

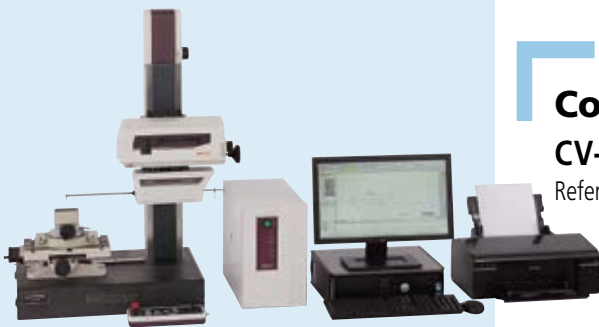
New Products



Surftest

SJ-310, SJ-410

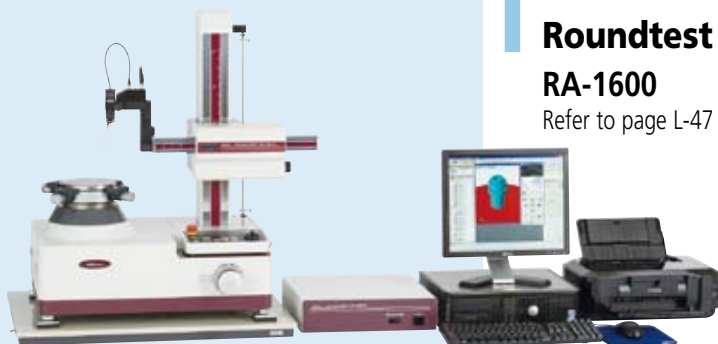
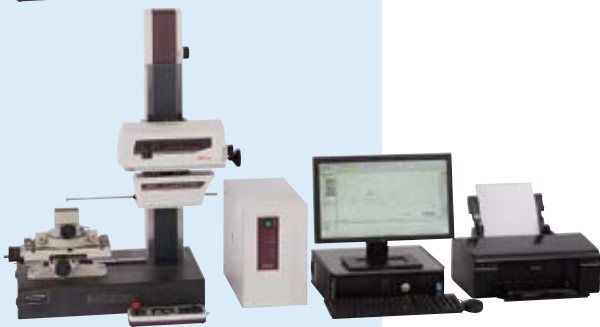
Refer to pages L-3 - L-8 for details.



Contracer

CV-3200, CV-4500

Refer to pages L-29 - L-32 for details.



Roundtest

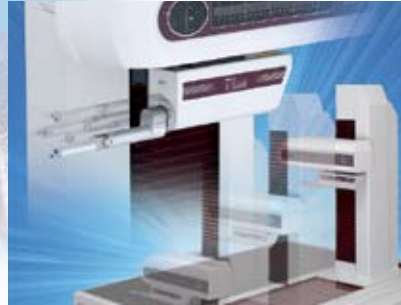
RA-1600

Refer to page L-47 for details.



Surftest

Surftest



Formtracer

Formtracer



Contracer

Contracer



Roundtest

Roundtest



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Surftest

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Surftest

Performs brilliantly in many situations such as in the quality control room, on the factory floor and on the production line.

Surftest SJ-210/SJ-310

SERIES 178 — Portable Surface Roughness Tester



Surftest SJ-210



Surftest SJ-310



FEATURES: SJ-210

- The 2.4-inch color graphic LCD provides excellent readability and an intuitive display that is easy to negotiate. 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 measurement conditions 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 allows you to protect your settings.
- The display interface supports 16 languages, which can be freely switched.
- An alarm warns you when the cumulative measurement distance exceeds a preset limit.
- 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.



FEATURES: SJ-310

- The handheld data processing unit and the 5.7-inch color 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 sets of measurement conditions can be saved in the measurement unit—an optional memory card can save measurement conditions and the measured profile.



Technical Data: SJ-210

X axis (drive unit)	
Measuring range:	17.5, 5.6mm (Transverse tracing drive unit type)
Measuring speed:	0.25, 0.5, 0.75mm/s 1mm/s (Returning)
Detector	
Range:	360μm (-200μm to +160μm)
Measuring method:	skidded
Measuring force:	0.75mN or 4mN: See page L-4
Stylus tip:	Diamond, 90° / 5μmR (60° / 2μmR: See page L-4)
Skid radius of curvature:	40mm
Skid force:	less than 400mN
Type:	Differential inductance
Power supply:	Two-way power supply: battery (rechargeable Ni-MH battery) and AC adapter
Charging time:	about 4hours (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 12AAL069)
Dimensions (WxDxH)	
Display unit:	52.1 x 65.8 x 160mm
Drive unit:	115 x 23 x 26mm
Mass:	About 0.5kg (Display unit + Drive unit + Standard detector)

Evaluation Capability: SJ-210

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, RPl, Rsm, Rz1max, S, HSC, RzJIS, Rppi, RΔa, RΔq, Rlr, Rmr, Rmr(c), Rdc, Rk, Rpk, Rvk, Mr1, Mr2, A1, A2, Vo, Rpm, tp, Htp, R, Rx, AR, Possible Customize
Analysis graphs:	Bearing area curve / Amplitude distribution curve
Digital filters:	Gaussian, 2CR75, PC75
Cut off length:	λc: 0.08, 0.25, 0.8, 2.5mm λs: 2.5, 8μm
Sampling length:	0.08, 0.25, 0.8, 2.5mm
Number of sampling lengths (x n):	x1, x2, x3, x4, x5, x6, x7, x8, x9, x10 arbitrary length (0.3 to 16.0mm: 0.01mm interval) x1, x2, x3, x4, x5, x6, x7, x8, x9, x10 arbitrary length (0.3 to 5.6mm: 0.01mm interval)*
	* Only for Transverse tracing drive unit type

Function: SJ-210

Customization:	Desired parameters can be selected for calculation and display.
GO/NG judgment:	By max value / 16% / Standard deviation
Storage of measurement condition:	Save the conditions at power OFF
Storage:	Internal memory: Measurement condition (10sets), Measured profile (1set) Memory card (Option): 500 measurement conditions, 10000 measured profiles, 500 display images Text file (Measurement conditions / 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

Technical Data: SJ-310

X axis (drive unit)
 Measuring range: 17.5, 5.6mm (Transverse tracing drive unit type)
 Measuring speed: 0.25, 0.5, 0.75mm/s 1mm/s (Returning)
 Detector
 Range: 360μm (-200μm to +160μm)
 Measuring method: skidded
 Measuring force: 0.75mN or 4mN: See page L-4
 Stylus tip: Diamond, 90° / 5μmR
 (60° / 2μmR: See page L-4)
 Skid radius of curvature: 40mm
 Skid force: less than 400mN
 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 198mm
 Drive unit: 115 x 23 x 26mm
 Mass
 Display unit: Approx. 1.7kg
 Drive unit: 0.2kg

Evaluation Capability: SJ-301

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, R_{Pc}, R_{3z}, R_{mr}(c), R_{pk}, R_{vk}, R_{dc}, R_k, Mr1, Mr2, Lo, R_{ppi}, R, AR, Rx, A1, A2, Vo, HSC, R_{mr}, SK, Ku, R_{Δa}, R_{Δq}, Rlr, λ_a, λ_q, R_{pm}, R_zJIS (JIS'01), tp (ANSI), Htp (ANSI), Wte, Wx, W, AW, R_{z1max} (ISO), R_{max} (VDA, ANSI, JIS'82), Possible Customize
 Analysis graphs:
 Bearing Area Curve (BAC), Amplitude Distribution Curve (ADC)
 Digital filter 2CR, PC75, Gaussian
 Cutoff length λ_c: 0.08, 0.25, 0.8, 2.5, 8mm
 λ_s: 2.5, 8μm
 Sampling length: 0.08, 0.25, 0.8, 2.5, 8mm
 Number of sampling lengths (x n):
 x1, x2, x3, x4, x5, x6, x7, x8, x9, x10 arbitrary length (0.3 to 16.0mm: 0.01mm interval)
 x1, x2, x3, x4, x5, x6, x7, x8, x9, x10 arbitrary length (0.3 to 5.6mm: 0.01mm interval)*
 * Only for Transverse tracing drive unit type
 Printer Thermal type
 Printing width 48mm (paper width: 58mm)
 Recording magnification
 Vertical magnification: 10X to 100,000X, Auto
 Horizontal magnification: 1X to 1,000X, Auto

Function: SJ-310

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
 GONG judgment: maximum value rule, 16% rule, average value rule, standard deviation (1σ, 2σ, 3σ)
 Storage: Internal memory: Measurement condition (10 sets)
 Memory card (Option): 500 measurement conditions, 10000 measured profiles, 500 display images, Text file (Measurement conditions / 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 light-off of Backlight by ECO mode.

SPECIFICATIONS/CONFIGURATION

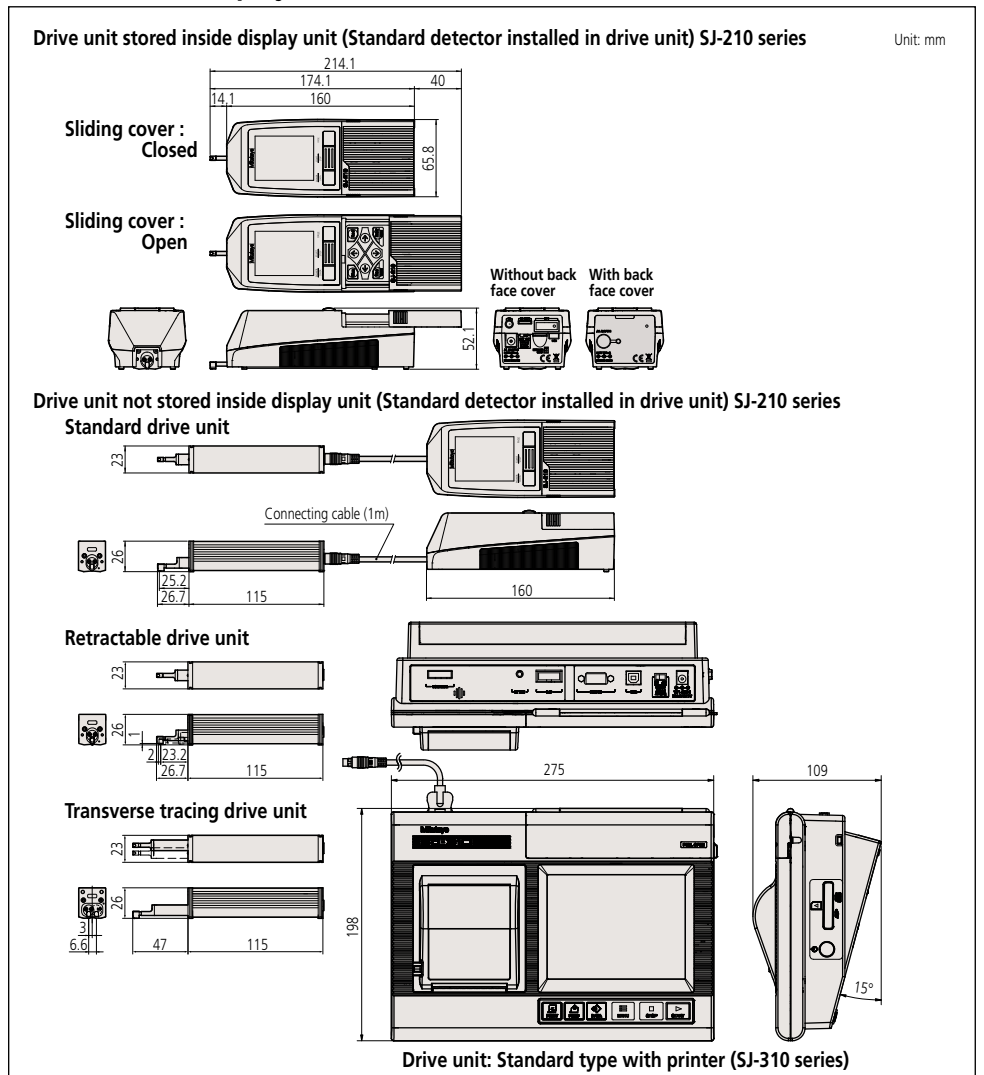
Model No.	SJ-210					
Order No. (mm)	178-560-01*	178-560-02*	178-562-01*	178-562-02*	178-564-01*	178-564-02*
Order No. (inch/mm)	178-561-01*	178-561-02*	178-563-01*	178-563-02*	178-565-01*	178-565-02*
Drive unit	Standard type (178-230-2)		Retractable type (178-235)		Transverse tracing type (178-233-2)	
Detector	0.75mM type (178-296)	4mM type (178-390)	0.75mM type (178-296)	4mM type (178-390)	0.75mM type (178-387)	4mM type (178-386)
Display unit	Compact type (mm: 178-252* inch/mm: 178-253*)					
Detector: Conical taper angle	60°	90°	60°	90°	60°	90°
Stylus tip radius	2μm	5μm	2μm	5μm	2μm	5μm
Detector measuring force	0.75mN	4mN	0.75mN	4mN	0.75mN	4mN

* To denote your AC power cable add the following suffixes to the order No.:
 "mm" type: **A** for UL/CSA, **C** for JIS (for Taiwan), **D** for CEE, **E** for BS, **DC** for China, **K** for KC
 "inch/mm" type: **A** for UL/CSA, **D** for CEE, **E** for BS, **DC** for China. **No suffix** is required for JIS/100V (for Taiwan)

Model No.	SJ-310					
Order No. (mm)	178-570-01*	178-570-02*	178-572-01*	178-572-02*	178-574-01*	178-574-02*
Order No. (inch/mm)	178-571-01*	178-571-02*	178-573-01*	178-573-02*	178-575-01*	178-575-02*
Order No. (mm for Japan)	178-570-01	178-570-02	178-572-01	178-572-02	178-574-01	178-574-02
Drive unit	Standard type (178-230-2)		Retractable type (178-235)		Transverse tracing type (178-233-2)	
Detector	0.75mM type (178-296)	4mM type (178-390)	0.75mM type (178-296)	4mM type (178-390)	0.75mM type (178-387)	4mM type (178-386)
Display unit	Standard type with printer					
Detector: Conical taper angle	60°	90°	60°	90°	60°	90°
Stylus tip radius	2μm	5μm	2μm	5μm	2μm	5μm
Detector measuring force	0.75mN	4mN	0.75mN	4mN	0.75mN	4mN

* To denote your AC power cable add the following suffixes to the order No.:
 "mm" type: **A** for UL/CSA, **C** for JIS (for Taiwan), **D** for CEE, **E** for BS, **DC** for China, **K** for KC
 "inch/mm" type: **A** for UL/CSA, **D** for CEE, **E** for BS, **DC** for China. **No suffix** is required for JIS/100V (for Taiwan)

DIMENSIONS Display unit, Drive unit



Surftest

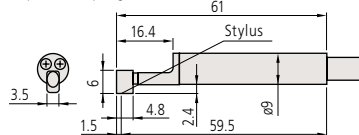
Performs brilliantly in many situations such as in the quality control room, on the factory floor and on the production line.

Detectors

Standard detectors

Order No.	Measuring force	Stylus profiles*	Remarks column
178-296	0.75mN	2µmR/60°	Dedicated to the standard/retractable drive unit
178-390	4 mN	5µmR/90°	Dedicated to the standard/retractable drive unit
178-387	0.75mN	2µmR/60°	Dedicated to the transverse tracing drive unit
178-386	4 mN	5µmR/90°	Dedicated to the transverse tracing drive unit
178-391	4 mN	10µmR/90°	Dedicated to the standard/retractable drive unit

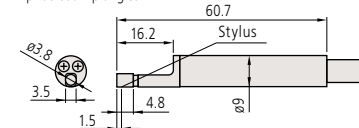
* Tip radius / Tip angles



Small hole detectors

Order No.	Measuring force	Stylus profiles*	Remarks column
178-383	0.75mN	2µmR/60°	Minimum measurable hole diameter: ø4.5mm
178-392	4 mN	5µmR/90°	

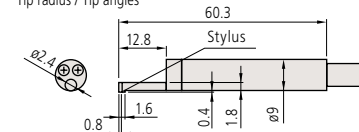
* Tip radius / Tip angles



Extra small hole detectors

Order No.	Measuring force	Stylus profiles*	Remarks column
178-384	0.75mN	2µmR/60°	Minimum measurable hole diameter: ø2.8mm
178-393	4 mN	5µmR/90°	

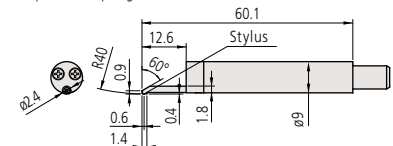
* Tip radius / Tip angles



Gear-tooth surface detectors

Order No.	Measuring force	Stylus profiles*
178-388	0.75mN	2µmR/60°
178-398	4 mN	5µmR/60°

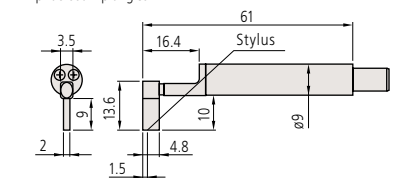
* Tip radius / Tip angles



Deep groove detectors

Order No.	Measuring force	Stylus profiles*	Remarks column
178-385	0.75mN	2µmR/60°	Not available for the transverse tracing drive unit
178-394	4 mN	5µmR/90°	

* Tip radius / Tip angles



SJ-Printer for SJ-210

Assessed profiles and calculation results and curves can be printed out by connecting the SJ-210-dedicated printer, which is palm sized (WxDxH: 93x125x70mm) and can run on an internal battery.

- Power supply can be selected. (AC adapter or battery pack)
- Printable items: Measurement conditions, 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 condition output (cable **965516**).



178-421

To denote your AC line voltage add the following suffixes (e.g. **178-421A**). -A for 120V, D for 230V



Example of the connection with **SJ-210**

Printer paper (5 packs): **270732**

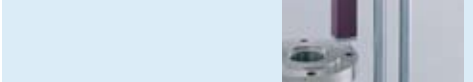
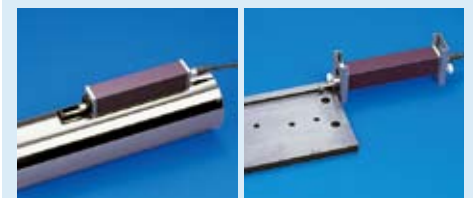


264-504*

* To denote your AC line voltage add the following suffixes (e.g. **264-504-5A**). -5A for 120V, -5D for 220V (for Europe), -5E for 240V (for UK), -1K for Korea without AC adapter, -5F for 240V (for Oceania)

Connecting cable: **936937** (1m)

Connecting cable: **965014** (2m)





MiCAT

Mitutoyo Intelligent Computer Aided Technology

the standard in world metrology software

FORM

Optional Software

SJ-Tools

Output software based on Microsoft-Excel* for controlling the devices and reproducing and storing the measurement data.

* Microsoft-Excel is not included in the scope of supply.

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

Optional cables are required.

12AAL068: USB PC connecting cable(USB cable) for SJ-210

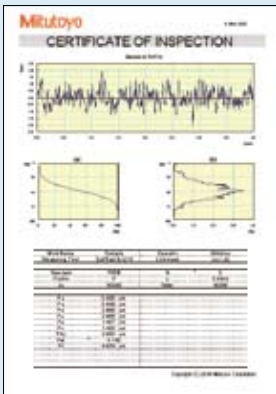
12AAD510: USB PC connecting cable(USB cable) for SJ-310

12AAL067: RS-232C cable for SJ-210

12AAA882: RS-232C cable for SJ-310



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.
<http://www.mitutoyo.co.jp>



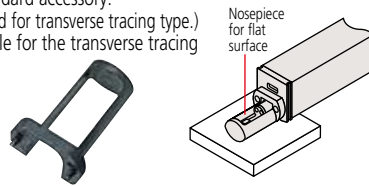
Refer to the SurfTest SJ-210 leaflet (E4388) for more details.

Nosepiece, Adapter

Nosepiece for flat surfaces

12AAA217

- SJ-310 standard accessory.
- (Not supplied for transverse tracing type.)
- Not available for the transverse tracing drive unit.



V-type adapter

12AAE644

- SJ-310 Transverse tracing type standard accessory.
- Dedicated to the transverse tracing drive unit.

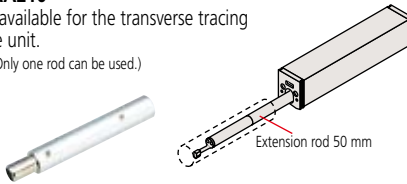


Extension rod (50mm)

12AAA210

- Not available for the transverse tracing drive unit.

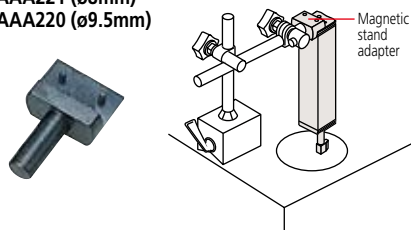
(Note: Only one rod can be used.)



Magnetic stand adapter

12AAA221 (ø8mm)

12AAA220 (ø9.5mm)



Extension cable (1m)

12BAA303

- Only one cable can be used.

Setting attachments

* Not available for the transverse tracing drive unit

Improves measurement efficiency by allowing the setup of multiple workpieces of the same type and the positioning of hard-to-access features of a workpiece.

No. 178-033

V-type for measuring in the cylinder axis direction

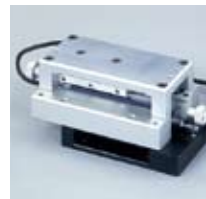


The V-width is adjustable to the cylinder diameter facilitating axial measurement of a wide range of cylinder diameters.

- Adjustable range: ø 5 - 150mm

No. 178-034

Setting attachment: Magnetic slider type



The magnet attached to the bottom surface of the frame allows hands-free measurements to be made.

No. 178-035

Setting attachment: Inside diameter type



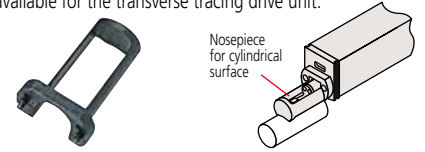
Greatly facilitates measurement of internal wall surfaces of, for example, cylinder-block bores.

- Applicable diameter: ø75 - ø95mm
- Accessible depth: 30 - 135mm

Nosepiece for cylindrical surfaces

12AAA218

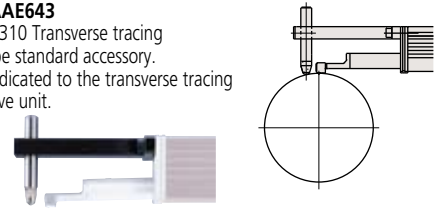
- SJ-310 standard accessory.
- (Not supplied for transverse tracing type.)
- Not available for the transverse tracing drive unit.



Point-contact adapter

12AAE643

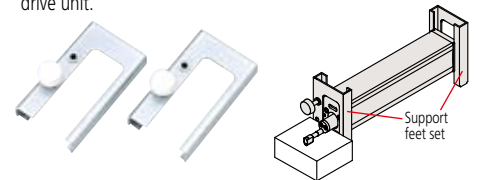
- SJ-310 Transverse tracing type standard accessory.
- Dedicated to the transverse tracing drive unit.



Support feet set

12AAA216

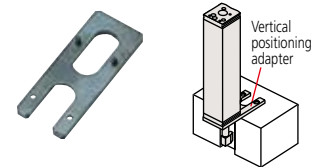
- SJ-301/301R standard accessory.
- Not available for the detector side of the transverse tracing drive unit.



Vertical positioning adapter

12AAA219

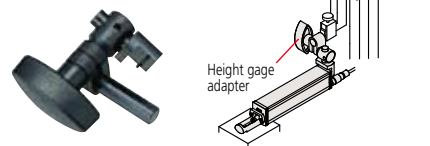
- Not available for the transverse tracing drive unit.



Height gage adapter

12AAA222 (9mm x 9mm)

12AAA233 (1/4" x 1/2")



Surftest

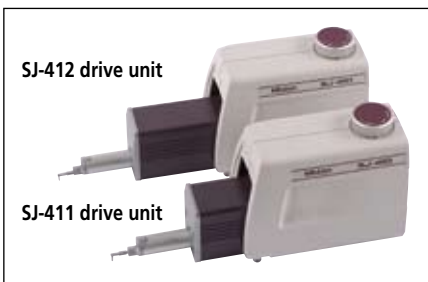
Performs brilliantly in many situations such as in the quality control room, on the factory floor and on the production line.

Surftest SJ-410

SERIES 178 — Portable Surface Roughness Tester

- Both skidded and skidless measurement are possible with this series. Equipped with 46 roughness parameters that conform to the latest ISO, DIN, ANSI, and JIS standards.
- A wide-range, high-resolution detector and a drive unit provide superior high-accuracy measurement in its class.

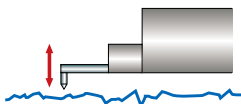
<Measuring range / Resolution>
800µm (at 0.0125µm resolution) / 0.0125µm (at 8mm range)
<Straightness / traverse length>
SJ-411 drive unit: 0.3µm / 25mm
SJ-412 drive unit: 0.5µm / 50mm



- 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 color 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 optional RS-232C or USB cable.
- Digital filter function for non-distorted roughness profiles.
- GO/NG judgment function.
- Auto-calibration function.
- The display interface supports 16 languages, which can be freely switched.
- Simplified contour analysis function supports the four types of measurement: step, level change, area and coordinate difference.
- Access to each feature can be password-protected, which prevents unintended operations and allows you to protect your settings.
- The optional attachments for mounting on a column stand significantly increase the operability.

- A skidless detector and a curved surface compensation function provide efficient evaluation of cylinder surface roughness.

Skidless measurement



Surftest SJ-411



SPECIFICATIONS

Model No.	SJ-411	SJ-411	SJ-412	SJ-412
Order No. (mm)	178-580-01*	178-580-02*	178-582-01*	178-582-02*
Order No. (inch/mm)	178-581-01*	178-581-02*	178-583-01*	178-583-02*
Order No. (mm for Japan)	178-580-01	178-580-02	178-582-01	178-582-02
Detector measuring force	0.75mN	4mN	0.75mN	4mN
Evaluation range	25mm	25mm	50mm	50mm
Stylus tip	Tip angle	60°	90°	60°
	Tip radius	2µm	5µm	2µm

* To denote your AC power cable add the following suffixes to the order No.:
"mm" type: **A** for UL/CSA, **C** for JIS (for Taiwan), **D** for CEE, **E** for BS, **DC** for China, **K** for KC
"inch/mm" type: **A** for UL/CSA, **D** for CEE, **E** for BS, **DC** for China. **No suffix** is required for JIS/100V (for Taiwan)

Technical Data

X axis (drive unit)
Measuring range: 25mm (SJ-411), 50mm (SJ-412)
Measuring speed: 0.05, 0.1, 0.2, 0.5, 1.0mm/s
Return speed: 0.5, 1, 2, 5mm/s
Traverse direction: Backward
Traverse linearity: 0.3µm/25mm (SJ-411), 0.5µm/50mm (SJ-412)
Positioning: ±1.5° (tilting), 10mm (up/down)
Detector
Range / resolution: 800µm/0.0125µm, 80µm/0.00125µm, 8µm/0.000125µm (up to 2400µm with an optional stylus)
Measurement method: Skidless / skidded
Measuring force: 0.75mN or 4mN See page L-7
Stylus tip: Diamond, 60° / 2µmR (90° / 5µmR: See page L-7)
Skid radius of curvature: 40mm
Type: Differential inductance
Power supply: Via AC adapter / rechargeable battery
Battery life: Max. app. 1000 measurements (w/o printing)
Recharge time: 4 hours Data output Via USB interface / RS-232C interface / SPC output
Storage: Internal memory: Measurement condition (10 sets)
Memory card (Option): 500 measurement conditions, 10000 measured profiles, 500 display images, Text file (Measurement conditions / Measured profile / Assessed profile / Bearing area curve / Amplitude distribution curve), 500 statistical data, etc.
Dimensions (WxDxH)
Display unit: 275 x 109 x 198mm
Height-tilt adjustment unit: 131 x 63 x 99mm
Drive unit: 128 x 36 x 47mm (SJ-411), 155 x 36 x 47mm (SJ-412)
Mass Control unit: Approx. 1.7kg
Height-tilt adjustment unit: Approx. 0.4kg
Drive unit: 0.6kg (SJ-411), 0.7kg (SJ-412)

Evaluation Capability

Applicable standards: JIS'82, JIS'94, JIS'01, ISO'97, ANSI, VDA, Free
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, Rpc, RSm, Rmax(VDA, ANSI), Rz1max(ISO'97), S, HSC, RzJIS(JIS'01), Rppi, RΔa, RΔq, Rlr, Rmr, Rmr(c), Rδc, Rk, Rpk, Rvk, Mr1, Mr2, A1, A2, Vo, λq, Lo, Rpm, tp(ANSI), Htp(ANSI), R, Rx, AR, W, AW, Wx, Wte
Analysis graphs: Bearing Area Curve (BAC), Amplitude Distribution Curve (ADC)
Digital filter: 2CR, PC75, Gaussian
Cutoff length: λc: 0.08, 0.25, 0.8, 2.5, 8mm
λs: 2.5, 8, 25µm (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 25mm (0.1 to 50mm: SJ-412) in 0.01mm increments
Number of sampling lengths: 1, 2, 3, ~20 (limited by traverse range)
Printer: Thermal type
Printing width: 48mm (paper width: 58mm)
Recording magnification
Vertical magnification: 10X to 100,000X, Auto
Horizontal magnification: 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
D.A.T. 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 light-off of Backlight by ECO mode.

* Only for SJ-412



MiCAT

Mitutoyo Intelligent Computer Aided Technology

the standard in world
metrology software

FORM

Optional Software

SJ-Tools

Output software based on Microsoft-Excel* for controlling the devices and reproducing and storing the measurement data.

*Microsoft-Excel is not included in the scope of supply.

Complete with exclusive accessories.

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

Optional cables are required.

12AAD510: USB PC connecting cable (USB cable)

12AAA882: RS-232C connecting cable

Optional Accessories

178-611: Reference step specimen (mm)

178-612: Reference step specimen (mm/inch)

178-610: Step gage (step: 1µm, 2µm, 5µm, 10µm)

12AAM556: Height/tilt adjustment unit for SJ-410

178-039: Manual column stand (granite base)
(vertical travel: 250mm)

178-010: Auto-set unit for **178-039**

178-020: X axis adjustment unit for **178-039**

178-030: Tilting adjustment unit (Inclination adjustment unit) for **178-039**

12AAB358: Cylindrical surface adapter
(workpiece dia.: 15 - 60mm)

178-016: Leveling table
(tilting: ±1.5°, max. loading: 15kg)

178-048: Leveling table with D.A.T function (mm)

(tilting: ±1.5°, max. loading: 15kg)

178-058: Leveling table with D.A.T function (inch)

(tilting: ±1.5°, max. loading: 15kg)

178-043-1: XY leveling table (25 x 25mm)

(tilting: ±1.5°, max. loading: 15kg, swiveling: ±3°)

178-053-1: XY leveling table (1" x 1")

(tilting: ±1.5°, max. loading: 15kg, swiveling: ±3°)

178-042-1: Digital XY leveling table (25 x 25mm)

(tilting: ±1.5°, max. loading: 15kg, swiveling: ±3°)

178-052-1: Digital XY leveling table (1" x 1")

(tilting: ±1.5°, max. loading: 15kg, swiveling: ±3°)

178-049: Digital XY leveling table (25 x 25mm)

(max. loading: 15kg)

178-059: Digimatic XY leveling table (1" x 1")

(max. loading: 15kg)

178-019: Precision vise for XY leveling table

(jaw opening: 36mm)

998291: Precision V-block for XY leveling table

(workpiece dia.: 1 - 160mm)

12AAL069: Memory card

12AAD510: USB PC connecting cable (USB cable)

12AAA882: PC connecting cable (RS-232C cable)

965014: SPC cable (2m)

264-012-10: Input tool (USB type)

264-504: DP-1VR (Refer to the page A-13.)

—: Detectors, Styli, and nosepieces

(Refer to the page L-23~L-24.)

Consumables

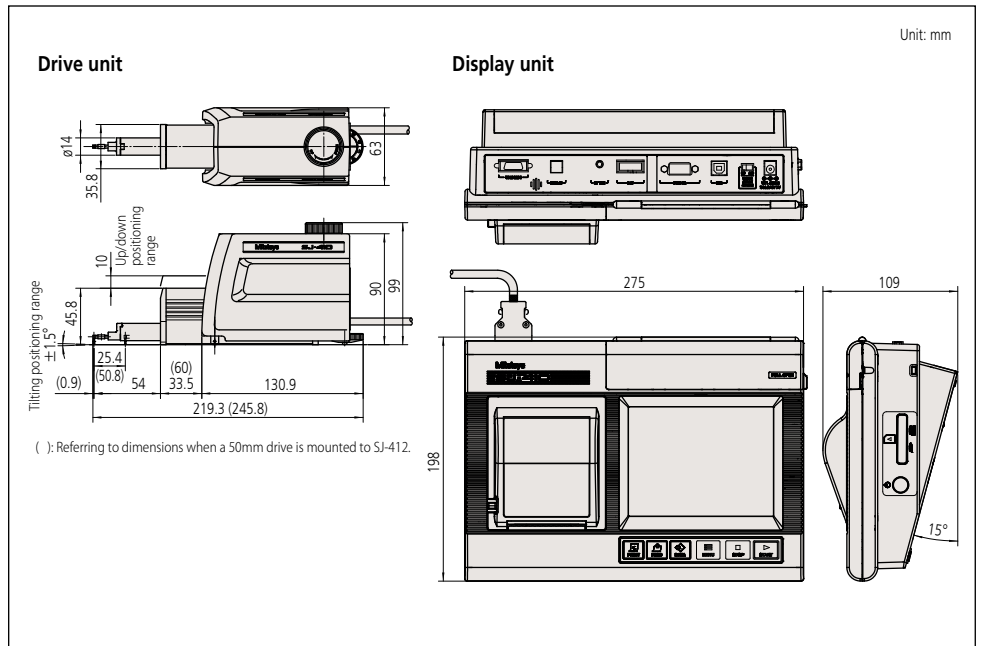
12AAN040: LCD protective sheet (10 sheets/set)

12AAA876: Durable printer paper (25m, 5 rolls/set)

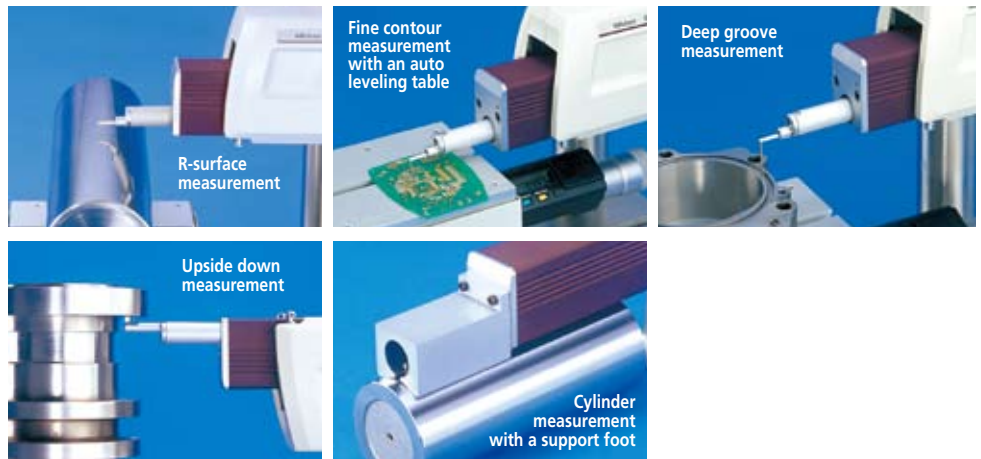
12AAN046: Replacement battery

12AAJ088: Footswitch

DIMENSIONS



MEASUREMENT APPLICATIONS



Carrying case is a standard accessory.



With optional accessories.

Surftest

Performs brilliantly in many situations such as in the quality control room, on the factory floor and on the production line.

Surftest SJ-500, SV-2100 SERIES 178 — with Dedicated Control / Display Unit

High precision and high performance type surface roughness tester with a dedicated control unit, achieving user-friendly display and simple operation.

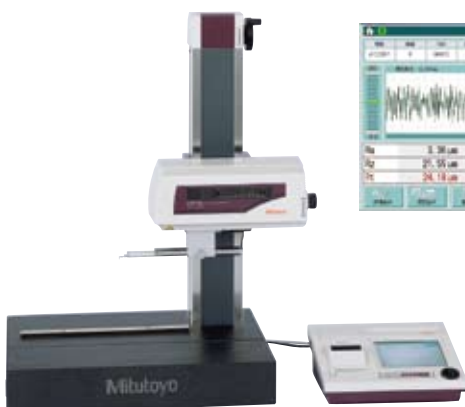
- Equipped with a 7.5-inch, color TFT LCD, large color icons and touch panel controls, the display unit is easy to read and simple to operate.
- A built-in joystick in the control unit allows quick and easy positioning. The manual knob allows fine positioning of a small stylus for measuring small holes.

- 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 measuring condition settings can easily be entered by selecting a drawing instruction symbol from the surface roughness menu.

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



SJ-500



SV-2100M4



SV-2100S4

SPECIFICATIONS

Model No.	SJ-500	SJ-500	SV-2100M4	SV-2100M4	
Order No.* (mm)	178-532-01	178-532-02	178-636-01	178-636-02	
Order No.* (inch/mm)	178-533-01	178-533-02	178-637-01	178-637-02	
Stylus tip	Tip angle	60°	90°	60°	90°
	Tip radius	2μm	5μm	2μm	5μm
Detector measuring force	0.75mN	4mN	0.75mN	4mN	
X1-axis measuring range	50mm		100mm		
Vertical travel	—		350mm manual column		
Granite base size (WxD)	—		600 x 450mm		
Dimensions (main unit, WxDxH)	—		716 x 450 x 863mm		
Mass	6.7kg (Drive unit: 2.7kg Control unit: 4.0kg)		144kg		

Model No.	SV-2100S4	SV-2100S4	SV-2100H4	SV-2100H4	SV-2100W4	SV-2100W4	
Order No.* (mm)	178-680-01	178-680-02	178-682-01	178-682-02	178-684-01	178-684-02	
Order No.* (inch/mm)	178-681-01	178-681-02	178-683-01	178-683-02	178-685-01	178-385-02	
Stylus tip	Tip angle	60°	90°	60°	90°	60°	90°
	Tip radius	2μm	5μm	2μm	5μm	2μm	5μm
Detector measuring force	0.75mN	4mN	0.75mN	4mN	0.75mN	4mN	
X1-axis measuring range	100mm		100mm		100mm		
Vertical travel	350mm power column		550mm power column		550mm power column		
Granite base size (WxD)	600 x 450mm		600 x 450mm		1000 x 450mm		
Dimensions (main unit, WxDxH)	766 x 482 x 966mm		766 x 482 x 1166mm		1166 x 482 x 1176mm		
Mass	147kg		157kg		227kg		

* To denote your AC power cable add the following suffixes to the order No.: **A** for UL/CSA, **D** for CEE, **DC** for CCC, **E** for BS, **K** for KC. **No suffix** is required for JIS/100V

Technical Data: SJ-500

X1 axis (drive unit)	
Measuring range:	50mm
Resolution:	0.05μm
Scale:	Linear encoder
Drive speed:	0 - 20mm/s
Measuring speed:	0.02 - 5mm/s
Traverse direction:	Backward
Traverse linearity:	0.2μm/50mm
Positioning:	±1.5° (tilting, with DAT function) 30mm (up/down)
Detector	
Range / resolution:	800μm/0.01μm, 80μm/0.001μm, 8μm/0.0001μm
Measurement method:	Skidless / skidded
Measuring force:	See specification table
Stylus tip:	See specification table
Skid radius of curvature:	40mm
Type:	Differential inductance
Control unit	
Display:	7.5" color TFT LCD with backlight
Printer:	Built-in thermal type
Magnification:	Horizontal: X0.5 to X10,000, Auto Vertical: X10 to X500,000, Auto
Drive unit control:	Joystick operation with manual adjustment knob

Technical Data: SV-2100

X1 axis (drive unit)	
Measuring range:	100mm
Resolution:	0.05μm
Scale:	Linear encoder
Drive speed:	0 - 40mm/s
Measuring speed:	0.02 - 5mm/s
Traverse direction:	Backward
Traverse linearity:	0.15μm/100mm
Z2 axis (column)	
Type:	Manual operation or power drive
Vertical travel:	350mm or 550mm*
Resolution*:	1μm
Scale type*:	Rotary encoder
Drive speed*:	0 - 20mm/s
* Only for power drive type	
Detector	
Range / resolution:	800μm/0.01μm, 80μm/0.001μm, 8μm/0.0001μm
Measurement method:	Skidless
Measuring force:	See specification table
Stylus tip:	See specification table
Type:	Differential inductance
Control unit	
Display:	7.5" color TFT LCD with backlight
Printer:	Built-in thermal type
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: 0.25μm, 0.8μm, 2.5μm, 8μm, 25μm, 80μm, 250μm, no filter
λc*: 0.025mm, 0.08mm, 0.25mm, 0.8mm, 2.5mm, 8mm, 25mm, 80mm (SV-2100)
λf: 0.08mm, 0.25mm, 0.8mm, 2.5mm, 8mm, 25mm, 80mm (SV-2100), no filter

Sampling length*:
0.025mm, 0.08mm, 0.25mm, 0.8mm, 2.5mm, 8mm, 25mm, 80mm (SV-2100 only)

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 0.02mm to 50mm.

Optional Accessory

12AA876: Durable printer paper (25m, 5 rolls/set)

Technical Data: SJ-500P

X1 axis (drive unit)	
Measuring range:	50mm
Resolution:	0.05µm
Scale:	Linear encoder
Drive speed:	0 - 20mm/s
Measuring speed:	0.02 - 5mm/s
Traverse direction:	Backward
Traverse linearity:	0.2µm/50mm
Positioning:	±1.5° (tilting, with DAT function) 30mm (up/down)
Detector	
Range / resolution:	800µm/0.01µm, 80µm/0.001µm, 8µm/0.0001µm
Measurement method:	Skidless / skidded
Measuring force:	See specification table
Stylus tip:	See specification table
Skid radius of curvature:	40mm
Type:	Differential inductance
Drive unit control:	PC

Technical Data: SV-2100M4 (PC type)

X1 axis (drive unit)	
Measuring range:	100mm
Resolution:	0.05µm
Scale:	Linear encoder
Drive speed:	0 - 40mm/s
Measuring speed:	0.02 - 5mm/s
Traverse direction:	Backward
Traverse linearity:	0.15µm/100mm
Z2 axis (column)	
Type:	Manual operation
Vertical travel:	350mm
Detector	
Range / resolution:	800µm/0.01µm, 80µm/0.001µm, 8µm/0.0001µm
Measurement method:	Skidless / skidded
Measuring force:	See specification table
Stylus tip:	See specification table
Type:	Differential inductance
Drive unit control:	PC

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, Rpmax, Rpi, Rv, Rvmax, Rvi, Rt, Rti, R3z, R3zi, R3y, S, Pc (Ppi), Sm, HSC, mr, δc, plateau ratio, mrd, Rk, Rpk, Rvk, Mr1, Mr2, Δa, Δq, λa, λq, 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, auto-correlation 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*:
λc: 0.025mm, 0.08mm, 0.25mm, 0.8mm, 2.5mm, 8mm, 25mm
fl: 0.08mm, 0.25mm, 0.8mm, 2.5mm, 8mm, 25mm
fh: 0.08mm, 0.25mm, 0.8mm, 2.5mm, 8mm

Sampling length*:
0.025mm, 0.08mm, 0.25mm, 0.8mm, 2.5mm, 8mm, 25mm

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 0.025mm to the maximum traverse length.

Surftest SJ-500P, SV-2100M4 (PC type) SERIES 178 — with PC (Personal computer)

Highly precise, high-performance surface roughness testers that use the advantages of sophisticated analysis software. The SJ-500P is a stand-alone instrument whereas the SV-2100M4 is a benchtop machine incorporating a precision column with manual drive.

- A built-in joystick in the control unit allows quick and easy positioning. The manual knob allows fine positioning of a small stylus for measuring small holes.
- Simple setup for surface roughness measuring conditions.

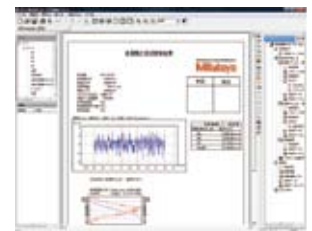
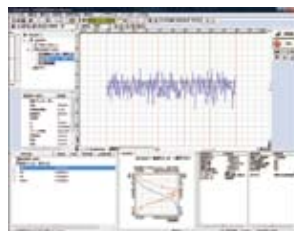
A simple input function is used to calculate according to ISO/JIS roughness standard drawing instruction symbols. Complicated measuring condition settings can easily be entered by selecting a drawing instruction symbol from the surface roughness menu.



SJ-500P



SV-2100M4 (PC type)



SPECIFICATIONS

Model No.	SJ-500P	SJ-500P	SV-2100M4	SV-2100M4
Order No.* (mm)	178-530-01	178-530-02	178-634-01	178-634-02
Order No.* (inch/mm)	178-531-01	178-531-02	178-635-01	178-635-02
Stylus tip	Tip angle	60°	60°	90°
	Tip radius	2µm	5µm	2µm
Detector measuring force	0.75mN	4mN	0.75mN	4mN
X1-axis measuring range	50mm		100mm	
Vertical travel	—		350mm manual column	
Granite base size (WxD)	—		600 x 450mm	
Dimensions (main unit, WxDxH)	—		716 x 450 x 863mm	
Mass	6.5kg (Main Unit 2.7kg; PC I/F Unit 3.8kg)		144kg (Main Unit 140kg; PC I/F Unit 3.8kg)	

* To denote your AC power cable add the following suffixes to the order No.: **A** for UL/CSA, **D** for CEE, **DC** for CCC, **E** for BS, **K** for KC. **No suffix** is required for JIS/100V

Surftest

Performs brilliantly in many situations such as in the quality control room, on the factory floor and on the production line.

Surftest SV-3100

SERIES 178 — Surface Roughness Testers

MiCAT

Mitutoyo Intelligent Computer Aided Technology

the standard in world
metrology software

FORM



SV-3100H4 with personal computer system

- Mitutoyo's Surftest SV-3100 Series provides highly accurate, high-level analysis, and multi-functionality in three dimensional analysis and measurement of fine contour, as well as the conventional type surface roughness measurement.
- Peripheral devices such as the auto-leveling table are available to enhance operability and enable automatic measurement.
- Includes FORMTRACEPAK data analysis software. FORMTRACEPAK 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. No lubrication is required.
- High-accuracy glass scales, built-in on the X1-axis (resolution: 0.05 μ m) and Z2-axis (column, resolution: 1 μ m) ensure high accuracy positioning. The SV-3100 series produces high-reliability, particularly in horizontal roughness parameters (S, Sm), that require high-accuracy X1-axis travel.

- Equipped with a highly accurate detector stylus.
- Capabilities include a "straightness compensation" function, which improves the linear accuracy of the X1-axis; a "circular compensation" function for the vertical movement of the stylus; and a "stylus-tip diameter 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, retracting, and other operations to be performed remotely. The Drive Unit up/down position and the X1-axis traverse can be finely controlled manually.

Technical Data

X1 axis	
Measuring range:	100mm or 200mm
Resolution:	0.05 μ m
Scale:	Linear encoder
Drive speed:	0 - 80mm/s
Measuring speed:	0.02 - 5mm/s
Traverse linearity:	See page L-12
Inclining range:	$\pm 45^\circ$ (with X1-axis inclination unit)
Z2 axis (column)	
Vertical travel:	300mm or 500mm, power drive
Resolution:	1 μ m
Scale:	ABSOLUTE linear encoder
Drive speed:	0 - 20mm/s

Detector	
Range / resolution:	800 μ m / 0.01 μ m, 80 μ m / 0.001 μ m, 8 μ m / 0.0001 μ m (up to 2400 μ m with an optional stylus)
Measurement method:	Skidless / skidded
Measuring force:	4mN or 0.75mN (See page L-12)
Stylus tip:	Diamond, 90° / 5 μ mR (60° / 2 μ mR: low force type)
Type:	Differential inductance
Base size (W x H):	600 x 450mm or 1000 x 450mm
Base material:	Granite
Dimensions (W x D x H):	756 x 482 x 966mm (S4 type)
(Main unit)	756 x 482 x 1166mm (H4 type)
	1156 x 482 x 1176mm (W4 type)
	766 x 482 x 966mm (S8 type)
	766 x 482 x 1166mm (H8 type)
	1166 x 482 x 1176mm (W8 type)
Mass (Main unit)	140kg (S4 type, S8 type)
	150kg (H4 type, H8 type)
	220kg (W4 type, W8 type)

Evaluation Capability: FORMTRACEPAK

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

Parameters:
Ra, Rq, Sk, Ku, Rp, Rv, Ry, RyDIN, RzDIN, Rt, Rc, Rz, R3z, R3y, S, Δa , Δq , λa , λq , Lo, lr, 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

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

Graphs:
Amplitude distribution graphs, BAC1, BAC2, Power spectrum curve, Auto correlation curve, Inclination angle distribution curve, Peek point height distribution curve, Parameter distribution curve

Data compensation:
Tilt compensation, R-surface compensation, Ellipse compensation, Parabola compensation, Hyperbolic compensation, Polynomial compensation, Conic automatic compensation, Polynomial 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, 80mm, Arbitrary
 λs : 0.8, 2.5, 8, 25, 80, 250, 800 μ m Arbitrary

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

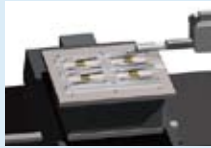
Optional Accessories

- 178-611:** Step gage (2μm, 10μm)
178-612: Step gage (2μm, 10μm, 79μinch, 394μinch)
178-610: Metric 4-step gage (1μm, 2μm, 5μm, 10μm)
178-047: Three-axis adjustment table (998291 is included.)
178-016: Leveling table
178-042-1: Digimatic XY leveling table (25 x 25mm)
178-052-1: Digimatic XY leveling table (1" x 1")
178-043-1: XY leveling table (25 x 25mm)
178-053-1: XY leveling table (1" x 1")
178-019: Precision vise*
998291: Precision V-block*
181-902-10: V-block set with clamp (Max. workpiece dia.: 25mm)
181-901-10: V-block set with clamp (Max. workpiece dia.: 1")
178-023: Vibration isolator
178-024: Stand for vibration isolator
218-007: Workbench
166-215: Workbench (with drawers)
218-010: Auxiliary desk
218-008: Auxiliary desk
 _____: Detectors, styli, and nosepieces (See pages L-23~L-24.)

* Use with an XY leveling table

Simplified CNC Function

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



Using Y-axis Table

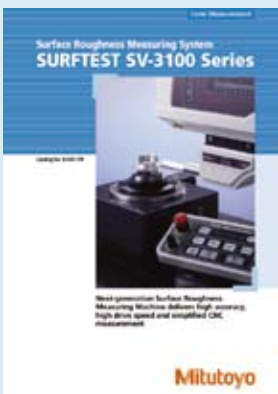


Using Rotary Table Ø100



Using Rotary Table Ø200

(See page L-37 for more details.)



Refer to the SurfTest SV-3100 Series leaflet (E4301) for more details.

SPECIFICATIONS

Model No.	SV-3100S4	SV-3100S4	SV-3100H4	SV-3100H4	SV-3100W4	SV-3100W4
Order No. (mm)	178-471-1*	178-471-2*	178-472-1*	178-472-2*	178-473-1*	178-473-2*
Order No. (inch)	178-481-1*	178-481-2*	178-482-1*	178-482-2*	178-483-1*	178-483-2*
Order No. (mm)	178-451-1*	178-451-2*	178-452-1*	178-452-2*	178-453-1*	178-453-2*
Order No. (inch)	178-461-1*	178-461-2*	178-462-1*	178-462-2*	178-463-1*	178-463-2*
Stylus tip	Tip angle	60°	90°	60°	90°	90°
	Tip radius	2μm	5μm	2μm	5μm	2μm
Detector measuring force	0.75mN	4mN	0.75mN	4mN	0.75mN	4mN
X1-axis measuring range	100mm					
X1-axis Traverse linearity	(0.05+1L/1000)μm L=Measured length (mm)					
Vertical travel	300mm power column		500mm power column		500mm manual column	
Granite base size (WxD)	600 x 450mm		600 x 450mm		1000 x 450mm	
Dimensions (main unit, WxDxH)	756 x 482 x 966mm		756 x 482 x 1166mm		1156 x 482 x 1176mm	
Mass (main unit)	140kg		150kg		220kg	

Model No.	SV-3100S8	SV-3100S8	SV-3100H8	SV-3100H8	SV-3100W8	SV-3100W8
Order No. (mm)	178-476-1*	178-476-2*	178-477-1*	178-477-2*	178-478-1*	178-478-2*
Order No. (inch)	178-486-1*	178-486-2*	178-487-1*	178-487-2*	178-488-1*	178-488-2*
Order No. (mm)	178-456-1*	178-456-2*	178-457-1*	178-457-2*	178-458-1*	178-458-2*
Order No. (inch)	178-466-1*	178-466-2*	178-467-1*	178-467-2*	178-468-1*	178-468-2*
Stylus tip	Tip angle	60°	90°	60°	90°	90°
	Tip radius	2μm	5μm	2μm	5μm	2μm
Detector measuring force	0.75mN	4mN	0.75mN	4mN	0.75mN	4mN
X1-axis measuring range	200mm					
X1-axis Traverse linearity	0.5μm/200mm					
Vertical travel	300mm power column		500mm power column		500mm manual column	
Granite base size (WxD)	600 x 450mm		600 x 450mm		1000 x 450mm	
Dimensions (main unit, WxDxH)	766 x 482 x 966mm		766 x 482 x 1166mm		1166 x 482 x 1176mm	
Mass (main unit)	140kg		150kg		220kg	

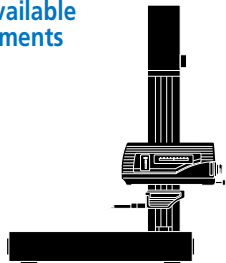
* To denote your AC power cable add the following suffixes to the order No.:
A for UUCSA, **D** for CEE, **DC** for CCC, **E** for BS, **K** for KC. **No suffix** is required for JIS/100V

Models without X1-axis inclination function

A variety of models available for measuring requirements

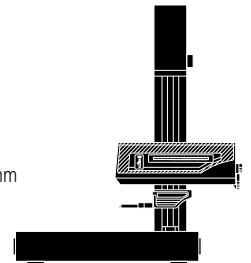
SV-3100S4

Traverse range: 100mm
 Vertical travel: 300mm
 Base size (W x D): 600 x 450mm
 Base material: Granite



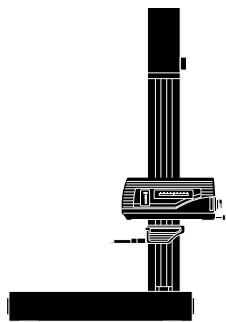
SV-3100S8

Traverse range: 200mm
 Vertical travel: 300mm
 Base size (W x D): 600 x 450mm
 Base material: Granite



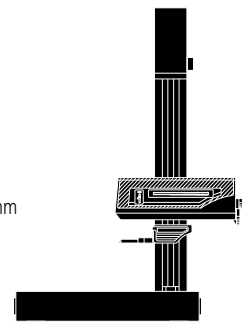
SV-3100H4

Traverse range: 100mm
 Vertical travel: 500mm
 Base size (W x D): 600 x 450mm
 Base material: Granite



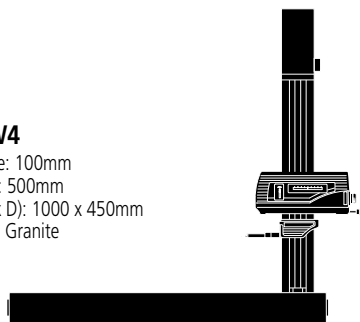
SV-3100H8

Traverse range: 200mm
 Vertical travel: 500mm
 Base size (W x D): 600 x 450mm
 Base material: Granite



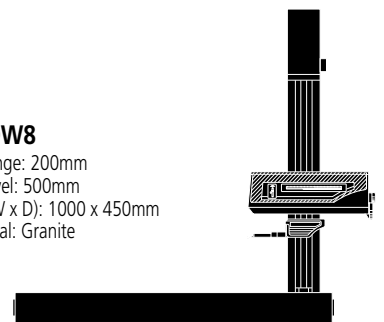
SV-3100W4

Traverse range: 100mm
 Vertical travel: 500mm
 Base size (W x D): 1000 x 450mm
 Base material: Granite



SV-3100W8

Traverse range: 200mm
 Vertical travel: 500mm
 Base size (W x D): 1000 x 450mm
 Base material: Granite



Surftest

Performs brilliantly in many situations such as in the quality control room, on the factory floor and on the production line.

Surftest Extreme SV-3000CNC / SV-M3000CNC SERIES 178 — CNC Surface Roughness Testers

- A highly accurate measuring instrument that allows CNC measurement of surface roughness and contour.
- Each axis has a maximum drive speed of 200mm/s, permitting high-speed positioning for increased throughput of multiple-profile/multiple-workpiece measurement tasks.
- For models equipped with the α 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 detector unit incorporates an anti-collision safety device that stops the detector unit if its main body 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.



SV-3000CNC with personal computer system and software

SPECIFICATIONS

Model No.	SV-3000CNC	SV-3000CNC	SV-3000CNC	SV-3000CNC	SV-3000CNC	SV-3000CNC	SV-3000CNC	SV-3000CNC
Order No. (100V - 120V)	178-521-1	178-541-1	178-522-1	178-542-1	178-523-1	178-543-1	178-524-1	178-544-1
Order No. (200V - 240V)	178-521-2	178-541-2	178-522-2	178-542-2	178-523-2	178-543-2	178-524-2	178-544-2
X1-axis measuring range	200mm	200mm	200mm	200mm	200mm	200mm	200mm	200mm
Z2-axis vertical travel	300mm	500mm	300mm	500mm	300mm	500mm	300mm	500mm
Y-axis table unit	—	—	—	—	Installed	Installed	Installed	Installed
α -axis unit	—	—	Installed	Installed	—	—	Installed	Installed

Technical Data: SV-3000CNC

X1 axis	
Measuring range:	200mm
Resolution:	0.05 μ m
Scale:	Reflective-type linear encoder
Drive speed:	200mm/s (max., CNC)
0 - 60mm/s (joystick)	
Measuring speed:	0.02 - 2mm/s
Traverse linearity:	0.5 μ m/200mm
α axis	
Inclination angle:	-45° to +10°
Resolution:	0.000225°
Rotating speed:	1rpm
Z2 axis (column)	
Vertical travel:	300mm (500mm)*
Resolution:	0.05 μ m
Scale:	Reflective-type linear encoder
Drive speed:	200mm/s (max., CNC)
0 - 60mm/s (joystick)	
Base size (W x H):	750 x 600mm
Base material:	Granite
Detector	
Range / resolution:	800 μ m / 0.01 μ m, 80 μ m / 0.001 μ m, 8 μ m / 0.0001 μ m
Measuring force:	4mN (Order No. 178-397-2) 0.75mN (low force type. Order No. 178-396-2)
Stylus tip:	Diamond, 90° / 5 μ mR (60° / 2 μ mR: low force type)
Dimension (W x D x H):	800 x 651 x 1000mm (800 x 651 x 1200mm)*
Mass:	240kg (250kg)*
* High column model	

Optional Accessories

Vibration insulating stand	
Vibration insulating mechanism:	Diaphragm air spring
Natural frequency :	2.5 - 3.5Hz
Damping mechanism:	Orifice
Leveling mechanism:	Automatic control with mechanical valves
Air supply pressure:	0.4MPa
Allowable loading capacity:	350kg
Dimension(WxDxH):	1000 x 895 x 715mm
Mass:	315kg
Y-axis table unit	
Measuring range:	200mm
Minimum reading :	0.05 μ m
Scale unit:	Reflective-type Linear Encoder
Drive speed:	200mm/s (max., CNC)
0 - 60mm/s (joystick)	
Maximum loading capacity:	20kg
Traverse linearity	0.5 μ m / 200mm
Accuracy (at 20°C):	$\pm(2+2L/100)\mu$ m, L: Dimension between two measured points (mm)
Table size:	200 x 200mm
Dimension(WxDxH):	320 x 646 x 105mm
Mass:	35kg



Refer to the CNC Form Measuring Instrument Series leaflet (E4284) for more details.

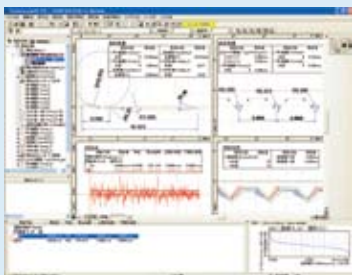
Technical Data: SV-M3000CNC

X1 axis	
Measuring range:	200mm
Resolution:	0.05µm
Scale:	Reflective-type linear encoder
Drive speed:	200mm/s (max., CNC) 0 - 50mm/s (joystick)
Measuring speed:	0.02 - 2mm/s
Traverse linearity:	0.5µm / 200mm 0.7µm / 200mm (long-type detector) 0.5µm / 200mm (rotary-type detector, up/down direction) 0.7µm / 200mm rotary-type detector, forward/backward direction)
α axis	
Inclination angle:	-45° to +10°
Resolution:	0.000225°
Rotating speed:	1rpm
Z2 axis (column)	
Vertical travel:	500mm
Resolution:	0.05µm
Scale:	Reflective-type linear encoder
Drive speed:	200mm/s (max., CNC) 0 - 50mm/s (joystick)
Y axis	
Measuring range:	800mm
Resolution:	0.05µm
Scale:	Reflective-type linear encoder
Drive speed:	200mm/s (max., CNC) 0 - 50mm/s (joystick)
Measuring speed:	0.02 - 2mm/s
Traverse linearity:	0.5µm / 50mm, 2µm / 800mm 0.7µm / 50mm, 3µm / 800mm (long-type detector) 0.7µm / 50mm, 3µm / 800mm (rotary-type detector, up/down direction)
Base unit	
Size (W x H):	600 x 1500mm
Material:	Steel
Loading capacity:	300kg
Detector	
Range / resolution:	800µm / 0.01µm, 80µm / 0.001µm, 8µm / 0.0001µm (up to 2400µm with an optional stylus)
Measuring force:	4mN (Order No. 178-397-2) 0.75mN (low force type. 178-396-2)
Stylus tip:	Diamond, 90° / 5µmR (60° / 2µmR: low force type)
Type:	Differential inductance
Dimension (W x D x H):	1085 x 1695 x 1922mm
Mass:	1600Kg (including vibration isolating unit)



Optional Software FORMTRACEPAK

Enables control of the optional motor-driven Y-axis table and rotary table for realizing efficient measurement automation. You can also perform contour evaluation that allows free analysis of level differences, angle, pitch, area and other characteristics based on surface roughness data. In addition, you can create an original inspection certificate by setting the print format to suit your particular requirements.



SV-M3000CNC with personal computer system and software

- A CNC Surface Roughness Tester that handles measurement of large/heavy workpieces such as engine blocks, crankshafts, etc.
- Combined with surface roughness detector swiveling 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 100kg, or a large Ø2 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 contractions. Advantageous for measuring large, heavy workpieces such as engine blocks, crankshafts, etc.
- An 800mm 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.

SPECIFICATIONS

Model No.	SV-M3000CNC		
Order No. (100V - 120V)	178-549-1		
Order No. (200V - 240V)	178-549-2		
Detector hold type (Essential option)	Standard S-3000 178-071	Long-type S-3000L 178-072	Rotary-type S-3000 178-073
X1-axis measuring range	200mm		
Z2-axis column travel range	500mm		
Y-axis travel range	800mm		
α-axis inclination angle	-45° (CCW), +10° (CW)		

Formtracer

Hybrid machine with dual-role capability

Formtracer SV-C3200 / SV-C4500 SERIES 525 — Surface Roughness / Contour Measuring System



SV-C3200S4 with personal computer system and software

- Dramatically increased drive speed (X1 axis: 80mm/s, Z2 axis column: 30mm/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 traverse linearity 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.

Automatic Measurement

- A wide range of optional peripherals are available for use with CNC models for automatic measurement.



Using Y axis Table



Using Rotary Table 01



Using Rotary Table 02

(See page L-37 for more details.)

Surface Roughness Measurement



- Traverse linearity: $\pm(0.05+0.001L)\mu\text{m}^*$
Designed to handle workpieces calling for high accuracy.
* S4, H4, W4 types, L = Drive length (mm)
- Compliant with JIS '82/'94/'01, ISO, ANSI, DIN, VDA, and other international surface roughness standards.
- Equipped as standard with a high accuracy detector (0.75mN / 4mN measuring force) providing a resolution down to 0.0001 μm .

Contour Drive Measurement



- X1-axis accuracy: $\pm(0.8+0.01L)\mu\text{m}^*$
Z1-axis accuracy: $\pm(0.8+12H/100)\mu\text{m}^{**}$
Designed to handle workpieces calling for high accuracy.
* SV-C3200S4, H4, W4, SV-C4500S4, H4, W4 types, L = Drive length
** SV-C4500S4, H4, W4, S8, H8, W8 types, H = Measurement height (mm)
- The contour drive unit of SV-C4500 series instruments can continuously measure in the upward and downward directions without the need to change the arm orientation or reset the workpiece, when combined with the double cone-end stylus (a new product with contact points in the upward and downward directions).

Technical Data: Common

Base size (W x H):	600 x 450mm or 1000 x 450mm
Base material:	Granite
Mass	
Main unit:	140kg (S4), 150kg (H4), 220kg (W4) 140kg (S8), 150kg (H8), 220kg (W8)
Controller Unit:	14kg
Remote Control Box:	0.9kg
Power supply:	100 - 120V AC $\pm 10\%$, 200 - 240V AC $\pm 10\%$, 50/60Hz
Power consumption:	400W (main unit only)

Technical Data: Contour Measurement

X1 axis	
Measuring range:	100mm or 200mm
Resolution:	0.05 μm
Scale:	Reflective-type linear encoder
Drive speed:	0 - 80mm/s and manual
Measuring speed:	0.02 - 5mm/s
Measuring direction:	Forward/backward <small>* As for SV-C4500, set the measurement force with Formtracepak.</small>
Traverse linearity:	0.8 μm / 100mm, 2 μm / 200mm <small>* with the X1 axis in horizontal orientation</small>
Accuracy (at 20°C):	$\pm(0.8+0.01L)\mu\text{m}$ (SV-C3200S4, H4, W4, SV-C4500S4, H4, W4) $\pm(0.8+0.02L)\mu\text{m}$ (SV-C3200S8, H8, W8, SV-C4500S8, H8, W8) <small>* L = Drive length (mm)</small>
Inclining range:	$\pm 45^\circ$ (with X1 axis inclination unit)
Z2 axis (column)	
Vertical travel:	300mm or 500mm
Resolution:	1 μm
Scale:	ABSOLUTE linear encoder
Drive speed:	0 - 30mm/s and manual
Z1 axis (detector unit)	
Measuring range:	$\pm 30\text{mm}$
Resolution:	0.04 μm (SV-C3200), 0.02 μm (SV-C4500)
Scale:	Rotary arc encoder
Accuracy (at 20°C):	$\pm(1.6+12H/100)\mu\text{m}$ (SV-C3200) $\pm(0.8+12H/100)\mu\text{m}$ (SV-C4500) <small>* H: Measurement height from the horizontal position (mm)</small>
Stylus up/down operation:	Arc movement
Face of stylus:	Upward/downward (SV-C3200) Upward/downward (Direction switch by Formtracepak) (SV-C4500)
Measuring force:	30mN (SV-C3200) 10, 20, 30, 40, 50mN (SV-C4500) <small>* As for SV-C4500, set the measurement force with Formtracepak.</small>
Traceable angle:	Ascent: 77° , descent: 83° <small>(using the standard stylus provided and depending on the surface roughness)</small>
Stylus tip	Radius: 25 μm , carbide tip

Technical Data: Surface Roughness Measurement

X1 axis	
Measuring range:	100mm or 200mm
Resolution:	0.05 μm
Scale:	Linear encoder
Drive speed:	0 - 80mm/s and manual
Traverse direction:	Backward
Traverse linearity:	$(0.05+1L/1000)\mu\text{m}$ (S4, H4, W4 types) 0.5 μm /200mm (S8, H8, W8 types)
Z2 axis (column)	
Vertical travel:	300mm or 500mm
Resolution:	1 μm
Scale:	ABSOLUTE linear encoder
Drive speed:	0 - 30mm/s and manual
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)
Measuring force:	4mN or 0.75mN (low force type)
Stylus tip:	Diamond, 90° / 5 μm R (60° / 2 μm R: low force type)
Type:	Differential inductance



MiCAT

Mitutoyo Intelligent Computer Aided Technology

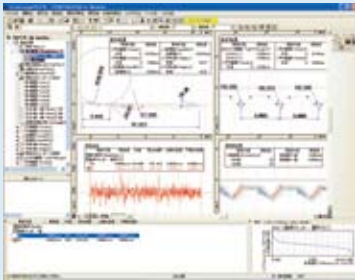
the standard in world
metrology software

FORM

Optional Software

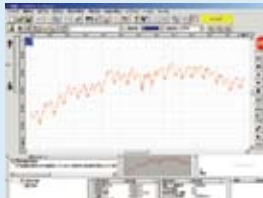
FORMTRACEPAK

Allows control of the optional motor-driven Y-axis table and rotary table for efficient measurement automation. Contour evaluation can be performed using analysis of level differences, angle, pitch, area and other characteristics based on surface roughness data. An original inspection certificate can be created by setting the print format to selected requirements.



Contour Measurement Screen

Surface Roughness Measurement Screen



SPECIFICATIONS

Model No.	SV-C3200S4	SV-C3200S4	SV-C3200H4	SV-C3200H4	SV-C3200W4	SV-C3200W4
Order No. (mm)	525-481*-1	525-481*-2	525-482*-1	525-482*-2	525-483*-1	525-483*-2
Order No. (inch)	525-491*-1	525-491*-2	525-492*-1	525-492*-2	525-493*-1	525-493*-2

Model No.	SV-C4500S4	SV-C4500S4	SV-C4500H4	SV-C4500H4	SV-C4500W4	SV-C4500W4
Order No. (mm)	525-441*-1	525-441*-2	525-442*-1	525-442*-2	525-443*-1	525-443*-2
Order No. (inch)	525-451*-1	525-451*-2	525-452*-1	525-452*-2	525-453*-1	525-453*-2
X1-axis measuring range	100mm	100mm	100mm	100mm	100mm	100mm
Detector measuring force	0.75mN	4mN	0.75mN	4mN	0.75mN	4mN
Vertical travel	300mm power column		500mm power column		500mm power column	
Granite base size (WxD)	600 x 450mm		600 x 450mm		1000 x 450mm	
Dimensions (main unit, WxDxH)	996 x 575 x 966mm		996 x 575 x 1176mm		1396 x 575 x 1176mm	
Mass (main unit)	140kg		150kg		220kg	

Model No.	SV-C3200S8	SV-C3200S8	SV-C3200H8	SV-C3200H8	SV-C3200W8	SV-C3200W8
Order No. (mm)	525-486*-1	525-486*-2	525-487*-1	525-487*-2	525-488*-1	525-488*-2
Order No. (inch)	525-496*-1	525-496*-2	525-497*-1	525-497*-2	525-498*-1	525-498*-2

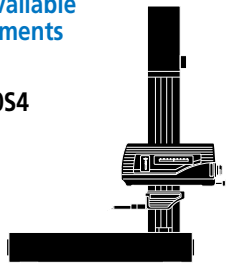
Model No.	SV-C4500S8	SV-C4500S8	SV-C4500H8	SV-C4500H8	SV-C4500W8	SV-C4500W8
Order No. (mm)	525-446*-1	525-446*-2	525-447*-1	525-447*-2	525-448*-1	525-448*-2
Order No. (inch)	525-456*-1	525-456*-2	525-457*-1	525-457*-2	525-458*-1	525-458*-2
X1-axis measuring range	200mm	200mm	200mm	200mm	200mm	200mm
Detector measuring force	0.75mN	4mN	0.75mN	4mN	0.75mN	4mN
Vertical travel	300mm power column		500mm power column		500mm power column	
Granite base size (WxD)	600 x 450mm		600 x 450mm		1000 x 450mm	
Dimensions (main unit, WxDxH)	1006 x 575 x 966mm		1006 x 575 x 1176mm		1406 x 575 x 1176mm	
Mass (main unit)	140kg		150kg		220kg	

* To denote your AC power cable add the following suffixes to the order No.:
 "mm" type: **A** for UL/CSA, **C** for JIS (for Taiwan), **D** for CEE, **E** for BS, **DC** for China, **K** for KC
 "inch" type: **A** for UL/CSA, **D** for CEE, **E** for BS, **DC** for China. **No suffix** is required for JIS/100V (for Taiwan)

A variety of models available for measuring requirements

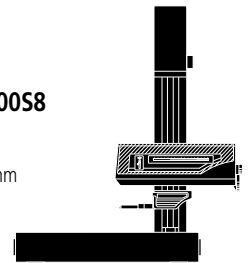
SV-C3200S4 / SV-C4500S4

Traverse range: 100mm
 Vertical travel: 300mm
 Base size (W x D): 600 x 450mm
 Base material: Granite



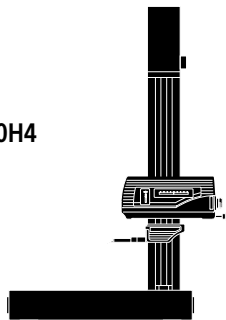
SV-C3200S8 / SV-C4500S8

Traverse range: 200mm
 Vertical travel: 300mm
 Base size (W x D): 600 x 450mm
 Base material: Granite



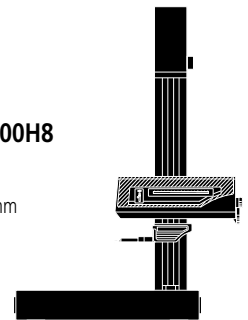
SV-C3200H4 / SV-C4500H4

Traverse range: 100mm
 Vertical travel: 500mm
 Base size (W x D): 600 x 450mm
 Base material: Granite



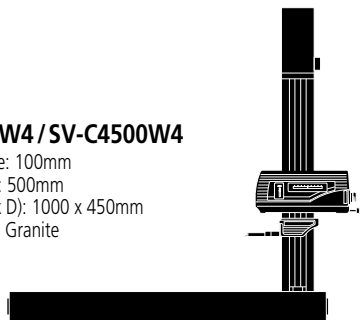
SV-C3200H8 / SV-C4500H8

Traverse range: 200mm
 Vertical travel: 500mm
 Base size (W x D): 600 x 450mm
 Base material: Granite



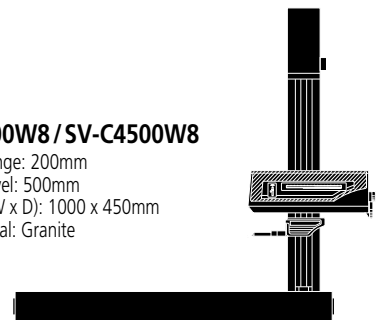
SV-C3200W4 / SV-C4500W4

Traverse range: 100mm
 Vertical travel: 500mm
 Base size (W x D): 1000 x 450mm
 Base material: Granite



SV-C3200W8 / SV-C4500W8

Traverse range: 200mm
 Vertical travel: 500mm
 Base size (W x D): 1000 x 450mm
 Base material: Granite



Formtracer

Hybrid machine with dual-role capability

Formtracer Extreme SV-C3000CNC / SV-C4000CNC SERIES 525 — Surface Roughness/Form Measuring Instrument



SV-C3000CNC with personal computer system and software

Surface roughness drive unit



Contour drive unit



- High-accuracy CNC Measuring Instrument that allows measurement of surface roughness and form/contour with one unit.
- Each axis has the maximum drive speed of 200mm/s, which permits high-speed positioning that may result in a large increase in the throughput of multiple-profile/multiple-workpiece measurement tasks.
- For models with the α axis, it is possible to perform continuous measurement over horizontal and inclined surfaces by power-tilting the detector 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 of SV-C4000CNC series is equipped with a Laser Hologage detector giving excellent narrow/wide range accuracy and resolution in the Z1-axis.

- Enables inclined plane measurements through simultaneous control of the X1 and Z2-axes.
- When the detector for form/contour measurement is replaced with that for surface roughness measurement, or vice versa, it is a simple, one-touch replacement without re-routing of the connecting cables.
- Since the Z1-axis detector incorporates an anti-collision safety device, the detector unit will automatically stop even if its main body 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.

Technical Data: Common

Base size (W x D):	750 x 600mm
Base material:	Granite
Mass:	240kg, 250kg (high column type)
Power supply:	100 - 240V AC $\pm 10\%$, 50/60Hz
Power consumption:	500W (main unit only)

Technical Data: Contour Measurement

X1 axis	
Measuring range:	200mm
Resolution:	0.05 μ m
Scale type:	Reflective-type linear encoder
Drive speed:	200mm/s (max., CNC) 0 - 60mm/s (joystick)
Measuring speed:	0.02 - 2mm/s
Measuring direction:	Forward/backward
Traverse linearity:	2 μ m / 200mm
Accuracy (at 20°C):	$\pm(1+4L/200)\mu$ m (SV-C3000CNC) $\pm(0.8+4L/200)\mu$ m (SV-C4000CNC)
Inclination angle:	-45° to +10°
Resolution:	0.000225°
Rotating speed:	1rpm
Z2 axis (column)	
Vertical travel:	300mm or 500mm
Resolution:	0.05 μ m
Scale type:	Reflective-type linear encoder
Drive speed:	200mm/s (max., CNC) 0 - 60mm/s (joystick)
Z1 axis (detector unit)	
Measuring range:	± 25 mm
Resolution:	0.2 μ m (SV-C3000CNC), 0.05 μ m (SV-C4000CNC)
Scale type:	Linear encoder (SV-C3000CNC), laser hologage (SV-C4000CNC)
Accuracy (at 20°C):	$\pm(2+4H/100)\mu$ m (SV-C3000CNC) $\pm(0.8+10.5H/25)\mu$ m (SV-C4000CNC)
	* H: Measurement height from the horizontal position (mm)
Stylus movement:	Arc
Face of stylus:	Downward
Measuring force:	30mN
Traceable angle:	Ascent: 70°, descent: 70° (using the standard stylus provided and depending on the surface roughness)
Stylus tip:	Radius: 25 μ m, carbide tip

Technical Data: Surface Roughness Measurement

X1 axis	
Measuring range:	200mm
Resolution:	0.05 μ m
Scale type:	Reflective-type linear encoder
Drive speed:	200mm/s (max., CNC) 0 - 60mm/s (joystick)
Measuring speed:	0.02 - 2mm/s
Traverse linearity:	0.5 μ m / 200mm
α axis	
Inclination angle:	-45° to +10°
Resolution:	0.000225°
Rotating speed:	1rpm
Z2 axis (column)	
Vertical travel:	300mm or 500mm
Resolution:	0.05 μ m
Scale type:	Reflective-type linear encoder
Drive speed:	200mm/s (max., CNC) 0 - 60mm/s (joystick)
Detector (optional)	
Range/resolution:	800 μ m / 0.01 μ m, 80 μ m / 0.001 μ m, 8 μ m / 0.0001 μ m (up to 2400 μ m with an optional stylus)
Measuring force:	4mN or 0.75mN (low force type)
Stylus tip:	Diamond, 90° / 5 μ mR (60° / 2 μ mR: low force type)
Detecting method:	Differential inductance

Optional Accessories

Vibration insulating stand

Vibration insulating mechanism: Diaphragm air spring
 Natural frequency: 2.5 - 3.5Hz
 Damping mechanism: Orifice
 Leveling mechanism: Automatic control with mechanical valves
 Air supply pressure: 0.4Mpa
 Allowable loading capacity: 350kg
 Dimensions (WxDxH): 1000 x 895 x 715mm
 Mass: 315kg

Y-axis table unit

Measuring range: 200mm
 Minimum reading: 0.05µm
 Scale unit: Reflective-type Linear Encoder
 Drive speed: 200mm/s (max., CNC)
 0 - 60mm/s (joystick)

Maximum loading capacity: 20 kg
 Traverse linearity: 0.5µm/200mm
 Accuracy (at 20°C): ± (2+2L/100)µm, contour mode
 L: Dimension between two measured points (mm)

Table size: 200 x 200mm
 Dimensions (WxDxH): 320 x 646 x 105mm
 Mass: 35kg



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

Optional Software FORMTRACEPAK

Enables control of the optional motor-driven Y-axis table and rotary table for realizing efficient measurement automation. You can also perform contour evaluation that allows free analysis of level differences, angle, pitch, area and other characteristics based on surface roughness data. In addition, you can create an original inspection certificate by setting the print format to suit your particular requirements.



Refer to the CNC Form Measuring Instrument Series leaflet (E4284) for more details.

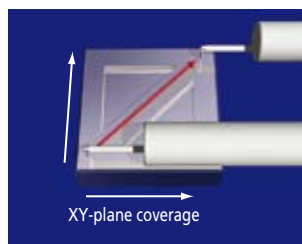
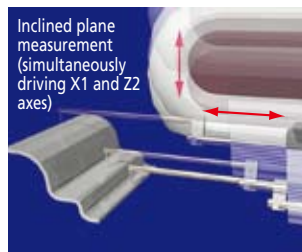
SPECIFICATIONS

Model No.	SV-C3000CNC	SV-C3000CNC	SV-C3000CNC	SV-C3000CNC
Order No. (100V - 120V)	525-521-1	525-522-1	525-523-1	525-524-1
Order No. (200V - 240V)	525-521-2	525-522-2	525-523-2	525-524-2
X1-axis measuring range	200mm	200mm	200mm	200mm
Z2-axis vertical travel	300mm	300mm	300mm	300mm
Y-axis table unit	—	—	Installed	Installed
α-axis unit	—	Installed	—	Installed
Granite base size (WxD)	750 x 600mm	750 x 600mm	750 x 600mm	750 x 600mm
Dimensions (main unit, WxDxH)	800 x 651 x 1000mm	800 x 651 x 1000mm	800 x 651 x 1000mm	800 x 651 x 1000mm
Mass (main unit)	240kg	240kg	240kg	240kg

Model No.	SV-C3000CNC	SV-C3000CNC	SV-C3000CNC	SV-C3000CNC
Order No. (100V - 120V)	525-541-1	525-542-1	525-543-1	525-544-1
Order No. (200V - 240V)	525-541-2	525-542-2	525-543-2	525-544-2
X1-axis measuring range	200mm	200mm	200mm	200mm
Z2-axis vertical travel	500mm	500mm	500mm	500mm
Y-axis table unit	—	—	Installed	Installed
α-axis unit	—	Installed	—	Installed
Granite base size (WxD)	750 x 600mm	750 x 600mm	750 x 600mm	750 x 600mm
Dimensions (main unit, WxDxH)	800 x 651 x 1200mm	800 x 651 x 1200mm	800 x 651 x 1200mm	800 x 651 x 1200mm
Mass (main unit)	250kg	250kg	250kg	250kg

Model No.	SV-C4000CNC	SV-C4000CNC	SV-C4000CNC	SV-C4000CNC
Order No. (100V - 120V)	525-621-1	525-622-1	525-623-1	525-624-1
Order No. (200V - 240V)	525-621-2	525-622-2	525-623-2	525-624-2
X1-axis measuring range	200mm	200mm	200mm	200mm
Z2-axis vertical travel	300mm	300mm	300mm	300mm
Y-axis table unit	—	—	Installed	Installed
α-axis unit	—	Installed	—	Installed
Granite base size (WxD)	750 x 600mm	750 x 600mm	750 x 600mm	750 x 600mm
Dimensions (main unit, WxDxH)	800 x 651 x 1000mm	800 x 651 x 1000mm	800 x 651 x 1000mm	800 x 651 x 1000mm
Mass (main unit)	240kg	240kg	240kg	240kg

Model No.	SV-C4000CNC	SV-C4000CNC	SV-C4000CNC	SV-C4000CNC
Order No. (100V - 120V)	525-641-1	525-642-1	525-643-1	525-644-1
Order No. (200V - 240V)	525-641-2	525-642-2	525-643-2	525-644-2
X1-axis measuring range	200mm	200mm	200mm	200mm
Z2-axis vertical travel	500mm	500mm	500mm	500mm
Y-axis table unit	—	—	Installed	Installed
α-axis unit	—	Installed	—	Installed
Granite base size (WxD)	750 x 600mm	750 x 600mm	750 x 600mm	750 x 600mm
Dimensions (main unit, WxDxH)	800 x 651 x 1200mm	800 x 651 x 1200mm	800 x 651 x 1200mm	800 x 651 x 1200mm
Mass (main unit)	250kg	250kg	250kg	250kg



Formtracer

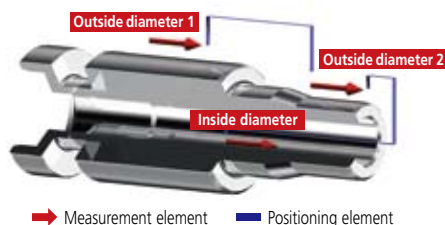
Hybrid machine with dual-role capability

Formtracer CS-3200 SERIES 525 — Surface Roughness / Contour Measuring System

CS-3200S4 with personal computer system and software



- 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)

- 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 5mm to 50mm when contour detector units 3000, or 4000, are specified. (Both are factory-installed options.)
- Drive unit (X1-axis) tilting function powerfully supports measurements on inclined planes and for heavy workpieces that are not easily moved.

- Dramatically increased drive speed (X1 axis: 80mm/s, Z2 axis: 20mm/s) further reduces total measurement time. Small holes can be efficiently measured using the fine-feed knobs on the X and Z2 axes.

Technical Data: Common

Base size (W x D):	600 x 450mm
Base material:	Granite
Dimension (W x D x H):	756 x 482 x 966mm (main unit)
Mass:	140kg (main unit)
Power supply:	100 - 240V AC ±10%, 50/60Hz
Power consumption:	400W (main unit only)

Technical Data:

X1 axis	
Measuring range:	100mm
Resolution:	0.05μm
Drive speed:	0 - 80mm/s and manual
Measuring speed:	0.02, 0.05, 0.1, 0.2mm/s (in surface roughness measurement) 0.02, 0.05, 0.1, 0.2, 0.5, 1, 2mm/s (In contour measurement)
Measuring direction:	Forward / backward
Traverse linearity:	0.2μm/100mm (0.4μm/100mm: at the extended detector position) * with the X1 axis in horizontal orientation
Accuracy (at 20°C):	±(0.8+0.01L)μm L = Drive length (mm)
Inclining range:	±45°
Z1 axis	
Measuring range:	5mm
Resolution:	80nm (5mm range) 8nm (0.5mm range) 0.8nm (0.05mm range)
Accuracy (at 20°C):	±(1.5+12H/100)μm * H: Measurement height from the horizontal position (mm)
Measuring force:	0.75mN
Traceable angle:	Ascent: 65°, Descent: 65° (using the standard chisel-cut stylus and depending on the surface roughness)
Stylus tip (standard):	Tip angle: 60°, Tip radius: 2μm, Diamond tip
Stylus tip (cone):	Tip angle: 30°, Tip radius: 25μm, Sapphire tip
Face of stylus:	Downward
Z2 axis (column)	
Column travel:	300mm
Resolution:	1μm
Drive speed:	0 - 20mm/s and manual

Main Unit Startup System

This machine incorporates a startup system (relocation detection system), which disables operation when an unexpected vibration is applied or the machine is relocated. Be sure to contact your nearest Mitutoyo office prior to relocating this machine after initial installation. Refer to page IX for details.



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FORM

Optional Software
FORMTRACEPAK-6000

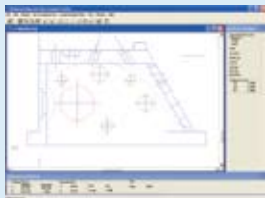


Measuring instrument control

Contour analysis



Surface roughness analysis



Contour verification



Inspection certificate creation



Refer to the Formtracer CS-3200 leaflet (E4327) for more details.

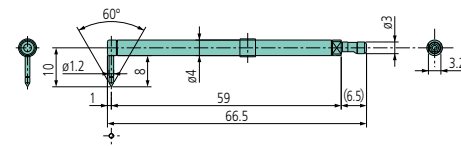
SPECIFICATIONS

Model No.	CS-3200S4
Order No. (mm)	525-401*
Order No. (inch)	525-411*
X1-axis measuring range	100mm
Z2-axis vertical travel	300mm
Y-axis table unit	Option
α-axis unit	Installed

* To denote your AC power cable add the following suffixes to the order No.:
"mm" type: **A** for UL/CSA, **C** for JIS (for Taiwan), **D** for CEE, **E** for BS, **DC** for China, **K** for KC
"inch" type: **A** for UL/CSA, **D** for CEE, **E** for BS, **DC** for China. **No suffix** is required for JIS/100V (for Taiwan)

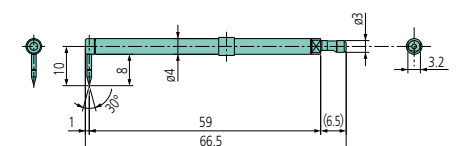
Stylus

No.12AAD554: Standard stylus (Standard accessory)
For contour/surface roughness measurement



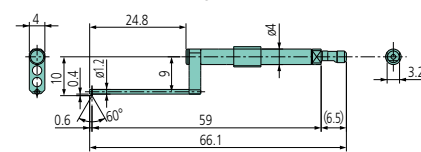
Tip radius: 2µm
Tip material: Diamond

No.12AAD552: Cone stylus (Standard accessory)
For contour measurement



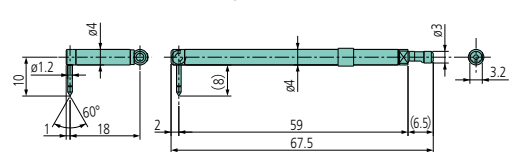
Tip radius: 25µm
Tip material: Sapphire

No.12AAD556: Small hole stylus
For contour/surface roughness measurement



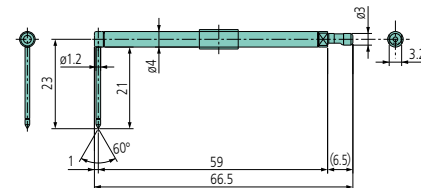
Tip radius: 2µm
Tip material: Diamond

No.12AAD558: Eccentric type stylus
For contour/surface roughness measurement



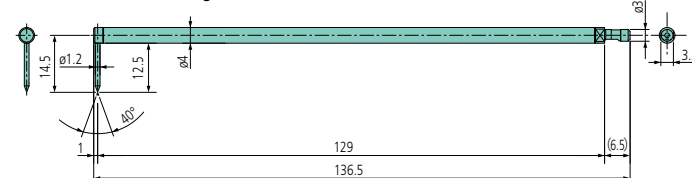
Tip radius: 2µm
Tip material: Diamond

No.12AAD560: Deep groove stylus
For contour/surface roughness measurement



Tip radius: 2µm
Tip material: Diamond

No.12AAD562: 2x-long stylus*1
For contour/surface roughness measurement



Tip radius: 5µm
Tip material: Diamond

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

Formtracer

Hybrid machine with dual-role capability

Formtracer Extreme CS-5000CNC / CS-H5000CNC SERIES 525 — CNC Form Measuring Instruments



CS-H5000CNC with personal computer system and software

Remote box



Wide range detector employing active control technology



- 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 40mm/s and 200mm/s, respectively. This permits high-speed positioning that may result in a large increase in the throughput of multiple-profile / multiple-workpiece measurement tasks.
- A Mitutoyo Laser Hologram is incorporated in the X1 and Z1 axes so that high resolution [X1 axis: 6.25nm, Z1 axis: 4nm / 8nm (CS-5000CNC), 1nm / 2nm (CS-H5000CNC)] is achieved and batch measurement of form/contour and surface roughness can be made.
- 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.

- Since the Z1-axis detector incorporates an anti-collision safety device, the detector unit will automatically stop even if its main body collides with a workpiece or jig.
- The CS-5000CNC model has an α axis, enabling continuous measurement over horizontal and inclined surfaces by power-tilting the X1-axis.
- 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.
- Supplied with the easy-to-operate Remote Box, on 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.
- Uses USB for communicating with the Data Processing / Analysis Unit (optional).

Technical Data:

X1 axis	
Measuring range:	200mm
Resolution:	0.00625 μ m
Scale type:	Laser Hologram
Drive speed:	Max. 40mm/s (in CNC mode) 0 - 40mm/s (in joystick control mode)
Measuring speed:	0.02 - 0.2mm/s (surface roughness) 0.02 - 2mm/s (form/contour)
Measuring direction:	Forward / backward direction
Traverse linearity:	(0.1+0.0015L) μ m with standard stylus (0.2+0.0015L) μ m with 2X-long stylus
Traverse linearity:	(0.05+0.0003L)μm with standard stylus (0.1+0.0015L)μm with 2X-long stylus (CS-H5000CNC)
Accuracy (at 20°C):	\pm (0.3+0.002L) μ m
Accuracy (at 20°C):	\pm(0.16+0.001L)μm L = Measured length (mm)
Z1 axis	
Measuring range:	12mm (with standard stylus) 24mm (with 2X-long stylus)
Resolution:	0.004 μ m (with standard stylus) 0.008 μ m (with 2X-long stylus) 0.001 μ m (with standard stylus) (CS-H5000CNC) 0.002 μ m (with 2X-long stylus) (CS-H5000CNC)
Stylus movement:	Arc
Scale type:	Laser Hologram
Accuracy (at 20°C):	\pm (0.3+{0.02H}) μ m
Accuracy (at 20°C):	\pm(0.07+{0.02H})μm H = Measured height (mm)
Measuring force:	4mN (with standard stylus) 0.75mN (with 2X-long stylus)
Traceable angle:	60° for ascent, 60° for descent (Depending on the workpiece surface condition)
Stylus tip:	See the L-22 page
Face of stylus:	Downward
Z2 axis (column unit)	
Traverse range:	300mm or 500mm * CS-H5000CNC : 300mm only.
Resolution:	0.05 μ m
Scale type:	Reflective-type linear encoder
Drive speed:	Max. 200mm/s (in CNC mode) 0 - 50mm/s (in joystick control mode)
Base size (W x D):	750 x 600mm
Base material:	Granite
Y axis	
Measuring range:	200mm
Resolution :	0.05 μ m
Drive speed:	Max. 200mm/s (in CNC mode) 0~50mm/s (in joystick control mode)
Max. workpiece load:	20kg
Traverse linearity:	0.5 μ m/200mm
Accuracy (at 20°C):	\pm (2+2L/100) μ m L = Measured length (mm)
Dimension(WxDxH):	800 x 620 x 1000mm (800 x 620 x 1200mm: high column type)
Mass:	240kg (250kg: high column type)

* Data in red are for CS-H5000CNC



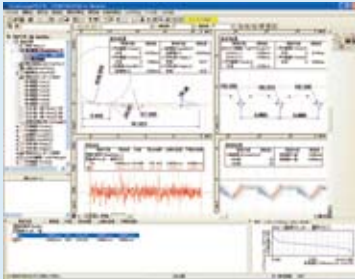
MiCAT
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FORM

**Optional Software
FORMTRACEPAK**

Enables control of the optional motor-driven Y-axis table and rotary table for realizing efficient measurement automation. You can also perform contour evaluation that allows free analysis of level differences, angle, pitch, area and other characteristics based on surface roughness data. In addition, you can create an original inspection certificate by setting the print format to suit your particular requirements.



ASLPAK
Aspherical lens analysis program



SPECIFICATIONS

Model No.	CS-5000CNC	CS-5000CNC	CS-5000CNC	CS-5000CNC
Order No.* (100V - 120V)	525-721-1	525-722-1	525-723-1	525-724-1
Order No.* (200V - 240V)	525-721-2	525-722-2	525-723-2	525-724-2
X1-axis measuring range	200mm	200mm	200mm	200mm
Z2-axis vertical travel	300mm	300mm	300mm	300mm
Y-axis table unit	—	—	Installed	Installed
α-axis unit	—	Installed	—	Installed

Model No.	CS-5000CNC	CS-5000CNC	CS-5000CNC	CS-5000CNC
Order No.* (100V - 120V)	525-741-1	525-742-1	525-743-1	525-744-1
Order No.* (200V - 240V)	525-741-2	525-742-2	525-743-2	525-744-2
X1-axis measuring range	200mm	200mm	200mm	200mm
Z2-axis vertical travel	500mm	500mm	500mm	500mm
Y-axis table unit	—	—	Installed	Installed
α-axis unit	—	Installed	—	Installed

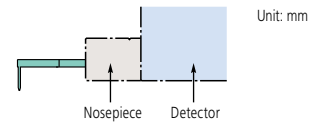
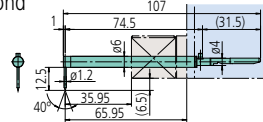
* Select one of the optional accessory sets suited to your AC line voltage and measurement unit. **12AAL412** (mm, UL/CSA), **12AAL413** (mm, EU), **12AAL414** (mm, BS), **12AAL418** (mm, China), **12AAL419** (mm, KC), **12AAL415** (inch, UL/CSA), **12AAL416** (inch, EU), **12AAL417** (inch, BS), **12AAL420** (inch, China)

Model No.	CS-H5000CNC	CS-H5000CNC
Order No.* (100V - 120V)	525-761-1	525-763-1
Order No.* (200V - 240V)	525-761-2	525-763-2
X1-axis measuring range	200mm	200mm
Z2-axis vertical travel	300mm	300mm
Y-axis table unit	—	Installed
α-axis unit	—	—

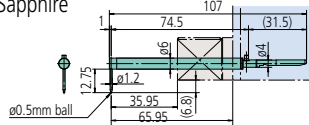
* Select one of the optional accessory sets suited to your AC line voltage and measurement unit. **12AAL422** (mm, UL/CSA), **12AAL423** (mm, EU), **12AAL424** (mm, BS), **12AAL428** (mm, China), **12AAL429** (mm, KC), **12AAL425** (inch, UL/CSA), **12AAL426** (inch, EU), **12AAL427** (inch, BS), **12AAL430** (inch, China)

Stylus

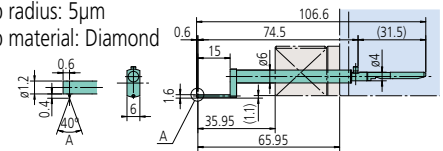
12AAD543*1: Standard-length stylus (tip radius: 5µm)
12AAJ037*2: For CS-H5000CNC (tip radius: 5µm)
Tip material: Diamond



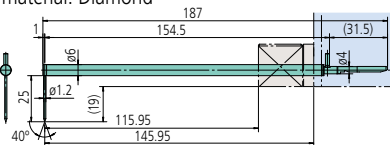
12AAD544*1*2: Standard-length ball stylus (tip radius: 5µm)
Tip material: Sapphire



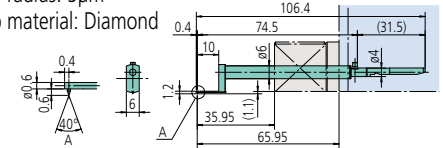
12AAD651: Standard-length stylus for small hole
Tip radius: 5µm
Tip material: Diamond



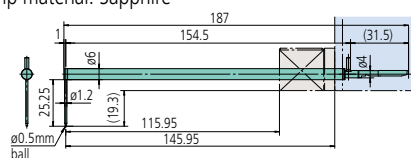
12AAD545*1: Double-length stylus (tip radius: 5µm)
12AAJ039*2: For CS-H5000CNC (tip radius: 5µm)
Tip material: Diamond



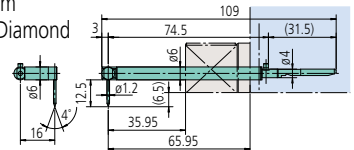
12AAD652: Standard-length stylus for extra-small hole
Tip radius: 5µm
Tip material: Diamond



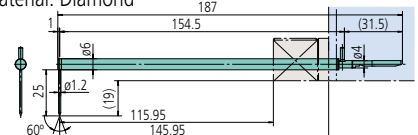
12AAD546*1*2: Double-length ball stylus
Tip material: Sapphire



12AAD653: Standard-length eccentric stylus
Tip radius: 5µm
Tip material: Diamond



12AAJ041*2: Double-length stylus (tip radius: 2µm)
Tip material: Diamond



*1: Standard accessory for CS-5000CNC
*2: Standard accessory for CS-H5000CNC



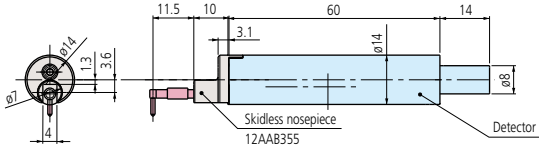
Refer to the CNC Form Measuring Instrument Series leaflet (E4284) for more details.

Optional Accessories

To measure surface roughness, waviness, profile, roundness and straightness

Optional Styli for Surface Roughness Measurement

Compatible with SJ-400, SJ-500, SV-2100, SV-3100, SV-C3200, SV-C4500 series



Detector (0.75mN): **178-396-2**
 Detector (4mN): **178-397-2**

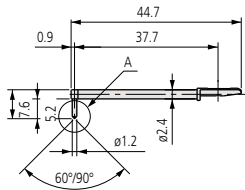
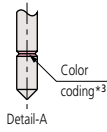


Extension rods
(12AAG202: 50mm, 12AAG203: 100mm)

Styli

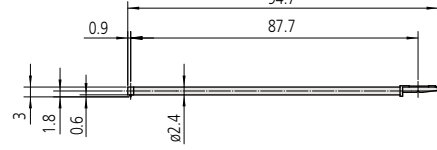
Unit: mm

Standard stylus



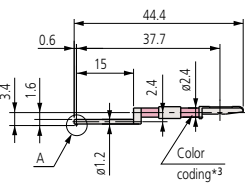
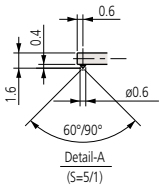
12AAE882 (1μm)*1
12AAE924 (1μm)*2
12AAC731 (2μm)*1
12AAB403 (5μm)*2
12AAB415 (10μm)*2
12AAE883 (250μm)*1
 () : Tip radius

Double-length for deep hole*4



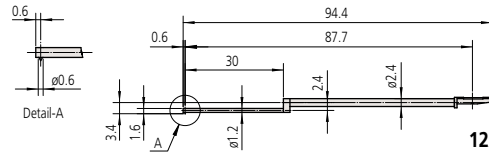
12AAE898 (2μm)*1
12AAE914 (5μm)*2
 () : Tip radius

For small hole



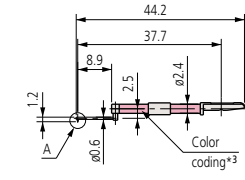
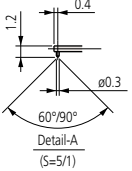
12AAC732 (2μm)*1
12AAB404 (5μm)*2
12AAB416 (10μm)*2
 () : Tip radius

For small hole/Double-length for deep hole*4



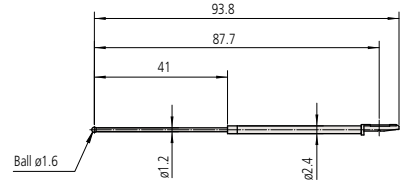
12AAE892 (2μm)*1
12AAE908 (5μm)*2
 () : Tip radius

For extra small hole



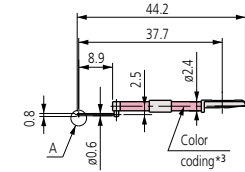
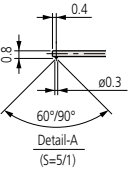
12AAC733 (2μm)*1
12AAB405 (5μm)*2
12AAB417 (10μm)*2
 () : Tip radius

For small hole*4*5



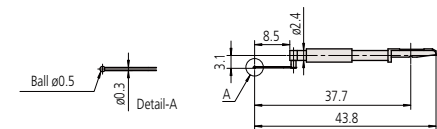
12AAE884 (0.8mm)
 () : Tip radius

For extra minute hole



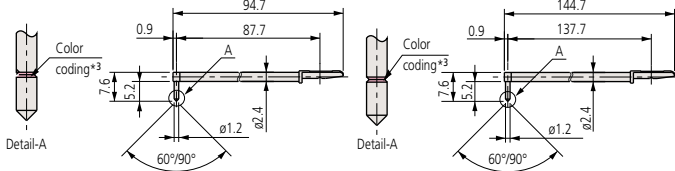
12AAC734 (2μm)*1
12AAB406 (5μm)*2
12AAB418 (10μm)*2
 () : Tip radius

For ultra small hole*4*5



12AAJ662 (0.25mm)
 () : Tip radius

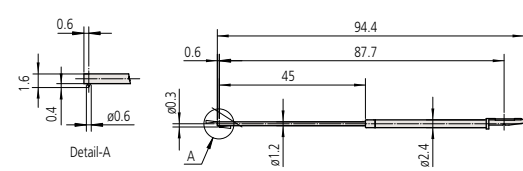
For deep hole (double-length and triple-length)*4



2X stylus
12AAC740 (2μm)*1
12AAB413 (5μm)*2
12AAB425 (10μm)*2
 () : Tip radius

3X stylus
12AAC741 (2μm)*1
12AAB414 (5μm)*2
12AAB426 (10μm)*2
 () : Tip radius

For small slotted hole*4



12AAE938 (2μm)*1
12AAE940 (5μm)*2
 () : Tip radius

*1: Tip angle 60°

*2: Tip angle 90°

*3:

Tip radius	1μm	2μm	5μm	10μm	250μm
Color coding	White	Black	No color	Yellow	No notch or color

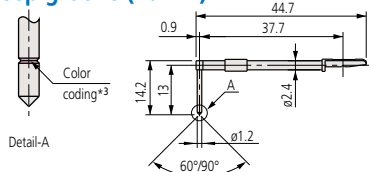
*4: For downward-facing measurement only

*5: Used for calibration, a standard step gauge (No.178-611, option) is also required.

Styli

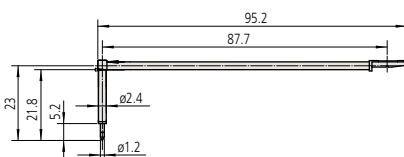
Unit: mm

For deep groove (10mm)



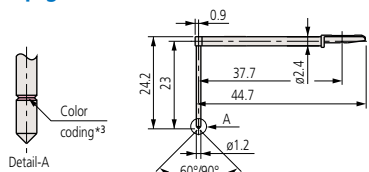
12AAC735 (2μm)^{*1}
12AAB409 (5μm)^{*2}
12AAB421 (10μm)^{*2}
 () : Tip radius

For deep groove (20mm)^{*4} / Double-length for deep hole



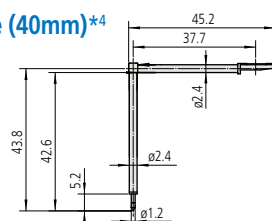
12AAE893 (2μm)^{*1}
12AAE909 (5μm)^{*2}
 () : Tip radius

For deep groove (20mm)^{*4}



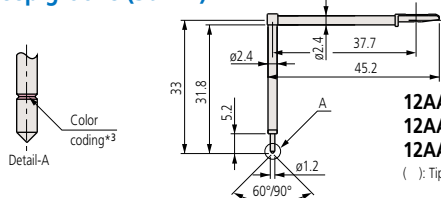
12AAC736 (2μm)^{*1}
12AAB408 (5μm)^{*2}
12AAB420 (10μm)^{*2}
 () : Tip radius

For deep groove (40mm)^{*4}



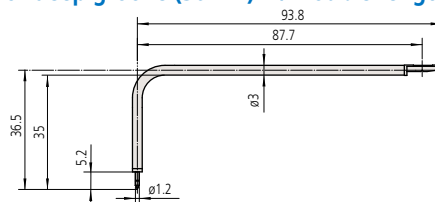
12AAE895 (2μm)^{*1}
12AAE912 (5μm)^{*2}
 () : Tip radius

For deep groove (30mm)^{*4}



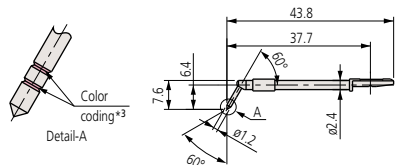
12AAC737 (2μm)^{*1}
12AAB407 (5μm)^{*2}
12AAB419 (10μm)^{*2}
 () : Tip radius

For deep groove (30mm)^{*4} / Double-length for deep hole



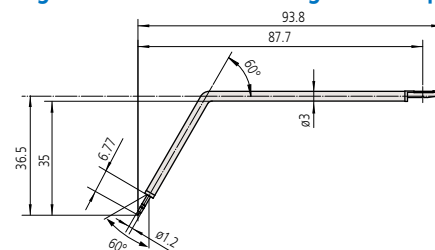
12AAE894 (2μm)^{*1}
12AAE910 (5μm)^{*2}
 () : Tip radius

For gear tooth



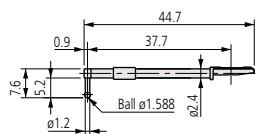
12AAB339 (2μm)^{*1}
12AAB410 (5μm)^{*1}
12AAB422 (10μm)^{*1}
 () : Tip radius

For gear tooth^{*4} / Double-length for deep hole



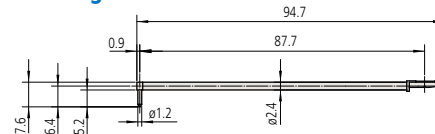
12AAE896 (2μm)^{*1}
12AAE912 (5μm)^{*1}
 () : Tip radius

For rolling circle waviness surface^{*5}



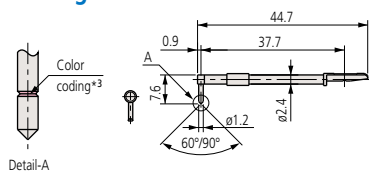
12AAB338 (0.8mm)
 () : Tip radius

For rolling circle waviness^{*4} /^{*5} Double-length for deep hole



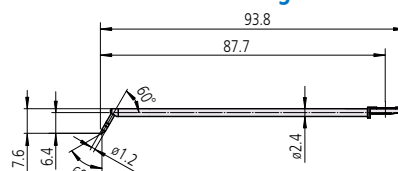
12AAE886 (0.25mm)
 () : Tip radius

For knife-edge detector



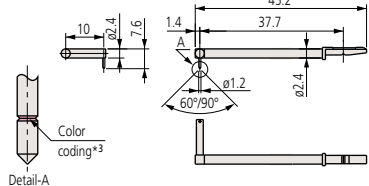
12AAC738 (2μm)^{*1}
12AAB411 (5μm)^{*2}
12AAB423 (10μm)^{*2}
 () : Tip radius

For corner hole^{*4} / Double-length for deep hole



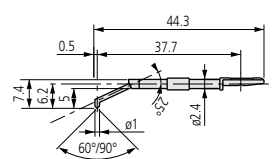
12AAM601 (2μm)^{*1}
12AAM603 (5μm)^{*1}
 () : Tip radius

For eccentric arm^{*4}



12AAC739 (2μm)^{*1}
12AAB412 (5μm)^{*2}
12AAB424 (10μm)^{*2}
 () : Tip radius

For bottom surface



12AAE899 (2μm)^{*1}
12AAE915 (5μm)^{*2}
 () : Tip radius

*1: Tip angle 60°

*2: Tip angle 90°

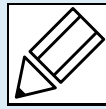
*3:

Tip radius	1μm	2μm	5μm	10μm	250μm
Color coding	White	Black	No color	Yellow	No notch or color

*4: For downward-facing measurement only

*5: Used for calibration, a standard step gauge (No. 178-611, option) is also required.

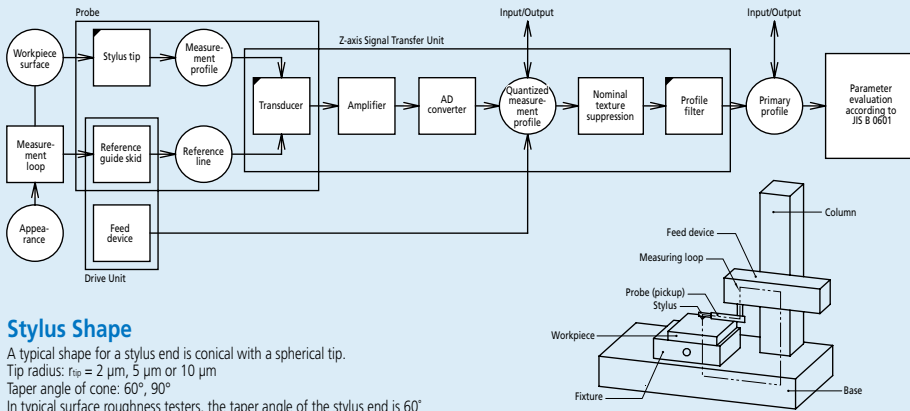
Quick Guide to Precision Measuring Instruments



Surftest (Surface Roughness Testers)

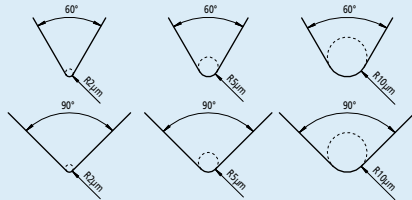
- JIS B 0601: 2001 Geometric Product Specifications (GPS) –Surface Texture: Profile method– Terms, definitions, and surface texture parameters
- JIS B 0632: 2001 Geometric Product Specifications (GPS) –Surface Texture: Profile method– Metrological characterization of phase-correct filters
- JIS B 0633: 2001 Geometric Product Specifications (GPS) –Surface Texture: Profile method– Rules and procedures for the assessment of surface texture
- JIS B 0651: 2001 Geometric Product Specifications (GPS) –Surface Texture: Profile method– Nominal characteristics of contact (stylus) instruments

Nominal Characteristics of Contact (Stylus) Instruments



Stylus Shape

A typical shape for a stylus end is conical with a spherical tip.
 Tip radius: $r_{tip} = 2 \mu\text{m}, 5 \mu\text{m}$ or $10 \mu\text{m}$
 Taper angle of cone: $60^\circ, 90^\circ$
 In typical surface roughness testers, the taper angle of the stylus end is 60° unless otherwise specified.



Static Measuring Force

Nominal radius of curvature of stylus tip: μm	Static measuring force at the mean position of stylus: mN	Tolerance on static measuring force variations: mN/ μm
2	0.75	0.035
5	0.75 (4.0) Note 1	0.2
10		

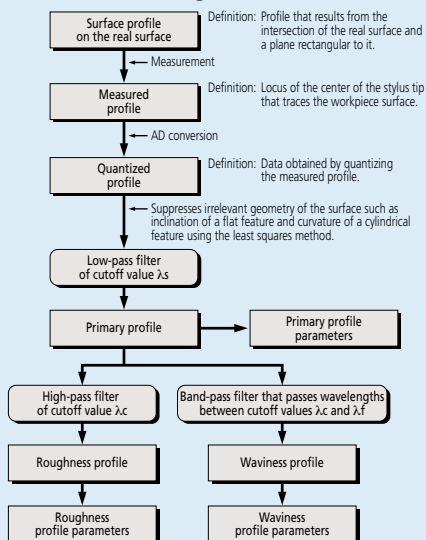
Note 1: The maximum value of static measuring force at the average position of a stylus is to be 4.0mN for a special structured probe including a replaceable stylus.

Metrological Characterization of Phase Correct Filters

A profile filter is a phase-correct filter without phase delay (cause of profile distortion dependent on wavelength).
 The weight function of a phase-correct filter shows a normal (Gaussian) distribution in which the amplitude transmission is 50% at the cutoff wavelength.

JIS B 0632: 2001 (ISO 11562: 1996)

Data Processing Flow



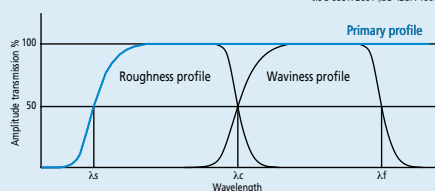
Relationship between Cutoff Value and Stylus Tip Radius

The following table lists the relationship between the roughness profile cutoff value λ_c , stylus tip radius r_{tip} , and cutoff ratio λ_c/λ_s .

λ_c mm	λ_s μm	λ_c/λ_s	Maximum r_{tip} μm	Maximum sampling length mm
0.08	2.5	30	2	0.5
0.25	2.5	100	2	0.5
0.8	2.5	300	2 Note 1	0.5
2.5	8	300	5 Note 2	1.5
8	25	300	10 Note 2	5

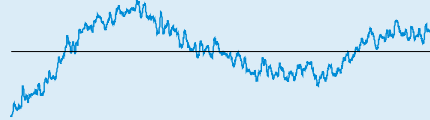
Note 1: For a surface with $Ra > 0.5 \mu\text{m}$ or $Rz > 3 \mu\text{m}$, a significant error will not usually occur in a measurement even if $r_{tip} = 5 \mu\text{m}$.
 Note 2: If a cutoff value λ_c is $\geq 2.5 \text{ mm}$ or $5 \mu\text{m}$, attenuation of the signal due to the mechanical filtering effect of a stylus with the recommended tip radius appears outside the roughness profile pass band. Therefore, a small error in stylus tip radius or shape does not affect parameter values calculated from measurements. If a specific cutoff ratio is required, the ratio must be defined.

Surface Profiles



Primary Profile

Profile obtained from the measured profile by applying a low-pass filter with cutoff value λ_s .



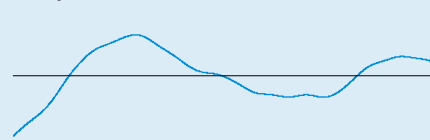
Roughness Profile

Profile obtained from the primary profile by suppressing the longer wavelength components using a high-pass filter of cutoff value λ_c .



Waviness Profile

Profile obtained by applying a band-pass filter to the primary profile to remove the longer wavelengths above λ_f and the shorter wavelengths below λ_c .

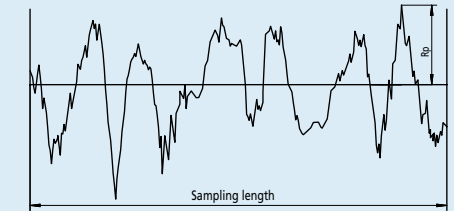


Definition of Parameters

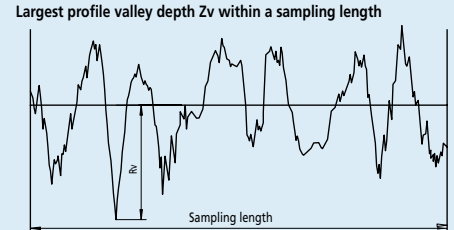
JIS B 0601: 2001 (ISO 4287: 1997)

Amplitude Parameters (peak and valley)

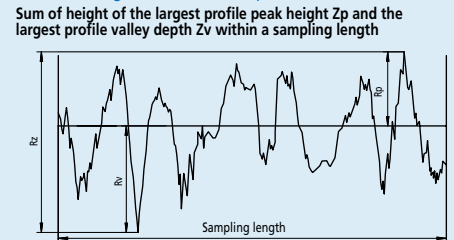
- Maximum peak height of the primary profile P_p
- Maximum peak height of the roughness profile R_p
- Maximum peak height of the waviness profile W_p
- Largest profile peak height Z_p within a sampling length



- Maximum valley depth of the primary profile P_v
- Maximum valley depth of the roughness profile R_v
- Maximum valley depth of the waviness profile W_v
- Largest profile valley depth Z_v within a sampling length

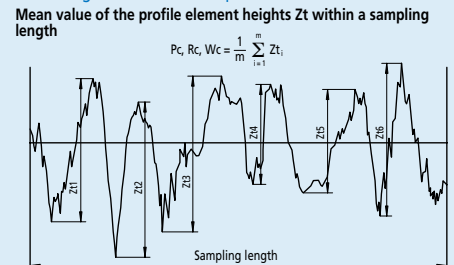


- Maximum height of the primary profile P_z
- Maximum height of the roughness profile R_z
- Maximum height of the waviness profile W_z
- Sum of height of the largest profile peak height Z_p and the largest profile valley depth Z_v within a sampling length

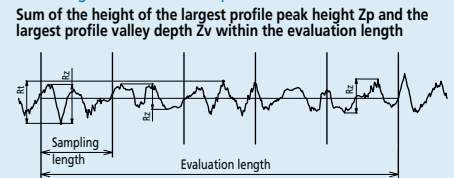


⚠ In Old JIS and ISO 4287-1: 1984, R_z was used to indicate the "ten point height of irregularities". Care must be taken because differences between results obtained according to the existing and old standards are not always negligibly small. (Be sure to check whether the drawing instructions conform to existing or old standards.)

- Mean height of the primary profile elements P_c
- Mean height of the roughness profile elements R_c
- Mean height of the waviness profile elements W_c
- Mean value of the profile element heights Z_t within a sampling length



- Total height of the primary profile P_t
- Total height of the roughness profile R_t
- Total height of the waviness profile W_t
- Sum of the height of the largest profile peak height Z_p and the largest profile valley depth Z_v within the evaluation length



Amplitude Parameters (average of ordinates)

Arithmetical mean deviation of the primary profile P_a
 Arithmetical mean deviation of the roughness profile R_a
 Arithmetical mean deviation of the waviness profile W_a

Arithmetic mean of the absolute ordinate values $Z(x)$ within a sampling length

$$P_a, R_a, W_a = \frac{1}{l} \int_0^l |Z(x)| dx$$

with l as l_p , l_r , or l_w according to the case.

Root mean square deviation of the primary profile P_q
 Root mean square deviation of the roughness profile R_q
 Root mean square deviation of the waviness profile W_q
 Root mean square value of the ordinate values $Z(x)$ within a sampling length

$$P_q, R_q, W_q = \sqrt{\frac{1}{l} \int_0^l Z^2(x) dx}$$

with l as l_p , l_r , or l_w according to the case.

Skewness of the primary profile P_{sk}
 Skewness of the roughness profile R_{sk}
 Skewness of the waviness profile W_{sk}

Quotient of the mean cube value of the ordinate values $Z(x)$ and the cube of P_q , R_q , or W_q respectively, within a sampling length

$$R_{sk} = \frac{1}{R_q^3} \left[\frac{1}{l_r} \int_0^{R_{0c}} Z^3(x) dx \right]$$

The above equation defines R_{sk} . P_{sk} and W_{sk} are defined in a similar manner. P_{sk} , R_{sk} , and W_{sk} are measures of the asymmetry of the probability density function of the ordinate values.

Kurtosis of the primary profile P_{ku}
 Kurtosis of the roughness profile R_{ku}
 Kurtosis of the waviness profile W_{ku}

Quotient of the mean quartic value of the ordinate values $Z(x)$ and the fourth power of P_q , R_q , or W_q respectively, within a sampling length

$$R_{ku} = \frac{1}{R_q^4} \left[\frac{1}{l_r} \int_0^{R_{0c}} Z^4(x) dx \right]$$

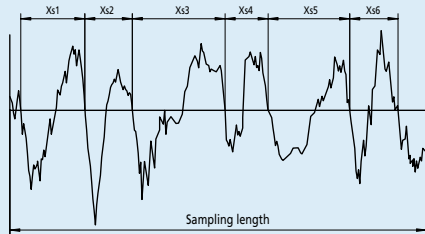
The above equation defines R_{ku} . P_{ku} and W_{ku} are defined in a similar manner. P_{ku} , R_{ku} , and W_{ku} are measures of the sharpness of the probability density function of the ordinate values.

Spacing Parameters

Mean width of the primary profile elements P_{Sm}
 Mean width of the roughness profile elements R_{Sm}
 Mean width of the waviness profile elements W_{Sm}

Mean value of the profile element widths X_s within a sampling length

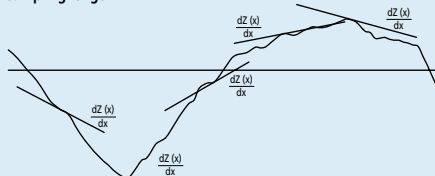
$$P_{Sm}, R_{Sm}, W_{Sm} = \frac{1}{m} \sum_{s=1}^m X_s$$



Hybrid Parameters

Root mean square slope of the primary profile $P_{\Delta q}$
 Root mean square slope of the roughness profile $R_{\Delta q}$
 Root mean square slope of the waviness profile $W_{\Delta q}$

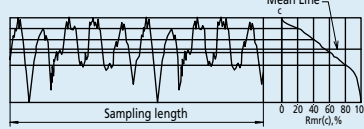
Root mean square value of the ordinate slopes dZ/dX within a sampling length



Curves, Probability Density Function, and Related Parameters

Material ratio curve of the profile (Abbott-Firestone curve)

Curve representing the material ratio of the profile as a function of section level c



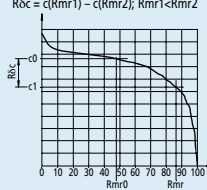
Material ratio of the primary profile $Pmr(c)$
 Material ratio of the roughness profile $Rmr(c)$
 Material ratio of the waviness profile $Wmr(c)$

Ratio of the material length of the profile elements $MI(c)$ at a given level c to the evaluation length

$$Pmr(c), Rmr(c), Wmr(c) = \frac{MI(c)}{l_n}$$

Section height difference of the primary profile P_{dc}
 Section height difference of the roughness profile R_{dc}
 Section height difference of the waviness profile W_{dc}

Vertical distance between two section levels of a given material ratio



Relative material ratio of the primary profile Pmr
 Relative material ratio of the roughness profile Rmr
 Relative material ratio of the waviness profile Wmr

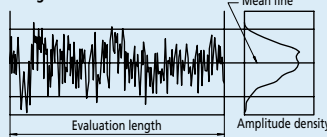
Material ratio determined at a profile section level R_{0c} (or P_{0c} or W_{0c}), related to the reference section level c_0

$$Pmr, Rmr, Wmr = Pmr(c_1), Rmr(c_1), Wmr(c_1)$$

where $c_1 = c_0 - R_{0c}(R_{0c}, W_{0c})$
 $c_0 = c(Pm_0, Rm_0, Wm_0)$

Probability density function (profile height amplitude distribution curve)

Sample probability density function of the ordinate $Z(x)$ within the evaluation length

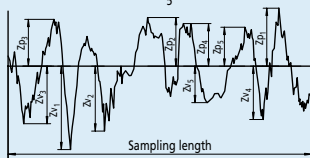


JIS Specific Parameters

Ten-point height of irregularities, Rz_{10}

Sum of the absolute mean height of the five highest profile peaks and the absolute mean depth of the five deepest profile valleys, measured from the mean line within the sampling length of a roughness profile. This profile is obtained from the primary profile using a phase-correct band-pass filter with cutoff values of lc and hc .

$$Rz_{10} = \frac{|Zp_1 + Zp_2 + Zp_3 + Zp_4 + Zp_5| + |Zv_1 + Zv_2 + Zv_3 + Zv_4 + Zv_5|}{5}$$



Symbol	Used profile
RzJIS82	Surface profile as measured
RzJIS94	Roughness profile derived from the primary profile using a phase-correct high-pass filter

Arithmetic mean deviation of the profile Ra_{75}

Arithmetic mean of the absolute values of the profile deviations from the mean line within the sampling length of the roughness profile (75%). This profile is obtained from a measurement profile using an analog high-pass filter with an attenuation factor of 12db/octave and a cutoff value of λ_c .

$$Ra_{75} = \frac{1}{l_n} \int_0^{l_n} |Z(x)| dx$$

Sampling Length for Surface Roughness Parameters

JIS B 0633: 2001 (ISO 4288: 1996)

Table 1: Sampling lengths for aperiodic profile roughness parameters (R_a , R_q , R_{sk} , R_{ku} , $R_{\Delta q}$), material ratio curve, probability density function, and related parameters

R_a μm	Sampling length l_r mm	Evaluation length l_n mm
(0.006) < R_a ≤ 0.02	0.08	0.4
0.02 < R_a ≤ 0.1	0.25	1.25
0.1 < R_a ≤ 2	0.8	4
2 < R_a ≤ 10	2.5	12.5
10 < R_a ≤ 80	8	40

Table 2: Sampling lengths for aperiodic profile roughness parameters (R_z , R_v , R_p , R_c , R_t)

R_z R_{z1max} μm	Sampling length l_r mm	Evaluation length l_n mm
(0.025) < R_z , R_{z1max} ≤ 0.1	0.08	0.4
0.1 < R_z , R_{z1max} ≤ 0.5	0.25	1.25
0.5 < R_z , R_{z1max} ≤ 10	0.8	4
10 < R_z , R_{z1max} ≤ 50	2.5	12.5
50 < R_z , R_{z1max} ≤ 200	8	40

1) R_z is used for measurement of R_z , R_v , R_p , R_c , and R_t .
 2) R_{z1max} only used for measurement of R_{z1max} , R_{v1max} , R_{p1max} , and R_{c1max} .

Table 3: Sampling lengths for measurement of periodic roughness profile roughness parameters and periodic or aperiodic profile parameter R_{sm}

R_{sm} mm	Sampling length l_r mm	Evaluation length l_n mm
0.013 < R_{sm} ≤ 0.04	0.08	0.4
0.04 < R_{sm} ≤ 0.13	0.25	1.25
0.13 < R_{sm} ≤ 0.4	0.8	4
0.4 < R_{sm} ≤ 1.3	2.5	12.5
1.3 < R_{sm} ≤ 4	8	40

Procedure for determining a sampling length if it is not specified

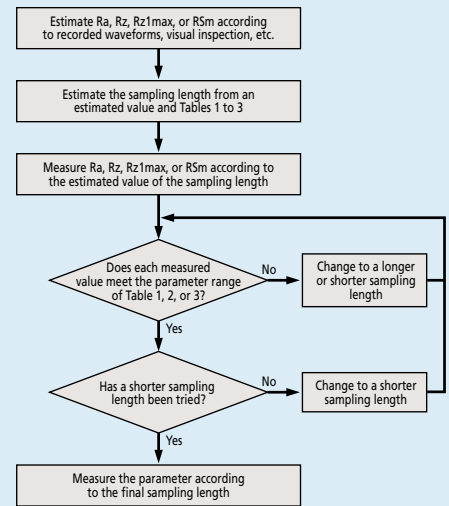


Fig.1 Procedure for determining the sampling length of an aperiodic profile if it is not specified.

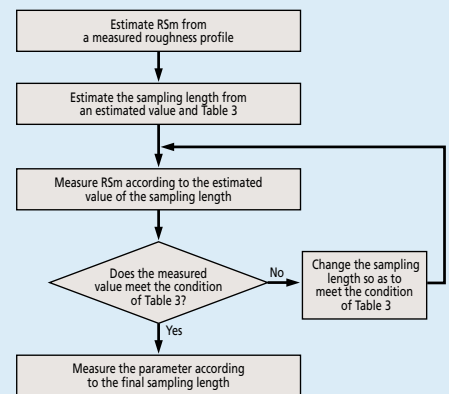


Fig.2 Procedure for determining the sampling length of a periodic profile if it is not specified.