mm		1026x575x1166 mm	
Mass (main unit)		140 kg		150 kg	

Model		SV-3200W8		SV-3200L8	
Without X-axis tilting mechanism	Code No. (mm)	178-419-11E	178-419-12E	178-455-11E	178-455-12E
	Code No. (inch)	178-429-11E	178-429-12E	178-465-11E	178-465-12E
With X-axis tilting mechanism	Code No. (mm)	178-439-11E	178-439-12E	178-475-11E	178-475-12E
	Code No. (inch)	178-449-11E	178-449-12E	178-485-11E	178-485-12E
Stylus tip	Angle	60°	90°	60°	90°
	Radius	2 μm	5 μm	2 μm	5 μm
Detector measuring force		0.75 mN	4 mN	0.75 mN	4 mN
X1-axis measuring range		200 mm			
X1-axis traverse straightness*		(0.1+2L/1000) μm L = measured length (mm)			
Dimensions (main unit, WxDxH)		1426x575x1176 mm		1426x575x1436 mm	
Mass (main unit)		220 kg		270 kg	

\* With the X1 axis in the horizontal orientation.

### Simplified CNC Function

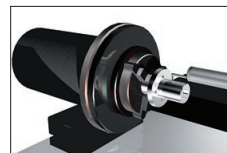
Support for a wide range of optional peripherals designed for use with the CNC models enables automatic measurement.



Using Y-axis table.



Using rotary table 01.



Using rotary table 02.



# Surftest Extreme SV-3000CNC

## SERIES 178 – CNC Surface Roughness Testers

- A highly accurate measuring instrument that allows CNC measurement of surface roughness and fine contour.
- Each axis has a maximum drive speed of 200 mm/s, permitting high-speed positioning for increased throughput of multiple-profile/multiple-workpiece measurement tasks.
- For models equipped with the  $\alpha$  axis, it is possible to perform continuous measurement over horizontal and inclined surfaces by power-tilting the drive unit.
- For models with the Y-axis table, it is possible to expand the measuring range for multiple workpieces, etc., through positioning in the Y-axis direction.
- With optional rotary tables for axes  $\theta 1$  and  $\theta 2$ , designed for use with the CNC models, it is possible to expand the CNC measurement application range.
- Inclined plane measurement is possible through simultaneous control of the X1 and Z2-axes.
- The Z1 axis incorporates an anti-collision safety device to automatically stop the detector unit if it collides with a workpiece or jig.
- An easy-to-operate Remote Box enables the user to make any movement by selecting the required axis using the two joysticks. The current axis selection is easily identified by the icon on the key top.
- Communication with the Data Processing / Analysis section is via USB.

Surftest Extreme SV-3000CNC



### Technical Data

<b>X1 axis</b>	
Measuring range:	200 mm
Resolution:	0.05 $\mu\text{m}$
Scale:	Reflective-type linear encoder
Drive speed:	Max. 200 mm/s (CNC) 0-60 mm/s (joystick)
Measuring speed:	0.02 - 2 mm/s
Traverse straightness:	0.5 $\mu\text{m}/200\text{ mm}$
<b><math>\alpha</math> axis</b>	
Inclination angle:	-45° to +10°
Resolution:	0.000225°
Rotation speed:	1 rpm
<b>Z2 axis (column)</b>	
Vertical travel:	300 mm (500 mm)*
Resolution:	0.05 $\mu\text{m}$
Scale:	Reflective-type linear encoder
Drive speed:	Max. 200 mm/s (CNC) 0-60 mm/s (joystick)
Base size (W x D):	750 x 600 mm
<b>Detector</b>	
Range / resolution:	800 $\mu\text{m}/0.01\text{ }\mu\text{m}$ , 80 $\mu\text{m}/0.001\text{ }\mu\text{m}$ , 8 $\mu\text{m}/0.0001\text{ }\mu\text{m}$
Measuring force:	4 mN (178-397-2) 0.75 mN (low force type 178-396-2)
Stylus tip:	Diamond, 90°/R5 $\mu\text{m}$ (60°/R2 $\mu\text{m}$ : low force type)
Dimension (W x D x H):	800 x 651 x 1000 mm (800 x 651 x 1200 mm)*
Mass:	240 kg (250 kg)*

\* Tall-column model

### Optional Accessories

#### Vibration isolation stand

Vibration isolation mechanism:	Diaphragm air spring
Natural frequency :	2.5 - 3.5 Hz
Damping mechanism:	Orifice
Levelling mechanism:	Automatic control with mechanical valves
Air supply pressure:	0.4 MPa
Allowable loading capacity:	350 kg
Dimension (W x D x H):	1000 x 895 x 715 mm
Mass:	315 kg

#### Y-axis table unit

Measuring range:	200 mm
Resolution:	0.05 $\mu\text{m}$
Scale unit:	Reflective-type linear encoder
Drive speed:	200 mm/s (max., CNC) 0-60 mm/s (joystick)
Maximum loading capacity:	20 kg
Traverse straightness:	0.5 $\mu\text{m}/200\text{ mm}$
Accuracy (at 20°C):	$\pm(2+2L/100)$ , L : dimension between two measured points (mm)
Table size:	200 x 200 mm
Dimension (W x D x H):	320 x 646 x 105 mm
Mass:	35 kg

### Specifications

Model	SV-3000CNC			
Without Y-axis table unit				
Code No.	178-521-2E	178-541-2E	178-522-2E	178-542-2E
With Y-axis table unit				
Code No.	178-523-2E	178-543-2E	178-524-2E	178-544-2E
X1-axis measuring range	200 mm			
Z2-axis vertical travel	300 mm	500 mm	300 mm	500 mm
Y-axis table unit	—			
$\alpha$ -axis unit	—		Installed	

## Technical Data

### X1 axis

Traverse straightness: 0.5  $\mu\text{m}/200\text{ mm}$   
 0.7  $\mu\text{m}/200\text{ mm}$  (long-type detector)  
 0.5  $\mu\text{m}/200\text{ mm}$  (rotary-type detector, up/down direction)  
 0.7  $\mu\text{m}/200\text{ mm}$  rotary-type detector, forward/backward direction)

### $\alpha$ axis

Inclination angle:  $-45^\circ$  to  $+10^\circ$   
 Resolution: 0.000225°  
 Rotation speed: 1 rpm

### Y axis

Measuring range: 800 mm  
 Resolution: 0.05  $\mu\text{m}$   
 Scale: Reflective-type linear encoder  
 Traverse straightness: 0.5  $\mu\text{m}/50\text{ mm}$ , 2  $\mu\text{m}/800\text{ mm}$   
 0.7  $\mu\text{m}/50\text{ mm}$ , 3  $\mu\text{m}/800\text{ mm}$  (long-type detector)  
 0.7  $\mu\text{m}/50\text{ mm}$ , 3  $\mu\text{m}/800\text{ mm}$  (rotary-type detector, up/down direction)

### Base unit

Loading capacity: 300 kg

### Detector

Range / resolution: 800  $\mu\text{m}/0.01\text{ }\mu\text{m}$ , 80  $\mu\text{m}/0.001\text{ }\mu\text{m}$ ,  
 8  $\mu\text{m}/0.0001\text{ }\mu\text{m}$  (up to 2400  $\mu\text{m}$  with an optional stylus)

### Measuring force:

4 mN (178-397-2)  
 0.75 mN (low force type 178-396-2)

### Stylus tip:

Diamond, 90° / R5  $\mu\text{m}$   
 (60° / R2  $\mu\text{m}$ : low force type)

### Type:

Differential inductance

**MiCAT**

Mitutoyo Intelligent Computer Aided Technology

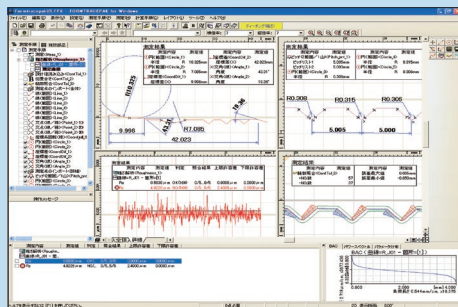
the standard in world  
metrology software

**FORM**

## Standard Software

### FORMTRACEPAK

Enables control of the optional motor-driven Y-axis table and rotary table for realizing efficient measurement automation. Contour evaluation can be performed such as analysis of level differences, angle, pitch, area and other characteristics based on surface roughness data. In addition, an original inspection certificate can be created by setting the print format to suit your particular requirements.



# Surftest Extreme SV-M3000CNC

## SERIES 178 – CNC Surface Roughness Testers

- A CNC Surface Roughness Tester that handles measurement of large/heavy workpieces such as engine blocks, crankshafts, etc.
- Combined with the surface roughness detector swivelling unit, S-3000AR (optional), continuous measurement over the bottom, top and side surfaces of a workpiece is possible.
- With an optional large table for supporting a load of 100 kg, or a large  $\emptyset 2$  table, continuous automatic measurement of larger workpieces is possible.
- Suitable for automatic surface roughness measurement on large and heavy workpieces.
- A moving column configuration eliminates workpiece size constrictions. Advantageous for measuring large, heavy workpieces such as engine blocks, crankshafts, etc.
- An 800 mm Y-axis stroke makes measurement of multiple profiles on large workpieces possible.
- The load table has a self-contained structure ensuring that variously sized workpieces, and standard and custom jigs, auto-feed devices, etc., are easily accommodated.

### Surftest Extreme SV-M3000CNC



## Specifications

Model	SV-M3000CNC		
Code No.	178-549-2E		
X1-axis measuring range	200 mm		
Detector holder type (required option)	Standard S-3000 178-071	Long-type S-3000L 178-072	Rotary-type S-3000 178-073
Resolution	0.05 $\mu\text{m}$		
Scale	Reflective-type linear encoder		
Drive speed	Max. 200 mm/s (CNC), 0-50 mm/s (joystick)		
Measuring speed	0.02 - 2 mm/s		
Z2-axis vertical travel	500 mm		
Y-axis travel range	800 mm		
$\alpha$ -axis inclination angle	$-45^\circ$ (CCW), $+10^\circ$ (CW)		
Steel base size (W x D)	600 x 1500 mm		
Dimension (W x D x H)	1085 x 1695 x 1922 mm		
Mass (main unit)	1600 kg (including vibration isolation unit)		

# Formtracer SV-C3200/SV-C4500

## SERIES 525 – Surface Roughness/Contour Measuring System

- A highly accurate measuring system that allows measurement of surface roughness and contour with just one instrument.
- Dramatically increased drive speed (X1 axis: 80 mm/s, Z2 axis column: 30 mm/s) further reduces total measurement time.
- Mitutoyo has adopted highly rigid ceramic guides, combining small secular change and remarkable resistance to abrasion, to maintain the outstanding traverse straightness specification for an extended period of time.
- The drive unit (X1 axis) and column (Z2 axis) are equipped with highly accurate linear encoders (ABS type on the Z2 axis). This improves reproducibility of continuous automatic measurement of small holes in the vertical direction and repeated measurement of parts which are difficult to position.
- Measurement accuracy specifications for the drive unit and column are exceptional, as is that for the drive unit traverse straightness – all excellent characteristics for handling workpieces calling for high accuracy.



Formtracer SV-C3200S4

### Surface Roughness Detector



- Compliant with JIS '82/'94/'01, ISO, ANSI, DIN, VDA, and other international surface roughness standards.
- The standard surface roughness detector supplied is the high-accuracy model (0.75 mN/4 mN measuring force) that provides a resolution down to 0.0001  $\mu\text{m}$ .

### Contour Detector



- The contour detector of the SV-C4500 series instruments can continuously measure in the upward and downward directions without the need to change the arm orientation or reposition the workpiece, when combined with the double-cone stylus (a new product with contact points in the upward and downward directions).

### Technical Data

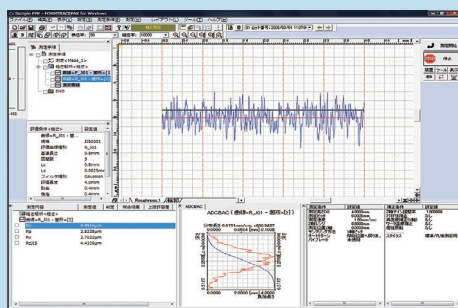
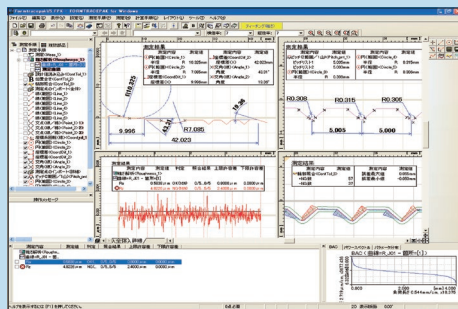
X1 axis (drive unit)	
Resolution:	0.05 $\mu\text{m}$
Scale:	Reflective-type linear encoder
Drive speed:	0 - 80 mm/s and manual
Measuring speed:	0.02 - 5 mm/s
Measuring direction:	Forward/backward
Note: As for SV-C4500, set the measurement force with FORMTRACEPAK	
Accuracy (at 20°C):	$\pm(0.8+L/100)$ $\mu\text{m}$ (SV-C3200S4/H4/W4/L4; SV-C4500S4/H4/W4/L4), $\pm(0.8+2L/100)$ $\mu\text{m}$ (SV-C3200S8/H8/W8/L8; SV-C4500S8/H8/W8/L8) L = drive length (mm)
Inclination range:	$\pm 45^\circ$ (with X1 axis inclination unit)
Z1 axis (contour detector)	
Measuring range:	$\pm 30$ mm
Resolution:	0.04 $\mu\text{m}$ (SV-C3200), 0.02 $\mu\text{m}$ (SV-C4500)
Scale:	Rotary arc encoder
Accuracy (at 20°C):	$\pm(1.6+2H/100)$ $\mu\text{m}$ (SV-C3200) $\pm(0.8+2H/100)$ $\mu\text{m}$ (SV-C4500) Note: H = measurement height from the horizontal position (mm)
Stylus up/down operation:	Arc movement
Face of stylus:	Upward/downward (SV-C3200), Upward/downward, direction switch by FORMTRACEPAK (SV-C4500)
Measuring force:	30 mN (SV-C3200) 10, 20, 30, 40, 50 mN (SV-C4500) Note: As for SV-C4500, set the measurement force with FORMTRACEPAK
Traceable angle:	Ascent: $77^\circ$ , descent: $83^\circ$ (using the standard stylus provided and depending on the surface roughness)
Stylus tip:	Carbide, R25 $\mu\text{m}$
Z1 axis (surface roughness detector)	
Range / resolution:	800 $\mu\text{m}/0.01$ $\mu\text{m}$ , 80 $\mu\text{m}/0.001$ $\mu\text{m}$ , 8 $\mu\text{m}/0.0001$ $\mu\text{m}$ (up to 2400 $\mu\text{m}$ with an optional stylus)
Stylus tip:	Diamond, 90°/R5 $\mu\text{m}$ (60°/R2 $\mu\text{m}$ : low force type)
Type:	Differential inductance
Z2 axis (column)	
Resolution:	1 $\mu\text{m}$
Scale:	ABSOLUTE linear encoder
Drive speed:	0 - 30 mm/s and manual
Mass	
Controller unit:	14 kg
Remote control box:	0.9 kg
Power supply:	240VAC $\pm 10\%$ , 50/60Hz
Power consumption:	400 W (main unit only)



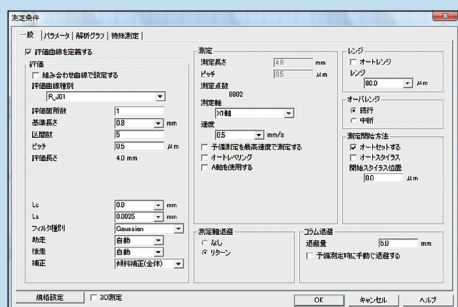
## Standard Software

### FORMTRACEPAK

Enables control of the optional motor-driven Y-axis table and rotary table for realizing efficient measurement automation. Contour evaluation can be performed such as analysis of level differences, angle, pitch, area and other characteristics based on surface roughness data. In addition, an original inspection certificate can be created by setting the print format to suit your particular requirements.



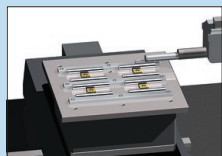
Contour measurement screen.



Surface roughness measurement screen.

## Simplified CNC Function

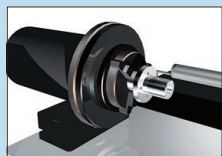
Support for a wide range of optional peripherals designed for use with the CNC models enables automatic measurement.



Using Y-axis table.



Using rotary table θ1.



Using rotary table θ2.

## Specifications

Model	SV-C3200S4		SV-C3200H4	
Code No. (mm)	525-481-11E	525-481-12E	525-482-11E	525-482-12E
Code No. (inch)	525-491-11E	525-491-12E	525-492-11E	525-492-12E

Model	SV-C4500S4		SV-C4500H4	
Code No. (mm)	525-441-11E	525-441-12E	525-442-11E	525-442-12E
Code No. (inch)	525-451-11E	525-451-12E	525-452-11E	525-452-12E
Stylus tip	Angle	60°	90°	60°
	Radius	2 μm	5 μm	2 μm
Detector measuring force	0.75 mN		4 mN	0.75 mN
X1-axis measuring range	100 mm			
X1-axis traverse straightness*	(0.05+1L/1000) μm L = measured length (mm)			
Dimensions (main unit, WxDxH)	1016x575x966 mm		1016x575x1166 mm	
Mass (main unit)	140 kg		150 kg	

Model	SV-C3200W4		SV-C3200L4	
Code No. (mm)	525-483-11E	525-483-12E	525-484-11E	525-484-12E
Code No. (inch)	525-493-11E	525-493-12E	525-494-11E	525-494-12E

Model	SV-C4500W4		SV-C4500L4	
Code No. (mm)	525-443-11E	525-443-12E	525-444-11E	525-444-12E
Code No. (inch)	525-453-11E	525-453-12E	525-454-11E	525-454-12E
Stylus tip	Angle	60°	90°	60°
	Radius	2 μm	5 μm	2 μm
Detector measuring force	0.75 mN		4 mN	0.75 mN
X1-axis measuring range	100 mm			
X1-axis traverse straightness*	(0.05+1L/1000) μm L = measured length (mm)			
Dimensions (main unit, WxDxH)	1416x575x1176 mm		1416x575x1436 mm	
Mass (main unit)	220 kg		270 kg	

Model	SV-C3200S8		SV-C3200H8	
Code No. (mm)	525-486-11E	525-486-12E	525-487-11E	525-487-12E
Code No. (inch)	525-496-11E	525-496-12E	525-497-11E	525-497-12E

Model	SV-C4500S8		SV-C4500H8	
Code No. (mm)	525-446-11E	525-446-12E	525-447-11E	525-447-12E
Code No. (inch)	525-456-11E	525-456-12E	525-457-11E	525-457-12E
Stylus tip	Angle	60°	90°	60°
	Radius	2 μm	5 μm	2 μm
Detector measuring force	0.75 mN		4 mN	0.75 mN
X1-axis measuring range	200 mm			
X1-axis traverse straightness*	(0.1+2L/1000) μm L = measured length (mm)			
Dimensions (main unit, WxDxH)	1026x575x966 mm		1026x575x1166 mm	
Mass (main unit)	140 kg		150 kg	

Model	SV-C3200W8		SV-C3200L8	
Code No. (mm)	525-488-11E	525-488-12E	525-489-11E	525-489-12E
Code No. (inch)	525-498-11E	525-498-12E	525-499-11E	525-499-12E

Model	SV-C4500W8		SV-C4500L8	
Code No. (mm)	525-448-11E	525-448-12E	525-449-11E	525-449-12E
Code No. (inch)	525-458-11E	525-458-12E	525-459-11E	525-459-12E
Stylus tip	Angle	60°	90°	60°
	Radius	2 μm	5 μm	2 μm
Detector measuring force	0.75 mN		4 mN	0.75 mN
X1-axis measuring range	200 mm			
X1-axis traverse straightness*	(0.1+2L/1000) μm L = measured length (mm)			
Dimensions (main unit, WxDxH)	1426x575x1176 mm		1426x575x1436 mm	
Mass (main unit)	220 kg		270 kg	

\* With the X1 axis in the horizontal orientation.



# Formtracer Extreme SV-C4500CNC

## SERIES 525 – Surface Roughness/Contour Measuring System

- A high-accuracy CNC measuring system that enables measurement of surface roughness and form/contour with just one instrument.
- Each axis has a maximum drive speed of 200 mm/s, which permits high-speed positioning that potentially offers a large increase in the throughput of multiple-profile / multiple-workpiece measurement tasks.
- For models with the  $\alpha$  axis, it is possible to perform continuous measurement over horizontal and inclined surfaces by power-tilting the drive unit.
- For models with the Y-axis table, it is possible to expand the measuring range for multiple workpieces, etc., through positioning in the Y-axis direction.
- The contour drive unit is equipped with a Laser Hologage detector giving excellent narrow- and wide-range accuracy and resolution in the Z1 axis.
- Enables inclined plane measurements through simultaneous control of the X1 and Z2 axes.
- If the contour detector is replaced with that for surface roughness measurement, or vice versa, it is a simple, one-touch replacement without rerouting of the connecting cables.
- The Z1 axis incorporates an anti-collision safety device to automatically stop the detector if it collides with a workpiece or jig.
- Supplied with an easy-to-operate Remote Box, from which the user can make any movement by selecting the required axis using the two joysticks. The current axis selection is easily identified by the icon on the key top.
- Communication with the Data Processing/Analysis section is via USB.

Formtracer Extreme SV-C4500CNC



### Technical Data

<b>X1 axis (drive unit)</b>	
Resolution:	0.05 $\mu\text{m}$
Scale:	Reflective-type linear encoder
Accuracy (at 20°C):	$\pm(0.8+4L/200)$ $\mu\text{m}$ , L = drive length (mm)
Drive speed:	Max. 200 mm/s (in CNC mode) 0-50 mm/s (in joystick control mode)
Measuring speed:	0.02 - 2 mm/s
Measuring direction:	Forward/backward
Traverse straightness:	0.5 $\mu\text{m}/200$ mm
<b>Z1 axis (contour detector)</b>	
Measuring range:	60 mm ( $\pm 30$ mm from the horizontal position)
Resolution:	0.02 $\mu\text{m}$
Scale type:	Laser Hologage
Accuracy (at 20°C):	$\pm(0.8+2H/100)$ $\mu\text{m}$ , H = measured height from the horizontal position (mm)
Stylus up/down operation:	Circular movement
Face of stylus:	Downward
Measuring force:	0.75 mN
Traceable angle:	Ascent: 70°, Descent: 70° (using the standard chisel-cut stylus and depending on the surface roughness)
Stylus tip:	Carbide, 30°
<b>Z1 axis (surface roughness detector)</b>	
Range / resolution:	800 $\mu\text{m}/0.01$ $\mu\text{m}$ , 80 $\mu\text{m}/0.001$ $\mu\text{m}$ , 8 $\mu\text{m}/0.0001$ $\mu\text{m}$
Measuring force:	0.75 mN
Stylus tip:	60°, R2 $\mu\text{m}$
Detecting method:	Differential inductance
<b>Z2 axis (column)</b>	
Vertical travel:	300 mm or 500 mm
Resolution:	0.05 $\mu\text{m}$
Scale type:	Reflective-type linear encoder
Drive speed:	Max. 200 mm/s (in CNC mode) 0-50 mm/s (in joystick control mode)
<b><math>\alpha</math> axis</b>	
Inclination angle:	-45° (CCW), +10° (CW)
Resolution:	0.000225°
Rotation speed:	1 rpm
<b>Mass</b>	
Controller unit:	28 kg
Remote control box:	1.5 kg
Power supply:	240VAC $\pm 10\%$ , 50/60Hz
Power consumption:	500 W (main unit only)

### Surface Roughness Detector



### Contour Detector



## Optional Accessories

### Vibration isolation stand

Vibration isolation

mechanism: Diaphragm air spring

Natural frequency : 2.5-3.5 Hz

Damping mechanism: Orifice

Levelling mechanism: Automatic control with mechanical valves

Air supply pressure: 0.4 MPa

Allowable loading

capacity: 350 kg

Dimension

(W x D x H): 1000 x 895 x 715 mm

Mass: 315 kg

### Y-axis table unit

Measuring range: 200 mm

Resolution: 0.05  $\mu$ m

Scale unit: Reflective-type linear encoder

Drive speed: 200 mm/s (max., CNC),  
0-50 mm/s (joystick)

Maximum loading

capacity: 20 kg

Traverse straightness: 0.5  $\mu$ m/200 mm

Accuracy (at 20°C):  $\pm(2+2L/100)$   $\mu$ m,  
L = measured length (mm)

Table size: 200 x 200 mm

Dimension

(W x D x H): 320 x 646 x 105 mm

Mass: 35 kg

**MiCAT**

Mitutoyo Intelligent Computer Aided Technology

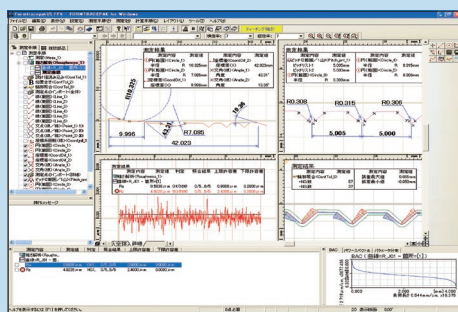
the standard in world  
metrology software

**FORM**

## Standard Software

### FORMTRACEPAK

Enables control of the optional motor-driven Y-axis table and rotary table for realizing efficient measurement automation. Contour evaluation can be performed such as analysis of level differences, angle, pitch, area and other characteristics based on surface roughness data. In addition, an original inspection certificate can be created by setting the print format to suit your particular requirements.

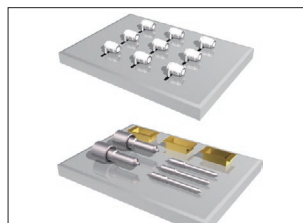
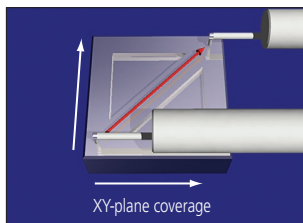
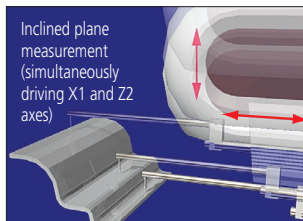


## Specifications

Model	SV-C4500CNC			
Code No. (mm)	525-661E	525-662E	525-663E	525-664E
Code No. (inch)	525-671E	525-672E	525-673E	525-674E
X1-axis measuring range	200 mm			
Z2-axis vertical travel	300 mm			
Y-axis table unit	—		Installed	
$\alpha$ -axis unit	—	Installed	—	Installed
Granite base size (W x D)	200 x 200 mm			
Dimensions (main unit, W x D x H)	800 x 620 x 1000 mm			
Mass (main unit)	240 kg			

Model	SV-C4500CNC			
Code No. (mm)	525-681E	525-682E	525-683E	525-684E
Code No. (inch)	525-691E	525-692E	525-693E	525-694E
X1-axis measuring range	200 mm			
Z2-axis vertical travel	500 mm			
Y-axis table unit	—		Installed	
$\alpha$ -axis unit	—	Installed	—	Installed
Granite base size (W x D)	200 x 200 mm			
Dimensions (main unit, W x D x H)	800 x 620 x 1200 mm			
Mass (main unit)	250 kg			

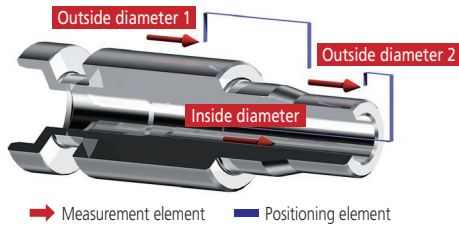
## Measurement Applications



# Formtracer CS-3200

## SERIES 525 – Surface Roughness/Contour Measuring System

- High-accuracy CNC measuring system that enables measurement of surface roughness and form/contour with just one instrument using a single detector.
- The drive unit (X1 axis) and column (Z2 axis) are equipped with high-accuracy linear scales (ABS type) enabling fully automatic measurement combining vertical and horizontal movement. This improves reproducibility of continuous automatic measurement of small holes in the vertical direction and repeated measurement of parts which are difficult to position.



Continuous measurement example  
(Outside diameter 1 → Outside diameter 2 → Inside diameter)

- Dramatically increased drive speed (X1 axis: 80 mm/s, Z2 axis: 20 mm/s) further reduces total measurement time. Small holes can be efficiently measured using the fine-feed knobs on the X and Z2 axes.
- The detector unit can be extended to avoid interference between the drive unit and workpiece. All detector and drive unit cables are housed inside the main unit to eliminate any risk of abrasion and guarantee trouble free, high-speed operation.
- Measuring range in the Z1-axis (height) direction is dramatically increased from 5 mm to 50 mm when contour detector units 3000 or 4000 are specified. (Both are factory-fit options.)
- The drive unit (X1 axis) tilting function is a great help with measurements on inclined planes and when working with heavy workpieces that are not easily moved.

Formtracer CS-3200S4



### Technical Data

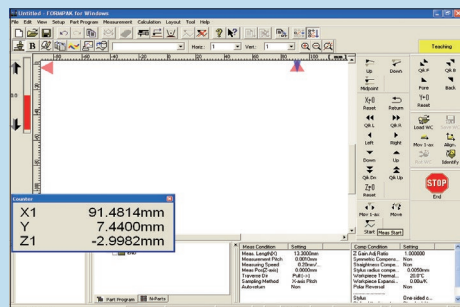
<b>X1 axis</b>	
Measuring range:	100 mm
Resolution:	0.05 µm
Drive speed:	0-80 mm/s and manual
Measuring speed:	0.02, 0.05, 0.1, 0.2 mm/s (surface roughness measurement) 0.02, 0.05, 0.1, 0.2, 0.5, 1, 2 mm/s (contour measurement)
Measuring direction:	Forward/backward
Traverse straightness:	0.2 µm/100 mm (0.4 µm/100 mm: at the extended detector position) with the X1 axis in horizontal orientation
Accuracy (at 20°C):	±(0.8+L/100) µm, L = drive length (mm)
Inclination range:	±45°
<b>Z1 axis</b>	
Measuring range:	5 mm
Resolution:	80 nm (5 mm range) 8 nm (0.5 mm range) 0.8 nm (0.05 mm range)
Accuracy (at 20°C):	±(1.5+2H/100) µm, H = measured height from the horizontal position (mm)
Measuring force:	0.75 mN
Traceable angle:	Ascent: 65°, Descent: 65° (using the standard chisel-cut stylus and depending on the surface roughness)
Stylus tip (standard):	Diamond, 60°/R2 µm
Stylus tip (cone):	Sapphire, 30°/R25 µm
Face of stylus:	Downward
<b>Z2 axis (column)</b>	
Column travel:	300 mm
Resolution:	1 µm
Drive speed:	0-20 mm/s and manual
Base size (WxD):	600 x 450 mm
Base material:	Granite
Dimension (WxD x H):	756 x 482 x 966 mm (main unit)
Mass:	140 kg (main unit)
Power supply:	240VAC ±10%, 50/60Hz
Power consumption:	400 W (main unit only)

#### Main Unit Startup System

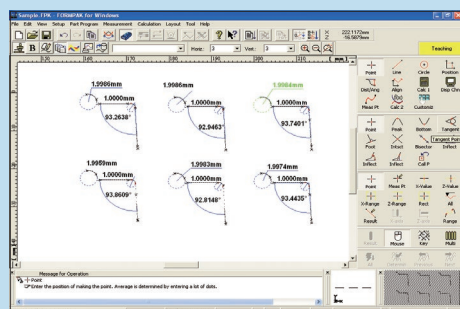
A start-up system (relocation detection sensor) is an integral security feature of this machine and will disable its operation if subject to relocation or strong vibration. Please be advised to contact your nearest Mitutoyo Service Centre as soon as possible or in advance of such circumstance.

### Specifications

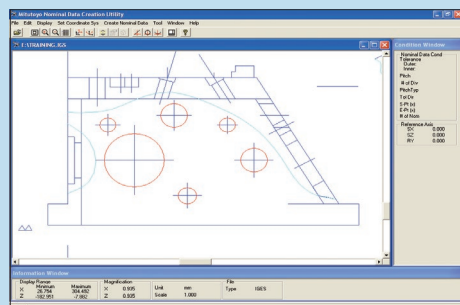
<b>Model</b>	<b>CS-3200S4</b>
<b>Code No. (mm)</b>	<b>525-401E</b>
<b>Code No. (inch)</b>	<b>525-411E</b>
X1-axis measuring range	100 mm
Z2-axis vertical travel	300 mm
Y-axis travel range	Optional
α-axis unit	Installed



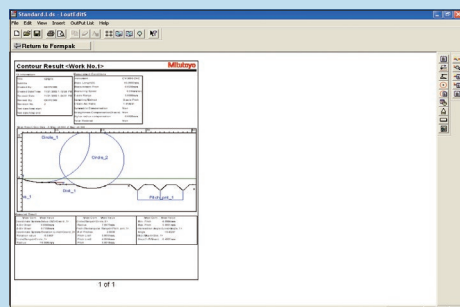
Measuring instrument control.



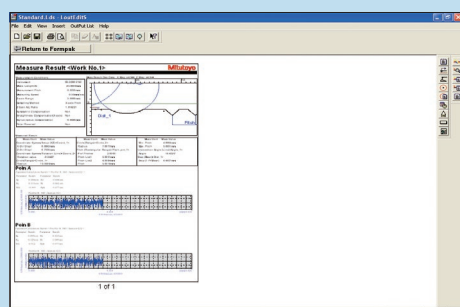
Contour analysis.



CAD import.



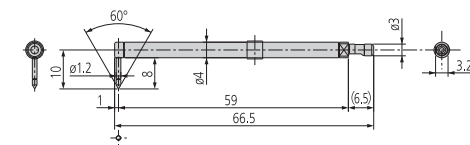
Inspection certificate creation.



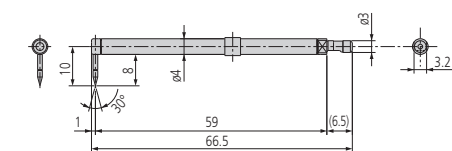
Inspection certificate creation.

## Styli

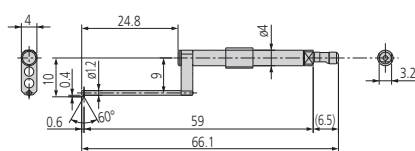
### 12AAD554



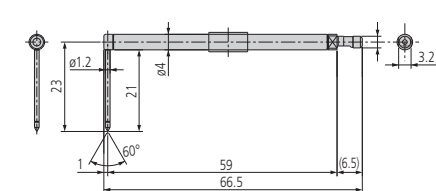
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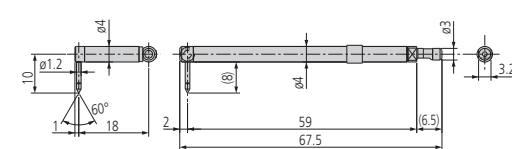
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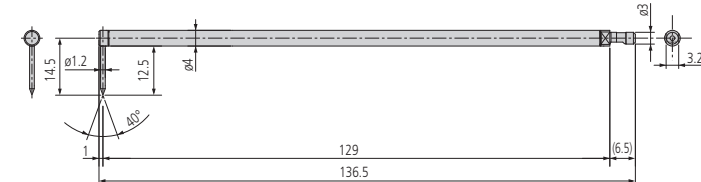
### 12AAD560



### 12AAD558



### 12AAD562



Code No.	Description	Measurement use	Tip radius	Tip material	Standard accessory
12AAD554	Standard stylus	Contour/surface roughness	2 μm	Diamond	✓
12AAD552	Cone stylus	Contour	25 μm	Sapphire	✓
12AAD556	Small hole stylus	Contour/surface roughness	2 μm	Diamond	—
12AAD558	Eccentric type stylus	Contour/surface roughness	2 μm	Diamond	—
12AAD560	Deep groove stylus	Contour/surface roughness	2 μm	Diamond	—
12AAD562	2x-long stylus*	Contour/surface roughness	5 μm	Diamond	—

\*Measuring force is 4 mN and the Z1 measuring range and resolution is double that of the standard stylus.



# Formtracer Extreme CS-5000CNC/CS-H5000CNC

## SERIES 525 – CNC Form Measuring Instruments

- High-accuracy stylus type CNC Surface Measuring Instrument that allows simultaneous measurement of surface roughness and form/contour.
- The X1 and Z2 axes have maximum drive speeds of 40 mm/s and 200 mm/s, respectively. This permits high-speed positioning that potentially offers a large increase in the throughput of multiple-profile/multiple-workpiece measurement tasks.
- Mitutoyo Laser HoloScales are incorporated in the X1 and Z1 axes to provide sufficiently high resolution for simultaneous measurement of form/contour and surface roughness, which is vital for batch working.
- The active control method is employed for the Z1-axis detector to implement a wide-range measurement capability wherein the variation in dynamic measuring force is restricted.
- The Z1 axis incorporates an anti-collision safety device to automatically stop the detector unit if it collides with a workpiece or jig.
- The CS-5000CNC model has an  $\alpha$  axis, enabling continuous measurement over horizontal and inclined surfaces by power-tilting the detector unit.
- Models with the Y-axis table installed allow greater coverage of larger workpieces and enable multiple workpieces to be measured at one setup.
- Supplied with the easy-to-operate Remote Box by which the user can control any movement by selecting the required axis using the two joysticks.
- Uses USB for communicating with the Data Processing/Analysis Unit (optional).



Formtracer Extreme CS-H5000CNC



Remote box

### Technical Data

<b>X1 axis</b>	
Measuring range:	200 mm
Resolution:	0.00625 $\mu\text{m}$
Scale type:	Laser HoloScale
Drive speed:	Max. 40 mm/s (in CNC mode) 0–40 mm/s (in joystick control mode)
Measuring speed:	0.02–0.2 mm/s (surface roughness) 0.02–2 mm/s (form/contour)
Measuring direction:	Forward/backward direction
Traverse straightness:	CS-5000CNC: (0.1+0.0015L) $\mu\text{m}$ - standard stylus (0.2+0.0015L) $\mu\text{m}$ - 2X-long stylus CS-H5000CNC: (0.05+0.0003L) $\mu\text{m}$ - standard stylus (0.1+0.0015L) $\mu\text{m}$ - 2X-long stylus
Accuracy (at 20°C):	CS-5000CNC: $\pm(0.3+0.002L)$ $\mu\text{m}$ CS-H5000CNC: $\pm(0.16+0.001L)$ $\mu\text{m}$ L = measured length (mm)
<b>Z1 axis</b>	
Measuring range:	12 mm (with standard stylus) 24 mm (with 2X-long stylus)
Resolution:	CS-5000CNC: 0.004 $\mu\text{m}$ (with standard stylus) 0.008 $\mu\text{m}$ (with 2X-long stylus) CS-H5000CNC: 0.001 $\mu\text{m}$ (with standard stylus) 0.002 $\mu\text{m}$ (with 2X-long stylus)
Stylus movement:	Arc
Scale type:	Laser HoloScale
Accuracy (at 20°C):	CS-5000CNC: $\pm(0.3+ 0.02H )$ $\mu\text{m}$ CS-H5000CNC: $\pm(0.07+ 0.02H )$ $\mu\text{m}$ H = measured height (mm)
Measuring force:	4 mN (with standard stylus) 0.75 mN (with 2X-long stylus)
Traceable angle:	60° for ascent, 60° for descent (Depending on the workpiece surface condition)
Face of stylus:	Downward
<b>Z2 axis (column unit)</b>	
Traverse range:	300 mm or 500 mm*
Resolution:	0.05 $\mu\text{m}$
Scale type:	Reflective-type linear encoder
Drive speed:	Max. 200 mm/s (in CNC mode) 0–50 mm/s (in joystick control mode)
Base size (W x D):	750 x 600 mm
Base material:	Granite
<b>Y axis</b>	
Measuring range:	200 mm
Resolution:	0.05 $\mu\text{m}$
Drive speed:	Max. 200 mm/s (in CNC mode) 0–50 mm/s (in joystick control mode)
Max. table load:	20 kg
Traverse linearity:	0.5 $\mu\text{m}/200$ mm
Accuracy (at 20°C):	$\pm(2+2L/100)$ $\mu\text{m}$ L = measured length (mm)
Dimension (W x D x H):	800 x 620 x 1000 mm (800 x 620 x 1200 mm: tall-column type)
Mass:	240 kg (250 kg: tall-column type)
* Not for CS-H5000CNC.	



Wide-range detector employing active control technology.

FORM

## FORMTRACEPAK



## Aspherical lens analysis program.

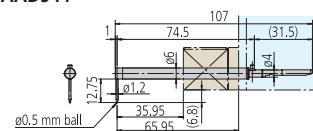
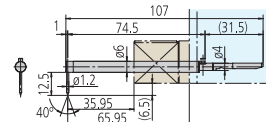
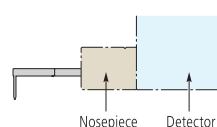
Model	CS-5000CNC			
Code No.	525-721-2E	525-722-2E	525-723-2E	525-724-2E
X1-axis measuring range	200 mm			
Z2-axis vertical travel	300 mm			
Y-axis table unit	—		Installed	
α-axis unit	—	Installed	—	Installed

Model	CS-5000CNC			
Code No.	525-741-2E	525-742-2E	525-743-2E	525-744-2E
X1-axis measuring range	200 mm			
Z2-axis vertical travel	500 mm			
Y-axis table unit	—		Installed	
$\alpha$ -axis unit	—	Installed	—	Installed

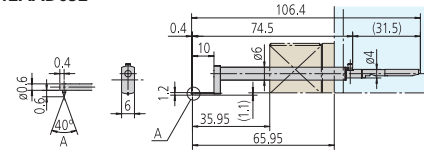
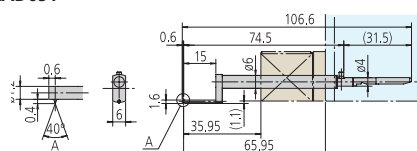
Model	CS-H5000CNC	
Code No.	525-761-2E	525-763-2E
X1-axis measuring range	200 mm	
Z2-axis vertical travel	300 mm	
Y-axis table unit	—	Installed
$\alpha$ -axis unit	—	

## Unit: mm

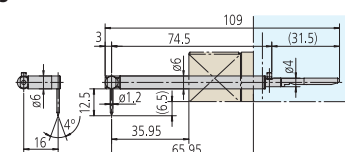
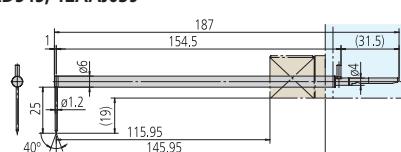
## 12AAD544



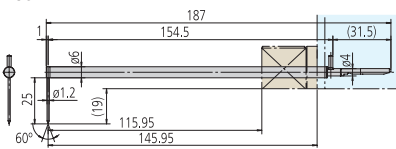
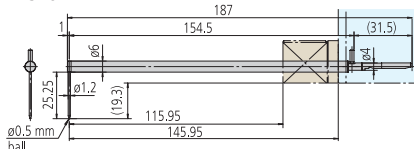
## 12AAD652



## 12AAD653



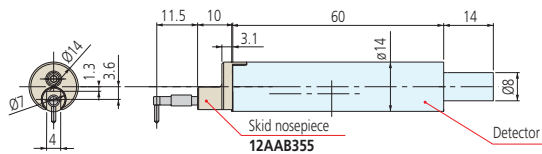
## 12AAJ041



Code No.	Description	Tip radius	Tip material	Standard accessory	
				CS-5000CNC	CS-H5000CNC
12AAD543	Standard-length stylus	5 μm	Diamond	✓	—
12AAJ037	Standard-length stylus	5 μm	Diamond	—	✓
12AAD544	Standard-length ball stylus	—	Sapphire	✓	✓
12AAD545	Double-length stylus	5 μm	Diamond	✓	—
12AAJ039	Double-length stylus	5 μm	Diamond	—	✓
12AAD546	Double-length ball stylus	—	Sapphire	✓	✓
12AAD651	Standard-length stylus for small hole	5 μm	Diamond	—	—
12AAD652	Standard-length stylus for extra-small hole	5 μm	Diamond	—	—
12AAD653	Standard-length eccentric stylus	5 μm	Diamond	—	—
12AAJ041	Double-length stylus	2 μm	Diamond	—	✓

# Optional Styli

Compatible with SJ-410, SJ-500, SV-2100, SV-3200, SV-C3200, SV-C4500 Series

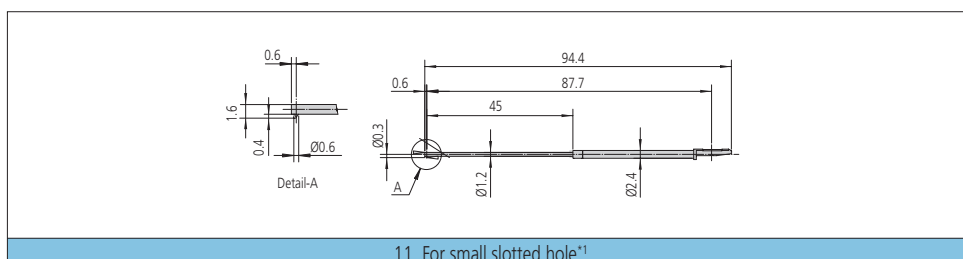
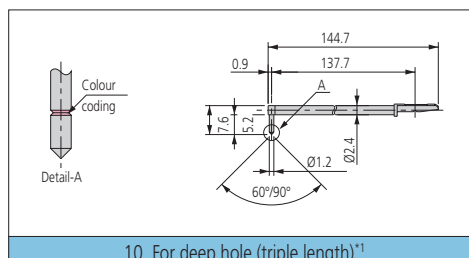
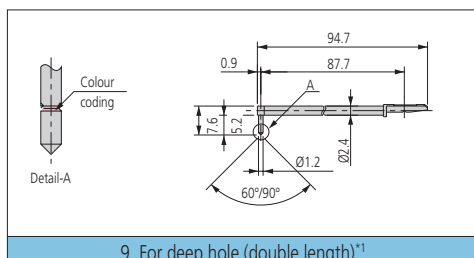
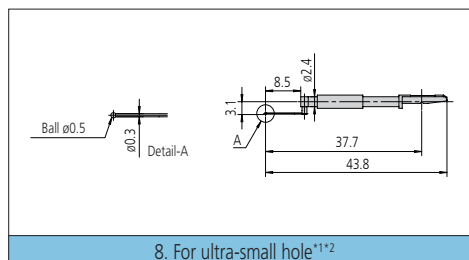
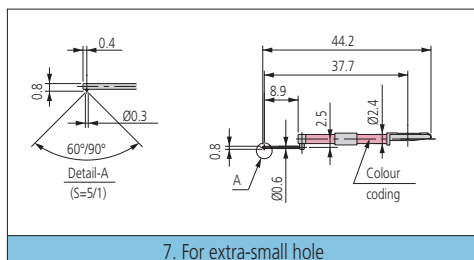
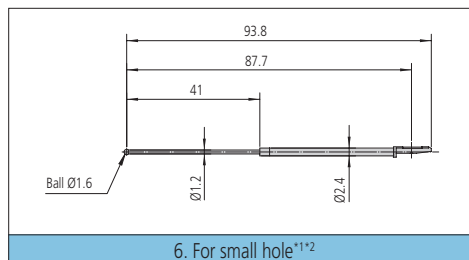
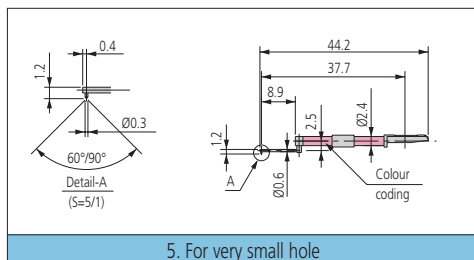
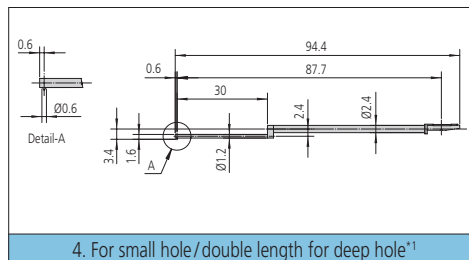
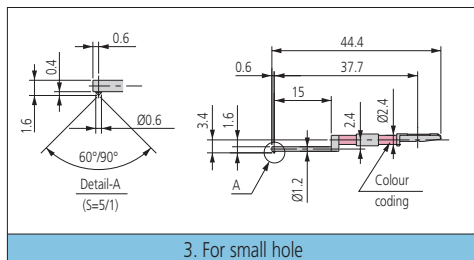
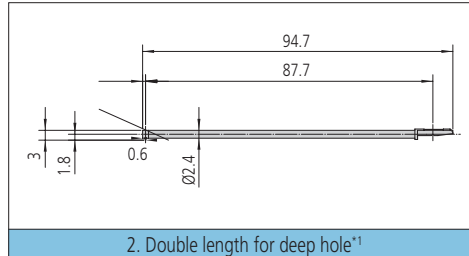
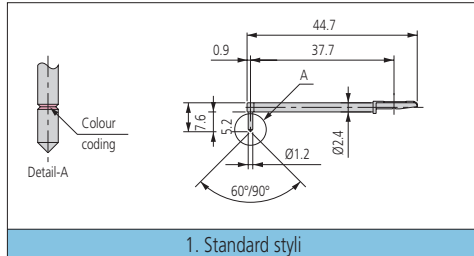


178-396-2 Detector (0.75 mN)

178-397-2 Detector (4 mN)

12AAG202 50 mm extension rod

12AAG203 100 mm extension rod



## Technical Data

Code No.	Stylus tip radius	Stylus tip angle
1. Standard styli		
12AAE882	1 µm	60°
12AAE924	1 µm	90°
12AAC731	2 µm	60°
12AAB403	5 µm	90°
12AAB415	10 µm	90°
12AAE883	250 µm	60°
2. Double length for deep hole		
12AAE898	2 µm	60°
12AAE914	5 µm	90°
3. For small hole		
12AAC732	2 µm	60°
12AAB404	5 µm	90°
12AAB416	10 µm	90°
4. For small hole / double length for deep hole		
12AAE892	2 µm	60°
12AAE908	5 µm	90°
5. For very small hole		
12AAC733	2 µm	60°
12AAB405	5 µm	90°
12AAB417	10 µm	90°
6. For small hole		
12AAE884	0.8 mm	—
7. For extra-small hole		
12AAC734	2 µm	60°
12AAB406	5 µm	90°
12AAB418	10 µm	90°
8. For ultra-small hole		
12AAJ662	250 µm	—
9. For deep hole (double length)		
12AAC740	2 µm	60°
12AAB413	5 µm	90°
12AAB425	10 µm	90°
10. For deep hole (triple length)		
12AAC741	2 µm	60°
12AAB414	5 µm	90°
12AAB426	10 µm	90°
11. For small slotted hole		
12AAE938	2 µm	60°
12AAE940	5 µm	90°

Tip radius	1 µm	2 µm	5 µm	10 µm	250 µm
Colour coding	White	Black	No colour	Yellow	No notch or colour

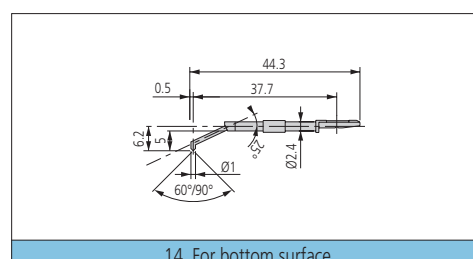
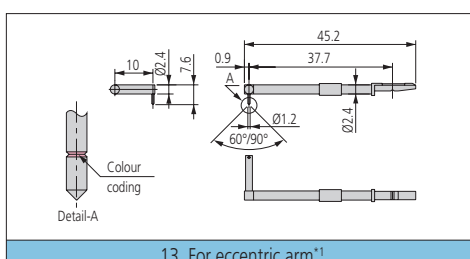
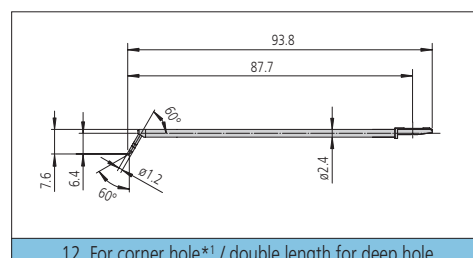
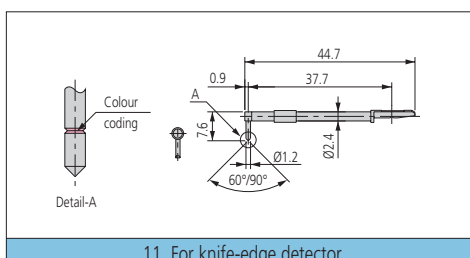
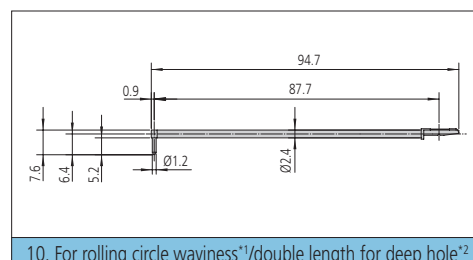
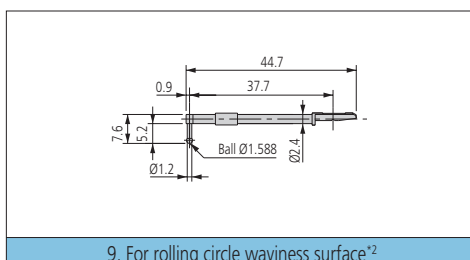
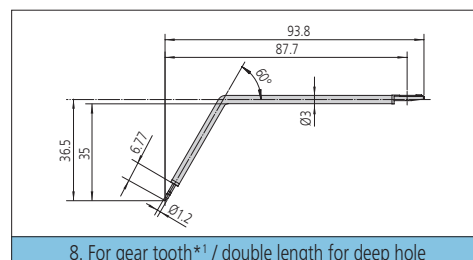
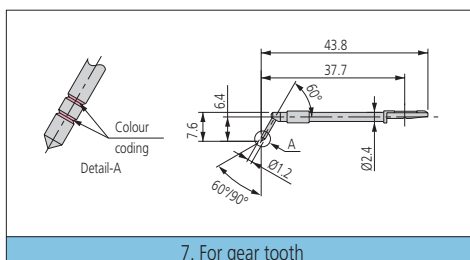
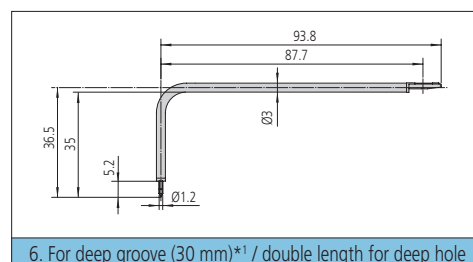
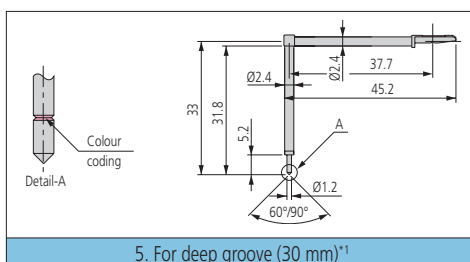
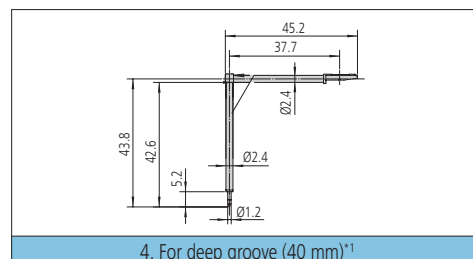
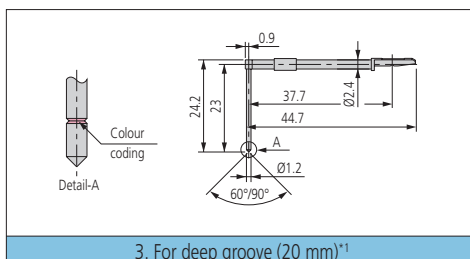
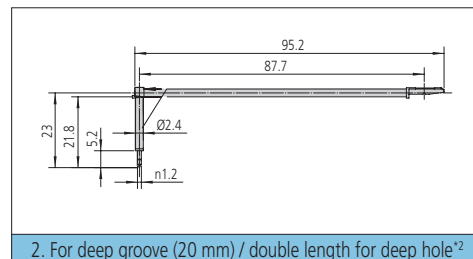
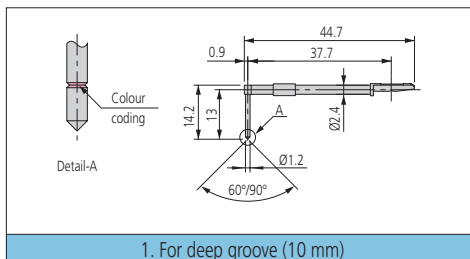
\*1 For downward-facing measurement only.

\*2 Used for calibration, a standard step gauge (178-611 optional accessory) is also required.

## Technical Data

Code No.	Stylus tip radius	Stylus tip angle
1. For deep groove (10 mm)		
12AAC735	2 µm	60°
12AAB409	5 µm	90°
12AAB421	10 µm	90°
2. For deep groove (20 mm)/double length for deep hole		
12AAE893	2 µm	60°
12AAE909	5 µm	90°
3. For deep groove (20 mm)		
12AAC736	2 µm	60°
12AAB408	5 µm	90°
12AAB420	10 µm	90°
4. For deep groove (40 mm)		
12AAE895	2 µm	60°
12AAE911	5 µm	90°
5. For deep groove (30 mm)		
12AAC737	2 µm	60°
12AAB407	5 µm	90°
12AAB419	10 µm	90°
6. For deep groove (30 mm)/double length for deep hole		
12AAE894	2 µm	60°
12AAE910	5 µm	90°
7. For gear tooth		
12AAB339	2 µm	60°
12AAB410	5 µm	60°
12AAB422	10 µm	60°
8. For gear tooth / double length for deep hole		
12AAE896	2 µm	60°
12AAE912	5 µm	60°
9. For rolling circle waviness surface		
12AAB338	0.8 mm	—
10. For rolling circle waviness/double length for deep hole		
12AAE886	250 µm	—
11. For knife-edge detector		
12AAC738	2 µm	60°
12AAB411	5 µm	90°
12AAB423	10 µm	90°
12. For corner hole / double length for deep hole		
12AAM601	2 µm	60°
12AAM603	5 µm	60°
13. For eccentric arm		
12AAC739	2 µm	60°
12AAB412	5 µm	90°
12AAB424	10 µm	90°
14. For bottom surface		
12AAE899	2 µm	60°
12AAE915	5 µm	90°

Tip radius	1 µm	2 µm	5 µm	10 µm	250 µm
Colour coding	White	Black	No colour	Yellow	No notch or colour



<sup>\*1</sup> For downward-facing measurement only

<sup>\*2</sup> Used for calibration, a standard step gauge (178-611 optional accessory) is also required.



# Contracer CV-2100N4

## SERIES 218 – Contour Measuring Instruments

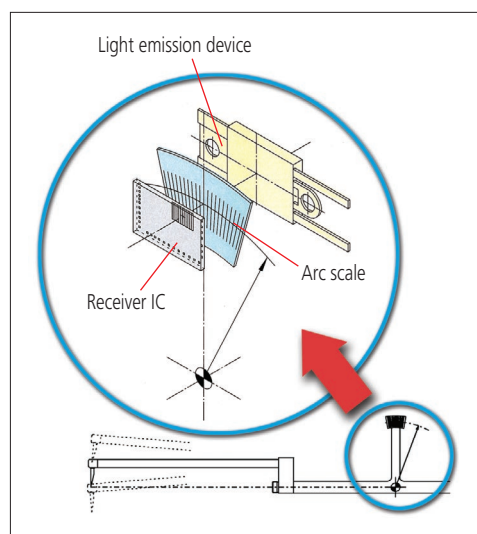
- A digital arc-scale is equipped in the Z-axis detecting unit. This gives a wider range of measurement with higher resolution. No more reliance on measurement magnification.
- A data analysis system (PC system and FORMTRACEPAK software) is available.
- The CV-2100N4 is portable and can be carried to the machine shop for measurement of large workpieces.

Contracer CV-2100N4



### Specifications

Model	CV-2100N4
Code No. (mm)	218-613E
Code No. (inch/mm)	218-623E
X1-axis measuring range	100 mm
Z1-axis measuring range	50 mm



Arc scale on the Z axis.

### Technical Data

#### X1 axis

Measuring range:	100 mm
Resolution:	0.1 $\mu$ m,
Scale type:	Reflective-type linear encoder
Drive speed:	0.2, 1 mm/s and manual
Measuring speed:	0.2, 0.5 mm/s
Measuring direction:	Forward and backward
Traverse straightness:	2.5 $\mu$ m/100 mm
Accuracy (at 20°C):	$\pm(2.5+2L/100)$ $\mu$ m, L = Drive length (mm)

#### Z1 axis (detector unit)

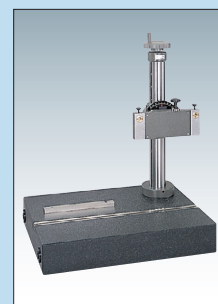
Measuring range:	50 mm
Resolution:	0.1 $\mu$ m
Scale type:	Arc encoder
Accuracy (at 20°C):	$\pm(2.5+0.2H)$ $\mu$ m
	H: measurement height from the horizontal position (mm)

Stylus movement:	Arc
Stylus orientation:	Downward
Measuring force:	30 $\pm$ 10 mN
Traceable angle:	Ascent: 77°, descent: 87° using the standard stylus provided and depending on the surface roughness

Stylus tip:	Carbide, R25 $\mu$ m
Mass (main unit):	146 kg
Power supply:	240VAC $\pm$ 10%, 50/60Hz

### Optional Accessories

Code No.	Description	Price
218-024	Column stand (vertical travel: 320 mm, inclination: $\pm$ 45°)	£3410.00
218-001	Cross-travel table (XY range: 100x50 mm)	£1860.00
218-011	Cross-travel table (XY range: 4x2")	£2170.00
218-041	Cross-travel table (XY range: 50 x 25 mm)	£2280.00
218-051	Cross-travel table (XY range: 2 x 1")	£2130.00
218-002	Rugged table	£1240.00
176-107	Holder with clamp	£171.00
218-003	Rotary vice (heavy-duty type)	£1140.00
172-144	Rotary vice	£613.00
172-234	V-block with clamp (max. workpiece $\phi$ 50 mm)	£298.00
172-378	V-block with clamp (max. workpiece $\phi$ 25 mm)	£224.00
172-197	Swivel centre support	£401.00
172-142	Centre support	£586.00
172-143	Centre support riser	£236.00
178-023	Vibration isolator	£2910.00
178-024	Vibration isolator stand	£744.00
998862	Pin gauge unit for calibration (mm)	£235.00
998861	Pin gauge unit for calibration (inch)	£235.00



CV-2100N4 can be attached to the optional column stand.

# Contracer CV-2100M4

## SERIES 218 – Contour Measuring Instruments

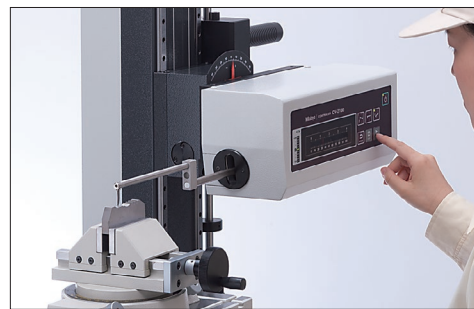
- A digital arc-scale is equipped in the Z-axis detecting unit. This gives a wider range of measurement with higher resolution. No more reliance on measurement magnification.
- A data analysis system (PC system and FORMTRACEPAK software) is available.

Contracer CV-2100M4



### Specifications

Model	CV-2100M4
Code No. (mm)	218-633E
Code No. (inch/mm)	218-643E
X1-axis measuring range	100 mm
Z1-axis measuring range	50 mm
Z2-axis vertical travel	350 mm



Centralised front control panel.



Motor-driven jog shuttle.



Motor-driven jog shuttle.

### Technical Data

#### X1 axis

Measuring range: 100 mm  
 Resolution: 0.1  $\mu$ m,  
 Scale type: Reflective-type linear encoder  
 Drive speed: 0.2, 1 mm/s and manual  
 Measuring speed: 0.2, 0.5 mm/s  
 Measuring direction: Forward and backward  
 Traverse straightness: 2.5  $\mu$ m/100 mm  
 Accuracy (at 20°C):  $\pm(2.5+2L/100)$   $\mu$ m, L = Drive length (mm)  
 Inclination range:  $\pm 45^\circ$

#### Z2 axis (column)

Column type: Manual  
 Vertical travel: 350 mm  
 Drive speed: 1-5 mm/s and manual

#### Z1 axis (detector unit)

Measuring range: 50 mm  
 Resolution: 0.1  $\mu$ m  
 Scale type: Arc encoder  
 Accuracy (at 20°C):  $\pm(2.5+0.2H)$   $\mu$ m  
 H: measurement height from the horizontal position (mm)

Stylus movement: Arc  
 Stylus orientation: Downward  
 Measuring force: 30 $\pm$ 10 mN  
 Traceable angle: Ascent: 77°, descent: 87° using the standard stylus provided and depending on the surface roughness

Stylus tip: Carbide, R25  $\mu$ m  
 Base size (W x H): 600 x 450 mm  
 Base material: Granite  
 Mass (main unit): 146 kg  
 Power supply: 240VAC  $\pm$ 10%, 50/60Hz

### Optional Accessories

Code No.	Description	Price
218-001	Cross-travel table (XY range: 100 x 50 mm)	£1860.00
218-011	Cross-travel table (XY range: 4 x 2")	£2170.00
218-041	Cross-travel table (XY range: 50 x 25 mm)	£2280.00
218-051	Cross-travel table (XY range: 2 x 1")	£2130.00
218-002	Rugged table	£1240.00
176-107	Holder with clamp	£171.00
218-003	Rotary vice (heavy-duty type)	£1140.00
172-144	Rotary vice	£613.00
172-234	V-block with clamp (max. workpiece $\phi$ 50 mm)	£298.00
172-378	V-block with clamp (max. workpiece $\phi$ 25 mm)	£224.00
172-197	Swivel centre support	£401.00
172-142	Centre support	£586.00
172-143	Centre support riser	£236.00
178-023	Vibration isolator	£2910.00
178-024	Vibration isolator stand	£744.00
998862	Pin gauge unit for calibration (mm)	£235.00
998861	Pin gauge unit for calibration (inch)	£235.00

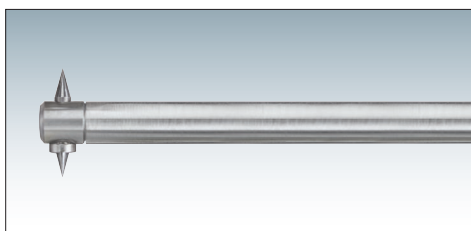
# Contracer CV-3200/CV-4500

## SERIES 218 – Contour Measuring Instruments

- Dramatically increased drive speed (X1 axis: 80 mm/s, Z2 axis: 30 mm/s) further reduces total measurement time.
- In order to maintain the traverse straightness specification for an extended period of time, Mitutoyo has adopted highly rigid ceramic guides that combine the characteristics of smallest secular change and remarkable resistance to abrasion.
- The drive unit (X1 axis) and column (Z2 axis) are equipped with high-accuracy linear encoders (ABS type on Z2 axis). This improves reproducibility of continuous automatic measurement of small holes in the vertical direction and repeated measurement of parts which are difficult to position.
- A newly designed straight arm has reduced interference with the workpiece and expanded the measurement range in the Z1 axis (height) direction.
- One-touch mounting and removal of the arm.
- Designed to handle workpieces calling for high accuracy

### CV-4500 only:

- With the addition of a new function for continuously measuring top and bottom faces, the variable measuring force function has become more useful, enabling a wide variety of efficient, high-precision measurements.
- When combined with the double-cone stylus (a new product with diametrically opposed contact points), the instrument can continuously measure in the upward and downward directions without the need to change the arm orientation or reset the workpiece fixturing.
- The measuring force can be switched among five levels (upward and downward) from the data-processing program (FORMTRACEPAK).



CV-4500 double-cone stylus.



Contracer CV-3200S4

## Technical Data

### X1 axis

Resolution:	0.05 $\mu\text{m}$
Scale type:	Linear encoder
Drive speed:	0-80 mm/s and manual
Measuring speed:	0.02-5 mm/s
Measuring direction:	Forward/backward
Traverse straightness:	0.8 $\mu\text{m}/100\text{ mm}$ , 2 $\mu\text{m}/200\text{ mm}$ with the X1 axis in horizontal orientation

Accuracy (at 20°C):	$\pm(0.8+0.01L)\text{ }\mu\text{m}$ (CV-3200/4500 S4, H4, W4)
	$\pm(0.8+0.02L)\text{ }\mu\text{m}$ (CV-3200/4500S8, H8, W8)
	L = drive length (mm)

Inclination range:	$\pm 45^\circ$
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### Z2 axis (column)

Resolution:	1 $\mu\text{m}$
Scale type:	ABSOLUTE linear encoder
Drive speed:	0-30 mm/s and manual

### Z1 axis (detector unit)

Measuring range:	$\pm 30\text{ mm}$
Resolution:	0.04 $\mu\text{m}$ (CV-3200) 0.02 $\mu\text{m}$ (CV-4500)
Scale type:	Rotary arc encoder
Accuracy (at 20°C):	$\pm(1.6+12H/100)\text{ }\mu\text{m}$ (CV-3200) $\pm(0.8+12H/100)\text{ }\mu\text{m}$ (CV-4500)

H: measurement height from the horizontal position (mm)

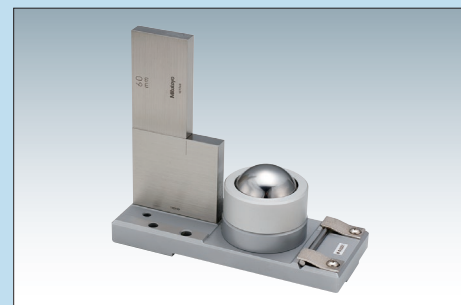
Stylus orientation:	Upward/downward
Measuring force:	30 mN (CV-3200) 10, 20, 30, 40, 50 mN (CV-4500 specified from the data-processing program FORMTRACEPAK)

Traceable angle:	Ascent: $77^\circ$ , descent: $83^\circ$ using the standard stylus provided and depending on the surface roughness
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Stylus tip	Carbide, R25 $\mu\text{m}$ (CV-3200)
Base material:	Granite

### Mass

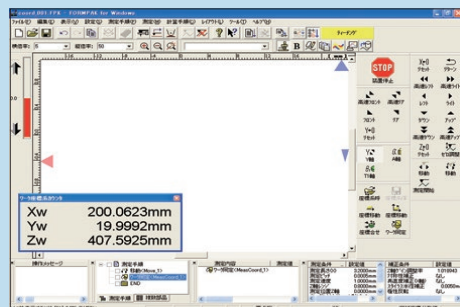
Main unit:	See table
Controller unit:	14 kg
Remote control box:	0.9 kg
Power supply:	240VAC $\pm 10\%$ , 50/60 Hz
Power consumption:	400 W (main unit only)



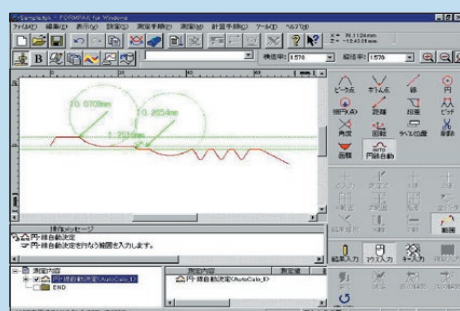
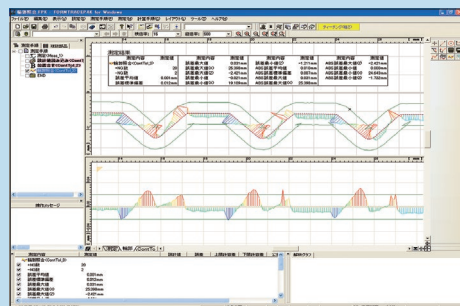
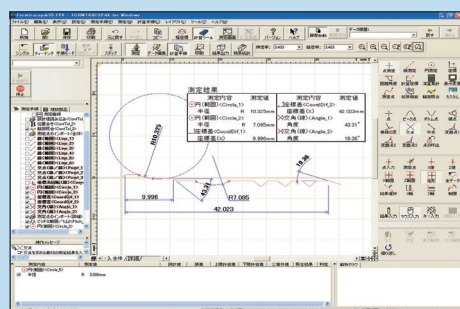
### Combined Calibration Gauge

A dedicated calibration gauge enables the user to calibrate the instrument for Z-axis gain, symmetry, stylus-tip radius, etc., in a single procedure.

**Software**  
**FORMTRACEPAK V5**



Measuring control screen.



Automatic circle/line application function.

**Specifications**

Model	CV-3200S4	CV-4500S4	CV-3200H4	CV-4500H4
Code No. (mm)	218-481-10E	218-441-10E	218-482-10E	218-442-10E
Code No. (inch/mm)	218-491-10E	218-451-10E	218-492-10E	218-452-10E
X1-axis measuring range	100 mm			
Dimensions (main unit, WxDxH)	756 x 482 x 966 mm		756 x 482 x 1166 mm	
Mass (main unit)	140 kg		150 kg	

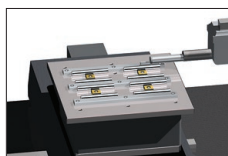
Model	CV-3200W4	CV-4500W4	CV-3200L4	CV-4500L4
Code No. (mm)	218-483-10E	218-443-10E	218-484-10E	218-444-10E
Code No. (inch/mm)	218-493-10E	218-453-10E	218-494-10E	218-454-10E
X1-axis measuring range	100 mm			
Dimensions (main unit, WxDxH)	1156 x 482 x 1176 mm		1156 x 492 x 1436 mm	
Mass (main unit)	220 kg		270 kg	

Model	CV-3200S8	CV-4500S8	CV-3200H8	CV-4500H8
Code No. (mm)	218-486-10E	218-446-10E	218-487-10E	218-447-10E
Code No. (inch/mm)	218-496-10E	218-456-10E	218-497-10E	218-457-10E
X1-axis measuring range	200 mm			
Dimensions (main unit, WxDxH)	766 x 482 x 966 mm		766 x 482 x 1166 mm	
Mass (main unit)	140 kg		150 kg	

Model	CV-3200W8	CV-4500W8	CV-3200L8	CV-4500L8
Code No. (mm)	218-488-10E	218-448-10E	218-489-10E	218-449-10E
Code No. (inch/mm)	218-498-10E	218-458-10E	218-499-10E	218-459-10E
X1-axis measuring range	200 mm			
Dimensions (main unit, WxDxH)	1166 x 482 x 1176 mm		1166 x 492 x 1436 mm	
Mass (main unit)	220 kg		270 kg	

**Simplified CNC Function**

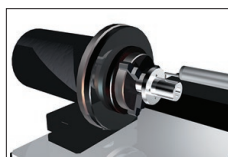
Support for a wide range of optional peripherals designed for use with the CNC models enables automatic measurement.



Using Y-axis table.

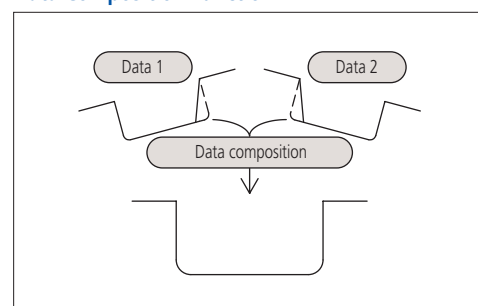


Using rotary table θ1.



Using rotary table θ2.

**Data Composition Function**



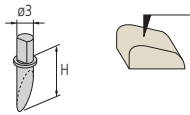


# Optional Arms and Styli

For CV-2100

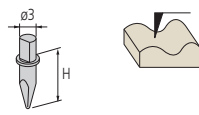
## Styli

### Single bevel



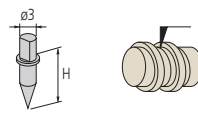
Tip angle: 12°  
Tip radius: 25 µm  
Tip material: Carbide

### Cross ground



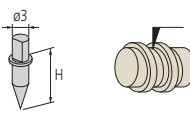
Tip angle: 20°  
Tip radius: 25 µm  
Tip material: Carbide

### Cone



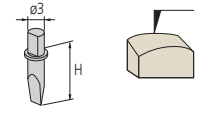
Tip angle: 20°  
Tip radius: 25 µm  
Tip material: Carbide

### Cone



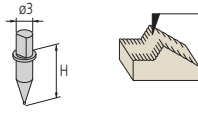
Tip angle: 30° (SPH-79: 50°)  
Tip radius: 25 µm  
Tip material: Carbide, Sapphire (SPH-79: Diamond)

### Knife edge



Tip angle: 20°  
Edge width: 3 mm  
Tip radius: 25 µm  
Tip material: Carbide

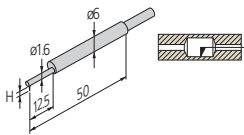
### Ball



Ball diameter: 1 mm  
Tip material: Carbide

### Small hole:

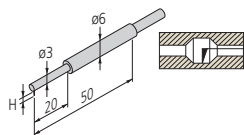
932693/12AAE873



932693 12AAE873  
Tip shape: Single Bevel cone  
Tip angle: 20° 30°  
Tip radius: 25 µm 25 µm  
Tip material: Carbide Carbide

### Small hole:

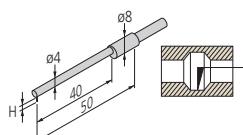
932694/12AAE874



932694 12AAE874  
Tip shape: Single Bevel cone  
Tip angle: 20° 30°  
Tip radius: 25 µm 25 µm  
Tip material: Carbide Carbide

### Small hole:

932695/12AAE875



932695 12AAE875  
Tip shape: Single Bevel cone  
Tip angle: 20° 30°  
Tip radius: 25 µm 25 µm  
Tip material: Carbide Carbide

Stylus No.	Code No.	Compatible arm No.	H (mm)
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### Single-bevel stylus carbide-tipped

SPH-51	354882	AB-51, 52	6
SPH-61	354883	AB-61, 62	12
SPH-71*	354884	AB-71, 72	20
SPH-81	354885	AB-81, 82	30
SPH-91	354886	AB-91, 92	42

### Cross-ground stylus carbide-tipped

SPH-52	354887	AB-51, 52	6
SPH-62	354888	AB-61, 62	12
SPH-72	354889	AB-71, 72	20
SPH-82	354890	AB-81, 82	30
SPH-92	354891	AB-91, 92	42

### Cone stylus carbide-tipped tip angle 20°

SPH-57	12AAE865	AB-51, 52	6
SPH-67	12AAE866	AB-61, 62	12
SPH-77	12AAE867	AB-71, 72	20
SPH-87	12AAE868	AB-81, 82	30
SPH-97	12AAE869	AB-91, 92	42

### Cone stylus sapphire-tipped tip angle 30°

SPH-53	354892	AB-51, 52	6
SPH-63	354893	AB-61, 62	12
SPH-73	354894	AB-71, 72	20
SPH-83	354895	AB-81, 82	30
SPH-93	354896	AB-91, 92	42

### Cone stylus diamond-tipped tip angle 50°

SPH-79	355129	AB-71, 72	20
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\*Supplied as standard.

Stylus No.	Code No.	Compatible arm No.	H (mm)
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### Cone stylus carbide-tipped tip angle 30°

SPH-56	12AAA566	AB-51, 52	6
SPH-66	12AAA567	AB-61, 62	12
SPH-76	12AAA568	AB-71, 72	20
SPH-86	12AAA569	AB-81, 82	30
SPH-96	12AAA570	AB-91, 92	42

### Knife-edge stylus carbide-tipped

SPH-54	354897	AB-51, 52	6
SPH-64	354898	AB-61, 62	12
SPH-74	354899	AB-71, 72	20
SPH-84	354900	AB-81, 82	30
SPH-94	354901	AB-91, 92	42

### Ball stylus carbide-tipped

SPH-55	354902	AB-51, 52	6
SPH-65	354903	AB-61, 62	12
SPH-75	354904	AB-71, 72	20
SPH-85	354905	AB-81, 82	30
SPH-95	354906	AB-91, 92	42

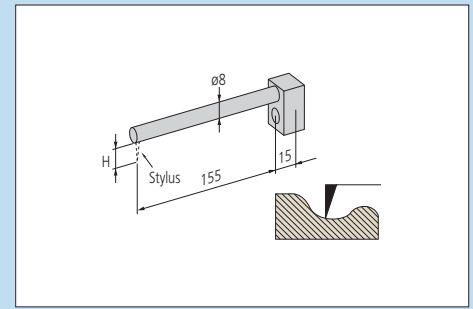
### Small-hole stylus carbide-tipped one-sided cut

SP-11	932693	AB-11	0.4
SP-12	932694		1
SP-13	932695		2.5

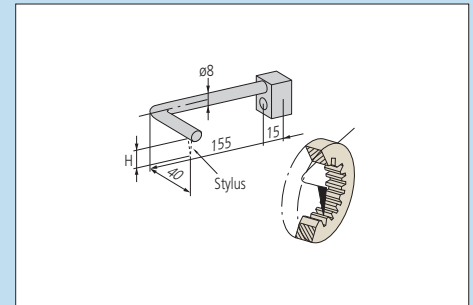
### Small-hole stylus carbide-tipped cone

SP-31	12AAE873	AB-11	0.4
SP-32	12AAE874		1
SP-33	12AAE875		2.5

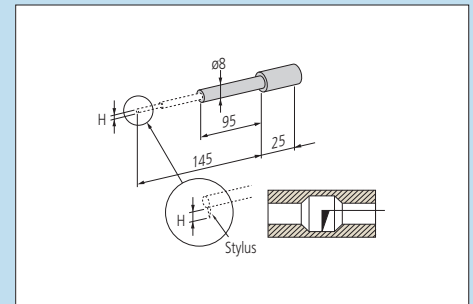
## Arms



Straight type.



Eccentric type.



For small-hole stylus.

Arm No.	Code No.	Compatible stylus No.	H (mm)
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### Straight type

AB-51	935111	SPH-5x	6
AB-61	935112	SPH-6x	12
AB-71*	935113	SPH-7x	20
AB-81	935114	SPH-8x	30
AB-91	935115	SPH-9x	42

### Eccentric type

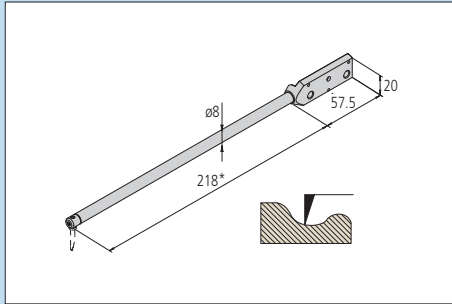
AB-52	935116	SPH-5x	6
AB-62	935117	SPH-6x	12
AB-72	935118	SPH-7x	20
AB-82	935119	SPH-8x	30
AB-92	935120	SPH-9x	42

### Small hole

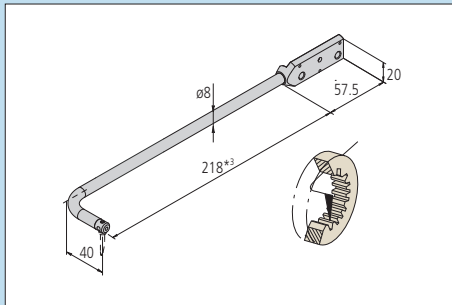
AB-11	9351216	SP-11, 31	0.4
		SP-12, 32	1
		SP-13, 33	2.5

\*Supplied as standard.

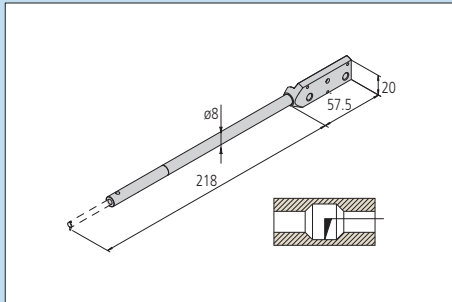
## Arms



Straight type.



Eccentric type.



For small-hole stylus.

Arm No.	Code No.	Compatible stylus No.
<b>Straight type</b>		
AB-31* <sup>1</sup>	<b>12AAM101</b>	SPH-5x, 6x, 7x, 8x, 9x SPHW* <sup>2</sup> -56, 66, 76
<b>Eccentric type</b>		
AB-32* <sup>3</sup>	<b>12AAM102</b>	SPH-5x, 6x, 7x, 8x, 9x SPHW* <sup>2</sup> -56, 66, 76
<b>Small hole</b>		
AB-33	<b>12AAM103</b>	SPH-41, 41, 43

\*<sup>1</sup> Supplied as standard.

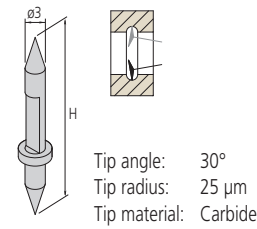
\*<sup>2</sup> Stylus for CV-4500 series.

\*<sup>3</sup> One-sided cut stylus SPH-71 (standard accessory) mounting.

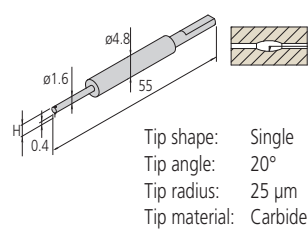
## For CV-3200 and CV-4500

### Styli

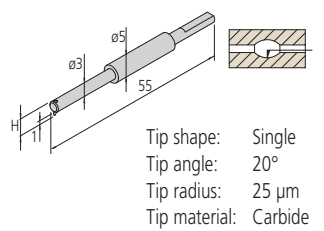
#### Double cone



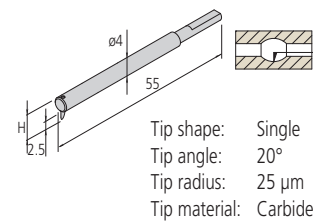
#### Small hole: SPH-41



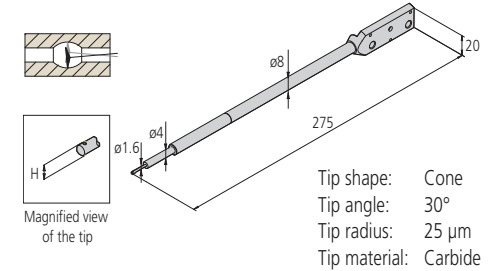
#### Small hole: SPH-42



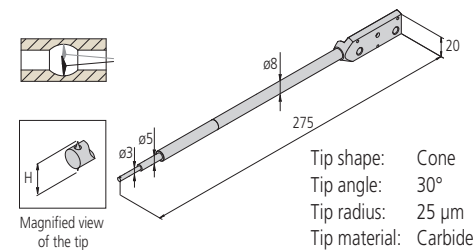
#### Small hole: SPH-43



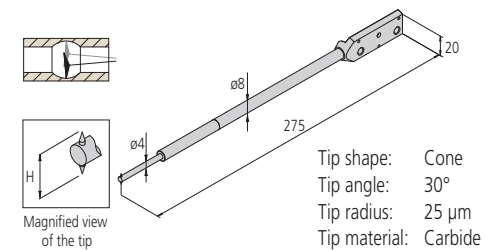
#### Double small-hole arm stylus: SPHW-31



#### Double small-hole arm stylus: SPHW-32



#### Double small-hole arm stylus: SPHW-33



Stylus No.	Code No.	Compatible arm No.	H (mm)
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#### Double-cone stylus \*<sup>4</sup>

SPHW-56	<b>12AAM095</b> * <sup>5</sup>	AB-31, 32	20
SPHW-66	<b>12AAM096</b>		32
SPHW-76	<b>12AAM097</b>		48

#### Single-bevel stylus carbide-tipped

SPH-51	<b>354882</b>	AB-31, 32	6
SPH-61	<b>354883</b>		12
SPH-71	<b>354884</b> * <sup>6</sup>		20
SPH-81	<b>354885</b>		30
SPH-91	<b>354886</b>		42

#### Cross-ground stylus carbide-tipped (see page opposite)

SPH-52	<b>354887</b>	AB-31, 32	6
SPH-62	<b>354888</b>		12
SPH-72	<b>354889</b>		20
SPH-82	<b>354890</b>		30
SPH-92	<b>354891</b>		42

#### Cone stylus sapphire-tipped tip angle 30° (see page opposite)

SPH-53	<b>354892</b>	AB-31, 32	6
SPH-63	<b>354893</b>		12
SPH-73	<b>354894</b>		20
SPH-83	<b>354895</b>		30
SPH-93	<b>354896</b>		42

#### Cone stylus carbide-tipped tip angle 30° (see page opposite)

SPH-56	<b>12AAA566</b>	AB-31, 32	6
SPH-66	<b>12AAA567</b>		12
SPH-76	<b>12AAA568</b>		20
SPH-86	<b>12AAA569</b>		30
SPH-96	<b>12AAA570</b>		42

\*<sup>4</sup> Stylus for CV-4500 series.

\*<sup>5</sup> Standard accessory of CV-4500 series.

\*<sup>6</sup> Standard accessory of CV-3200 series.

Stylus No.	Code No.	Compatible arm No.	H (mm)
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#### Cone stylus carbide-tipped tip angle 20° (see page opposite)

SPH-57	<b>12AAE865</b>	AB-31, 32	6
SPH-67	<b>12AAE866</b>		12
SPH-77	<b>12AAE867</b>		20
SPH-87	<b>12AAE868</b>		30
SPH-97	<b>12AAE869</b>		42

#### Cone stylus diamond-tipped tip angle 50° (see page opposite)

SPH-79	<b>355129</b>	AB-31, 32	20
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#### Knife-edge stylus carbide-tipped (see page opposite)

SPH-54	<b>354897</b>	AB-31, 32	6
SPH-64	<b>354898</b>		12
SPH-74	<b>354899</b>		20
SPH-84	<b>354900</b>		30
SPH-94	<b>354901</b>		42

#### Ball stylus carbide-tipped (see page opposite)

SPH-55	<b>354902</b>	AB-31, 32	6
SPH-65	<b>354903</b>		12
SPH-75	<b>354904</b>		20
SPH-85	<b>354905</b>		30
SPH-95	<b>354906</b>		42

#### Small-hole stylus

SPH-41	<b>12AAM104</b>	AB-33	2
SPH-42	<b>12AAM105</b>		4
SPH-43	<b>12AAM106</b>		6.5

#### Double small-hole arm stylus\*<sup>7</sup> (integrated arm and stylus) only for CV-4500

SPHW-31	<b>12AAM108</b>	—	2.4
SPHW-32	<b>12AAM109</b>		5
SPHW-33	<b>12AAM110</b>		9

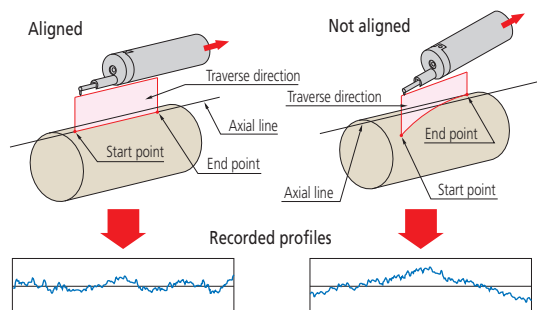
\*<sup>7</sup> Arm stylus for CV-4500 series.

# Optional Accessories

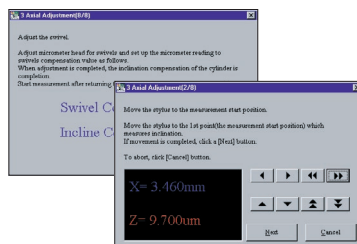
## For Surftest, Formtracer and Contracer

### 3-Axis Adjustment Table

This table helps make the alignment adjustments required when measuring cylindrical surfaces. The corrections for the pitch angle and the swivel angle are determined from a preliminary measurement and the Digimatic micrometers are adjusted accordingly. A flat-surfaced workpiece can also be levelled with this table.



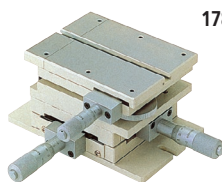
178-047



Code No.	Description	Price
178-047	3-axis adjustment table	£3650.00

### Levelling Table

- Table top: 130 x 100 mm
- Levelling range:  $\pm 1.5^\circ$
- XY travel:  $\pm 12.5$  mm

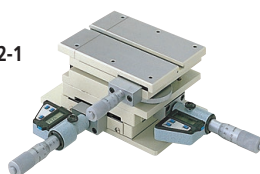


178-043-1

Code No.	Description	Price
178-043-1	Levelling table (mm)	£2370.00
178-053-1	Levelling table (inch)	£2030.00

### Digital Levelling Table

- Table top: 130 x 100 mm
- Levelling range:  $\pm 1.5^\circ$
- XY travel:  $\pm 12.5$  mm



178-042-1

Code No.	Description	Price
178-042-1	Digital levelling table (mm)	£3070.00

### Cross-Travel Table

- Table top: 280 x 180 mm
- XY travel: 100 x 50 mm

218-001



Code No.	Description	Price
218-001	Cross-travel table (mm)	£1860.00

### Levelling Table

- Table top: 130 x 100 mm
- Levelling range:  $\pm 1.5^\circ$
- Height: 40 mm

178-016

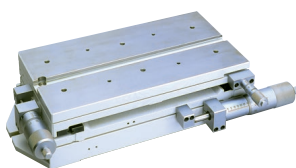


Code No.	Description	Price
178-016	Levelling table	£631.00

### Cross-Travel Table

- Table top: 280 x 152 mm
- XY travel: 50 x 25 mm

218-041



Code No.	Description	Price
218-041	Cross-travel table (mm)	£2280.00
218-051	Cross-travel table (inch)	£2130.00

### V-Block

- Workpiece diameter: 1 to 160 mm
- Can be mounted on a levelling table

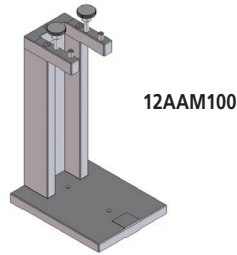
998291



Code No.	Description	Price
998291	V-block	£639.00

### Calibration Stand

Required for calibrating upward measurement of CV-3200 series.

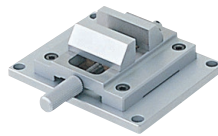


Code No.	Description	Price
12AAM100	Calibration stand	POA

### Precision Vice

- Maximum workpiece size: 36 mm
- Can be mounted on a levelling table

178-019



Code No.	Description	Price
178-019	Precision vice	£700.00

### Swivel Centre Support

- Maximum workpiece diameter: 80 mm\*
- Max. workpiece length: 140 mm
- \* 65 mm when swivelled 10°

172-197



Code No.	Description	Price
172-197	Swivel centre support	£401.00

### Centre Support

- Maximum workpiece diameter: 120 mm
- 60 mm riser is optional

172-142



Code No.	Description	Price
172-142	Centre support	£586.00

### V-Block with Clamp

- Used with a cross-travel table or rugged table

178-234



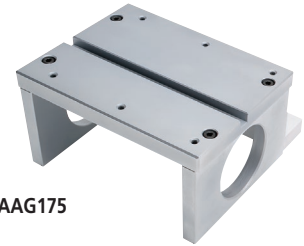
178-378



Code No.	Description	Price
172-234	V-block with clamp (max. workpiece ø50 mm)	£298.00
172-378	V-block with clamp (max. workpiece ø25 mm)	£224.00

### Calibration Stand

Required for calibrating in bulk by mounting straight arm/small-hole stylus arm without using cross-travel table and Y-axis table.



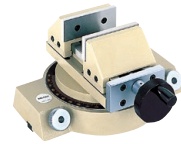
12AAG175

Code No.	Description	Price
12AAG175	Calibration stand	£288.00

### Rotary Vice

- Two-slide jaw type
- Maximum workpiece size: ø60 mm
- Resolution: 1°

218-003



Code No.	Description	Price
218-003	Rotary vice	£1140.00

### Holder with Clamp

- Used with a cross-travel table or rugged table
- Maximum workpiece height: 35 mm

176-107



Code No.	Description	Price
176-107	Holder with clamp	£171.00

### Centre Support Riser

- Used with a centre support.
- Maximum workpiece diameter: 240 mm

172-143



Code No.	Description	Price
172-143	Centre support riser	£236.00

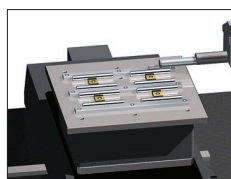
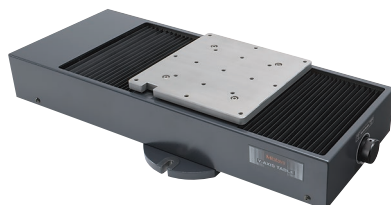


# Optional Accessories

## For Surftest, Formtracer and Contracer

### Y-Axis Table

Enables efficient, automatic measurement of multiple aligned workpieces and multiple points on a single measurement surface. Allows semi-automatic measurement with a manually operated machine.  
(Not for CNC models.)

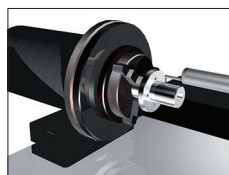
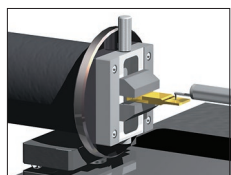
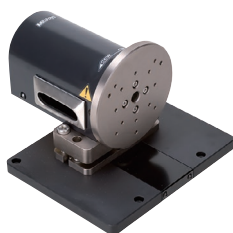


Code No.	178-097
Travel range	200 mm
Resolution	0.05 $\mu$ m
Positioning accuracy	$\pm 3 \mu$ m
Drive speed	Max. 80 mm/s
Maximum load	50 kg
Mass	28 kg
Price	POA

### $\theta$ 2-Axis Table

Enables measurement of multiple points on a cylindrical workpiece and automation of front/rear/side measurement. Allows semi-automatic measurement with a manually operated machine.

Note:  $\theta$ 2-axis mounting plate (12AAE718) is required when directly installing on the base of the SV-3100.

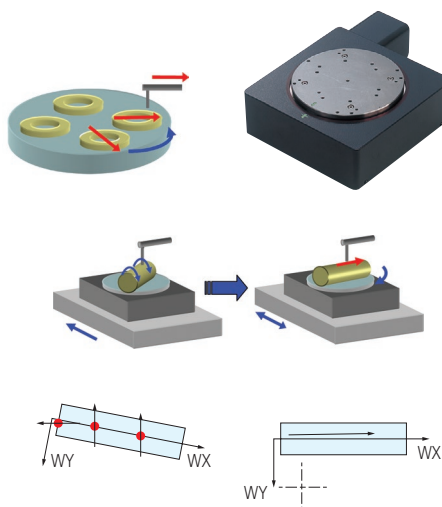


Code No.	178-078
Displacement	360°
Resolution	0.0072°
Maximum load (loading moment)	4 kg
Rotational speed	Max. 18°/s
Mass	5 kg
Price	POA

### $\theta$ 1-Axis Table

For efficient measurement in the axial/transverse directions. When measuring a cylindrical workpiece, automatic alignment can be performed in combination with the Y-axis table.

Note:  $\theta$ 1-axis mounting plate (12AAE630) is required when directly installing on the base of the SV-3100.



Code No.	12AAD975
Displacement	360°
Resolution	0.004°
Maximum load	12 kg
Rotational speed	Max. 10°/s
Mass	7 kg
Price	POA

### Automatic-Levelling Table

This is a stage that performs fully automatic levelling as measurement starts, freeing the user from this troublesome operation. Fully automatic levelling can be done quickly, easily and reliably.



Code No.	178-087	178-037
For models	SV, CV, CS-3200	CNC
Inclination adjustment angle	$\pm 2^\circ$	
Maximum load	7 kg	
Table dimensions	130 x 100 mm	
Mass	3.5 kg	
Price	POA	POA

### Quick Chuck

This chuck is useful when measuring small workpieces, which are easily clamped by tightening the knurled ring.



Code No.		211-032
Holding capacity	Internal jaws	OD: 1 - 36 mm
	Internal jaws	ID: 14 - 70 mm
	External jaws	OD: 25 - 79 mm
Dimensions		ø118 x 41 mm
Mass		1.2 kg
Price		£1410.00

### Micro-Chuck

This chuck is suitable for clamping extra-small diameter workpieces ( $\phi 1$  mm or less), which cannot be retained with the Quick chuck.



Code No.	211-031
Holding capacity	OD: 0.1 - 1.5 mm
Dimensions	$\phi 107 \times 48.5$ mm
Mass	0.6 kg
Price	£1090.00

## Examples of Optimal Combinations of Accessories for CNC Models

Function	Y-axis table	θ1 axis table	θ2 axis table	Optional accessory		
				Drive unit tilting function (Patent pending: Japan)	Large θ table	Rotary-type detector holder
Automatic levelling	—	—	—	●	—	—
Automatic alignment (Patent registered: Japan)	●	●	—	▲	—	—
Multiple workpiece batch measurement	▲	—	—	—	—	—
Measurement in the Y-axis direction	●	—	—	—	—	—
Oblique measurement in the XY plane*	●	—	—	—	—	—
Outside 3D surface roughness measurement/evaluation*	●	—	—	▲	—	—
Multiple-piece measurement in the Y-axis direction (positioning in the Y-axis direction)	●	—	—	—	—	—
Multiple-piece measurement in the radial direction (rotary positioning in the XY plane)	▲	●	—	—	—	—
Tracking measurement in the Z-axis direction**	—	—	—	●	—	—
Inclined surface measurement in the X-axis direction	▲	—	—	●	—	—
Inclined hole inside measurement in the X-axis direction	▲	—	—	●	—	—
Multiple cylinder generatrix line measurement	▲	—	●	—	—	—
Measurement of both top and bottom surfaces	▲	—	●	—	—	—
Rotary positioning of large workpiece***	—	—	—	—	●	—
Upward/downward and frontward/backward measurement of large workpiece***	—	—	—	—	—	●

● Highly suitable

▲ Suitable

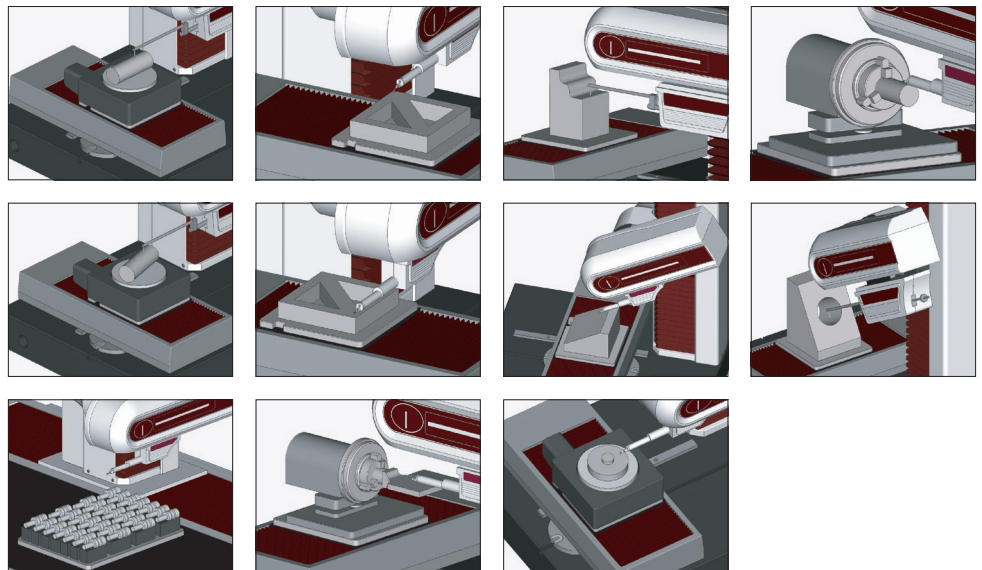
— Not required

\* Applicable only to surface roughness measurement

\*\* Applicable only to form/contour measurement

\*\*\* Applicable only for SV-M3000CNC

For the combinations and the specifications of various optional accessories described in this catalogue, contact your nearest Mitutoyo sales office.



# Roundtest RA-10

## SERIES 211 – Roundness Measuring Instruments

- Compact roundness tester combines outstanding cost and performance with full measurement capabilities and user-friendly operation.
- The control panel has large keys and an intuitive layout for easy operation.
- One-touch setup recall function: Complex setups can be stored in advance and recalled with a single keystroke.
- Zero-set function: The detector level can be set to zero (0) with a single keystroke, thus relieving the user of the need for precise detector positioning.
- The positioning handles for vertical direction (Z axis) and radial direction (X axis) adjustments have been placed on the slider for best operability.
- Despite being a low-priced model, the turntable with air bearings offers rotational accuracy as high as  $(0.04+6H/10000) \mu\text{m}$ , thus assuring accuracy that compares well with that of higher-priced models.
- Measurement results and recorded profiles are easy-to-view with the large LCD panel display.
- The machine has a compact body with integrated electronics and printer making it ideal for crowded inspection areas.

Roundtest RA-10 with optional X-axis stop and Z-axis scale unit.



### Specifications

Model	RA-10
Code No.	211-601E



Optional X-axis stop.



Optional Z-axis scale unit.

### Technical Data

#### Turntable

Rotational accuracy:  $(0.04+6H/10000) \mu\text{m}$   
H: probing height (mm)

Rotational speed: 6 rpm  
Table diameter: 150 mm  
Max. probing diameter: 100 mm  
Max. workpiece diameter: 320 mm  
Max. table loading: 10 kg

#### Vertical column (Z-axis)

Vertical travel: 117 mm  
Max. probing height: 152 mm from the turntable surface  
Max. probing depth: 100 mm (min. ID: 30 mm)

#### Horizontal arm (X-axis)

Horizontal travel: 75 mm (Including a protrusion of 25 mm over the turntable axis)

#### Probe and stylus

Measuring range:  $\pm 1000 \mu\text{m}$   
Measuring force: 70 to 100 mN  
Standard stylus: **12AAL021**, carbide ball,  $\phi 1.6 \text{ mm}$   
Measuring direction: Bi-directional  
Stylus angle adjustment:  $\pm 45^\circ$  (with graduations)

#### Data analysis unit

Processing unit: Built-in  
Data sampling points: Max. 3600 points/rotation  
Data analysis items: Roundness, coaxiality, concentricity, flatness, circular runout (radial)

#### Types of roundness evaluation:

LSC, MZC, MIC, MCC

Recording device: Built-in thermal line printer (optional external printer)

#### Recording magnification:

X5 to X200,000 (15-step)

#### Roughness component reduction:

Low pass filter, band pass filter  
Filter type: 2CR-75%, 2CR-50%, 2CRPC-75% (phase corrected), 2CRPC-50% (phase corrected), Gaussian, filter OFF

#### Cutoff values:

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

#### Air supply

Air pressure: 390 kPa  
Air consumption: 30 L/min.

#### Power supply:

240VAC  $\pm 10\%$ , 50/60Hz

Dimensions (W x D x H): 450 x 360 x 486 mm

Mass: 26 kg

### Consumables

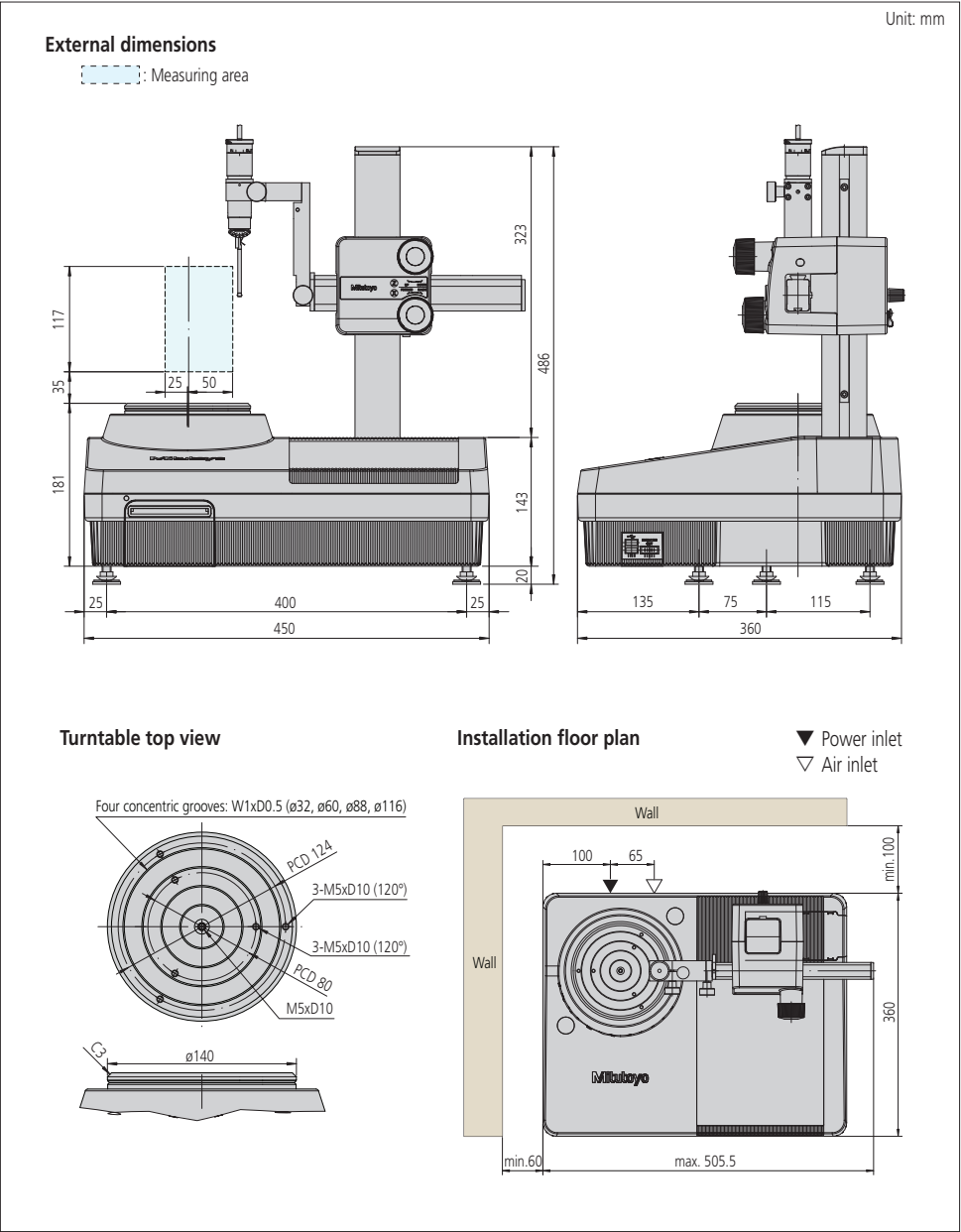
Code No.	Description	Price
<b>12AAH181</b>	Printer paper (10 rolls/set)	<b>£72.20</b>
<b>358592</b>	Element for air filter (1 pc./set)	<b>£47.10</b>
<b>358593</b>	Element for air regulator (10 pcs./set)	<b>£66.60</b>

Optional Accessories

Code No.	Description	Price
211-016	Reference hemisphere	£748.00
12AAH420	Spacer for reference hemisphere	£58.70
997090	Gauge block set for calibration	£240.00
211-045	Magnification checking gauge	£2280.00
211-032	Quick chuck (OD: 1 - 79 mm, ID: 16 - 69 mm)*	£1410.00
211-031	Micro-chuck (OD: 0.1 - 1.5 mm)*	£1090.00
356038	Auxiliary stage for a low-height workpiece*	£316.00
12AAH425	Alignment table with DAT function (mm)	£2320.00
12AAH426	Alignment table with DAT function (inch/mm)	£2320.00
211-052	Quick chuck (OD: 1 - 79 mm, ID: 16 - 69 mm)	£1380.00
211-053	V-block jig A (for ø50 mm)	£863.00
211-054	V-block jig B (for ø50 mm)	£1035.00
211-055	OD/ID mating jig (for ø10 mm)	£1035.00
211-051	Collet chuck (OD: 0.5 - 10 mm)	£989.00
12AAH402	Collet (ø0.5 - 1.0 mm)	£161.00
12AAH403	Collet (ø1.0 - 1.5 mm)	£161.00
12AAH404	Collet (ø1.5 - 2.0 mm)	£127.00
12AAH405	Collet (ø2.0 - 2.5 mm)	£127.00
12AAH406	Collet (ø2.5 - 3.0 mm)	£115.00
12AAH407	Collet (ø3.0 - 3.5 mm)	£115.00
12AAH408	Collet (ø3.5 - 4.0 mm)	£115.00
12AAH409	Collet (ø4.0 - 5.0 mm)	£115.00
12AAH410	Collet (ø5.0 - 6.0 mm)	£115.00
12AAH411	Collet (ø6.0 - 7.0 mm)	£115.00
12AAH412	Collet (ø7.0 - 8.0 mm)	£115.00
12AAH413	Collet (ø8.0 - 9.0 mm)	£115.00
12AAH414	Collet (ø9.0 - 10.0 mm)	£115.00
12AAH318	Z-axis scale unit	£276.00
12AAH320	X-axis stop	£92.00
938882	SR44 (for Z-axis scale unit and alignment table head)	£4.10
211-013	Vibration damping stand	£3370.00

\* Can be installed on the alignment table (12AAH425/6/7 ) only.

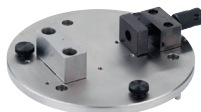
Dimensions



211-052



211-055



211-053



211-054



211-051



211-016



12AAH425



# Roundtest RA-120

## SERIES 211 – Roundness Measuring Instruments

- The Roundtest RA-120/120P are compact, affordable, and simple-to-use devices for measuring part geometry on the shop floor.
- They provide the outstanding data analysis capabilities required of a laboratory roundness measuring instrument having a  $\pm 1000 \mu\text{m}$  wide range detector and a precision turntable with excellent rotational accuracy.
- The RA-120 model has a dedicated processor and control panel incorporated in the main unit for controlling operations.
- The RA-120P is a PC-based model with all operations controlled via ROUNDPAK software (optional).



Optional X-axis stop.



Optional Z-axis scale unit.

Roundtest RA-120



### Specifications

Model	RA-120		
Code No.	211-621E	211-622E	211-623E
Remarks	With mechanical table	With DAT function (mm)	With DAT function (inch/mm)

Roundtest RA-120P



### Specifications

Model	RA-120P		
Code No.	211-625E	211-626E	211-627E
Remarks	With mechanical table	With DAT function (mm)	With DAT function (inch/mm)

### Technical Data

#### Turntable

##### Rotational accuracy

Radial:  $(0.04+6H/10000) \mu\text{m}$

H: Probing height (mm)

Axial:  $(0.04+6X/10000) \mu\text{m}$

X: probing radius (mm)

Rotational speed: 6 rpm

Table diameter: 150 mm

Centering range:  $\pm 3 \text{ mm}$

Levelling range:  $\pm 1^\circ$

Max. probing diameter: 280 mm (380 mm when the detector is vertical, in which orientation measurement is restricted to features more than 50 mm above the table surface)

Max. workpiece diameter: 440 mm

Max. table loading: 25 kg

#### Vertical column (Z-axis)

Vertical travel: 280 mm

Max. probing height: 280 mm from the turntable surface

Max. probing depth: 100 mm (min. ID: 30 mm)

#### Horizontal arm (X-axis)

Horizontal travel: 165 mm (Including a protrusion of 25 mm over the turntable axis)

#### Probe and stylus

Measuring range:  $\pm 1000 \mu\text{m}$

Measuring force: 70 to 100 mN

Standard stylus: **12AAL021**, carbide ball,  $\phi 1.6 \text{ mm}$

Measuring direction: Bi-directional

Stylus angle

adjustment:  $\pm 45^\circ$  (with graduations)

#### Data analysis unit

Processing unit: Built-in (PC with Roundpak-120P)\*

Data sampling

points: Max. 3600 points/revolution

Types of roundness

evaluation: LSC, MZC, MIC, MCC

Recording device: Built-in thermal line printer (optional external printer)\*

#### Recording

magnification: X5 to X200,000 (15-steps), Auto (X1 to X500,000)\*

#### Roughness component

reduction: Low pass filter, band pass filter

Filter type: 2CR-75%, 2CR-50%, 2CRPC-75% (phase corrected), 2CRPC-50% (phase corrected), Gaussian, filter OFF

Cutoff values: 15 upr, 50 upr, 150 upr, 500 upr, 15-150 upr, 15-500 upr, 50-500 upr, Manual setting\*

Number of measuring sections: Max. 5-section (100-section)\*

#### Air supply

Air pressure: 390 kPa

Air consumption: 30 L/min.

Power supply: 240VAC  $\pm 10\%$ , 50/60Hz

Dimensions (WxDxH): 450x360x636 mm

Mass: 32 kg (main unit), 2 kg (air regulator)

\*RA-120P

**MiCAT**  
Mitutoyo Intelligent Computer Aided Technology

the standard in world  
metrology software  
**FORM**

Optional Accessories

Code No.	Description	Price
211-032	Quick chuck (OD: 1 - 79 mm, ID: 16 - 69 mm)	£1410.00
211-014	Three-Jaw chuck (OD: 2 - 78 mm, ID: 25 - 68 mm)	£590.00
211-031	Micro-chuck (OD: 0.1 - 1.5 mm)	£1090.00
211-061	Collet chuck (OD: 0.5 - 10 mm)	£771.00
356038	Auxiliary stage for a low-height workpiece	£316.00
211-016	Reference hemisphere	£748.00
211-045	Magnification checking gauge	£2280.00
997090	Gauge block set for calibration	£240.00
12AAH320	X-axis stop	£92.00
211-013	Vibration damping stand	£3370.00

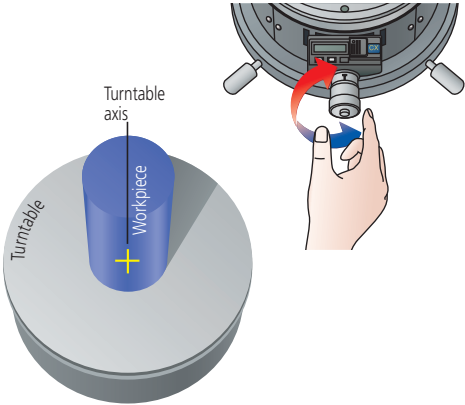
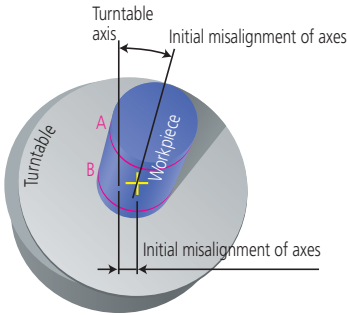
Consumables

Code No.	Description	Price
12AAH181	Printer paper (10 rolls/set)	£72.20
358592	Element for air filter (1 pc./set)	£47.10
358593	Element for air regulator (10 pcs./set)	£66.60

DAT (Digital Adjustment Table) function

The turntable displays centering and levelling adjustments digitally, making this challenging task simple enough for even an untrained operator to perform.

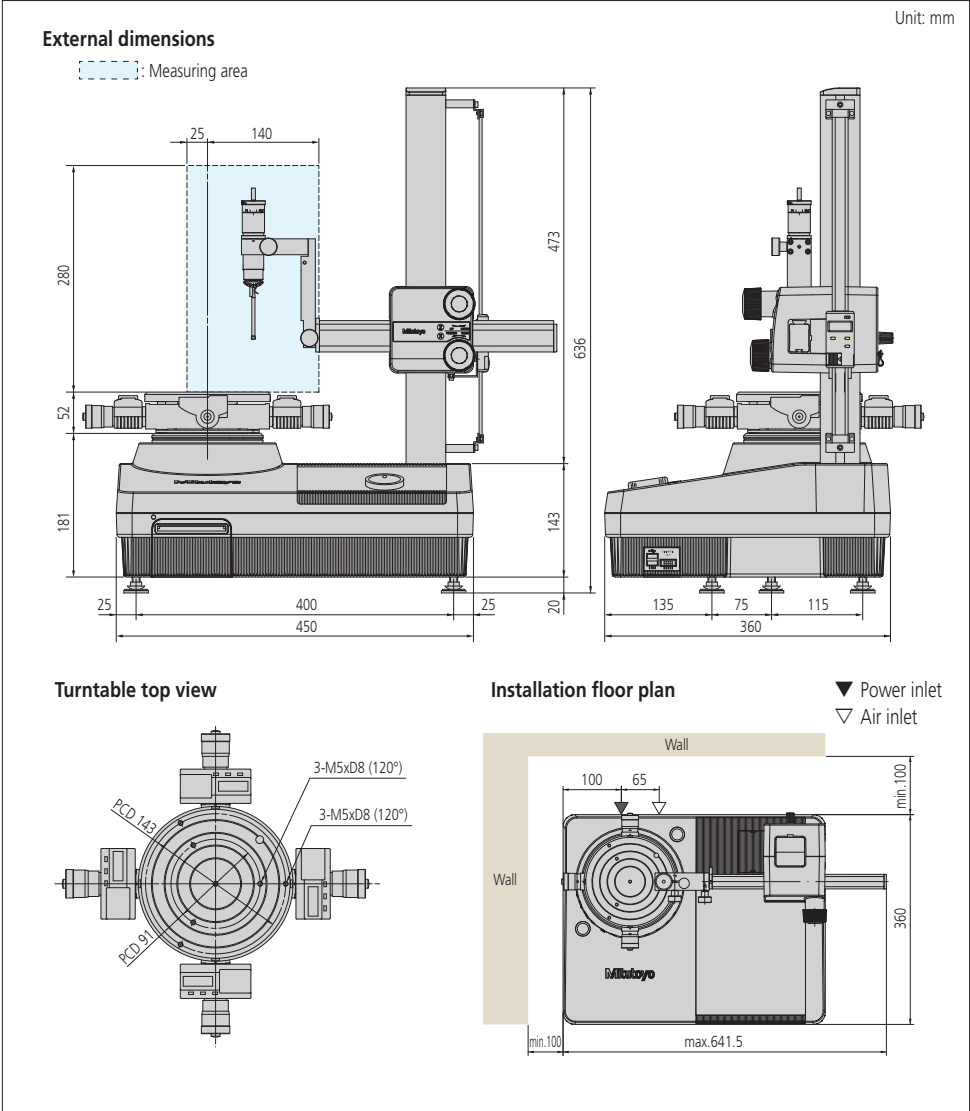
1. Preliminary measurement of two cross sections "A" and "B".
3. By adjusting the digital micrometer heads on the rotary table, the adjustment values displayed on the monitor can be achieved.



2. Following preliminary measurement, the centering and levelling adjustment values are displayed on the monitor.

4. Centering and levelling is complete. Centering range:  $\pm 3$  mm  
Levelling (inclination) range:  $\pm 1^\circ$

Dimensions



# Roundtest RA-220

## SERIES 211 – Roundness Measuring Instruments

- The RA-220 is a small, manual type Roundness /Cylindricity measuring instrument.
- Exceptional analysis capabilities and easy operation.
- X/Z axes fine-adjustment mechanism.
- Scale incorporated in the Z axis.
- Inside/outside diameter continuous measurement function.
- DAT function.
- Wide-range detector.
- Compact and highly accurate (equipped with premium quality air-bearing).

Roundtest RA-220



### Specifications

Model	RA-220
Code No. (mm)	211-642E
Code No. (inch/mm)	211-643E

### Technical Data

Turntable	
Rotational accuracy	
Radial:	(0.04+6H/10000) $\mu$ m
H: probing height (mm)	
Axial:	(0.04+6X/10000) $\mu$ m
X: Probing radius (mm)	
Rotational speed:	6 rpm
Table diameter:	150 mm
Centering range:	$\pm$ 3 mm
Levelling range:	$\pm$ 1°
Max. probing diameter:	280 mm (380 mm when the detector is vertical, in which orientation measurement is restricted to features more than 50 mm above the turntable surface)
Max. workpiece diameter:	470 mm
Max. table loading:	25 kg
Vertical column (Z-axis)	
Vertical travel:	280 mm
Straightness	
(in narrow range):	0.2 $\mu$ m/20 mm
Straightness	
(in entire range):	0.5 $\mu$ m/100 mm
Parallelism with turntable axis:	0.5 $\mu$ m/100 mm
Max. probing height:	280 mm from the turntable surface
Max. probing depth:	100 mm (min. ID: 30 mm)
Horizontal arm (X-axis)	
Horizontal travel:	165 mm (including a protrusion of 25 mm over the turntable axis)
Probe and stylus	
Measuring range:	$\pm$ 1000 $\mu$ m ( $\pm$ 30%)
Measuring force:	70 to 100 mN ( $\pm$ 30%)
Standard stylus:	<b>12AAL021</b> , carbide ball, $\phi$ 1.6 mm
Measuring direction:	Bi-directional
Stylus angle	
adjustment:	$\pm$ 45° (with graduations)
Data analysis unit	
Processing unit:	Built-in
Types of roundness evaluation:	LSC, MZC, MIC, MCC
Recording device:	Built-in thermal line printer (optional external printer)
Recording	
magnification:	X5, X10, X20, X50, X100, X200, X500, X1k, X2k, X5k, X10k, X20k, X50k, X100k, X200k (15 step)
Roughness component	
reduction:	Low pass filter, band pass filter
Filter type:	2CR-75%, 2CR-50%, 2CRPC-75% (phase corrected), 2CRPC-50% (phase corrected), Gaussian, filter OFF
Cutoff values:	15 upr, 50 upr, 150 upr, 500 upr, 15-150 upr, 15-500 upr, 50-500 upr
Number of measuring sections	
(1) 1-5 cross sections:	Roundness, coaxiality, flatness
(2) 1-3 cross sections:	Radial runout, perpendicularity (axis reference)
(3) 2 cross sections:	Concentricity, thickness deviation, parallelism
(4) 3 cross sections:	Perpendicularity (plane reference)
(5) 3-5 cross sections:	Cylindricity
Air supply	
Air pressure:	390 kPa
Air consumption:	30 L/min
Power supply:	240VAC $\pm$ 10%, 50/60Hz
Dimensions (WxDxH):	585.5x546x775 mm
Mass:	151 kg (main unit), 2 kg (air regulator)

Optional Accessories

Code No.	Description	Price
211-032	Quick chuck (OD: 1 - 79 mm, ID: 16 - 69 mm)	£1410.00
211-014	Three-Jaw chuck (OD: 2 - 78 mm, ID: 25 - 68 mm)	£590.00
211-031	Micro-chuck (OD: 0.1 - 1.5 mm)	£1090.00
211-061	Collet chuck (OD: 0.5 - 10 mm)	£771.00
356038	Auxiliary stage for a low-height workpiece	£316.00
211-045	Magnification checking gauge	£2280.00
997090	Gauge block set for calibration	£240.00
12AAH320	X-axis stop	£92.00
178-025	Vibration damping stand	£5510.00

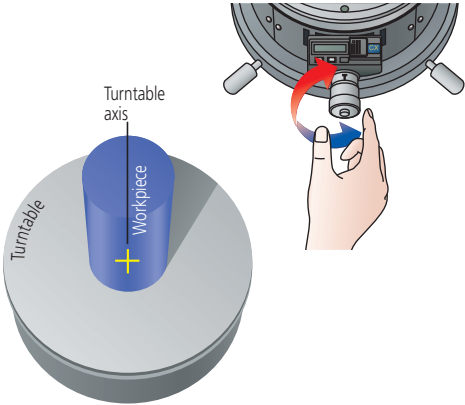
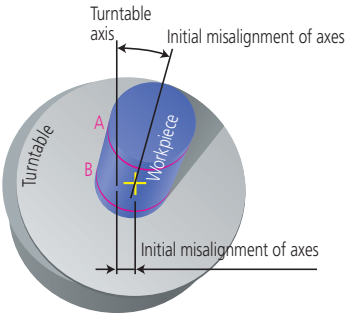
Consumables

Code No.	Description	Price
12AAH181	Printer paper (10 rolls/set)	£72.20
358592	Element for air filter (1 pc./set)	£47.10
358593	Element for air regulator (10 pcs./set)	£66.60

DAT (Digital Adjustment Table) function

The turntable displays centering and levelling adjustments digitally, making this challenging task simple enough for even an untrained operator to perform.

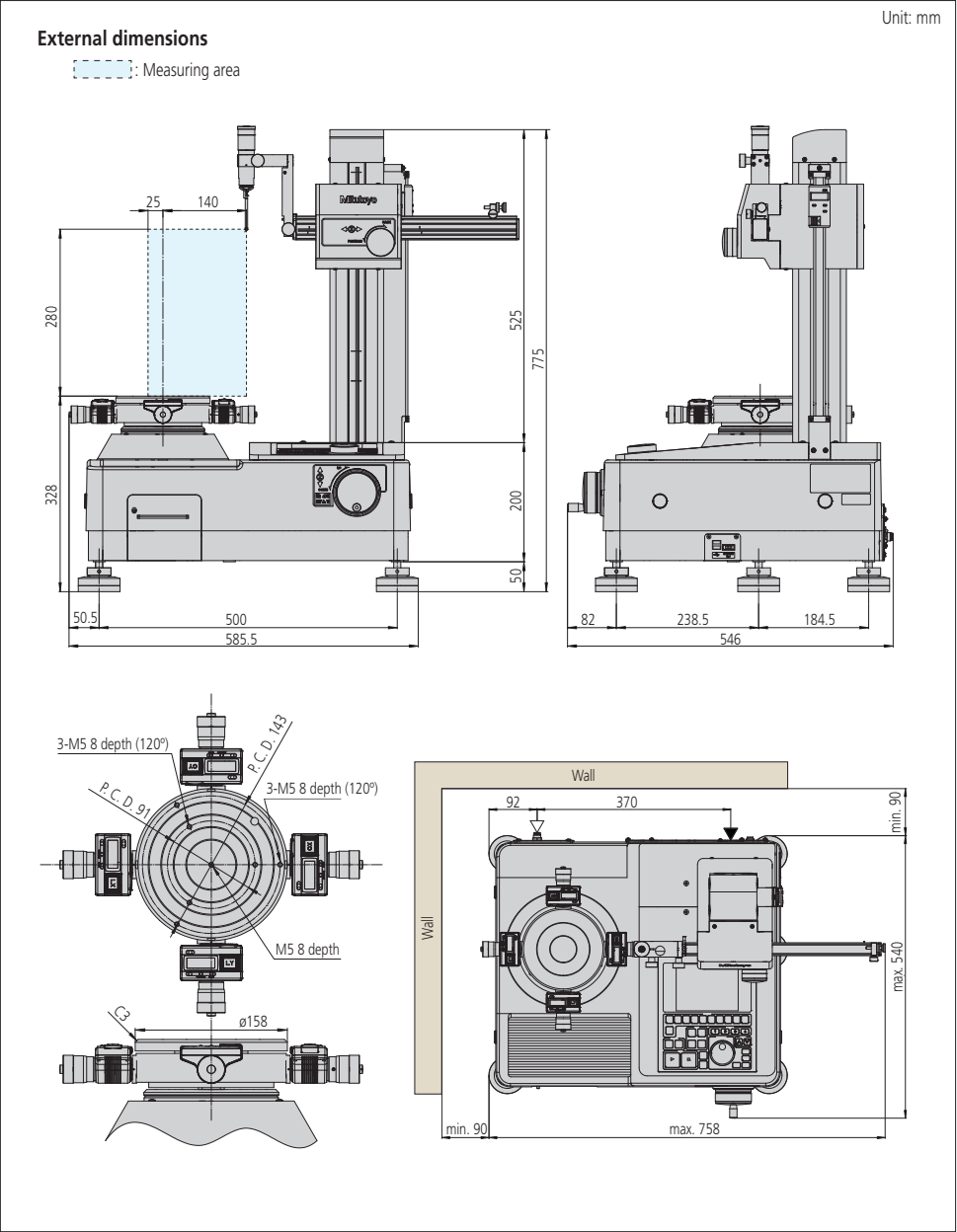
1. Preliminary measurement of two cross sections "A" and "B".
3. By adjusting the digital micrometer heads on the rotary table, the adjustment values displayed on the monitor can be achieved.



2. Following preliminary measurement, the centering and levelling adjustment values are displayed on the monitor.

4. Centering and levelling is complete. Centering range: ±3 mm  
Levelling (inclination) range: ±1°

Dimensions

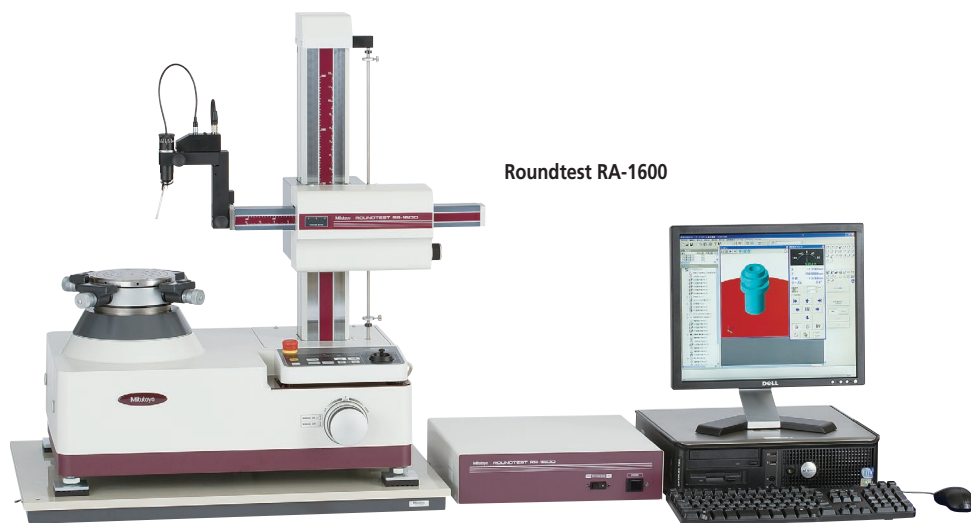




# Roundtest RA-1600

## SERIES 211 – Roundness/Cylindricity Measuring System

- Our latest PC-compliant roundness and cylindrical form measuring instrument with extensive analysis features to enable measurement of a wide variety of workpieces.



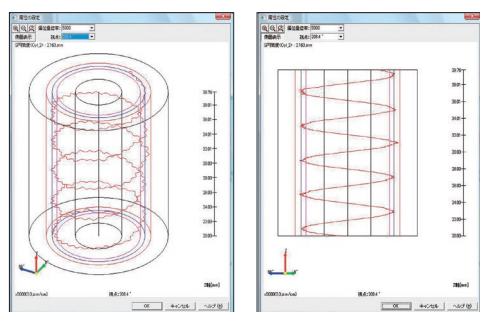
Roundtest RA-1600

### Spiral measurement/analysis

The spiral-mode measurement function combines table rotation and rectilinear action allowing cylindricity, coaxiality, and similar measurements to be performed based on whole-surface data.

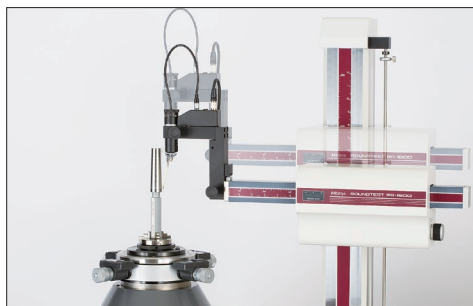


Spiral-mode cylindricity measurement.



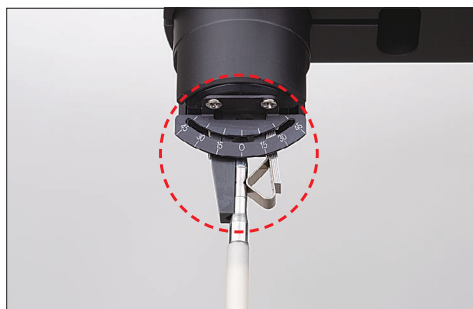
### Measurement through X-axis tracking

Measurement while tracing is possible through a built-in linear scale in the X axis. This type of measurement is useful when displacement due to form variation exceeds the measuring range of the detector, and X-axis motion is necessary to maintain contact with the workpiece surface.



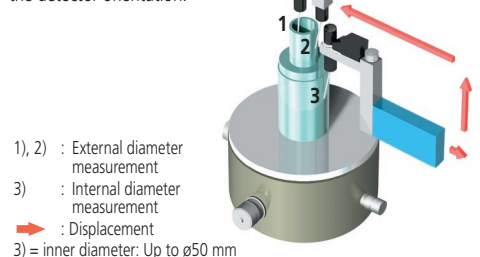
### Safety mechanisms provided as standard features

A collision-sensing function has been incorporated in the detector unit (when it is in the vertical orientation) to prevent collision in the Z-axis direction. Additionally, an accidental collision prevention function, which stops the system when the detector displacement exceeds its range, has been added. When an accidental touch is detected, the dedicated analysis software (ROUNDPAK) senses the error and automatically stops the system.



### Continuous internal/external diameter measurement

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



### Technical Data

Turntable	
Rotational accuracy (radial):	$(0.02+6H/10000) \mu\text{m}$
H: Probing height (mm)	
Rotational accuracy (axial):	$(0.02+6X/10000) \mu\text{m}$
X: probing radius (mm)	
Rotational speed:	4, 6, 10 rpm
Table diameter:	150 mm
Centering range:	$\pm 3$ mm (with DAT function)
Levelling range:	$\pm 1^\circ$ (with DAT function)
Max. probing diameter:	280 mm
Max. workpiece diameter:	560 mm
Max. table loading:	25 kg
Vertical column (Z-axis)	
Vertical travel:	300 mm
Straightness (in narrow range):	$0.20 \mu\text{m}/100$ mm
Straightness (in entire range):	$0.30 \mu\text{m}/300$ mm
Parallelism with turntable axis:	$1.5 \mu\text{m}/300$ mm
Positioning speed:	Max. 15 mm/s
Measuring speed:	0.5, 1, 2, 5 mm/s
Max. probing height (ID/OD):	300 mm*
Max. probing depth:	91 mm (over $\phi 32$ ) 50 mm (over $\phi 7$ )

### Horizontal arm (X-axis)

Horizontal travel:	165 mm (from table axis $-25$ mm~ $\pm 140$ mm)
Positioning speed:	Max. 15 mm/s
Measuring speed:	0.5, 1, 2, 5 mm/s

### Probe and stylus

Measuring range:	$\pm 400 \mu\text{m}/\pm 40 \mu\text{m}/\pm 4 \mu\text{m}$
Measuring force:	10 to 50 mN (5 level switching)
Standard stylus:	<b>12AAL021</b> , carbide ball, $\phi 1.6$ mm
Measuring direction:	Bi-directional
Stylus angle adjustment:	$\pm 45^\circ$ (with graduations)

### Air supply

Air pressure:	0.39 MPa (4 kgf/cm <sup>2</sup> )
Air consumption:	22 L/min.

Power supply: 240VAC  $\pm 10\%$ , 50/60Hz

Dimensions (WxDxH): 890x490x840 mm

Mass: 170 kg

\* Use the optional auxiliary stage (**356038**) for measuring a workpiece whose height is 20 mm or less.

**MiCAT**

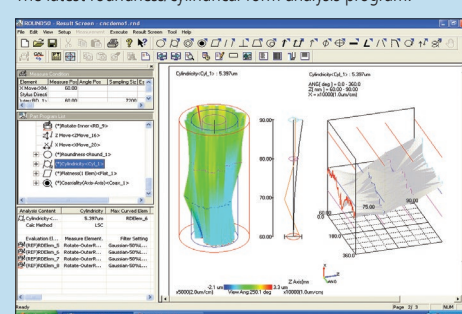
Mitutoyo Intelligent Computer Aided Technology

the standard in world  
metrology software  
**FORM**

### Software

#### ROUNDPAK

The latest roundness/cylindrical form analysis program.



## Optional Accessories

Code No.	Description	Price
350850	Cylindrical square	£420.00
356038	Auxiliary stage for a low-height workpiece	£316.00
12AAF203	2X extension detector holder	£1980.00
12AAF204	Auxiliary detector holder for a large-diameter workpiece	£1560.00
12AAL090	Sliding detector holder	£1500.00
211-045	Magnification checking gauge	£2280.00
211-014	Chuck (OD: $\varnothing$ 2-78 mm, ID: $\varnothing$ 25-68 mm)	£590.00
211-032	Quick chuck (OD: 1-79 mm, ID: 16-69 mm)	£1410.00
211-031	Micro-chuck (OD: 0.1-1.5 mm)	£1090.00
178-025	Vibration damping table	£5510.00
12AAK110	Vibration isolator (desk type)	£12470.00
12AAK120	Monitor arm (for 12AAK110)	£1420.00
12AAL019	Side table (for 12AAK110)	POA

## Sliding detector-unit holder provided as a standard feature (Option)

The detector-unit holder is equipped with a sliding mechanism, enabling one-touch measurement of a workpiece with a deep hole having a thick wall, which has been difficult with the conventional standard arm.



### Sliding distance: 112 mm

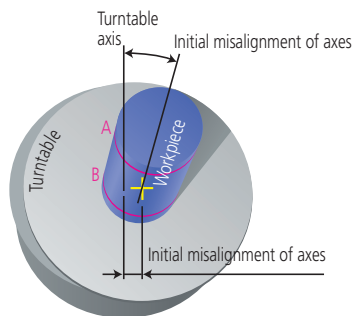
The detector-unit holder can be stopped at a position sufficiently higher than the workpiece along the Z axis, and then lowered and positioned to make measurements. Furthermore, internal/external diameters can be easily measured with the continuous internal/external diameter measurement function\*.

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

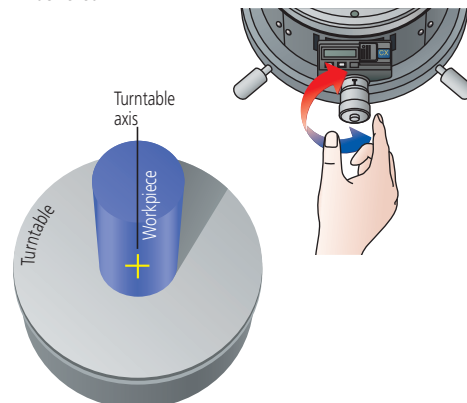
## DAT (Digital Adjustment Table) function

The turntable displays centering and levelling adjustments digitally, making this challenging task simple enough for even an untrained operator to perform.

1. Preliminary measurement of two cross sections "A" and "B".
3. By adjusting the digital micrometer heads on the rotary table, the adjustment values displayed on the monitor can be achieved.



2. Following preliminary measurement, the centering and levelling adjustment values are displayed on the monitor.

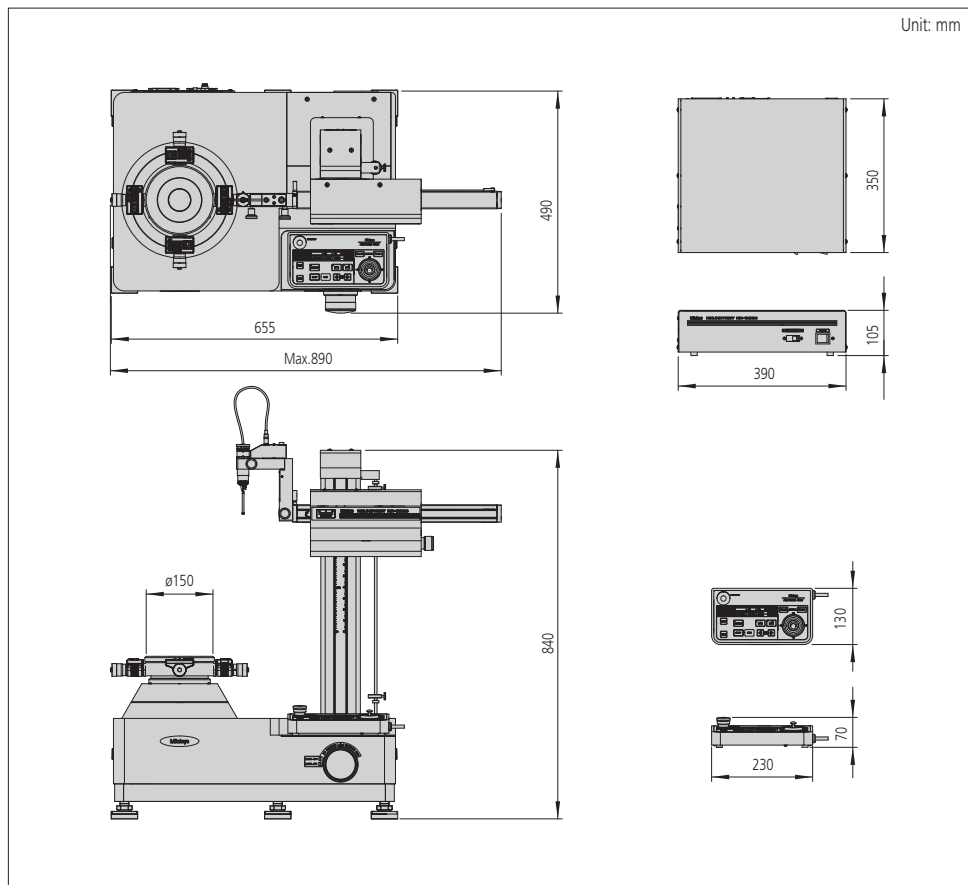


4. Centering and levelling is complete. Centering range:  $\pm 3$  mm  
Levelling (inclination) range:  $\pm 1^\circ$

## Specifications

Model	RA-1600
Code No. (mm)	211-723E
Code No. (inch/mm)	211-733E

## Dimensions



# Roundtest RA-2200

## SERIES 211 – Roundness/Cylindricity Measuring System

- The RA-2200 provides high accuracy, high speed and high performance roundness measurement.
- The fully-automatic AAT or semi-automatic DAT functionality aids manual workpiece centering and levelling, turning a once challenging task into something simple enough for even the untrained user and substantially reducing overall measurement time.
- The RA-2200 system comes with the powerful ROUNDPAK data analysis software, with enhanced functionality and easy operation through the use of the mouse and icon selection.

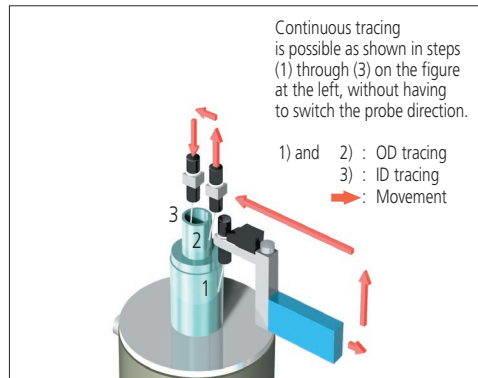
Roundtest RA-2200AS and vibration isolator with side table



### Greater productivity by continuous measurement

Both the OD and ID of a workpiece\* can be traced in succession without the need for changing the traverse direction of the stylus.

\*Inside diameter up to 50 mm



Mitutoyo uses high accuracy, highly repeatable linear scales in the X/Z drive unit to guarantee the high-precision positioning vital for repetitive measurement.

### Highly accurate and easy-to-use turntable

With extremely high rotational accuracy, both in the radial and axial directions, the turntable allows high-accuracy flatness testing to be performed in addition to roundness and cylindricity measurements.

### Unique design allows system upgrading

The system can be upgraded to CNC operation by replacing and adjusting the detector unit. (This task should be performed by a Mitutoyo technician.)

## Technical Data

### Turntable

#### Rotational accuracy

Radial: (0.02+3.5H/10000)  $\mu$ m

H: Probing height (mm)

Axial: (0.02+3.5X/10000)  $\mu$ m

R: probing radius (mm)

Rotational speed: 2, 4, 6, 10 rpm

Table diameter: 235 mm (200 mm: DS, DH models)

Centering range:  $\pm$ 3 mm ( $\pm$ 5 mm: DS, DH models)

Levelling range:  $\pm$ 1°

Max. probing diameter: 300 mm

Max. workpiece diameter: 580 mm

Max. table loading: 30 kg

### Vertical column (Z-axis)

Vertical travel: 300 mm (500 mm: AH, DH models)

Straightness ( $\lambda$ c2.5): 0.10  $\mu$ m/100 mm, 0.15  $\mu$ m/300 mm (0.25  $\mu$ m/500 mm: AH, DH models)

### Parallelism with

turntable axis: 0.7  $\mu$ m/300 mm (1.2  $\mu$ m/500 mm: AH, DH models)

Positioning speed: Max. 50 mm/s

Measuring speed: 0.5, 1, 2, 5 mm/s

Max. probing height: 300 mm (OD), 300 mm (ID) [500 mm: AH, DH models]

Max. probing depth: 85 mm for  $\phi$ 32 mm or more, 50 mm for  $\phi$ 7 mm or more

### Horizontal arm (X-axis)

Horizontal travel: 175 mm (from table axis -25 mm ~ +150 mm)

Straightness ( $\lambda$ c2.5): 0.7  $\mu$ m/150 mm

### Squareness with

turntable axis: 1.0  $\mu$ m/150 mm

Positioning speed: Max. 30 mm/s with joystick operation

Measuring speed: 0.5, 1, 2, 5 mm/s

### Probe and stylus

Measuring range:  $\pm$ 400  $\mu$ m/ $\pm$ 40  $\mu$ m/ $\pm$ 4  $\mu$ m

Measuring force: 10 to 50 mN (5 level switching)

Standard stylus: **12AAL021**, carbide ball,  $\phi$ 1.6 mm

Measuring direction: Bi-directional

Stylus angle adjustment:  $\pm$ 45° (with graduations)

### Air supply

Air pressure: 0.39 MPa

Air consumption: 30 L/min.

### Power supply:

240VAC  $\pm$ 10%, 50/60Hz

### Dimensions (WxDxH):

940x510x900 mm: AS models

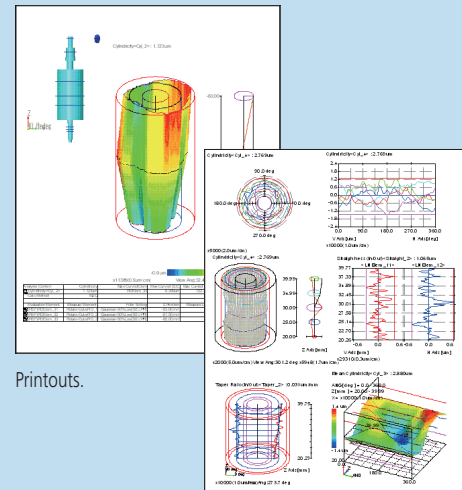
910x510x900 mm: DS models

940x510x1100 mm: AH models

910x510x1100 mm: DH models

### Mass:

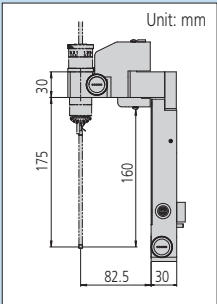
180 kg (200 kg: AH, DH models)



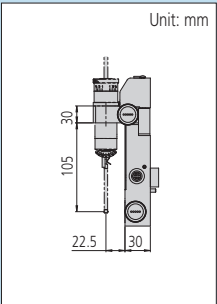
Printouts.

Optional Accessories

Code No.	Description	Price
350850	Cylindrical square	£420.00
12AAF203	2X extension detector holder	£1980.00
12AAF204	Auxiliary detector holder for a large-diameter workpiece	£1560.00
211-045	Magnification checking gauge	£2280.00
211-014	Chuck (OD: 2 - 78 mm, ID: 25 - 68 mm)	£590.00
211-032	Quick chuck (OD: 1 - 79 mm, ID: 16 - 69 mm)	£1410.00
211-031	Micro-chuck (OD: 0.1 - 1.5 mm)	£1090.00
178-025	Vibration damping table	£5510.00
178-024	Stand for vibration isolator	£744.00



12AAF203

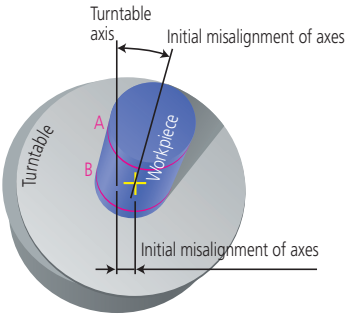


12AAF204

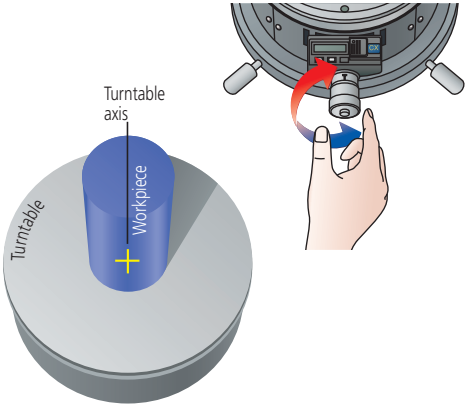
DAT (Digital Adjustment Table) function

A guidance system (DAT) is incorporated into the turntable on the RA-2200DS/DH models to help the operator perform manual centering and levelling smoothly and simply.

1. Preliminary measurement of two cross sections "A" and "B".
3. By adjusting the digital micrometer heads on the rotary table, the adjustment values displayed on the monitor can be achieved.



2. Following preliminary measurement, the centering and levelling adjustment values are displayed on the monitor.



4. Centering and levelling is complete. Centering range:  $\pm 3$  mm  
Levelling (inclination) range:  $\pm 1^\circ$

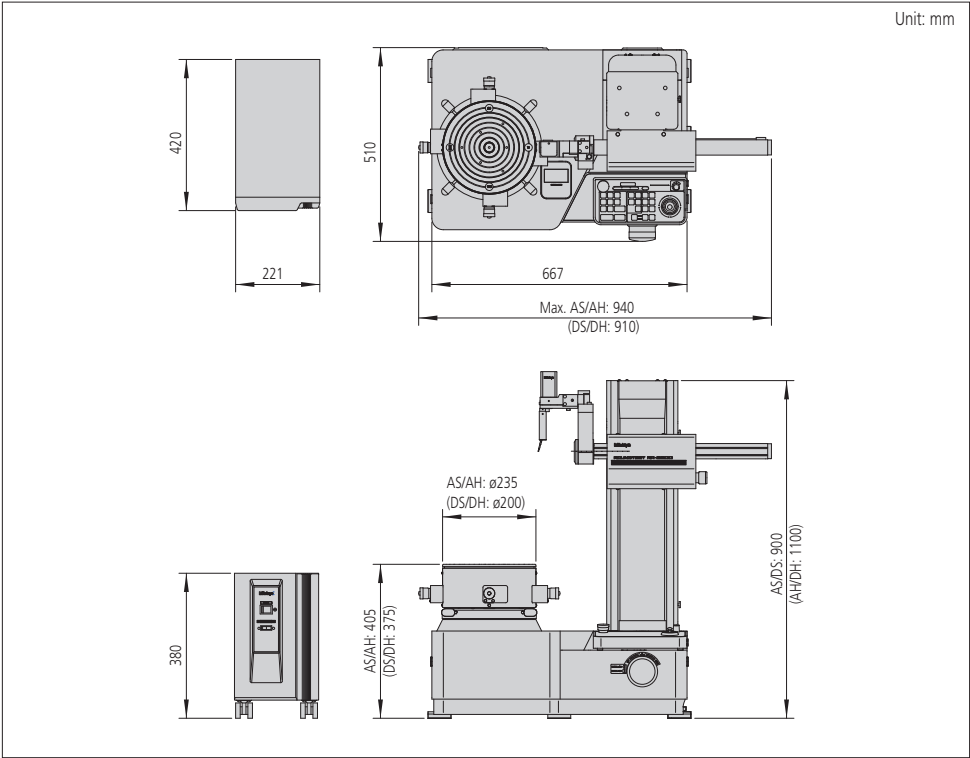
AAT (Automatic Adjustment Table) function

Incorporating an Automatic Adjustment Table (AAT), the top-of-the-line RA-2200AS/AH models relieve the operator of workpiece centering and levelling.

Specifications

Model	RA-2200AS	RA-2200DS	RA-2200AH	RA-2200DH
Code No.	211-511E (mm)	211-513E (mm) 211-514E (inch)	211-512E (mm)	211-515E (mm) 211-516E (inch)
Effective table diameter	235 mm	200 mm	235 mm	200 mm
Centering/levelling adjustment*	AAT (Automatic Adjustment Table)	(DAT) Digital Adjustment Table	AAT (Automatic Adjustment Table)	(DAT) Digital Adjustment Table
Centering range	$\pm 3$ mm	$\pm 5$ mm	$\pm 3$ mm	$\pm 5$ mm
Column travel	300 mm (standard column)		500 mm (tall column)	
Basic unit mass	180 kg		200 kg	

Dimensions



Unit: mm

L



# Roundtest RA-H5200

## SERIES 211 – Roundness/Cylindricity Measuring System

- RA-H5200AS/AH, a roundness/cylindricity measuring system developed to combine world-class accuracy with flexibility and high analysis capability.
- Enhanced measurement functions include tracking measurement and automatic OD/ID measurement capabilities.
- Also capable of roughness measurement if an optional roughness detector unit is incorporated into the system, measuring in the circumferential direction around the turntable axis as well as in the X- and Z-directions with the turntable stopped.

Roundtest RA-5200AH



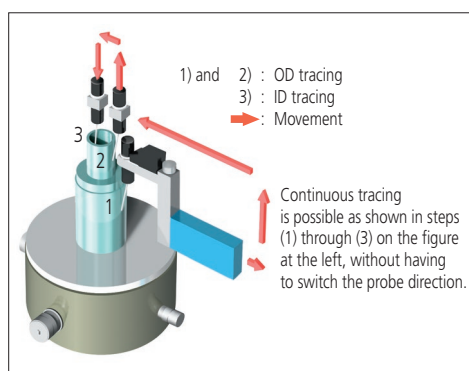
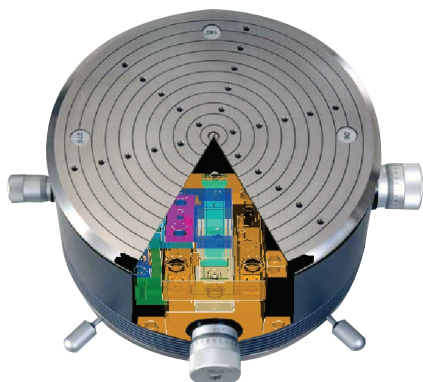
### High-accuracy automatic centering/levelling turntable

A highly accurate, highly rigid turntable has been created through exceptional manufacturing accuracy of critical components, such as the rotor and stator. In addition, an air bearing incorporating a complex aperture provides superior rigidity and uniform pressure distribution, resulting in an industry leading  $(0.02+3.5H/10000)$   $\mu\text{m}$  rotational accuracy (radial).

### Automatic continuous OD/ID measurement

Continuous automatic measurement can be performed from external diameter to internal diameter without changing probe orientation. This reduces measurement time and also eliminates errors associated with probe position changes, greatly facilitating high-accuracy measurement.

The automatic centering/levelling mechanism incorporates a high-precision glass scale on each axis of the turntable. This generates feedback preventing positioning errors from affecting centering/levelling adjustments.



## Technical Data

### Turntable

#### Rotational accuracy

Radial:  $(0.02+3.5H/10000)$   $\mu\text{m}$

H: Probing height (mm)

Axial:  $(0.02+3.5X/10000)$   $\mu\text{m}$

X: distance from the turntable axis (mm)

Rotational speed: 2, 4, 6, 10 rpm (20 rpm: auto-centering)

Table diameter: 300 mm

Centering range:  $\pm 5$  mm

Levelling range:  $\pm 1^\circ$

Max. probing diameter: 400 mm

Max. workpiece diameter: 680 mm

Max. table loading: 80 kg (65 kg: auto-centering)

### Vertical column (Z-axis)

Vertical travel: 350 mm: AS model;  
550 mm: AH model

### Straightness ( $\lambda c2.5$ )

AS model:  $0.05 \mu\text{m}/100$  mm,  $0.14 \mu\text{m}/350$  mm

AH model:  $0.05 \mu\text{m}/100$  mm,  $0.2 \mu\text{m}/550$  mm

### Parallelism with turntable axis

AS model:  $0.2 \mu\text{m}/350$  mm

AH model:  $0.32 \mu\text{m}/550$  mm

Positioning speed: Max. 60 mm/s

Measuring speed: 0.5, 1, 2, 5 mm/s

Max. probing height: 350 mm (OD), 350 mm (ID)  
[550 mm (OD/ID): AH model]

Max. probing depth: 85 mm for  $\phi 32$  mm or more,  
50 mm for  $\phi 7$  mm or more

### Horizontal arm (X-axis)

Horizontal travel: 225 mm

Straightness ( $\lambda c2.5$ ):  $0.4 \mu\text{m}/200$  mm

### Squareness with

turntable axis:  $0.5 \mu\text{m}/200$  mm

Positioning speed: Max. 50 mm/s

Measuring speed: 0.5, 1, 2, 5 mm/s

### Probe and stylus

Measuring range:  $\pm 400 \mu\text{m}/\pm 40 \mu\text{m}/\pm 4 \mu\text{m}$

Measuring force: 10 to 50 mN (5 level switching)

Standard stylus: **12AAL021**, carbide ball,  $\phi 1.6$  mm

Measuring direction: Bi-directional

### Stylus angle

adjustment:  $\pm 45^\circ$  (with graduations)

### Air supply

Air pressure: 0.39 MPa

Air consumption: 45 L/min.

### Power supply:

240VAC  $\pm 10\%$ , 50/60Hz

### Dimensions (WxDxH):

1260 x 710 x 1700 mm

(1260 x 710 x 1900 mm: AH model)

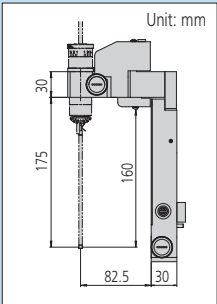
### Mass:

650 kg: AS model; 670 kg: AH model

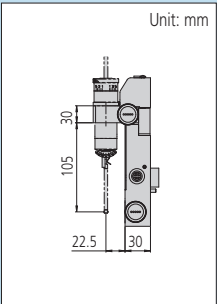
with vibration isolation stand: 170 kg

Optional Accessories

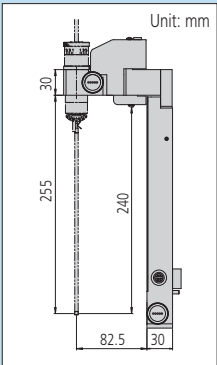
Code No.	Description	Price
350850	Cylindrical square	£420.00
12AAF203	2X extension detector holder	£1980.00
12AAF204	Auxiliary detector holder for a large-diameter workpiece	£1560.00
12AAF205	3X extension detector holder	£2160.00
211-045	Magnification checking gauge	£2280.00
211-014	Chuck (OD: 2 - 78 mm, ID: 25 - 68 mm)	£590.00
211-032	Quick chuck (OD: 1 - 79 mm, ID: 16 - 69 mm)	£1410.00
211-031	Micro-chuck (OD: 0.1 - 1.5 mm)	£1090.00
12AAB598	Protective shield	£1470.00



12AAF203



12AAF204



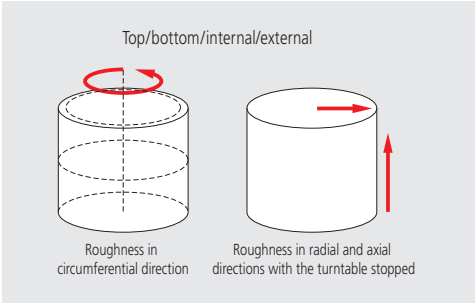
12AAF205



X-axis tracking measurement

A linear scale incorporated into the X axis enables measurement to be extended by tracking the workpiece surface (tracking range:  $\pm 5$  mm). This capability is effective for measuring a workpiece with a displacement that exceeds the detection range of the probe when measuring roundness/cylindricity or a taper that is determined with slider/column movement.

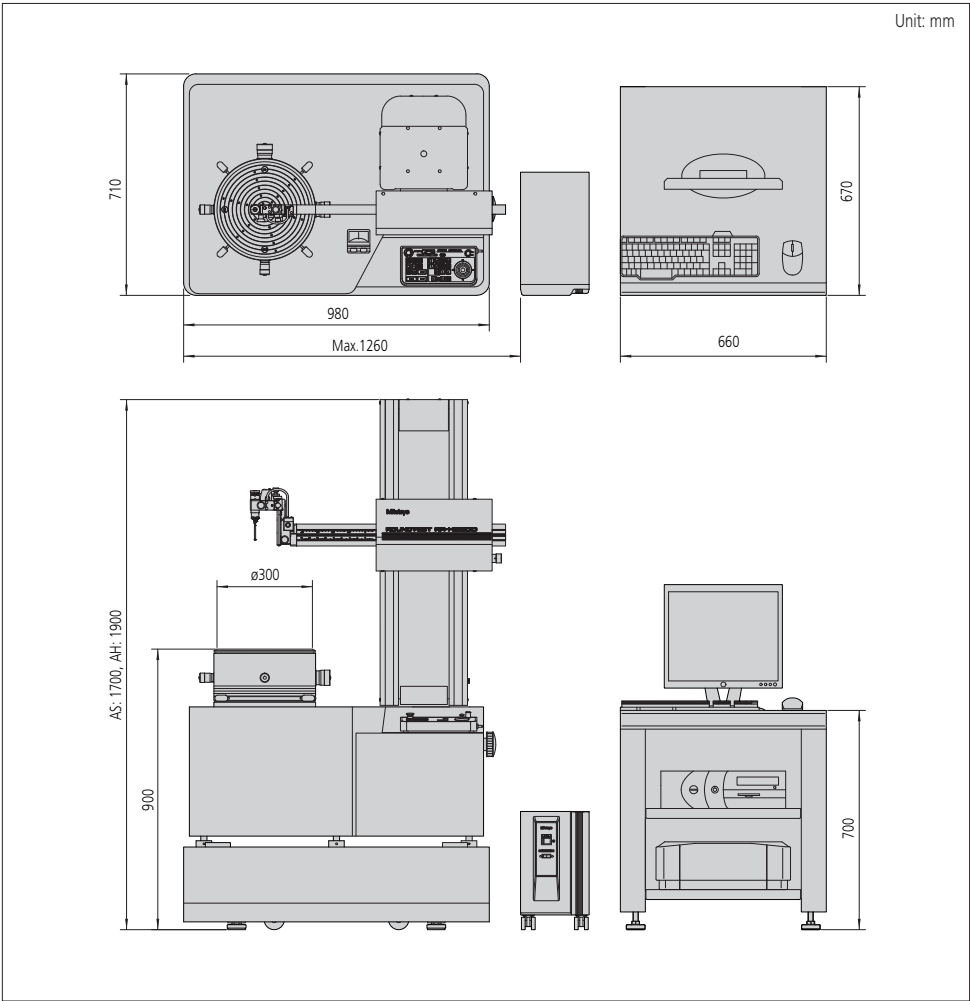
Roughness measurement



Specifications

Model	RA-H5200AS	RA-H5200AH
Code No. (with vibration isolation stand)	211-531E	211-532E
Column travel	350 mm (standard column)	550 mm (tall column)

Dimensions



# Roundtest Extreme RA-2200CNC

## SERIES 211 – CNC Roundness/Cylindricity Measuring System

- Mitutoyo offers innovative roundness/cylindricity measuring systems capable of automated measurement with independent/simultaneous multi-axis CNC control. In addition to high measuring accuracy and reliability, these CNC models provide excellent inspection productivity.
- Roundness and surface roughness measurements are both available from a single measuring system so workpiece resetting for roughness measurement is not required if an optional roughness detector unit is incorporated into the system, with measurement possible in the circumferential direction around the turntable axis as well as in the X- and Z-directions with the turntable stopped.



Roundtest RA-2200CNC and vibration isolator with side table

### Technical Data

#### Turntable

##### Rotational accuracy

Radial:	(0.02+3.5H/10000) $\mu$ m
H:	Probing height (mm)
Axial:	(0.02+3.5X/10000) $\mu$ m
X:	distance from the turntable axis (mm)

Rotational speed: 2, 4, 6, 10 rpm

Table diameter: 235 mm

Centering range:  $\pm 3$  mm

Levelling range:  $\pm 1^\circ$

Max. probing diameter: 256 mm

Max. workpiece diameter: 580 mm

Max. table loading: 30 kg

#### Vertical column (Z-axis)

Vertical travel: 300 mm (500 mm)\*

Straightness ( $\lambda c2.5$ ): 0.10  $\mu$ m/100 mm, 0.15  $\mu$ m/300 mm (0.25  $\mu$ m/500 mm)\*

#### Parallelism with

turntable axis: 0.7  $\mu$ m/300 mm (1.2  $\mu$ m/500 mm)\*

Positioning speed: Max. 50 mm/s

Measuring speed: 0.5, 1, 2, 5 mm/s

Max. probing height: 300 mm (OD), 300 mm (ID) [500 mm (OD/ID)]\*

Max. probing depth: 104 mm ( $\phi 32$  mm or more) 26 mm ( $\phi 12.7$  mm or more)

#### Horizontal arm (X-axis)

Horizontal travel: 175 mm (from table axis -25 mm ~ +150 mm)

Straightness ( $\lambda c2.5$ ): 0.7  $\mu$ m/150 mm

#### Squareness with

turntable axis: 1.0  $\mu$ m/150 mm

Positioning speed: Max. 30 mm/s

Measuring speed: 0.5, 1, 2, 5 mm/s

#### Probe and stylus

Measuring range:  $\pm 400$   $\mu$ m ( $\pm 5$  mm: tracking range)

Measuring force: 40 mN

Standard stylus: **12AAE301**, carbide ball,  $\phi 1.6$  mm

Measuring direction: Bi-directional

Stylus angle

adjustment: Fixed

#### Air supply

Air pressure: 0.39 MPa

Air consumption: 30 L/min.

Power supply: 240VAC  $\pm 10\%$ , 50/60 Hz

Dimensions (WxDxH): 940x510x900 mm (940x510x1100 mm)\*

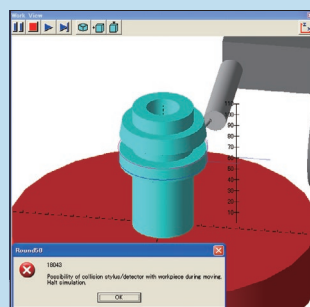
Mass: 180 kg (200 kg)\*

\*Tall-column type.



### Specifications

Model	RA-2200CNC	
Code No. (with vibration isolation stand)	211-517E	211-518E
Column travel	300 mm (standard column)	500 mm (tall column)



## Optional Accessories

Code No.	Description	Price
350850	Cylindrical square	£420.00
211-045	Magnification checking gauge	£2280.00
211-014	Chuck (OD: 2 - 78 mm, ID: 25 - 68 mm)	£590.00
211-032	Quick chuck (OD: 1 - 79 mm, ID: 16 - 69 mm)	£1410.00
211-031	Micro-chuck (OD: 0.1 - 1.5 mm)	£1090.00
12AAB598	Protective shield	£1470.00

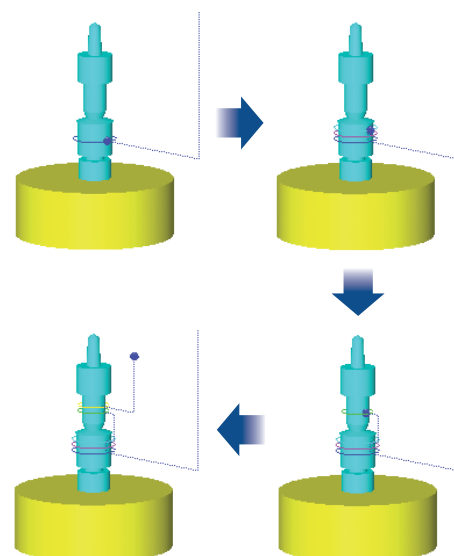
## ROUNDPAK

### Off-line measurement procedure programming function

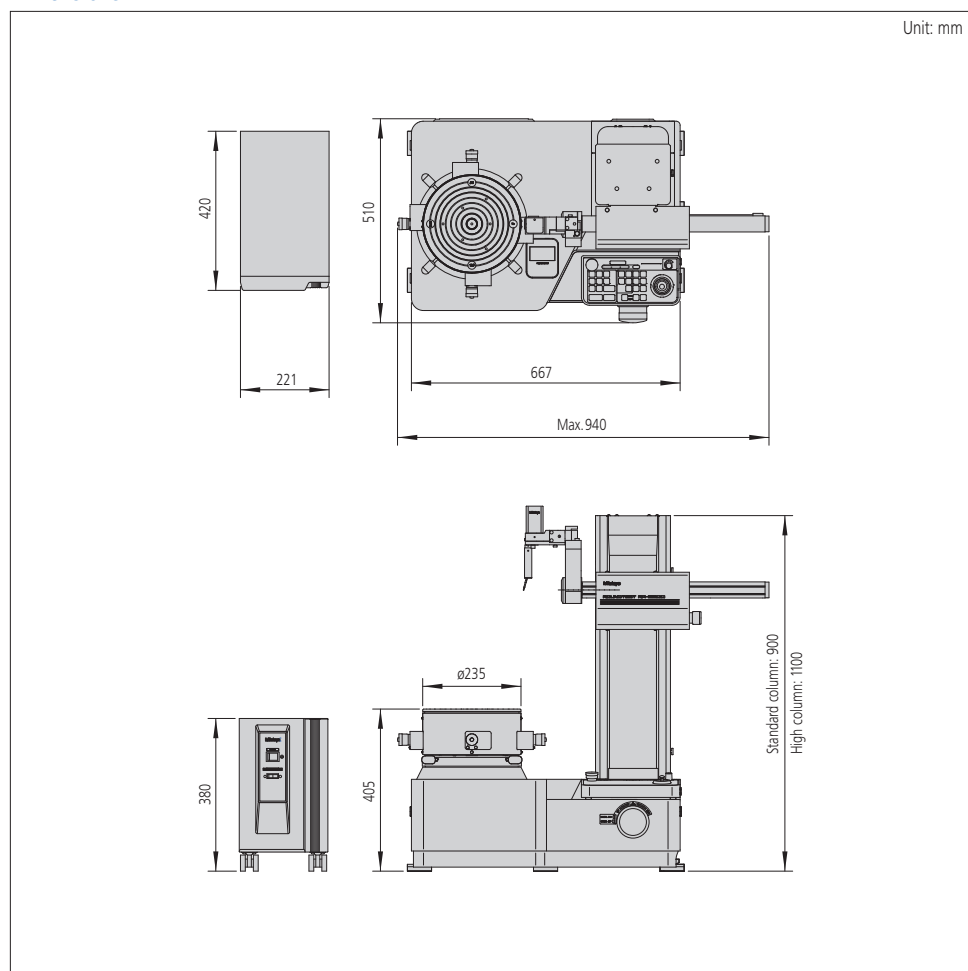
On-screen, virtual 3D simulation measurements can be performed with an integrated off-line teaching function that allows a part program (measurement procedure) to be created without an objective workpiece. The probe and the holder unit of the Roundtest Extreme can be accurately represented in the simulation making the prediction of collision risks and warning alarms possible.



3D simulation screens (work-view windows) can be generated after entering CAD data (in IGES, DXF form) and text data.



## Dimensions





# Roundtest Extreme RA-H5200CNC

## SERIES 211 – CNC Roundness/Cylindricity Measuring System

- Mitutoyo offers innovative roundness/cylindricity measuring systems capable of automated measurement with independent/simultaneous multi-axis CNC control. In addition to high measuring accuracy and reliability, these CNC models provide excellent inspection productivity.
- Roundness and surface roughness measurements are both available from a single measuring system so workpiece resetting for roughness measurement is not required if an optional roughness detector unit is incorporated into the system, with roughness measurement possible in the circumferential direction around the turntable axis as well as in the X- and Z-directions with the turntable stopped.

Roundtest RA-H5200CNC



### Technical Data

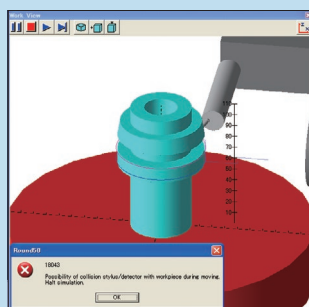
Turntable	
Rotational accuracy	
Radial:	(0.02+3.5H/10000) $\mu$ m H: probing height (mm)
Axial:	(0.02+3.5X/10000) $\mu$ m X: distance from the turntable axis (mm)
Rotational speed:	2, 4, 6, 10 rpm (20 rpm: auto-centering)
Table diameter:	300 mm
Centering range:	$\pm$ 5 mm
Levelling range:	$\pm$ 1°
Max. probing diameter:	356 mm
Max. workpiece diameter:	680 mm
Max. table loading:	80 kg (65 kg: auto-centering)
Vertical column (Z-axis)	
Vertical travel:	350 mm (550 mm)*
Straightness ( $\lambda$ c2.5):	0.05 $\mu$ m/100 mm, 0.14 $\mu$ m/350 mm (0.2 $\mu$ m/550 mm)*
Parallelism with turntable axis:	0.2 $\mu$ m/350 mm (0.32 $\mu$ m/550 mm)*
Positioning speed:	Max. 60 mm/s
Measuring speed:	0.5, 1, 2, 5 mm/s
Max. probing height:	350 mm (OD), 350 mm (ID) [550 mm (OD / ID)]*
Max. probing depth:	104 mm ( $\phi$ 32 mm or more) 26 mm (12.7 mm or more)
Horizontal arm (X-axis)	
Horizontal travel:	225 mm
Straightness ( $\lambda$ c2.5):	0.4 $\mu$ m/200 mm
Squareness with turntable axis:	0.5 $\mu$ m/200 mm
Positioning speed:	Max. 50 mm/s
Measuring speed:	0.5, 1, 2, 5 mm/s
Probe and stylus	
Measuring range:	$\pm$ 400 $\mu$ m/ $\pm$ 40 $\mu$ m/ $\pm$ 4 $\mu$ m ( $\pm$ 5 mm: tracking range)
Measuring force:	40 mN
Standard stylus:	<b>12AAE301</b> , carbide ball, $\phi$ 1.6 mm
Measuring direction:	Bi-directional
Stylus angle adjustment:	Fixed
Air supply	
Air pressure:	0.39 MPa
Air consumption:	45 L/min.
Power supply:	240VAC $\pm$ 10%, 50/60Hz
Dimensions (WxDxH):	1260x710x1700 mm (1260x710x1900 mm)*
Mass:	650 kg (670 kg)* with vibration isolation stand: 170 kg

\*Tall-column type.



### Specifications

Model	RA-H5200CNC	
Code No. (with vibration isolation stand)	211-533E	211-534E
Column travel	350 mm (standard column)	550 mm (tall column)



### Optional Accessories

Code No.	Description	Price
350850	Cylindrical square	£420.00
211-045	Magnification checking gauge	£2280.00
211-014	Chuck (OD: 2 - 78 mm, ID: 25 - 68 mm)	£590.00
211-032	Quick chuck (OD: 1 - 79 mm, ID: 16 - 69 mm)	£1410.00
211-031	Micro-chuck (OD: 0.1 - 1.5 mm)	£1090.00
12AAB598	Protective shield	£1470.00

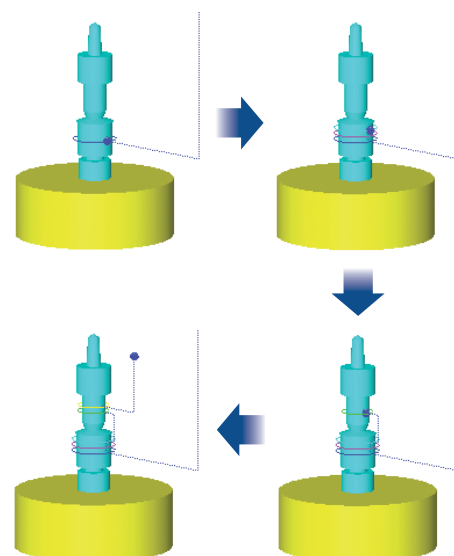
### ROUNDPAK

#### Off-line measurement procedure programming function

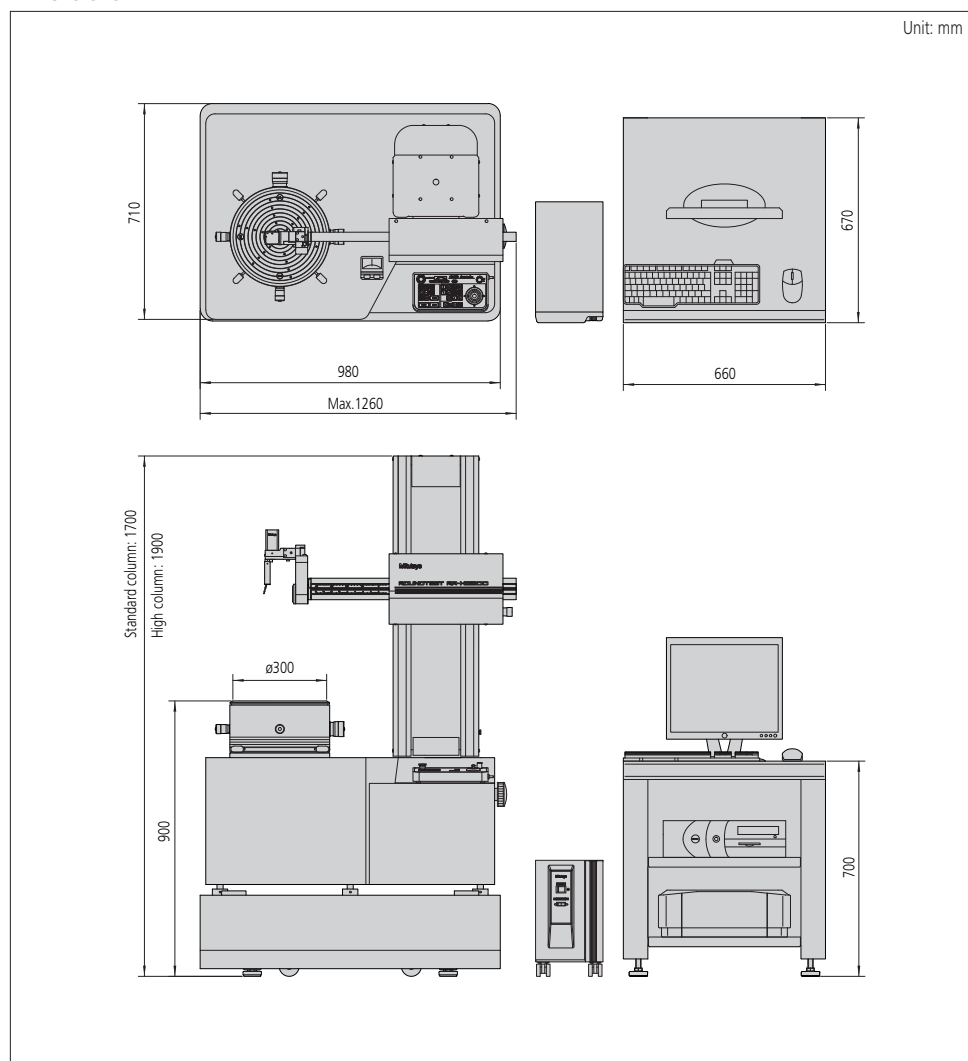
On-screen, virtual 3D simulation measurements can be performed with an integrated off-line teaching function that allows a part program (measurement procedure) to be created without an objective workpiece. The probe and the holder unit of the Roundtest Extreme can be accurately represented in the simulation making the prediction of collision risks and warning alarms possible.



3D simulation screens (work-view windows) can be generated after entering CAD data (in IGES, DXF form) and text data.

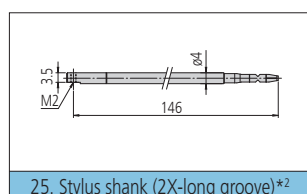
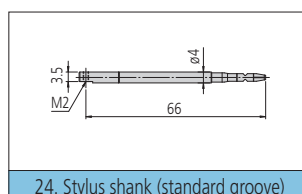
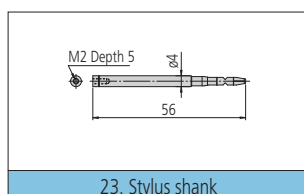
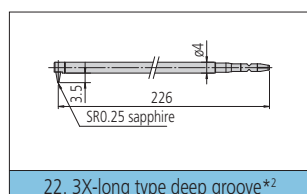
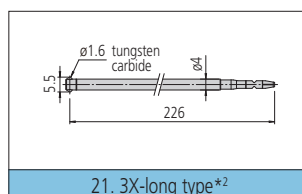
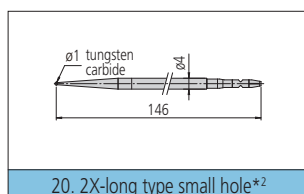
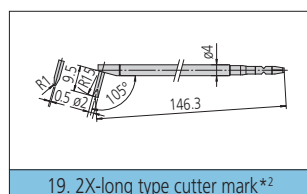
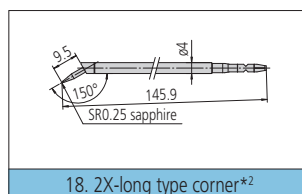
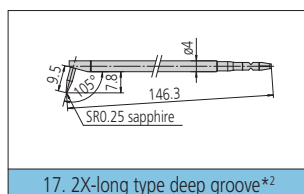
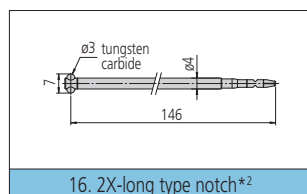
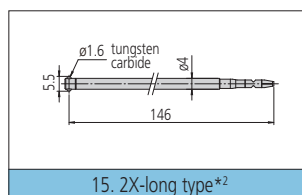
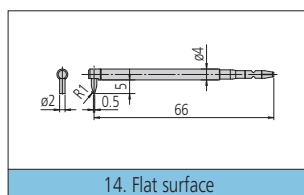
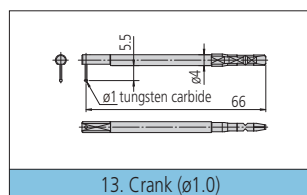
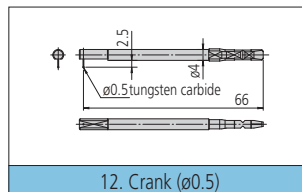
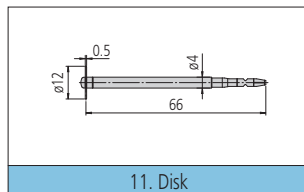
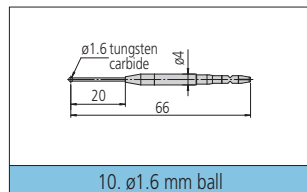
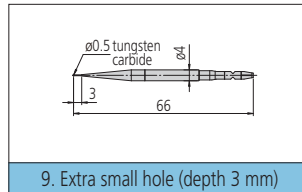
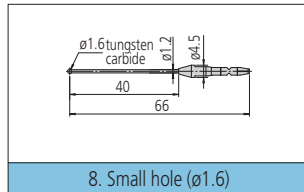
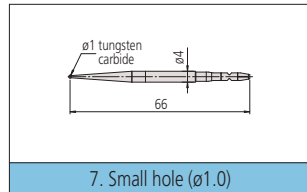
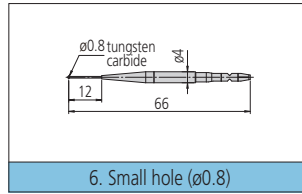
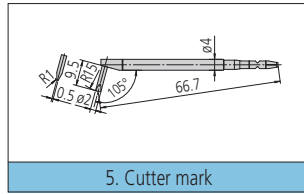
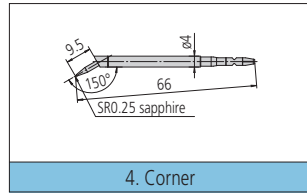
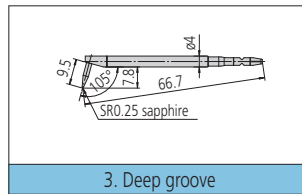
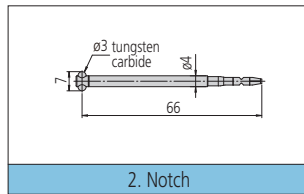
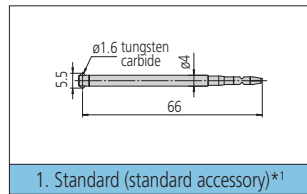


### Dimensions



# Optional Styli

Compatible with Non-CNC Roundness Measuring Instruments



Unit: mm

\*<sup>1</sup> Standard accessory for all Roundtest models.

\*<sup>2</sup> Measuring is only possible in the vertical direction.  
Not available for RA-10, RA-120, RA-120P, RA-220.

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

## Technical Data

Code No.	Description
1. Standard (standard accessory)* <sup>1</sup>	
12AAL021	ø1.6 mm tungsten carbide
2. Notch	
12AAL022	ø3 mm tungsten carbide
3. Deep groove	
12AAL023	SR0.25 mm sapphire
4. Corner	
12AAL024	SR0.25 mm sapphire
5. Cutter mark	
12AAL025	Tungsten carbide
6. Small hole (ø0.8)	
12AAL026	ø0.8 mm tungsten carbide
7. Small hole (ø1.0)	
12AAL027	ø1 mm tungsten carbide
8. Small hole (ø1.6)	
12AAL028	ø1.6 mm tungsten carbide
9. Extra small hole (depth 3 mm)	
12AAL029	ø0.5 mm tungsten carbide
10. ø1.6 mm ball	
12AAL030	ø1.6 mm tungsten carbide
11. Disk	
12AAL031	ø12 mm tungsten carbide
12. Crank (ø0.5)	
12AAL032	ø0.5 mm tungsten carbide (depth 2.5 mm)
13. Crank (ø1.0)	
12AAL033	ø1 mm tungsten carbide (depth 5.5 mm)
14. Flat surface	
12AAL034	Tungsten carbide
15. 2X-long type* <sup>2</sup>	
12AAL035	ø1.6 mm tungsten carbide
16. 2X-long type notch* <sup>2</sup>	
12AAL036	ø3 mm tungsten carbide
17. 2X-long type deep groove* <sup>2</sup>	
12AAL037	SR0.25 mm sapphire
18. 2X-long type corner* <sup>2</sup>	
12AAL038	SR0.25 mm sapphire
19. 2X-long type cutter mark* <sup>2</sup>	
12AAL039	Tungsten carbide
20. 2X-long type small hole* <sup>2</sup>	
12AAL040	ø1 mm tungsten carbide
21. 3X-long type* <sup>2</sup>	
12AAL041	ø1.6 mm tungsten carbide
22. 3X-long type deep groove* <sup>2</sup>	
12AAL042	SR0.25 mm sapphire
23. Stylus shank	
12AAL043	For mounting CMM stylus (mounting thread M2)
24. Stylus shank (standard groove)	
12AAL044	For mounting CMM stylus (mounting thread M2)
25. Stylus shank (2X-long groove)* <sup>2</sup>	
12AAL045	For mounting CMM stylus (mounting thread M2)

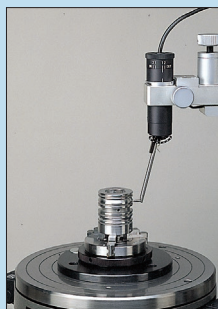
## Technical Data

Code No.	Description
1. Standard	
12AAE301	ø1.6 mm tungsten carbide
2. Flat surface	
12AAE302	ø1.6 mm tungsten carbide
3. ø1.6 mm ball	
12AAE303	ø1.6 mm tungsten carbide
4. ø0.8 mm ball	
12AAE304	ø0.8 mm tungsten carbide
5. ø0.5 mm ball	
12AAE305	ø0.5 mm tungsten carbide
6. Deep hole A	
12AAE306	ø1.6 mm tungsten carbide
7. Deep hole B	
12AAE307	ø1.6 mm tungsten carbide
8. Deep groove	
12AAE308	ø1.6 mm tungsten carbide
9. Notch	
12AAE309	ø3 mm tungsten carbide
10. Deep groove	
12AAE310	ø1.6 mm tungsten carbide

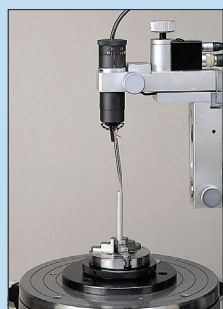
## Usage examples of various styli



Cutter mark.



Corner.



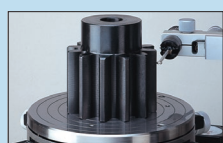
Small hole.



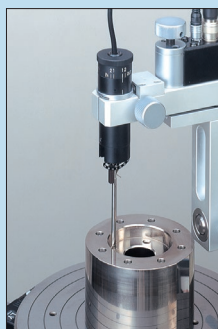
Small hole.



Flatness measurement.

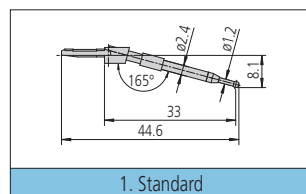


Notched workpiece measurement.

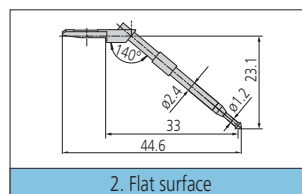


ID measurement.

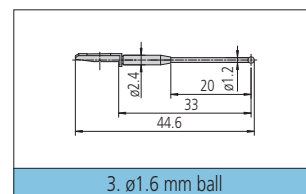
## Compatible with CNC Roundness Measuring Instruments



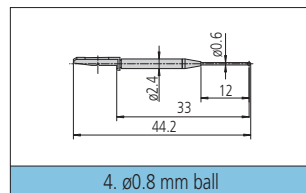
1. Standard



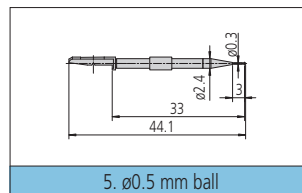
2. Flat surface



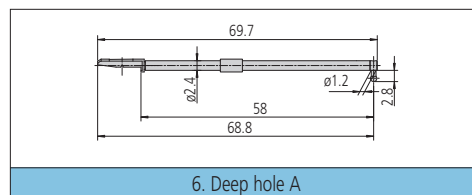
3. ø1.6 mm ball



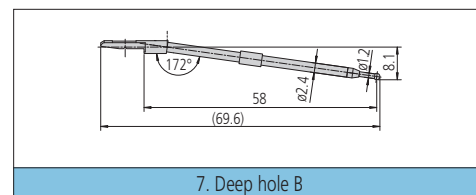
4. ø0.8 mm ball



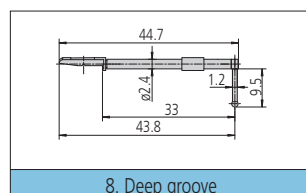
5. ø0.5 mm ball



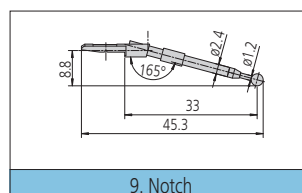
6. Deep hole A



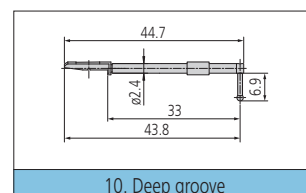
7. Deep hole B



8. Deep groove



9. Notch



10. Deep groove

Analyzing items		Models						
		RA-H5200CNC / RA-H5200	RA-2200CNC / RA-2200	RA-1600	RA-220	RA-120P	RA-120	RA-10
○	Roundness	✓	✓	✓	✓	✓	✓	✓
⊘	Cylindricity	✓	✓	✓	✓	—	—	—
◎	Concentricity	✓	✓	✓	✓	✓	✓	✓
⊙	Coaxiality	Axis-element	✓	✓	✓	✓	✓	✓
		Axis-axis	✓	✓	—	✓	—	—
□	Flatness	✓	✓	✓	✓	✓	✓	✓
//	Parallelism	✓	✓	✓	✓	✓	✓	—
⊥	Perpendicularity	✓	✓	✓	✓	✓	✓	—
↗	Runout	✓	✓	✓	✓	✓	✓	✓
↗	Total runout	✓	✓	✓	—	—	—	—
—	Straightness	✓	✓	✓	—	—	—	—
∠	Inclination	✓	✓	✓	—	—	—	—
∧	Taper	✓	✓	✓	—	—	—	—



# Optional Accessories

## For Roundness Measuring Instruments

### Collet Chuck

- Used for holding parts with a collet (optional).



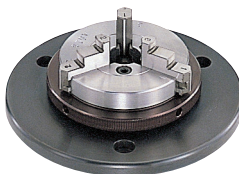
Code No.	211-061
Holding capacity	OD: 0.5 - 10 mm <sup>*1</sup>
Centering error	50 µm or less <sup>*2</sup>
Mass	1.4 kg
Price	£771.00

<sup>\*1</sup> Collets compatible with the workpiece are optional.

<sup>\*2</sup> When measured with a ø5 mm pin gauge at the measurement height of 30 mm.

### Centering Chuck (ring operated)

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



Code No.		211-032
Holding capacity	Internal jaws	OD: 1 - 36 mm ID: 16 - 69 mm
	External jaws	OD: 35 - 78 mm
External dimensions (D x H)		ø118 x 41 mm
Mass		1.2 kg
Price		£1410.00

### Micro-Chuck

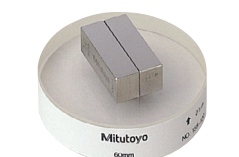
- Used for clamping a workpiece (less than ø1 mm) that the centering chuck cannot handle.



Code No.	211-031
Holding capacity	OD: 0.1 - 1.5 mm
External dimensions (D x H)	ø107 x 48.5 mm
Mass	0.6 kg
Price	£1090.00

### Magnification Checking Kit<sup>\*4</sup>

- A combination of gauge blocks and an optical flat.



Code No.	997090
Price	£240.00

<sup>\*4</sup> Supplied with RA-H5200/RA-H5200 CNC/RA-2200/RA-2200 CNC as standard.

### Collets

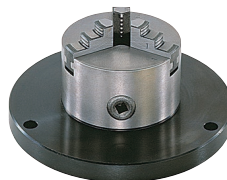
- Individual collets for the collet chuck.<sup>\*3</sup>

Code No.	Holding capacity	Price
12AAH402	OD: 0.5 - 1.0 mm	£161.00
12AAH403	OD: 1.0 - 1.5 mm	£161.00
12AAH404	OD: 1.5 - 2.0 mm	£127.00
12AAH405	OD: 2.0 - 2.5 mm	£127.00
12AAH406	OD: 2.5 - 3.0 mm	£115.00
12AAH407	OD: 3.0 - 3.5 mm	£115.00
12AAH408	OD: 3.5 - 4.0 mm	£115.00
12AAH409	OD: 4.0 - 5.0 mm	£115.00
12AAH410	OD: 5.0 - 6.0 mm	£115.00
12AAH411	OD: 6.0 - 7.0 mm	£115.00
12AAH412	OD: 7.0 - 8.0 mm	£115.00
12AAH413	OD: 8.0 - 9.0 mm	£115.00
12AAH414	OD: 9.0 - 10.0 mm	£115.00

<sup>\*3</sup> Collet chuck (211-061) is necessary to mount collets.

### Centering Chuck (handle operated)

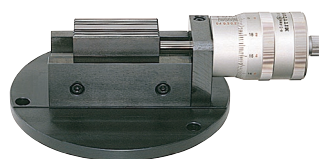
- Suitable for holding longer parts and those requiring a relatively powerful clamp such as crankshafts.



Code No.		211-014
Holding capacity	Internal jaws	OD: 2 - 35 mm ID: 25 - 68 mm
	External jaws	OD: 35 - 78 mm
External dimensions (D x H)		ø157 x 70.6 mm
Mass		3.8 kg
Price		£590.00

### Magnification Calibration Gauge

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



Code No.	211-045
Max. calibration range	400 µm
Graduation	0.2 µm
External dimensions (W x D x H)	235 (max) x 185 x 70 mm
Mass	4 kg
Price	£2280.00

### Recording Paper Set

- For the RA-10, RA-120 and RA-220 thermal printers.

Code No.	12AAH181
Number of rolls	10 (25 m per roll)
Price	£72.20

### Cylindrical Square

- Only for models capable of measuring cylindricity.



<b>Code No.</b>	<b>350850</b>
Cylindricity	2 $\mu$ m
Straightness	1 $\mu$ m
External dimensions (D x H)	$\varnothing 70 \times 250$ mm
Mass	7.5 kg
<b>Price</b>	<b>£420.00</b>

### Origin-Point Gauge<sup>\*6</sup>

- For zero setting the R- and Z-axes.



<b>Code No.</b>	<b>998382</b>
<b>Price</b>	<b>£321.00</b>

<sup>\*6</sup> Supplied with RA-H5200/RA-2200 as standard.

### Vibration Isolator

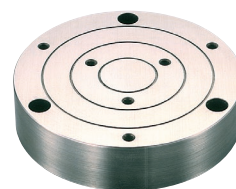
- Desk type compatible with RA-2200.



<b>Code No.</b>	<b>12AAK110</b>
Vibration isolation method	Diaphragm system
External dimensions (W x D x H)	830 x 800 x 700 mm
<b>Price</b>	<b>£12470.00</b>

Optional accessories used with this vibration isolator:  
Monitor arm (12AAK120), Side table (12AAL019).

### Auxiliary Workpiece Stand<sup>\*5</sup>



<b>Code No.</b>	<b>356038</b>
Loading diameter	100 mm
External dimensions (D x H)	$\varnothing 105 \times 25$ mm
Mass	1.7 kg
<b>Price</b>	<b>£316.00</b>

<sup>\*5</sup> Supplied with RA-H5200 as standard.

### Vibration Isolator

- Air suspension system.



For RA-220 and RA-1600

<b>Code No.</b>	<b>178-025</b>
Vibration isolation method	Diaphragm isolation system
External dimensions (W x D x H)	750 x 550 x 57 mm
<b>Price</b>	<b>£5510.00</b>

Optional accessory used with this vibration isolator: Stand (178-024)

For RA-10, RA-120 and RA-120P

<b>Code No.</b>	<b>211-013</b>
Vibration isolation method	Diaphragm isolation system
External dimensions (W x D x H)	615 x 515 x 51 mm
<b>Price</b>	<b>£3370.00</b>

### 3X Extension Detector Holder

- For the measurement of deep holes with the RA-H200.

<b>Code No.</b>	<b>12AAF205</b>
Mass	1.3 kg
<b>Price</b>	<b>£2160.00</b>

### 2X Extension Detector Holder

- For the measurement of deep holes with the RA-1600, RA-2200 and RA-H200.

<b>Code No.</b>	<b>12AAF203</b>
Mass	1.1 kg
<b>Price</b>	<b>£1980.00</b>

### Sliding Detector Holder

- For the RA-1600 (supplied with RA-H5200/RA-2200 as standard).

<b>Code No.</b>	<b>12AAL090</b>
<b>Price</b>	<b>£1500.00</b>