Surftest SJ-400

Bulletin No. 1902

Portable Surface Roughness Tester

Mitutoyo

Surftest SJ-400 Series

Revolutionary New Portable Surface Roughness Testers Make Their Debut

Long-awaited performance and functionality are here: compact design, skidless and high-accuracy roughness measurements, multi-functionality and ease of operation.

Requirement 1

High-accuracy measurements with a hand-held tester

A wide range, high-resolution detector and an ultra-straight drive unit provide class-leading accuracy.

Detector

Measuring range: 800µm
Resolution: 0.000125µm (on 8µm range)

Drive unit

Straightness/traverse length
SJ-401: 0.3µm/.98"(25mm)
SJ-402: 0.5µm/1.96"(50mm)

Requirement 3

Cylinder surface roughness measurements with a hand-held tester

The skidless measurement and R-surface compensation functions make it possible to evaluate cylinder surface roughness.

Requirement 2

Roughness parameters that conform to international standards

The SJ-400 series can evaluate 36 kinds of roughness parameters conforming to the latest ISO, DIN, and ANSI standards, as well as to JIS standards (1994/1982).

Requirement 4

Measurement/evaluation of stepped features and straightness

Ultra-fine steps, straightness and waviness are easily measured by switching to skidless measurement mode. The ruler function enables simpler surface feature evaluation on the LCD monitor.

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Requirement

5

Advanced data processing with extended analysis

The SJ-400 series allows data processing identical to that in the high-end class. These data analysis and report creation capabilities are achieved using the surface roughness analysis program SURFPAK-SJ.

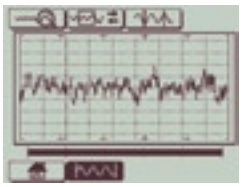
Requirement

6

Confirmation of measurement results and assessed profiles without a printout

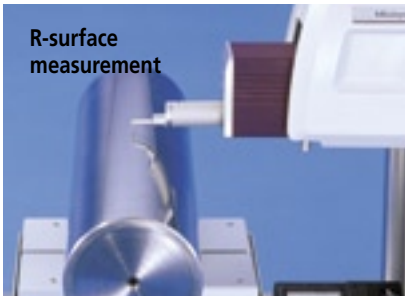
The large, integrated, touch-panel LCD monitor clearly displays evaluation results and measured profiles.

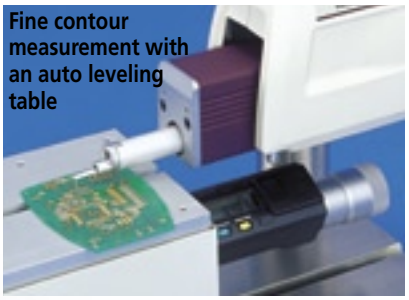
Calculation Result Screen

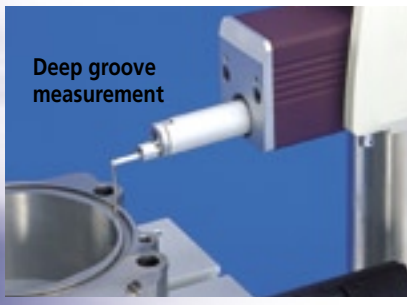


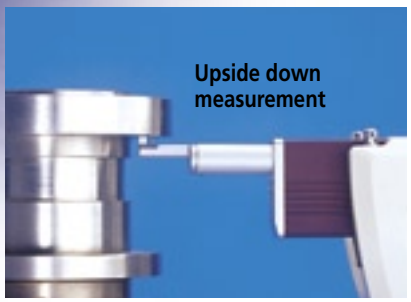
Measured Profile Screen

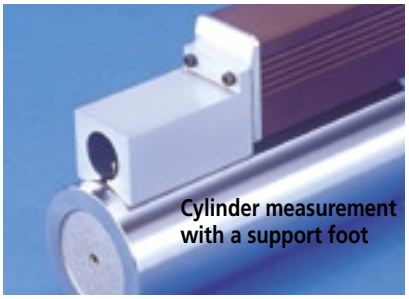
Measurement Applications







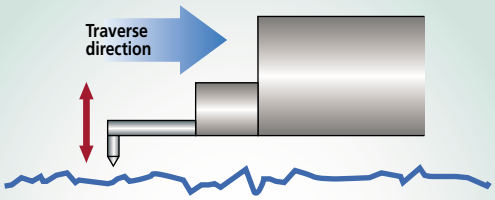




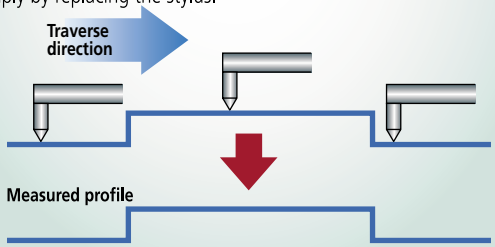
The SJ-400 Series Performs Skidless Measurements

The SJ-400 series detector uses interchangeable nosepieces that allow skid- or skidless measurements to suit the type of measurement required.

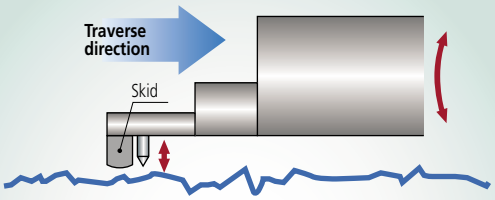
Skidless measurement



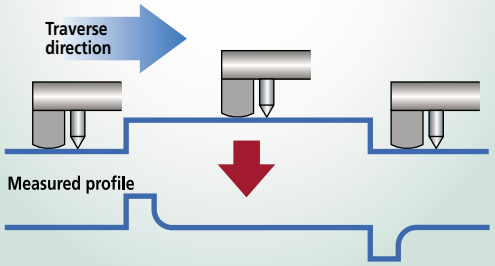
- Skidless measurement is where surface features are measured relative to the drive unit reference surface. This measures waviness and finely stepped features accurately, in addition to surface roughness, but range is limited to the stylus travel available.
- The SJ-400 series supports a variety of surface feature measurements simply by replacing the stylus.



Skidded measurement

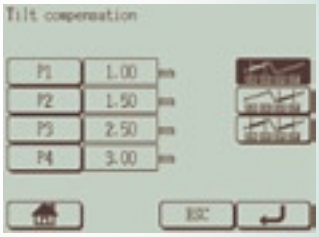


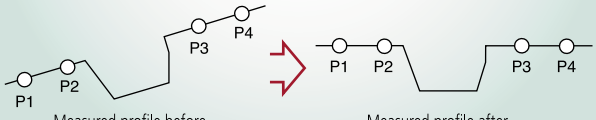
- In skidded measurements, surface features are measured with reference to a skid following close behind the stylus. This cannot measure waviness and stepped features exactly but measuring range is greater because the skid tracks the workpiece surface contour.



Tilt compensation function

- The Tilt Compensation Datum Points are selectable from all of the profile (choose P1 and P2) or any arbitrary two sections on the profile (choose P1, P2, P3 and P4), as required. If you choose adjacent sections for tilt compensation then the characteristics of features of interest between these sections, such as scratch depth, etc, can be measured directly.



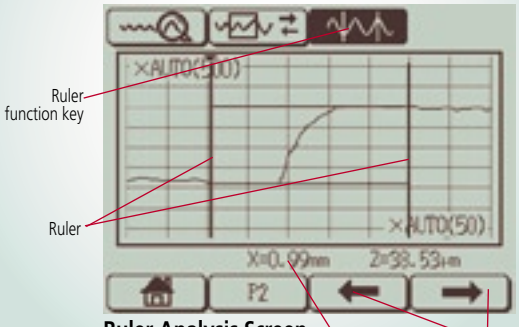


Measured profile before tilt compensation

Measured profile after tilt compensation

Simplified surface feature evaluation with the ruler function

- This function determines the coordinate difference between two arbitrary points so feature characteristics, such as step height and width, etc, can be measured.



Ruler Analysis Screen

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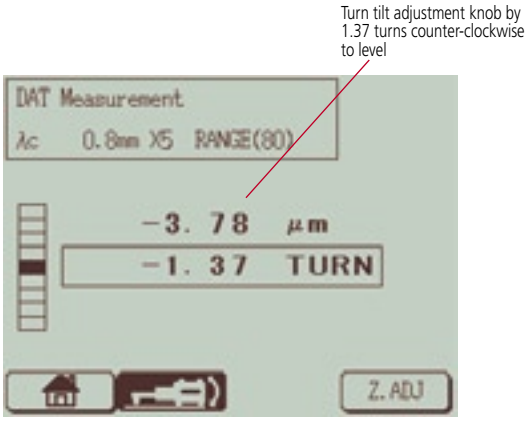
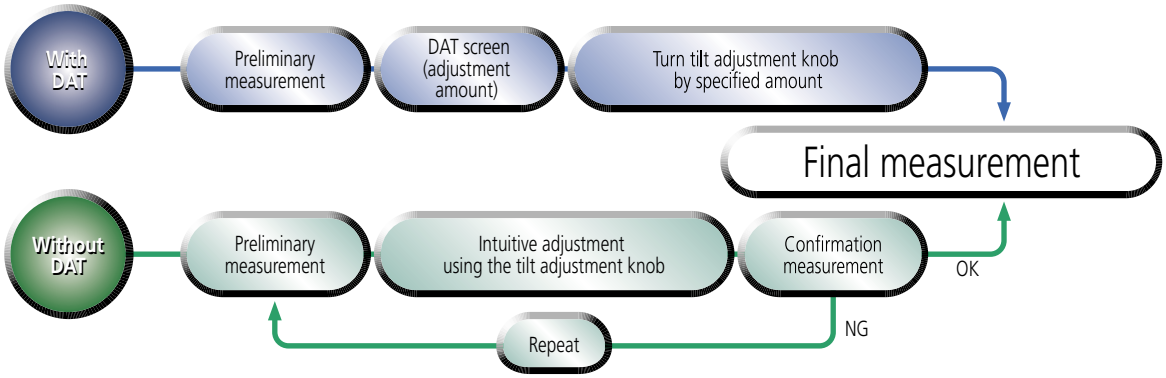
Powerful Support for Leveling

The height/tilt adjustment unit comes as standard for leveling the drive unit prior to making skidless measurements and, supported by guidance from the unique DAT function, makes it easy to achieve highly accurate alignment.

The DAT Function

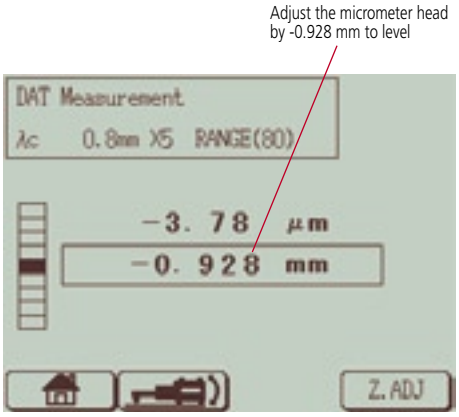


DAT screen guides the user when leveling



DAT Function for the optional leveling table

With the SJ-400 mounted on a stand, the DAT function also works with the optional leveling table.



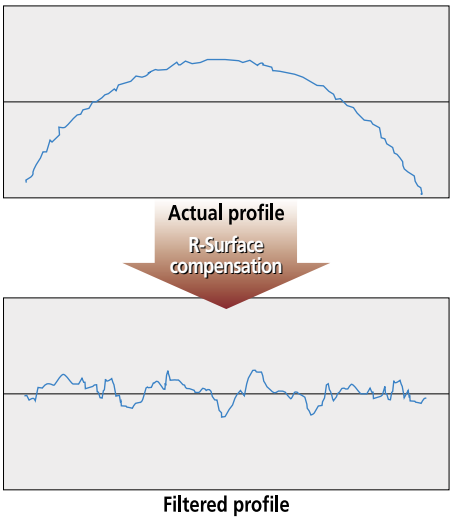
DAT screen guides the user when leveling

More Measuring Functions Than Expected From a Compact Tester

Measuring curved-surface roughness

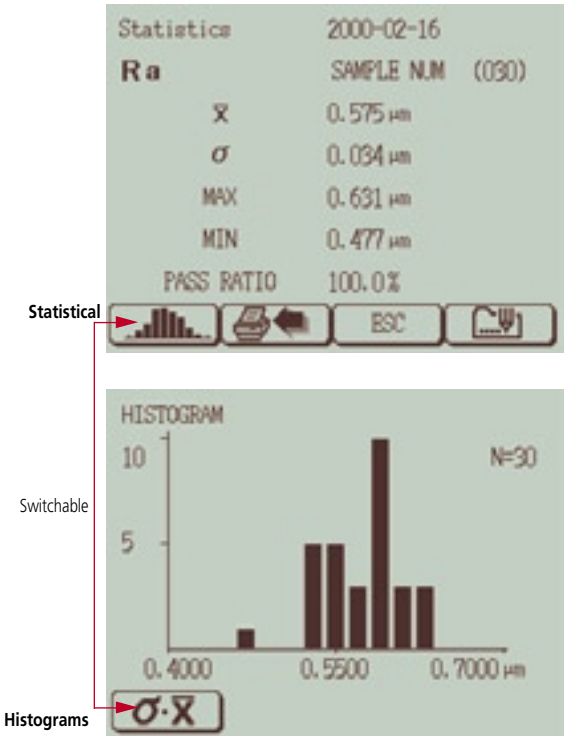
(skidless measurement)

Usually, a spherical or cylindrical surface (R-surface) cannot be evaluated, but, by removing the radius with a filter, R-surface data is processed as if taken from a flat surface.



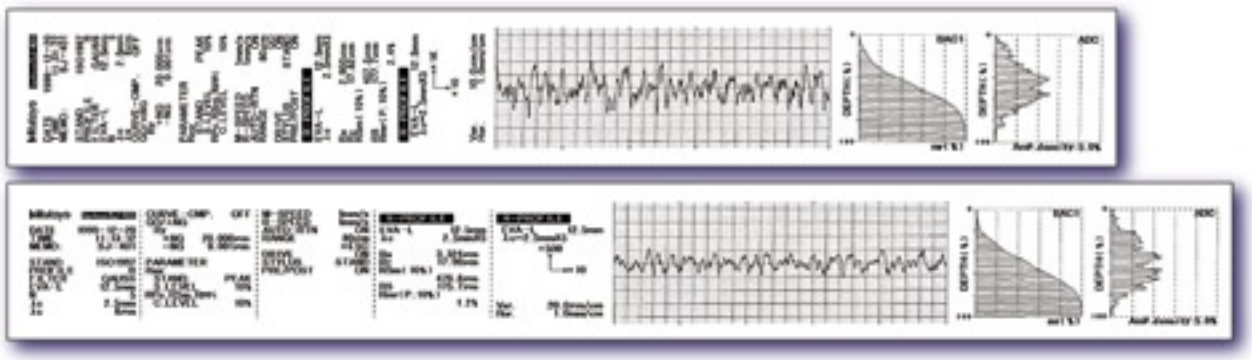
Statistics

Statistical processing can be performed on multiple measurements for one roughness parameter. Histograms can be displayed and printed in addition to statistical results (mean, standard deviation, maximum/minimum value and acceptance ratio).



Built-in thermal printer

A high quality, high-speed thermal printer prints out measured results. It can also print a BAC curve or an ADC curve as well as calculated results and assessed profiles. These results and profiles are printed out in landscape format, just as they appear on the LCD, in easy-to-understand form.



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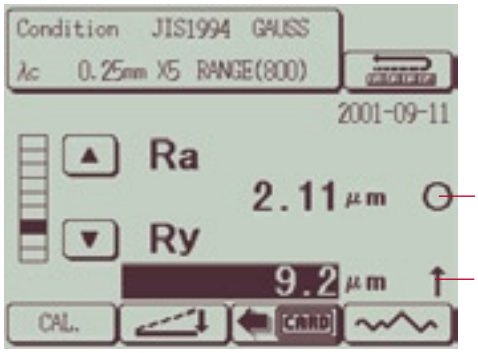
GO/NG indication

Upper and lower tolerance limits can be set for up to 3 roughness parameters. A GO/NG indication is displayed after a measurement. The calculation result is highlighted if NG.



Calculation Result Screen with GO / NG judgment result

Real sampling

This function samples stylus displacement for a specified time without engaging detector traverse. This function has a wide range of uses, such as a simplified vibration meter or a displacement gage incorporated in another system.

Recalculating

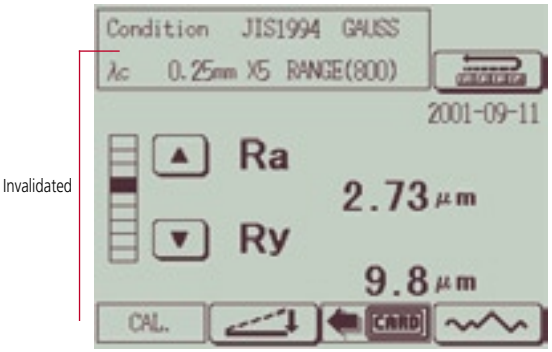
Previously measured data can be recalculated for use in other evaluations by changing the current standard, assessed profile and roughness parameters.

Arbitrary length measurement

This function allows a sampling length to be arbitrarily set in .004" (0.1mm) increments SJ-401: .004" to .98" (0.1mm to 25mm), SJ-402: .004" to 1.96" (0.1mm to 50mm). It also allows the SJ-400 series to make both narrow and wide range measurements.

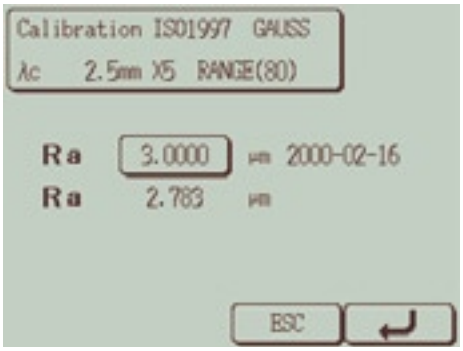
Key masking

Locks out input from the touch panel keys. This eliminates the possibility of the operator accidentally changing the calibration or measurement conditions.



Auto-Calibration

The SJ-400 series is equipped with Ra calibration and step calibration methods for detector calibration (gain adjustment). In both calibration methods only the calibrated value of the precision specimen needs to be entered. No other operations are required to calibrate the tester.



Calibration Screen

Storing/recalling measured data and conditions

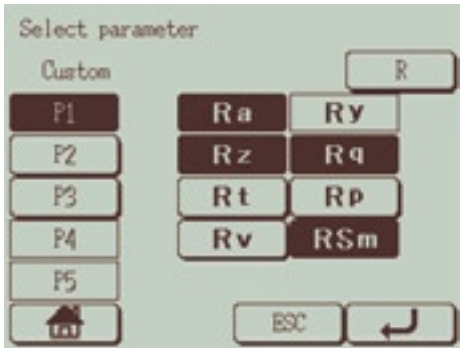
The measurement conditions and data can be stored in the control unit or memory card (optional) and recalled as required. Batch printout of data after on-site measurement improves measuring efficiency.

Storage capacity

Measurement conditions	Control unit: 5 conditions Memory card: 20 conditions
Measurement data	Memory card: 50 or more pieces of data

Customizing

The SJ-400 series can be set up to calculate and display only a subset of the roughness parameters available. Parameters can be added later for recalculation, if required.



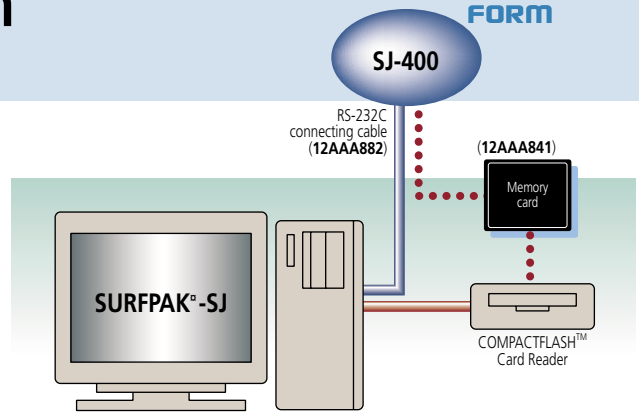
Customized Screen

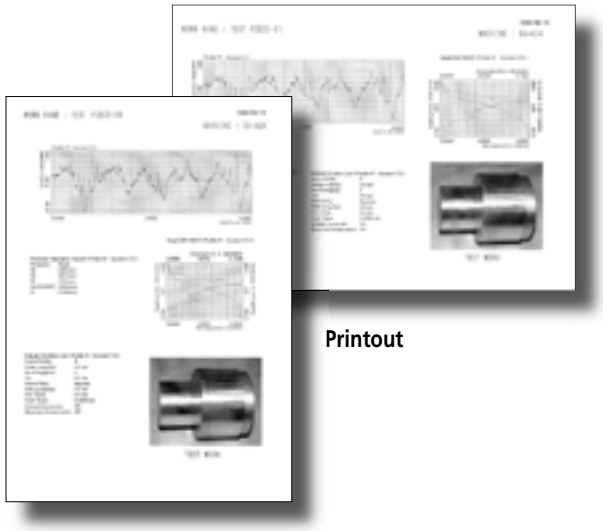
Wide Choice of Evaluation Possibilities with Analyzing Program

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

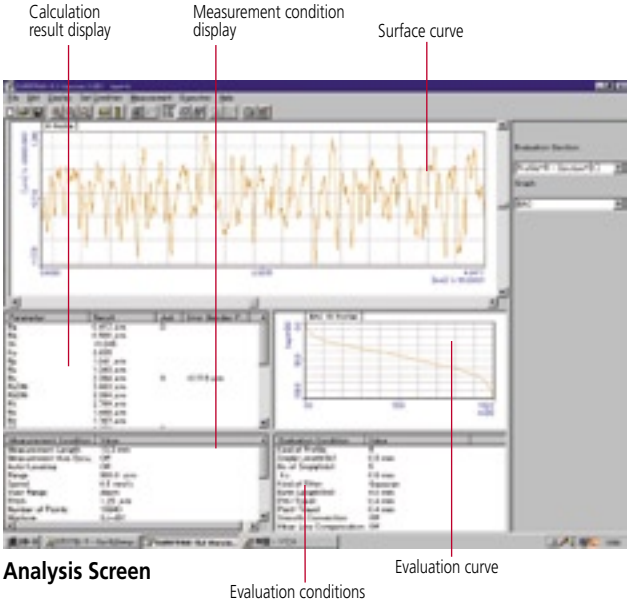
Surface roughness analyzing program SURFPAK-SJ

The SURFPAK-SJ program gives the SJ-400 series the same excellent operability and advanced analysis performance achieved by high-end desktop testers. More roughness parameters and analysis graphs are available, unnecessary data can be filtered out and surface features, including step and pitch, can easily be evaluated. SURFPAK-SJ transforms this small machine into the equivalent of a high-end desktop evaluation system.





Printout



Analysis Screen

SURFPAK-SJ Specification

Inch/(Metric)

Industrial standards met		ISO 4287:1997, ANSI / ASME B46.1-1995, JIS B0601 1994, etc.
Assessed profiles		P (primary profile), R (roughness profile), WC, WCA, WE WEA DIN4776 profile, E (envelope residual profile), R - motif (roughness/waviness motif)
Evaluation Parameters	P, R, WC, WCA, WE, WEA, DIN4776, E	Ra, Rq, Rz, Rz(JIS), Ry, Ry (DIN), Rc, Rpi, Rp, Rpmax Rvi, Rv, Rvmax, Rti, Rt, R3zi, R3z, 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
	R - motif	Rx, R AR, SR, SAR, NR, NCRX, CPM
	W - motif	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% (phase corrected)
Cutoff length*		λc: .001", .003", .01", .03", .1", 3", 1" or arbitrary value (0.025mm, 0.08mm, 0.25mm, 0.8mm, 2.5mm, 8mm, 25mm or arbitrary value) fl: .01", .03" or arbitrary value (0.25mm, 0.8mm, 2.5mm, 8mm or arbitrary value) fh: .01", .03" or arbitrary value (0.25mm, 0.8mm, 2.5mm, 8mm or arbitrary value)
Sampling length (L)*		.001", .003",.01", .1", .3", 1" or arbitrary value (0.025mm, 0.08mm, 0.25mm, 0.8mm, 2.5mm, 8mm, 25mm or arbitrary value)
Data compensation		Tilt compensation, R-plane (curved surface) compensation, ellipse compensation, parabola compensation, hyperbola compensation, Conic automatic compensation, polynomial compensation, polynomial automatic compensation
Data deletion function		• Data deletion to avoid an over-range error • Data deletion in a specific range to perform recalculation • Automatic data deletion (according to conditions set previously)
Recording magnifications		Vertical: 100X - 500,000X Horizontal: 1X - 10,000X
Special functions for report generation		• Bit-map image paste-up function • Multiple data layout function
OS requirement		Windows®95 / Windows®98 / Windows®NT4.0

*Arbitrary can be specified in the following range: from .012" (0.3mm) to the values maximum traverse length.

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Carrying case is a standard accessory

Specification

Inch/(Metric)

Order No.*		**SJ-401**	**178-946-2** (mm)	**178-947-2** (inch/mm)	**178-956-2** (mm)	**178-957-2** (inch/mm)
		SJ-402	**178-940-2** (mm)	**178-945-2** (inch/mm)	**178-958-2** (mm)	**178-959-2** (inch/mm)
Measuring method			Skidless/Skidded measurement			
Measuring range	Z-axis		32000µin, 3200µin, 320µin (800µm, 80µm, 8µm) (Up to 2,400µm with an option stylus)			
	X-axis		SJ-401: 1" (25mm) SJ-402: 2" (50mm)			
Drive method	Straightness		SJ-401: 12µin/1" (0.3µm/25mm) SJ-402: 20µin/2" (0.5µm/50mm)			
	Measuring speed		.002", .004", .02", .04"/s (0.05, 0.1, 0.5, 1.0mm/s)			
	Return speed		.02", .04", .08"/s (0.5, 1.0, 2.0 mm/s)			
Height-Tilt adjustment unit	Tilt adjustment range		±1.5°			
	Height adjustment amount		.39"/10mm			
Assessed profile			Primary profile (P), Roughness profile (R), Filtered waviness profile (W), DIN4776, MOTIF (R, W)			
Evaluation parameters			Ra, Ry, Rz, Rq, Pc, R3z, mr, Rt, Rp, Rv, Sm, S, δc, Rk, Rpk, Rvk, Mr1, Mr2, A1, A2, Lo, Ppi, R, AR, Rx, Δa, Δq, Ku, HSC, mrd, Sk, W, AW, Wte, Wx, Vo			
Analysis graphs			Bearing Area Curve (BAC), Amplitude Distribution Curve (ADC)			
Number of sampling length			X1, X3, X5, XL* (*=arbitrary length)			
Arbitrary length			SJ-401: .01" to 2" (.01" increments) [0.1 to 25mm (0.1mm increments)] SJ-402: .04" to 2" (.01" increments) [0.1 to 50mm (0.1mm increments)]			
Sampling length (L)			.003", .01", .03", .1", .3" (0.08, 0.25, 0.8, 2.5, 8mm)			
Printing width			1.89" (48mm)/paper width: 2.28" (58mm)			
Recording magnification	Vertical magnification		10 to 100K magnification, Auto			
	Horizontal magnification		1 to 1K magnification, Auto			
Detector	Detection method		Differential inductance method			
	Minimum resolution		.005µin (320µin range)/0.000125µm (8µm range)			
	Stylus tip		Corn 90°, Radius 5µm, Diamond		Corn 60°, Radius 2µm, Diamond	
	Measuring force		4mN		0.75mN	
	Radius of skid		1.57"(40mm)			
	Skid force		Less than 400mN			
Function	Customize		Display/Roughness parameter selectable			
	Data compensation		R-surface, Tilt compensation			
	Ruler function		Displays the coordinate difference of any two points			
	D.A.T. function		Helps to adjust leveling during skidless measurement			
	Displacement detection mode		Enables the stylus displacement to be input while the drive unit is stopped			
	Statistical processing		Maximum value, Minimum value, Mean value, Standard deviation (s), Pass ratio, Histogram			
	Tolerance judgment		Upper and lower limit values for three parameters can be specified			
	Measuring Condition storage		Five sets of measuring conditions (control unit)			
Printer			Thermal printer			
Cut-off length			.003", .01", .03", .1", .3" (0.08, 0.25, 0.8, 2.5, 8mm)			
Digital filter			2CR, PC75 (phase corrected), Gauss			
Calibration			Ra, Step (Automatic calibration entering the value of roughness specimen)			
Power supply			Via AC adapter, built-in rechargeable battery (Ni-H)			
Battery	Charging time		15 hours			
	Number of measurements		600 maximum without printing			
Power consumption			43W (max.)			
Dimension	Control unit		12.09"x6.50"x3.7" (307x165x94mm)			
	Height-Tilt adjustment unit		5.16"x2.48"x3.90" (131x63x99mm)			
	Drive unit		SJ-401: 5.04"x1.42"x1.85" (128x36x47mm) SJ-402: 6.08"x1.41"x1.84" (155x36x47mm)			
Roughness standard			JIS (JIS B0601-1994-1982), DIN, ISO, ANSI			
LCD size			Touch panel			
Data output			RS-232C input/output, SPC output			
External control			Connection to data processing system (option)			
Mass	Control unit		2.64lbs. (1.2kg)			
	Height-Tilt adjustment unit		1.88lbs. (0.4kg)			
	Drive unit		SJ-401: 1.32lbs. (0.6kg) SJ-402: 1.41lbs. (0.64kg)			
Standard accessories			AC adapter, Carrying case, Printing paper, Touch pen, Protect sheet, Skidless nosepiece, User's manual, one-sheet manual, tools			

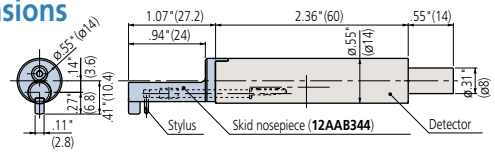
* To denote your AC line voltage add the following suffixes (e.g. **178-946-2A**). **A** for 120V, **C** for 110V, **D** for 220V, **E** for 240V, **No suffix** is required for 100V.

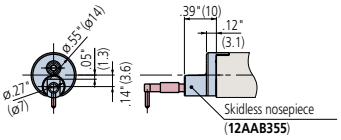
Optional Accessories

Detector

178-396-2: 0.75mN measuring force, with **12AAC731** standard type stylus (2µm tip radius)
178-397: 4mN measuring force, with **12AAB403** standard type stylus (5µm tip radius)

Set configuration/Dimensions

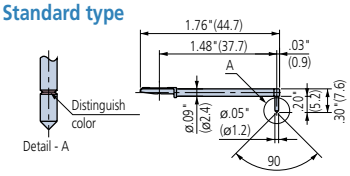




Unit: Inch/(Metric)

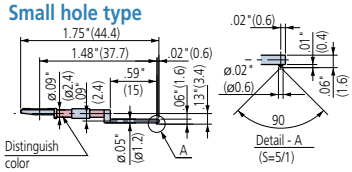
Stylus

Standard type



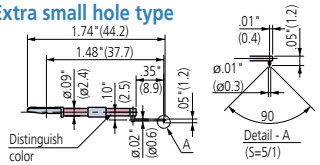
12AAC731 [.08"(2m)]*1
12AAB403 [.18"(5m)]
12AAB415 [.39"(10m)]
[ ]: Tip radius

Small hole type



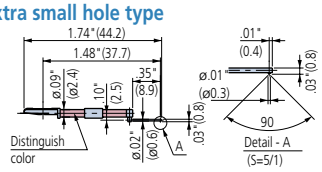
12AAC732 [.08"(2m)]*1
12AAB404 [.18"(5m)]
12AAB416 [.39"(10m)]
[ ]: Tip radius

Extra small hole type



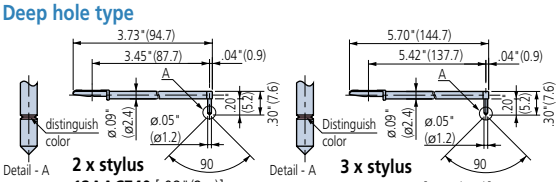
12AAC733 [.08"(2m)]*1
12AAB405 [.18"(5m)]
12AAB417 [.39"(10m)]
[ ]: Tip radius

Extra small hole type



12AAC734 [.08"(2m)]*1
12AAB406 [.18"(5m)]
12AAB418 [.39"(10m)]
[ ]: Tip radius

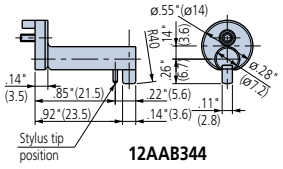
Deep hole type



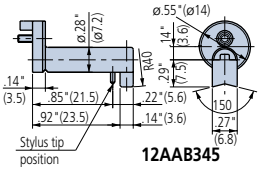
2 x stylus
12AAC740 [.08"(2m)]
12AAB413 [.18"(5m)]
12AAB425 [.39"(10m)]
[ ]: Tip radius

3 x stylus
12AAC741 [.08"(2m)]*1
12AAB414 [.18"(5m)]
12AAB426 [.39"(10m)]
[ ]: Tip radius

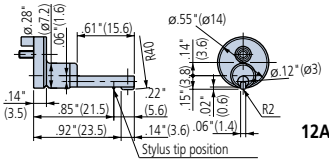
Applicable skid nosepiece



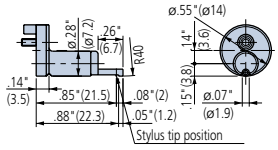
12AAB344



12AAB345

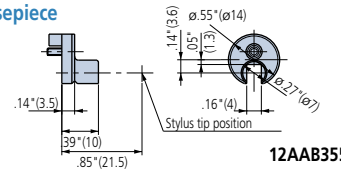


12AAB346



12AAB347

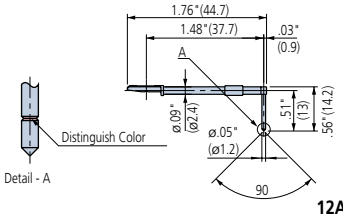
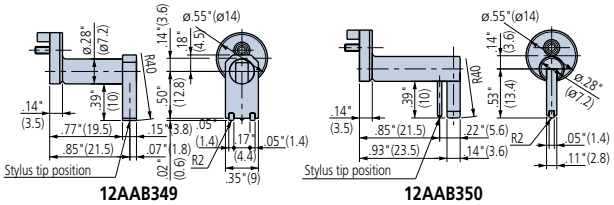
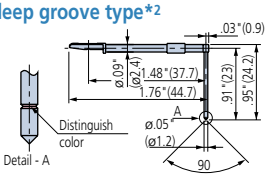
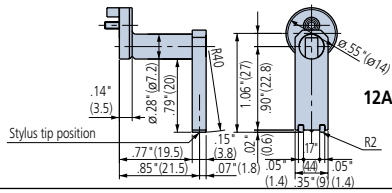
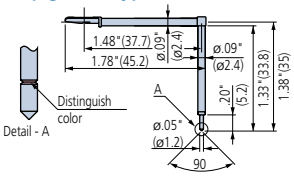
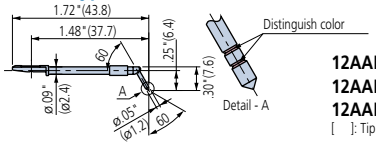
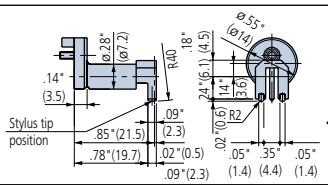
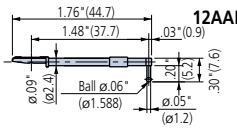
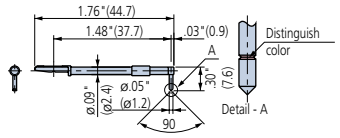
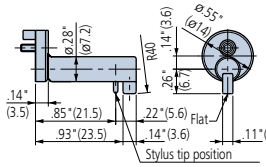
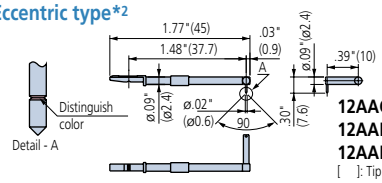
Skidless nosepiece



12AAB355

*1 Tip angle is 60

Unit: Inch/(Metric)

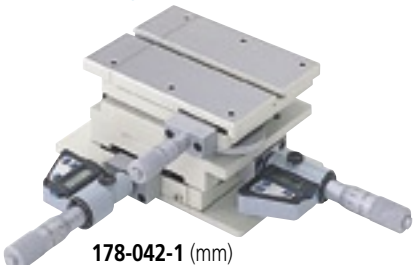
Stylus	Applicable skid nosepiece
Deep groove type*2	
	
12AAC735 [.08"(2m)]*1 **12AAB409** [.18"(5m)] **12AAB421** [.39"(10m)] [ ]: Tip radius	**12AAB349** **12AAB350** **12AAB351** **12AAB352**
Extra deep groove type*2	
	
12AAC736 [.08"(2m)]*1 **12AAB408** [.18"(5m)] **12AAB420** [.39"(10m)] [ ]: Tip radius	**12AAB348**
Extra deep groove type*2	
	
12AAC737 [.08"(2m)]*1 **12AAB407** [.18"(5m)] **12AAB419** [.39"(10m)] [ ]: Tip radius	
Gear face type	
	
12AAB339 [.08"(2m)]*1 **12AAB410** [.18"(5m)] **12AAB422** [.39"(10m)] [ ]: Tip radius	**12AAB353**
WE-curve type	
	
12AAB338	
Knife edge type	
	
12AAC738 [.08"(2m)]*1 **12AAB411** [.18"(5m)] **12AAB423** [.39"(10m)] [ ]: Tip radius	**12AAB354**
Eccentric type*2	
	
12AAC739 [.08"(2m)]*1 **12AAB412** [.18"(5m)] **12AAB424** [.39"(10m)] [ ]: Tip radius	

*1 Tip angle is 60 *2 When using this stylus the measuring force at the detector cannot be guaranteed.

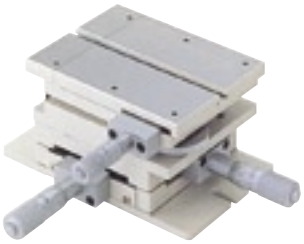
Optional Accessories

Stand, Tables

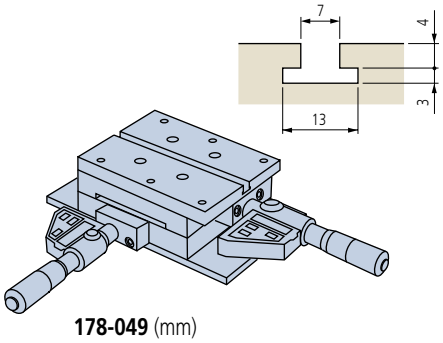
XY leveling tables



178-042-1 (mm)
178-052-1 (inch/mm)



178-043-1 (mm)
178-053-1 (inch/mm)



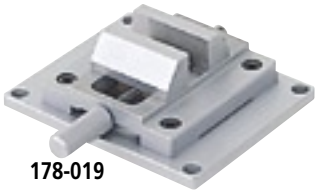
178-049 (mm)
178-059 (inch/mm)

Order No.	178-042-1,178-052-1	178-043-1,178-053-1	178-049,178-059
Table size	5.12″ x 3.94″(130 x 100mm)		
Maximum loading	15kgf		
Inclination angle	±1.5°		—
Horizontal rotating angle	±3°		—
X, Y axis displacement	±.49″(12.5mm)	±.49″(12.5mm)	±.49″(12.5mm)
Min. reading of the micrometer head	.00005″(0.001mm)*	.001″(0.001mm)*	.00005″(0.001mm)*
Dimension	10.31"x9.17"x3.27" (262x233x83mm)	8.66"x7.44"x3.27" (220x189x83mm)	10.31"x9.17"x2.16" (262x233x55mm)
Mass	13.89 lbs. (6.3kg)	13.22 lbs. (6kg)	11.02 lbs. (5kg)

* Digital display

Precision vise

• Can be used with the XY leveling table.

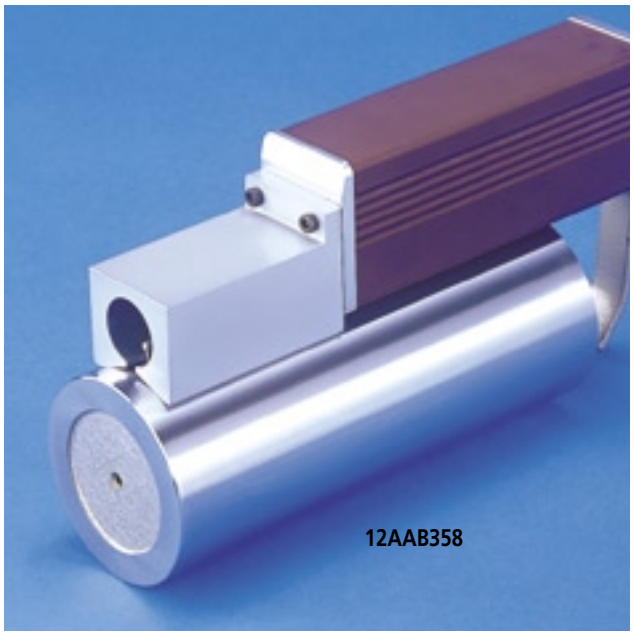


178-019

Order No	178-019
Clamping method	Sliding jaws
Jaw opening	1.42″(36mm)
Jaw width	1.73″(44mm)
Jaw depth	.63″(16mm)
Height	1.50″(38mm)

Cylinder attachment

Used to attach on a cylinder
Diameter: ø.59" up to 2.36" (ø15mm up to 60mm)



Mitutoyo

Manual column stand

Column travel: 7.87"(200mm)
Dimensions: 14.57"x7.87"x29.13"
(370x200x740mm)
Mass: 28.66 lbs. (13kg)

178-009

Leveling table (for D.A.T. function)

- Can be used with the XY leveling tables.

Table swivels: ±1.5°
Table size: 5.12"x3.94"
(130x100mm)
Max. Loading: 15kgf

178-048 (mm)
178-058 (inch/mm)

Measuring data output

Input tool

Data input device for spreadsheet software.

264-005

SPC connecting cables

Connects a control unit with DP-1VR.
3'(1m): **936937**
6'(2m: **965014**

DP-1VR

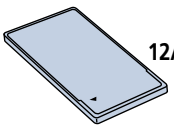
Performs various statistical processing

264-503 (100V)
264-503A (120V)
264-503D (220V)
264-503E (240/220V)

Others

Memory card

Stores/recalls the measuring conditions (up to 20), measured data, and statistical data.
Memory: 8MB



12AAA841

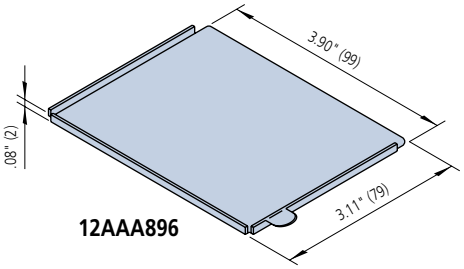
Reference step specimen

Used to calibrate detector sensitivity.
Step nominal value: 2µm/10µm

178-611 (mm)
178-612 (inch/mm)

LCD protective sheet

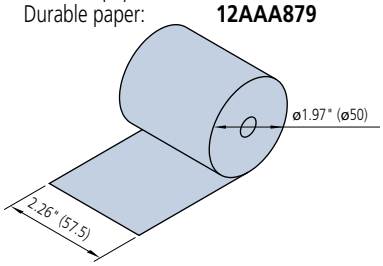
For touch panel protection
(10 sheet set)



12AAA896

Printer paper

Five rolls (25m)
Standard paper: **270732**
Durable paper: **12AAA879**



Specifications are subject to change without notice.

- Coordinate Measuring Machines
- Vision Measuring Systems
- Form Measurement
- Optical Measuring
- Sensor Systems
- Testing Equipment and Seismometer
- Digital Scale and DRO Systems
- Small Tool Instruments and Data Management

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