Portable Surface Roughness Tester
Surftest SJ-410 Series
Portable Surface Roughness Tester

**Surftest SJ-410 Series**

Analysis functions that are a notch above the usual

1. **User benefit 1**
   Easy and safe measurements that anyone can perform efficiently

2. **User benefit 2**
   Higher level of quality control
Touch screen for easier operations

The high-visibility color-graphic LCD touch screen clearly displays calculated results and assessed profiles. A backlight enables comfortable viewing even under poor lighting conditions.

User benefit 3

Doing double duty for space saving

SJ-412
Traverse range 50 mm

SJ-411
Traverse range 25 mm
Easy and safe measurements that anyone can perform efficiently

The auto-set unit* enables measurements to be made with a single button push, saving you time and increasing work efficiency.

The auto-set function safely controls descent of the detector, eliminating the possibility of operator error causing damage to the stylus.

Auto-set unit*
178-010
This unit automatically completes a full measurement cycle of stylus contact, measurement, stylus retraction and detector auto-return from just one button push (stylus retraction and detector auto-return can be switched on and off by operating the drive unit).

Options for SJ-410 Series

X-axis adjustment unit* 178-020
This unit helps fine-tune the horizontal (X axis) direction.

Tilting adjustment unit* 178-030
This unit is used for aligning the workpiece surface with the detector reference plane. It supports the DAT function to make the leveling of workpiece surfaces easier.

Complete set*

Tilting adjustment unit 178-030
Auto-set unit 178-010
X-axis adjustment unit 178-020

* This is an optional accessory for the SJ-410 Series. It can only be used on the simple column stand (optional accessory, order No. 178-039). When the units are used in combination, straightness for SJ-411/412 drive unit will be degraded about 0.2 μm. Cannot be used when the tester’s main unit is an older model (SJ-401/402).
Assessing a single measurement result under two different evaluation conditions

A single measurement enables simultaneous analysis under two different evaluation conditions. A single measurement allows calculation of parameters and analysis of filtered profiles without the need for recalculation after saving data, contributing to higher work efficiency.

3-axis Adjustment Table <Option> 178-047

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

DAT Function for the leveling table <Option>

The levelling table can be used to align the surface to be tested with the detector reference plane. The operator is guided through the procedure by screen prompts.

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.

Simple column stand for SJ-410 Series <Option> 178-039

Vertical adjustment range: 250 mm
Dimensions: 400x250x578 mm
Mass: 20 kg
Anyone can easily perform high-level data collection.

Higher level of quality control
Wireless communication and advanced analysis

Wireless and quick capture of measurement results on a PC. No more handwriting, and also easy data input with a single touch <Option>

Wireless Input Tool
U-WAVE

This unit allows you to remotely load Surftest SJ-410 calculation results (SPC output) into commercial spreadsheet software on a PC. You can essentially use a one-touch operation to enter the calculation results (values) into the cells in the spreadsheet software.

<table>
<thead>
<tr>
<th>U-WAVE-R (Connects to the PC)</th>
<th>02AZD810D</th>
</tr>
</thead>
<tbody>
<tr>
<td>U-WAVE-T* (Connects to the SJ-410)</td>
<td>02AZD880G</td>
</tr>
</tbody>
</table>

* Requires the optional Surftest SJ-410 connection cable. 02AZD790D

One-touch Input
USB Input Tool

This unit allows you to load Surftest SJ-410 calculation results (SPC output) into commercial spreadsheet software on a PC via a USB connector. You can essentially use a one-touch operation to enter the calculation results (values) into the cells in the spreadsheet software.

<table>
<thead>
<tr>
<th>USB Input Tool Direct</th>
<th>USB-ITN-D</th>
<th>06AFM380D</th>
</tr>
</thead>
<tbody>
<tr>
<td>USB keyboard signal conversion type*</td>
<td>IT-016U</td>
<td>264-016-10</td>
</tr>
</tbody>
</table>

* Requires the optional Surftest SJ-410 connection cable.
1 m: 936937
2 m: 965014

User benefit 2
Higher level of quality control
Wireless communication and advanced analysis

Anyone can easily perform high-level data collection.
Contour/Roughness analysis software

**FORMTRACEPAK-AP**

More advanced analysis can be performed by loading **SJ-410** Series measurement data to software program **FORMTRACEPAK-AP** via a memory card (option) for processing back at base.

### Higher accuracy measurements with selectable drive unit

- **Detector**
  - Measuring range/resolution:
    - 800 μm/0.01 μm
    - 80 μm/0.001 μm
    - 8 μm/0.0001 μm

- **High straightness drive unit**
  - Drive unit
  - Straightness/traverse length:
    - 0.3 μm/25 mm (**SJ-411**)
    - 0.5 μm/50 mm (**SJ-412**)

### Extending measurement to narrow features

Surface roughness measurement requires a run-up distance before starting the measurement (or retrieving data). When the **SJ-410** Series measures, its run-up distance is normally set to 0.5 mm. However, this distance can be shortened to 0.15 mm using the narrow-part measurement function. This function extends the measurement of narrow locations to features such as piston-ring grooves and O-ring grooves.

#### Typical applications

- **Surface roughness measurement of piston-ring groove**
- **Surface roughness measurement of O-ring groove**

### Easily measures R-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. Other curved surfaces can be processed besides cylindrical, such as paraboloidal and ellipsoidal.
Supporting not only surface roughness measurement but also contour (fine contour) measurement

Simple contour analysis function

Point group data collected for surface roughness evaluation is used to perform simplified contour analysis (step, step height, area and coordinate difference). It assesses minute forms that cannot be assessed by a regular contour measuring machine.

Your choice of skidless or skidded measurement

**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.

**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 the range of movement within which measurement can be made is greater because the skid tracks the workpiece surface contour.
Easy to use and highly functional

This portable surface roughness tester is equipped with analysis functionality rivaling that of benchtop surface roughness testers.

Equipped with externally controllable interfaces as standard

A variety of interfaces supplied as standard
The external device interfaces that come as standard include USB, RS-232C, SPC output and foot switch I/F.

Data storage

Memory card (optional) is supported
The measurement conditions and data can be stored in a memory card (optional) and recalled as required. This enables batch analysis and printout of data after on-site measurement.

High-speed thermal printer built in

High-speed printer prints out measurement results on site
A high-quality, high-speed thermal printer prints out measurement 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 color-graphic LCD.

Equipped with convenient carrying case as standard

The unit is easily transported in a dedicated carrying case which includes holders for the accessories as well as the tester itself. (Standard accessory)
Other Optional Accessories

**XY leveling tables**
The tester includes X- and Y-axes micrometer heads. This makes axis alignment much easier because the tilt adjustment center is the same as the rotation center of the table.
(Order No. 178-042-1/178-043-1)

Movement is in X and Y axes only.

<table>
<thead>
<tr>
<th>Items</th>
<th>178-042-1</th>
<th>178-043-1</th>
<th>178-049</th>
</tr>
</thead>
<tbody>
<tr>
<td>Table dimensions</td>
<td>130×100 mm</td>
<td>100×100</td>
<td>100×55</td>
</tr>
<tr>
<td>Maximum load</td>
<td>15 kg</td>
<td>15 kg</td>
<td>10 kg</td>
</tr>
<tr>
<td>Inclination angle</td>
<td>±1.5°</td>
<td>±1.5°</td>
<td>±1.5°</td>
</tr>
<tr>
<td>Swiveling angle</td>
<td>±2°</td>
<td>±2°</td>
<td>±2°</td>
</tr>
<tr>
<td>X/Y-axis travel range</td>
<td>±12.5 mm</td>
<td>±12.5 mm</td>
<td>±12.5 mm</td>
</tr>
<tr>
<td>Resolution</td>
<td>0.001 mm</td>
<td>0.01 mm</td>
<td>0.001 mm</td>
</tr>
<tr>
<td>Dimensions</td>
<td>262×233×83 mm</td>
<td>220×189×83 mm</td>
<td>262×233×55 mm</td>
</tr>
<tr>
<td>Mass</td>
<td>6.3 kg</td>
<td>6 kg</td>
<td>5 kg</td>
</tr>
</tbody>
</table>

**Precision vise**
Fits on the stand.

<table>
<thead>
<tr>
<th>Order No.</th>
<th>Items</th>
</tr>
</thead>
<tbody>
<tr>
<td>178-019</td>
<td>Clamping method</td>
</tr>
<tr>
<td></td>
<td>Sliding jaws</td>
</tr>
<tr>
<td></td>
<td>Jaw opening</td>
</tr>
<tr>
<td></td>
<td>36 mm</td>
</tr>
<tr>
<td></td>
<td>Jaw width</td>
</tr>
<tr>
<td></td>
<td>44 mm</td>
</tr>
<tr>
<td></td>
<td>Jaw depth</td>
</tr>
<tr>
<td></td>
<td>16 mm</td>
</tr>
<tr>
<td></td>
<td>Height</td>
</tr>
<tr>
<td></td>
<td>38 mm</td>
</tr>
</tbody>
</table>

**Roughness specimen W**
Display: Ra = Approx. 3 μm, Approx. 0.4 μm

178-604
Note: Ra = Approx. 0.4 μm can only be used for stylus tip checking.

**Reference step specimen**
Used to calibrate detector sensitivity.

178-611
Step nominal values: 2 μm/10 μm

**Cylinder attachment**
This block can be positioned on top of cylindrical objects to perform measurements.

12AAB358
Diameter: ø15 to 60 mm

Configuration
- Cylindrical measurement block
- Auxiliary block
- Clamp

**Optional accessories, consumables, and others for SJ-410**

- Printer paper (5 rolls)
  270732
- Durable printer paper (5 rolls)
  12AAA876
- Touch-screen protector sheet (10 sheets)
  12AAN040
- Memory card * (2 GB)
  12AAW452
- Connecting cable (for RS-232C)
  12AAA882
- Foot switch
  12AAJ088

* micro SD card (with a conversion adapter to SD card)

**Vibration Isolator (Air cushion type)**
Vibration isolator for simple column stand for SJ-410 Series (178-039).

178-093-1
Note: No pump is supplied. An American-valve-compatible hand pump is required.
Enhanced standard functions

Sheet buttons

Single button measurements
A sturdy sheet-button panel with superior durability in any environment is provided. For repeat measurement of the same work, simply pressing the start switch can complete measurement, analysis and printout.

Recalculating

Previously measured data can be recalculated for use in other evaluations by changing the current standard, assessed profile and roughness parameters.
Note: Some conditions are limited.

GO/NG judgement function

An “GO/NG” judgment symbol is displayed when limits are set for the roughness parameter. In case of “NG,” the calculated result is highlighted. The calculated result can also be printed out.

Password protection

Access to functions can be restricted by a password
A pre-registered password can limit use of measurement conditions and other settings to the tester’s administrator.

Arbitrary sampling length setting

This function allows a sampling length to be arbitrarily set in 0.01 mm increments (SJ-411: 0.1 mm to 25 mm, SJ-412: 0.1 mm to 50 mm). It also allows the SJ-410 Series to make both narrow and wide range measurements.

Applicable standards

Complies with many industry standards

Multilingual support

The display interface supports 16 languages.
(Japanese, English, German, French, Italian, Spanish, Portuguese, Korean, Chinese (simplified/traditional), Czech, Polish, Hungarian, Turkish, Swedish, Dutch)
## Detectors / Styli

### Detectors

<table>
<thead>
<tr>
<th>Order No.</th>
<th>Measuring force</th>
</tr>
</thead>
<tbody>
<tr>
<td>178-396-2*</td>
<td>0.75 mN</td>
</tr>
<tr>
<td>178-397-2*</td>
<td>4 mN</td>
</tr>
<tr>
<td>178-396**</td>
<td>0.75 mN</td>
</tr>
<tr>
<td>178-397**</td>
<td>4 mN</td>
</tr>
</tbody>
</table>

* Detectors that comply with previous standards, for general use, etc.
** Detectors that comply with previous standards, for general use, etc.

For ultra-small hole:

- 12AAB418 (ø0.5 mm)
- 12AAB417 (10 μm)**

For small hole:

- 12AAB347
- 12AAB346
- 12AAB345

For round bar:

- 12AAB344
- 12AAB343

For standard:

- 12AAC743 (ø1.2 mm)
- 12AAC734 (2 μm)

For skidless nosepiece:

- 12AAC741 (5 μm)**
- 12AAC733 (1 μm)**

For ball nosepiece (

- 12AAC738 (2 μm)
- 12AAC940 (5 μm)**

### Styli

#### Standard stylus

<table>
<thead>
<tr>
<th>Order No.</th>
<th>Tip radius</th>
</tr>
</thead>
<tbody>
<tr>
<td>12AAB418</td>
<td>(10 μm)**</td>
</tr>
<tr>
<td>12AAB405</td>
<td>(5 μm)**</td>
</tr>
<tr>
<td>12AAC733</td>
<td>(1 μm)**</td>
</tr>
</tbody>
</table>

#### Nosepiece

For standard:

- 12AAB344
- 12AAB343

For round bar:

- 12AAB345

For small hole:

- 12AAB346

For extra-small hole:

- 12AAB347

For ultra-small hole:

- 12AAB348

### For small hole

- 12AAB346

### For extra-small hole

- 12AAB347

### For ultra-small hole

- 12AAB348

### Double-length for deep hole

- 12AAB355

### For small hole / Double-length for deep hole

- 12AAB356

### For ultra-small hole

- 12AAC734 (2 μm)
- 12AAC940 (5 μm)**

### For small slotted hole

- 12AAB349

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* Tip angle 90°
*6 For downward-facing measurement only.
*7 Tip radius

<table>
<thead>
<tr>
<th>Color coding</th>
<th>White</th>
<th>Black</th>
<th>No Color</th>
<th>Yellow</th>
<th>No notch or color</th>
</tr>
</thead>
</table>

*8 Used for calibration, a standard step gauge (178-611, option) is also required.
### Specifications

<table>
<thead>
<tr>
<th>Model No.</th>
<th>51-411</th>
<th>51-412</th>
</tr>
</thead>
<tbody>
<tr>
<td>Order No.</td>
<td>178-580-11</td>
<td>178-580-12</td>
</tr>
<tr>
<td>Measuring range</td>
<td></td>
<td></td>
</tr>
<tr>
<td>X axis</td>
<td>25 mm</td>
<td>50 mm</td>
</tr>
<tr>
<td>Z axis (detection)</td>
<td>800 μm, 8 μm, 8 μm</td>
<td>Up to 2,400 μm when using an optional stylus.</td>
</tr>
<tr>
<td>Detector</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Resolution</td>
<td>0.01 μm (800 μm range), 0.001 μm (8 μm range), 0.0001 μm (8 μm range)</td>
<td></td>
</tr>
<tr>
<td>Stylus tip shape (Angle/Radius)</td>
<td>60°/2 μm, 90°/75 μm, 60°/12 μm, 90°/15 μm</td>
<td></td>
</tr>
<tr>
<td>Measuring force</td>
<td>0.75 mN, 4 mN, 0.75 mN, 4 mN</td>
<td></td>
</tr>
<tr>
<td>Radius of skid curvature</td>
<td>40 mm</td>
<td></td>
</tr>
<tr>
<td>Measuring methods</td>
<td>Skidless/Skidded (switchable)</td>
<td></td>
</tr>
<tr>
<td>Drive unit (X axis)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Measuring speed</td>
<td>0.05, 0.1, 0.2, 0.5, 1.0 mm/s</td>
<td></td>
</tr>
<tr>
<td>Measuring range X axis</td>
<td>25 mm, 50 mm</td>
<td></td>
</tr>
<tr>
<td>Day &amp; night inclination unit</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vertical travel</td>
<td>10 mm</td>
<td></td>
</tr>
<tr>
<td>Drive unit (X axis)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vertical travel</td>
<td>10 mm</td>
<td></td>
</tr>
<tr>
<td>Inclination adjustment angle</td>
<td>±1.5°</td>
<td></td>
</tr>
<tr>
<td>Measuring methods</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Measuring range X axis</td>
<td>25 mm, 50 mm</td>
<td></td>
</tr>
<tr>
<td>Inclination adjustment angle</td>
<td>±1.5°</td>
<td></td>
</tr>
<tr>
<td>Measuring methods</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Measuring range X axis</td>
<td>25 mm, 50 mm</td>
<td></td>
</tr>
</tbody>
</table>

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**Model No.** 51-411, 51-412

**Order No.** 178-580-11, 178-580-12, 178-582-11, 178-582-12

**Measuring range**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Ra, Rq, Rz, Ry, Rp, Rv, Rt, R3z, Rsk, Rku, Rc, RPc, RSm, Rmax<em>1, Rz1max</em>2, S, HSC, RzJIS*3, Rppi, R</th>
</tr>
</thead>
<tbody>
<tr>
<td>Determining method</td>
<td>External power supply</td>
</tr>
<tr>
<td>Dimensions</td>
<td>(W×D×H)</td>
</tr>
<tr>
<td>Ra, Rq, Rz, Ry, Rp, Rv, Rt, R3z, Rsk, Rku, Rc, RPc, RSm, Rmax<em>1, Rz1max</em>2, S, HSC, RzJIS*3, Rppi, R</td>
<td></td>
</tr>
<tr>
<td>Up/down inclination unit</td>
<td>130.9×63×99 mm</td>
</tr>
<tr>
<td>Drive unit (X axis)</td>
<td>128×35.8×46.6 mm, 154.5×35.8×46.6 mm</td>
</tr>
<tr>
<td>Measuring force</td>
<td>0.75 mN, 4 mN, 0.75 mN, 4 mN</td>
</tr>
<tr>
<td>Measuring range X axis</td>
<td>25 mm, 50 mm</td>
</tr>
<tr>
<td>Measuring methods</td>
<td>Skidless/Skidded (switchable)</td>
</tr>
<tr>
<td>Drive unit (X axis)</td>
<td>0.5 μm/50 mm</td>
</tr>
<tr>
<td>Measuring methods</td>
<td></td>
</tr>
<tr>
<td>Measuring range X axis</td>
<td>25 mm, 50 mm</td>
</tr>
</tbody>
</table>

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**Standard Accessories**

- Detector**7**/Standard stylus**8**
- Roughness specimen (Ra2 μm)
- Receptacle paper (Standard type: 5-roll set)
- Protective sheet for the LCD (×1 sheet)
- Touch pen
- Carrying case**4**
- AC adapter, Power cable, Flat-blade screwdriver, Phillips screwdriver, Hex wrench, Strap for the touch pen, Operation manual, One-sheet manual, Warranty card

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Note 1: Refer to pages 12 to 13 for details of Detector, Stylus and Nosepiece.

Note 2: To denote your AC line voltage add the following suffixes (e.g. 178-580-11A) A for 120 V, C for 100 V, D for 230 V, E for 230 V (for UK), DC for 220 V (for China), K for 220 V (for Korea).

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**Note 7:** Depending on the Order No. of the 51-410 Series main unit, 178-396 or 178-397 is provided as standard.

**Note 8:** Standard stylus (12AAC731 or 12AA8403) supporting the provided detector is provided as standard.
Dimensions

Example of mounting on simple column stand. (178-039)*1

*1 For details see page 5.

*2 This is the lowest position of the standard stylus mounted on the simple column stand. Since it is 35 mm from the base top, a block of suitable height is required for calibration with a roughness specimen. Use the stand in combination with optional accessories such as a leveling table (178-016) or an XY leveling table (178-024).

Note: The dimensions in parentheses indicate those for SJ-412.
Whatever your challenges are, Mitutoyo supports you from start to finish.

Mitutoyo is not only a manufacturer of top quality measuring products but one that also offers qualified support for the lifetime of the equipment, backed up by comprehensive services that ensure your staff can make the very best use of the investment.

Apart from the basics of calibration and repair, Mitutoyo offers product and metrology training, as well as IT support for the sophisticated software used in modern measuring technology. We can also design, build, test and deliver bespoke measuring solutions and even, if deemed cost-effective, take your critical measurement challenges in-house on a sub-contract basis.