Portable surface roughness tester evolution
Rich choice of options provide easier, smoother and more accurate measurements
Portable surface roughness tester evolves!
The large touch-screen, color-graphic LCD ensures both intuitive control and advanced operability

**Enhanced power for making measurements on site**

**Color-graphic LCD**
The color-graphic LCD with excellent visibility displays calculated results and assessed profiles even clearer. This is really useful for checking results without printing them out.

**Backlight provided**
A backlight improves usability in dim testing environments.

**Touch screen for easier operations**
The screen display can be switched between icon display and text display. Successfully combining operability with utility and usability.

**Easy to use and highly functional**
This portable surface roughness tester is equipped with analysis functionality rivaling that of benchtop surface roughness testers.

**Applicable standards**
Complies with many industry standards

**Multilingual support**
The display interface supports 16 languages.

**High accuracy measuring**
A wide range, high-resolution detector
Measuring range/ resolution
- 800µm/0.01µm
- 80µm/0.001µm
- 8µm/0.0001µm

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

A variety of interfaces supplied as standard

The external device interfaces that come as standard include USB, RS-232C, SPC output and footswitch I/F.

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**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.

- **Measurement condition**
  - Internal memory: 10 sets
  - Memory card: 500 sets
- **Measurement result**
  - Memory card: 1000 sets

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**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.

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**Carrying case**

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

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**Key-sheet buttons**

A sturdy key-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.

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**Printer**

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.
Enhanced measuring functions

**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. The SJ-410 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 the range of movement within which measurement can be made is greater because the skid tracks the workpiece surface contour.

**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 D.A.T. function, makes it easy to achieve highly accurate alignment.

- **Height/tilt adjustment unit (Standard accessory)**

When the SJ-410 Series detector is mounted on the manual column stand\(^*1\) for measurement, it can be combined with any of the optional products for easier leveling: leveling table\(^*2\), 3-axis alignment table\(^*3\) or tilt adjustment unit\(^*4\).

\(^*1\): For details about optional products, see P6-7.
More measuring functions than expected from a compact tester

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.

Recalculating

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

GO/NG judgement function

An “OK/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.

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 assessed profiles without the need for recalculation after saving data, contributing to higher work efficiency.

Arbitrary sampling length setting

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

Narrow space measuring function

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 0.5mm. This distance, however, can be shortened to 0.15mm using the narrow part measurement function (starting from the origin point of the drive unit). The function extends the possibility of measurement of narrow locations such as grooves in piston ring / O-ring mounts.

Typical applications

- Example: surface roughness measuring of piston-ring groove
- Example: surface roughness measuring of O-ring groove

Real sampling

This function samples stylus displacement for a specified time without engaging detector traverse, which enables use as a simplified vibration meter or displacement gage incorporated in another system.
Optional Accessories

**Simple column stand**

Can be adjusted to match the height of the item to be measured.

**No.178-039**
Vertical adjustment range: 250mm
Dimensions: 400×250×578mm
Mass: 20kg

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**Options for simple column stand**

Three new optional products are available to be attached to the manual column stand (No.178-039). You can choose the unit that suits your application. Or, you can also use the three products in any combination. Using the optional units makes SJ-411/412 more convenient and easier to use to ensure accurate measurements.

- **Auto-set unit (178-010)**
  This unit enables the vertical (Z axis) direction to be positioned automatically (auto-set function).
  A single button operation completes a series of operations from measurement, saving and auto-return (saving and auto-return can be switched on and off by operating the drive unit).

- **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.

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

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*Cannot be used when the tester’s main unit is an older model (SJ-401/402).*
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. (Code No. 178-042-1/178-043-1)

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 optional leveling table

The leveling 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.

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. (Code No. 178-042-1/178-043-1)

Order No. 178-042-1(mm) 178-052-1(inch) 178-043-1(mm) 178-053-1(inch) 178-049(mm) 178-058(mm/nm) 178-049 (mm) 178-058(mm/nm)
*with digital heads *with analog heads

Table dimensions: 130×100mm
Maximum load: 15kg

Inclination adjustment angle: ±1.5°
Swiveling angle: ±3°
X/Y-axis travel range: ±12.5mm ±12.5mm ±12.5mm

Dimensions (WxDxH): 262×233×83mm 220×189×83mm 262×233×55mm
Masses: 6.3kg 6kg 5kg

Precision vise

Fits on the stand.

Cylinder attachment

This block can be positioned on top of cylindrical objects to perform measurements.
No.12AAB358
Diameter: ø15~60mm
Configuration:
•Cylindrical measurement block
•Auxiliary block
•Clamp
*Drive unit not included.

Reference step specimen

Used to calibrate detector sensitivity.
No.178-611
Step nominal values: 2µm/10µm
Optional Accessories: Detectors / Styli

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### Detectors

**Unit: mm**

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>178-396-2</td>
<td>0.75mN</td>
<td>ISO-1997 and JIS-2001 compliant detectors</td>
</tr>
<tr>
<td>178-397-2</td>
<td>4mN</td>
<td>Detectors that comply with previous standards, for general use, etc.</td>
</tr>
</tbody>
</table>

### Extension rods

- **12AAG202** Extension rod 50mm
- **12AAG203** Extension rod 100mm

*No more than one extension rod can be connected.*

### Styli

#### Standard stylus

<table>
<thead>
<tr>
<th>Model</th>
<th>Tip radius</th>
<th>Diameter</th>
<th>Length</th>
<th>Color coding</th>
</tr>
</thead>
<tbody>
<tr>
<td>12AAE882</td>
<td>1μm</td>
<td>0.9</td>
<td>44.7</td>
<td>White</td>
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<tr>
<td>12AAE883</td>
<td>250 μm</td>
<td>9</td>
<td>87.7</td>
<td>Black</td>
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</tbody>
</table>

*No more than one extension rod can be connected.*

#### Double-length for deep hole

<table>
<thead>
<tr>
<th>Model</th>
<th>Tip radius</th>
<th>Diameter</th>
<th>Length</th>
<th>Color coding</th>
</tr>
</thead>
<tbody>
<tr>
<td>12AAE898</td>
<td>2μm</td>
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<tr>
<td>12AAE908</td>
<td>5μm</td>
<td>30</td>
<td>87.7</td>
<td>Black</td>
</tr>
</tbody>
</table>

For small hole / Double-length for deep hole

<table>
<thead>
<tr>
<th>Model</th>
<th>Tip radius</th>
<th>Diameter</th>
<th>Length</th>
<th>Color coding</th>
</tr>
</thead>
<tbody>
<tr>
<td>12AAE892</td>
<td>2μm</td>
<td>0.9</td>
<td>87.7</td>
<td>White</td>
</tr>
<tr>
<td>12AAE908</td>
<td>5μm</td>
<td>30</td>
<td>87.7</td>
<td>Black</td>
</tr>
</tbody>
</table>

#### For small hole

<table>
<thead>
<tr>
<th>Model</th>
<th>Tip radius</th>
<th>Diameter</th>
<th>Length</th>
<th>Color coding</th>
</tr>
</thead>
<tbody>
<tr>
<td>12AAC732</td>
<td>2μm</td>
<td>0.9</td>
<td>87.7</td>
<td>White</td>
</tr>
<tr>
<td>12AAB416</td>
<td>10μm</td>
<td>30</td>
<td>87.7</td>
<td>Black</td>
</tr>
</tbody>
</table>

#### For small hole

<table>
<thead>
<tr>
<th>Model</th>
<th>Tip radius</th>
<th>Diameter</th>
<th>Length</th>
<th>Color coding</th>
</tr>
</thead>
<tbody>
<tr>
<td>12AAC733</td>
<td>2μm</td>
<td>0.9</td>
<td>87.7</td>
<td>White</td>
</tr>
<tr>
<td>12AAB417</td>
<td>10μm</td>
<td>30</td>
<td>87.7</td>
<td>Black</td>
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</tbody>
</table>

#### For extra-small hole

<table>
<thead>
<tr>
<th>Model</th>
<th>Tip radius</th>
<th>Diameter</th>
<th>Length</th>
<th>Color coding</th>
</tr>
</thead>
<tbody>
<tr>
<td>12AAC734</td>
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<td>87.7</td>
<td>White</td>
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<tr>
<td>12AAB418</td>
<td>10μm</td>
<td>30</td>
<td>87.7</td>
<td>Black</td>
</tr>
</tbody>
</table>

#### For small sloped hole

<table>
<thead>
<tr>
<th>Model</th>
<th>Tip radius</th>
<th>Diameter</th>
<th>Length</th>
<th>Color coding</th>
</tr>
</thead>
<tbody>
<tr>
<td>12AAE938</td>
<td>2μm</td>
<td>0.9</td>
<td>87.7</td>
<td>White</td>
</tr>
<tr>
<td>12AAE940</td>
<td>5μm</td>
<td>30</td>
<td>87.7</td>
<td>Black</td>
</tr>
</tbody>
</table>

### For ultra-small hole

<table>
<thead>
<tr>
<th>Model</th>
<th>Tip radius</th>
<th>Diameter</th>
<th>Length</th>
<th>Color coding</th>
</tr>
</thead>
<tbody>
<tr>
<td>12AAB406</td>
<td>5μm</td>
<td>8.5</td>
<td>37.7</td>
<td>White</td>
</tr>
<tr>
<td>12AAB419</td>
<td>10μm</td>
<td>30</td>
<td>87.7</td>
<td>Black</td>
</tr>
</tbody>
</table>

### For ultra-small hole

<table>
<thead>
<tr>
<th>Model</th>
<th>Tip radius</th>
<th>Diameter</th>
<th>Length</th>
<th>Color coding</th>
</tr>
</thead>
<tbody>
<tr>
<td>12AAB407</td>
<td>5μm</td>
<td>8.5</td>
<td>37.7</td>
<td>White</td>
</tr>
<tr>
<td>12AAB419</td>
<td>10μm</td>
<td>30</td>
<td>87.7</td>
<td>Black</td>
</tr>
</tbody>
</table>

### For deep hole (double-length and triple-length)

<table>
<thead>
<tr>
<th>Model</th>
<th>Tip radius</th>
<th>Diameter</th>
<th>Length</th>
<th>Color coding</th>
</tr>
</thead>
<tbody>
<tr>
<td>12AAB740</td>
<td>2μm</td>
<td>0.9</td>
<td>87.7</td>
<td>White</td>
</tr>
<tr>
<td>12AAB741</td>
<td>2μm</td>
<td>0.9</td>
<td>87.7</td>
<td>White</td>
</tr>
<tr>
<td>12AAB742</td>
<td>2μm</td>
<td>0.9</td>
<td>87.7</td>
<td>White</td>
</tr>
</tbody>
</table>

### For small slopped hole

<table>
<thead>
<tr>
<th>Model</th>
<th>Tip radius</th>
<th>Diameter</th>
<th>Length</th>
<th>Color coding</th>
</tr>
</thead>
<tbody>
<tr>
<td>12AAE938</td>
<td>2μm</td>
<td>0.9</td>
<td>87.7</td>
<td>White</td>
</tr>
<tr>
<td>12AAE940</td>
<td>5μm</td>
<td>30</td>
<td>87.7</td>
<td>Black</td>
</tr>
</tbody>
</table>

*1: Tip angle 60°  
*2: For downward-facing measurement only.  
*3: Tip radius 1μm 2μm 5μm 10μm 250μm  
Color coding White Black No color Yellow No notch or color  
*4: Used for calibration, a standard step gauge (No.178-611, option) is also required.
### Styli

**For deep groove (10mm)**
- 12AAC735 (2μm) *
- 12AAB409 (5μm)
- 12AAB421 (10μm)

**Tip radius**: 12AAB421

**For deep groove *2 (20mm)**
- 12AAC736 (2μm) *
- 12AAB408 (5μm)
- 12AAB420 (10μm)

**Tip radius**: 12AAB420

**For deep groove *2 (40mm)**
- 12AAC737 (2μm) *
- 12AAB407 (5μm)
- 12AAB419 (10μm)

**Tip radius**: 12AAB419

**For deep groove *2 (30mm)**
- 12AAC738 (2μm) *
- 12AAB406 (5μm)
- 12AAB418 (10μm)

**Tip radius**: 12AAB418

**For deep groove *2 (30mm) / Double-length for deep hole *2**
- 12AAB418 (2μm) *
- 12AAB417 (5μm)
- 12AAB416 (10μm)

**Tip radius**: 12AAB416

**For gear tooth**
- 12AAB339 (2μm) *
- 12AAB410 (5μm)
- 12AAB422 (10μm)

**Tip radius**: 12AAB422

**For gear tooth / Double-length for deep hole *2**
- 12AAB422 (2μm) *
- 12AAB421 (5μm)
- 12AAB420 (10μm)

**Tip radius**: 12AAB420

**For rolling circle waviness surface *4**
- 12AAB338 (φ1.588)

**Tip radius**: 12AAB338

**For rolling circle waviness / Double-length for deep hole *2 *4**
- 12AAB338 (250μm)

**Tip radius**: 12AAB338

**For knife-edge *4**
- 12AAC738 (2μm) *
- 12AAB411 (5μm)
- 12AAB423 (10μm)

**Tip radius**: 12AAB423

**For corner hole / Double-length for deep hole *2**
- 12AAB423 (2μm) *
- 12AAB422 (5μm)
- 12AAB421 (10μm)

**Tip radius**: 12AAB421

**For eccentric arm *2**
- 12AAC739 (2μm) *
- 12AAB412 (5μm)
- 12AAB424 (10μm)

**Tip radius**: 12AAB424

**For hole bottom**
- 12AAB424 (2μm) *
- 12AAB423 (5μm)
- 12AAB422 (10μm)

**Tip radius**: 12AAB422

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*1: Tip angle 60°

*2: For downward-facing measurement only.

*3: Customized special interchangeable stylis are available on request. Please contact any Mitutoyo office for more information.

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

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**Color coding**
- Black
- No color
- Yellow
Optional Accessories: For External Output

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

Digimatic mini processor DP-1VR
By connecting this printer to the Surftest SJ-410’s digimatic output, you can print calculation results, perform a variety of statistical analyses, draw a histogram or D chart, and also perform complicated operations for X-R control charts.

Simplified communication program for SURFTEST SJ series
The Surftest SJ-410 series has a USB interface, enabling data to be transferred to a spreadsheet or other software. We also provide a program that lets you create inspection record tables using a Microsoft Excel* macro.

 Required environment*
- OS: Windows XP-SP3
  - Windows Vista
  - Windows 7
- Spreadsheet software:
  - Microsoft Excel 2002
  - Microsoft Excel 2003
  - Microsoft Excel 2007
  - Microsoft Excel 2010

*Windows OS and Microsoft Excel are products of Microsoft Corporation.
*PC OS must be 32-Bits

The optional USB cable is also required.
- USB cable for SJ-410 series No.12AAD510

Calculation results input unit INPUT TOOL
This unit allows you to 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.

USB-ITN-D No.06ADV380D
USB keyboard signal conversion type*
- IT-012U
  - No.264-012-10

*Requires the optional Surftest SJ-410 connection cable.
1m: No.936937
2m: No.965014

Optional accessories, consumables, and others for SJ-410
- Printer paper (5 rolls) No.270732
- Durable printer paper (5 rolls) No.12AAA876
- Touch-screen protector sheet (10 sheets) No.12AAN040
- Memory card (2GB) * No.12AAL069
- Connecting cable (for RS-232C) No.12AAA882

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

<table>
<thead>
<tr>
<th>Model No.</th>
<th>SJ-411</th>
<th>SJ-412</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>inch/mm</strong></td>
<td>178-581-01A</td>
<td>178-581-02A</td>
</tr>
<tr>
<td><strong>Measuring range</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>X axis</td>
<td>25mm (1 inch)</td>
<td></td>
</tr>
</tbody>
</table>
| Z axis (detector unit) | | | | *
| **Detector** | | | | |
| Resolution | 0.01µm (800µm range) / 0.001µm (80µm range) / 0.0001µm (8µm range) | | 0.4µinch (32000µinch) / 0.04µinch (3200µinch) / 0.004µinch (320µinch) |
| Measuring force | 0.75mN | 0.75mN | 0.75mN | 0.75mN |
| **Drive unit: X-axis** | | | | |
| Measuring speed | 0.05, 0.1, 0.2, 0.5, 1.0mm/s (0.002, 0.004, 0.02, 0.04 inch/s) | | | |
| Drive speed | 0.5, 1, 2, 5mm/s (0.02, 0.04, 0.08, 0.2 inch/s) | | | |
| Straightness | 0.3µm / 25mm (12µinch/ 1 inch) | 0.5µm / 50mm (20µinch/ 2 inch) |
| **Height-tilt adjustment unit** | | | | |
| Height adjustment | 10mm (0.39 inch) | | | |
| Tilt adjustment | ±1.5° | | | |
| **Standards** | | | | |
| **Parameters** | | | | |
| Ra, Rq, Rz, Ry, Rp, Rv, Rmax, S, HSc, RzJIS, Rppi, R, Rx, AR, AW, Vx, W, Wte, Possible Customize |
| **Graph analysis** | | | | |
| BAC and ADC curves |
| Parabola, Hyperbola, Ellipse, Circle, Conic, Tilting, Compensation off |
| 2C, PC75, Gaussian filter |
| 2.5, 8.0, 25.0mm (100, 300, 1000µinch) |
| 0.08, 0.25, 0.8, 2.5, 8.0mm |
| 2.5, 8.0, 25.0mm (100, 300, 1000µinch) |
| x1, x2, x3, x4, x5, x6, x7, x8, x9, x10, x11, x12, x13, x14, x15, x16, x17, x18, x19, x20 |
| 0.1–25mm |
| 0.1–50mm |
| **Arbitrary length** | | | | |
| **Customization** | | | | |
| Desired parameters can be selected for calculation and display |
| Step, Step volume, Dimensions, Coordinate difference |
| **DAT function** | | | | |
| Helps to adjust leveling during skidless measurement |
| **Real sampling function** | | | | |
| Samples stylus displacement for a specified time without engaging detector traverse |
| **Statistical processing** | | | | |
| Static measurement (max. 3 parameters) is possible: Static processing for MAX, MIN, AVERAGE, standard deviation, histogram and pass rate is possible |
| **GO/ NG judgement** | | | | |
| Max rule / 16% rule / Average rule / Standard deviation (1σ, 2σ, 3σ) |
| **Storage functions** | | | | |
| 10 measuring conditions can be stored in internal memory |
| **Printing function** | | | | |
| Measurement conditions / Calculation results / GO / NG judgement result / Calculation results for each sampling length / Measurement curve / BAC / ADC / Environmental setting information |
| **Display languages** | | | | |
| Japanese, English, German, French, Italian, Spanish, Portuguese, Korean, Traditional Chinese, Simplified Chinese, Czech, Polish, Hungarian, Turkish, Swedish, Dutch |
| **Storage** | | | | |
| Internal memory: Measurement condition (10 sets) / Memory card (option): 5000 measuring data, 10000 text data, 500 statistic data, 1 backup of machine setting, the last ten traces (Trace 10) |
| **External I/O** | | | | |
| USB IF, Digimatic output, RS-232C IF, External SW IF |
| **Power supply** | | | | |
| Battery: two-way power supply; battery (rechargeable Ni-MH battery and AC adapter) |
| Charging time: about 4 hours (may vary due to ambient temperature) |
| *Endurance: about 1500 measurements (differs slightly due to use conditions / environment) |
| **Size (WxDxH)** | | | | |
| Display unit | 275x195x109mm (10.83x7.72x4.29 inch) | | | |
| Height adjustment unit | 130.9x63x99mm (5.16x2.48x3.90 inch) | | | |
| Drive unit | 128x35.8x46.6mm (5.04x1.41x1.83 inch) | 154.3x35.8x46.6mm (6.08x1.41x1.83 inch) |
| **Mass** | | | | |
| Display unit | 1.2kg | | | |
| Height adjustment unit | 0.4kg |
| Drive unit | 0.6kg | 0.64kg |

**Standard accessories**

- Detector**, Stylus**, Roughness specimen 270732, Printing paper 12BAL402, Touch-screen protection sheet 12BAAG834, Touch pen 12AAN041, Carrying case
- AC adapter, Philips screwdriver, Strap for stylus pen, Operation manual, Quick reference manual, Warranty

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*1: Only for VDA/ANSI/JIS’92 standards.  
*2: Only for JIS’97 standard.  
*3: Only for JIS’01 standard.  
*4: Only for ANSI standard.  
*5: λs may not be switchable depending on standard selected.  
*6: Standard deviation only can be selected in ANSI, 16% rule cannot be selected in VDA.  
*7: Either No.178-396-2 or No.178-397-2 is supplied as a standard accessory depending on the Order No. of the main unit for SJ-410 Series.  
*8: The standard stylus (No.12AAC731 or No.12AAB403), which is compatible with the detector supplied, is a standard accessory.
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