Surftest SJ-400

PORTABLE SURFACE ROUGHNESS TESTER

Mitutoyo

Surftest SJ-400

Revolutionary New Portable Surface Roughness Testers Make Their Debut!

Now, long-awaited specifications and functions are at hand: compactness, skidless measurement, high-accuracy roughness detection, multi-function, and ease of operation.

Requirement 1

High-accuracy measurements with a hand-held tester

A wide-range, high-resolution detector and an straight drive unit provide superior high-accuracy measurement in its class.

<Detector>
Measuring range: 800μm
Resolution: 0.000125μm (at 8μm range)
<Drive unit>
Straightness/traverse length
SJ-401: 0.3μm/25mm
SJ-402: 0.5μm/50mm

SJ-402

SJ-401

Requirement 2

Roughness parameters that conform to international standards

The SJ-400 series performs 36 kinds of roughness measurements that conform to the latest ISO, DIN, and ANSI standards as well as to JIS standards (1994/1982).

Requirement 3

Measurement of cylinder surface roughness even with a compact type

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

Requirement 4

Measurement/evaluation of stepped features and straightness

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

SJ-401

Requirement 5

Advanced data processing with an extended analyzing program

The SJ-400 series allows data processing that is identical to that in the high-end class. These data analysis and report creation capabilities can be achieved with this system using the surface roughness analyzing program SURFPAK-SJ.

Series

Requirement 6

Confirmation of a measurement results and an assessed profile without printout

Using the integrated large touch-panel LCD monitor, measurement results and an assessed profile can be clearly displayed.

Calculation Result screen

Measured Profile screen

Deep groove measurement

Upside down measurement

Cylinder measurement with a support foot

Measurement with a stand and a leveling table

R-surface measurement


Fine contour measurement

# The SJ-400 Series Performs Skidless Measurements

The SJ-400 series employs a detector with exchangeable nosepiece that is interchangeable between skidless measurement and skid measurement. It allows optional evaluation according to measurement conditions.

Skidless measurement

- In skidless measurement surface irregularities are detected with reference to the guide on the drive unit, it can measure waviness and finely stepped features in addition to surface roughness.
- The SJ-400 series supports a variety of surface feature measurements by replacing the stylus.

Skid measurement

- In skid measurement surface irregularities are detected with reference to the skid that traces waviness on a measuring surface, it cannot measure waviness and stepped features exactly.
- This measurement facilitates the leveling of the detector/drive unit.

Simplified surface feature evaluation with the ruler function

- This function determines the coordinate difference between two arbitrary points, such as a step height and a pitch interval.

Ruler Analysis screen
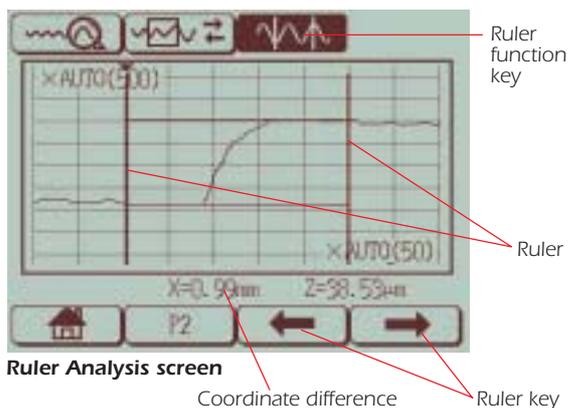
## A variety of accessories

- A stylus and a nosepiece can be selected according to the measurement condition. (See page 9 – 11.)
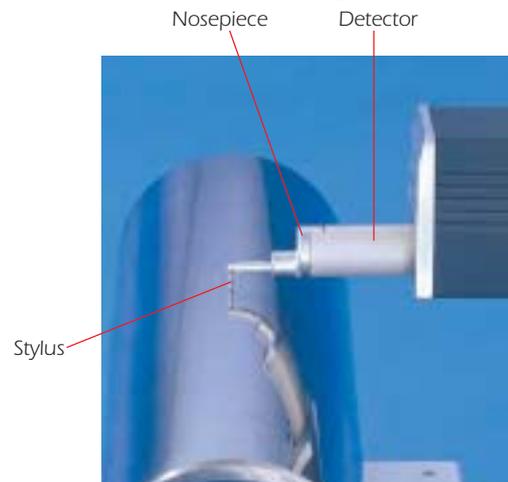
Powerful Support for Leveling

The height-tilt adjustment unit comes as standard for powerful support of the leveling operation at skidless measurement. This unique and convenient function has achieved high-accuracy measurement with ease of operation.

The D.A.T. Function

Height adjusting knob

Tilt adjusting knob

Height-tilt adjustment unit

DAT Measurement
Ac   0.8mm X5 RANGE(80)

−3.78 μm
−1.37 TURN

Z.ADJ

Turn the tilt adjusting knob by this amount.

DAT screen showing the amount to be adjusted

With D.A.T → Preliminary measurement → DAT screen (adjustment amount) → Adjustment of the tilt adjustment knob by the specified amount →

Final measurement

Without D.A.T → Preliminary measurement → Intuitive adjustment using the tilt adjustment knob → Confirmation measurement → OK

NG → Repeat →

The D.A.T. Function for the optional leveling table

When using with the stand, the D.A.T. function can work with the optional leveling table.

Leveling table (for D.A.T.)

Digimatic micrometer head

DAT Measurement
Ac   0.8mm X5 RANGE(80)

−3.78 μm
−0.928 mm

Z.ADJ

Move the micrometer head by this amount.
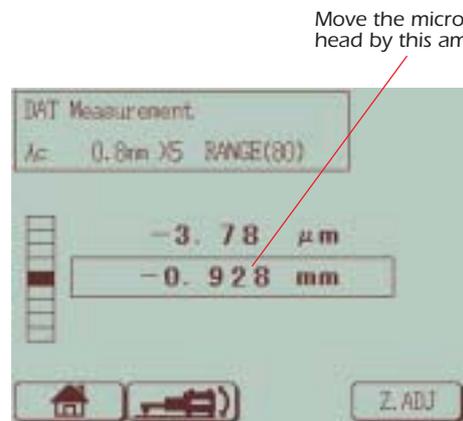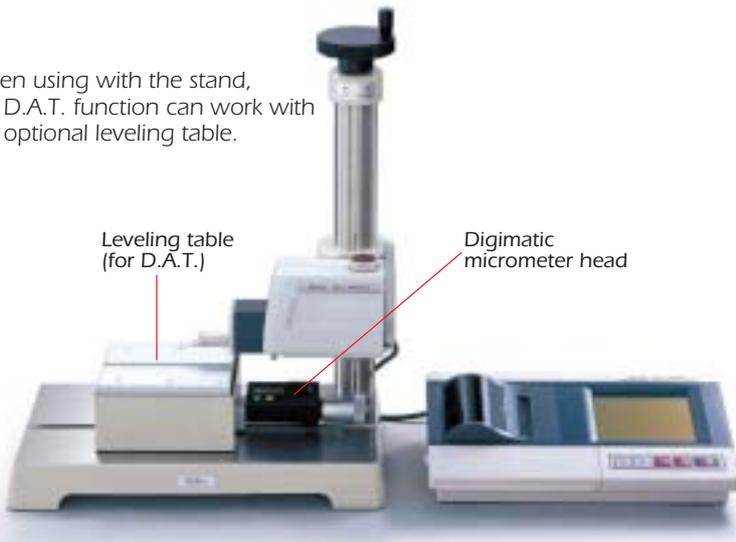
DAT screen showing the amount to be adjusted

Full Equipped Measuring Functions Even in a Compact Tester

Support for R-surface roughness measurement (skidless measurement)

Usually a workpiece with a spherical or cylindrical surface cannot be evaluated. By eliminating the round surface element with a filter, this function processes this R-surface data as if it was taken from a flat surface.

Measurement of a cylindrical surface

Measured profile

R-Surface compensation
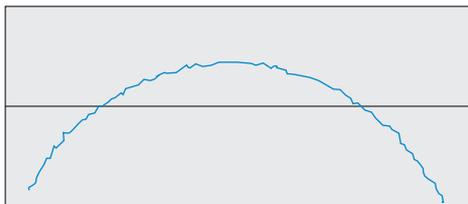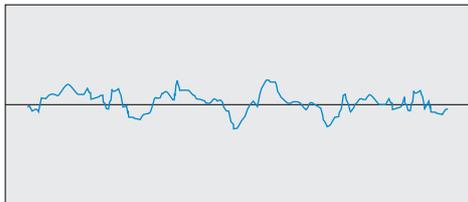
Assessed profile

Statistical processing function

This function performs statistical processing of multiple measurements for one roughness parameter. It is possible to display and print histograms in addition to statistical results (mean, standard deviation, maximum value/minimum value, and acceptance ratio).


Statistical

Switchable

Histograms
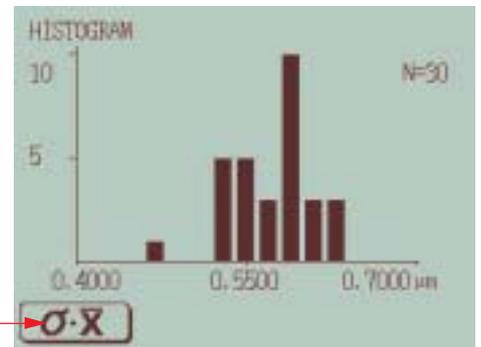
Built-in thermal printer

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 result and assessed profile. These results and profiles can be printed out in landscape format, just as they appear on the LCD. They are presented in an easy-to-understand form.
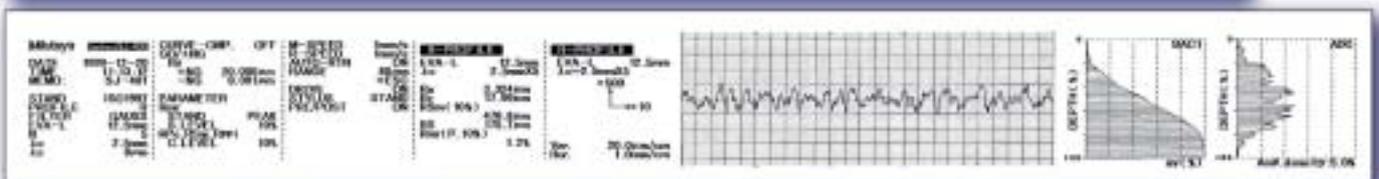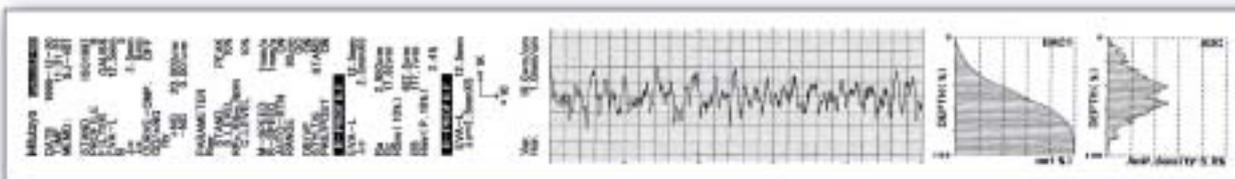
GO/NG judgment function

According to the upper/lower tolerance limits set the GO/NG judgment sign is displayed and the calculation result is highlighted (max. for 3 roughness parameters).
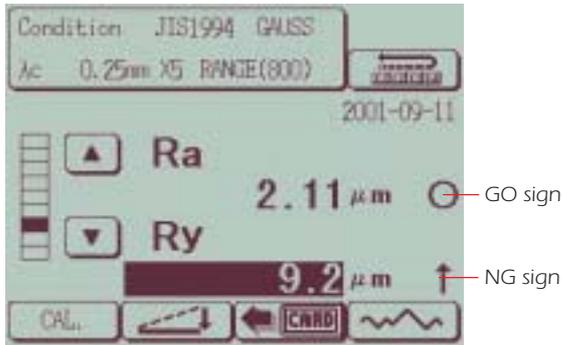
Calculation Result screen with GO / NG judgment result

Real sampling function

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

Recalculation function

It is possible to recalculate already measured data for other evaluation by changing the current standard, assessed profile and roughness parameters.

Arbitrary length measurement function

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

Key masking function

This function invalidates the key operation on the touch panel. Since only the sheet key operation is valid, there is no chance for error in data, including calibration conditions and measurement conditions.
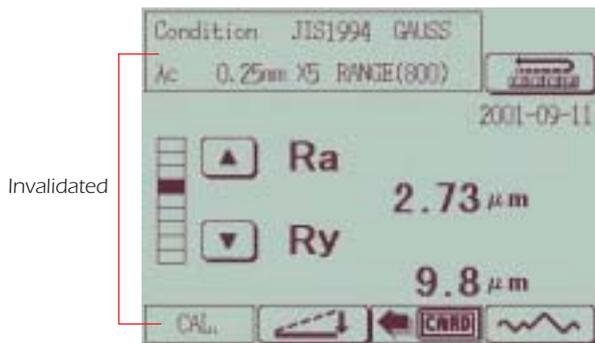
Auto-Calibration function

The SJ-400 series is equipped with the Ra calibration and step calibration methods for detector calibration (gain adjustment). In both calibration methods only the reference value described in the precision specimen needs to be entered. No other operation such as volume control is required.

Calibration screen

Saving/calling the measured data and conditions

It is possible to save the measurement conditions and measured data in the control unit or memory card (optional) and to recall the data from both.
Batch printout of the measured data after performing on-site measurement and saving the data will raise measurement efficiency.

Saving capacity

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

Customize function

This function selects only the necessary parameters for calculation/display from a variety of roughness parameters. It is also possible to add parameters later for recalculation.
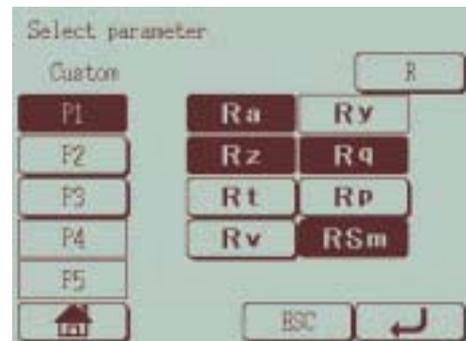
Customized screen

Various Evaluations in Conjunction with the Analyzing Program

SJ-400

RS-232C connecting cable
(**12AAA882**)

(**12AAA841**)

Memory card

COMPACTFLASH™ Card Reader

Surface roughness analyzing program SURFPAK-SJ

In conjunction with SURFPAK-SJ, the SJ-400 series has the same excellent operability and advanced analysis performance that is achieved by a high-end desk top tester. The SURFPAK-SJ increases the number of roughness parameters and analysis graphs, and also allows the elimination of unnecessary data and the evaluation of surface features including step and pitch. In addition to surface roughness capabilities, the SJ-400 series can make a total evaluation of a complete set of surface features. This small system can be used as a high-end desktop evaluation system.

SURFPAK®-SJ

Printout

Calculation result display

Measurement condition display

Evaluation Curve display

Analysis screen

Evaluation condition display

Analysis graph display
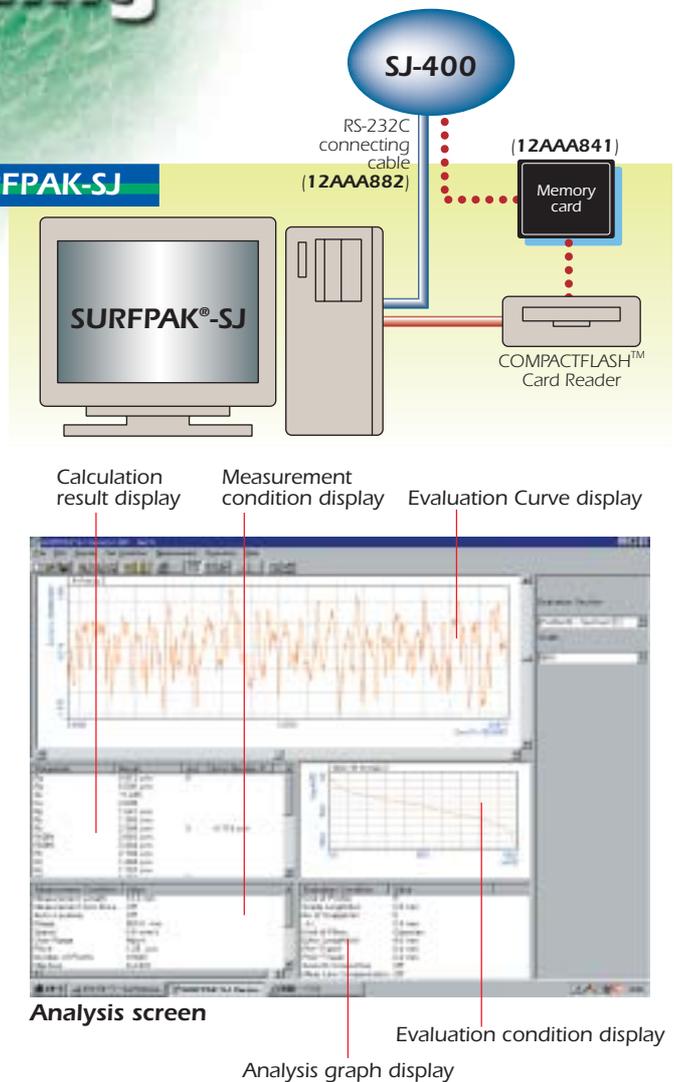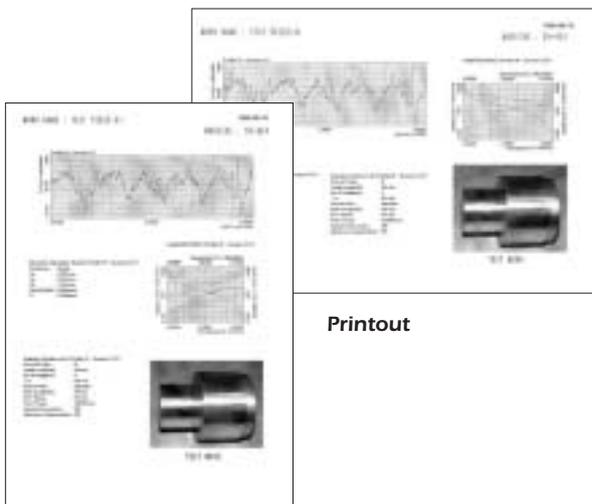
SURFPAK-SJ Specifications

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 motif (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: 0.025mm, 0.08mm, 0.25mm, 0.8mm, 2.5mm, 8mm, 25mm or arbitrary value (.001", .003", .01", .03", .1", .3", 1" or arbitrary value) fl: 0.25mm, 0.8mm, 2.5mm, 8mm or arbitrary value (.01", .03" or arbitrary value) fh: 0.25mm, 0.8mm, 2.5mm, 8mm or arbitrary value (.01", .03" or arbitrary value)
Sampling length (L)*		0.025mm, 0.08mm, 0.25mm, 0.8mm, 2.5mm, 8mm, 25mm or arbitrary value (.001", .003",.01", .1", .3", 1")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 value can be specified in the following range: from 0.3mm (.012") to the maximum traverse length.

Carrying case is a standard accessory

Specifications

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/Skid measurement				
Measuring range	Z-axis	800µm, 80µm, 8µm (32000µin, 3200µin, 320µin) (Up to 2,400µm with an option stylus)				
	X-axis	SJ-401: 25mm (1") SJ-402: 50mm (2")				
Drive method	Straightness	SJ-401: 0.3µm/25mm (12µin/1") SJ-402: 0.5µm/50mm (20µin/2")				
	Measuring speed	0.05, 0.1, 0.5, 1.0mm/s (.002", .004", .02", .04"/s)				
	Return speed	0.5, 1.0, 2.0 mm/s (.02", .04", .08"/s)				
Height-Tilt adjustment unit	Tilt adjustment range	±1.5°				
	Height adjustment amount	10mm/.39"				
Assessed profile		Primary profile (P), Roughness profile (R), Filtered waviness profile (W), DIN4776, MOTIF (R, W)				
Evaluation parameter		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 graph		Bearing Area Curve (BAC), Amplitude Distribution Curve (ADC)				
Number of sampling length		X1, X3, X5, XL* (*=arbitrary length)				
Arbitrary length		SJ-401: 0.1 to 25mm (0.1mm increments) [.01" to 2" (.01" increments)] SJ-402: 0.1 to 50mm (0.1mm increments) [.04" to 2" (.01" increments)]				
Sampling length (L)		0.08, 0.25, 0.8, 2.5, 8mm (.003", .01", .03", .1", .3")				
Printing width		48mm (1.89")/paper width: 58mm (2.28")				
Recording magnification	Vertical magnification	10 to 100K magnification, Auto				
	Horizontal magnification	1 to 1K magnification, Auto				
Detector	Detection method	Differential inductance method				
	Minimum resolution	0.000125µm (8µm range)/.005µin (320µin range)				
	Stylus tip	Corn 90°, Radius 5µm, Diamond		Corn 60°, Radius 2µm, Diamond		
	Measuring force	4mN		0.75mN		
	Radius of skid curvature	40mm/1.57"				
	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 the leveling during the skidless measurement				
	Displacement detection mode	Input the stylus displacement 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		0.08, 0.25, 0.8, 2.5, 8mm (.003", .01", .03", .1", .3")				
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 measurement	600 maximum without printing				
Power consumption		43W (max.)				
Dimension	Control unit	307x165x94mm (12.09"x6.50"x3.7")				
	Height-Tilt adjustment unit	131x63x99mm (5.16"x2.48"x3.90")				
	Drive unit	SJ-401: 128x36x47mm (5.04"x1.42"x1.85") SJ-402: 155x36x47mm (6.08"x1.41"x1.84")				
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 the data processing system (option)				
Mass	Control unit	1.2kg (2.64lbs.)				
	Height-Tilt adjustment unit	0.4kg (1.88lbs.)				
	Drive unit	SJ-401: 0.6kg (1.32lbs.) SJ-402: 0.64kg (1.41lbs.)				
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 suffixs (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
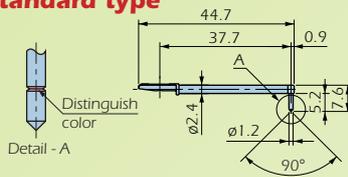
Stylus Skid nosepiece (**12AAB344**) Detector

Skidless nosepiece (**12AAB355**)

Unit: mm

Stylus	Applicable skid nosepiece

Standard type

12AAC731 (2μm)*¹
12AAB403 (5μm)
12AAB415 (10μm)
( ): Tip radius

Stylus tip position **12AAB344**
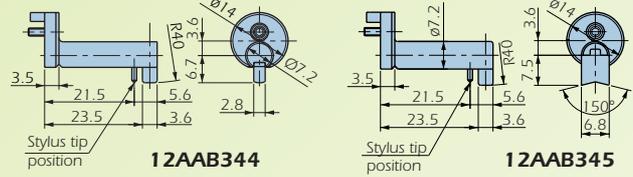
Stylus tip position **12AAB345**

Small hole type

Distinguish color

Detail - A (S=5/1)

12AAC732 (2μm)*¹
12AAB404 (5μm)
12AAB416 (10μm)
( ): Tip radius
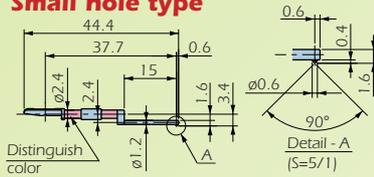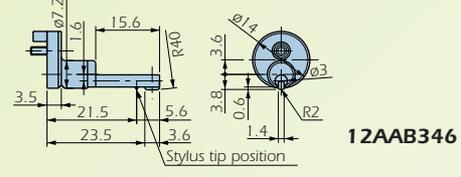
Stylus tip position **12AAB346**

Extra small hole type

Distinguish color

Detail - A (S=5/1)

12AAC733 (2μm)*¹
12AAB405 (5μm)
12AAB417 (10μm)
( ): Tip radius
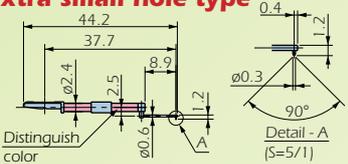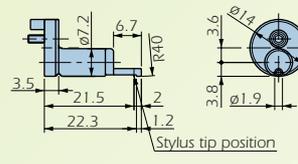
Stylus tip position **12AAB347**

Extra small hole type

Distinguish color

Detail - A (S=5/1)
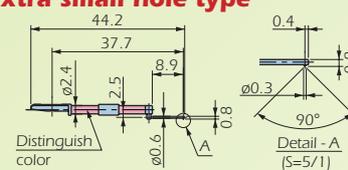
12AAC734 (2μm)*¹
12AAB406 (5μm)
12AAB418 (10μm)
( ): Tip radius

Deep hole type

distinguish color

Detail - A **2 x stylus**
12AAC740 (2μm)
12AAB413 (5μm)
12AAB425 (10μm)
( ): Tip radius

Distinguish color
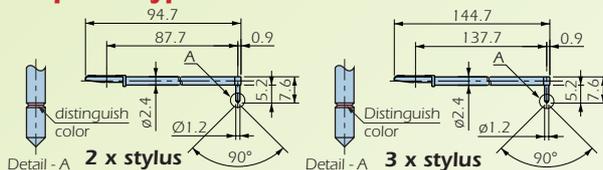
Detail - A **3 x stylus**
12AAC741 (2μm)*¹
12AAB414 (5μm)
12AAB426 (10μm)
( ): Tip radius

*¹ Tip angle is 60°

Skidless nosepiece

Stylus tip position **12AAB355**

Stylus	Applicable skid nosepiece

Deep groove type*²

Detail - A
Distinguish Color

44.7
37.7
0.9
A
ø2.4
13
14.2
ø1.2
90°
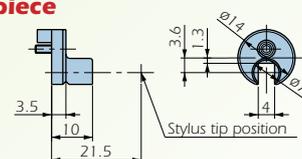
12AAC735 (2μm)*¹
12AAB409 (5μm)
12AAB421 (10μm)
( ): Tip radius

ø7.2 3.6 ø14 R40 12.8 3.8 1.8 0.6 1.4 4.4 1.4 9
3.5 19.5 21.5
Stylus tip position

12AAB349

ø14 3.6 R40 ø7.2 13.4 5.6 3.6 R2 1.4 2.8
3.5 21.5 23.5
Stylus tip position

12AAB350

ø7.2 3.6 ø14 R40 13.4 5 (8.4) 3.8 1.8 ø1.5 2.5 9
3.5 19.5 21.5
Stylus tip position

12AAB351

ø7.2 4.5 ø14 R40 17.9 13.4 3.6 3 3 10 5 R2 1 5 9 1.4 11.6
3.5 21.5
Stylus tip position

12AAB352

Extra deep groove type*²

0.9
ø2.4 37.7 23 24.2
44.7
A
Distinguish color
Detail - A
ø1.2 90°
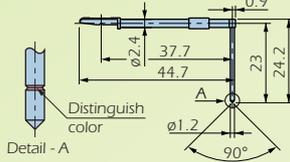
12AAC736 (2μm)*¹
12AAB408 (5μm)
12AAB420 (10μm)
( ): Tip radius

ø7.2 R40 ø14 20 27 22.8
3.5 19.5 21.5 3.8 1.8 0.6 1.4 4.4 1.4 9 R2
Stylus tip position

12AAB348

Extra deep groove type*²

37.7 ø2.4 ø2.4
45.2
33.8 35
A 5.2
Distinguish color
Detail - A
ø1.2 90°
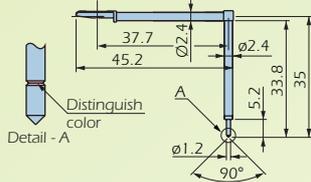
12AAC737 (2μm)*¹
12AAB407 (5μm)
12AAB419 (10μm)
( ): Tip radius

Gear face type

43.8
37.7
60° 6.4
ø2.4 7.6 A
ø1.2 60°
Distinguish color
Detail - A
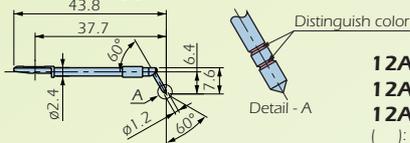
12AAB339 (2μm)*¹
12AAB410 (5μm)
12AAB422 (10μm)
( ): Tip radius

ø7.2 R40 4.5 ø14 6.1 3.6 2.3 R2 0.5 1.4 4.4 1.4 2.3
3.5 21.5 19.7
Stylus tip position

12AAB353

WE-curve type

44.7
37.7 0.9
ø2.4 5.2 7.6
Ball ø1.588 ø1.2
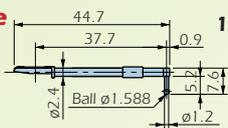
12AAB338

Knife edge type

44.7
37.7 0.9
A 7.6
ø2.4 ø1.2 90°
Distinguish color
Detail - A
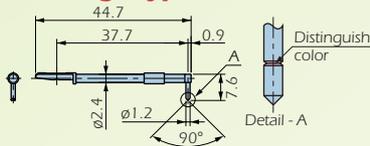
12AAC738 (2μm)*¹
12AAB411 (5μm)
12AAB423 (10μm)
( ): Tip radius

ø7.2 R40 3.6 ø14 6.7 Flat 2.8
3.5 21.5 23.5 5.6 3.6
Stylus tip position

12AAB354

Eccentric type*²

45
37.7 0.9 ø2.4 10
A 7.6
ø2.4 ø0.6 90°
Distinguish color
Detail - A
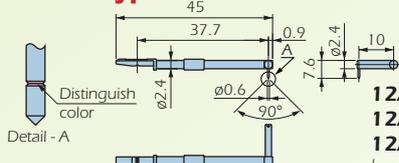
12AAC739 (2μm)*¹
12AAB412 (5μm)
12AAB424 (10μm)
( ): Tip radius
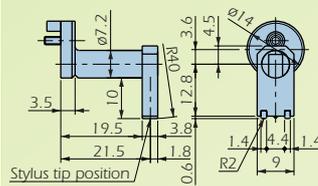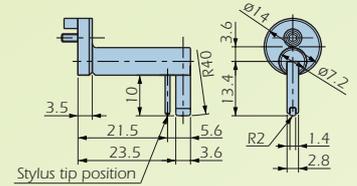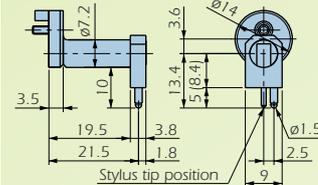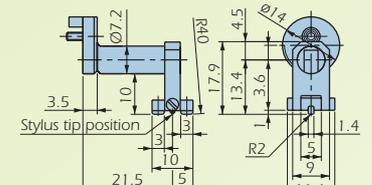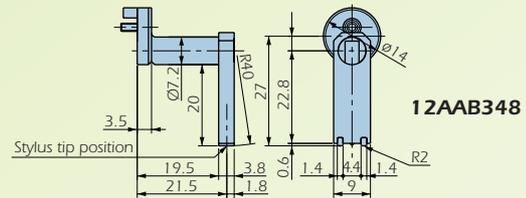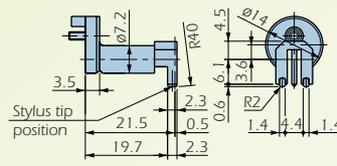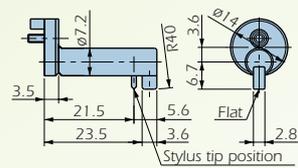
*¹ Tip angle is 60°   *² At using this stylus, measuring force of the detector does not guarantee.

Stand, Tables

XY leveling tables

178-042-1 (mm)
178-052-1 (inch/mm)
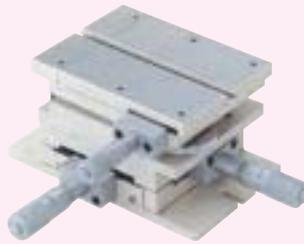
178-043-1 (mm)
178-053-1 (inch/mm)
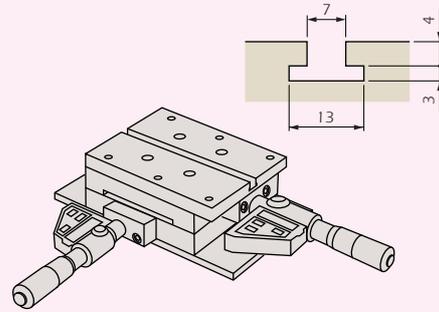
178-049 (mm)
178-059 (inch/mm)

Order No.	178-042-1,178-052-1	178-043-1,178-053-1	178-049,178-059
Table size	130 x 100mm/5.12" x 3.94"		
Maximum loading weight	15Kg		
Inclination angle	±1.5°		—
Horizontal rotating angle	±3°		—
X, Y axis displacement	±12.5mm/.49"	±12.5mm/.49"	±12.5mm/.49"
Min. reading of the micrometer head	0.001mm/.00005"*	0.001mm/.001"*	0.001mm/.00005"*
Dimension	262 x 233 x 83mm	220 x 189 x 83mm	262 x 233 x 55mm
Mass	6.3kg	6kg	5kg

* Digital display

Precision vise

▪ Can be used with the XY leveling table.

178-019

Order No.	178-019
Mounting method	Two-sliding- jaw
Clamp opening	36mm/1.42"
Clamp width	44mm/1.73"
Clamp depth	16mm/.63"
Height	38mm/1.50"

Manual column stand

Column travel: 200mm
Dimensions: 370x200x740mm
Mass: 13kg

178-009

Cylinder attachment

Used to attach on a cylinder
Diameter: ø15mm up to 60mm

12AAB358
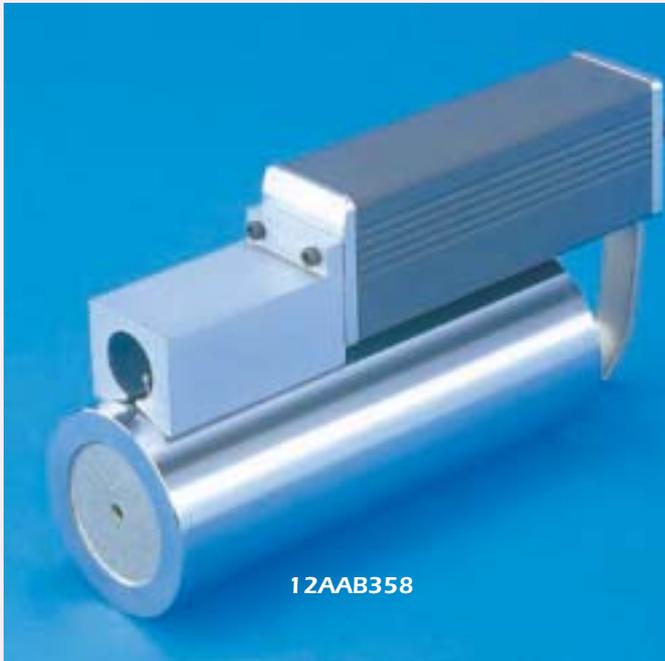
Leveling table

▪ Can be used with the XY leveling table.
Table swivels: ±1.5°
Table size: 130x100mm
Max. Loading weight: 15kg

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

Input tool

Data input device for spread sheet software.

264-005

SPC connecting cables

Connects a control unit with DP-1VR.
1m: **936937**
2m: **965014**

DP-1VR

Performs various statistical processing

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

Others

Memory card

Saves/Retrieves 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 sheets set)

2 (.08")
99 (3.90")
79 (3.11")

12AAA896

Printer paper

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

Ø50 (1.97")
57.5 (2.26")

Coordinate Measuring Machines

Vision Measuring Systems

Surface-, Form- and Contour Measurement

Digital Scale and DRO Systems

Optical Measuring

Sensor Systems

Hardness Measuring

Small Tool Instruments and Data Management

Mitutoyo America Corporation
www.mitutoyo.com

M³ Solution Center

Michigan
Phone: (734) 459-2810

Illinois
Phone: (630) 978-5385

California
Phone: (626) 961-9661

Massachusetts
Phone: (978) 692-8765

Indiana
Phone: (317) 577-6070

North Carolina
Phone: (704) 875-8332

Job No.11B-8

Mitutoyo