SURFTEST
SJ-210

Surface Roughness Measuring Tester SJ-210

User's Manual

Read this User's Manual thoroughly before operating the instrument. After reading, retain it close at hand for future reference.

Mitutoyo

CONVENTIONS USED IN THIS MANUAL

Safety Precautions

To ensure that instruments are operated correctly and safely, Mitutoyo manuals use various safety symbols (Signal Words and Safety Alert Symbols) to identify and warn against hazards and potential accidents.

The following signs indicate **general** warnings:

⚠️ **DANGER**	Indicates an imminently hazardous situation which, if not avoided, will result in serious injury or death.

⚠️ **WARNING**	Indicates a potentially hazardous situation which, if not avoided, could result in serious injury or death.

⚠️ **CAUTION**	Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury or property damage.

The following signs indicate **specific** warnings or prohibited actions, or indicate a mandatory action:

⚡	Alerts the user to a specific hazardous situation. The given example means "Caution, risk of electric shock".

🚫	Prohibits a specific action. The given example means "Do not disassemble".

⏚	Specifies a required action. The given example means "Ground".

CONVENTIONS USED IN THIS MANUAL

Types of Notes

The following types of **notes** are used in this manual to help the operator obtain reliable measurement data through correct instrument operation.

IMPORTANT
- An *important note* provides information essential to the completion of a task. You cannot disregard this note to complete the task.
- An *important note* is a type of precaution, which if neglected could result in a loss of data, decreased accuracy or instrument malfunction/failure.

NOTE
A *note* emphasizes or supplements important points of the main text. It also supplies information about specific situations (e.g., memory limitations, equipment configurations, or details that apply to specific versions of a program).

TIP
A *tip* is a type of note that helps the user apply the techniques and procedures described in the text to his or her specific needs.

It also provides reference information associated with the topic being discussed.

Precautions for Use

To obtain the highest performance from this instrument and to use it safely, read this User's Manual prior to use.

This user's manual is intended for users of surface roughness testers SJ-210 standard type, SJ-210 transverse tracing drive type, and SJ-210 detector retracting type.

"SJ-210" is used in almost all descriptions of this user's manual. If using model SJ-210 detector retracting type read this manual assuming "SJ-210" as "SJ-210 detector retracting type". Unless otherwise noted, the manual gives common information about the SJ-210 standard type and SJ-210 detector retracting type.

Observe the following precautions to get the most of the instrument and to attain high accuracy for long time.

⚠️
CAUTION

- This instrument has a sharp stylus at the edge of the detector. Take care not to be injured.

IMPORTANT
- For the power supply, follow the conditions described on the AC adapter supplied. Do not use other than the AC adapter provided.

- Do not disassemble the instrument unless otherwise specified in this User's Manual. It will result in instrument failure or damage. The instrument has been rigorously adjusted and assembled at the factory.

- Do not drop or give impact to the detector. The detector is a precision part.

- Do not use the instrument in an environment where it is subject to dust or vibrations. Also keep it as far apart from noise generator such as large power supply, high-voltage relay switch as possible.

- Avoid using the instrument where there is sudden temperature change, and operate it where the temperature is between 10 and 30 °C (RH: 85 % or less, free from dew condensation). Do not operate/store the instrument close to a room heater or in the direct sunlight.

- Store the instrument where the temperature can be controlled between –10 and 50 °C.

- When mounting the detector to the drive unit, take care not to apply excessive force to the drive unit.

- Before connecting/detaching the connector or connecting cable, turn the power off (by auto sleep function).

- The stylus tip is machined precisely. Take care not to break it.

- Before measurement, wipe off oil or dust on the work piece surface to be measured.

Warranty

In the event that the Mitutoyo product, except software product, should prove defective in workmanship or material, within one year from the date of original purchase for use, it will be repaired or replaced, at our option, free of charge upon its prepaid return to us.

If the product fails or is damaged for any of the following reasons, it will be subject to a repair charge, even if it is still under warranty.

1   Failure or damage owing to inappropriate handling or unauthorized modification.

2   Failure or damage owing to transport, dropping, or relocation of the instrument after purchase.

3   Failure or damage owing to inappropriate maintenance, storage, and preservation.

4   Failure or damage owing to abnormal voltage or usage of electric power supply (voltage, frequency) that is not specified.

5   Failure or damage owing to fire disaster, earthquake, flood disaster, thunderbolt, the other acts of providence, environmental destruction, smoke pollution, or gas pollution (such as sulfuretted gas).

6   Not presenting guarantee certificate.

7   The other failures or damages we can not be responsible for (such as damages owing to the misuse of this product).

This warranty is effective only where the instrument is properly installed and operated in conformance with the instructions in this manual.

Export Control Compliance

This Product falls into the Catch-All-Controlled Goods or Program under the Category 16 of the Separate Table 1 of the Export Trade Control Order or the Category 16 of the Separate Table of the Foreign Exchange Control Order, based on the Foreign Exchange and Foreign Trade Law of Japan.

Further, this User's Manual also falls into the Catch-All-Controlled Technology for use of the Catch-All-Controlled Goods or Program, under the Category 16 of the Separate Table of the Foreign Exchange Control Order.

If you intend re-exporting or re-providing the product or technology to any party other than yourself, please consult with Mitutoyo prior to such re-exporting or re-providing.

Disposal of Old Electrical & Electronic Equipment (Applicable in the European Union and other European countries with separate collection systems)

This symbol on the product or on its packaging indicates that this product shall not be treated as household waste. To reduce the environmental impact of WEEE (Waste Electrical and Electronic Equipment) and minimize the volume of WEEE entering landfills, please reuse and recycle.

For further information, please contact your local dealer or distributors.

Contents

Service Network

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SJ-210 OVERVIEW

This section explains the structures and the features of the SJ-210.

1.1   Outline of the SJ-210

The Surftest SJ-210 is a shop-floor type surface-roughness measuring instrument, which traces the surfaces of various machine parts, calculates their surface roughness based on roughness standards, and displays the results.

■ SJ-210 roughness measurement process

A pick-up (hereinafter referred to as the "stylus") attached to the detector unit of the SJ-210 traces the minute irregularities of the work piece surface. The vertical stylus displacement during the trace is processed and digitally displayed on the liquid crystal display of the SJ-210.

2. The up-and-down motion of the stylus tracing the work piece is converted into electrical signals.

3. The electrical signals are subject to various calculation processes.

1. The detector's stylus traces the work piece surface (measurement surface).

AC adapter
(The instrument can also be powered by the built-in battery.)

SJ-210

DP-1VR
(optional)

Print and analyze measurement results and saved data

Work piece

4. Calculation (measurement) results are displayed

Printer
(optional)

Print measurement results and saved data

Direction of detector motion

Work-piece surface

Stylus

Measurement with the SJ-210, Connection to related equipment

■ Features of the SJ-210

- Designed to be convenient to carry
  The SJ-210 has a lightweight (0.5 kg) design for excellent portability. In addition, it is made compact so that it can be held and operated in one hand. The built-in battery makes it easy to perform roughness measurement on the shop floor or other sites where there may be no AC power supply.

NOTE • No power is drawn from the battery while the instrument is supplied power via the AC adapter. For more information about the built-in battery, refer to 3.4.1, "Recharging the built-in battery".

- Wide measurement range and various roughness parameters.
  Has a maximum range of 360μm (-200μm to +160μm), and can display various roughness parameters about the surface's roughness.

- Auto-sleep function to save power
  With auto-sleep set to ON under operation on the built-in battery, the SJ-210 automatically turns the power off (enters the auto-sleep state) when it is not in operation for more than a certain time even when the power is on. It is possible to set the length of time that the SJ-210 waits before entering the auto-sleep state. The SJ-210 still retains the set measurement conditions and the measurement results in memory even when the power is turned off.

- Color monitor with the display backlight and external output functions
  When the display backlight is turned on, measurement results are displayed on the color monitor clearly and vividly even when the SJ-210 is used in a dark place. These measurement results can also be output externally as SPC (Statistical Process Control) data. When connected to a personal computer, the SJ-210 can be remotely controlled (for output or measurement commands) via the RS-232C or the USB communication interface.

- Measurement result saving function
  The SJ-210 can save measurement results in the main unit up to 10 cases of measurements. Using a memory card (optional), the SJ-210 can save the measurement conditions up to 500 cases and the measurement data up to 10000 cases of measurements. The SJ-210 also can load the saved data to display on the color monitor and print the data.

- Compatible with various roughness standards
  The SJ-210 outputs measurement results conforming to a variety of roughness standards, including JIS (JIS-B-0601-2001, JIS-B-0601-1994, JIS-B-0601-1982), VDA, ISO-1997, and ANSI.

■ Features of the SJ-210 (detector retracting type)   *1-3*

- Detector retraction function

  For the SJ-210 detector retracting type, the detector extends outwards without contacting the measurement surface. Thereby, the detector can be set up for measurement without the detector tip being in contact with a work piece.

NOTE • Unless otherwise noted, this manual gives common information about the SJ-210 (standard type) and SJ-210 (detector retraction type).

■ Features of the SJ-210 (transverse tracing drive type)

- Detector transverse tracing drive function

  For the SJ-210 transverse tracing drive type, the detector moves horizontally. Thereby, the detector can be set up for roughness measurement on a work piece that has limited dimensions (e.g., crankshafts).

NOTE • Unless otherwise noted, this manual gives common information about the SJ-210 (standard type) and SJ-210 (transverse tracing drive type).

1.2   Standard SJ-210 Configuration

This section explains the standard configuration, the standard set, and typical uses of the optional accessories.

■ SJ-210 standard type: Standard configuration
(set no.178-560-02: measuring force 4 mN/178-560-01: measuring force 0.75 mN)

Check that the purchased package contains all the products shown in the following figure.

Display Unit
No.178-252
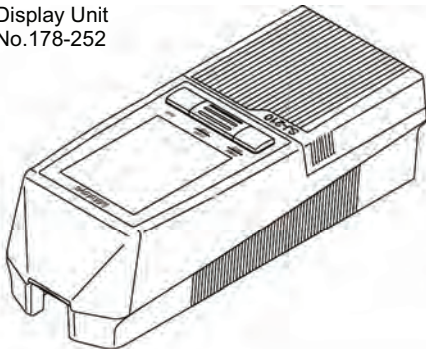
Drive/detector unit

Drive unit
No.178-230-2
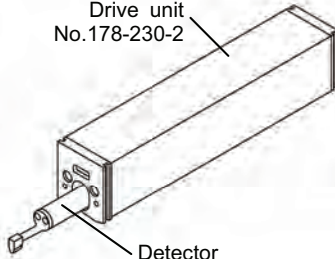
Detector
No.178-390 (Measuring force: 4 mN)
No.178-296 (Measuring force: 0.75 mN)

Standard accessory

Carrying case
No.12BAK699

Connection cable (1 m/40 in)
No.12BAA303

AC adapter
No.12BAK728

Power cord set

Precision roughness
specimen (with case)
No.178-601(mm)
No.178-602(inch/mm)

Ra 3. 05 μm   Rmax 9. 9 μm
(Ry)
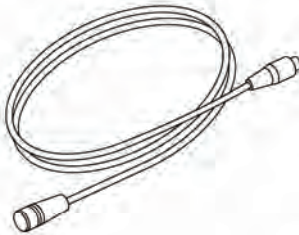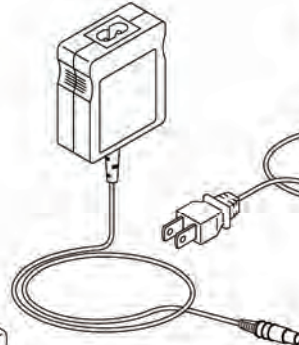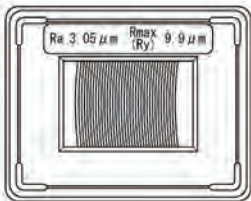
Calibration stage
No. 12BAK700
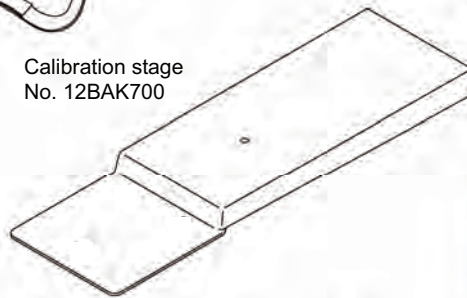
Operation
manual
No. 99MBB122A

Quick reference
manual
No. 99MBB123A

Display protection sheet
No.12BAK820
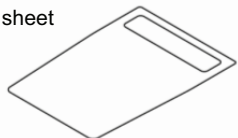
⚠ **Caution**

• Only use the supplied AC adapter for this instrument. Using the adapter with equipment other than the SJ-210 may cause damage to the adapter or equipment.

■ SJ-210 detector retracting type: Standard configuration
　(set no.178-562-02: measuring force 4 mN/178-562-01: measuring force 0.75 mN)

Check that the purchased package contains all the products shown in the following figure.

Display Unit
No.178-252

Drive/detector unit

Drive unit
No.178-235

Detector
No.178-390 (Measuring force: 4 mN)
No.178-296 (Measuring force: 0.75 mN)

Standard accessory

Carrying case
No.12BAK699

Connection cable (1 m/40 in)
No.12BAA303

AC adapter
No.12BAK728

Power cord set

Precision roughness
specimen (with case)
No.178-601(mm)
No.178-602(inch/mm)

Ra 3.05 μm Rmax(Ry) 9.9 μm

Calibration stage
No. 12BAK700

Operation
manual
No. 99MBB122A

Quick reference
manual
No. 99MBB123A

Display protection sheet
No.12BAK820
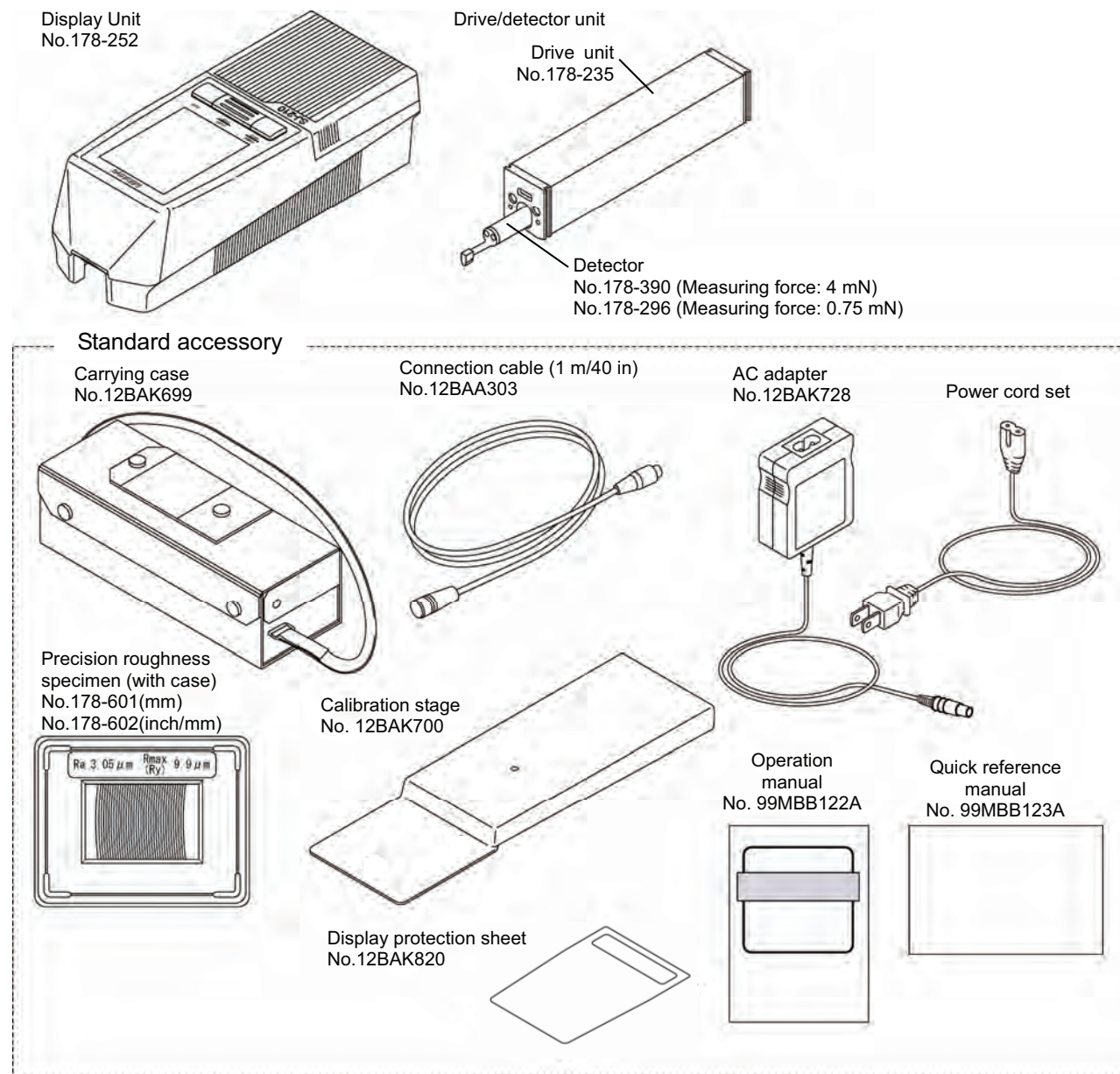
⚠ **Caution**	• Use the supplied AC adapter for this instrument only. Using the adapter with equipment other than the SJ-210 may cause damage to the adapter or equipment.

NOTE	• Unless otherwise noted, this manual gives common information about the SJ-210 (standard type) and SJ-210 (detector retraction type).

■ SJ-210 transverse tracing drive type: Standard configuration
(set no.178-564-02: measuring force 4 mN/178-564-02: measuring force 0.75 mN)

Check that the purchased package contains all the products shown in the following figure.

Display Unit
No.178-252
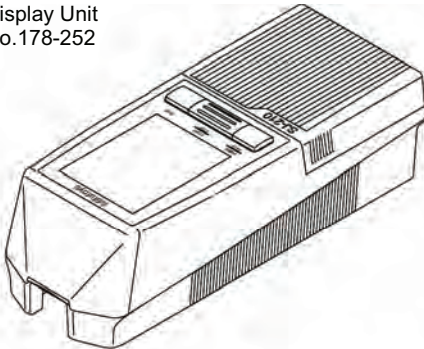
Drive/detector unit

Drive unit
No.178-233-2
Drive unit set
No.178-234-2
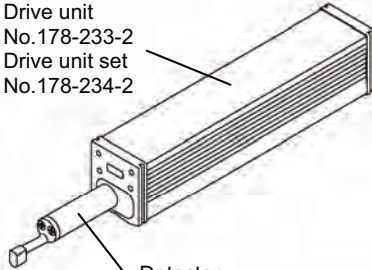
Detector
No.178-386 (Measuring force: 4 mN)
No.178-387 (Measuring force: 0.75 mN)
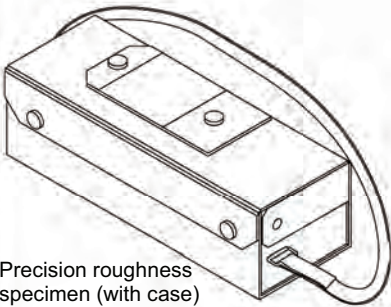
Standard accessory

Carrying case
No.12BAK699

Connection cable (1 m/40 in)
No.12BAA303
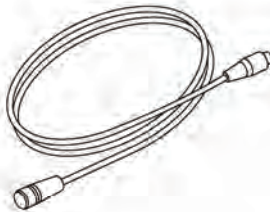
AC adapter
No.12BAK728
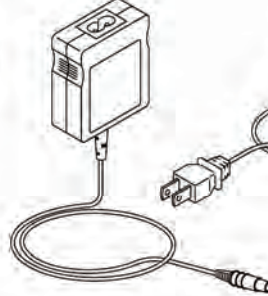
Power cord set
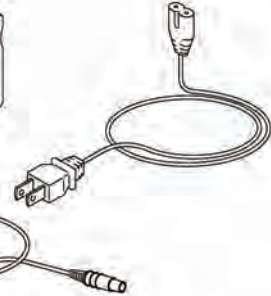
Precision roughness
specimen (with case)
No.178-605(mm)
No.178-606(inch/mm)

REFERENCE SPECIMEN
530E

Ra 1.0 μm
Rz 0.1 μm
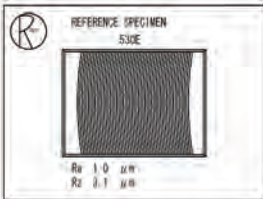
Calibration stage
No. 12BAK700
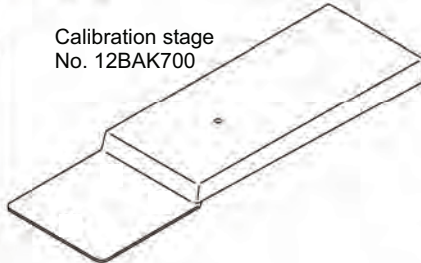
Contact adapter
No. 12AAE643
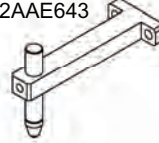
V-shaped adapter
No. 12AAE644
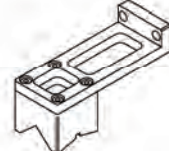
Operation manual
No. 99MBB122A

Quick reference manual
No. 99MBB123A

Hexagonal wrench
Nominal size 2.5
No.538615
Nominal size 1.5
No.538613

Hex-socket head screw
(M3)×8 (screws×4)
No.390151

Display protection sheet
No.12BAK820
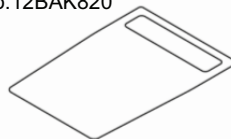
⚠ Caution

• Use the supplied AC adapter for this instrument only. Using the adapter with equipment other than the SJ-210 may cause damage to the adapter or equipment.

■ SJ-210 optional accessories   *1-7*

>   Depending on the shape of the work piece, it may be necessary to use optional accessories to set up the SJ-210. Consider the shape of the work piece when purchasing optional accessories.

TIP • For information about optional accessories, refer to Chapter 14, "INSTALLING THE SJ-210 WITH OPTIONAL ACCESSORIES".

1.3 Name of Each Part on the SJ-210

This section gives the name of each part (such as keys on the display unit).

■ Display unit and drive/detector unit

The SJ-210 consists of the display unit and drive/detector unit. The drive/detector unit is designed to be used in both ways: attached to or detached from the display unit. Depending on the shape of the work piece, it may be easier to perform measurement with (or without) mounting the drive/detector unit to the display unit. Use the SJ-210 in more suitable way.
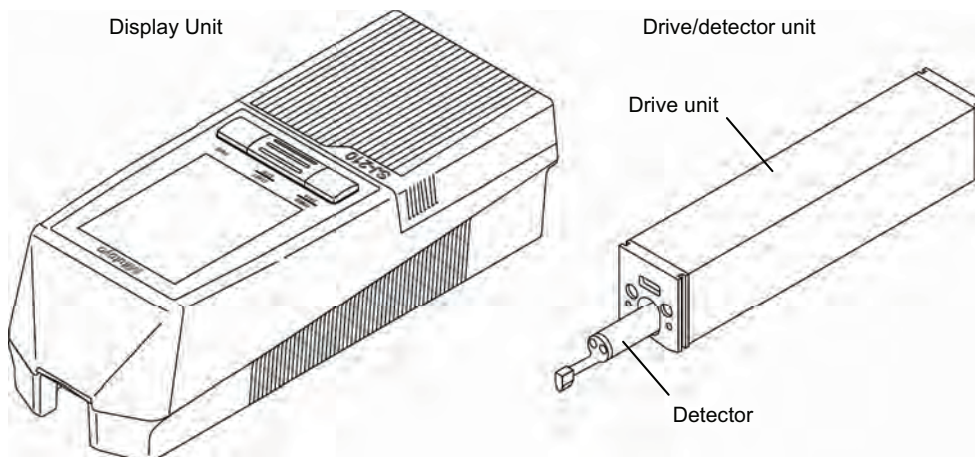
Display unit and drive/detector unit

TIP • For information about attaching and detaching the drive/detector unit, refer to 3.2, "Attaching and Detaching the Drive/Detector Unit".

■ Names of each part on the drive/detector unit

1-9
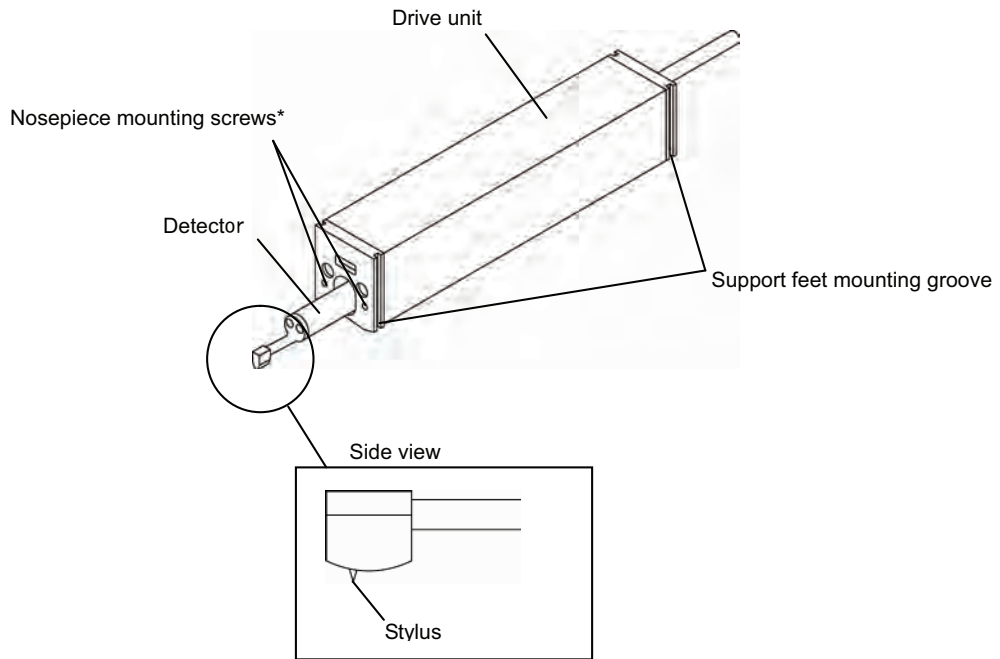
*: Nosepiece and support feet are optional accessories.

Drive/detector unit

■ Display unit cover

The top cover of the display unit slides to allow access to the setting modification keys underneath.
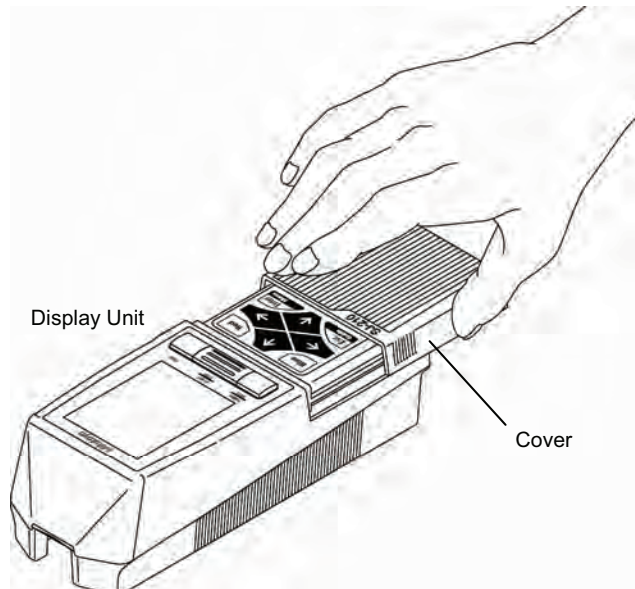
Display unit cover

■ Name of each part on the display unit

Display

POWER / DATA

START / STOP

PAGE

Primary operation keys
The main operations for SJ-210 are performed using the following 3 keys:
   [POWER/DATA] key
   [START/STOP] key
   [PAGE] key

Operation keys

Blue

Red

Esc / Guide

Enter / Menu

Setting modification keys
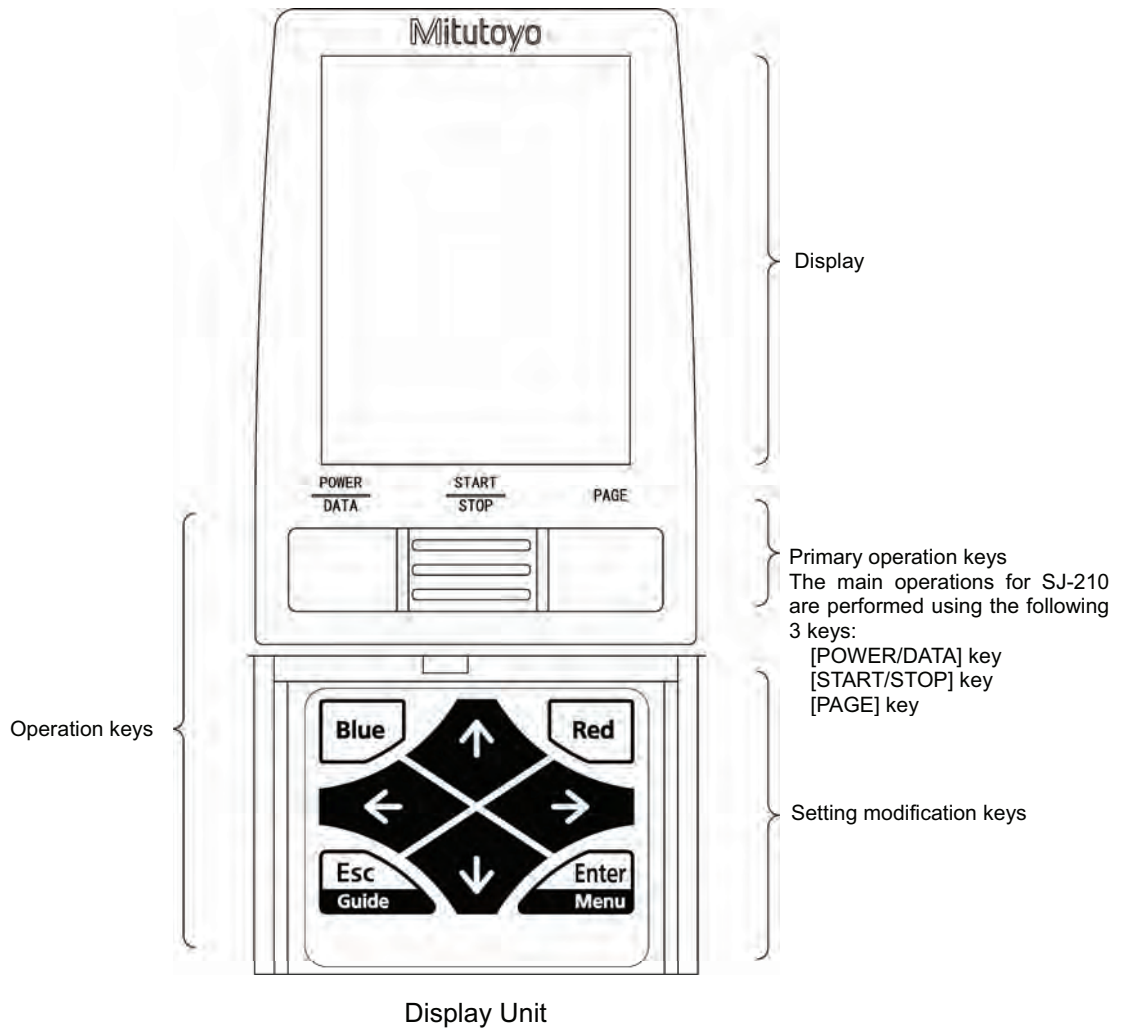
Display Unit

<Names of each key>
- ・[POWER/DATA] key （Power/Data key）
- ・[START/STOP] key （Start/Stop key）
- ・[PAGE] key （Page key）
- ・[Blue] key （Blue key）
- ・[Red] key （Red key）
- ・[↑], [↓], [←], [→] key （Cursor key）
- ・[Esc/Guide] key （Escape/Guide key）
- ・[Enter/Menu] key （Enter/Menu key）

■ Names of the connectors on the display unit   *1-11*

Rear of the display unit   View with rear cover of display unit removed

Foot switch connector   RS-232C connector   SPC connector

Connector cap   Rear cover

AC adapter connector   Built-in battery on/off switch   Memory Card card slot   USB connector

When the drive/detector unit connection plug is being placed in the storage position, neatly fit the cable in the groove of the display unit.

Bottom of the display unit

Drive/detector unit connection plug

Drive/detector unit retaining plate   Drive/detector unit retaining pin

Rear and bottom of the display unit

MEMO

2 OPERATION KEYS AND DISPLAY OF THE SJ-210

The SJ-210 is operated with the operation keys on the display unit. This chapter explains the basic functions of the operation keys, the screens, and icons shown on the display.

2.1 Functions of Operation Keys

The primary operations of the SJ-210 (start measurement, measurement condition loading, data output, etc.) are performed with the operation keys. Each operation key function is explained here.

■ Operation keys on the display unit
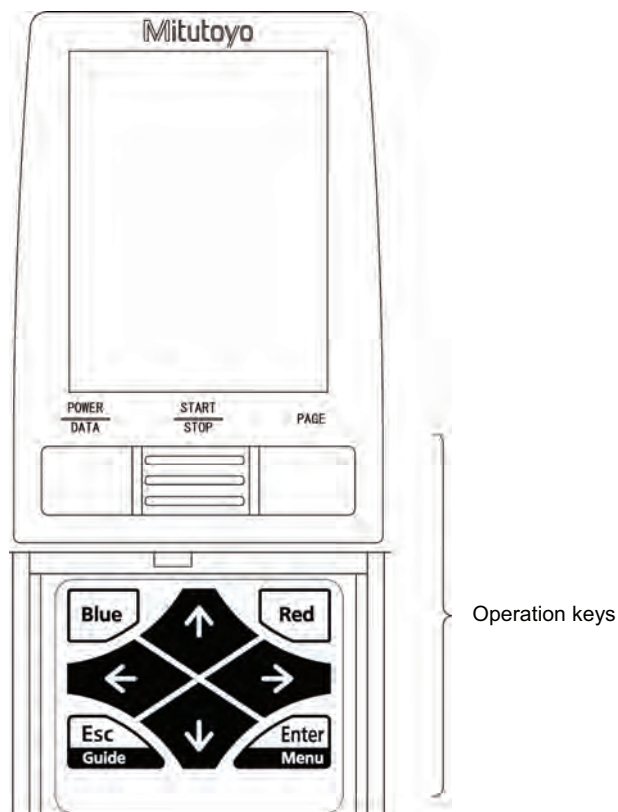
Position of Operation keys

■ Functions of operation keys

- [POWER/DATA] key
  Used to turn the power of the SJ-210 on.
  Used to output data when DP-1VR or a printer is connected to the SJ-210.
  It is also used to store the displayed contents on the monitor in the memory card i the BMP file format.

- [START/STOP] key
  Used to start or stop measurements.

- [PAGE] key
  Used to display measurement results for the other parameters, evaluation profiles, graphs, lists of conditions.

- [Blue] key
  Used to return to the Home screen, delete numeric values, or execute functions displayed on the monitor.

- [Red] key
  Used to display the sub menu, switch the available character type for entering, or executes functions displayed on the monitor.

- Cursor key ([↑], [↓], [←], [→])
  Used to select desired items, switch the page, enter numeric values/characters.

- [Esc/Guide] key
  Used to return to the previous screen. This key also functions to turn the power of the SJ-210 off.

- [Enter/Menu] key
  Used to make the setup items take effects.

2.2 Home Screen

When the power to the SJ-210 is turned on, the Home screen appears on the display of the display unit.

This section explains the items and icons displayed on the Home screen.

■ Display on the Home screen

● Vertical display
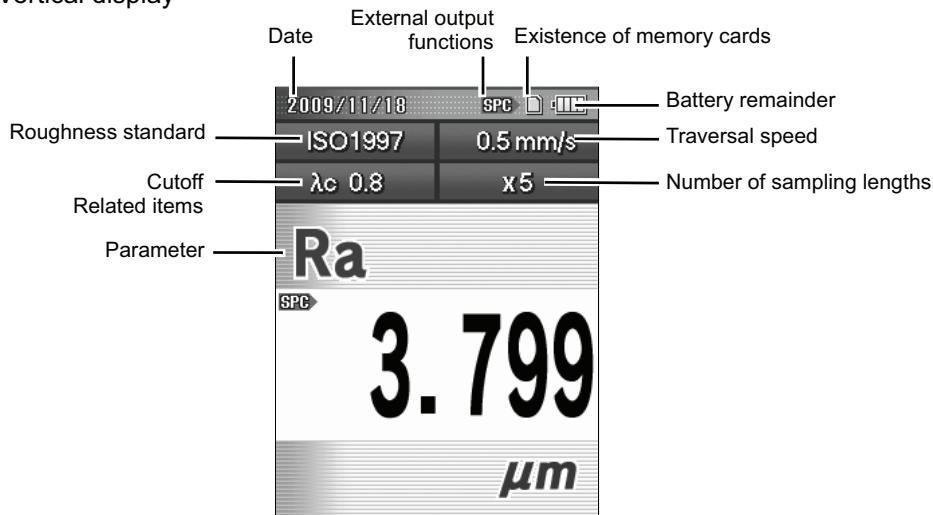
● Horizontal display
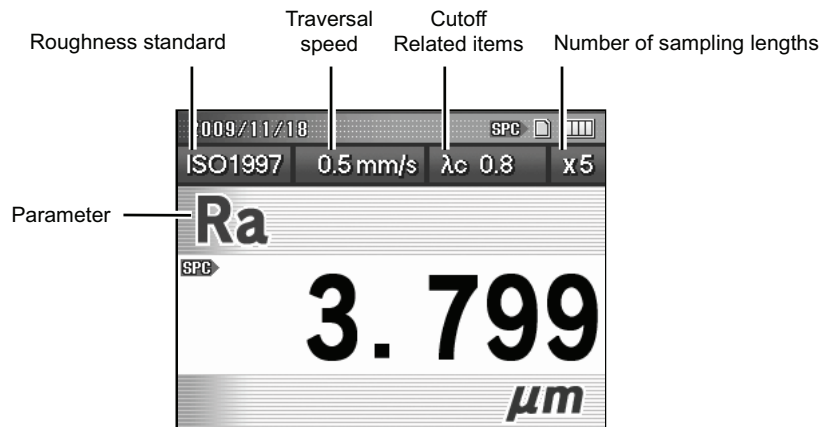
NOTE • The items of "Date" and "Battery remainder" on the top of the screen are displayed on every screen.

TIP • For information about switching the display directions, refer to 11.3, "Switching Calculation Results Screen".

■ Measurable indicator

When the detector is attached to the drive/detector unit, it is possible to check whether or not the detector is in the measurable position on the Home screen.

When the detector is in the measurable position, the item "Date" on the top of the screen turns blue.

 This part is blue.
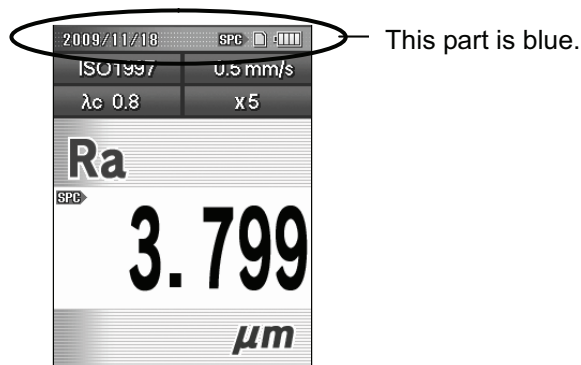
Home screen (when the detector is within the measurable range)

When the detector is not in the measurable position, the item "Date" on the top of the screen turns red.

 This part is red.
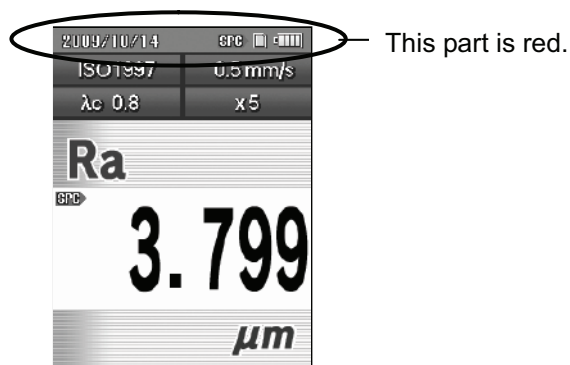
Home screen （when the detector is out of the measurable range）

■ Displaying the remaining battery power

The icon for displaying the remaining battery power appears on the display of the display unit. While the battery is being charged, an icon indicating that charging is taking place is displayed.

During the AC adapter powered operation, the battery is automatically charged according to the power consumption.

The icon for displaying the remaining battery power
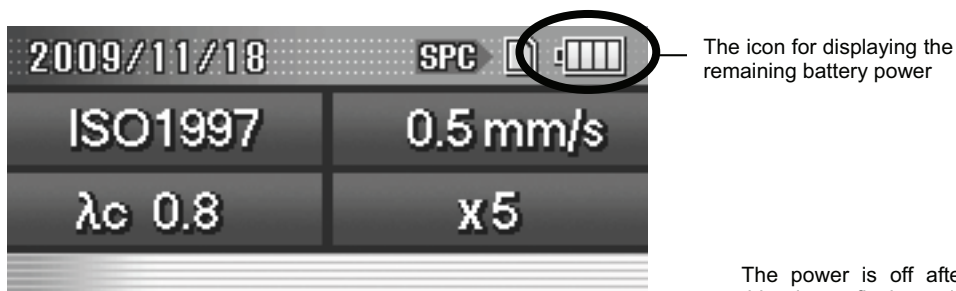
The power is off after this icon flashes 10 seconds.

Indication of remaining voltage

| 100 to 80% | 80 to 60% | 60 to 40% | 40 to 20% | 20 to 0% |

Indication condition of charge

Charging in progress

The display when the built-in battery switch is OFF.
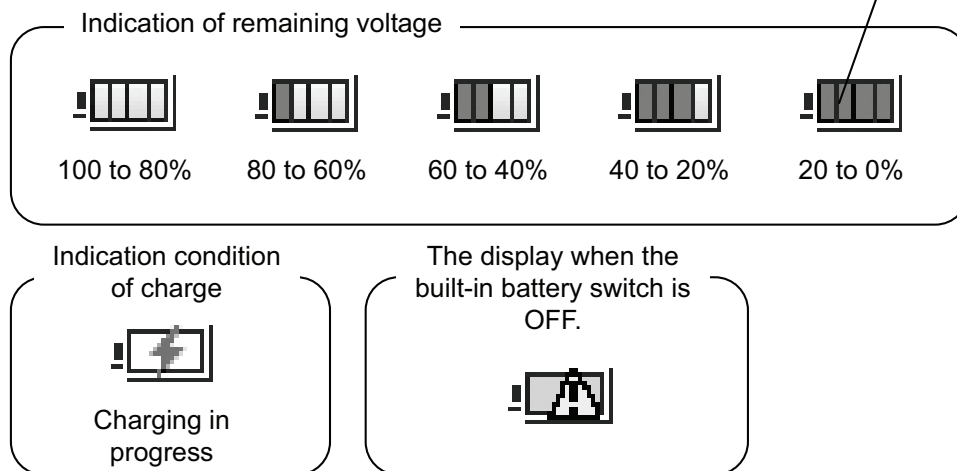
IMPORTANT • Observe the following when the SJ-210 is not powered with the AC adapter.

• When the remaining battery power falls between 20% and 40%, connect the AC adapter as soon as possible.

• When the remaining battery power approaches 0%, connect the AC adapter immediately. When SJ-210 is left with no battery charge, measurement results might be erased.

TIP • For more information about the charging procedure, refer to 3.4.1, "Recharging the built-in battery".

2.3 Screen Hierarchy in the Display

The hierarchy of the screens shown in the display is shown in the following pages.

■ Checking the measurement results

> **TIP** • For information about checking the measurement results, refer to Chapter 5, "MEASUREMENT RESULT DISPLAY".

Screen Hierarchy	Related section
Home screen	—
Screen showing calculation results for each parameter	5.1.1
Evaluation Profile screen	5.1.2
Graph screen	5.1.3
Condition List screen	5.1.4

■ Setting up parameters from the Home screen

Screen Hierarchy	Related section
Home screen	—
Main Menu screen	—
Calibration Measurement screen	Chapter 6
Measurement Conditions Menu screen	Chapter 7
Measurement Result Menu screen	Chapter 9
Parameter Setup screen	Chapter 8
Operating Environment Setup menu screen	Chapter 10
Screen Change Menu screen	Chapter 11
Sampling Lengths Result screen	5.2

■ Calibration Measurement screen sub-screens

TIP	• For information about calibration, refer to Chapter 6, "CALIBRATION".

Screen Hierarchy	Related section
Calibration Measurement screen	−
Calibration Menu screen	−
Nominal Value Setup screen	6.4
Calibration Condition Setup screen	−
Number of Measurement Setup screen	6.5.1
Roughness Standard Setup screen	6.5.2
Filter Setup screen	6.5.3
Cutoff Length Setup screen	6.5.4
Number of Sampling Lengths Setup screen	6.5.5
Arbitrary Length Setup screen	6.5.6
Traversing Speed Setup screen	6.5.7
Measurement Range Setup screen	6.5.8
Calibration History screen	6.6
Stylus Alarm screen	6.7
Threshold Setup screen	

■ Measurement Condition Menu screen sub-screens

Screen Hierarchy	Related section
Measurement Conditions Menu screen	—
Measurement Conditions screen	—
Measurement Condition Save Location screen	7.13.2
Internal Memory Save screen	
Save New screen	
Memory Card Save screen	
Roughness Standard Setup screen	7.2
Evaluation Profile Setup screen	7.3
Parameter Setup screen	7.4, Chapter 8
Filter Setup screen	7.5
Cutoff Value (λc) Setup screen	7.6
Cutoff Value (λc) Setup screen	
Number of Sampling Lengths Setup screen	7.7
Arbitrary Length Setup screen	7.8
Pre-travel/Post-travel Setup screen	7.9
Traversing Speed Setup screen	7.10
Measurement Range Setup screen	7.11
Measurement Condition Load Select screen	7.13.3
Internal Memory Load screen	
Memory Card Load screen	
Measurement Condition Deletion Select screen	7.13.4
Internal Memory Deletion screen	
Memory Card Delete screen	
Measurement Condition File Rename Selection screen	7.13.5
Internal Memory File Rename screen	
Memory Card File Rename screen	

■ Measurement Result Menu screen sub-screens **2-9**

TIP	• For information about the measurement results data control, refer to Chapter 9, "MEASUREMENT RESULTS (LOAD/SAVE/DELETE/RENAME)".

Screen Hierarchy	Related section
Measurement Result Menu screen	－
Loading Folder Select screen	9.4
Measurement Result Load screen	
Measurement Result Search screen	
Save Folder Select screen	9.5
Measurement Result Save screen	
Save New screen	
Measurement Result Search screen	
Delete Folder Select screen	9.6
Measurement Result Deletion screen	
Measurement Result Search screen	
File Rename Folder Select screen	9.7
Measurement Result File Rename screen	
File Rename screen	
Measurement Result Search screen	

■ Parameter Setup screen sub-screens

Screen Hierarchy	Related section
Parameter Setup screen	8.2
Submenu screen	—
GO/NG Judgment Rule Setup screen	8.3
Judgment Rule Setup screen	
Upper Limit Setup screen	
Lower Limit Setup screen	
Setting Details Selection screen	—
Sm/Pc/Ppi/Rc Setup screen	8.4.1
Count Level Setup screen	
HSC Setup screen	8.4.2
Count Level Setup screen	
mr Setup screen	8.4.3
Reference Line Setup screen	
Slice Depth Setup screen	
mr(c) Setup screen	8.4.4
Slice Level Setup screen	
δc Setup screen	8.4.5
Reference Line Setup screen	
Slice Level Setup screen	

■ Environment Setup Menu screen sub-screens

2-11

| TIP | • For information about setting the environment, refer to Chapter 10, "OPERATING ENVIRONMENT SETUP". |

Screen Hierarchy	Related section
Operating Environment Setup menu screen	−
Date/Time screen	10.2
Date/Time Setup screen	
Data Output Setup screen	10.3.1, 10.3.2, 10.3.3, 10.3.4
Print Setup screen	10.3.2, 10.3.2.1
Vertical Print Magnification Setup screen	10.3.2.2
Horizontal Print Magnification Setup screen	
Language Selection screen	10.4
Drive Unit Setup screen	10.5
Calibration Setup screen	
Nominal Value Setup screen	
Unit Selection screen	10.6
Decimal Point selection screen	10.7
Volume Adjustment screen	10.8
Function Restriction Setup screen	10.9
Password Setup screen	
Memory Card Setup screen	10.10.1, 10.10.2, 10.10.3, 10.10.4
Usage Condition screen	10.10.2
Text File Saving Setup screen	10.10.3
Backup screen	10.10.5
Auto-Sleep Setup screen	10.11
Waiting Time Setup screen	
Self-Timer Setup screen	10.12
Waiting Time Setup screen	

Screen Hierarchy	Related section
PC Communication Setup screen	10.13
Communication Speed Setup screen	
Parity Setup screen	
Detector Position Display screen	10.14
LCD/Key Test screen	10.15
Version information	10.17

■ Screen Change Menu screen sub-screens

TIP • For information about switching the measurement display directions, refer to Chapter 11, "SWITCHING THE CALCULATION RESULTS SCREEN".

Screen Hierarchy	Related section
Screen Change Menu screen	―
Calculation Result Display Setup screen	11.3
Evaluation Profile Display Setup screen	11.4
Graph Display Setup screen	11.5
Condition List Display Setup screen	11.6
Condition Display Setup screen	11.7
Display Direction Setup screen	11.8

■ Sampling Lengths Result screen sub-screens

TIP • For information about displaying the sampling lengths result, refer to 5.2, "Sampling Length Result Display".

Screen Hierarchy	Related section
Sampling Lengths Result screen	5.2
Screen showing measurement results (at each sampling length) for each parameter	

2.4 Displaying the Guide Screen

The SJ-210 operation keys have various functions that correspond to each screen. Functions of the operation keys on each screen can be checked on the Guide screen. This section explains the Guide screen and the functions of the operation keys.

When the [Esc/Guide] key is pressed on the screens (such as Parameter Calculation Results screen, Evaluation Profile screen, Condition List screen), the Guide screen corresponding to each screen appears.

Calculation Result screen   Evaluation Profile screen   Condition List screen
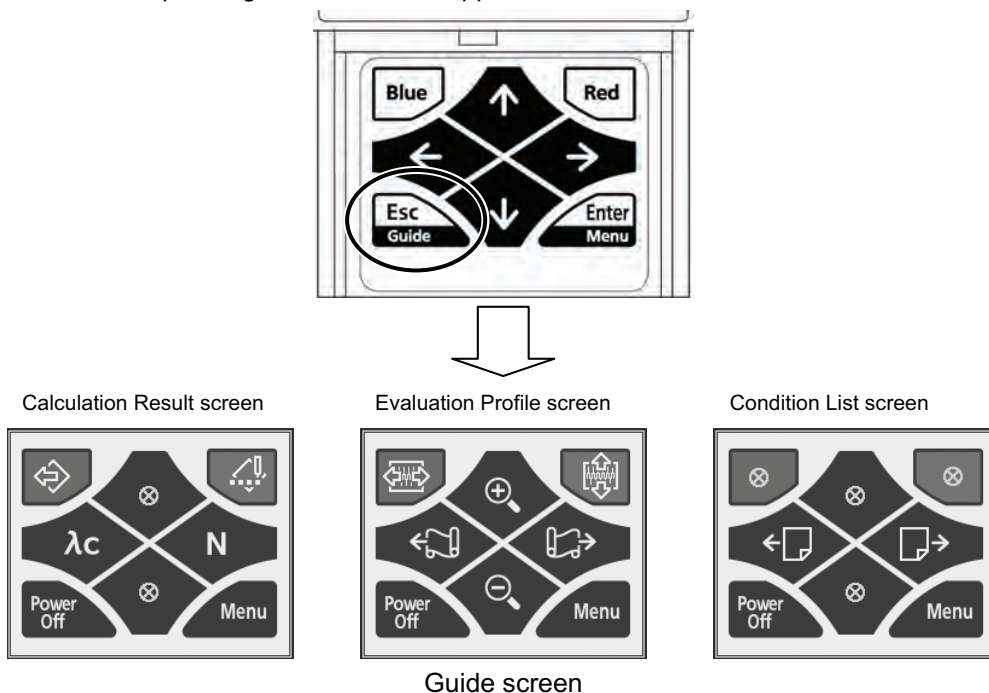
Guide screen

The following icons are used in the Guide screen. The table below explains the function/meaning of the icons.

Calculation Result screen

Operation keys	Function
⇦	Displays the SJ-210 Measurement Condition Loading screen.
	Displays the Measurement Condition Setup screen.
Power Off	Turns the power off by keeping pressing.
Menu	Calls the Main Menu screen.
λc	Changes the cutoff length.
N	Changes the number of sampling lengths.

Evaluation Profile screen

Operation keys	Function
	Switches the direction for zooming in/out to the horizontal direction.
	Switches the direction for zooming in/out to the vertical direction.
Power Off	Turns the power off by keeping pressing.
Menu	Calls the Main Menu screen.
	Zooms in/out the evaluation profiles.
	Scrolls the evaluation profiles to the right and left.

Condition List screen

Operation keys	Function
Power Off	Turns the power off by keeping pressing.
Menu	Calls the Main Menu screen.
	Switches the page of the Condition List screen.
⊗	None

2.5 Entering Numeric Values/Characters

It is sometimes necessary to enter numeric values (including "-" and "_") or characters (alphabet) for such operations as modifying the measurement condition with the SJ-210. This section explains how to enter a numeric value or a character.

■ Key operation required to enter a numeric value or a character to modify the measurement condition

When entering a numeric value or a character, select a specific digit place for an increment. Numeric values include the symbols "-" and "_".
The following keys are used to enter a numeric value or a character.

- [↑] key: Count-up (increment the numeric value or the character)

- [↓] key: Count-down (decrease the numeric value or the character)

- [←] key: Shift the input cursor to the left

- [→] key: Shift the input cursor to the right

- [Red] key: Changing the available character type for entering (numeric values or characters)

- [Enter/Menu] key: Accepting the entered numeric value

The operating procedures are explained using an example where a file name is modified from "09081801" to "090818R3" when specifying a new measurement condition.

NOTE · Do not press the [Enter/Menu] key before the numeric value has been entered. Only press the [Enter/Menu] key to terminate numeric value entry and accept it at that point in time.

1 Press the [→] key to move cursor to the 8th digit.

2 Press the [↑] key two times.

> The 8th digit changes to "3".

3 Press the [←] key once.

> Cursor moves to the 7th digit.

4 Press the "ABC" ([Red] key).

> The character type for entering changes from numeric values to alphabets.

5 Press the [↑] key or [↓] key until "R" appears.

6 Press the [Enter/Menu] key.

➢ The entered value is accepted.

2.6 List of Icons

The following icons are used in the display to express the function/meaning of the buttons.

■ Battery

Icon	Meaning
	Indicates the state of the built-in battery being charged.
	Indicates the state of the battery switch being OFF or abnormal battery status.
	Indicates the state of the built-in battery being fully charged or almost fully charged. (Battery remainder: 100 to 80%)
	Indicates the battery remainder.(Battery remainder: 80 to 60%)
	Indicates the battery remainder.(Battery remainder: 60 to 40%)
	Indicates the battery remainder.(Battery remainder: 40 to 20%)
	Indicates the battery remainder being empty.

■ Card

Icon	Meaning
	Indicates the memory card is being recognized.

■ Data output

Icon	Meaning
SPC	Indicates the data output destination is SPC when the [POWER/DATA] key is pressed. It also indicates the parameter for the SPC output is being selected when appearing in the upper left-hand corner of a parameter title.
	Indicates the data output destination is printer when the [POWER/DATA] key is pressed.
	Indicates the command transmission with the PC is being performed. In this case, the [POWER/DATA] key is not related.

Icon	Meaning
⇒⟩	Indicates the data output destination is memory card when the [POWER/DATA] key is pressed.
🖿	Indicates the displayed contents on screens are stored on the memory card in the BMP file format, when the [POWER/DATA] key is pressed.

■ Main Menu

The following table explains settings for various functions and major items of operations.

Icon	Meaning
	Performs the calibration measurement and specifies the calibration measurement conditions.
	Specifies the measurement conditions.
	Controls the measurement results.
ⓡ	Performs the parameter setup.
	Performs the environment setup.
	Switches the measurement display directions.
N	Displays the sampling lengths result.

■ Calibration measurement

The following table explains the functions related to calibration measurement and items of operations.

Icon	Meaning
START	Urges to start the measurement.
	Indicates the nominal value of the precision roughness specimen.
	Indicates the calibration measurement result.
	Specifies the nominal values.

Icon	Meaning
	Specifies the calibration measurement conditions.
	Checks the calibration history.
	Checks the stylus alarm (cumulative distance) and specifies the threshold.

■ Measurement conditions and results

Icon	Meaning
	Specifies the measurement conditions.
	Loads the saved measurement conditions/results.
	Saves the measurement results.
	Deletes the saved measurement conditions/results.
	Changes the file name of the saved measurement conditions/results.
	Loads the Save10 data.

■ Environment Setup

The following table explains each setting for instruments and items of indicators.

Icon	Meaning
	Specifies the Date/Time.
	Performs the data output.
	Switches the display language.
	Performs the drive unit setup.
	Switches the units.

Icon	Meaning
	Switches the decimal points.
	Adjusts the volume.
	Specifies the function restriction.
	Performs the setup for memory cards.
	Performs the auto-sleep function setup.
	Performs the self timer function setup.
	Performs the setup for the pc-to-pc communication and the RS-232C.
	Displays the detector position.
	Performs the LCD/Key test.
	Initialize all settings.
	Displays the version information.
	Indicates that the buzzer volume is set to mute.
	Indicates that the buzzer function works properly.

■ Operation and setup for screens

Icon	Meaning
	Indicates that the screen returns to the Home screen when the [Blue] key is pressed.
	Indicates that the cursor keys can be used for operations.

■ Messages

Icon	Meaning
❗	Indicates that the state of the instruments (e.g., "XXX is in progress") and a message providing some information.
⚠	Indicates an alarm message.
🚫	Indicates an alarm message that is more serious.

2.7   Screen Settings

The number of the parameters to be displayed can be increased and the display direction can be changed as desired.

TIP • For information about changing the display screen setup, refer to Chapter 11, "SWITCHING THE CALCULATION RESULTS SCREEN".
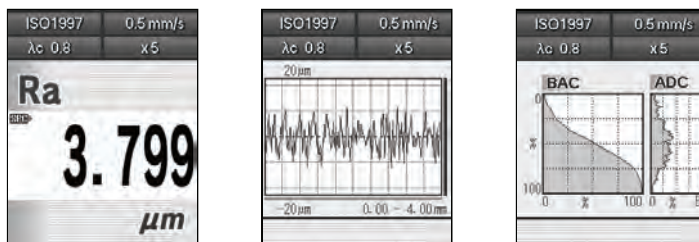
Vertical display example
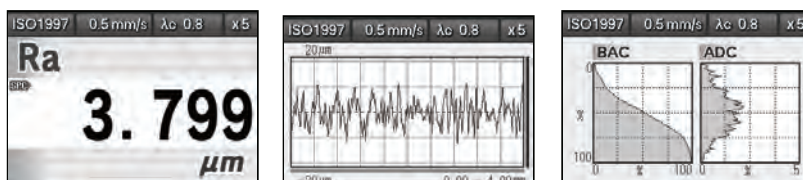
Horizontal display example
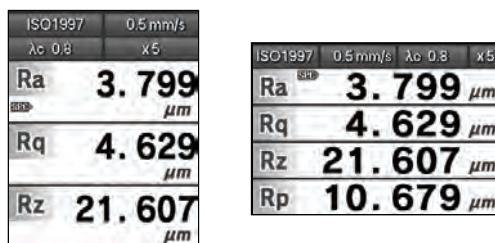
Displaying multiple parameters

MEMO

3

SETTING UP THE SJ-210

This chapter explains the attachment procedure and the initial settings of the drive/detector unit.

3.1   SJ-210 Settings

The following settings must be made before making measurements with the SJ-210.

- Installing the drive/detector unit and the detector
  The SJ-210 is shipped with the display unit, detector, and drive unit packed separately.
  Connect the three units with connecting cables.
  This section explains how to attach and detach the drive/detector unit.

- Applying the display protection sheet
  Apply the display protection sheet on the display of the display unit.
  This section explains how to attach the display protection sheet.

- Turning on the power supply
  Recharge the built-in battery of the display unit and turn the power on.
  This section also explains turning the power of/off during usual operations.

- Initial settings
  Set up the items such as the date (including the time) and the display language.

- Using the carrying case
  For safe use of the SJ-210, put the display unit in the carrying case,
   following the procedures given in this chapter.

3.2　Attaching and Detaching the Drive/Detector Unit

3.2.1　Attaching and detaching the detector

The detector can be detached from the drive unit. After completing a measurement task with the SJ-210, detach the detector from the drive unit and store it in a safe place to prevent damage caused by such as a blow, etc.

IMPORTANT　• Turn off the drive unit before you attach or detach the detector. Attaching or detaching the detector while the drive unit is on can result in damage to the unit.

　• Attach and detach the detector when the drive unit is at the origin point position. When the drive unit is not at the origin point position, attaching or detaching the detector can be difficult and might also damage the unit.

Detector

Connector

Drive unit at the origin point position

Detector

Connector

Drive unit not at the origin point position
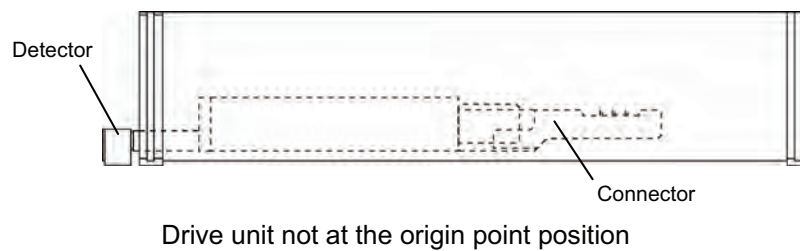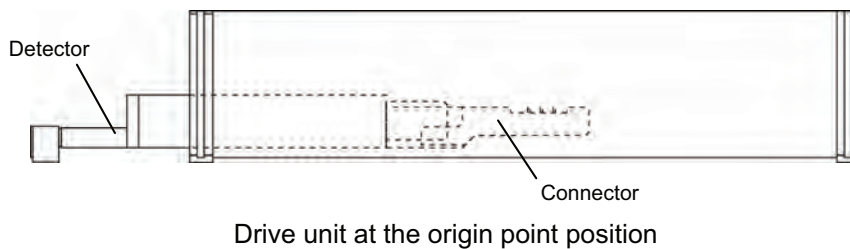
IMPORTANT • Always hold the detector body when attaching or detaching the detector. If the tip or stylus is held during attachment or detachment, the detector may be damaged.
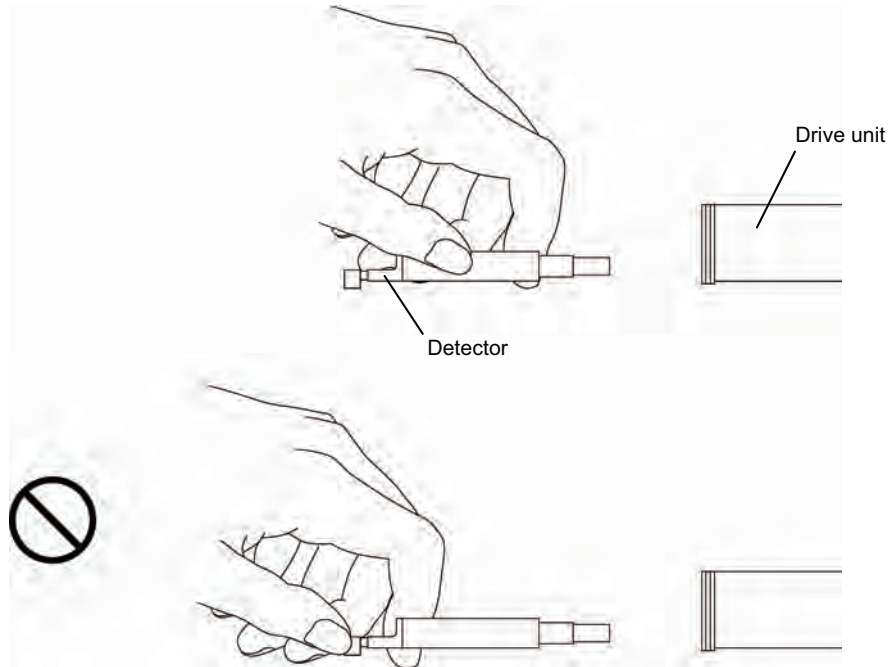
How to hold the detector

IMPORTANT • Never touch the stylus, otherwise, it may be damaged.
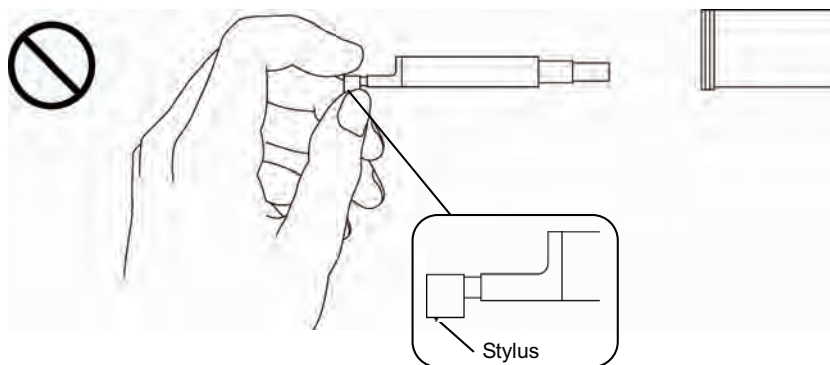
Stylus

■ Attaching the detector

IMPORTANT • When fitting the detector into the drive unit, do not force the detector. Doing so may damage the instrument.

• The detector moves smoothly at first being fitted with the guide way in the drive unit, then pins of the connectors on the detector and the drive unit must be fitted to each other. After the detector is felt tight in the guide of the drive unit, further push in the detector until it stops with the pins on the connectors fitted.
When the detector (the standard/retracting type) is firmly fitted in the drive unit, the screw position on the top of the detector is aligned with the end face of the drive unit, as shown in the following illustration of the standard detector type.
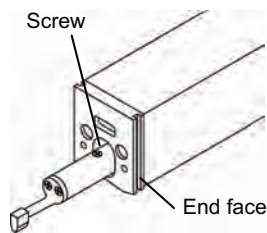
After the detector is attached

1 Reposition the drive unit to the origin point position.
Once you have confirmed that the drive unit is at the origin point position, proceed to step 2.

TIP • When the detector is in retracted position, you must first release the retraction. For information about releasing the detector from retraction, refer to 15.2, "Retracting the Detector".

a Press the [POWER/DATA] key to turn on the power.

b Press the [START/STOP] key to move the connector position of the drive unit to the origin.
When you have moved the drive unit to the origin point position, the drive unit returns to the origin after performing a measurement.

c Press the [Esc/Guide] key to turn the power off.

2 After confirming the orientation of both detector and drive unit connectors (pin positions), gently and straightforward insert the detector into the drive unit hole.
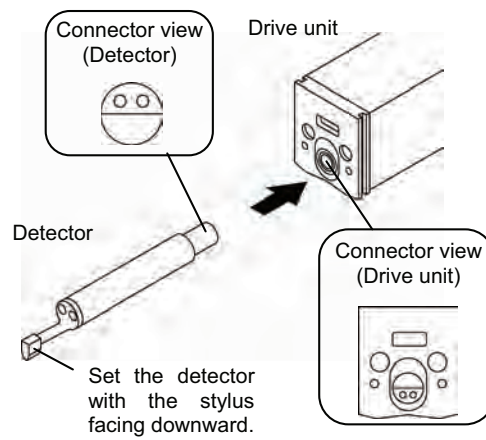
Attaching the detector

■ Detaching the detector

With the drive unit at the origin point position, quietly pull out the detector from the drive unit.
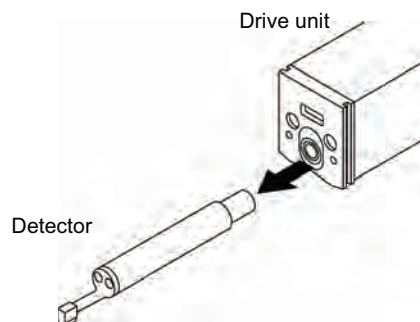
Detaching the detector

3.2.2　Attaching and detaching the drive/detector unit

Follow the method below to attach and detach the drive/detector unit to/from the display unit.

■ Detaching the drive/detector unit

1　While pressing section A in the direction indicated by the arrow (1), erect the drive/detector unit in the direction indicated by the arrow (2). Pull out the drive/detector unit from the hook on the drive/detector unit retaining plate

2　While pulling out section B in the direction indicated by the arrow (3), detach the drive/detector unit from the drive/detector unit retaining pin.

Position of the drive/detector unit retaining pin

Drive/detector unit retaining plate　　Drive/detector unit retaining pin
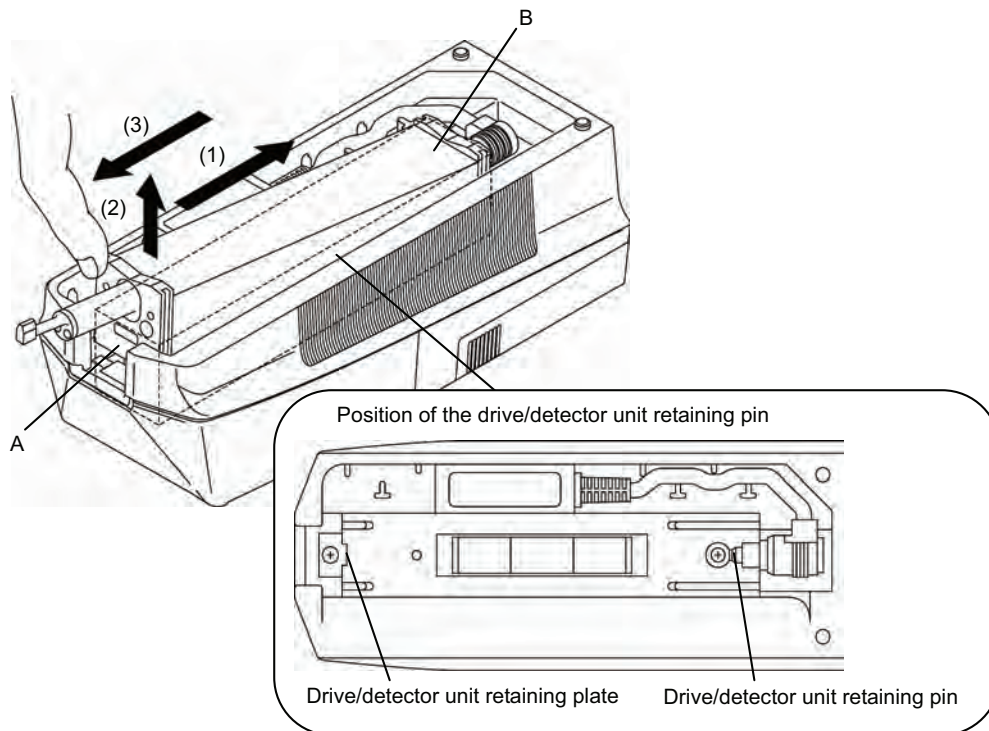
Detaching the drive/detector unit

IMPORTANT　• Do not hold the detector when detaching the drive/detector unit. Otherwise, the detector may be damaged.

■ Mounting the drive/detector unit

1　Push the drive/detector unit all the way into the display unit as indicated by the arrow (1). It fits with the drive unit retaining pin.

2　Lower the drive/detector unit in the direction indicated by the arrow (2) while pressing it in the direction indicated by the other arrow (1) until it is caught by the hook on the drive unit retaining plate.

Position of the drive/detector unit retaining pin

Drive/detector unit retaining plate　　　Drive/detector unit retaining pin
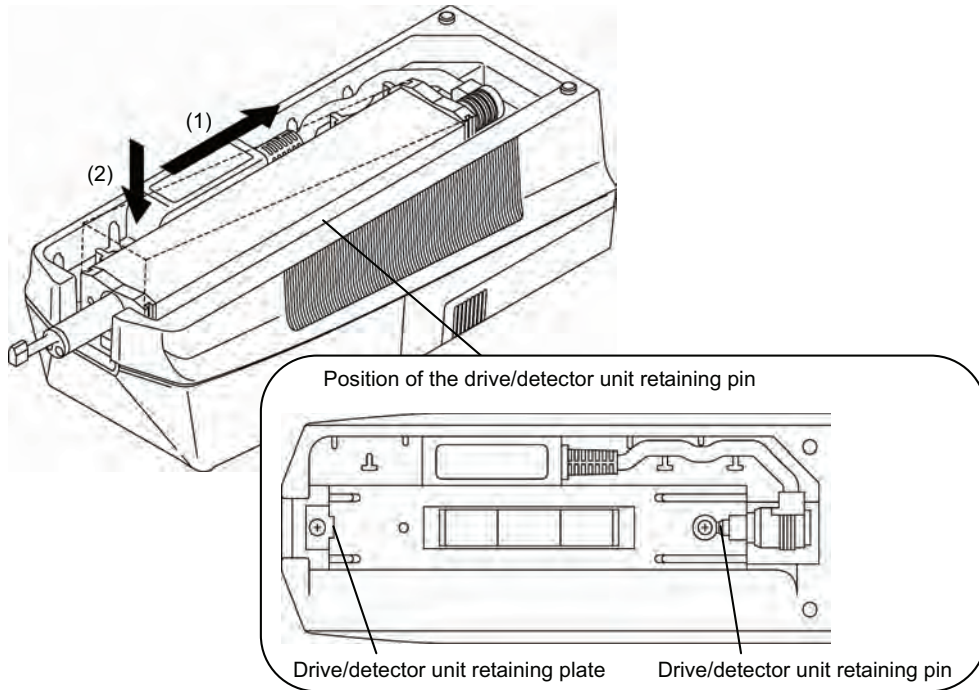
Mounting the drive/detector unit

3.2.3 Plugging in and unplugging the display unit cable

IMPORTANT • These connections (or disconnections) should be made while the power to the SJ-210 is off (or in the auto-sleep mode).

■ Disconnecting the display unit cable

1 Slide the section to be held in the direction indicated by the arrow (1) and remove the drive/detector unit connection plug from the socket connector at the rear of the drive/detector unit.
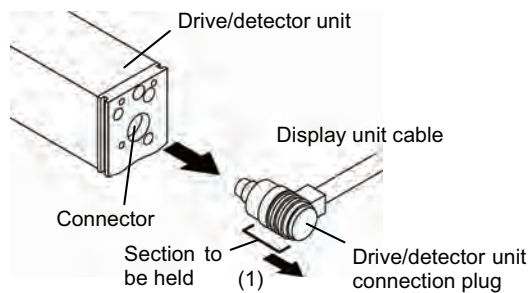
Disconnecting the display unit cable

■ Connecting the display unit cable

1 After confirming the orientation of the socket connector (pin positions) at the drive/detector unit and that of the drive/detector unit connection plug (pin positions), insert the plug into the connector.
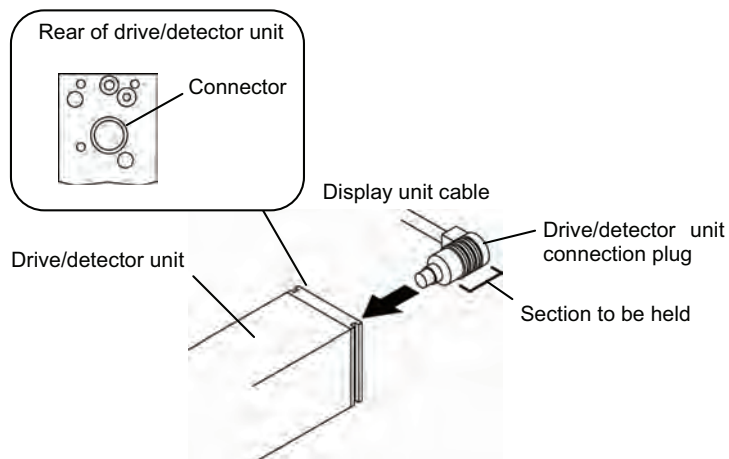
Connecting the display unit cable

3.2.4   Using the connection cable   *3-9*

To operate the drive/detector unit separately from the display unit, use the connection cable as shown below.

Display Unit

Connection cable

Drive/detector unit
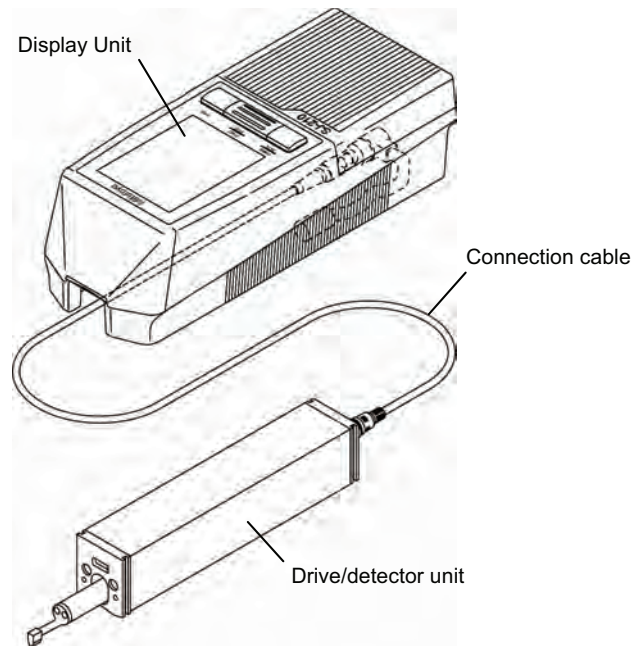
Using the connection cable

■ Plugging in and unplugging the connection cable

Plug in and unplug the connection cable as shown below:

View in the connector direction

Drive/detector unit connection plug

C

Connector

Connection cable

View in the connector direction

Connector

View in the plug direction

Plug

B

Drive/detector unit

A

View in the connector direction
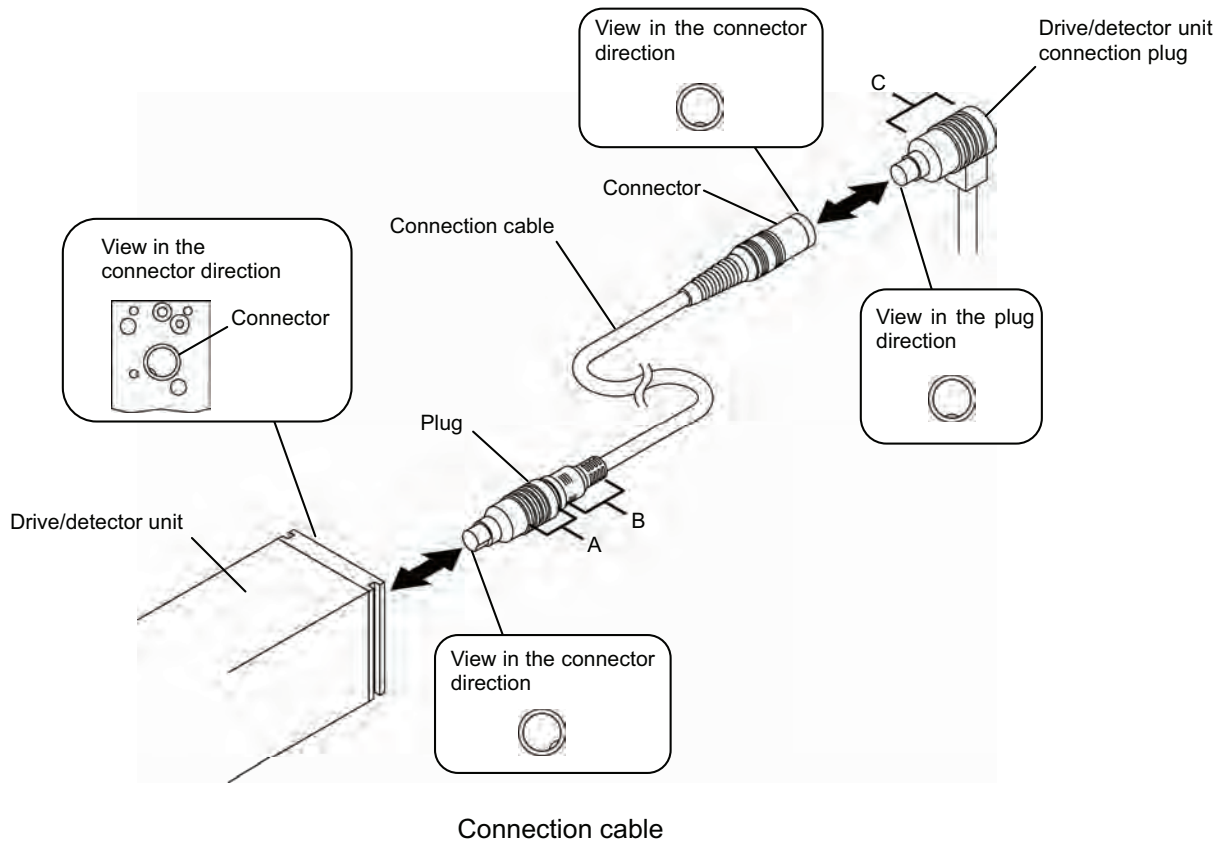
Connection cable

- Connecting the drive/detector unit connection plug
  Check the orientation of the mating connector and plug, then connect the connector and the plug while firmly holding section C.

- Disconnecting the drive/detector unit connection plug
  Pull out the plug while firmly holding section C.

- Connecting the connection cable plug
  Check the orientation of the mating connector and plug, then insert the plug into the drive unit connector while firmly holding section B.

- Disconnecting the connection cable plug
  While holding the section A, slide A towards B, then pull out the plug.

■ Retaining the connection cable

3-11

The connection cable should be positioned such that it is held in place by the hook provided on the bottom of the display unit.

Bottom of the display unit

Connection cable

Hook
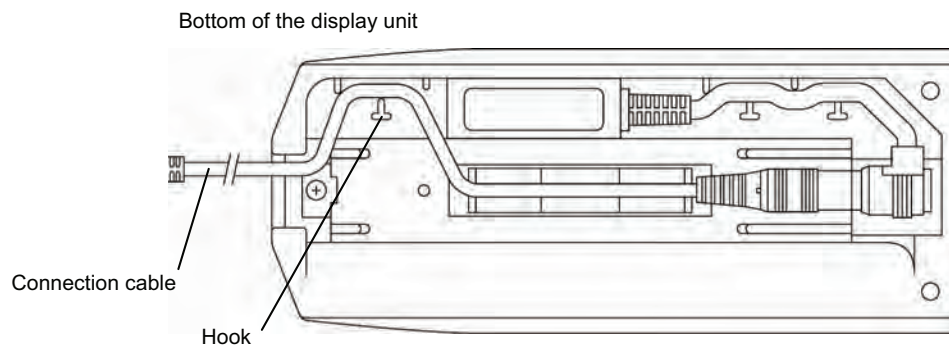
Retaining the connection cable

3.3 Attaching the Display Protection Sheet

■ Attaching the display protection sheet

NOTE ・ Before attaching the display protection sheet, wipe the display clean using a dry cloth.

1 Peel the separator (sheet protecting the self-adhesive surface) from the display protection sheet.

2 Put the display protection sheet in place and press the entire surface lightly using a dry cloth.

Display protection sheet Str
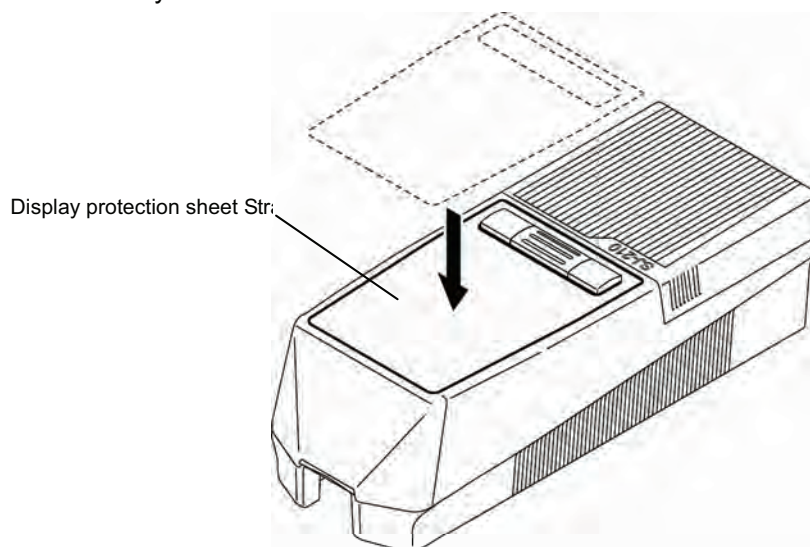
Attaching the display protection sheet

■ Replacement of the display protection sheet

Check the condition of the protection sheet after completing a measurement task. Replace the protection sheet if it is heavily soiled or if the display cannot be viewed easily.

A replacement of the display protection sheet can be purchased from your SJ-210 dealer.

・ Display protection sheet

Part No.	Qty
12BAK820	1
12AAL066	5

3.4   Power Supply   *3-13*

A built-in battery and an AC adapter are provided to supply power to the SJ-210.

When a built-in battery is used, the SJ-210 itself can turn the power on without connecting the AC adapter to the SJ-210.

When an external power supply is available, connect the AC adapter to the SJ-210 and turn on the power.

IMPORTANT
- Upon purchase the built-in battery switch is set to OFF. Be sure to set the built-in battery switch to ON before using this instrument.

- When the AC adapter is connected while the built-in battery switch is set to OFF, the below icon is displayed. Disconnect the AC adapter, set the built-in battery switch to ON, and then reconnect the AC adapter.

The icon when the built-in battery switch is OFF.

- When the built-in battery power is almost consumed, the power cannot be turned on. Charge the built-in battery to drive the SJ-210 again with the battery. However, notice that the measurement conditions and results saved in the built-in memory are cleared.

- When the built-in battery switch is OFF, the measurement results and conditions are cleared. Keep the built-in battery switch ON unless the SJ-210 is not used for a long period of time (more than 2 to 3 weeks).

- The following items are saved in the SJ-210's internal memory even when the built-in battery switch is OFF or when the internal battery is replaced.
  - Detector calibration factor
  - Drive unit traversing speed calibration factor
  - Drive unit type
  - Language
  - Unit
  - Decimal Point
  - Date Format

3.4.1 Recharging the built-in battery

At the point of purchase, the built-in battery is not fully charged. Also, the built-in battery switch is set to OFF. Before using the SJ-210, set the built-in battery switch to ON, and charge the built-in battery.

NOTE • The built-in battery cannot be recharged when the built-in battery on/off switch is set to OFF. Make sure to set the battery switch to ON as explained below.

TIP • When almost all the built-in battery power is exhausted, it takes about maximum 4 hours to fully recharge it.

■ Recharging the built-in battery

1 Place your nail on the hollow provided on the rear cover, and push the rear cover in the direction indicated by the arrow (1).

2 Pull the rear cover in the direction indicated by the arrow (2) and remove it.

Detaching the rear cover

3 Set the built-in battery on/off switch to ON.

Built-in battery on/off switch

OFF   ON
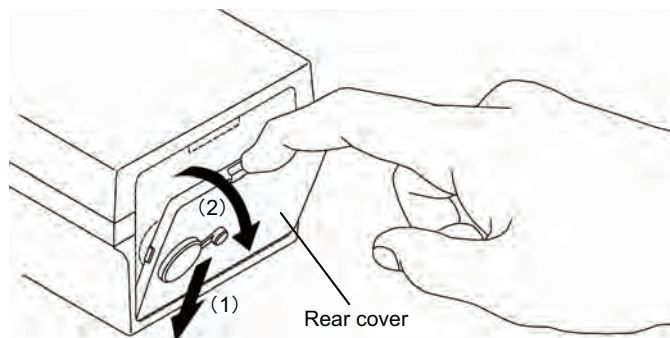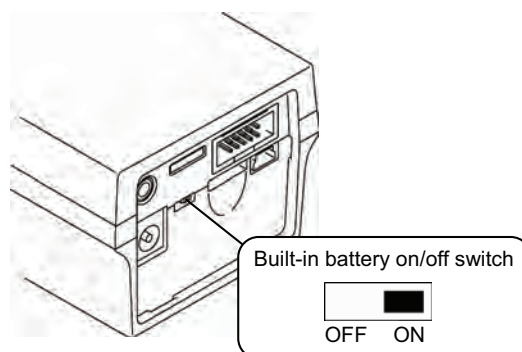
Built-in battery on/off switch

4 Fit the rear cover to the hollow of the rear of the display unit in the direction indicated by the arrow (1).

5 Push the rear cover in the direction indicated by the arrow (2) and attach it.
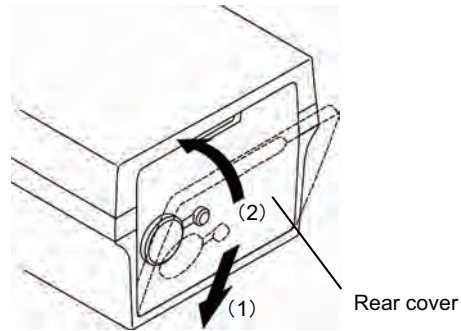
Attaching the rear cover

6 Connect the AC adapter to the wall outlet.

7 Remove the connector cap from the rear cover, then insert the AC adapter plug into the connector.
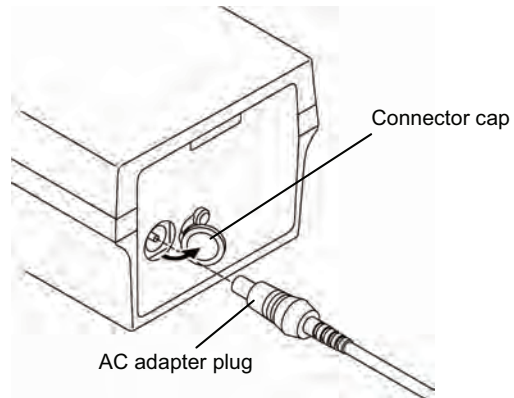
Connection of the AC adapter

➢ When the AC adapter is connected to the display unit, recharging of the battery automatically starts.

The icon indicating the progress of charging appears during charging the battery. When fully charged, the icon disappears.

Recharging progress icon

➢ When the built-in battery is fully charged or almost fully charged, recharging does not start even when the AC adapter is connected to the display unit.

In this case, the icon indicating that the battery is fully charged appears on the display for several seconds.

Full-charge icon

NOTE • Do not turn off the built-in battery on/off switch during charging. Charging is terminated when the switch is turned off.

• Never connect/disconnect the AC adapter during recharging. Otherwise, recharging may stop before the built-in battery is fully charged.

3.4.2   Turning on the power supply   *3-17*

■ Power supply from a built-in battery (when using a built-in battery)

1   Place your nail on the hollow provided on the rear cover, and push the rear cover in the direction indicated by the arrow (1).

2   Pull the rear cover in the direction indicated by the arrow (2) and remove it.
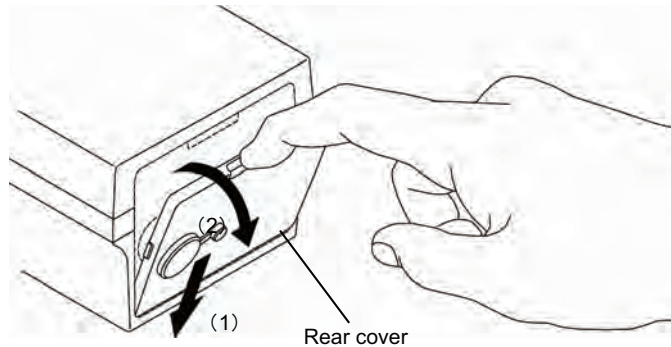
Detaching the rear cover

3   Set the built-in battery on/off switch to ON.
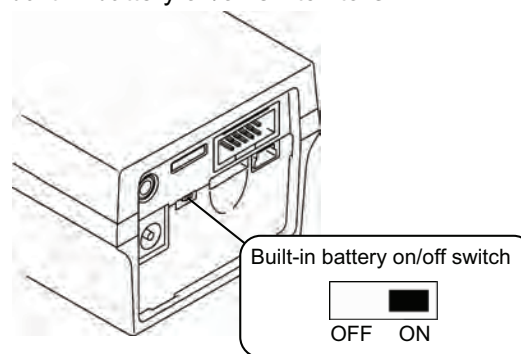
Built-in battery on/off switch

4   Fit the rear cover to the hollow of the rear of the display unit in the direction indicated by the arrow (1).

5   Push the rear cover in the direction indicated by the arrow (2) and attach it.
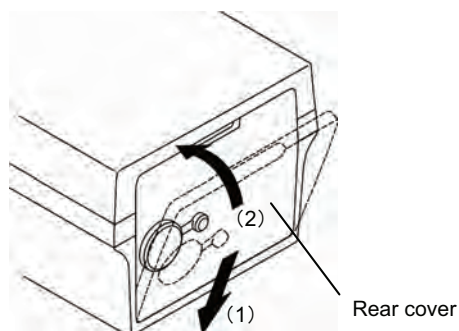
Attaching the rear cover

6 Press the [POWER/DATA] key.
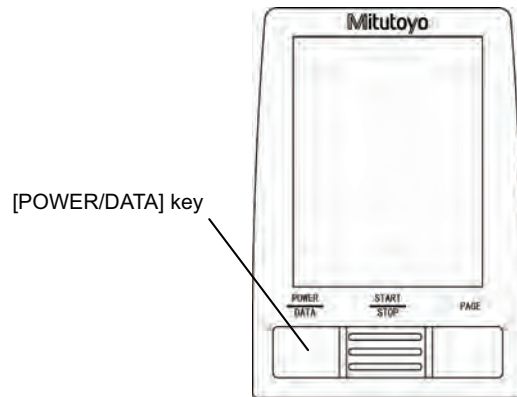
[POWER/DATA] key

Operation key ([POWER/DATA] key)

TIP • The icon showing that recharging is in progress also stays on during auto-sleep. For more information about recharging the built-in battery, refer to 3.4.1, "Recharging the built-in battery".

For more information about setting auto-sleep, refer to 3.4.3, "Setting the auto-sleep function when using the built-in battery".

■ Power supply from an AC adapter (when using an AC adapter)

IMPORTANT
- Do not connect the AC adapter to a power line which may cause electrical interference. Although this instrument has reasonable protection against electrical interference, supplying power from such a line may hamper correct measurement.

- When you have removed the rear cover of the display unit, take care and do not have the AC adapter plug contact with the SPC or RS-232C connector. Instrument failure results.

1 Set the built-in battery on/off switch to ON. For more information about the built-in battery on/off switch, refer to "■ Power supply from a built-in battery (when using a built-in battery)".
Proceed to the next step once the battery switch is on.

2 Connect the AC adapter to the wall outlet.

3 Remove the connector cap from the rear cover, then insert the AC adapter plug into the connector.

Connector cap
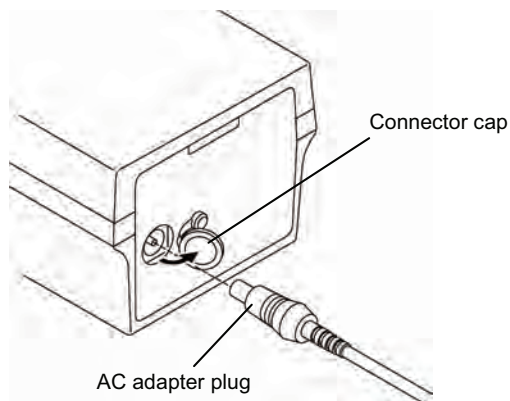
AC adapter plug

Connection of the AC adapter
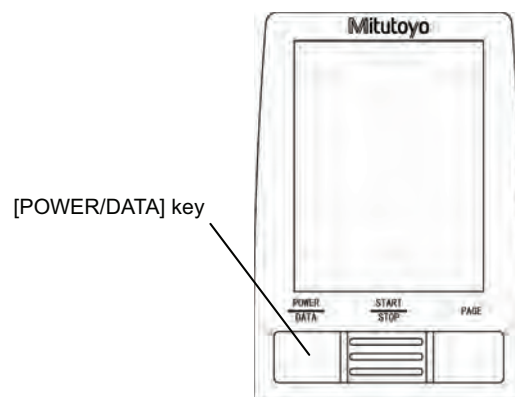
4 Press the [POWER/DATA] key.

[POWER/DATA] key

IMPORTANT • If the instrument is forcibly turned OFF while writing to the internal memory (during re-calibration, etc.), the data written to the memory may become invalid.

Do not suddenly switch OFF the built-in battery or unplug the AC adapter during operation.

If the contents of the internal memory have become invalid, all settings are reset and the following message is displayed right after the unit is turned back ON.

At this time all settings are reset to their initial values.

When this message is displayed, gain calibration and speed calibration must be performed.
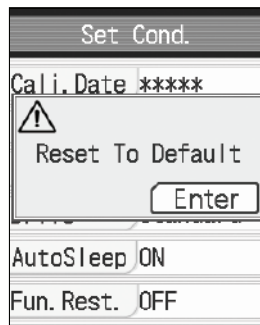
Total reset message

NOTE • When the AC adapter is connected and the [POWER/DATA] key is pressed to turn the power on, recharging progress indicator may appear on the display.

While the recharging progress indicator is showing, press the [POWER/DATA] key again to turn on the power normally.
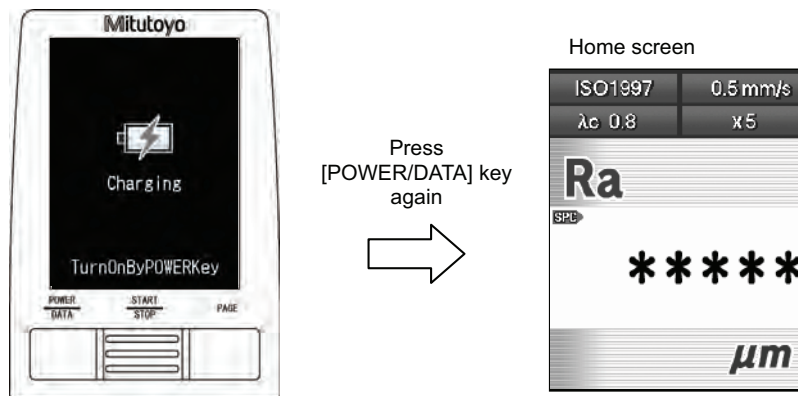
Indication condition of charge

■ Turning the power off

3-21

The following two methods are available for tuning the power off.

- Power off keeping pressing the [Esc/Guide] key

- Power off with auto-sleep in use of the built-in battery

● Power off keeping pressing the [Esc/Guide] key

Keep pressing the [Esc/Guide] key to turn the power off.

Operation key ([Esc/Guide] key)
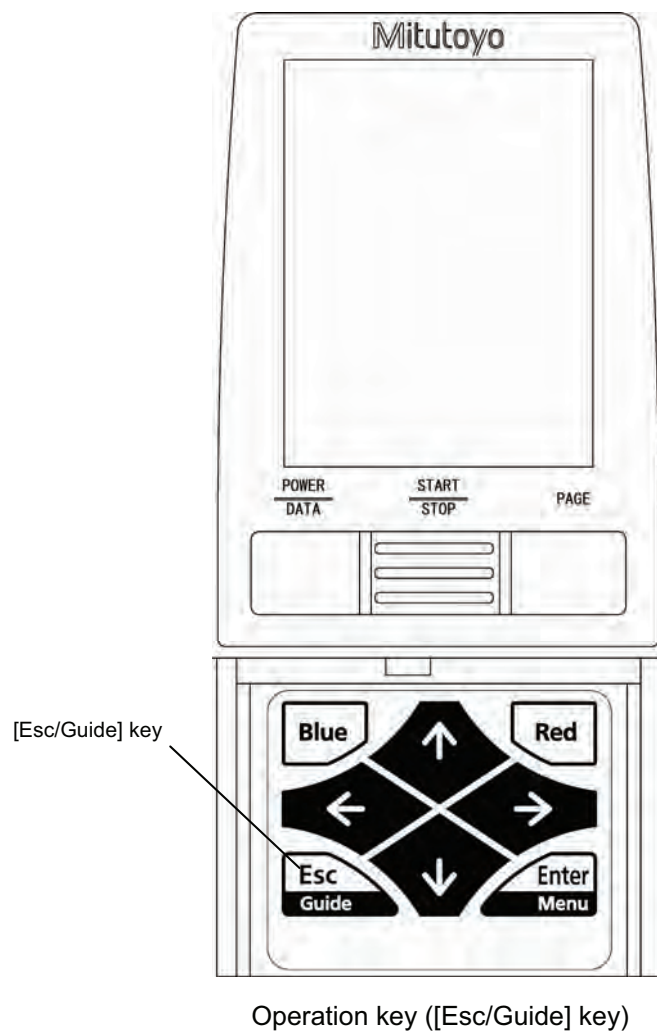
● Power off with auto-sleep in use of the built-in battery

With the built-in battery in use and auto-sleep set to ON, when the SJ-210 is not operated for more than a constant time after power-on, the power is automatically turned off with the auto-sleep function.

Even when the power is turned off by the auto-sleep function, the measurement conditions and results are retained and are displayed the next time the power is turned on.

NOTE
- When a request signal (REQUEST signal) is input from an external device during SPC data output, the SJ-210 power is not turned off for a specified period of time after signal input.

- When the power is being supplied by the AC adapter, the auto-sleep function is disabled.
  To turn the power off, keep pressing the [Esc/Guide] key.

TIP
- For more information about the auto-sleep function, refer to 3.4.3, "Setting the auto-sleep function when using the built-in battery".

3.4.3   Setting the auto-sleep function when using the built-in battery

The SJ-210 is capable of setting the auto-sleep function in use of the built-in battery.

NOTE • When the AC adapter is used, auto-sleep does not function irrespective of the setting of the auto-sleep function. To turn off the SJ-210 power, press and hold the [Esc/Guide] key.

TIP • For information about setting the auto-sleep function, refer to 10.11, "Setting the auto-sleep function".

3.5 Initial Settings

To start using the SJ-210, you must complete the initial settings.

Initial settings include the following items.

Setup item	Description	Related section
Date	Specify the date and time. Date can be included into the measurement condition record and useful for record control.	10.2
Display language	When necessary, change the language for the display. The language can be selected from 16 languages including Japanese, English, and German.	10.4
Switch unit	When necessary, change the unit for the data such as the measurement results shown on the display.	10.6
Decimal Point	When necessary, change the decimal point type for the data such as the measurement results shown on the display.	10.7
Buzzer volume	You can adjust the volume of the buzzer that sounds when the operation keys are pressed.	10.8

IMPORTANT
- Connect the AC adapter to prevent power to the instrument from being interrupted during operation.
- When using the built-in battery, make sure it is sufficiently charged. If operations are performed when the battery power is low, the SJ-210 may shut off during operation.

3.6 Carrying Case *3-25*

The supplied carrying case is convenient for safekeeping, protecting, and transporting the SJ-210.

It is also possible to perform measurement with the drive/detector unit being connected via connecting cable to the display unit housed in the case.

Carrying case
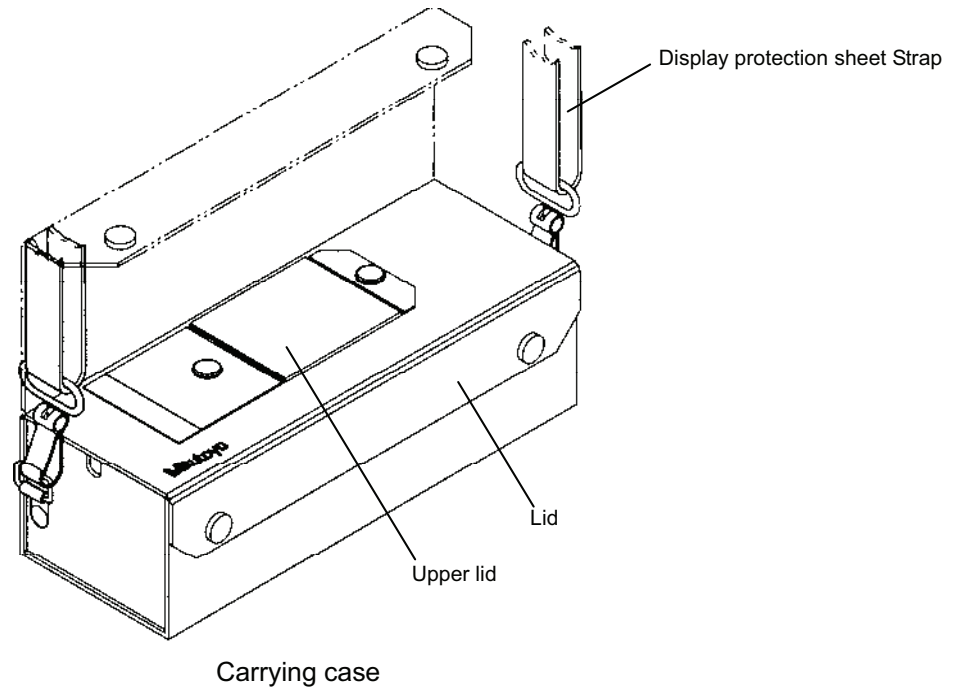
■ Opening the upper lid

Open the upper lid as shown below, and the LCD display of the display unit is located, permitting operation of the primary operation keys.

When not in use, close the upper lid for safekeeping.

Upper lid
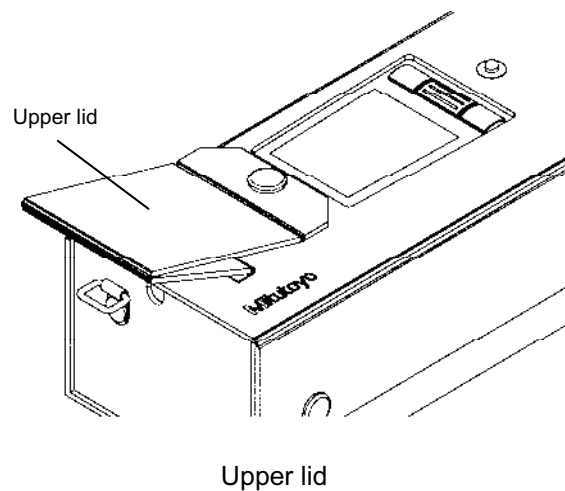
■ Connecting the connecting cable

There are windows on both sides of the carrying case as shown below, through which you can connect the display unit in the case to the external drive/detector unit.

Window for connecting cable

Window for each connecting cable
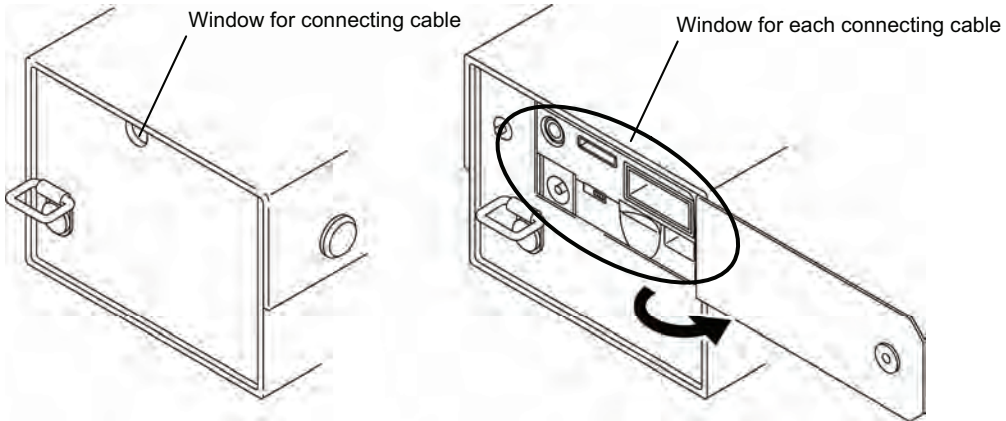
The side of the carrying case

■ Housing accessories

Accessories of SJ-210 can be stored to the carrying case in position as specified below.

Space for detectors (4 pcs)
[For keeping standard and optional detectors or extension rods.]
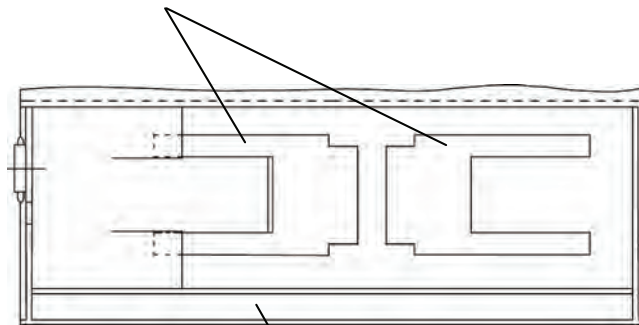
Space for calibration stage and precision roughness specimen.

Accessories housing position

4 MEASUREMENT OPERATION

In this chapter, the surface roughness measurement with the SJ-210 is described according to the general procedures.

4.1   Overall Measurement Flow

Overall measurement flow is described below.

There are two types of operations: general operations and operations on demand. In the flow chart below, solid lines indicate general operations and dotted line indicates operations on demand.

Settings the SJ-210 → "3.2 Attaching and Detaching the Drive/Detector Unit"	Set up the SJ-210 (attaching/detaching the drive/detector unit, and cable connection, etc.) according to the shape of the workpiece to be measured.
Turning on the power supply → "3.4 Power Supply"	Select either the AC adapter or built-in battery as the power supply. Recharge the built-in battery as required.
Performing calibration → "Chapter 6 CALIBRATION"	Calibration is a means of adjusting the detector gain so that the SJ-210 can yield correct measurements. This can be easily performed by measuring a supplied precision roughness specimen.
Modifying the measurement conditions → "Chapter 7 MODIFYING THE MEASUREMENT CONDITIONS"	Modify the measurement conditions. For information about measurement conditions that can be modified, refer to the next page.
Executing the actual measurement of the roughness specimen → "4.3 Measurement"	Measure the roughness specimen and display the result.
Recording measurement results → "4.4 Measurement Result Management"	Measurement results can be saved, printed, output as SPC data, and communicated with a personal computer.
Daily maintenance → "Chapter 15 MAINTENANCE AND INSPECTION OF SJ-210"	After measurement, store the SJ-210 safely by detaching the drive/detector unit, etc.

■ List of measurement conditions that can be modified

The following table shows the measurement conditions that can be modified by the user. When they are not modified, then measurement is performed according to the default values (factory settings).

TIP • For information about modifying the measurement conditions, refer to Chapter 7, "MODIFYING THE MEASUREMENT CONDITIONS".

Measurement conditions	Default value	Remark	Related section
Nominal value	2.950 μm (116.14 μin)	Enter the value of the precision roughness specimen.	6.4
Roughness standard	ISO1997	Set to the desired standard.	7.2
Evaluation profiles	Roughness profile		7.3
Roughness parameter	Only Ra, Rq, Rz	Parameters to be yielded can be set on/off as required.	7.4
Filters	GAUSS		7.5
Cutoff length (sampling length)	0.8 mm (0.03 in)		7.6
λs	2.5 μm (100μin)		
Number of sampling lengths	×5		7.7
Arbitrary evaluation length	None	When measurement is not performed with the cutoff length and the number of sampling lengths provided by the SJ-210, set an arbitrary length for measuring.	7.8
To include pre-travel/post-travel length in the traversing length	ON	Since the existing roughness standards require the pre-travel/post-travel length to be included in the traversing length, the setting is usually set to "ON". However, when these lengths can not be traced due to the limited space, the setting can be changed to "OFF".	7.9
Measurement speed	0.5 mm/s (0.020 in/s)	Default measuring speed (driving speed) can be modified.	7.10
Measurement range	AUTO		7.11
Application of GO/NG judgment and the range	None	Set the upper or lower roughness limit to discriminate between measured workpieces to be accepted or rejected.	8.3
Drive	Standard	The default value for the SJ-210 is "Standard".	10.5
Communication speed	38400 bps	Change this to a communication speed when communicating with a personal computer. Select one from 9600 bps, 19200 bps, or 38400 bps.	10.13
Parity	NONE	Select one from EVEN, ODD, or NONE.	
Auto-sleep setup	ON	Sets the auto-sleep function to ON/OFF in use of the built-in battery,	10.11

4.2 Calibration

Depending on the usage of the SJ-210, calibration should be performed periodically. In addition, when the instrument is used for the first time or when the detector has been attached or detached, calibration is necessary.

Without properly calibrating the instrument, correct measurements can not be obtained.

TIP • For information about calibration, refer to Chapter 6, "CALIBRATION".

4.3   Measurement

To start measurement, set the SJ-210 on a workpiece and press the [START/STOP] key. While measurement is being performed, the measured profile is displayed. After measurement has been completed, the measurement result is displayed for confirmation.

4.3.1   Setting the workpiece and SJ-210

■ Setting the workpiece and SJ-210

When the workpiece surface is larger than the SJ-210, place the SJ-210 on the workpiece.

For surface roughness measurement to be successful, it should be performed on a firm base that is insulated as well as possible from all sources of vibration. When measurement is performed being subject to significant vibrations, results may be unreliable.

TIP   • In cases where the measured surface is smaller than the SJ-210 or where the surface is curved (cylindrical, etc.), install the SJ-210 using an appropriate optional accessory. For information about optional accessories, refer to Chapter 14, "INSTALLING THE SJ-210 WITH OPTIONAL ACCESSORIES".

---

1   Position the work piece so that the measured surface is level.

2   Place the SJ-210 on the workpiece.
In this operation, support the SJ-210 by reference surfaces A and B on the bottom of the driving unit, as shown below.
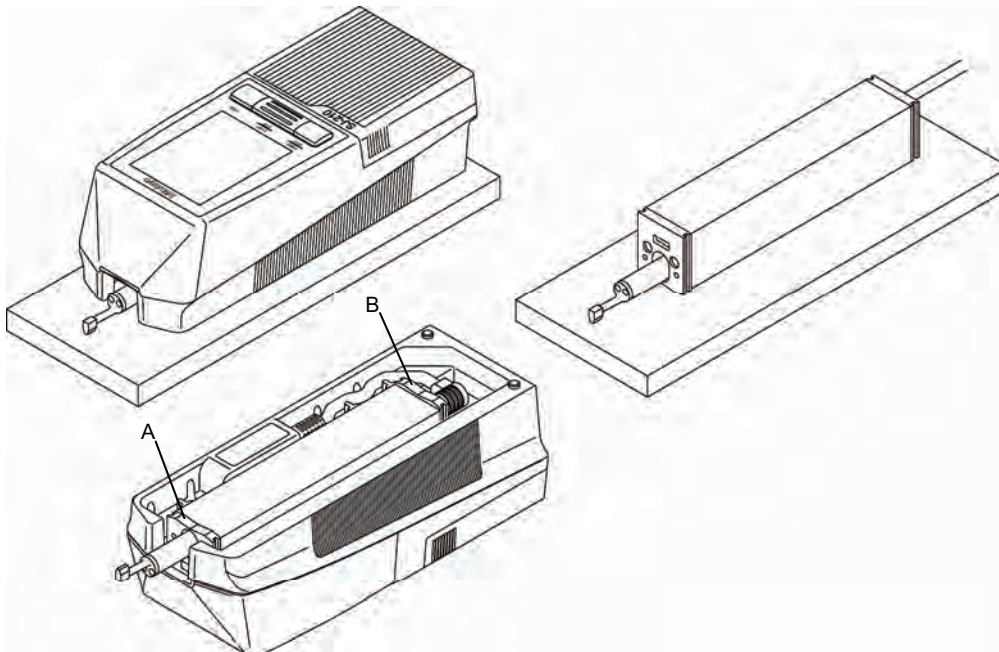
Setting the SJ-210 on the workpiece

3 Confirm that the stylus is in proper contact with the measured surface.
In addition, confirm that the detector is parallel to the measured surface.
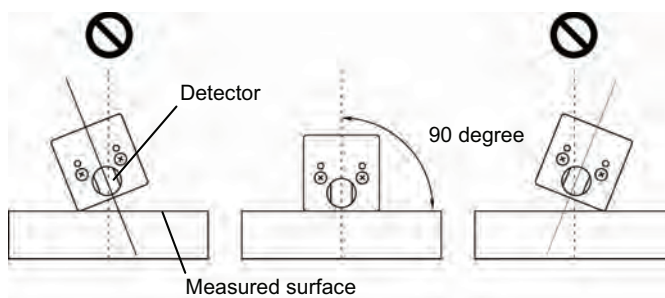
- Front view of detector

Detector

90 degree

Measured surface

- Side view of detector

Detector

Measured surface

Checking the detector position

4.3.2 Starting measurement

■ Operation procedure

Home screen

ISO1997	0.5 mm/s
λc 0.8	x 5

Ra

SPC

3. 799

μm
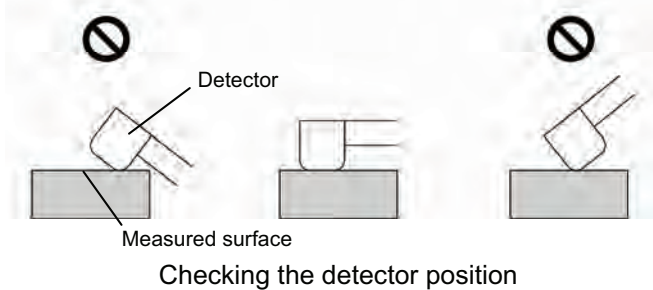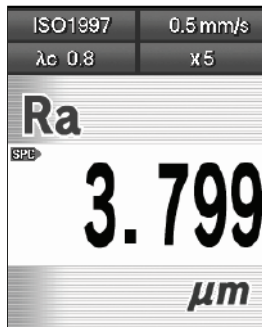
START

1 Press the [START/STOP] key on the Home screen.

Measurement Waveform Display screen

ISO1997	0.5 mm/s
λc 0.8	x 5

20μm

−20μm 0. 00 − 4. 80 mm
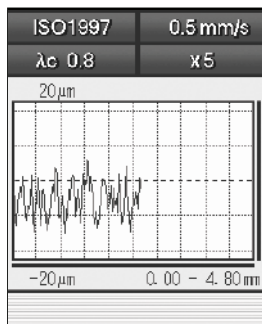
➤ The detector starts traversing to perform measurement.
While measurement is being performed (detector is traversing), the Measurement Waveform Display screen is displayed.

NOTE • Press the [START/STOP] key during measurement to stop for unavoidable reasons.

Home screen

ISO1997	0.5 mm/s
λc 0.8	x 5

Ra

SPC

3. 799

μm
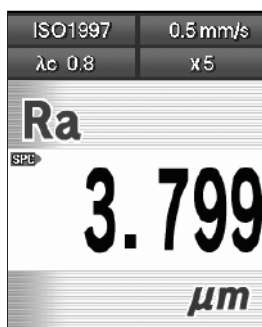
➤ After the measurement has been completed, the measured value is displayed.

TIP • For information about the measurement results, refer to Chapter 5, "MEASUREMENT RESULT DISPLAY".

4.4   Measurement Result Management

The latest measurement results are retained in the memory of the SJ-210. Using a memory card (optional), the SJ-210 can save the measurement results up to 10,000 cases of measurements.

4.4.1   Loading/Saving/Deleting/Renaming measurement results

The operation flow of saving measurement results is explained here.

NOTE ・A memory card (optional) is required to perform loading/saving/deleting/renaming of measurement results.

TIP ・A memory card (optional) is required to perform loading/saving/deleting/renaming of measurement results.

・For information about loading/saving/deleting/renaming measurement results, refer to Chapter 9, "MEASUREMENT RESULTS (LOAD/SAVE/DELETE/RENAME)".

■ Procedure for saving measurement results

1 After measurement, switch the screens in the following order: Home → Main Menu → Measurement Result

2 Select "Save" with the cursor key, and press the [Enter/Menu] key.

3 Navigate to the save location folder with the cursor key, and press the [Enter/Menu] key.

4 Select "Save New" with the cursor key, and press the [Enter/Menu] key.

5 Specify the file name, and press the [Enter/Menu] key.

➤ The measurement results are saved.

4.4.2   Outputting the measurement results

The SJ-210 has the function to output the measurement results (saved in the SJ-210 memory or the memory card) to a Mitutoyo Digimatic Data Processor (DP-1VR, etc.) or personal computers.

The SJ-210 also has the function to print the measurement results when connected to a printer (optional accessory).

TIP ・For information about outputting the measurement results, refer to Chapter 13, "SAVE AND OUTPUT RESULTS USING [POWER/DATA] KEY".

MEMO

5 MEASUREMENT RESULT DISPLAY

The results of the measurements performed using the SJ-210 can be displayed in various formats.

The SJ-210 has the functions to display the following calculation results and conditions after performing measurement and recalculation. The measurement results to be displayed can be switched by pressing the [PAGE] key.

In addition, the state of display can be set up according to the operational conditions.

- Parameter calculated results display

  The display can be set up to show the calculated results vertically/horizontally on the screens. It can also be set up to show multiple numbers of parameter on one screen. Using the tracing function, the SJ-210 can store and display the calculation results of the latest 10 measurements.

  The SJ-210 can also show the GO/NG judgment results for parameters.

- Evaluation profile display

  The display can be set up to show the calculated results vertically/horizontally on the screens. It can also be selected whether to show the results on the screen or not.

  The waveform can be zoomed in/out to the vertical/horizontal direction.

- BAC/ADC graph display

  The display can be set up to show the calculated results vertically/horizontally on the screens.

- Measurement condition display

  The display can be set up to show the calculated results vertically/horizontally on the screens. It can also be selected whether to show the results on the screen or not.

5.1 Switching the Measurement Result Display with the [PAGE] Key

When the [PAGE] key is pressed on the Home screen, the following measurement results can be displayed: The calculation results, evaluation profiles, BAC/ADC graphs, and the measurement condition list for the customized parameters.
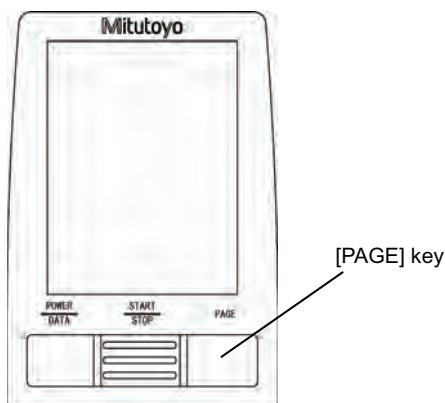
Operation key ([PAGE] key)

■ Transition of screens when the measurement result display is switched
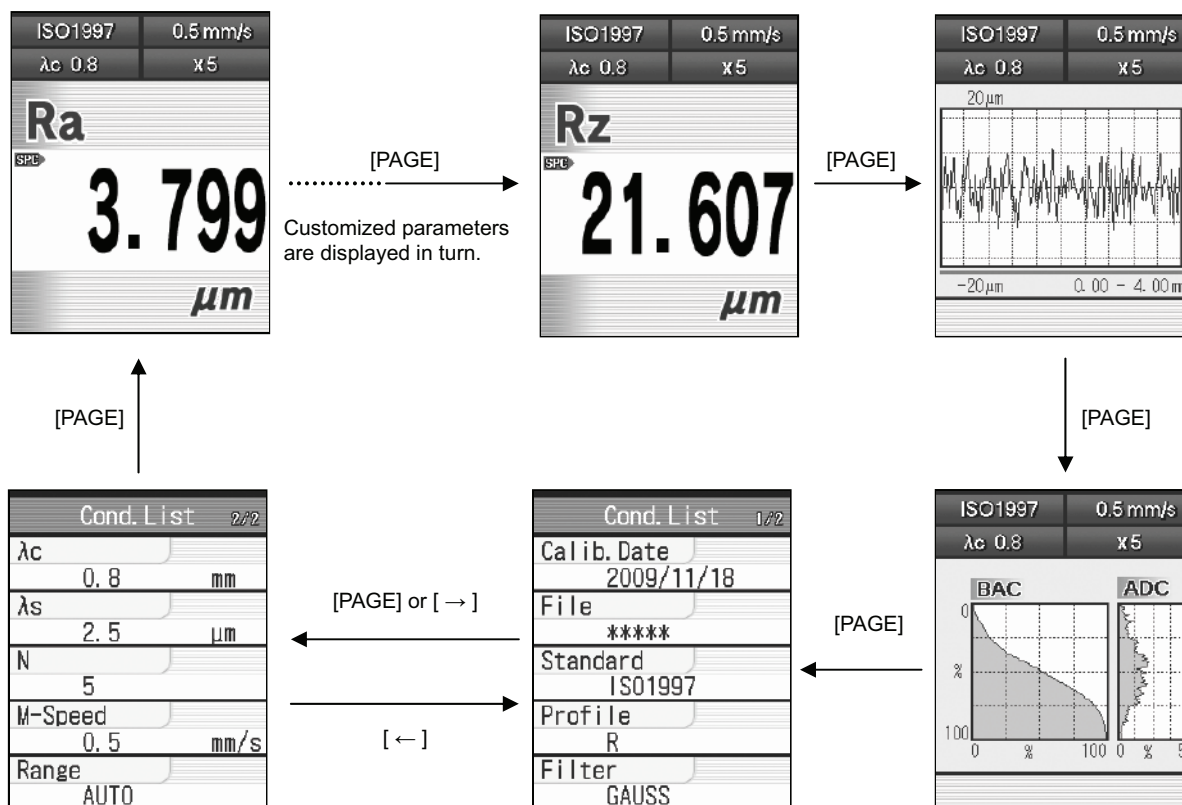
5.1.1 Switching the parameter display

When displaying the measurement results, the objective parameter to be displayed can be switched to another customized parameter.

Each time the [PAGE] key is pressed, the displayed parameter that has been selected using the parameter customize function changes in the following order: "Ra" → "Rq" → "Rz" → XXX.

The objective parameters to be displayed are limited to the parameters that have been customized using the parameter customize function.

TIP • For information about the parameter customize function, refer to 8.2, "Selecting the Displayed Parameters (Parameter Customization)".

• For information about switching the display directions, displaying multiple parameters on one screen, and trace display, refer to 11.3, "Switching Calculation Results Screen".
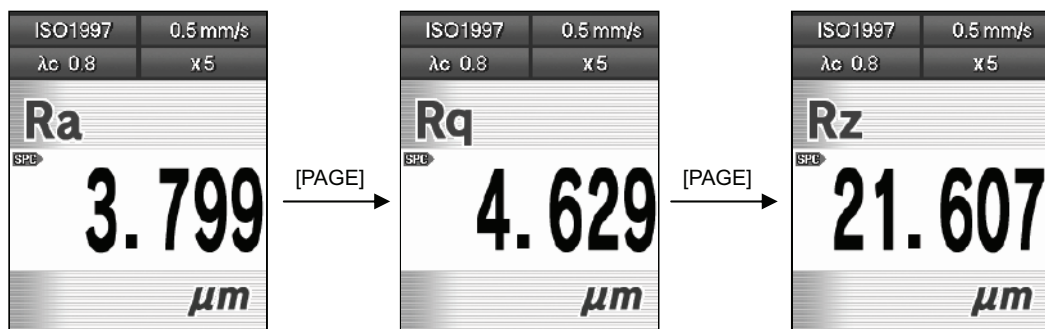
Switching the parameter display

5.1.2 Evaluation profile display

The measurement results can be displayed in the measured profile (evaluation profile).
The Evaluation Profile screen appears after the parameter that has been selected using the parameter customize function.
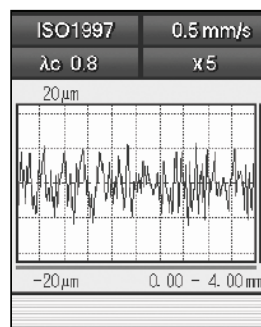
Evaluation Profile screen

TIP • For information about setting the display directions and whether to display the evaluation profile or not, refer to 11.4, "Switching Evaluation Profile Screen".

■ Zooming in/out of the evaluation profile

The evaluation profile displayed on the screen can be zoomed in/out.
The operating procedures are explained using an example where the evaluation profile is displayed vertically on the screen.

Evaluation Profile screen

ISO1997	0.5 mm/s
λc 0.8	x5

20 μm

−20 μm   0.00 − 4.00 mm
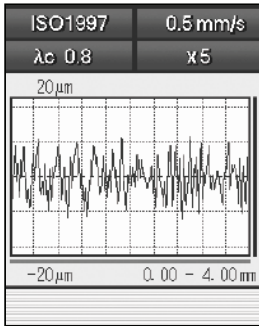
1   Press the [PAGE] key to display the Evaluation Profile screen.

Evaluation Profile screen

ISO1997	0.5 mm/s
λc 0.8	x5

20 μm

−20 μm   0.00 − 4.00 mm
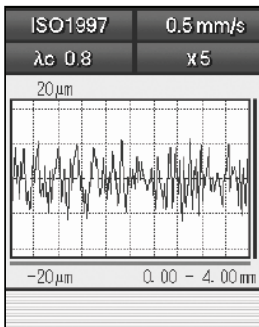
Blue

2   Select the direction for zooming in/out.

a   Press the [Blue] key to zoom in/out to the horizontal direction.

➢   The horizontal scroll bar turns red. It indicates that the evaluation profile can be zoomed in/out to the horizontal direction.

Evaluation Profile screen

ISO1997	0.5 mm/s
λc 0.8	x5

20 μm

−20 μm   0.00 − 4.00 mm
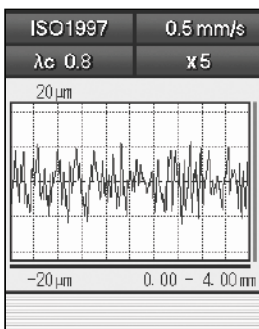
Red

b   Press the [Red] key to zoom in/out to the vertical direction.

➢   The vertical scroll bar turns red. It indicates that the evaluation profile can be zoomed in/out to the vertical direction.

Evaluation Profile screen

ISO1997	0.5 mm/s
λc 0.8	x5

20 μm

−20 μm   0.00 − 1.72 mm

↑

↓
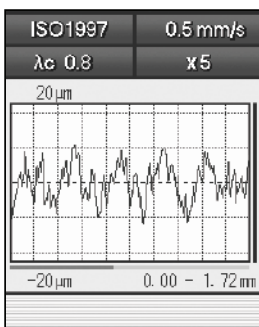
3   Press the [↑] key to zoom in, and press the [↓] key to zoom out.

5-4

Evaluation Profile screen
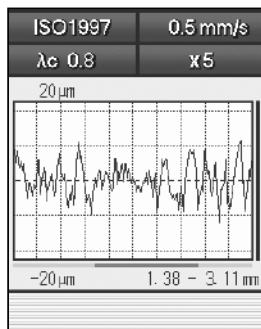
4 Press the [←] key and [→] key to scroll the evaluation profile.

TIP • Depending on the display directions (vertical, horizontal (rightward), horizontal (leftward)), the direction keys ([↑] [↓] [←] [→]) are assigned with different functions.

• Press the [Esc/Guide] key to display the Guide screen. Functions of the operation keys can be checked on the Guide screen. For information about the Guide screen, refer to 2.4, "Displaying the Guide Screen".
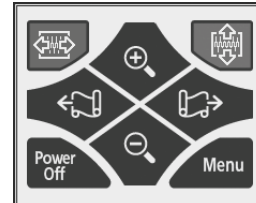
Guide screen

5.1.3 Graph display

The measurement results can be displayed in the BAC/ADC graphs.
The Graph screen appears after the Evaluation Profile screen.
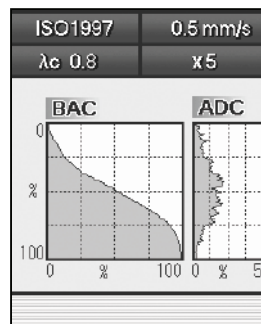
Graph screen

TIP • For information about setting the display directions and whether to display the BAC/ADC graphs or not, refer to 11.5, "Switching Graph Display Screen".

5.1.4　Condition list display

The list of the measurement conditions can be displayed. When the saved measurement results or conditions are loaded, the file name of the loaded data is displayed in "File".

The Condition List screen appears after the Graph screen.

The [→]/[←] key also can be used to switch the display on the Condition List screen.
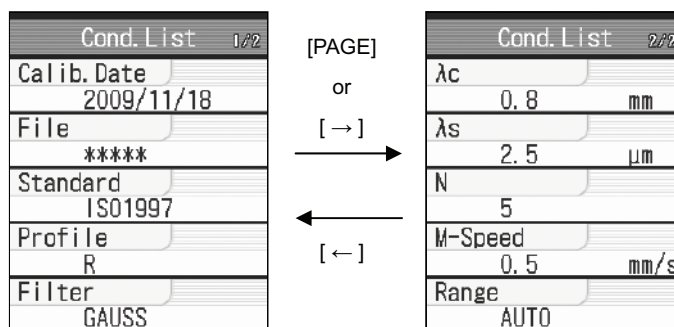
Condition List screen

TIP ・ For information about setting the display directions and whether to display the condition list or not, refer to 11.6, "Switching Measurement Conditions List Screen".

5.1.5　GO/NG judgment result display

When the GO/NG judgment function is used, the measurement data is compared with its upper and lower tolerance limits. When the measurement falls outside the limits, the display color of the measurement result changes.

When the measurement is within tolerance limits, the "OK" sign appears to the right of the parameter name.
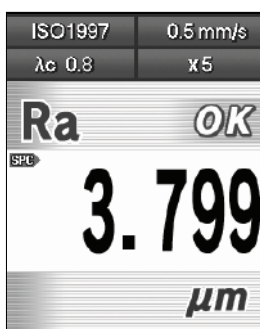
GO/NG judgment result (GO)

When the measurement exceeds the upper limit, the "+NG" sign appears to the right of the parameter name, and the displayed measurement result turns red.
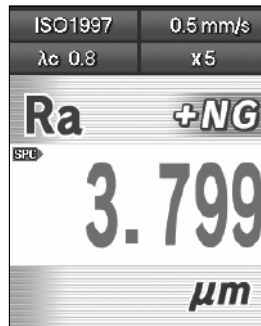
GO/NG judgment result (above the upper limit)

When the measurement falls below the lower limit, the "-NG" sign appears on the right side of the parameter name. In addition, the part indicating the measurement result turns blue.
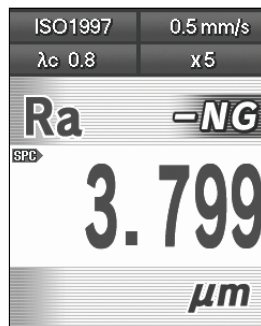
GO/NG judgment result (below the lower limit)

NOTE • When the upper or lower limit is set at 0, the limit is not be enabled for GO/NG judgment.
The upper limit and lower limit can be set individually. Therefore, it is possible to individually disable the GO/NG judgment with the upper/lower limits.

TIP • For information about setting the GO/NG judgment function, refer to 8.3, "Setting the GO/NG Judgment Function".

5.1.6 Trace display

The SJ-210 can save measurement results of the last 10 measurements for every customized parameter.

The measurement results are displayed in chronological order. The latest measurement result is displayed in the highest row on the screen. The older measurement results are displayed in the lower rows in chronological order.

The [↑] [↓] key can be used to switch the displays shown in the lower rows than the second highest row.

Only the latest measurement result can be saved in the memory card, printed, and output as SPC data.

Trace screen

NOTE • The result data of the measurements performed before the last 10 measurements are deleted in order from the oldest data.

 • The trace data is cleared when the Trace screen is refreshed.

 • The trace data may be cleared when the measurement conditions are changed.

TIP • For information about setting the Trace screen, refer to 11.3, "Switching Calculation Results Screen".

■ Clearing the trace data

It is possible to clear all of the saved trace data.

Trace screen

1 Press the [Blue] key on the Trace screen.

Trace screen

➢ A message is displayed to confirm that it is OK to clear the trace data.

2 Press the [Enter/Menu] key.

➢ All of the saved trace data is cleared.

5.2   Sampling Length Result Display

It is possible to check the measurement results at each specified sampling length and the GO/NG judgment results for each parameter.

■ Screens guide

1

Home screen

ISO1997	0.5 mm/s
λc 0.8	x5

Ra
SPC
3.799
μm

[Enter/Menu] →

← [Esc/Guide]

2

Main Menu screen

Main menu
- 📖 Meas. Condition
- 🗄 Measured Data
- 📖 Parameters
- 📝 Set Environ.
- 🗔 Screen Change
- **N Result**

"N Result"
[Enter/Menu] →

← [Esc/Guide]

3

Sampling Lengths Result screen

N Result	2/3
Ra	3.799 μm
▶Rq	4.629 μm
Rz	21.607 μm

| Up Limit | 5.000 |
| LowLimit | 4.000 |

Parameter Selection
[Enter/Menu] →

← [Esc/Guide]

4

Measurement Result at Each Sampling Length screen

N	Rq
1	4.822 μm
2	5.029 μm
3	3.787 μm
4	5.310 μm
5	4.199 μm
6	
7	
8	
9	
10	

■ Operation procedure

Home screen

ISO1997	0.5 mm/s
λc 0.8	x5

Ra
SPC
3.799
μm

Enter/Menu

1   Press the [Enter/Menu] key on the Home screen.

Main Menu screen

Main menu
- 📖 Meas. Condition
- 🗄 Measured Data
- 📖 Parameters
- 📝 Set Environ.
- 🗔 Screen Change
- **N Result**

↑
↓
Enter/Menu

2   Select "N Result" with the [↑] [↓] key, and press the [Enter/Menu] key.

Sampling Lengths Result screen

ⓘN N Result	2/3
Ra	3.799 µm
➡Rq	4.629 µm
Rz	21.607 µm
Up Limit	5.000
LowLimit	4.000

3 To check the measurement results at each sampling length and the GO/NG judgment results for each parameter, select the desired parameter with the [↑] [↓] key, and press the [Enter/Menu] key.

When a parameter is selected, the upper and lower roughness limits that have been specified in the GO/NG judgment settings are displayed at the bottom of the screen.

Measurement Result at Each Sampling Length screen

ⓘN	Rq
1	4.823 µm
2	5.029 µm
3	3.786 µm
4	5.309 µm
5	4.199 µm
6	
7	
8	
9	
10	

4 Check the measurement results at each sampling length and the GO/NG judgment results.

When the measurement results are over the upper limit, at each sampling length, the sampling length part is displayed in red. When the measurement results are below the lower limit, the sampling length part is displayed in blue.

> **TIP** • Press the [Esc/Guide] key to return to the previous screen.

MEMO

6

CALIBRATION

In this chapter how to perform calibration is described.

The process of calibration involves the measurement of a reference workpiece (precision roughness specimen) and the adjustment of the difference (gain adjustment), when there is one between the measured value of the SJ-210 and the reference value (precision roughness specimen).

Depending on the usage of the SJ-210, calibration should be performed periodically. In addition, when the instrument is used for the first time or when the detector has been attached or detached, calibration is necessary.

Without properly calibrating the instrument, correct measurements can not be obtained.

When the drive unit has been changed, first change the drive unit settings. For more information, refer to 10.5, "Calibrating Drive Unit Speed and Settings".

6.1 Calibration Preparation

To perform calibration, measure the precision roughness specimen and adjust gain so that measured value is equal to Ra of the precision roughness specimen. Measured surface of the precision roughness specimen has a series of sine wave shapes, and Ra (nominal value) is displayed.

Depending on the usage of the SJ-210, calibration should be performed periodically. In addition, when the instrument is used for the first time or when the detector has been attached or detached, calibration is necessary.

Without properly calibrating the instrument, correct measurements can not be obtained.

6.1.1 Calibration preparation (standard type, retracting type)

Use the supplied precision roughness specimen for calibration.

NOTE • When calibration needs to be performed with a standard other than the supplied precision roughness specimen, it must only be done after the default calibration conditions have been modified so they are suitable for the roughness specimen. For information about the procedure used to modify the calibration conditions, refer to 6.4, "Setting the Nominal Value of the Precision Roughness Specimen" and 6.5, "Setting Calibration Conditions".

■ Setting up the precision roughness specimen, calibration stage, and SJ-210

1 Place the precision roughness specimen and calibration stage on a level table.

Calibration stage

Precision roughness specimen
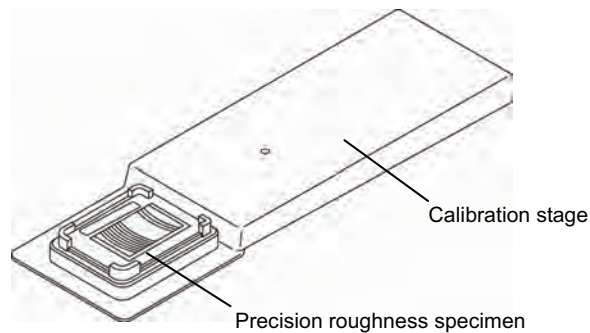
Precision roughness specimen and calibration stage

2   Mount the SJ-210 on the calibration stage.
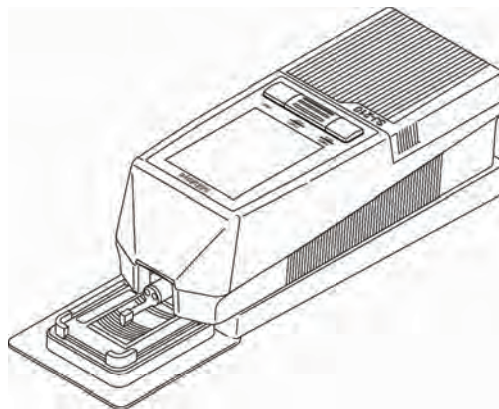
Setting of the SJ-210 on to the calibration stage

3   Set the SJ-210 so that the detector traversing direction is perpendicular to the cutter mark of the precision roughness specimen.
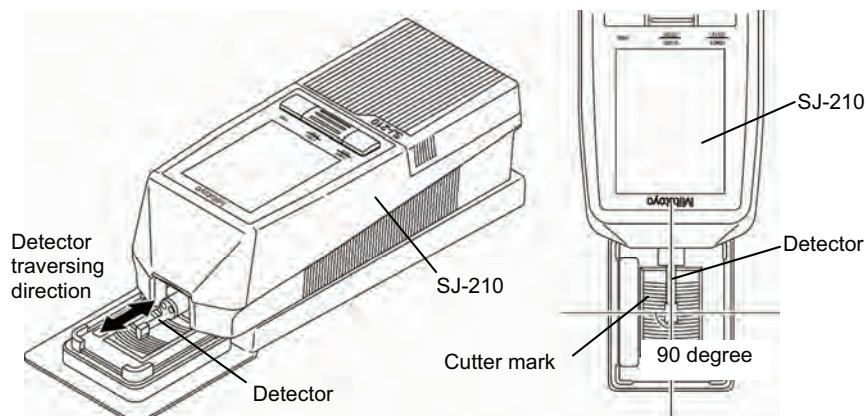
Setting positions of the SJ-210 (standard type and detector retracting type)
and precision roughness specimen

4 Confirm that the detector is parallel to the measured surface.

- Front view of detector

Detector

90 degree

Measured surface

- Side view of detector

Detector

Measured surface
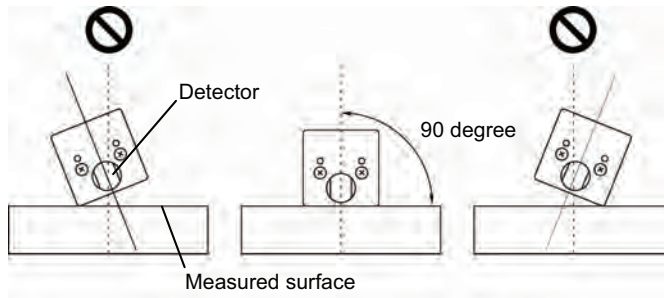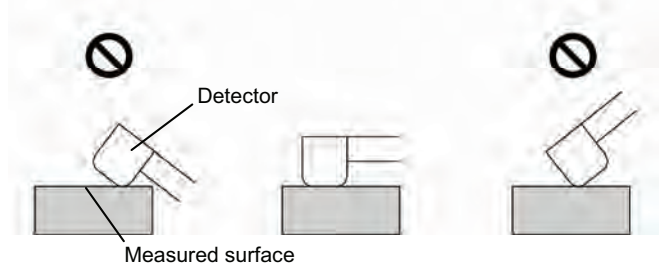
Detector position confirmation (standard type, detector retracting type)

6.1.2   Calibration preparation (transverse tracing type)

Use the supplied precision roughness specimen for calibration.

■ Setting up the precision roughness specimen, calibration stage, and transverse tracing drive unit

1   Place the precision roughness specimen and calibration stage on a level table.
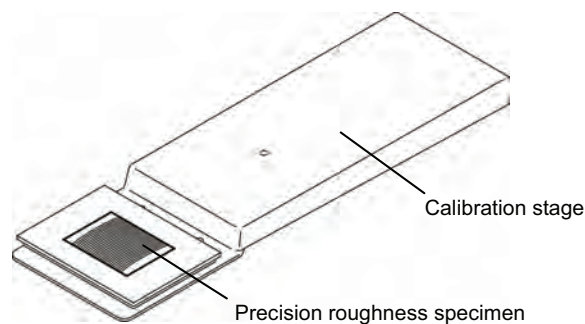
Precision roughness specimen and calibration stage

2   Mount the transverse tracing drive unit on the calibration stage.
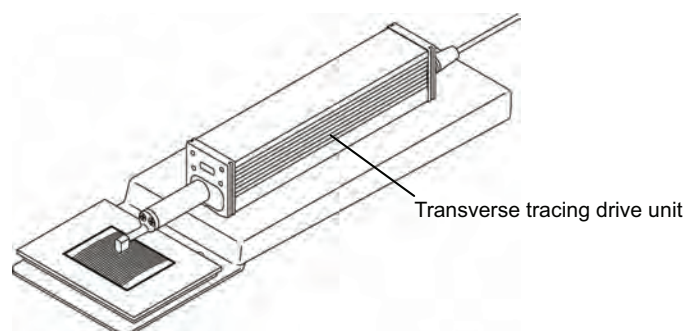
Setting of the drive unit (transverse tracing type) onto the calibration stage

3   Set the transverse tracing drive unit and precision roughness specimen so that the detector traversing direction is perpendicular to the cutter mark of the precision roughness specimen.
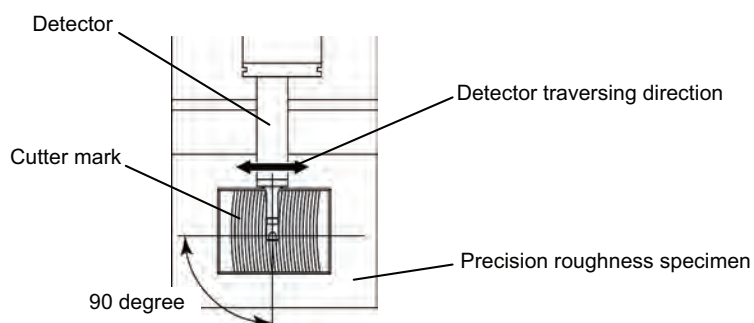
Setting positions of the drive unit (transverse tracing type) and precision roughness specimen

4 Confirm that the detector is parallel to the measured surface.

• Front view of detector

Detector

90 degree

Measured surface

• Side view of detector

Detector

Measured surface
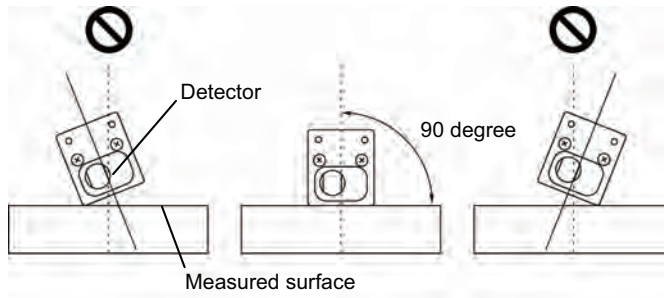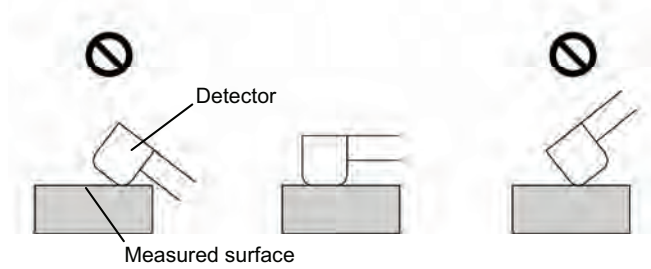
Detector position confirmation (transverse tracing type)

6.2   Calibration Condition Setup Screens Guide

■ Screens guide

1

Home screen

| ISO1997 | 0.5 mm/s |
| λc 0.8 | x5 |

Ra
SPC
3.799
µm

[Enter/Menu] →

← [Esc/Guide]

2

Main Menu screen

Main menu
🔧 Calib. Meas.
🔧 Meas. Condition
🗂 Measured Data
⚙ Parameters
🔧 Set Environ.
🔄 Screen Change

[Enter/Menu] →

← [Esc/Guide]

Calibration Measurement screen

| JIS1994 | 0.75 mm/s |
| λc 2.5 | x5 |

Ra   0/1
                      µm
2.950
〰   *µm*
     START
* * * * *
Submenu

[Red] →

← [Esc/Guide]

[START/STOP] ↓

4

Calibration Menu screen

🔧Calibration Menu
📷 Nom Val.
🔧 Cal. Condition
🗂 Calib. History
🔧 Stylus Alarm
🏠

Start calibration measurement

Measurement   Waveform
Display screen

| JIS1994 | 0.75 mm/s |
| λc 2.5 | x5 |

10µm

-10µm   0.00 - 15.00mm

Calibration   Measurement
screen

| JIS1994 | 0.75 mm/s |
| λc 2.5 | x5 |

Ra   1/1
                      µm
2.950
〰   *µm*
2.884
Cancel   Update

[Esc/Guide]

Select items
[Enter/Menu]

5

Nominal Value Setup
screen

🔧Calibration Menu
Nom Val.

⬆
+ 2.950
⬇
µm
0.000 ←···→ 999.99
AC   Decimal

Refer to 6.4

Calibration   Condition
Setup screen

🔧 Cal. Condition
Meas. No.	1
Standard	JIS1994
Filter	GAUSS
λc	2.5
N	5
M-Speed	0.75
	Initial.

Refer to 6.5

Calibration   History
screen

📋 Calb. Hist.   1/6
2009/07/17 15:08:09
2009/07/17 15:02:53
2009/07/15 15:02:08
2009/07/15 15:02:00
2009/07/13 15:01:36
2009/07/10 14:01:15
ClearCal

Refer to 6.6

Stylus Alarm screen

🔧 Stylus Alarm
Cumula. Dist.
0.1	m
Threshold
0.0	m
ClearDis   Thresh

Refer to 6.7

■ Accessing the Calibration Menu screen

Home screen

1 Press the [Enter/Menu] key on the Home screen to display the Main Menu screen.

Main Menu screen

2 Select "Calib. Meas." with the [↑] [↓] keys, and press the [Enter/Menu] key.

Calibration Measurement screen
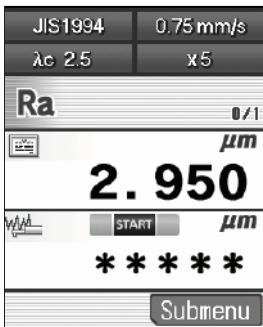
3 Press the "Submenu" ([Red] key).

TIP • To change the nominal value or modify the calibration conditions, press the "Submenu" ([Red] key) to display Calibration Menu screen.
When no change is necessary, perform calibration measurement in this screen.

6.3 Calibrating the SJ-210

When calibrating the SJ-210 with the roughness specimen supplied, be sure to calibrate with the default values (factory settings).

■ Default value of the calibration conditions (standard type, retracting type)

Calibrating condition setup item	Default value
Nominal value	2.950 μm (116.14 μin)
Roughness standard	JIS1994
Filters	GAUSS
λc	2.5 mm (0.1 in)
λs	NONE
Number of sampling lengths	5
Traversal speed	0.75 mm/s (0.03 in/s)
Measurement range	AUTO

■ Default value of the calibration conditions (transverse tracing type)

Calibrating condition setup item	Default value
Nominal value	1.000 μm (39.37 μin)
Roughness standard	JIS1994
Filters	GAUSS
λc	0.8 mm (0.03 in)
λs	NONE
Number of sampling lengths	5
Traversal speed	0.5 mm/s (0.02 in/s)
Measurement range	AUTO

NOTE • When the SJ-210 needs to be calibrated with a standard other than the supplied precision roughness specimen, the default calibration conditions must be modified for the roughness specimen to be used. For information about the procedure used to modify the calibration conditions, refer to 6.4, "Setting the Nominal Value of the Precision Roughness Specimen" and 6.5, "Setting Calibration Conditions".

■ Operating procedure (Refer to "■ Accessing the Calibration Menu screen" in Section 6.2.)

Home screen to Main Menu ⇒ 　[📺 Cal. Meas.]　 ⇒

Calibration Measurement screen

| JIS1994 | 0.75 mm/s |
| λc 2.5 | x 5 |

Ra 0/1
□ μm
2.950
〰 START μm
* * * * *
Submenu
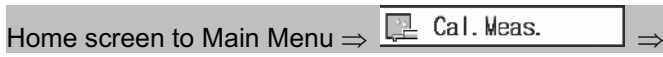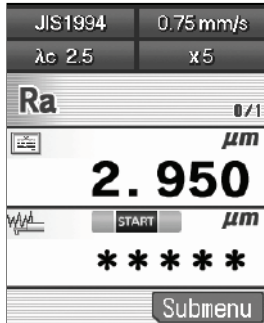
1 Check the calibration conditions on the Calibration Measurement screen.

When the conditions are different from the precision roughness specimen, modify the calibration conditions.

If the calibration conditions do not require modification, proceed to the next step.

> **TIP** • For information about the procedure used to modify the calibration conditions, refer to 6.4, "Setting the Nominal Value of the Precision Roughness Specimen" and 6.5, "Setting Calibration Conditions".

Measurement Waveform Display screen

JIS1994	0.75 mm/s
λc 2.5	x 5
10μm	
-10μm	0.00 - 15.00 mm
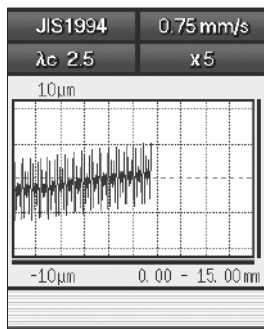
2 Press the [START/STOP] key.

➢ Start calibration measurement.

A calibration measurement with the precision roughness specimen is performed, and Measurement Waveform Display screen is displayed during the calibration measurement (while the detector is traversing).

When the calibration measurement has been completed, the measured value is displayed in the lower column.

Calibration Measurement screen

| JIS1994 | 0.75 mm/s |
| λc 2.5 | x 5 |

Ra 1/1
□ μm
2.950 [Red]
〰 μm
2.884
Cancel Update
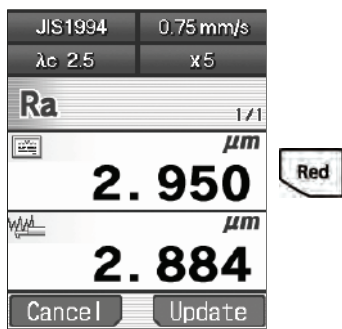
3 Press the "Update" ([Red] key) to update the calibration value.

> **TIP** • To cancel the measured value, press the "Cancel" ([Blue] key).

Calibration Measurement screen

| JIS1994 | 0.75 mm/s |
| λc 2.5 | x 5 |

Ra 2009/11/30 0/1
□ μm
2.950
〰 START μm
* * * * *
Submenu
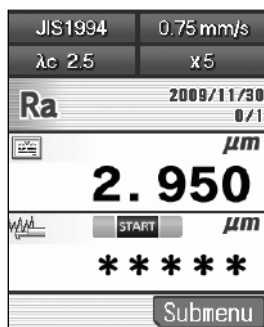
➢ The calibration factor is updated.

6.4   Setting the Nominal Value of the Precision Roughness Specimen

Set the nominal value according to the precision roughness specimen.

TIP • The nominal value to be set is the Ra value of which the precision roughness specimen has been calibrated.

■ Operating procedure (Refer to "■ Accessing the Calibration Menu screen" in Section 6.2.)

Home screen to Main Menu ⇒ Cal. Meas. ⇒ Red ⇒

Calibration Menu screen
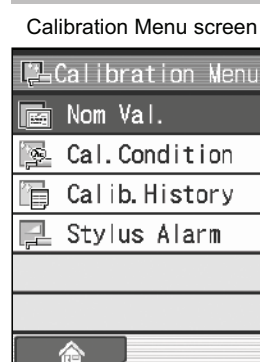
1 Select "Nom Val." with the [↑] [↓] keys, and press the [Enter/Menu] key.

Nominal Value Setup screen
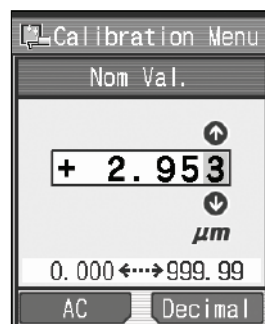
2 Set the nominal value.

TIP • Pressing the "AC" ([Blue] key) sets the value to 0.
To change the position of decimal point, place the cursor at the desired position and press the "Decimal" ([Red] key).

• For information about numeric value entry, refer to 2.5, "Entering Numeric Values/Characters".

3 Press the [Enter/Menu] key to accept the "Nom Val.".

TIP • To cancel settings input, press the [Esc/Guide] key instead of the [Enter/Menu] key.

Calibration Measurement screen

JIS1994	0.75 mm/s
λc 2.5	x 5

Ra   0/1

⌨   *µm*

2.953

⩘ START   *µm*

* * * * *

Submenu

4 Press the [Esc/Guide] key to move to the Calibration Measurement screen.
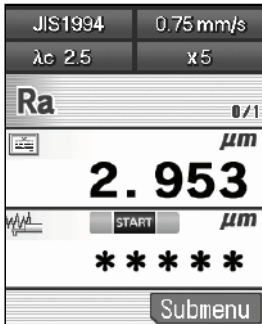
➢ The set values appear on the Calibration Measurement screen.

TIP • Press the [Esc/Guide] key to return to the previous screen.

6.5   Setting Calibration Conditions

Set the following calibration conditions according to the precision roughness specimen.

IMPORTANT • The default values of the calibration conditions are in accordance with Mitutoyo's precision roughness specimen. Unless otherwise required, perform calibration measurement with the default conditions.

- Number of measurements per charge

- Roughness standard

- Filters

- Cut-off value (λc)

- Number of sampling lengths (N), or evaluation length (arbitrary length)

- Traversal speed

- Measurement range

Calibration measurement settings are specified on the Calibration Condition Setup screen.

NOTE • To reset the calibration conditions collectively to the default values (factory settings), press the "Initial" ([Red] key) on the Calibration Condition Setup screen.

6.5.1   Setting the number of measurements

Specify the number of measurements for performing calibration.

The calibration results of specified numbers of measurements are averaged to adjust gain.

■ Operating procedure (Refer to "■ Accessing the Calibration Menu screen" in Section 6.2.)

Home screen to Main Menu ⇒ [🖥 Cal. Meas.] ⇒ [Red] ⇒

Calibration Menu screen
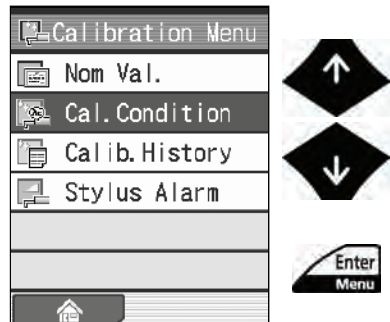
1   Select "Cal. Condition" with the [↑] [↓] keys, and press the [Enter/Menu] key.

Calibration Condition Setup screen
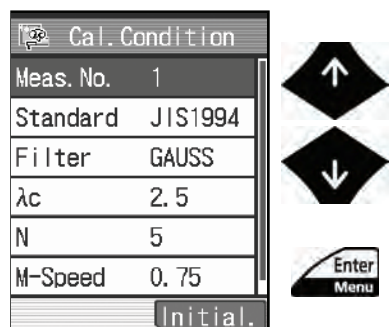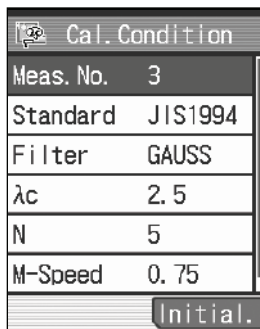
2   Select "Meas. No." with the [↑] [↓] keys, and press the [Enter/Menu] key.

Number of Measurement Setup screen
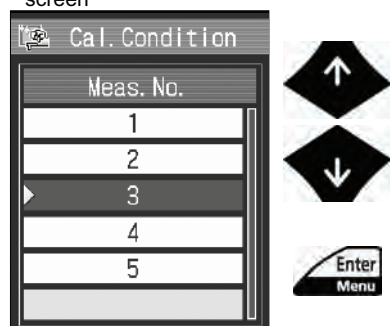
3   Select a measurement number for the calibration with the [↑] [↓] keys, and press the [Enter/Menu] key.

Calibration Condition Setup screen

Cal.Condition	
Meas. No.	3
Standard	JIS1994
Filter	GAUSS
λc	2.5
N	5
M-Speed	0.75
	Initial.

➢ Selected the number of measurements appears on the Calibration Condition Setup screen.

TIP • Press the [Esc/Guide] key to return to the previous screen.

6.5.2   Modifying the roughness standard

Set the roughness standard according to the precision roughness specimen.

NOTE ・Be careful when modifying the roughness standard, as the profile filter may be automatically modified as a result.

■ Operating procedure (Refer to "■ Accessing the Calibration Menu screen" in Section 6.2.)

Home screen to Main Menu ⇒ [🖵 Cal. Meas.] ⇒ [Red] ⇒

Calibration Menu screen
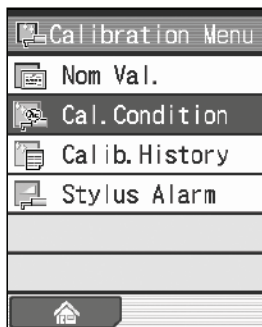
1   Select "Cal. Condition" with the [↑] [↓] keys, and press the [Enter/Menu] key.

Calibration Condition Setup screen
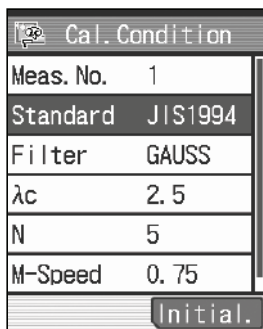
2   Select "Standard" with the [↑] [↓] keys, and press the [Enter/Menu] key.

Roughness Standard Setup screen
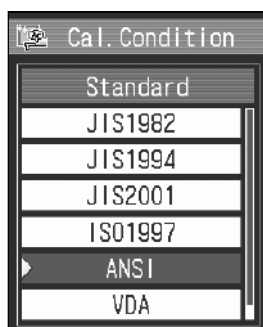
3   Select roughness standard which is compatible with the precision roughness specimen with the [↑] [↓] keys, and press the [Enter/Menu] key.

Calibration Condition Setup screen

📟 Cal.Condition	
Meas.No.	1
Standard	ANSI
Filter	GAUSS
λc	2.5
N	5
M-Speed	0.75
	Initial.

➢ Selected roughness standard are on the Calibration Condition Setup screen.

TIP • Press the [Esc/Guide] key to return to the previous screen.

6.5.3 Modifying profile filters

Set the profile filters according to the precision roughness specimen. Profile filters can be modified when multiple profile filters which are compatible with roughness standard exist.

SJ-210 modifies the profile filter automatically according to the roughness standard, when roughness standard is modified.

■ Operating procedure (Refer to "■ Accessing the Calibration Menu screen" in Section 6.2.)

Home screen to Main Menu ⇒ [Cal. Meas.] ⇒ [Red] ⇒

Calibration Menu screen
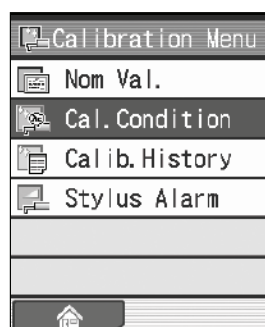
1 Select "Cal. Condition" with the [↑] [↓] keys, and press the [Enter/Menu] key.

Calibration Condition Setup screen
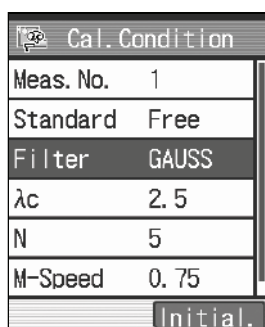
2 Select "Filter" with the [↑] [↓] keys, and press the [Enter/Menu] key.

Filter Setup screen
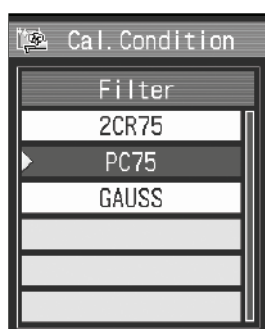
3 Select profile filter which is compatible with the precision roughness specimen with the [↑] [↓] keys, and press the [Enter/Menu] key.

Calibration Condition Setup screen

Cal.Condition	
Meas. No.	1
Standard	Free
Filter	PC75
λc	2.5
N	5
M-Speed	0.75
	Initial.

➢ Selected profile filter appears on the Calibration Condition Setup screen.

TIP • Press the [Esc/Guide] key to return to the previous screen.

6.5.4 Modifying the cutoff length (λc)

Set the cutoff length (λc) according to the precision roughness specimen.

■ Operating procedure (Refer to "■ Accessing the Calibration Menu screen" in Section 6.2.)

Home screen to Main Menu ⇒ [🖳 Cal. Meas.] ⇒ [Red] ⇒

Calibration Menu screen
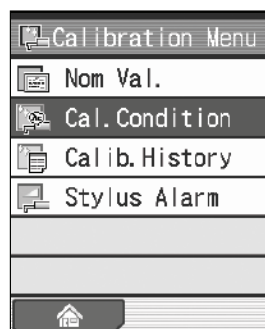
1 Select "Cal. Condition" with the [↑] [↓] keys, and press the [Enter/Menu] key.

Calibration Condition Setup screen
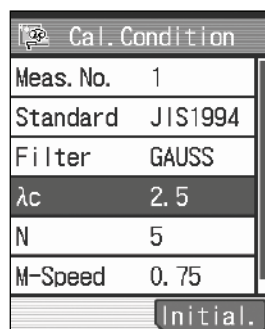
2 Select "λc" with the [↑] [↓] keys, and press the [Enter/Menu] key.

Cutoff Length Setup screen
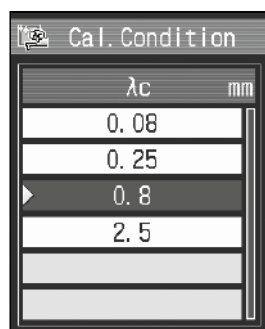
3 Select cutoff length which is compatible with the precision roughness specimen with the [↑] [↓] keys, and press the [Enter/Menu] key.

Calibration Condition Setup screen
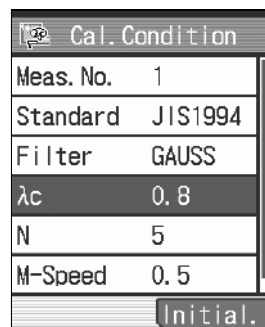
➢ Selected cutoff length appears on the Calibration Condition Setup screen.

TIP • Press the [Esc/Guide] key to return to the previous screen.

6.5.5 Modifying the number of sampling lengths (N)

Set the number of sampling lengths (N) according to the precision roughness specimen.

■ Operating procedure (Refer to "■ Accessing the Calibration Menu screen" in Section 6.2.)

Home screen to Main Menu ⇒ [🖳 Cal. Meas.] ⇒ [Red] ⇒

Calibration Menu screen
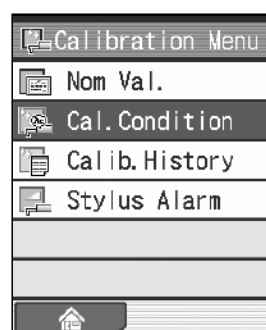
1 Select "Cal. Condition" with the [↑] [↓] keys, and press the [Enter/Menu] key.

Calibration Condition Setup screen
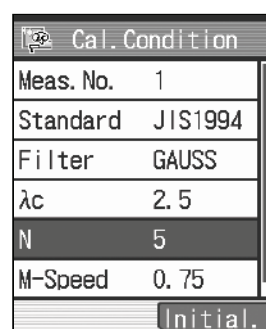
2 Select "N" with the [↑] [↓] keys, and press the [Enter/Menu] key.

Number of Sampling Lengths Setup screen
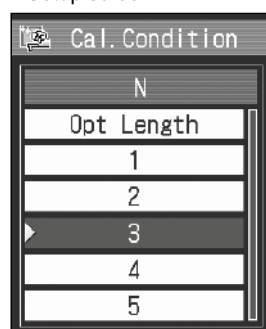
3 Select number of sampling lengths which is compatible with the precision roughness specimen with the [↑] [↓] keys, and press the [Enter/Menu] key.

Calibration Condition Setup screen
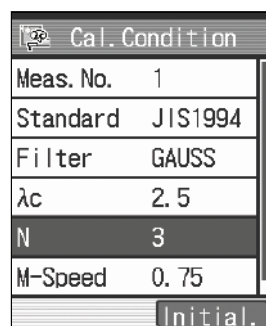
➢ Selected number of sampling lengths appears on the Calibration Condition Setup screen.

TIP • Press the [Esc/Guide] key to return to the previous screen.
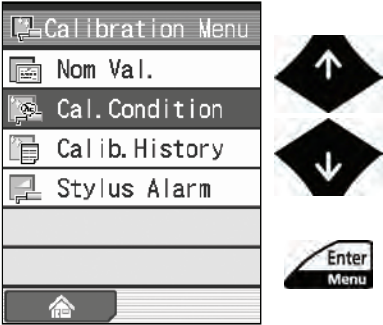
6.5.6 Setting the evaluation length to an arbitrary length

Set the evaluation length to an arbitrary length according to the precision roughness specimen.

■ Operating procedure (Refer to "■ Accessing the Calibration Menu screen" in Section 6.2.)
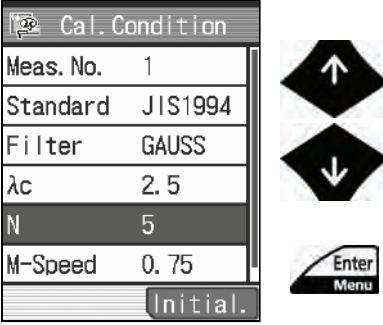
Home screen to Main Menu ⇒ [🖳 Cal. Meas.] ⇒ [Red] ⇒

Calibration Menu screen
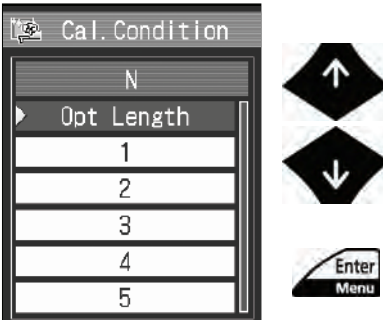
1 Select "Cal. Condition" with the [↑] [↓] keys, and press the [Enter/Menu] key.

Calibration Condition Setup screen

2 Select "N" with the [↑] [↓] keys, and press the [Enter/Menu] key.

Number of Sampling Lengths Setup screen

3 Select "Opt Length" with the [↑] [↓] keys, and press the [Enter/Menu] key.

Arbitrary Length Setup screen

Cal. Condition

Opt Length

⬆

| **+** | **7.55** |

⬇

mm

5.00 ←···→ 16.00

| AC | Decimal |

Calibration Condition Setup screen

Cal. Condition

Meas. No.	1
Standard	JIS1994
Filter	GAUSS
λc	2.5
Opt Length	7.55
M-Speed	0.75

| Initial. |
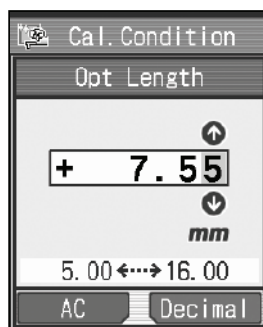
4 Set the arbitrary evaluation length, according to the precision roughness specimen.

> **TIP** • Pressing the "AC" ([Blue] key) sets the value to 0.
> To change the position of decimal point, place the cursor at the desired position and press the "Decimal" ([Red] key).
>
> • For information about numeric value entry, refer to 2.5, "Entering Numeric Values/Characters".
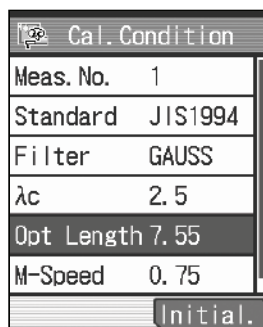
5 Press the [Enter/Menu] key to accept entered values.

➢ The set arbitrary evaluation length appears on the Calibration Condition Setup screen.

> **TIP** • Press the [Esc/Guide] key to return to the previous screen.

6.5.7 Modifying the traversing speed

Set the traversing speed according to the precision roughness specimen.

Traversing speed to select is restricted depending on the cutoff length (λc).

■ Operating procedure (Refer to "■ Accessing the Calibration Menu screen" in Section 6.2.)

Home screen to Main Menu ⇒ [🖳 Cal. Meas.] ⇒ [Red] ⇒

Calibration Menu screen
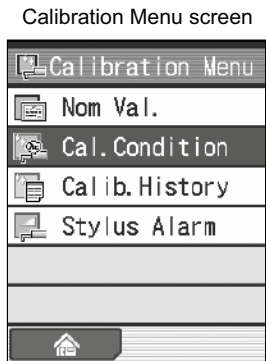
1 Select "Cal. Condition" with the [↑] [↓] keys, and press the [Enter/Menu] key.

Calibration Condition Setup screen
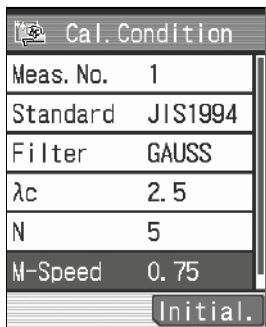
2 Select "M-Speed" with the [↑] [↓] keys, and press the [Enter/Menu] key.

Traversing Speed Setup screen
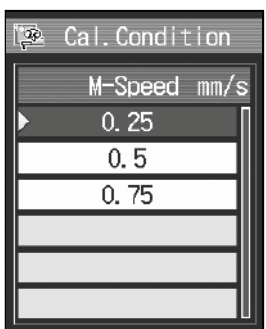
3 Select target traversing speed with the [↑] [↓] keys, and press the [Enter/Menu] key.

Calibration Condition Setup screen
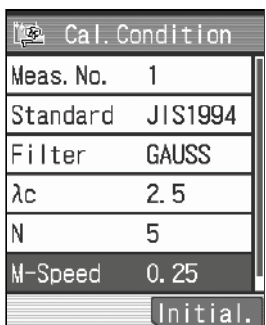
➢ Selected traversing speed appears on the Calibration Condition Setup screen.

TIP • Press the [Esc/Guide] key to return to the previous screen.

6.5.8 Modifying the measuring range

Set the measuring range according to the precision roughness specimen.

■ Operating procedure (Refer to "■ Accessing the Calibration Menu screen" in Section 6.2.)

Home screen to Main Menu ⇒ | 🖳 Cal. Meas. | ⇒ [Red] ⇒

Calibration Menu screen
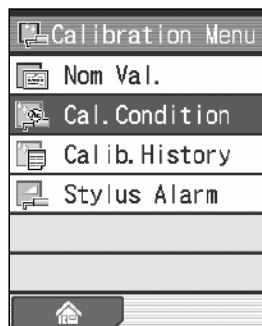
1 Select "Cal. Condition" with the [↑] [↓] keys, and press the [Enter/Menu] key.

Calibration Condition Setup screen
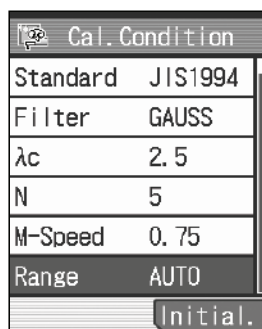
2 Select "Range" with the [↑] [↓] keys, and press the [Enter/Menu] key.

Measurement Range Setup screen
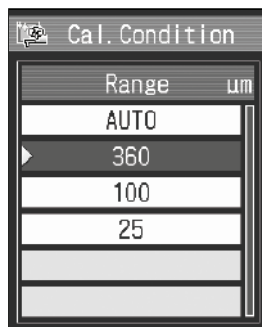
3 Select measuring range which is compatible with the precision roughness specimen with the [↑] [↓] keys, and press the [Enter/Menu] key.

Calibration Condition Setup screen
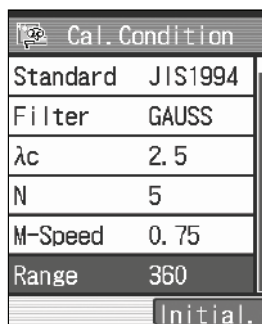
➢ Selected measuring range appears on the Calibration Condition Setup screen.

> **TIP** • Press the [Esc/Guide] key to return to the previous screen.

6.6 Checking the Calibration History

SJ-210 can store up to 100 date and time information as calibration history.

Check the calibration history following the procedures below.

NOTE • Be aware that the calibration history is completely cleared when the "Clear history" [Blue] key is pressed.

Also, be aware that the calibration history is completely cleared, when power supply from built-in battery is cut or "RestToDefault" in the "Set Environ." is performed.

■ Operating procedure (Refer to "■ Accessing the Calibration Menu screen" in Section 6.2.)

Home screen to Main Menu ⇒ 　Cal. Meas. 　⇒ Red ⇒

Calibration Menu screen
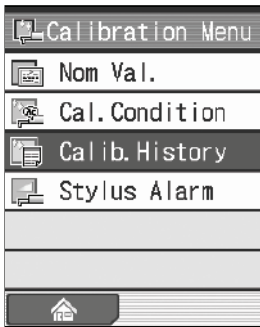
1 Select "Calib.History" with the [↑] [↓] keys, and press the [Enter/Menu] key.

Calibration History screen
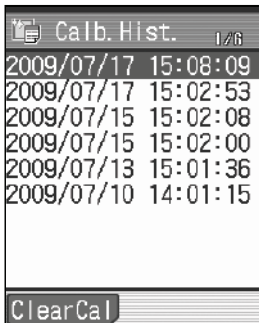
2 Check the data of time of the calibration.

TIP • To clear the calibration history, press the "Clear history" ([Blue] key).

6.7   Setting the Stylus Alarm

Stylus alarm is a function to notify when to replace the detector or perform regular calibration by setting the threshold for cumulative measured value.
This section explains how to specify the threshold.

NOTE • Be aware that the cumulative distance is completely cleared, when power supply from built-in battery is cut or "RestToDefault" in the "Set Environ." is performed.

■ Operating procedure (Refer to "■ Accessing the Calibration Menu screen" in Section 6.2.)

Home screen to Main Menu ⇒ | 🔲 Cal. Meas. | ⇒ | Red | ⇒

Calibration Menu screen
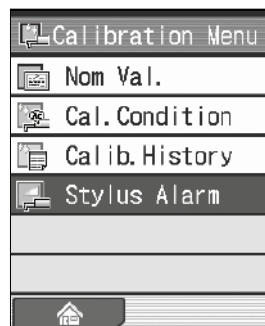
1   Select "Stylus Alarm" with the [↑] [↓] keys, and press the [Enter/Menu] key.

Stylus Alarm screen
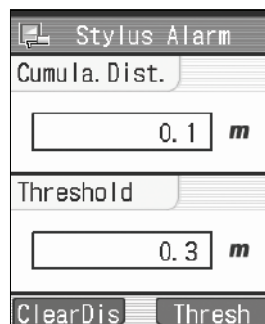
2   Press the "Thresh" ([Red] key).

> **TIP** • To clear the cumulative distance, press the "ClearDis" ([Blue] key) on the Stylus Alarm screen.

Threshold Setup screen
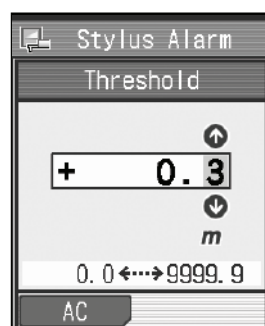
3   Specify the threshold.

> **TIP** • The value is set to 0 when the "AC" ([Blue] key) is pressed.
>
> • For information about numeric value entry, refer to 2.5, "Entering Numeric Values/Characters".

4 Press the [Enter/Menu] key to accept entered values.

> **TIP** • To cancel settings input, press the [Esc/Guide] key instead of the [Enter/Menu] key.

Stylus Alarm screen

> ➢ The set values are enabled.
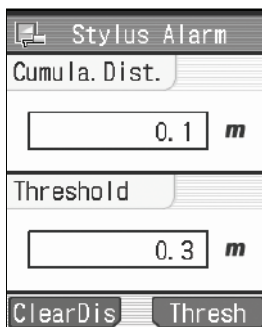
> **TIP** • Press the [Esc/Guide] key to return to the previous screen.
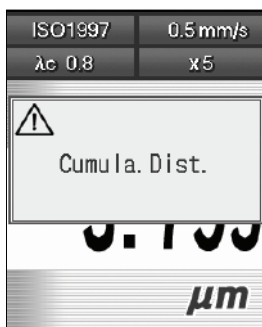
Home screen
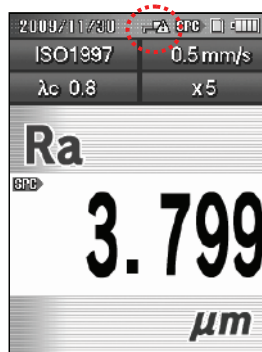
> ➢ A message is displayed when cumulative distance exceeds the limit for the first time after measurement has been completed.

Home screen

> ➢ After the message disappears, the alarm indicator of the stylus mark is displayed to indicate that cumulative distance has exceeded the threshold.

> **TIP** • To set the cumulative distance to 0, press the "ClearDis" ([Blue] key) on the Stylus Alarm screen.

7 MODIFYING MEASUREMENT CONDITIONS

In this chapter, measurement conditions are set or modified according to surface roughness parameters, degree of roughness, conditions of the location measured, etc.

The SJ-210 is compatible with each of the following roughness standards: JIS1982, JIS1994, JIS2001, ISO1997, ANSI, and VDA.

Referring to Chapter 18, "REFERENCE INFORMATION", set up the measurement conditions according to the roughness standard to be complied with.

■ About modifying the measurement conditions

Since measurement condition items to be set according to the standard are interrelated, setting a condition may also determine some other relevant conditions within the SJ-210.

For some measurement conditions, some choices may not be available due to being fixed for that standard, or because of other conditions.

For more information on the relationships between these measurement conditions, refer to 7.2, "Modifying the Roughness Standard" through 7.11, "Modifying the Measuring Range".

7.1 Measurement Condition Screens Guide

■ Screens guide

1

Home screen

ISO1997	0.5 mm/s
λc 0.8	x5

Ra

SPD

3.799

μm

[Enter/Menu] →

← [Esc/Guide]

2

Main Menu screen

Main menu
- Calib. Meas.
- Meas. Condition
- Measured Data
- Parameters
- Set Environ.
- Screen Change

[Enter/Menu] →

← [Esc/Guide]

3

Measurement Conditions Menu screen

Meas. Condition
- Setting
- Read
- Delete
- File Rename

[Enter/Menu] →

← [Esc/Guide]

4

Measurement Conditions screen

Meas. Condition	
Standard	ISO1997
Profile	R
Parameter	3
Filter	GAUSS
λc	0.8
λs	2.5
Re-Calc.	Save

Select items
[Esc/Guide] ↑ ↓ [Enter/Menu]

Shortcut [Red]

5

Roughness Standard Setup screen

Meas. Condition
Standard
JIS1982
JIS1994
JIS2001
▶ ISO1997
ANSI
VDA

Refer to 7.2

Evaluation Profile Setup screen

Meas. Condition
Profile
P
▶ R
DF
R-Motif

Refer to 7.3

Parameter Setup screen

Parameters	
Standard	ISO1997
Profile	R

Ra	Rq	Rz
Rp	Rv	Rsk
Rku	Rc	RSm
RΔq	Rmr	Rmr(c)
Rδc	Rt	Rz1max
Rk	Rpk	Rvk

Re-Calc. | Submenu

Refer to 7.4

Filter Setup screen

Meas. Condition
Filter
▶ GAUSS

Refer to 7.5

Cutoff Value (λc) Setup screen

Meas. Condition
λc   mm
0.08
0.25
▶ 0.8
2.5

Refer to 7.6

Cutoff Value (λs) Setup screen

Meas. Condition
λs   μm
▶ 2.5

Refer to 7.6

Interval Setup screen

Meas. Condition
N
Opt Length
1
2
3
4
▶ 5

Refer to 7.7, 7.8

Pre-travel/Post-travel Setup screen

Meas. Condition
Pre/Post
OFF
▶ ON

Refer to 7.9

Traversing Speed Setup screen

Meas. Condition
M-Speed   mm/s
0.25
▶ 0.5

Refer to 7.10

Measurement Range Setup screen

Meas. Condition
Range   μm
▶ AUTO
360
100
25

Refer to 7.11

■ Accessing the Measurement Conditions screen

Home screen

| ISO1997 | 0.5 mm/s |
| λc 0.8 | x5 |

Ra

3.799

μm

Enter
Menu

1 Press the [Enter/Menu] key on the Home screen to display the Main Menu screen.

Main Menu screen

Main menu
- 🔧 Calib. Meas.
- 📊 Meas. Condition
- 🗂 Measured Data
- 🔎 Parameters
- 🔧 Set Environ.
- 🔲 Screen Change

↑ ↓

Enter
Menu

2 Select "Meas. Condition" with the [↑] [↓] keys, and press the [Enter/Menu] key.

Measurement   Conditions
Menu screen

📊 Meas. Condition
- 🔧 Setting
- ➔ Read
- 🗑 Delete
- 🔲 File Rename

🏠

↑ ↓
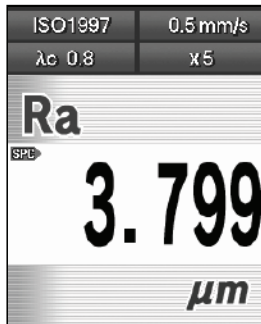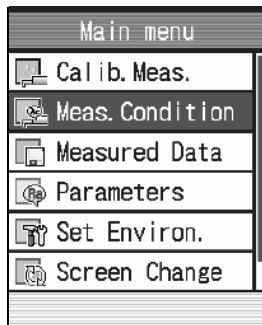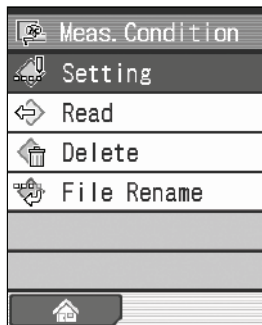
Enter
Menu

3 Select "Setting" with the [↑] [↓] keys, and press the [Enter/Menu] key.

TIP • You can access the measurement conditions setup screen directly from the home screen by pressing the shortcut [Red] key.

Home screen

| ISO1997 | 0.5 mm/s |
| λc 0.8 | x5 |

Ra

3.799

μm

Red

Measurement Conditions screen

Meas. Condition
Standard	ISO1997
Profile	R
Parameter	3
Filter	GAUSS
λc	0.8
λs	2.5
Re-Calc.	Save
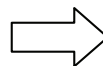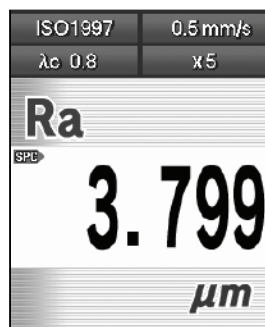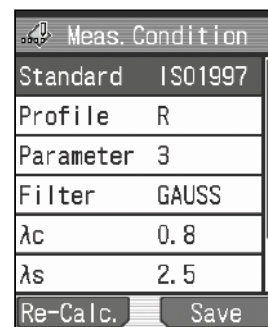
7.2   Modifying the Roughness Standard

The SJ-210 is compatible with each of the following roughness standards: JIS1982, JIS1994, JIS2001, ISO1997, ANSI, and VDA.

TIP • The currently specified roughness standard is indicated on the upper portion of the Home screen.

■ Operating procedure (Refer to "■ Accessing the Measurement Conditions screen" in Section 7.1.)

Home screen to Main Menu ⇒ [🖳 Meas. Condition] ⇒ [🔧 Setting] ⇒

Measurement Conditions screen
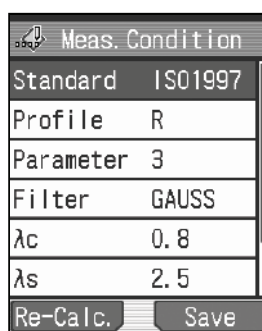
1 Select "Standard" with the [↑] [↓] keys, and press the [Enter/Menu] key.

Roughness Standard Setup screen
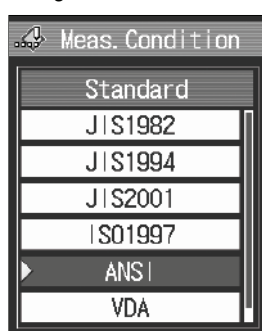
2 Select a roughness standard compatible with the target surface with the [↑] [↓] keys, and press the [Enter/Menu] key.

Measurement Conditions screen

➢ The selected roughness standard is displayed on the Measurement Conditions screen.

NOTE • Be careful when modifying the roughness standard, as other measurement condition items may be automatically modified as a result.

TIP • Press the [Esc/Guide] key to return to the previous screen.

• When the Measurement Conditions screen has been accessed using the shortcut [Red] key, pressing the [Esc/Guide] key once returns you to the Home screen.

7.3   Modifying the Evaluation Profile   7-5

You can modify the evaluation profile to match the target surface.

TIP　• For definitions of the evaluation profile and filter, refer to 18.2, "Evaluation Profiles and Filters".

■ Standards and evaluation profiles

Profiles selectable according to the standard are displayed.

Roughness standard	Evaluation profiles			
	P	**R**	**DF**	**R-Motif**
JIS1982	○	○	-	-
JIS1994	-	○	-	-
JIS2001	○	○	○	○
ISO1997	○	○	○	○
ANSI	-	○	-	-
VDA	○	○	○	-
Free	○	○	○	○

■ Operating procedure (Refer to "■ Accessing the Measurement Conditions screen" in Section 7.1.)

Home screen to Main Menu ⇒ [🔧 Meas. Condition] ⇒ [⚙ Setting] ⇒

Measurement Conditions screen
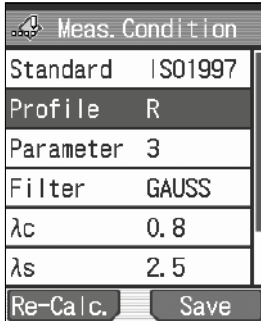
1 Select "Profile" with the [↑] [↓] keys, and press the [Enter/Menu] key.

🔧 Meas. Condition	
Standard	ISO1997
Profile	R
Parameter	3
Filter	GAUSS
λc	0.8
λs	2.5
Re-Calc.	Save

Evaluation Profile Setup screen
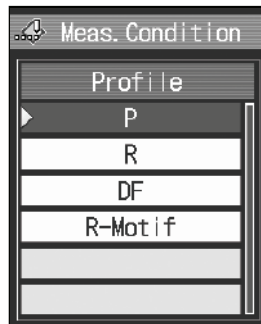
2 Select an evaluation profile compatible with the target surface with the [↑] [↓] keys, and press the [Enter/Menu] key.

🔧 Meas. Condition
Profile
▶ P
R
DF
R-Motif

Measurement Conditions screen
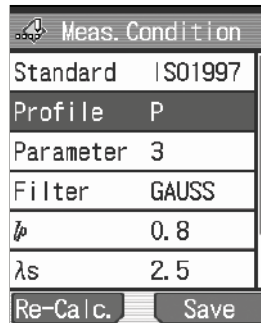
➢ The selected evaluation profile is displayed on the Measurement Conditions screen.

🔧 Meas. Condition	
Standard	ISO1997
Profile	P
Parameter	3
Filter	GAUSS
λp	0.8
λs	2.5
Re-Calc.	Save

TIP • Press the [Esc/Guide] key to return to the previous screen.

• When the Measurement Conditions screen has been accessed using the shortcut [Red] key, pressing the [Esc/Guide] key once returns you to the Home screen.

7.4   Modifying Display Parameters

You can set, calculate, and display evaluation parameters.

TIP • For more details about modifying display parameters, refer to 8.2, "Selecting the Displayed Parameters (Parameter Customization)".

7.5 Modifying Profile Filters

Profile filters can be set to 2CR75, PC75, or GAUSS.

NOTE • Be careful when modifying the roughness standard, as the profile filter may be automatically modified as a result.

■ Profile filters with roughness standards and evaluation profiles

Profile filters are automatically set according to the roughness standard and evaluation profile selected, as tabulated below.

Roughness Standard	Evaluation profiles			
	P	**R**	**DF**	**R-Motif**
JIS1982	NONE	2CR75	-	-
JIS1994	-	GAUSS	-	-
JIS2001	GAUSS	GAUSS	GAUSS	GAUSS
ISO1997	GAUSS	GAUSS	GAUSS	GAUSS
ANSI	-	PC75 GAUSS	-	-
VDA	(NONE[*1]) GAUSS	GAUSS	GAUSS	-
Free	(NONE[*1]) 2CR75 PC75 GAUSS	2CR75 PC75 GAUSS	GAUSS	(NONE[*1]) 2CR75 PC75 GAUSS

[*1]: When "λs" is set to "NONE".

Profile filters can be modified as necessary by following the procedure explained on the following page.

TIP • For information on the properties of profile filters, refer to 18.2.2, "Filters".

■ Operating procedure (Refer to "■ Accessing the Measurement Conditions screen" in Section 7.1.)

Home screen to Main Menu ⇒ [🖳 Meas. Condition] ⇒ [⚙ Setting] ⇒

Measurement Conditions screen

🛠 Meas. Condition	
Standard	ANSI
Profile	R
Parameter	3
Filter	GAUSS
λc	0.8
λs	2.5
Re-Calc.	Save

1 Select "Filter" with the [↑] [↓] keys, and press the [Enter/Menu] key.
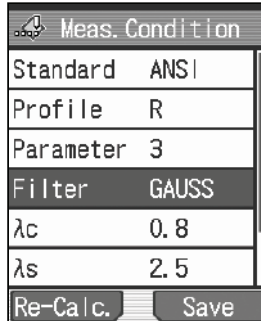
Filter Setup screen

🛠 Meas. Condition	
Filter	
▶ PC75	
GAUSS	

2 Select a profile filter compatible with the target surface with the [↑] [↓] keys, and press the [Enter/Menu] key.

Measurement Conditions screen

🛠 Meas. Condition	
Standard	ANSI
Profile	R
Parameter	3
Filter	PC75
λc	0.8
λs	2.5
Re-Calc.	Save

➢ The selected filter is displayed on the Measurement Conditions screen.

TIP	• Press the [Esc/Guide] key to return to the previous screen.
	• When the Measurement Conditions screen has been accessed using the shortcut [Red] key, pressing the [Esc/Guide] key once returns you to the Home screen.

7.6 Modifying Items Related to Cut-off

Items related to cut-off that can be modified include the cut-off value (λc, λs), measurement sampling length (ℓp, ℓ), and upper limit length (A).

NOTE • You can modify the related cut-off item from the Home screen by pressing the shortcut [←] key. Press the [←] key to cycle through the available values.

Here an example is given for modifying the value of λc. Other items related to cut-off can be modified using similar procedures.

■ Operating procedure (For modifying λc) (Refer to "■ Accessing the Measurement Conditions screen" in Section 7.1.)

Home screen to Main Menu ⇒ 　🖳 Meas. Condition 　⇒ 　 Setting 　 ⇒

Measurement Conditions screen

🖳 Meas. Condition	
Standard	ISO1997
Profile	R
Parameter	3
Filter	GAUSS
λc	0.8
λs	2.5
Re-Calc.	Save

1 Select "λc" with the [↑] [↓] keys, and press the [Enter/Menu] key.
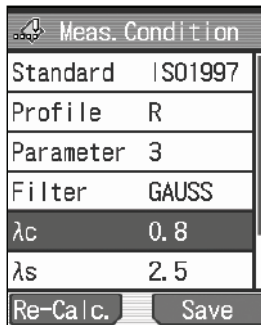
Cutoff Value (λc) Setup screen

🖳 Meas. Condition	
λc	mm
0.08	
▶ 0.25	
0.8	
2.5	
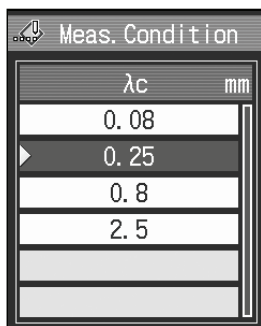
2 Select a cut-off value compatible with the target surface with the [↑] [↓] keys, and press the [Enter/Menu] key.

Measurement Conditions screen

🖳 Meas. Condition	
Standard	ISO1997
Profile	R
Parameter	3
Filter	GAUSS
λc	0.25
λs	2.5
Re-Calc.	Save

➢ The selected cut-off value (λc) is displayed on the Measurement Conditions screen.

TIP • Press the [Esc/Guide] key to return to the previous screen.

• When the Measurement Conditions screen has been accessed using the shortcut [Red] key, pressing the [Esc/Guide] key once returns you to the Home screen.

■ The relationship between the cut-off values (λc) and (λs)

When the evaluation profile is set to "R" or "DF" and a cut-off value is set for (λc), a value is determined for (λs) as detailed below.

Evaluation profiles	Cut-off value (λc) μ m(μ in)	Cut-off value (λs) μ m(μ in)
R	0.08(0.003)	2.5(100)[1, 2]
	0.25(0.01)	2.5(100)[1, 2]
	0.8(0.03)	2.5(100)[1, 2]
	2.5(0.1)	8(320)[1, 2]
DF	0.08(0.003)	2.5(100)[3]
	0.25(0.01)	2.5(100)[3]
	0.8(0.03)	2.5(100)[3]
	2.5(0.1)	8(320)[3]

[1]: When the roughness standard used is "JIS1982" the cut-off value (λs) is set to "NONE".

[2]: When the roughness standard used is "JIS1994", "VDA", or "Free" the cut-off value (λs) can be set to "NONE".

[3]: When the roughness standard used is "VDA", or "Free" the cut-off value (λs) can be set to "NONE".

■ The relationship between measurement sampling length and cut-off value (λs)

When "P" is selected for the evaluation profile, measurement sampling length is displayed as a cut-off related item. The symbol used to represent measurement sampling length changes according to the set roughness standard. When the roughness standards "JIS2001", "ISO1997", "VDA", or "Free" are selected, "ℓp" is displayed. When the roughness standard "JIS1982" is selected, "ℓ" is displayed.

When the measurement sampling length is set, the cut-off value (λs) is set accordingly, as detailed below.

Evaluation profiles	Measurement sampling length (ℓp, ℓ) μ m(μ in)	Cut-off value (λs) μ m(μ in)
P	0.08(0.003)	2.5(100)[*1, *2]
	0.25(0.01)	2.5(100)[*1, *2]
	0.8(0.03)	2.5(100)[*1, *2]
	2.5(0.1)	8(320)[*1, *2]

[*1]: When the roughness standard used is "VDA", or "Free" the cut-off value (λs) can be set to "NONE".

[*2]: When the roughness standard used is "JIS1982" the cut-off value (λs) is set to "NONE".

■ The relationship between the upper limit length and cut-off value (λs)

When "R-Motif" is selected for the evaluation profile, upper limit length (A) is displayed as a cut-off related item.

When the upper limit length is set, the cut-off value (λs) is set accordingly, as detailed below.

Evaluation profiles	Upper limit length (A) μ m(μ in)	Upper limit length (B)	Cut-off value (λs) μ m(μ in)
R-Motif	0.02(0.001)		2.5(100)[1]
	0.1(0.004)	—	2.5(100)[1]
	0.5(0.02)		8(320)[1]

[1]: When the roughness standard used is "Free" the cut-off value (λs) can be set to "NONE".

[2]: When W-Motif is selected, according to the setting for upper limit length (B), the value for upper limit length (A) is set as in the table.

7.7 Modifying the Number of Sampling Lengths

With the SJ-210, the evaluation length (cut-off value x number of sampling lengths) is derived from a number of sampling lengths 1-10 or an arbitrary length ("Opt Length"). When the number of sampling lengths is set to "Opt Length", the evaluation length can be set to an arbitrary length.

NOTE • When the evaluation profile is set to "R-Motif", the number of sampling lengths cannot be set.

■ Evaluation profiles and the number of sampling lengths

When the evaluation profile is changed, the number of sampling lengths is set to the following initial values. These values can be modified as necessary.

Evaluation profiles	Number of sampling lengths
P	1
R	5
DF	5
R-Motif	Designate arbitrary length

NOTE • When "Opt Length" is selected, the evaluation length can be set to an arbitrary length. Refer to 7.8, "Setting the Evaluation Length to an Arbitrary Length" for details.

• When GO/NG judgment is based on the 16% rule, 7 or more sampling lengths are required.

• For GO/NG judgement rules set with an arbitrary length, only the maximum value and average are valid.

TIP • You can modify the number of sampling lengths from the Home screen by pressing the shortcut [→] key. You can cycle through the available values. However, you cannot modify an arbitrary length.

■ Operating procedure (Refer to "■ Accessing the Measurement Conditions screen" in Section 7.1.)

Home screen to Main Menu ⇒ | 🖳 Meas. Condition | ⇒ | 🔧 Setting | ⇒

Measurement Conditions screen

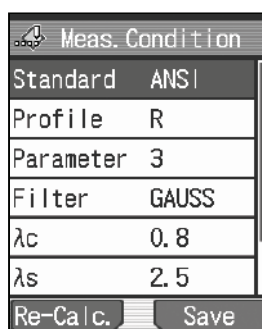| 🔧 Meas. Condition	
Profile	R
Parameter	3
Filter	GAUSS
λc	0.8
λs	2.5
N	5
Re-Calc.	Save

1 Select "N" with the [↑] [↓] keys, and press the [Enter/Menu] key.

Number of Sampling
Lengths Setup screen

🔧 Meas. Condition
N
Opt Length
1
2
▶ 3
4
5

2 Select a number of sampling lengths compatible with the target surface with the [↑] [↓] keys, and press the [Enter/Menu] key.

Measurement Conditions screen

🔧 Meas. Condition	
Profile	R
Parameter	3
Filter	GAUSS
λc	0.8
λs	2.5
N	3
Re-Calc.	Save

➢ The selected number of sampling lengths is displayed on the Measurement Conditions screen.

TIP • When "Opt Length" is set, the evaluation length can be set to an arbitrary length. For more information on setting the arbitrary length, refer to 7.8, "Setting the Evaluation Length to an Arbitrary Length".

TIP • Press the [Esc/Guide] key to return to the previous screen.

• When the Measurement Conditions screen has been accessed using the shortcut [Red] key, pressing the [Esc/Guide] key once returns you to the Home screen.

7.8   Setting the Evaluation Length to an Arbitrary Length

The SJ-210 is capable of setting the evaluation length to an arbitrary length in a range between 0.30 mm to 16.00 mm (0.0118 in to 0.6299 in).

The evaluation length is the distance of the arbitrary length minus the pre-travel/post-travel lengths.
When pre-travel/post-travel is set to "OFF", the evaluation distance is equal to the arbitrary length.
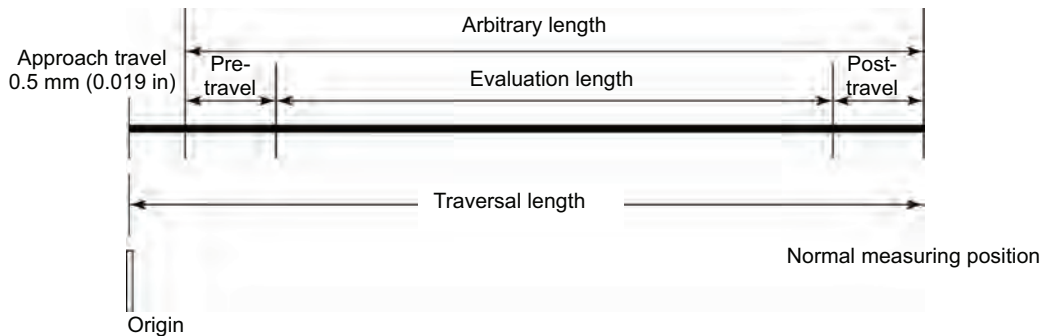
Setting an arbitrary length and the traversal length/evaluation length

NOTE
- The setting range of an arbitrary evaluation length depends on the cutoff value and filter settings. When performing measurement at an arbitrary evaluation length, set the length after setting a cut-off value and a filter.

- Note that the procedure for setting the evaluation length to an arbitrary length differs when "R-Motif" is selected as the evaluation profile. For information about the setting procedure, refer to "■ Operating procedure (when a Motif evaluation profile (R-Motif) is specified)" below.

TIP
- For more information about the relationship between the evaluation profile and pre-travel/post-travel, refer to 18.4, "Traversal Length".

- When pre-travel/post-travel is set to "OFF", pre-travel/post-travel is calculated with overlapping data included.

■ Evaluation length and cut-off values

The SJ-210 determines the possible range of evaluation lengths based on the set cut-off value and filter when evaluation profiles "R" or "DF" are selected. When "R-Motif" is the selected as the evaluation profile, the relationship between the upper limit length and evaluation length is as follows.

Upper limit length A	Evaluation length
0.02 mm (0.001 in)	$0.3 \leq L \leq 0.64$ mm $(0.0118 \leq L \leq 0.0252$ in)
0.1 mm (0.004 in)	$0.65 \leq L \leq 3.2$ mm $(0.0256 \leq L \leq 0.1260$ in)
0.5 mm (0.02in)	$3.3 \leq L \leq 16$ mm $(0.1299 \leq L \leq 0.6299$ in)

For evaluation profile P, $L \geq 0.3$ mm (0.0118 in).

■ Operating procedure (Refer to "■ Accessing the Measurement Conditions screen" in Section 7.1.)

Home screen to Main Menu ⇒ 🔆 Meas. Condition ⇒ 🔆 Setting ⇒

Measurement Conditions screen

1 Select "N" with the [↑] [↓] keys, and press the [Enter/Menu] key.

Meas. Condition	
Profile	R
Parameter	3
Filter	GAUSS
λc	0.8
λs	2.5
N	5
Re-Calc.	Save
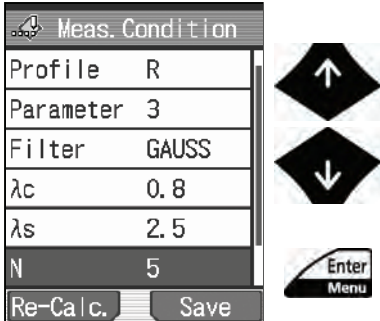
Number of Sampling Lengths Setup screen

2 Select "Opt Length" with the [↑] [↓] keys, and press the [Enter/Menu] key.

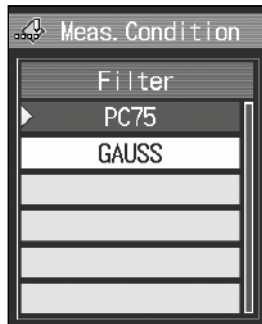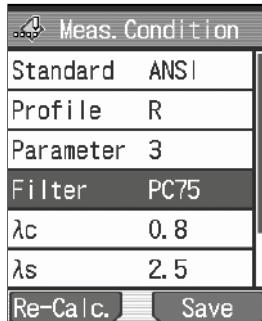| Meas. Condition |
|---|
| N |
| ▶ Opt Length |
| 1 |
| 2 |
| 3 |
| 4 |
| 5 |
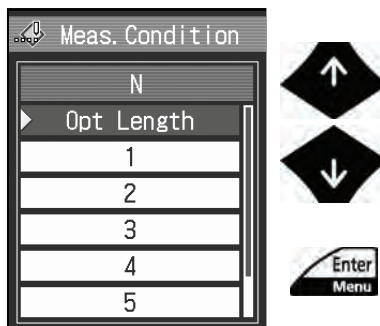
Arbitrary Length Setup screen

3 Set an arbitrary evaluation length compatible with the target surface.

Meas. Condition
Opt Length
🔼
+ 6. 00
🔽
mm
1. 60 ◂┈▸6. 40
AC	Decimal

TIP • Pressing the "AC" ([Blue] key) sets the value to 0.
To change the position of decimal point, place the cursor at the desired position and press the "Decimal" ([Red] key).

• For information about numeric value entry, refer to 2.5, "Entering Numeric Values/Characters".

4 Press the [Enter/Menu] key.

Measurement Conditions screen

➢ The set arbitrary evaluation length is displayed on the Measurement Conditions screen.

Meas. Condition	
Profile	R
Parameter	3
Filter	GAUSS
λc	0.8
λs	2.5
Opt Length 6. 00	
Re-Calc.	Save

TIP • Press the [Esc/Guide] key to return to the previous screen.

• When the Measurement Conditions screen has been accessed using the shortcut [Red] key, pressing the [Esc/Guide] key once returns you to the Home screen.

■ Operating procedure (when a Motif evaluation profile (R-Motif) is specified)
   (Refer to "■ Accessing the Measurement Conditions screen" in Section 7.1.)

Home screen to Main Menu ⇒ 🖳 Meas. Condition ⇒ 🛠 Setting ⇒
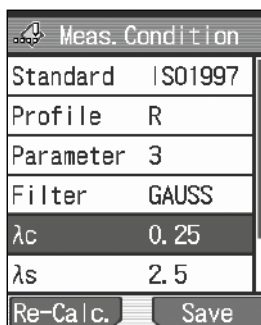
Measurement Conditions screen

🛠 Meas. Condition	
Profile	R-Motif
Parameter	3
Filter	GAUSS
A	0.1
λs	2.5
Opt Length 3.00	
Re-Calc.	Save

1 Select "Opt Length" with the [↑] [↓] keys, and press the [Enter/Menu] key.

Number of Sampling
Lengths Setup screen

🛠 Meas. Condition
N
▶ Opt Length

2 Press the [Enter/Menu] key.

Arbitrary Length Setup screen

🛠 Meas. Condition
Opt Length
⬆
+ 3.20
⬇
mm
0.65 ←⋯→ 3.20
AC	Decimal

3 Set an arbitrary evaluation length compatible with the target surface.

> **TIP** • Pressing the "AC" ([Blue] key) sets the value to 0.
>   To change the position of decimal point, place the cursor at the desired position and press the "Decimal" ([Red] key).
>
> • For information about numeric value entry, refer to 2.5, "Entering Numeric Values/Characters".
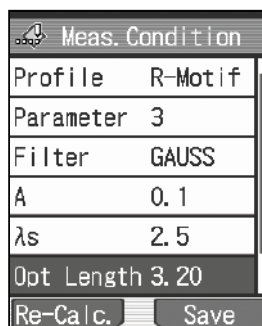
4 Press the [Enter/Menu] key.

➢ The set arbitrary evaluation length is displayed on the Measurement Conditions screen.

Measurement Conditions screen

🛠 Meas. Condition	
Profile	R-Motif
Parameter	3
Filter	GAUSS
A	0.1
λs	2.5
Opt Length 3.20	
Re-Calc.	Save

> **TIP** • Press the [Esc/Guide] key to return to the previous screen.
>
> • When the Measurement Conditions screen has been accessed using the shortcut [Red] key, pressing the [Esc/Guide] key once returns you to the Home screen.

7.9   Setting Pre-travel/Post-travel

Pre-travel/post-travel can be set to "OFF" for cases where evaluation profile "R" is selected and the measured surface is extremely short, etc. By setting pre-travel/post-travel to OFF, the traversal length can be reduced by as much as the length of the pre-travel and post-travel lengths, thus making it possible to measure the narrow surface.

The factory-set default of the pre-travel and post-travel is set to "ON".

IMPORTANT • Set the pre-travel and post-travel to "ON" unless otherwise required. When pre-travel or post-travel is set to OFF, very small errors may be introduced into the calculations due to measurement differing from the standard.

• When the evaluation profile is "P", "R-Motif", and "λs" is set to "NONE", the filter cannot be calculated and as a result, pre-travel/post-travel is fixed as "OFF".

TIP • For more information about the traversal length, refer to 18.4, "Traversal Length".

■ Operating procedure (Refer to "■ Accessing the Measurement Conditions screen" in Section 7.1.)

Home screen to Main Menu ⇒ 🖳 Meas. Condition ⇒ 🖉 Setting ⇒

Measurement Conditions screen
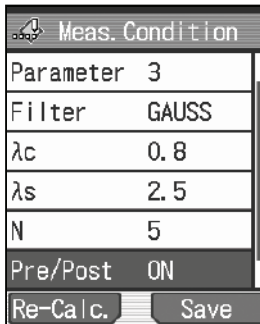
1 Select "Pre/Post" with the [↑] [↓] keys, and press the [Enter/Menu] key.

Pre-travel/Post-travel Setup screen
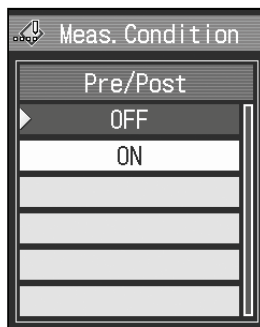
2 Select "ON" or "OFF" with the [↑] [↓] keys, and press the [Enter/Menu] key.

Measurement Conditions screen
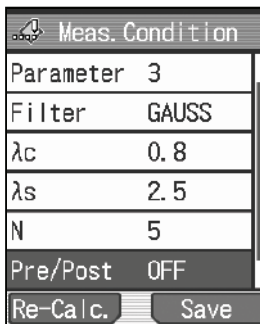
➢ The selected pre-travel/post-travel setting is displayed on the Measurement Conditions screen.

TIP • Press the [Esc/Guide] key to return to the previous screen.

• When the Measurement Conditions screen has been accessed using the shortcut [Red] key, pressing the [Esc/Guide] key once returns you to the Home screen.

7.10   Modifying the Traversing Speed

The traversing speed can be modified according to settings such as cut-off value (λc) and the upper limit length.

■ The cutoff value (sampling length) and the traversing speed

The traversing speed can be set according to the cutoff value (λc) and the upper limit length as detailed in the table below.

Cutoff value (sampling length) mm (in)	A mm (in) (for R-Motif)	Traversing speed mm/s (in/s)
0.08 (0.003)	–	0.25, 0.5 (0.010, 0.020)
0.25 (0.01)	0.02 (0.001)	0.25, 0.5 (0.010, 0.020)
0.8 (0.03)	0.10 (0.004)	0.25, 0.5 (0.010, 0.020)
2.5 (0.1)	0.5 (0.020)	0.25, 0.5, 0.75 (0.010, 0.020, 0.030)

■ Operating procedure (Refer to "■ Accessing the Measurement Conditions screen" in Section 7.1.)

Home screen to Main Menu ⇒ ⬚ Meas. Condition ⇒ ⬚ Setting ⇒

Measurement Conditions screen

Meas. Condition	
Filter	GAUSS
λc	0.8
λs	2.5
N	5
Pre/Post	ON
M-Speed	0.5
Re-Calc.	Save

1 Select "M-Speed" with the [↑] [↓] keys, and press the [Enter/Menu] key.

Traversing Speed Setup screen

Meas. Condition	
M-Speed mm/s	
▶ 0.25	
0.5	

2 Select a cut-off value or evaluation length compatible with the traversing speed with the [↑] [↓] keys, and press the [Enter/Menu] key.

Measurement Conditions screen

Meas. Condition	
Filter	GAUSS
λc	0.8
λs	2.5
N	5
Pre/Post	ON
M-Speed	0.25
Re-Calc.	Save

➢ The selected traversing speed is displayed on the Measurement Conditions screen.

TIP • Press the [Esc/Guide] key to return to the previous screen.

• When the Measurement Conditions screen has been accessed using the shortcut [Red] key, pressing the [Esc/Guide] key once returns you to the Home screen.

7.11 Modifying the Measuring Range

The SJ-210 can perform measurement in one of the following measuring ranges: 25, 100, 360 μm (1000, 4000, 14400 μin), and Auto. Use Auto range unless a range is specified: a narrow range is sensitive and is apt to lead to an overrange.

> **TIP** • When the measuring range is changed, the resolution also changes.

■ Operating procedure (Refer to "■ Accessing the Measurement Conditions screen" in Section 7.1.)

Home screen to Main Menu ⇒ [Meas. Condition] ⇒ [Setting] ⇒

Measurement Conditions screen

Meas. Condition	
λc	0.8
λs	2.5
N	5
Pre/Post	ON
M-Speed	0.5
Range	AUTO
Re-Calc.	Save

1 Select "Range" with the [↑] [↓] keys, and press the [Enter/Menu] key.

Measurement Range Setup screen

Meas. Condition	
Range	μm
AUTO	
▶ 360	
100	
25	

2 Select a measurement range compatible with the target surface with the [↑] [↓] keys, and press the [Enter/Menu] key.

Measurement Conditions screen

Meas. Condition	
λc	0.8
λs	2.5
N	5
Pre/Post	ON
M-Speed	0.5
Range	360
Re-Calc.	Save

➢ The selected measuring range appears on the Measurement Conditions screen.

> **TIP** • Press the [Esc/Guide] key to return to the previous screen.
>
> • When the Measurement Conditions screen has been accessed using the shortcut [Red] key, pressing the [Esc/Guide] key once returns you to the Home screen.

7.12 Reprocessing Calculation Results

After measurement, measurement conditions can be changed, and the result is recalculated.

The SJ-210 has a function to recalculate the measured data after performing a roughness measurement by modifying the measurement conditions. When this recalculation function is on, measurement data is recalculated and displayed based on the modified measurement conditions.

■ Measurement conditions that can be modified for recalculation

The SJ-210 can perform recalculation after the modification of the following measurement conditions.

・Roughness standard	・Evaluation profile
・Filter	・Number of sampling lengths (reduction)
・Parameters	・GO/NG judgment

NOTE • When the cut-off value or arbitrary length is modified and the sample pitch and data point conditions do not match, recalculation may not be possible.

• The recalculation function cannot be used when the number of sampling lengths has been increased, for example from "1" to "3".

• When pre-travel/post-travel is set to "ON" from "OFF", recalculation may be unavailable.

• When the filter or evaluation profile is modified and pre-travel/post-travel conditions do not match, recalculation may not be possible.

■ Operating procedure (Refer to "■ Accessing the Measurement Conditions screen" in Section 7.1.)

Home screen to Main Menu ⇒ 🖳 Meas.Condition ⇒ 🔧 Setting ⇒
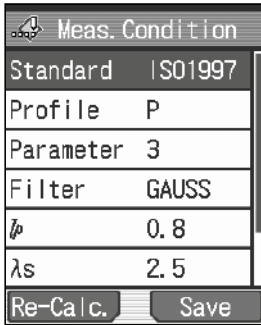
1 After a roughness measurement, measurement conditions can be modified while the calculation result is being displayed.

Measurement Conditions screen

🔧 Meas.Condition	
Standard	ISO1997
Profile	P
Parameter	3
Filter	GAUSS
λp	0.8
λs	2.5
Re-Calc.	Save

Blue

2 Press the "Re-Calc." ([Blue] key) on the Measurement Conditions screen.

Home screen

ISO1997	0.5 mm/s
λp 0.8	x1

Pa

SPC

3.601

μm
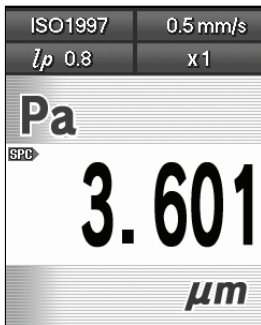
➢ A message indicating the progress of recalculation is displayed.
After recalculation has been completed, the Home screen is displayed. The recalculated measurement data is displayed on the Home screen.

7.13 Saving/Loading/Deleting/Renaming Measurement Conditions

The SJ-210 can save up to 10 measurement conditions onto the internal memory, or up to 500 onto the memory card (optional).

Saved measurement condition files can also be deleted or renamed.

IMPORTANT
- A microSD card is used as the memory card.

  microSD™ is the registered trademark of the SD Association.

  A microSD Logo is the registered trademark.

  In parts of this manual, "microSD™ card" is described as "microSD card" or "memory card". While designed to comply with existing standards, due to standards changes or additions, or the non-support of SPI mode, etc, some microSD cards may not be supported. Use the SD card designated by Mitutoyo (Part No. 12AAL069).

- Before use, the memory card must be formatted using the SJ-210. The memory card may not function properly when formatted in a device other than the SJ-210. For information about formatting the memory card, refer to 10.10.1, "Formatting the memory card".

- Connect the AC adapter to prevent power to the instrument from being interrupted during operation.

- When using the built-in battery, make sure it is sufficiently charged. When operations are performed when the battery power is low, the SJ-210 may shut off during operation.

7.13.1 Measurement condition management screens guide

■ Screens guide

1

Home screen

ISO1997	0.5 mm/s
λc 0.8	x5

Ra

SPC

3.799

μm

[Enter/Menu] →

← [Esc/Guide]

2

Main Menu screen

Main menu

- Calib. Meas.
- Meas. Condition
- Measured Data
- Parameters
- Set Environ.
- Screen Change

[Enter/Menu] →

← [Esc/Guide]

3

Measurement Conditions
Menu screen

Meas. Condition

- Setting
- Read
- Delete
- File Rename

🏠

[Esc/Guide] ↑   Select items
                 [Enter/Menu] ↓

4

Measurement Condition
Load Select screen

Meas. Condition

Read

▶ Direct
  Memory Card

Refer to 7.13.3

Measurement Condition
Deletion Select screen

Meas. Condition

Delete

▶ Direct
  Memory Card

Refer to 7.13.4

Measurement Condition File
Rename Selection screen

Meas. Condition

File Rename

▶ Direct
  Memory Card

Refer to 7.13.5

■ Accessing the Measurement Conditions Menu screen

Home screen

1 Press the [Enter/Menu] key on the Home screen to display the Main Menu screen.

Main Menu screen
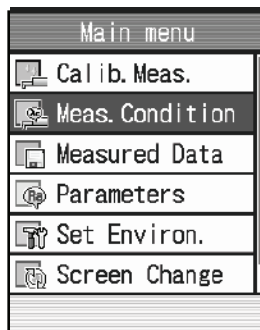
2 Select "Meas. Condition" with the [↑] [↓] keys, and press the [Enter/Menu] key.

7.13.2 Saving measurement conditions

A set of measurement conditions can be saved in the internal memory, or on the optional memory card.

IMPORTANT
- A new memory card must be formatted with the SJ-210 before it can be used. The memory card may not function properly when formatted in a device other than the SJ-210. For information about formatting the memory card, refer to 10.10.1, "Formatting the memory card".

- When the built-in battery is completely depleted, or the built-in battery switch is set to OFF, any measurement conditions saved to the internal memory is lost. It is recommended to make periodic backups to the memory card. Refer to 10.10.5, "Backing up the memory card and restoring backup data" for more information.

- When using the built-in battery, make sure it is sufficiently charged. If measurement conditions are saved when the battery power is low, the SJ-210 may shut off while the data is being saved.

■ Operating procedure (saving to the internal memory) (Refer to "■ Accessing the Measurement Conditions screen" in Section 7.1.)

Home screen to Main Menu ⇒ [⊞ Meas. Condition] ⇒ [⊿ Setting] ⇒

1 Set the measurement conditions.

Measurement Conditions screen

2 On the Measurement Conditions screen, press the "Save" ([Red] key).

⊿ Meas. Condition	
Standard	ISO1997
Profile	R
Parameter	3
Filter	GAUSS
λc	0.8
λs	2.5
Re-Calc.	Save

[Red]

Measurement Condition Save Location screen

3 Select "Direct" with the [↑] [↓] keys, and press the [Enter/Menu] key.

⊿ Meas. Condition	
Save	
▶ Direct	
Memory Card	

↑

↓

Enter
Menu

Internal Memory Save screen

Meas. Cond.

1	COND_01
2	******
3	******
4	******
5	******
6	******
7	******
8	******
9	******
10	******

4 Select a save number with the [↑] [↓] keys, and press the [Enter/Menu] key.

Save New screen

Meas. Cond.

Save New

C O N D _ 0 2

AC   123

5 Enter a name for the measurement conditions file.

> **TIP** • A name is automatically generated and displayed, but it can be changed as required. The name can consist of alphanumeric characters, "-" (hyphen), and "_" (underscore). Up to 8 characters can be used.
>
> • The name is cleared when the "AC" ([Blue] key) is pressed.
>
> • For information about character entry, refer to 2.5, "Entering Numeric Values/Characters".

Internal Memory Save screen

Meas. Cond.

1	COND_01
2	COND_02
3	******
4	******
5	******
6	******
7	******
8	******
9	******
10	******

6 Press the [Enter/Menu] key.

➢ The measurement conditions are saved to the internal memory.

> **TIP** • Press the [Esc/Guide] key to return to the previous screen.

■ Operating procedure (saving to the memory card) (Refer to "■ Accessing the Measurement Conditions screen" in Section 7.1.)

Home screen to Main Menu ⇒ 📇 Meas.Condition ⇒ ⚒ Setting ⇒

Measurement Conditions screen

🔧 Meas. Condition	
Standard	ISO1997
Profile	R
Parameter	3
Filter	GAUSS
λc	0.8
λs	2.5
Re-Calc.	Save

Red
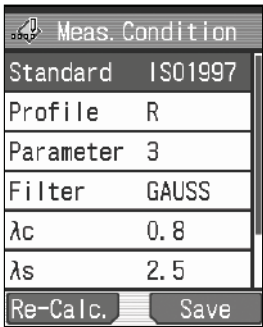
1 Set the measurement conditions.

2 On the Measurement Conditions screen, press the "Save" ([Red] key).

Measurement Condition
Save Location screen
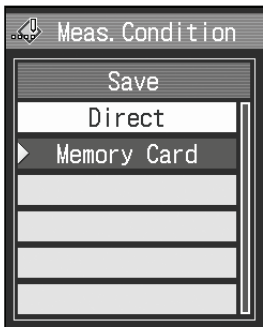
🔧 Meas. Condition
Save
Direct
▶ Memory Card

↑

↓

Enter
Menu

3 Select "Memory Card" with the [↑] [↓] keys, and press the [Enter/Menu] key.

Memory Card Save screen

⇨ Meas. Cond.	1/2
[Save New]	
09H24001 09/11/30	
	Search

↑

↓
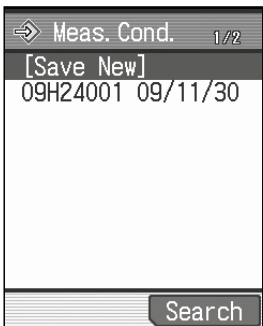
Enter
Menu

4 Select "Save New" with the [↑] [↓] keys, and press the [Enter/Menu] key.

TIP • When overwriting measurement conditions on the memory card, select the measurement conditions and press the [Enter/Menu] key. Press the [Enter/Menu] key when the message is displayed on the screen.

• By searching for measurement conditions to overwrite, you can narrow down applicable conditions. To search, press the "Search" ([Red] key) and enter a keyword. When the [Enter/Menu] key is pressed, measurement conditions that include the keyword are displayed.

Save New screen

Memory Card Save screen

5 Enter a name for the measurement conditions file.

TIP • A name is automatically generated and displayed, but it can be changed as required. The name can consist of alphanumeric characters, "-" (hyphen), and "_" (underscore). Up to 8 characters can be used.

• The name is cleared when the "AC" ([Blue] key) is pressed.
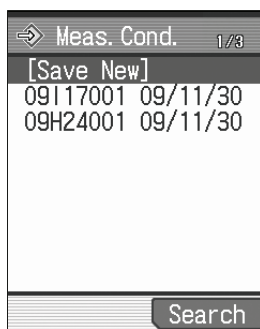
• For information about character entry, refer to 2.5, "Entering Numeric Values/Characters".

6 Press the [Enter/Menu] key.

➢ The measurement conditions are saved to the memory card.

TIP • Press the [Esc/Guide] key to return to the previous screen.

7.13.3 Loading measurement conditions

You can load measurement conditions that have been saved to either the internal memory or the memory card (optional).

To load measurement conditions, first display the Measurement Conditions Read screen from the Measurement Conditions Setup screen, then choose the read source (internal memory or memory card). Then, you can choose a file, etc.

IMPORTANT • When using the built-in battery, make sure it is sufficiently charged. If measurement conditions are loaded while the battery power is low, the SJ-210 may shut off while the data is being read.

■ Operating procedure (Refer to "■ Accessing the Measurement Conditions Menu screen" in Section 7.13.1.)

Home screen to Main Menu ⇒ 🔅 Meas. Condition ⇒

Measurement Conditions Menu screen
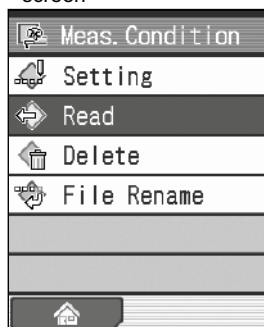
1 Select "Read" with the [↑] [↓] keys, and press the [Enter/Menu] key.

Measurement Condition Load Select screen
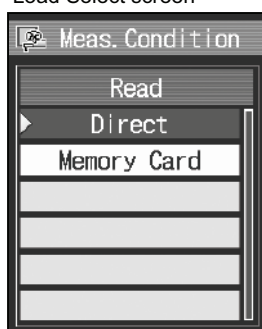
2 Select the read source with the [↑] [↓] key, and press the [Enter/Menu] key.
"Direct": Internal memory
"Memory Card": Memory card

Internal Memory Load screen
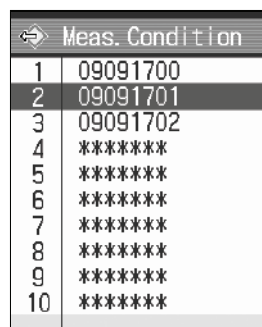
3 Select the measurement conditions to be loaded with the [↑] [↓] keys, and press the [Enter/Menu] key.

➢ The Home screen is restored.

7.13.4 Deleting measurement conditions

You can delete saved measurement conditions from the internal memory or memory card.

IMPORTANT • When using the built-in battery, make sure it is sufficiently charged. If measurement conditions are deleted while the battery power is low, the SJ-210 may shut off while the data is being deleted.

■ Operating procedure (Refer to "■ Accessing the Measurement Conditions Menu screen" in Section 7.13.1.)

Home screen to Main Menu ⇒ [Meas. Condition] ⇒

Measurement Conditions Menu screen
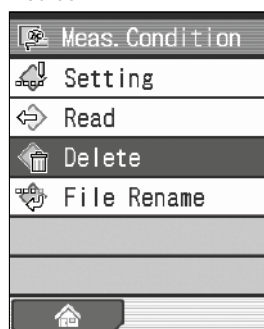
1 Select "Delete" with the [↑] [↓] keys, and press the [Enter/Menu] key.

Measurement Condition Deletion Select screen
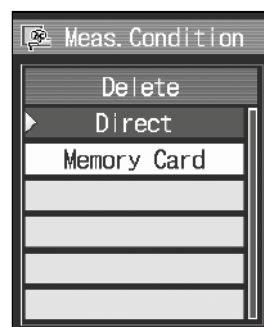
2 Select the save location that has the measurement conditions you want to delete with the [↑] [↓] keys, and press the [Enter/Menu] key.
"Direct": internal memory
"Memory Card": memory card

Internal Memory Deletion screen
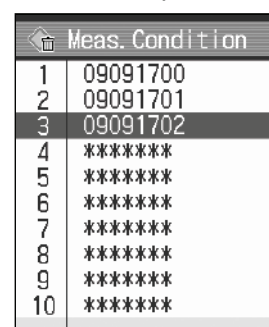
3 Select the measurement conditions to delete with the [↑] [↓] keys, and press the [Enter/Menu] key.

Internal Memory Deletion screen

	Meas. Condition
1	09091700
2	09091701
3	*******
4	*******
5	*******
6	*******
7	*******
8	*******
9	*******
10	*******

4 Press the [Enter/Menu] key.

➢ The selected measurement conditions are deleted. For the internal memory, the deleted location is displayed as "*******".

TIP • Press the [Esc/Guide] key to return to the previous screen.

7.13.5　Renaming saved measurement conditions

You can rename measurement conditions saved in the internal memory or on the memory card.

IMPORTANT ・When using the built-in battery, make sure it is sufficiently charged. If measurement conditions are renamed while the battery power is low, the SJ-210 may shut off while the data is being renamed.

■ Operating procedure (Refer to "■ Accessing the Measurement Conditions Menu screen" in Section 7.13.1.)

Home screen to Main Menu ⇒ 🖳 Meas. Condition ⇒

Measurement Conditions
Menu screen
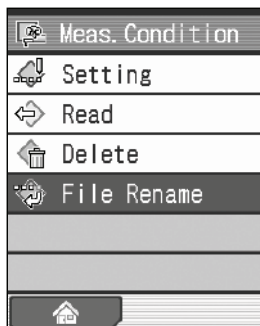
1　Select "File Rename" with the [↑] [↓] keys, and press the [Enter/Menu] key.

Measurement Condition File
Rename Selection screen
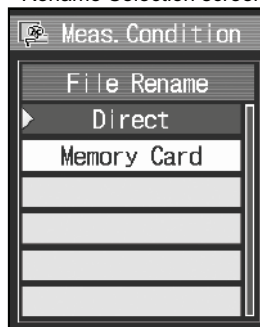
2　Select the save location that has the measurement conditions you want to rename with the [↑] [↓] keys, and press the [Enter/Menu] key.
"Direct": internal memory
"Memory Card": memory card

File Rename screen
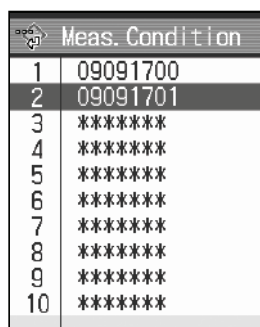
3　Select the measurement conditions file name to be modified with the [↑] [↓] keys, and press the [Enter/Menu] key.

Meas. Condition

File Rename

A B 0 9 1 7 1 0

AC | ABC
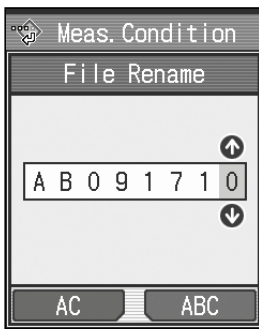
Internal Memory File
Rename screen

Meas. Condition
1 | 09091700
2 | AB091710
3 | *******
4 | *******
5 | *******
6 | *******
7 | *******
8 | *******
9 | *******
10 | *******

4 Rename the file.

> **TIP** • For information about character entry, refer to 2.5, "Entering Numeric Values/Characters".

5 Press the [Enter/Menu] key.

➢ The entered file name is displayed.

> **TIP** • Press the [Esc/Guide] key to return to the previous screen.

8

MODIFYING PARAMETERS

You can set parameters, parameter details, and GO/NG judgment.

8.1   Parameter Modification Screens Guide
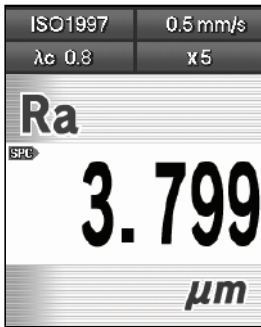
■ Screens guide

1

Home screen

[Enter/Menu]

[Esc/Guide]

2

Main Menu screen

[Enter/Menu]

[Esc/Guide]

3

Parameter Setup screen

[Red]

[Esc/Guide]

4

Submenu screen

Item selection

[Esc/Guide]   [Enter/Menu]

5

GO/NG Judgment Rule Setup screen

Refer to 8.3

Setting Details Selection screen

Refer to 8.4

■ Accessing the Submenu screen

Home screen

1 Press the [Enter/Menu] key on the Home screen to display the Main Menu screen.
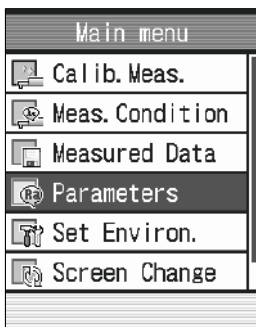
Main Menu screen

2 Select "Parameters" with the [↑] [↓] keys, and press the [Enter/Menu] key.

Parameter Setup screen
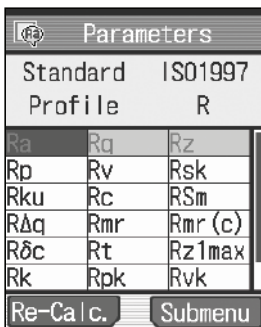
3 Press the "Submenu" ([Red] key).

> **TIP** • To select parameters individually, select them on this screen without proceeding to the submenu.

Submenu screen
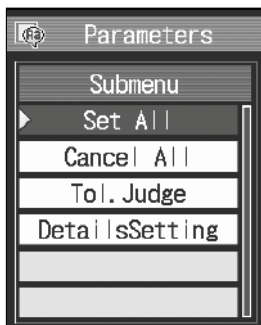
8.2 Selecting the Displayed Parameters (Parameter Customization)

Parameter customization functions can be used to set what is calculated and displayed.

8.2.1 Customizing parameters

■ Overview of the parameter customization function

The instrument is initially set at the factory to calculate and display the most commonly used parameters. For other parameters, you can use the parameter customization function to specify their calculation and display settings.

By calculating and displaying only specified parameters, the time required to calculate measurement results is shortened, and the key operations for switching parameter display, etc. can be simplified.

Also, parameters can be selected or deselected all at once.

TIP • The definition of each parameter is given in 18.5, "Definitions of the SJ-210 Roughness Parameters".

• When the Sm, Pc, or Ppi parameter is selected, the height of the count level must also be set. Refer to 8.4.1, "Setting calculation conditions when Sm, Pc, Ppi or Rc is selected" for setting procedure details.

• When the HSC parameter is selected, the height of the count level must also be set. Refer to 8.4.2, "Setting calculation conditions when HSC is selected" for setting procedure details.

• When the mr parameter is selected, the number of sections, reference line, and slice level must also be set. Refer to 8.4.3, "Setting calculation conditions when mr is selected" for setting procedure details.

• When the mr[c] parameter is selected, the slice level must also be set. Refer to 8.4.4, "Setting calculation conditions when mr[c] (tp for ANSI) is selected" for setting procedure details.

• When the δc parameter is selected, the reference line and slice level must also be set. Refer to 8.4.5, "Setting calculation conditions when δc (Htp for ANSI) is selected" for setting procedure details.

■ Parameters and roughness standards/evaluation profiles

Parameters can be selected and saved for each roughness standard and evaluation profile. When a roughness standard or evaluation profile is set, predetermined parameters are recalled.

Roughness standard	Evaluation profile	Parameter
JIS1982	P	Rz, Rmax
	R	Ra
JIS1994	R	Ra, Rz, Ry, Pc, Sm, S, mr(c)
JIS2001	P	Pa, Pq, Pz, Pp, Pv, Pt, Psk, Pku, Pc, PSm, PzJIS, PΔq, Pmr, Pmr(c), Pδc, Rk, Rpk, Rvk, Mr1, Mr2, A1, A2
	R	Ra, Rq, Rz, Rp, Rv, Rt, Rsk, Rku, Rc, RSm, RzJIS, RΔq, Rmr, Rmr(c), Rδc, Rk, Rpk, Rvk, Mr1, Mr2, A1, A2
	DF	Ra, Rq, Rz, Rp, Rv, Rt, Rsk, Rku, Rc, RSm, RzJIS, RΔq, Rmr, Rmr(c), Rδc, Rk, Rpk, Rvk, Mr1, Mr2, A1, A2
	R-Motif	R, Rx, AR
ISO1997	P	Pa, Pq, Pz, Pp, Pv, Pt, Psk, Pku, Pc, PSm, Pz1max, PΔq, Pmr, Pmr(c), Pδc, Rk, Rpk, Rvk, Mr1, Mr2, A1, A2
	R	Ra, Rq, Rz, Rp, Rv, Rt, Rsk, Rku, Rc, RSm, Rz1max, RΔq, Rmr, Rmr(c), Rδc, Rk, Rpk, Rvk, Mr1, Mr2, A1, A2
	DF	Ra, Rq, Rz, Rp, Rv, Rt, Rsk, Rku, Rc, RSm, Rz1max, RΔq, Rmr, Rmr(c), Rδc, Rk, Rpk, Rvk, Mr1, Mr2, A1, A2
	R-Motif	R, Rx, AR
	W-Motif	W, Wx, AW, Wte
ANSI	R	Ra, Rq, Rz, Rp, Rv, Rt, Rsk, Rku, RPc, RSm, Rmax, RΔa, RΔq, tp, Htp, Rpm
VDA	P	Pa, Pq, Pz, Pp, Pv, Pt, Psk, Pku, Pc, PSm, Pmax, PΔq, Pmr, Pmr(c), Pδc, Rk, Rpk, Rvk, Mr1, Mr2, A1, A2
	R	Ra, Rq, Rz, Rp, Rv, Rt, Rsk, Rku, Rc, RSm, Rmax, RΔq, Rmr, Rmr(c), Rδc, Rk, Rpk, Rvk, Mr1, Mr2, A1, A2
	DF	Ra, Rq, Rz, Rp, Rv, Rt, Rsk, Rku, Rc, RSm, Rmax, RΔq, Rmr, Rmr(c), Rδc, Rk, Rpk, Rvk, Mr1, Mr2, A1, A2

Roughness standard	Evaluation profile	Parameter
Free	P	Pa, Pq, Pz, Py, Pp, Pv, Pt, P3z, Psk, Pku, Pc, PPc, PSm, S, HSC, PzJIS, Pppi, PΔa, PΔq, Plr, Pmr, Pmr(c), Pδc, Rk, Rpk, Rvk, Mr1, Mr2, A1, A2, Vo, Ppm
	R	Ra, Rq, Rz, Ry, Rp, Rv, Rt, R3z, Rsk, Rku, Rc, RPc, RSm, S, HSC, RzJIS, Rppi, RΔa, RΔq, Rlr, Rmr, Rmr(c), Rδc, Rk, Rpk, Rvk, Mr1, Mr2, A1, A2, Vo, Rpm
	DF	Ra, Rq, Rz, Ry, Rp, Rv, Rt, R3z, Rsk, Rku, Rc, RPc, RSm, S, HSC, RzJIS, Rppi, RΔa, RΔq, Rlr, Rmr, Rmr(c), Rδc, Rk, Rpk, Rvk, Mr1, Mr2, A1, A2, Vo, Rpm
	R-Motif	R, Rx, AR

■ Operating procedure (when individual parameters are selected) (Refer to "■ Accessing the Submenu screen" in Section 8.1.)

Home screen to Main Menu ⇒ ⌐ Parameters ⇒

Parameter Setup screen
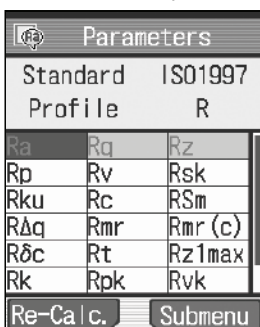
1   Check that the roughness standard and the evaluation profile are selected for the parameters to be customized.

When the roughness standard or evaluation profile differs, refer to 7.2, "Modifying the Roughness Standard" or 7.3, "Modifying the Evaluation Profile", and change the roughness standard or evaluation profile accordingly.

Parameter Setup screen
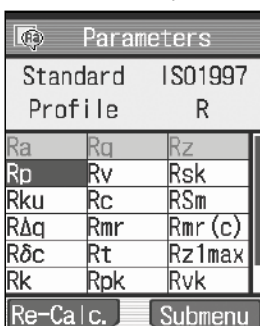
2   Set the parameters.

Select the parameter to be calculated and displayed with the [↑] [↓] keys, and press the [Enter/Menu] key.

Parameter Setup screen

> The set parameter's name turns red, and the background turns light blue.

Parameter Setup screen

3 Cancel a parameter setting.

Select the parameter to be canceled with the [↑] [↓] keys, and press the [Enter/Menu] key.

Parameter Setup screen

> The canceled parameter's name turns dark blue, and the background turns white.

4 Repeat steps 2 and 3 to set all the parameters you wish to calculate and display.

TIP • Press the [Esc/Guide] key to return to the previous screen.

■ Operating procedure (selecting all parameters at once) (Refer to "■ Accessing the Submenu screen" in Section 8.1.)

Home screen to Main Menu ⇒ [ⓡ Parameters] ⇒

Home screen

ⓡ	Parameters	
Standard	ISO1997	
Profile	R	
Ra	Rq	Rz
Rp	Rv	Rsk
Rku	Rc	RSm
RΔq	Rmr	Rmr(c)
Rδc	Rt	Rz1max
Rk	Rpk	Rvk
Re-Calc.		Submenu

1   Check that the roughness standard and evaluation profile are selected for the parameters to be customized.

When the roughness standard or evaluation profile differs, refer to 7.2, "Modifying the Roughness Standard" or 7.3, "Modifying the Evaluation Profile", and change the roughness standard or evaluation profile accordingly.

Parameter Setup screen

ⓡ	Parameters	
Standard	ISO1997	
Profile	R	
Ra	Rq	Rz
Rp	Rv	Rsk
Rku	Rc	RSm
RΔq	Rmr	Rmr(c)
Rδc	Rt	Rz1max
Rk	Rpk	Rvk
Re-Calc.		Submenu

2   Press the "Submenu" ([Red] key).

[Red]

Submenu screen

ⓡ	Parameters
	Submenu
▶	Set All
	Cancel All
	Tol. Judge
	DetailsSetting

3   Select "Set All" with the [↑] [↓] keys, and press the [Enter/Menu] key.

↑
↓
Enter Menu

Parameter Setup screen

ⓡ	Parameters	
Standard	ISO1997	
Profile	R	
Ra	Rq	Rz
Rp	Rv	Rsk
Rku	Rc	RSm
RΔq	Rmr	Rmr(c)
Rδc	Rt	Rz1max
Rk	Rpk	Rvk
Re-Calc.		Submenu
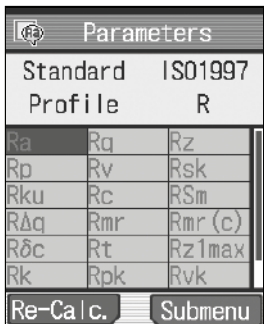
➢   All the parameter's names turn red, and the background turns light blue.
All items are displayed as being set.

TIP • Press the [Esc/Guide] key to return to the previous screen.

■ Operating procedure (deselecting all parameters at once) (Refer to "■ Accessing the Submenu screen" in Section 8.1.)

Home screen to Main Menu ⇒ | 🔟 Parameters | ⇒

Parameter Setup screen
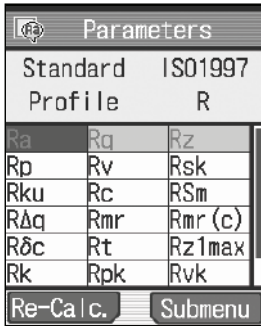
1 Press the "Submenu" ([Red] key).

Submenu screen
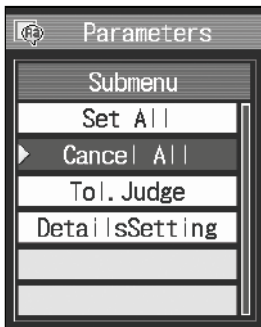
2 Select "Cancel All" with the [↑] [↓] keys, and press the [Enter/Menu] key.

Parameter Setup screen
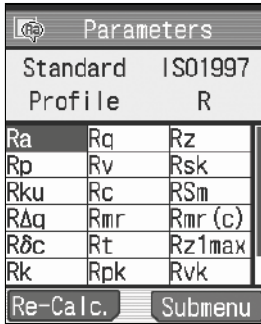
➢ All the parameter's names turn dark blue, and the background turns white.
All items are displayed as being deselected.

TIP • Press the [Esc/Guide] key to return to the previous screen.

8.3 Setting the GO/NG Judgment Function

The SJ-210 has a GO/NG judgment function. By using this function, a Go/No-go judgment can be made for the measured surface roughness of a specimen.

One of 3 patterns, Mean, 16%, or Max, can be selected as the verification rule of the GO/NG judgment function.

For the SJ-210, the GO/NG judgment function can be set to the selected parameters.

■ GO/NG judgment result display

When the GO/NG judgment function is used, the measurement data is compared with its upper and lower tolerance limits. When the measurement falls outside the limits, the display color of the measurement result changes. When the measurement is within tolerance limits, the "OK" sign appears to the right of the parameter name. When the measurement exceeds the upper limit, the "+NG" sign appears to the right of the parameter name, and the displayed measurement result turns red. When the measurement falls below the lower limit, the "-NG" sign appears to the right of the parameter name, and the displayed measurement result turns blue.
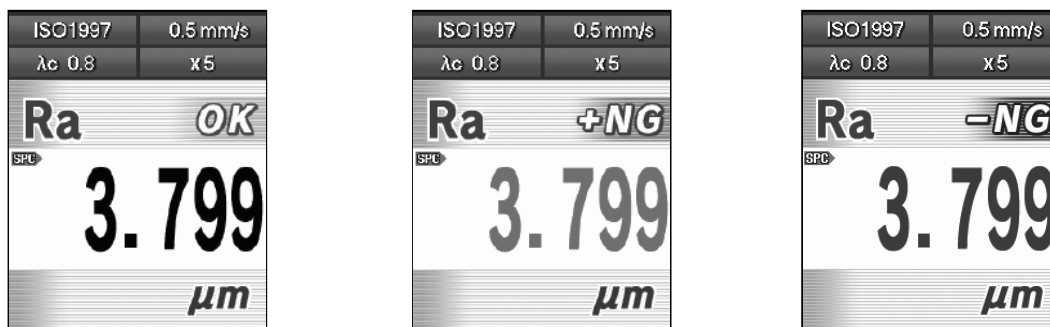
GO/NG judgment result (within limit, above upper limit, below lower limit)

NOTE • When the upper or lower limit is set to 0, the GO/NG judgment function based on the limits is turned off. The upper limit and lower limit can be set individually. Therefore, it is possible to individually disable the GO/NG judgment with the upper/lower limits.

■ GO/NG judgment verification rules

The SJ-210 can set the verification rule of the GO/NG judgment function to the Mean rule, 16% rule, or Max rule.

IMPORTANT
- The verification rules of the GO/NG judgment function apply only to parameters for which a value for each sampling length within the evaluation range has been obtained and an arithmetic mean determined.

- When the number of sampling lengths is 1 or a parameter value is determined by the entire sampling length, the following rule is applied irrespective of any verification rule. The result is No-Go when parameter value > upper limit value or parameter value < lower limit value.

Mean rule:	This rule decides Go or No-Go judgment through size comparison between a parameter value, determined as an arithmetic mean of measurements obtained for each sampling length within the evaluation range, and the upper/lower limit value.
16% rule:	The percentage of No-Go results for evaluation length measurement values is obtained by individually judging the measurement value for each sampling length against the upper/lower limit values. When the obtained percentage of No-Go sampling lengths is below 16%, the overall judgment is Go, and when the obtained percentage of No-Go sampling lengths is over 16%, the overall judgment is No-Go. The 16% rule gives the same results as the Max rule when less than 6 sampling lengths are evaluated.
Max rule:	The obtained measurement values of each evaluation length are compared against the upper and lower limit values, and when any evaluation length value exceeds the upper limit or falls below the lower limit, a No-Go judgment is made.

■ Operating procedure (Refer to "■ Accessing the Submenu screen" in Section 8.1.)

Home screen to Main Menu ⇒ [🔞 Parameters] ⇒ [Red] ⇒

Submenu screen
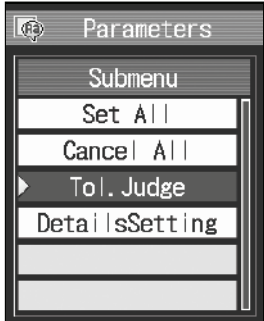
1 Select "Tol.Judge" with the [↑] [↓] keys, and press the [Enter/Menu] key.

GO/NG Judgment Rule
Setup screen
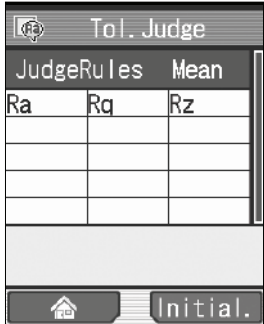
2 Set the judgment rules.

a Select "JudgeRules" with the [↑] [↓] keys, and press the [Enter/Menu] key.

Judgment Rule Setup screen
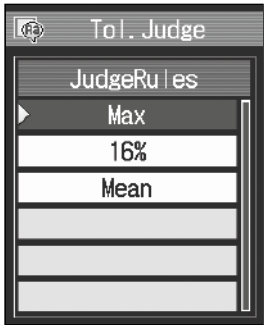
b Select "JudgeRules" with the [↑] [↓] keys, and press the [Enter/Menu] key.

3 Set which parameters use GO/NG judgment.

To set GO/NG judgment for each parameter, follow the below procedure.

a Select a parameter for GO/NG judgment with the [↑] [↓] keys, and press the [Enter/Menu] key.

GO/NG Judgment Rule
Setup screen

➢ The name of the set parameter turns red.

GO/NG Judgment Rule
Setup screen

b To set the upper limit value, press the "Up Limit" ([Red] key).
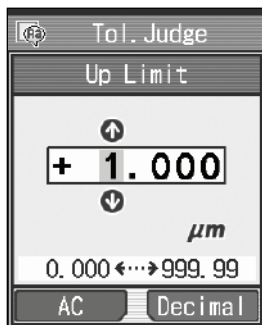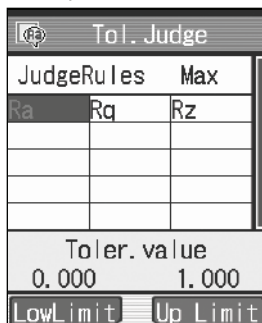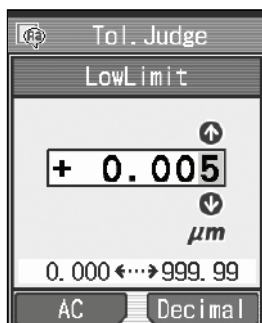
Upper Limit Setup screen
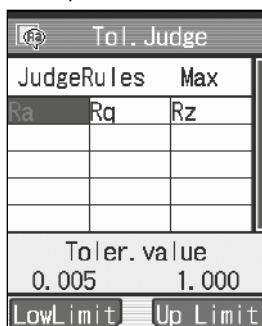
c   Set the upper limit value.
When the value is set, press the [Enter/Menu] key.

NOTE • When the upper limit is set to 0, GO/NG judgment by the upper limit is disabled.

TIP • Pressing the "AC" ([Blue] key) sets the value to 0.
To change the position of a decimal point, place the cursor at the desired position and press the "Decimal" ([Red] key).

• For information about numeric value entry, refer to 2.5, "Entering Numeric Values/Characters".

d   To set the lower limit value, press the "LowLimit" ([Blue] key).

GO/NG Judgment Rule Setup screen

Lower Limit Setup screen

e   Set the lower limit value.
When the value is set, press the [Enter/Menu] key.

NOTE • When the lower limit is set to 0, GO/NG judgment by the lower limit is disabled.

TIP • Pressing the "AC" ([Blue] key) sets the value to 0.
To change the position of decimal point, place the cursor at the desired position and press the "Decimal" ([Red] key).

• For information about numeric value entry, refer to 2.5, "Entering Numeric Values/Characters".

➢   The set GO/NG judgment rule and the set upper and lower limit values are displayed on the GO/NG Judgment Rule Setup screen.

TIP • Press the [Esc/Guide] key to return to the previous screen.

GO/NG Judgment Rule Setup screen

8.4　Parameter Detail Settings

Calculation conditions can be set as necessary for parameters such as Sm, Pc, Ppi, Rc, HSC, etc.

8.4.1　Setting calculation conditions when Sm, Pc, Ppi, or Rc is selected

When the "Sm", "Pc", or "Ppi" parameter is selected, the height of the count level, a calculation condition, must be set. Profile Element restriction definition settings can also be made.

Profile Element restriction definition (when the height of the count level is 10%)

(1) Zp / Zv　　:　　Zp>Zmin, Zv>Zmin　　　　Zmin=10% of Rz
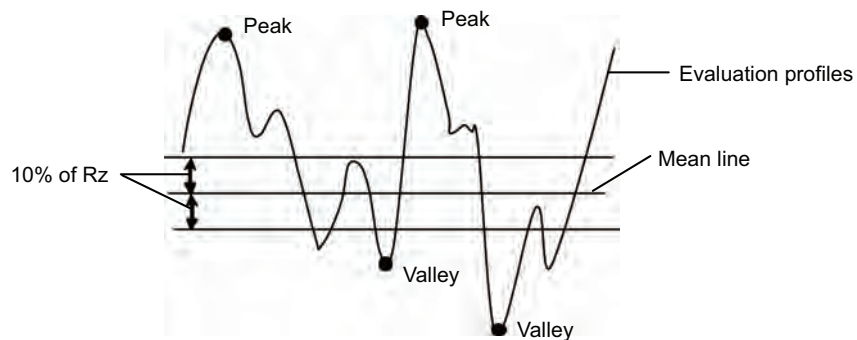
(2) Zt　　　　:　　Zt>Zmin　　　　　　　　Zmin=10% of Rz
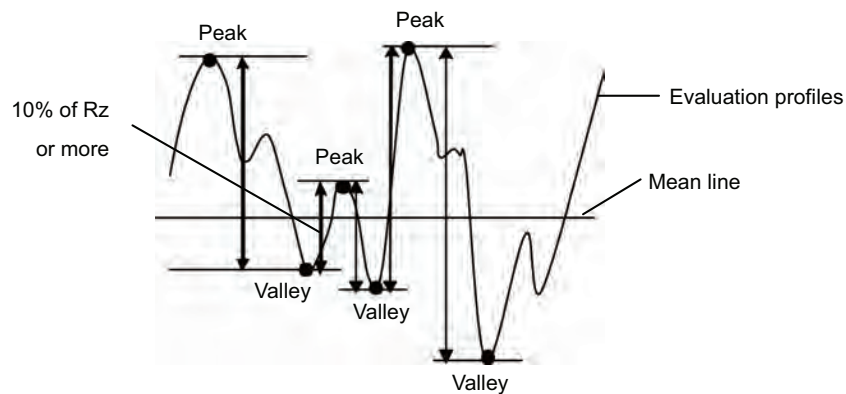
■ Operating procedure (Refer to "■ Accessing the Submenu screen" in Section 8.1.)

Home screen to Main Menu ⇒ [ⓐ Parameters] ⇒ [Red] ⇒

Submenu screen
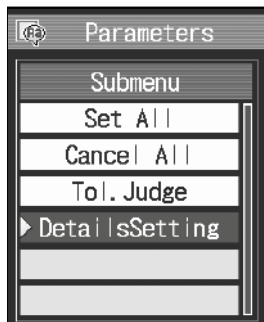
1 Select "DetailsSetting" with the [↑] [↓] keys, and press the [Enter/Menu] key.

Setting Details Selection screen
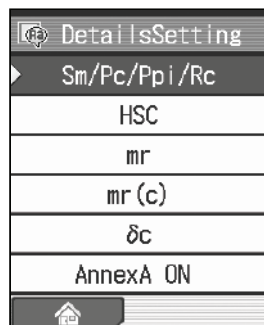
2 Select "Sm/Pc/Ppi/Rc" with the [↑] [↓] keys, and press the [Enter/Menu] key.

Sm/Pc/Ppi/Rc Setup screen
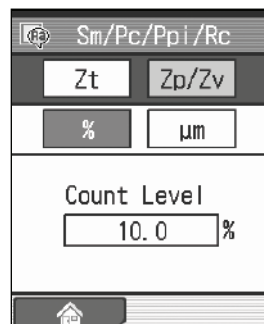
3 Select a Profile Element restriction definition, and press the [Enter/Menu] key.

Sm/Pc/Ppi/Rc Setup screen
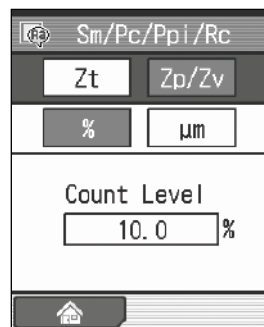
➢ The background of the selected Profile Element restriction turns blue.

Sm/Pc/Ppi/Rc Setup screen
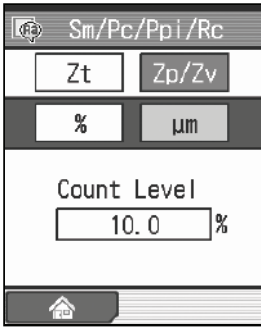
Sm/Pc/Ppi/Rc

| Zt | Zp/Zv |

| % | μm |

Count Level
10.0 %

Enter
Menu

4 Select the measurement type for the height of the count level, and press the [Enter/Menu] key.

Sm/Pc/Ppi/Rc Setup screen

Sm/Pc/Ppi/Rc

| Zt | Zp/Zv |

| % | μm |
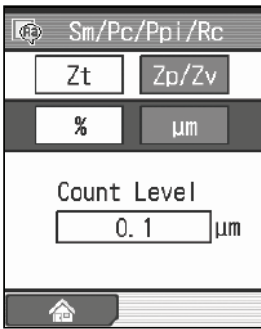
Count Level
0.1 μm

➢ The background of the selected measurement type turns blue.
The measurement type for the height of the count level is switched to the predetermined type.

5 Set the height of the count level.

Sm/Pc/Ppi/Rc Setup screen

Sm/Pc/Ppi/Rc

| Zt | Zp/Zv |

| % | μm |

Count Level
0.1 μm

↑

↓

Enter
Menu

a Select "Count Level" with the [↑] [↓] keys, and press the [Enter/Menu] key.

Count Level Setup screen

Sm/Pc/Ppi/Rc

Count Level

⊙

+   0.5

⊙

μm

0.0 ← ··· → 999.9

AC
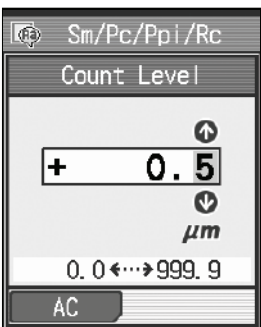
b Input the height of the count level.
The input range is as follows:
0.0 to 99.9 %
0.0 to 999.9μm (9999.9 μin)

TIP • The value is set to 0 when the "AC" ([Blue] key) is pressed.

• For information about numeric value entry, refer to 2.5, "Entering Numeric Values/Characters".

Sm/Pc/Ppi/Rc Setup screen

Sm/Pc/Ppi/Rc

| Zt | Zp/Zv |
| % | µm |

Count Level

0.5 µm
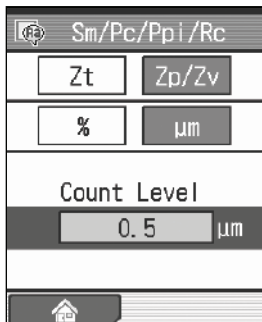
C Press the [Enter/Menu] key.

➢ The set height of the count level is displayed on the Sm/Pc/Ppi/Rc Setup screen.

TIP • Press the [Esc/Guide] key to return to the previous screen.

• The screen returns to the Home screen when the "Home" ([Blue] key) is pressed.

8.4.2 Setting calculation conditions when HSC is selected

When the "HSC" parameter is selected, the height of the count level, a calculation condition, must be set.

■ Operating procedure (Refer to "■ Accessing the Submenu screen" in Section 8.1.)
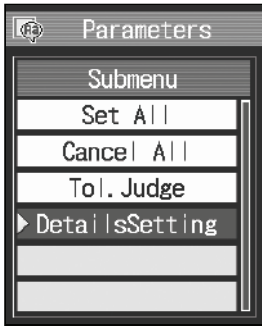
Home screen to Main Menu ⇒ [🔄 Parameters] ⇒ [Red] ⇒

Submenu screen

1 Select "DetailsSetting" with the [↑] [↓] keys, and press the [Enter/Menu] key.

Setting Details Selection screen
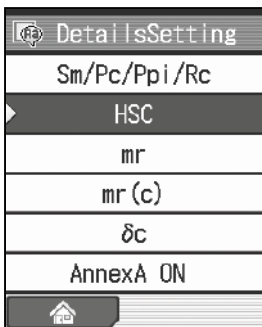
2 Select "HSC" with the [↑] [↓] keys, and press the [Enter/Menu] key.
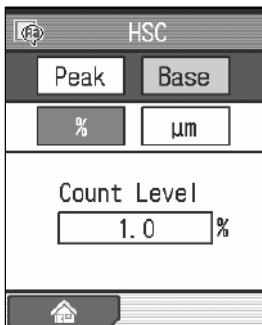
HSC Setup screen

3 Select the reference for the height of the count level, and press the [Enter/Menu] key.
"Peak": Set from the highest peak of the evaluation profile
"Base": Set from the mean line of the evaluation profile

HSC Setup screen
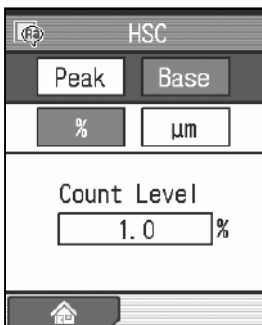
➢ The background of the selected reference of the height of the count level turns blue.

HSC Setup screen
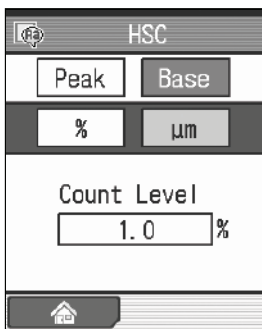
4 Select the measurement type for the height of the count level, and press the [Enter/Menu] key.
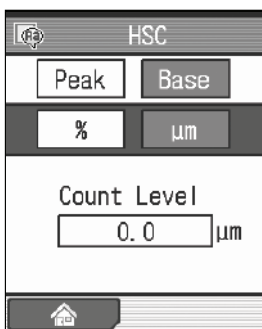
HSC Setup screen

➢ The background of the selected measurement type turns blue.
The set measurement type for the height of the count level is switched to the predetermined type.
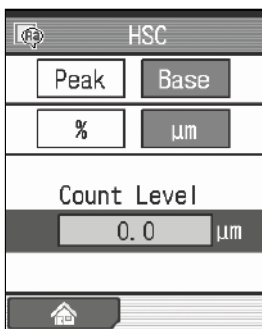
5 Setting the height of the count level.

HSC Setup screen

a Select "Count Level" with the [↑] [↓] keys, and press the [Enter/Menu] key.

Count Level Setup screen
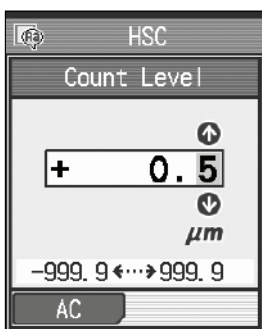
b Input the height of the slice level.
The input range is as follows:
Peak reference: 0.0 to 99.9%/0.0 to 999.9μm (9999.99 μin)
Base reference: -50% to +50%/-999.9 to +999.9μm (+/-9999.99 μin)

TIP • The value is set to 0 when the "AC" ([Blue] key) is pressed.

• For information about numeric value entry, refer to 2.5, "Entering Numeric Values/Characters".

HSC Setup screen

```
┌─────────────────────┐
│ ▣        HSC        │
├──────────┬──────────┤
│  Peak    │  Base    │
├──────────┼──────────┤
│    %     │   μm     │
├──────────┴──────────┤
│     Count Level     │
│   ┌──────────┬────┐ │
│   │   0.5    │ μm │ │
│   └──────────┴────┘ │
│                     │
├──┬──────────────────┤
│🏠│                  │
└──┴──────────────────┘
```
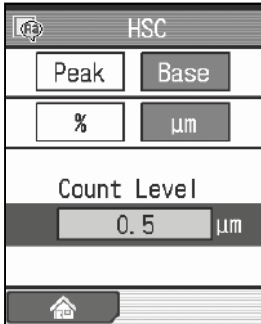
C Press the [Enter/Menu] key.

➢ The set height of the count level is displayed on the HSC Setup screen.

TIP • Press the [Esc/Guide] key to return to the previous screen.

• The screen returns to the Home screen when the "Home" ([Blue] key) is pressed.

8.4.3　Setting calculation conditions when mr is selected.

When the parameter "mr" is selected, the number of sections, reference line, and slice level must also be set as calculation conditions.

TIP • The calculation results for parameter "mr" are displayed according to the set number of sections (N).

• Parameters "mr(Rz)" and "mr(Rt)" can be set when the roughness standard is "Free".

■ Operating procedure (Refer to "■ Accessing the Submenu screen" in Section 8.1.)

Home screen to Main Menu ⇒ 　Parameters　 ⇒ Red ⇒

Submenu screen
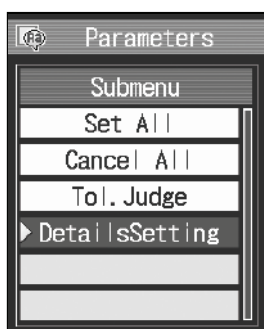
1　Select "DetailsSetting" with the [↑] [↓] keys, and press the [Enter/Menu] key.

Setting Details Selection screen
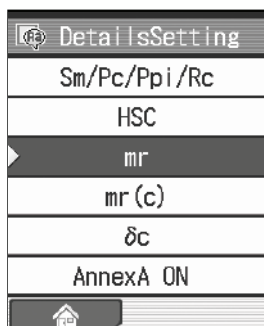
2　Select "mr" with the [↑] [↓] keys, and press the [Enter/Menu] key.
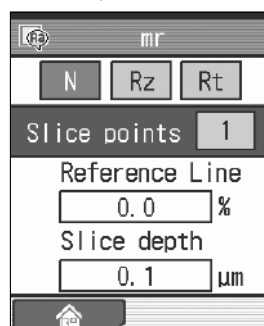
3　Set the number of sections.

mr Setup screen

a　Use the [↑] [↓] keys to select "Slice points".

mr Setup screen
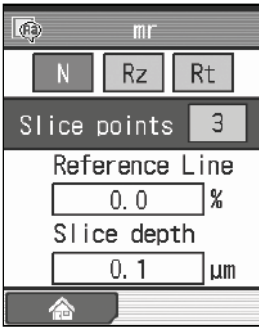
N | Rz | Rt

Slice points   3

Reference Line
    0.0   %

Slice depth
    0.1   μm

b Press the [Enter/Menu] key to set the number of sections.

Pressing the [Enter/Menu] key cycles through the available settings from "1" to "12".

4 Set the reference line.

mr Setup screen

N | Rz | Rt

Slice points   3

Reference Line
    0.0   %

Slice depth
    0.1   μm
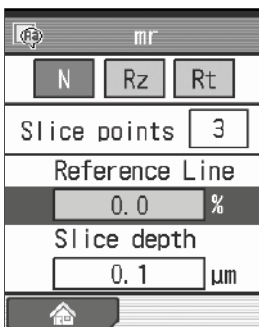
a Select "Reference Line" with the [↑] [↓] keys, and press the [Enter/Menu] key.

Reference Line Setup screen

mr

Reference Line

+   0.5

%

0.0 ◄···► 99.9

AC
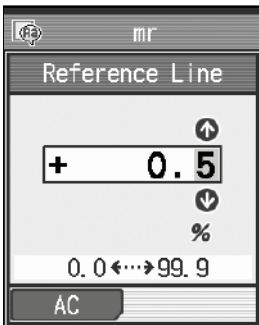
b Input the reference line.

The input range is as follows:

0.0 to 99.9 %

TIP • The value is set to 0 when the "AC" ([Blue] key) is pressed.

• For information about numeric value entry, refer to 2.5, "Entering Numeric Values/Characters".

---

c Press the [Enter/Menu] key.

➢ The set reference line is displayed on the mr Setup screen.

mr Setup screen

N | Rz | Rt

Slice points   3

Reference Line
    0.5   %

Slice depth
    0.1   μm

mr Setup screen

5 Set the slice depth.
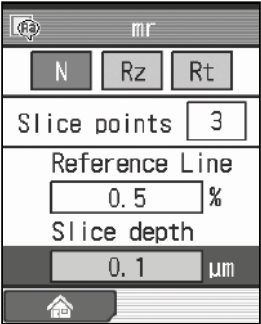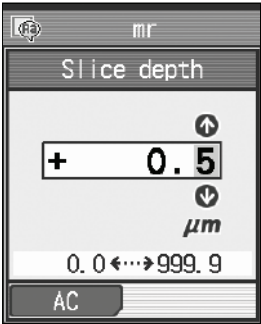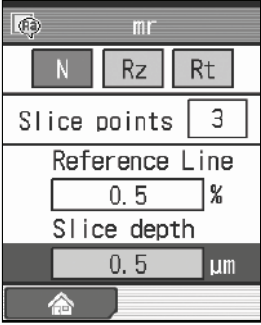
a Select "Slice depth" with the [↑] [↓] keys, and press the [Enter/Menu] key.

Slice Depth Setup screen

b Input the slice depth.
The input range is as follows:
0.0 to 999.9 μm (9999.99 μin)

> **TIP** • The value is set to 0 when the "AC" ([Blue] key) is pressed.
>
> • For information about numeric value entry, refer to 2.5, "Entering Numeric Values/Characters".

c Press the [Enter/Menu] key.

➢ The set slice depth is displayed on the mr Setup screen.

> **TIP** • Press the [Esc/Guide] key to return to the previous screen.
>
> • The screen returns to the Home screen when the "Home" ([Blue] key) is pressed.

mr Setup screen

8.4.4 Setting calculation conditions when mr[c] (tp for ANSI) is selected

When the parameter "mr(c)" ("tp" for ANSI) is selected, the slice level must also be set as a calculation condition.

■ Operating procedure (Refer to "■ Accessing the Submenu screen" in Section 8.1.)

Home screen to Main Menu ⇒ [🖻 Parameters] ⇒ [Red] ⇒

Submenu screen
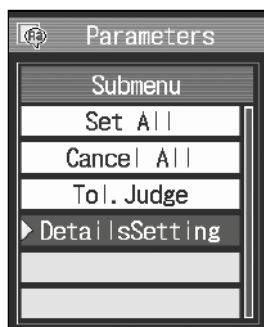
**1** Select "DetailsSetting" with the [↑] [↓] keys, and press the [Enter/Menu] key.

Setting Details Selection screen
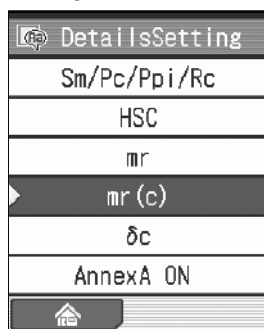
2 Select "mr(c)" ("tp" for ANSI) with the [↑] [↓] keys, and press the [Enter/Menu] key.
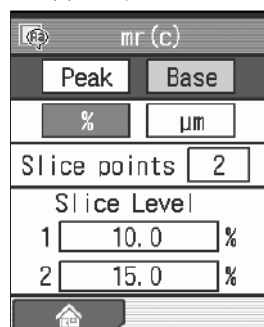
mr(c) Setup screen

3 Select the reference for the slice level, and press the [Enter/Menu] key.
"Peak": Set from the highest peak of the evaluation profile
"Base": Set from the mean line of the evaluation profile

mr(c) Setup screen
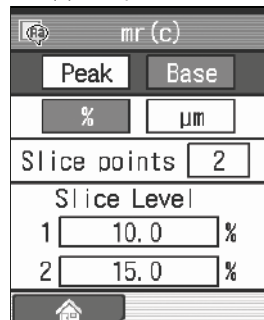
➢ The background of the selected slice level reference turns blue.
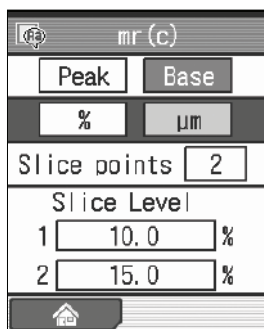
mr(c) Setup screen

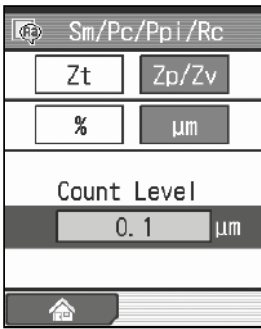**4** Select the measurement type for the slice level, and press the [Enter/Menu] key.
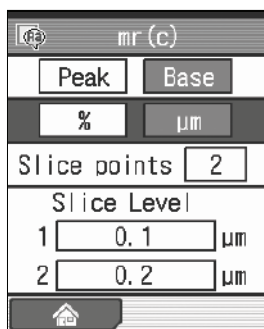
mr(c) Setup screen

➢ The background of the selected measurement type turns blue.
The set measurement type for the slice level switches.
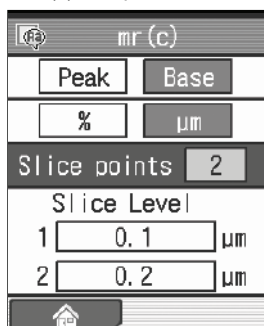
5 Set the number of sections.

mr(c) Setup screen

a Use the [↑] [↓] keys to select "Slice points".

mr(c) Setup screen
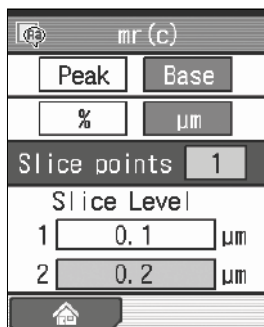
b Press the [Enter/Menu] key to set the number of sections.
Pressing the [Enter/Menu] key cycles through the available number of slice points "1" or "2".

6 Set the slice level.

When "slice points" is set to "2", two slice levels can be set.
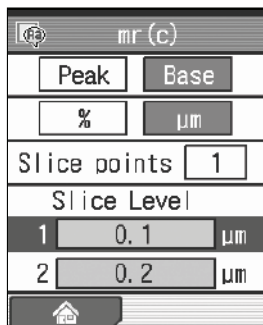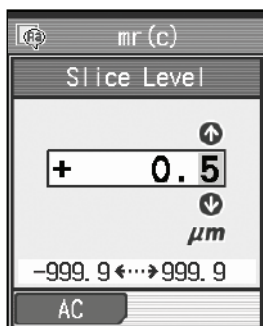
mr(c) Setup screen
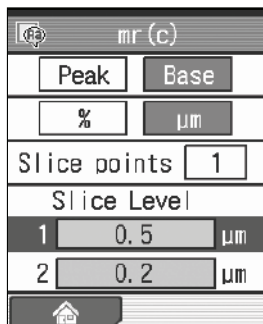
a Select "Slice level" "1" or "2" with the [↑] [↓] keys, and press the [Enter/Menu] key.

Slice Level Setup screen

b Input the slice level.

The input range is as follows:

0.0 to 99.9 %

0.0 to 999.9μm (9999.99 μin)

> **TIP** • The value is set to 0 when the "AC" ([Blue] key) is pressed.
>
> • For information about numeric value entry, refer to 2.5, "Entering Numeric Values/Characters".

c Press the [Enter/Menu] key.

mr(c) Setup screen

➢ The set slice level is displayed on the setup screen for mr(c) (tp for ANSI).

> **TIP** • Press the [Esc/Guide] key to return to the previous screen.
>
> • The screen returns to the Home screen when the "Home" ([Blue] key) is pressed.

8.4.5 Setting calculation conditions when δc (Htp for ANSI) is selected

When the parameter "δc" ("Htp" for ANSI) is selected, the slice level and reference line must also be set as calculation conditions.

■ Operating procedure (Refer to "■ Accessing the Submenu screen" in Section 8.1.)

Home screen to Main Menu ⇒ | 🅐 Parameters | ⇒ | Red | ⇒

Submenu screen
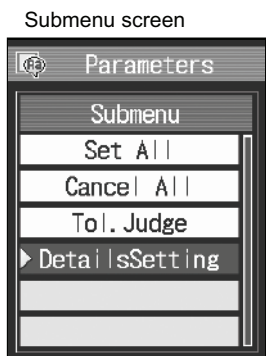
1 Select "DetailsSetting" with the [↑] [↓] keys, and press the [Enter/Menu] key.

Setting Details Selection screen
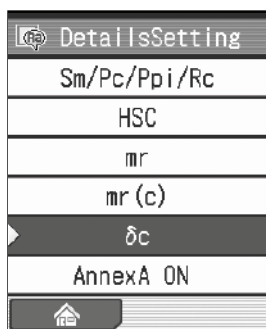
2 Select "δc" ("Htp" for ANSI) with the [↑] [↓] keys, and press the [Enter/Menu] key.
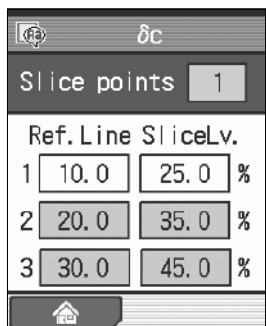
3 Set the number of sections.

δc Setup screen

    a Use the [↑] [↓] keys to select "Slice points".

δc Setup screen
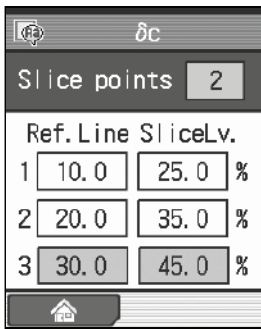
```
┌─────────────────────┐
│ ▣        δc         │
├─────────────────────┤
│ Slice points   2    │
├─────────────────────┤
│ Ref.Line SliceLv.   │
│ 1  10.0    25.0   % │
│ 2  20.0    35.0   % │
│ 3  30.0    45.0   % │
│ ⌂                   │
└─────────────────────┘
```

b Press the [Enter/Menu] key to set the number of sections.

Pressing the [Enter/Menu] key cycles through the available number of slice points from "1" to "3".

4 Set as many numbers of reference lines as the set number of sections. Settings that cannot be made have a gray background.
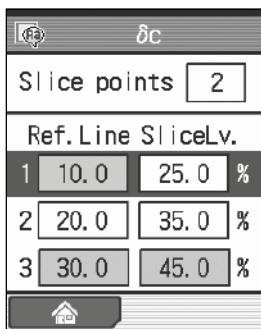
δc Setup screen

```
┌─────────────────────┐
│ ▣        δc         │
├─────────────────────┤
│ Slice points   2    │
├─────────────────────┤
│ Ref.Line SliceLv.   │
│ 1  10.0    25.0   % │
│ 2  20.0    35.0   % │
│ 3  30.0    45.0   % │
│ ⌂                   │
└─────────────────────┘
```

a Use the [↑] [↓] keys to select the parameters for a slice point.

δc Setup screen

```
┌─────────────────────┐
│ ▣        δc         │
├─────────────────────┤
│ Slice points   2    │
├─────────────────────┤
│ Ref.Line SliceLv.   │
│ 1  10.0    25.0   % │
│ 2  20.0    35.0   % │
│ 3  30.0    45.0   % │
│ ⌂                   │
└─────────────────────┘
```

b Select the reference line with the [←] [→] keys, and press the [Enter/Menu] key.

Reference Line Setup screen

```
┌─────────────────────┐
│ ▣        δc         │
├─────────────────────┤
│    Reference Line   │
│                     │
│         ⬆           │
│  +    10.5          │
│         ⬇           │
│         %           │
│   0.0 ←···→ 99.9    │
│ AC                  │
└─────────────────────┘
```

c Input the reference line.

The input range is as follows:

0.0 to 99.9%

TIP • The value is set to 0 when the "AC" ([Blue] key) is pressed.

• For information about numeric value entry, refer to 2.5, "Entering Numeric Values/Characters".

δc Setup screen

δc

Slice points 2

Ref.Line SliceLv.

1 10.5   25.0 %

2 20.0   35.0 %

3 30.0   45.0 %
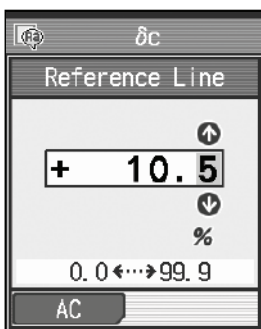
d Press the [Enter/Menu] key.

➢ The set reference line is displayed on the δc (Htp for ANSI) setup screen.

5 The number of slice levels to set matches the number of set slice points. Settings that cannot be made have a gray background.

δc Setup screen

δc

Slice points 2

Ref.Line SliceLv.

1 10.5   25.0 %

2 20.0   35.0 %

3 30.0   45.0 %

a Use the [↑] [↓] keys to select the parameters for a slice point.

δc Setup screen

δc

Slice points 2

Ref.Line SliceLv.

1 10.5   25.0 %

2 20.0   35.0 %

3 30.0   45.0 %
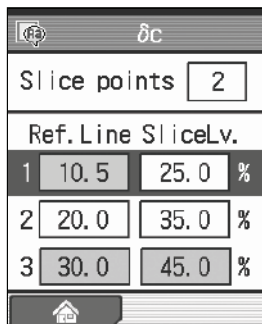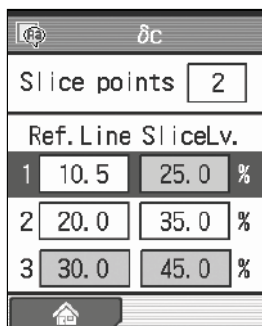
b Select the slice level with the [←] [→] keys, and press the [Enter/Menu] key.

Slice Level Setup screen

δc

Slice Level

+ 25.5

%

0.0 ←···→ 99.9

AC
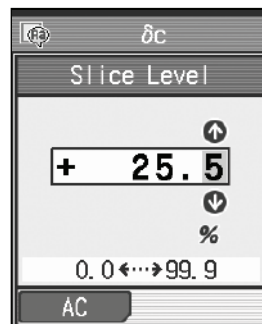
c Input the slice level.
The input range is as follows:
0.0 to 999.9 μm (9999.99 μin)

TIP • The value is set to 0 when the "AC" ([Blue] key) is pressed.

• For information about numeric value entry, refer to 2.5, "Entering Numeric Values/Characters".

δc Setup screen

𝄂	δc

Slice points [2]

Ref.Line SliceLv.

1	10.5	25.5	%
2	20.0	35.0	%
3	30.0	45.0	%

🏠

d Press the [Enter/Menu] key.

➢ The set slice level is displayed on the δc (Htp for ANSI) setup screen.

TIP • Press the [Esc/Guide] key to return to the previous screen.

• The screen returns to the Home screen when the "Home" ([Blue] key) is pressed.

8.4.6   Setting calculation conditions when a profile motif (R-Motif) is selected

The SJ-210 can use one of the following compliant motif connection methods when the "R-Motif" profile motifs are selected: The method described in the body of ISO 12085, and the method described in ISO 12085 Annex A.

■ Operating procedure (Refer to "■ Accessing the Submenu screen" in Section 8.1.)
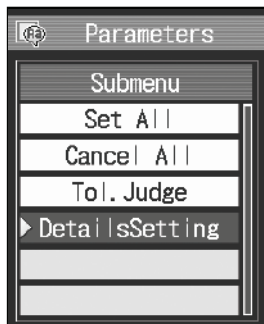
Home screen to Main Menu ⇒ [⊛ Parameters] ⇒ [Red] ⇒

Submenu screen

1   Select "DetailsSetting" with the [↑] [↓] keys, and press the [Enter/Menu] key.

Setting Details Selection screen
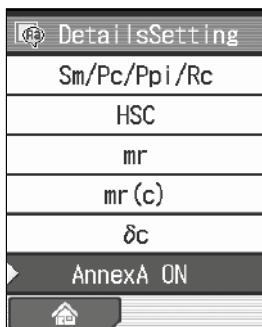
2   Select "AnnexA" with the [↑] [↓] keys.

Setting Details Selection screen
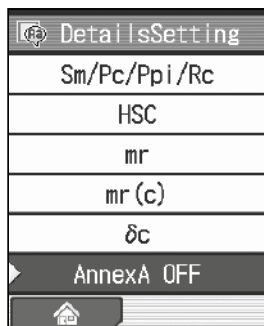
3   Press the [Enter/Menu] key.

Pressing the [Enter/Menu] key cycles through the available settings, "ON" and "OFF".

> **TIP** • Press the [Esc/Guide] key to return to the previous screen.

MEMO

9 MEASUREMENT RESULTS (LOAD/SAVE/DELETE/RENAME)

The SJ-210 can save the measurement conditions and results. It also can load the saved data.

The SJ-210 can save the measurement conditions and results in files and load the saved data. It also can delete and rename the files.

Note that a memory card (optional) is necessary for saving/loading the measurement conditions and results.

Using a memory card, the SJ-210 can save/load the measurement conditions up to 500 cases and the measurement results up to 10,000 cases of measurements.

This section explains the outline and procedures of loading/saving/deleting/renaming the measurement conditions and results.

IMPORTANT
- A microSD card is used as the memory card.
  microSD^{TM} is the registered trademark of the SD Association.

  A microSD Logo is the registered trademark.
  In some parts of this manual, "microSD^{TM} card" is described as "microSD card" or "memory card". While designed to comply with existing standards, due to standards changes or additions, or the non-support of SPI mode, etc, some microSD cards may not be supported. Use the SD card designated by Mitutoyo (Part No. 12AAL069).

- Before use, the memory card must be formatted using the SJ-210. The memory card may not function properly when formatted in a device other than the SJ-210. For information about formatting the memory card, refer to 10.10.1, "Formatting the memory card".

- Connect the AC adapter to prevent power to the instrument from being interrupted while making settings.

- When using the built-in battery, make sure it is sufficiently charged. When operations are performed while the battery power is low, the SJ-210 may shut off during operation.

9.1 Data To Be Saved and Storage Media

■ Data to save/load and its media

Data saving and loading is outlined below, where data is divided into two groups according to data handling.

Data group	Stored contents	Storage media
Measurement conditions	Measurement conditions	Internal memory (10 files max.), or Memory card (500 files max.)
Measured data	Measured profile data, calculation results	Internal memory (1 file of the latest measurement result), or Memory card (10,000 files max.)

NOTE • When data is loaded, the existing SJ-210 main unit setup is overwritten with the above described "storage contents" that are loaded together.

9.1.1 Handling the memory card

A memory card can be inserted in the slot on the rear side of the SJ-210.
Insert the memory card following the procedures below.

■ Inserting the memory card

IMPORTANT • Insert the memory card straightforward correctly fitting in the memory card slot guide. Otherwise the connector pins at the recess may be damaged.

• Insert the memory card with the pin assignment side facing up.

• Insert or remove the memory card while the power of the SJ-210 is off.

1 Place your nail on the hollow provided on the rear cover, and push the rear cover in the direction indicated by the arrow (1).

2 Pull the rear cover in the direction indicated by the arrow (2) and remove it.
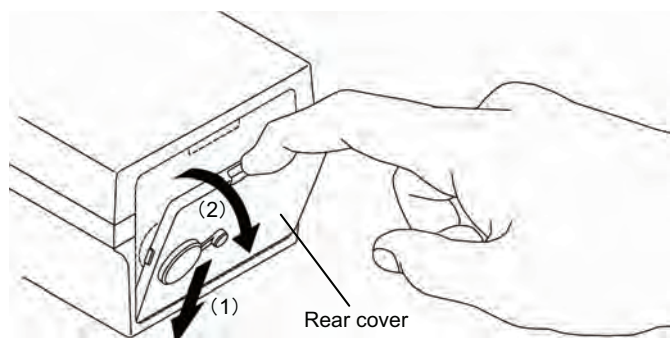
Detaching the rear cover

3 Insert the memory card, with the pin assignment side facing up, into the slot as far as possible.

IMPORTANT
Insert the memory card with the pin assignment side facing up.
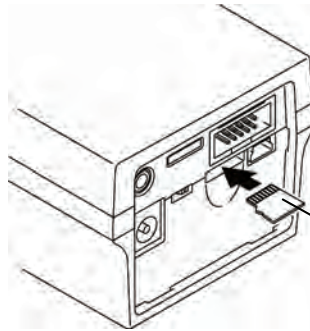
Inserting the memory card

4 Fit the rear cover to the hollow of the rear of the display unit in the direction indicated by the arrow (1).

5 Push the rear cover in the direction indicated by the arrow (2) and attach it.

(2)
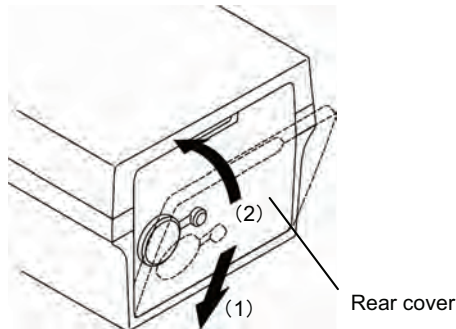
(1)   Rear cover

Attaching the rear cover

■ Removing the memory card

1 Place your nail on the hollow provided on the rear cover, and push the rear cover in the direction indicated by the arrow (1).

2 Pull the rear cover in the direction indicated by the arrow (2) and remove it.

(2)
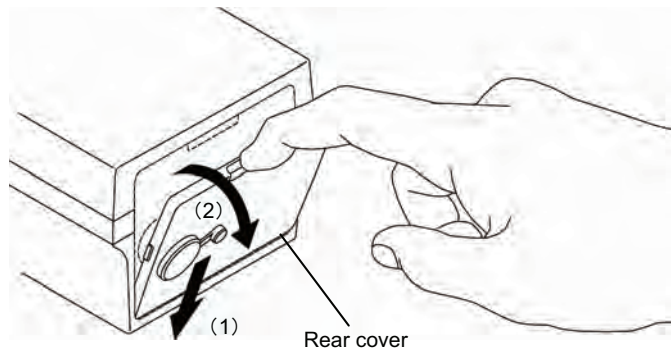
(1)   Rear cover

Detaching the rear cover

3   Push the memory card.

>   ➢   The memory card pops part of the way out of the slot.

4   Pull the memory card the rest of the way out of the slot.

5   Fit the rear cover to the hollow of the rear of the display unit in the direction indicated by the arrow (1).

6   Push the rear cover in the direction indicated by the arrow (2) and attach it.
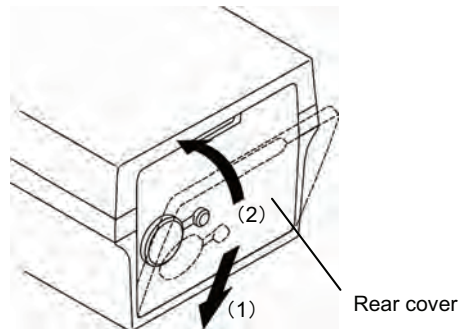
Attaching the rear cover

9.1.2   Memory card folder construction

When SJ-210 data is saved on the memory card, the data is saved in the following folders.

■ Memory Card Folder Construction

The folder construction in the memory card is explained below.

Folder	Meaning
10COND	Used for backup of the 10 conditions to be saved in the internal memory. This folder functions as temporal storage to avoid the loss of the condition file to be saved in the SJ-210. This is useful for such occasion as replacing the built-in battery.
10DATA	Used for the Save10 data.
BKUP	Used for backup of the basic information of the card.
COND	Used to save/load the measurement conditions. Maximum number of files to be saved: 500 files
DATA FOL-1 to 20	Used to save the measurement results. The DATA folder consists of 20 folders. The results of 500 measurements can be saved in each of 20 folders. The resulting data can be loaded only by the SJ-210. Maximum number of files to be saved: 10,000 files
IMG	Used to save the displayed contents on screens in the BMP file format when the hardcopy function is enabled. Maximum number of files to be saved: 500 files
USER FOL-1 to 20	Used to save the measurement results and calculation results in a text file. The USER folder consists of 20 folders. The results in 500 text files can be saved in each of 20 folders. The data saved in a text file can be registered using text editor on PCs, and therefore, are easy to access for users.

NOTE • The data files in the memory card that can be registered (and deleted) on PCs using card readers on the market are limited to graphic data in the "IMG" folder and text files in "USER" folder. Do not modify/delete the files in the other folders. Do not modify/delete the folders. It causes a card access error.

• When the text files in the "USER" folder are modified on a PC, the data cannot be loaded properly using communication software.

TIP • For information about changing the names of folders on a memory card and changing the main folder, refer to 9.3, "File Management".

9.1.3   Data saved on the memory card

■ Name of files created automatically
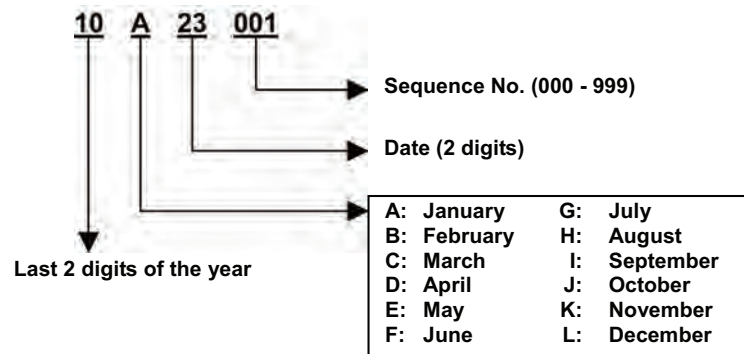
Rule for names of automatically created files

■ Content of the text file

The contents of the text file are explained below using an example where the text file is saved under the default conditions.

Stored contents	Description
// Header Version;SJ-210 V.1.000 Date;2009/10/01 Mode;ALL	The header part Model name, software version Date of measurement ALL: all data, RES: calculation results
// Condition Standard;ISO1997 Profile;R Filter;GAUSS Lc;0.8;mm Ls;2.5;um N;5 Pre_Length;ON Speed;0.5 Range;AUTO GO/NG;Average Pitch;0.5;um	Measurement conditions 　　　Measurement standard 　　　Profiles 　　　Filters 　　　λc 　　　λs 　　　Number of sampling lengths 　　　Pre-travel and post-travel setting 　　　Traversing speed 　　　Measurement range 　　　GO/NG judgment 　　　Sampling Pitch
// CalcResult Ra;2.936;um;; Rq;3.263;um;; Rz;9.314;um;;	Calculation results Parameter name; calculation results; unit; parameter detail settings; 　　　　　　　GO/NG judgment
// CalcData 8000 Z 4.3095 4.2304 4.1510 4.0703 ...	Measurement results Number of files Data

■ Graphic files

The graphic data saved in the BMP file format can be registered on PCs as graphic data as it is.

9.2 Measurement Results Screen Guide

■ Screens guide

Home screen

ISO1997	0.5 mm/s
λc 0.8	x 5

Ra

SPC

3.799

μm

2

Main Menu screen

Main menu
- Calib. Meas.
- Meas. Condition
- **Measured Data**
- Parameters
- Set Environ.
- Screen Change

[Enter/Menu]

[Esc/Guide]

3

Measurement Result Menu screen

Measured Data
- Read
- Save
- Delete
- File Rename
- Read10Data

🏠

Select items

[Esc/Guide]   [Enter/Menu]
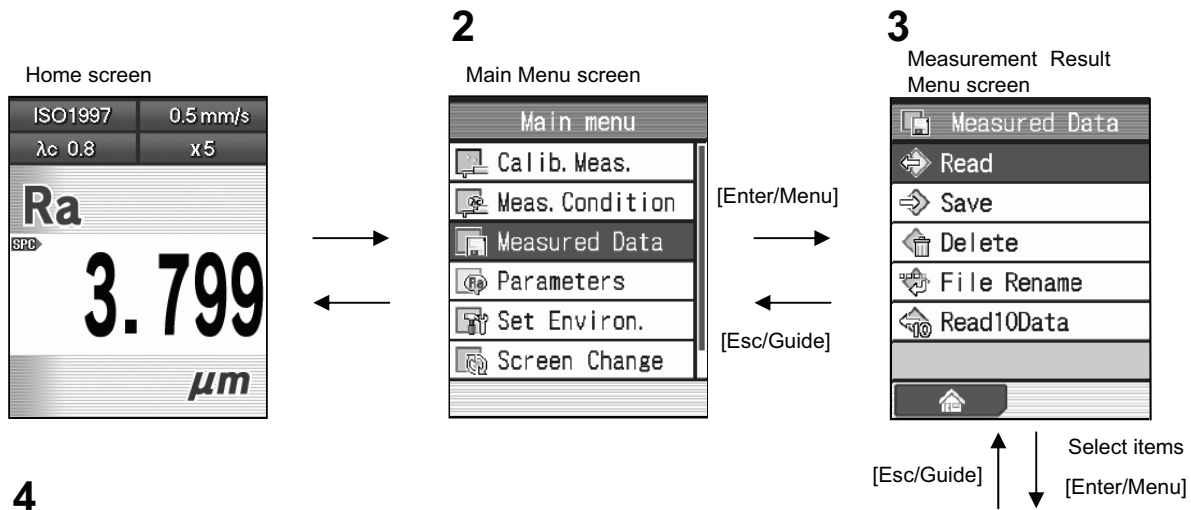
4

Loading Folder Select screen	Save Folder Select screen	Delete Folder Select screen	File Rename Folder Select screen

Meas. data 3/20	**Meas. data** 1/20	**Meas. data** 1/20	**Meas. data** 3/20
✳ FOLDER01 11	✳ FOLDER01 11	✳ FOLDER01 12	✳ FOLDER01 12
FOLDER02 3	FOLDER02 3	FOLDER02 3	FOLDER02 3
FOLDER03 9	FOLDER03 9	FOLDER03 9	FOLDER03 9
FOLDER04 0	FOLDER04 0	FOLDER04 0	FOLDER04 0
FOLDER05 0	FOLDER05 0	FOLDER05 0	FOLDER05 0
FOLDER06 0	FOLDER06 0	FOLDER06 0	FOLDER06 0
FOLDER07 0	FOLDER07 0	FOLDER07 0	FOLDER07 0
FOLDER08 0	FOLDER08 0	FOLDER08 0	FOLDER08 0
FOLDER09 0	FOLDER09 0	FOLDER09 0	FOLDER09 0
Sw. Main Rename	Sw. Main Rename	Sw. Main Rename	Sw. Main Rename
Refer to 9.4	**Refer to 9.5**	**Refer to 9.6**	**Refer to 9.7**

■ Accessing the Measurement Data Menu screen

Home screen

1 Press the [Enter/Menu] key on the Home screen to display the Main Menu screen.

Main Menu screen

2 Select "Measured Data" with the [↑] [↓] keys, and press the [Enter/Menu] key.

9.3 File Management

It is possible to modify the folder name of the internal memory and change the folder assignment as the main folder as desired.

9.3.1 Modifying folder names

It is possible to modify the name of the folder to which the measurement results are saved. Folder names can be modified on the following screens: Load Folder Select screen, Save Folder Select screen, Delete Folder Select screen, and File Rename Folder Select Screen. The operating procedures are explained using an example of the Load Folder Select screen. The operating procedures are the same for the other screens.

NOTE • The folder name cannot include [*], [￥], and [.].

■ Operating procedure (Refer to "■ Accessing the Measurement Data Menu screen" in Section 9.2.)

Home screen to Main Menu ⇒ [🖫 Meas. data] ⇒

Measurement Result Menu screen
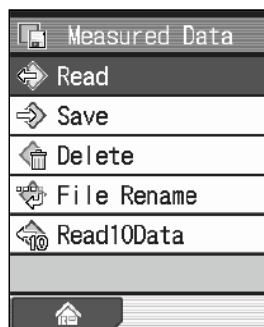
1 Select "Read" with the [↑] [↓] keys, and press the [Enter/Menu] key.

Loading Folder Select screen
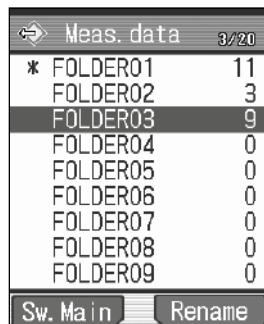
2 Select the desired folder of which name is to be modified with the [↑] [↓] keys, and press the "Rename" ([Red] key).

Rename Folder screen
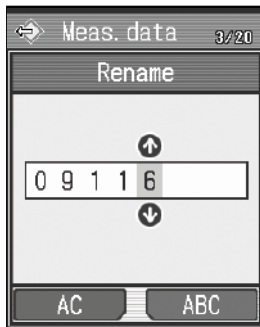
3   Enter the folder name.

> **TIP** • For information about character entry, refer to 2.5, "Entering Numeric Values/Characters".

Loading Folder Select screen
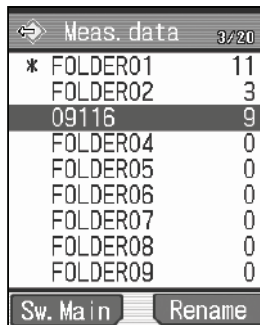
➢   The folder name is modified as entered.

> **TIP** • Press the [Esc/Guide] key to return to the previous screen.

9.3.2　Specifying the main folder

After the measurement, press the [POWER/DATA] key to save the measurement results in the main folder. A specific folder can be selected as this main folder.

The main folder can be specified on the following screens: Load Folder Select screen, Save Folder Select screen, Delete Folder Select screen, and File Rename Folder Select screen.

The operating procedures are explained using an example of the Load Folder Select screen. The operating procedures are the same for the other screens.

TIP ・For information about setting the data output, refer to 10.3, "Data Output Settings".

■ Operating procedure (Refer to "■ Accessing the Measurement Data Menu screen" in Section 9.2.)

Home screen to Main Menu ⇒ 〔🖴 Meas. data〕 ⇒

Measurement Result Menu screen
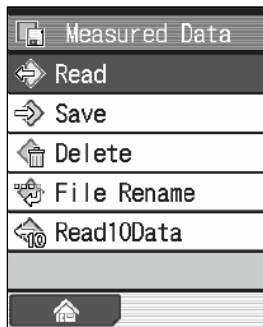
1　Select "Read" with the [↑] [↓] keys, and press the [Enter/Menu] key.

Load Folder Select screen
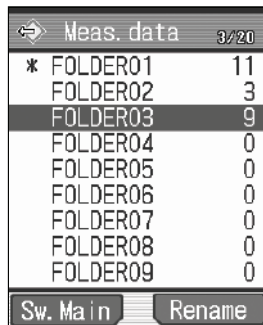
2　Select the desired folder to be specified as the main folder with the [↑] [↓] keys, and press the "Sw. Main" ([Blue] key).

Load Folder Select screen
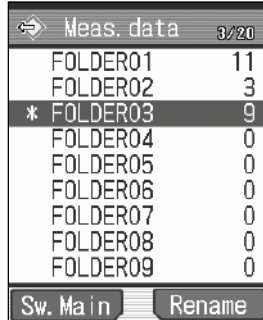
➢　"*" is added before the folder name.

TIP ・Press the [Esc/Guide] key to return to the previous screen.

9.4 Loading Measurement Results

The saved measurement results on the memory card can be loaded.

When the saved measurement results are loaded, the existing SJ-210 internal memory is overwritten with the saved measurement results, and the calculation results are displayed. The following operations can be performed for the loaded results just as for the results obtained through the measurement: recalculating the measurement results by modifying the measurement conditions, printing data on the printer, resaving back to the memory card.

IMPORTANT	• By loading the measurement results, the measurement conditions of the SJ-210 are modified to that when the measurement results are saved.
	• When using the built-in battery, make sure it is sufficiently charged. When the measurement results are loaded while the level of the battery remainder power is low, the power of the SJ-210 may be turned off during loading the data.

9.4.1 Loading the saved measurement results

■ Operating procedure (Refer to "■ Accessing the Measurement Data Menu screen" in Section 9.2.)

Home screen to Main Menu ⇒ [🖸 Meas. data] ⇒

Measurement Result Menu screen
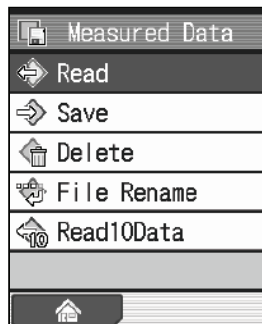
1 Select "Read" with the [↑] [↓] keys, and press the [Enter/Menu] key.

Load Folder Select screen
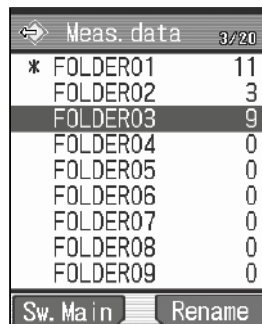
2 Select the desired folder containing the measurement results to be loaded with the [↑] [↓] keys, and press the [Enter/Menu] key.

> TIP • When the Save10 function is enabled, the results of the latest 10 measurements are automatically saved in the "Save10" folder. To load the results of the latest measurement, select the "Read 10 Data".
> For information about the Save 10 function, refer to 10.10.4, "Setting the Save 10 Function".

Measurement Result Load screen
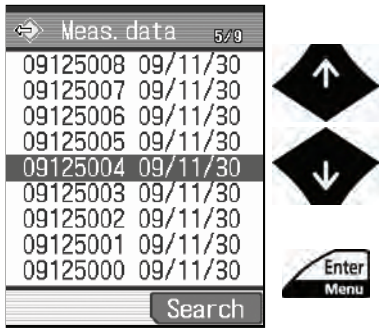
3 Select the measurement results to be read with the [↑] [↓] keys, and press the [Enter/Menu] key.

➢ The measurement results are loaded, and then the Home screen is restored.

9.4.2   Searching for files to load

When the result data of several measurements are saved in one folder, search for the file within the folder. It is a quick way to find the file to be loaded.

■ Operating procedure (Refer to "■ Accessing the Measurement Data Menu screen" in Section 9.2.)
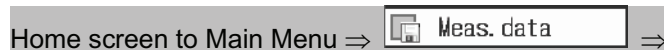
Home screen to Main Menu ⇒ 🔲 Meas. data ⇒

Measurement Result Menu screen
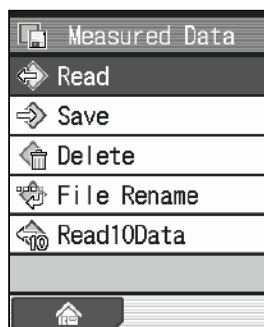
1   Select "Read" with the [↑] [↓] keys, and press the [Enter/Menu] key.

Load Folder Select screen
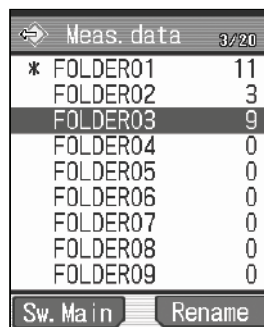
2   Select the desired folder containing the measurement results to be loaded with the [↑] [↓] keys, and press the [Enter/Menu] key.

Load File Select screen
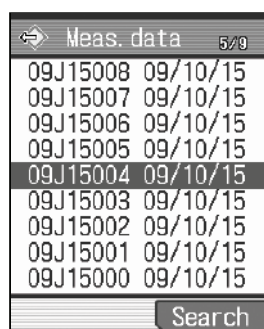
3   Press the "Search" ([Red] key).

Measurement Result Search screen
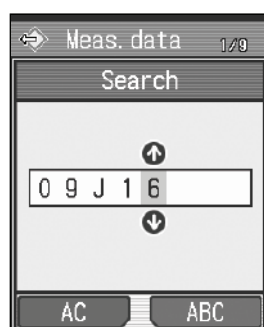
4   Enter the file name to be searched.

> **TIP** • For information about character entry, refer to 2.5, "Entering Numeric Values/Characters".

Measurement Result Load screen
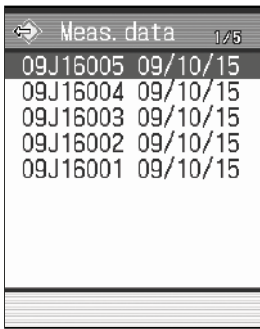
5 Press the [Enter/Menu] key.

➤ The relevant measurement results are found by searching with the entered character.
To cancel searching, press the [Esc/Guide] key.

Measurement Result Load screen
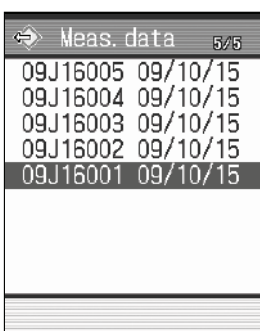
6 Select the measurement results to be read with the [↑] [↓] keys, and press the [Enter/Menu] key.

➤ The measurement results are loaded, and then the Home screen is restored.

9.5   Saving Measurement Results

The measurement results can be saved on the memory card.

IMPORTANT • When using the built-in battery, make sure it is sufficiently charged. When the measurement results are saved while battery power is low, the SJ-210 may shut off while the data is being saved.

NOTE • To load the saved measurement results with communication software, make sure to save the measurement results in a text file format beforehand. Refer to 10.10.3, "Saving text data to the memory card".

9.5.1   Saving the measurement results newly

■ Operating procedure (Refer to "■ Accessing the Measurement Data Menu screen" in Section 9.2.)
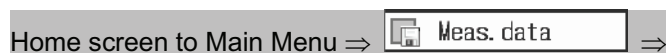
Home screen to Main Menu ⇒ [Meas. data] ⇒

Measurement Result Menu screen
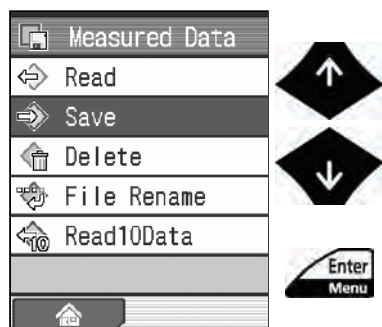
1   Select "Save" with the [↑] [↓] keys, and press the [Enter/Menu] key.

Save Folder Select screen
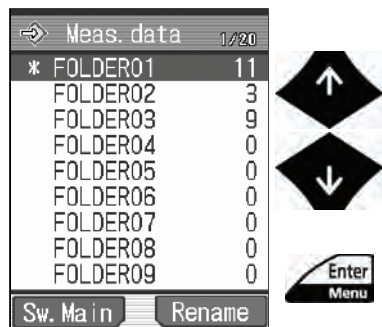
2   Select the folder to which the measurement results are saved with the [↑] [↓] keys, and press the [Enter/Menu] key.

Measurement Result Save screen
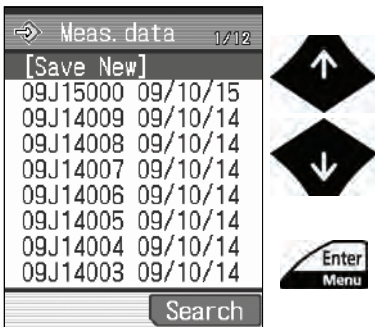
3 Select "Save New" with the [↑] [↓] keys, and press the [Enter/Menu] key.

Measurement Result
Save New screen

4 Enter a file name.

TIP • For information about character entry, refer to 2.5, "Entering Numeric Values/Characters".

Measurement Result
Save screen
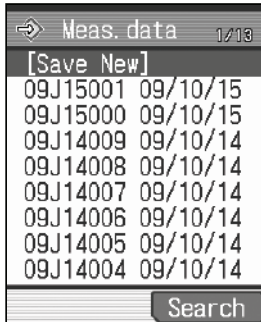
5 Press the [Enter/Menu] key.

➢ The measurement results are saved in the file whose name was entered in step 4.

TIP • Press the [Esc/Guide] key to return to the previous screen.

9.5.2   Overwriting the measurement results

■ Operating procedure (Refer to "■ Accessing the Measurement Data Menu screen" in Section 9.2.)

Home screen to Main Menu ⇒ | 🔲 Meas. data | ⇒

Measurement Result Menu screen
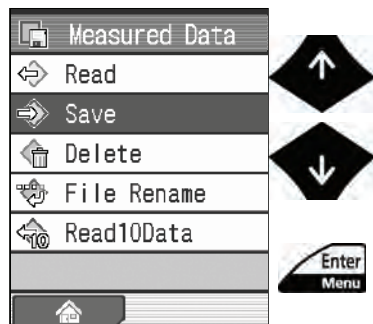
1   Select "Save" with the [↑] [↓] keys, and press the [Enter/Menu] key.

Save Folder Select screen
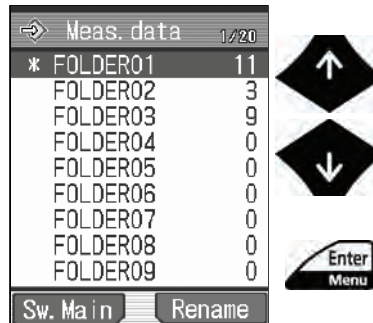
2   Select the folder to which the measurement results are saved with the [↑] [↓] keys, and press the [Enter/Menu] key.

Measurement Result
Save screen
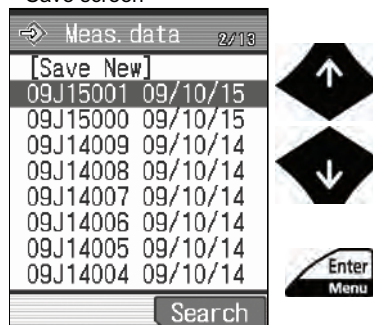
3   Select the measurement results to be overwritten with the [↑] [↓] keys, and press the [Enter/Menu] key.

> **TIP**   • It is possible to search for the measurement results to be overwritten. For more information about the searching procedure, refer to 9.4.2, "Searching for files to load".

4   Press the [Enter/Menu] key.
To cancel overwriting, press the [Esc/Guide] key.

➢   The measurement results are overwritten.

> **TIP**   • Press the [Esc/Guide] key to return to the previous screen.

9.6 Deleting Measurement Results

It is possible to delete the measurement results saved on the memory card.

IMPORTANT • When using the built-in battery, make sure it is sufficiently charged. When the measurement results are deleted while the level of the battery remainder power is low, the power of the SJ-210 may be turned off during deleting the data.

■ Operating procedure (Refer to "■ Accessing the Measurement Data Menu screen" in Section 9.2.)

Home screen to Main Menu ⇒ [Meas. data] ⇒

Measurement Result Menu screen
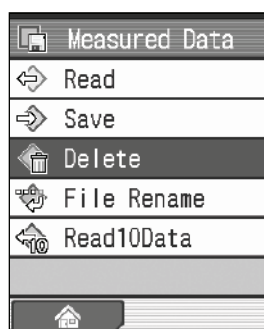
1 Select "Delete" with the [↑] [↓] keys, and press the [Enter/Menu] key.

Delete Folder Select screen
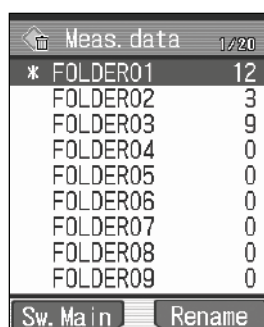
2 Select the folder containing the measurement results to be deleted with the [↑] [↓] keys, and press the [Enter/Menu] key.

Measurement Result Deletion screen
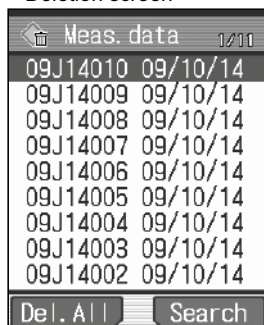
3 Select the measurement results to be deleted with the [↑] [↓] keys, and press the [Enter/Menu] key.
To delete all the saved measurement data, press the "Del. All" ([Blue] key).

NOTE • When deleting many data found by searching all at once, it may take several minutes.

TIP • It is possible to search for the measurement results to be deleted. For more information about the searching procedure, refer to 9.4.2, "Searching for files to load".

Measurement Result

Deletion screen

Meas. data	1/10
09J14009 09/10/14	
09J14008 09/10/14	
09J14007 09/10/14	
09J14006 09/10/14	
09J14005 09/10/14	
09J14004 09/10/14	
09J14003 09/10/14	
09J14002 09/10/14	
09J14001 09/10/14	
Del.All	Search
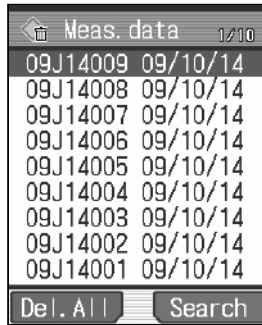
4 Press the [Enter/Menu] key.

➢ The selected measurement results are deleted.

TIP • Press the [Esc/Guide] key to return to the previous screen.

9.7 Renaming Measurement Results

It is possible to modify the file name of the measurement results saved on the memory card.

IMPORTANT · When using the built-in battery, make sure it is sufficiently charged. When the file names of the measurement results are modified while the level of the battery remainder power is low, the power of the SJ-210 may be turned off during modifying the file names.

NOTE · The file name cannot include [*], [¥], and [.].

■ Operating procedure (Refer to "■ Accessing the Measurement Data Menu screen" in Section 9.2.)

Home screen to Main Menu ⇒ [📇 Meas. data] ⇒

Measurement Result Menu screen
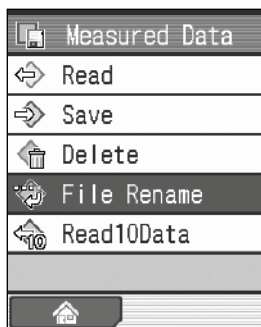
1 Select "File Rename" with the [↑] [↓] keys, and press the [Enter/Menu] key.

File Rename Folder Select screen
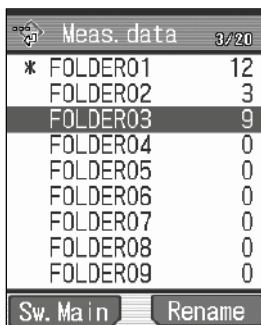
2 Select the folder containing the measurement results whose file name to be modified with the [↑] [↓] keys, and press the [Enter/Menu] key.

Measurement Result File Rename screen
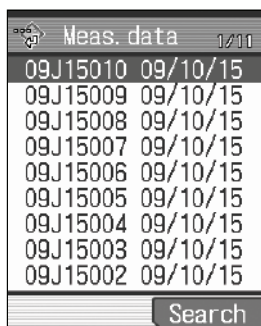
3 Select the measurement results file name to be modified with the [↑] [↓] keys, and press the [Enter/Menu] key.

TIP · It is possible to search for the measurement results whose file names are to be modified. For more information about the searching procedure, refer to 9.4.2, "Searching for files to load".

File Rename screen

Meas. data   1/11
File Rename

⬆
0 9 J 1 6 0 1 0
⬇

AC   ABC

4   Enter a file name.

> **TIP** • For information about character entry, refer to 2.5, "Entering Numeric Values/Characters".

Measurement Result File
Rename screen

Meas. data   1/11
09J16010 09/10/15
09J15009 09/10/15
09J15008 09/10/15
09J15007 09/10/15
09J15006 09/10/15
09J15005 09/10/15
09J15004 09/10/15
09J15003 09/10/15
09J15002 09/10/15
Search
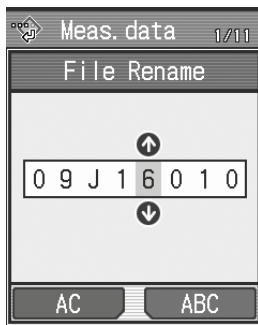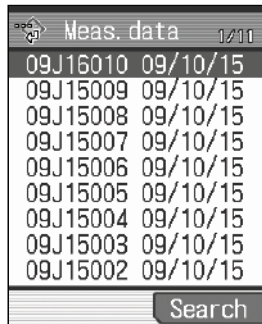
5   Press the [Enter/Menu] key.

> ➢   The file name entered in step 4 is displayed.

> **TIP** • Press the [Esc/Guide] key to return to the previous screen.

MEMO

10 OPERATING ENVIRONMENT SETUP

Setting up the basic operating environment of this instrument allows you to use its functions effectively.

You can set the following functions in the operating environment setup.

- Date/Time : Settings for date and time, and their display methods

- Data Output : Settings of functions assigned to the [POWER/DATA] key

- Select Language : Select the display language.

- Drive : Settings and calibration for the drive unit

- Switch Unit : Switches between millimeters and inches for the unit of measurement (fixed to millimeters when the language is Japanese).

- Decimal Point : Select a period or comma to use as the decimal point.

- Volume Adjustment : Adjust the volume of indicator sounds.

- Function Restriction : Restrict the settings of functions (password protection).

- Memory Card : Format or save to the memory card.

- Auto-sleep : Set the time and ON/OFF for the auto-sleep function.

- Self-timer : Set the time and ON/OFF for the self timer function.

- PC Communication : Set RS-232C communication conditions.

- Detector Position : Detector position confirmation screen (maintenance function)

- LCD/Key Test : Check the LCD display and key operation (maintenance function).

- Reset to Default : Reset the settings of instrument to factory default settings.

- Version : Confirm the version of the SJ-210's display unit

10.1 Operating Environment Setup Screen Guide

■ Screens guide
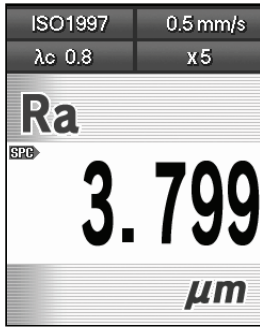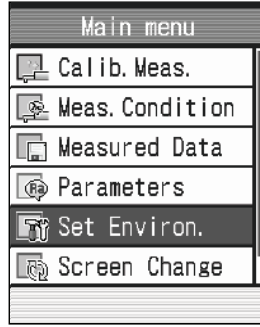
1

Home screen

| ISO1997 | 0.5 mm/s |
| λc 0.8 | x5 |

Ra

SPC

3.799

μm

[Enter/Menu] →

← [Esc/Guide]

2

Main Menu screen

Main menu
- Calib. Meas.
- Meas. Condition
- Measured Data
- Parameters
- Set Environ.
- Screen Change

[Enter/Menu] →

← [Esc/Guide]

3

Operating Environment Setup menu

Set Environ.
- Date/Time
- Data Output
- SelectLanguage
- Drive
- Switch unit
- Decimal Point
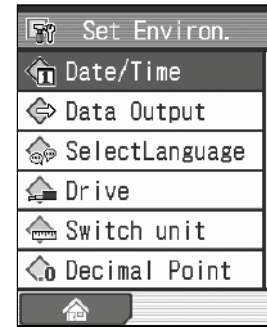
[Esc/Guide] ↑   Item Selection ↓ [Red]

4

Date/Time screen
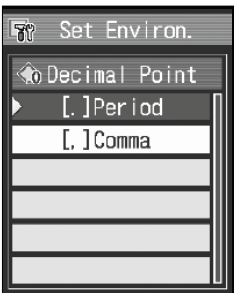
Date/Time
2009/10/14
Year	2009
Mon/Date	10/14
Time	13:21:16
Format	YYYY/MM/DD

Refer to 10.2

Data Output Setup screen

Set Environ.
Data Output
- SPC
- Printer
- Data storage
- Hard copy

Refer to 10.3

Language Selection screen

Set Environ.
SelectLanguage
- 日本語
- English
- Deutsch
- Français
- Italiano
- Español

Refer to 10.4

Drive Unit Setup screen

Set Environ.
Drive
- Standard
- Horiz. Drive
- Front Retract

Refer to 10.5

Unit Selection screen

Set Environ.
Switch unit
- mm
- inch

Refer to 10.6

Decimal Point selection screen

Set Environ.
Decimal Point
- [.] Period
- [,] Comma

Refer to 10.7

Volume Adjustment screen

Volume Adjust.

Refer to 10.8

Function Restriction Setup screen

Func. Restrict
Cal. Meas.	OFF
Meas. Condition	OFF
Meas. data	OFF
Parameters	OFF
Set Environ.	OFF
Screen Change	OFF
Password

Refer to 10.9

Memory Card Setup screen

Memory Card
microSD	Formatted
Use Cond.	1%
Text file	OFF
Save10Data	OFF
Backup	

Refer to 10.10

Auto-sleep Setup screen

Auto-sleep
Auto-sleep ON
Wait time 30[sec]

Refer to 10.11

Self-timer Setup screen

Self-timer
Self-timer ON
Wait time 5[sec]

Refer to 10.12

PC Communication Setup screen

PC communicat.
RS-232C	OFF
Speed	38400
Parity	NONE
Data	8bit
Stop bit	1bit

Refer to 10.13

Detector Position Display screen

Detect. Pos.
0.000
μm

Refer to 10.14

LCD/Key Test screen

POWER DATA   START STOP   PAGE

Blue   Red
Esc Guide   Enter Menu

Refer to 10.15

Version information

Mitutoyo   MiCAT
the standard in world
metrology software
FORM

SJ-210 V. 1. 000

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Refer to 10.17

■ Accessing the Operating Environment Setup Menu screen

Home screen
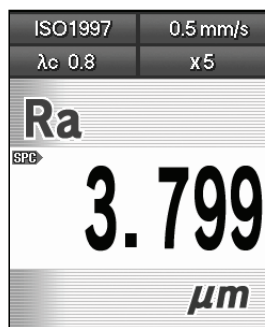
1 Press the [Enter/Menu] key on the Home screen to display the Main Menu screen.

Main Menu screen
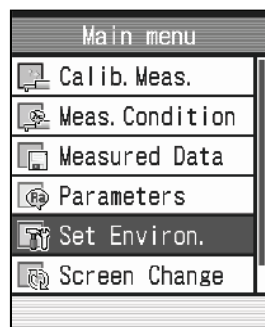
2 Select "Set Environ." with the [↑] [↓] keys, and press the [Enter/Menu] key.

10.2　Setting the Date and Time

You can set the date and time on the SJ-210. This is useful for records management, as the day and time are recorded as part of measurement data and conditions.

■ Operating procedure (Refer to "■ Accessing the Operating Environment Setup Menu screen" in Section 10.1.)

Home screen to Main Menu ⇒ [🔧 Set Environ.] ⇒

Operating Environment
Setup menu screen
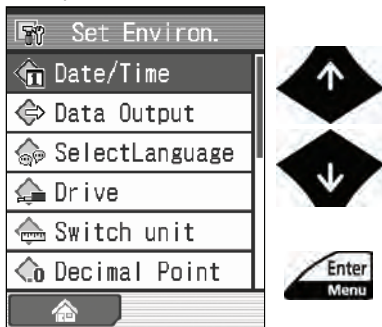
1　Select "Date/Time" with the [↑] [↓] keys, and press the [Enter/Menu] key.
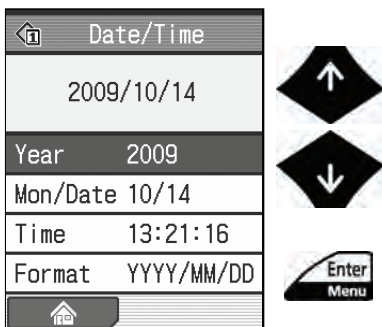
Date/Time screen

2　Select "Year" with the [↑] [↓] keys, and press the [Enter/Menu] key. "Mon/Date" and "Time" can be selected as well.

Date/Time Setup screen
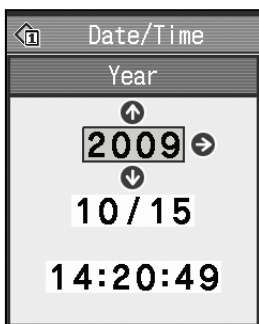
3　Specify the date and time.

> TIP • For information about numeric value entry, refer to 2.5, "Entering Numeric Values/Characters".
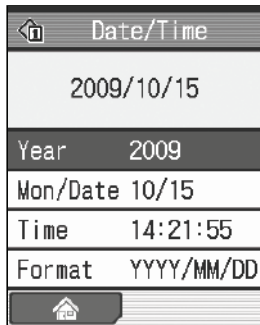
4 Press the [Enter/Menu] key.

➢ The day and time are set.

Date/Time screen

> **TIP** • To cancel settings input, press the [Esc/Guide] key instead of the [Enter/Menu] key.
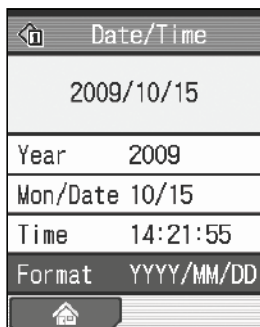
Date/Time screen

5 Select "Format" with the [↑] [↓] keys, and press the [Enter/Menu] key.

Date/Time Format Setup screen
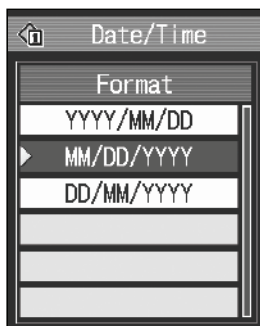
6 Select a date format (order of day, month, year) with the [↑] [↓] keys, and press the [Enter/Menu] key.

> **TIP** • YYYY is the year, MM the month, and DD the day.
>
> • To cancel settings input, press the [Esc/Guide] key instead of the [Enter/Menu] key.

Date/Time screen
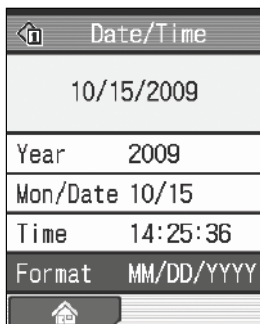
➢ The date format is set.

> **TIP** • Press the [Esc/Guide] key to return to the previous screen.
>
> • The screen returns to the Home screen when the "Home" ([Blue] key) is pressed.

10.3   Data Output Settings

The [POWER/DATA] key is assigned the below functions.
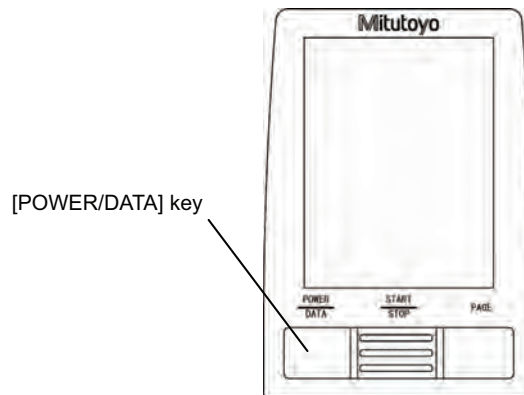
Operation key ([POWER/DATA] key）

By pressing the [POWER/DATA] key, you can output the selected function's measurement results.

SPC: You can output measurement results to a data processor.
                A data processor (ex.: DP-1VR) must be connected in advance.

Printer: You can output measurement results to a printer.
                Perform a communication check to set communication conditions.

Saving data: Measurement results can be saved on the memory card.
                (The file name is automatically generated.)

Hard copy: The currently displayed screen image is saved as an image file to the memory card. (The file name is automatically generated.)

10.3.1   Setting the data output to SPC

You can output calculation results from the SJ-210 to a DP-1VR when data output is set to "SPC".

With this setting, calculation results are output when the [POWER/DATA] key on the SJ-210 or the [DATA] key on the DP-1VR is pressed.

NOTE • The factory default setting for data output is "SPC".

TIP • For information of connecting the SJ-210 to a DP-1VR, and about SPC data output, refer to 13.1, "SPC Data Output".

■ Operating procedure (Refer to "■ Accessing the Operating Environment Setup Menu screen" in Section 10.1.)

Home screen to Main Menu ⇒ | 🖩 Set Environ. | ⇒

Operating   Environment
Setup menu screen

1   Select "Data Output" with the [↑] [↓] keys, and press the [Enter/Menu] key.

Data Output Setup screen

2   Select "SPC" with the [↑] [↓] keys, and press the [Enter/Menu] key.
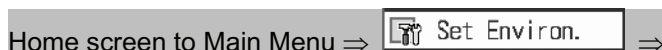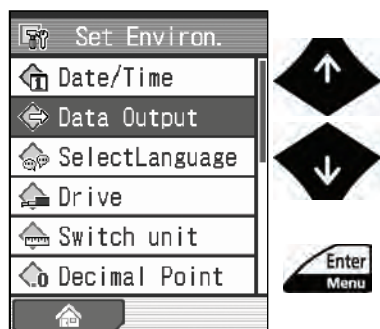
TIP • Press the [Esc/Guide] key to return to the previous screen.

10.3.2 Setting the data output to a printer

You can print out measurement results or conditions from the SJ-210 when data output is set to "Printer".

Printing commences when the [POWER/DATA] key is pressed.

There is also a function for automatic printing when a measurement is complete using the SJ-210.

> **TIP** • For information about connecting the SJ-210 to a printer, and about printing, refer to 13.2, "Printing to an External Printer".

■ Operating procedure (Refer to "■ Accessing the Operating Environment Setup Menu screen" in Section 10.1.)

Home screen to Main Menu ⇒ 🔧 Set Environ. ⇒

ironment Setup menu screen
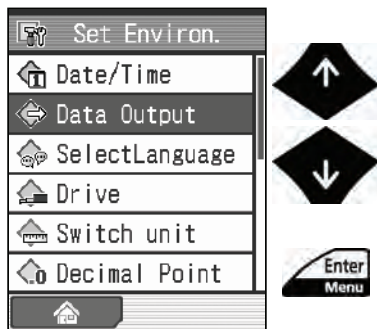
1 Select "Data Output" with the [↑] [↓] keys, and press the [Enter/Menu] key.

Data Output Setup screen
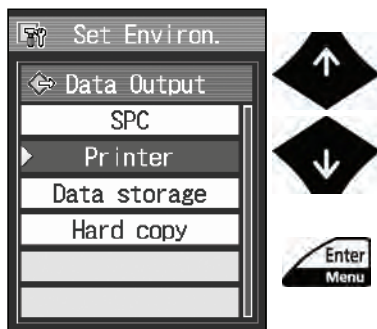
2 Select "Printer" with the [↑] [↓] keys, and press the [Enter/Menu] key.

> **NOTE** • The factory default setting for data output is "SPC". When using a printer for data output, make sure to change the output setting to "Printer".
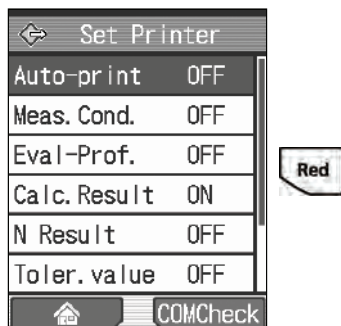
Print Setup screen

3 Confirm the communication status with the printer.

> **TIP** • For information about confirming the printer's communication status, refer to 13.2.2, "Setting the printer communication conditions".

10-8

Print Setup screen

⇔ Set Printer	
Auto-print	OFF
Meas. Cond.	OFF
Eval-Prof.	OFF
Calc. Result	ON
N Result	OFF
Toler. value	OFF
🏠	COMCheck
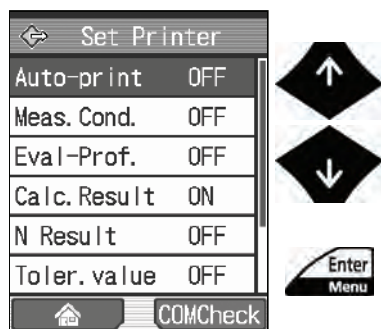
4 Select "Auto-print" with the [↑] [↓] keys.

5 Set the auto-print function to ON or OFF.
Auto-print is a function that automatically prints a measurement result after a measurement is complete.
Pressing the [Enter/Menu] key cycles through the available settings, "ON" and "OFF".
"ON": Sets the auto-print function to ON.
"OFF": Sets the auto-print function to OFF.

6 Set the items to print and the print magnification as required.

NOTE • For information about print item setup, refer to 10.3.2.1, "Setting the print items".

• For information about setting the print magnification, refer to 10.3.2.2, "Setting the print magnification". Note that the factory default setting for vertical and horizontal magnification is "AUTO" (automatic optimal magnification).

TIP • Press the [Esc/Guide] key to return to the previous screen.

• The screen returns to the Home screen when the "Home" ([Blue] key) is pressed.

10.3.2.1 Setting the print items

When printing output from the SJ-210, the following items can be printed.

- Measurement conditions

- Evaluation profiles

- Calculation results

- N (sampling lengths) result

- Tolerance limit value

- BAC

- ADC

For the SJ-210 these variables for printing are referred to as print items. Each print item can be individually set for printing.

■ Operating procedure (Refer to "■ Accessing the Operating Environment Setup Menu screen" in Section 10.1.)

Home screen to Main Menu ⇒ | 🖫 Set Environ. | ⇒

Operating Environment
Setup menu screen

1 Select "Data Output" with the [↑] [↓] keys, and press the [Enter/Menu] key.
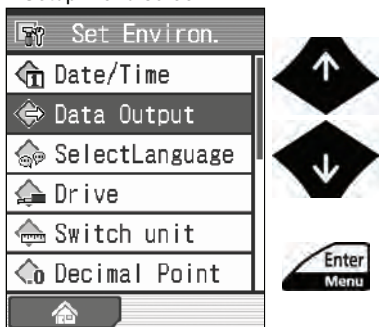
Data Output Setup screen

2 Select "Printer" with the [↑] [↓] keys, and press the [Enter/Menu] key.
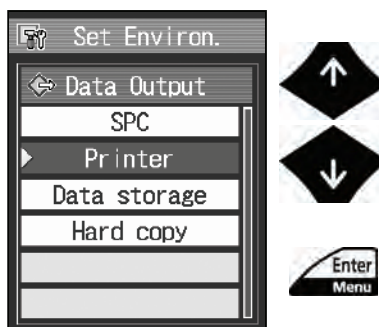
Print Setup screen

Set Printer	
Auto-print	OFF
Meas. Cond.	OFF
Eval-Prof.	OFF
Calc. Result	ON
N Result	OFF
Toler. value	OFF
🏠	COMCheck
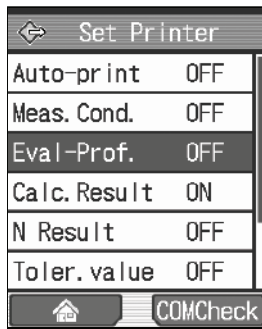
3 Select an item that you want to print with the [↑] [↓] keys, and press the [Enter/Menu] key.

Print Setup screen

Set Printer	
Auto-print	OFF
Meas. Cond.	OFF
Eval-Prof.	ON
Calc. Result	ON
N Result	OFF
Toler. value	OFF
🏠	COMCheck
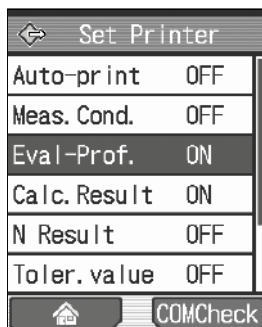
➢ The selected items displayed as "ON" are printed.

4 Carry out step 3 for all items that you want to print.

TIP • Press the [Esc/Guide] key to return to the previous screen.

• The screen returns to the Home screen when the "Home" ([Blue] key) is pressed.

10.3.2.2   Setting the print magnification

The SJ-210 can change the vertical and horizontal magnification of a printed evaluation profile.

■ Types of vertical and horizontal magnification

The following tables show the possible horizontal and vertical print magnifications that can be set.

Print Magnification

Vertical Magnification (factor)	Horizontal Magnification (factor)
10	1
20	2
50	5
100	10
200	20
500	50
1K	100
2K	200
5K	500
10K	1K
20K	AUTO
50K	
100K	
AUTO	

TIP • When "AUTO" is set, the optimal printing magnification is automatically chosen. During normal operation, it is recommended to use the "AUTO" setting.

• The vertical and horizontal magnification has been factory-set to "AUTO" (automatic optimal magnification).

■ Operating procedure (Refer to "■ Accessing the Operating Environment Setup Menu screen" in Section 10.1.)

Home screen to Main Menu ⇒ [🛠 Set Environ.] ⇒

Operating Environment
Setup menu screen
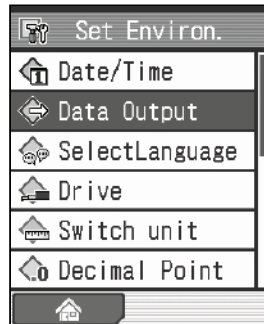
1 Select "Data Output" with the [↑] [↓] keys, and press the [Enter/Menu] key.

Data Output Setup screen
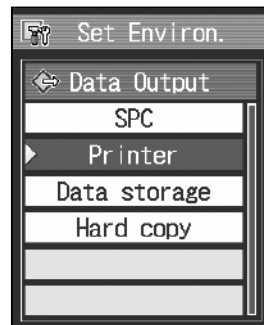
2 Select "Printer" with the [↑] [↓] keys, and press the [Enter/Menu] key.
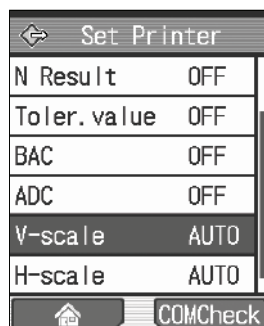
Print Setup screen

3 Select "V-scale" with the [↑] [↓] keys, and press the [Enter/Menu] key.

Vertical Print Magnification
Setup screen
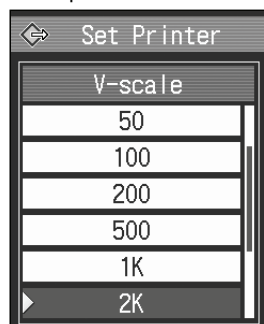
4 Select the vertical scale with the [↑] [↓] keys, and press the [Enter/Menu] key.

TIP • When "2K" is selected, the print magnification factor is set to 2000 times.

Print Setup screen

Set Printer	
N Result	OFF
Toler.value	OFF
BAC	OFF
ADC	OFF
V-scale	2K
H-scale	AUTO
⌂	COMCheck
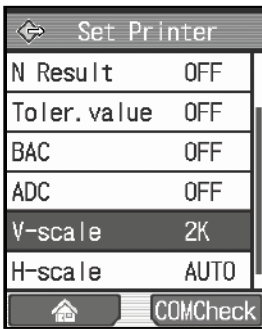
➤ The set vertical magnification is displayed on the Print Setup screen.

Print Setup screen

Set Printer	
N Result	OFF
Toler.value	OFF
BAC	OFF
ADC	OFF
V-scale	2K
H-scale	AUTO
⌂	COMCheck
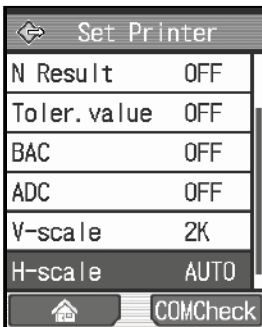
5 Select "H-scale" with the [↑] [↓] keys, and press the [Enter/Menu] key.

Horizontal Print Magnification Setup screen

Set Printer
H-scale
AUTO
1
2
5
10
▶ 20
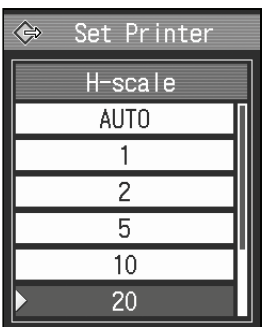
6 Select the horizontal scale with the [↑] [↓] keys, and press the [Enter/Menu] key.

Print Setup screen

Set Printer	
N Result	OFF
Toler.value	OFF
BAC	OFF
ADC	OFF
V-scale	2K
H-scale	20
⌂	COMCheck
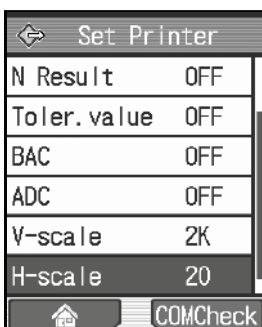
➤ The set horizontal magnification is displayed on the Print Setup screen.

TIP • Press the [Esc/Guide] key to return to the previous screen.

• The screen returns to the Home screen when the "Home" ([Blue] key) is pressed.

10.3.2.3 Setting the printer

The SJ-210 supports the following printers.

The necessary settings depend on the printer used.

Printer Type	Printer Model
PT-1	178-421
PT-2	—

■ Operating procedure (Refer to "■ Accessing the Operating Environment Setup Menu screen" in Section 10.1.)

Home screen to Main Menu ⇒ [🔧 Set Environ.] ⇒

Operating Environment Setup menu screen

Set Environ.
- 🏠 Date/Time
- ◇ Data Output
- 🐢 SelectLanguage
- 🏠 Drive
- Switch unit
- Decimal Point

1 Select "Data Output" with the [↑] [↓] keys, and press the [Enter/Menu] key.

Data Output Setup screen

Set Environ.
◇ Data Output
- SPC
- ▶ Printer
- Data storage
- Hard copy

2 Select "Printer" with the [↑] [↓] keys, and press the [Enter/Menu] key.

Print Setup screen
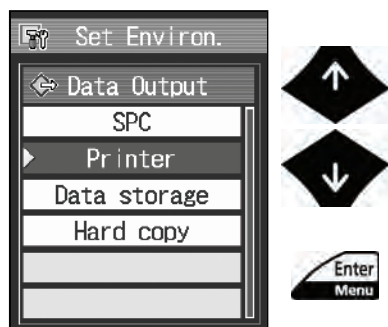
Set Printer
Toler.value	OFF
BAC	OFF
ADC	OFF
V-scale	AUTO
H-scale	AUTO
SelectPrint.	PT-1
🏠 COMCheck

3 Select "SelectPrint." with the [↑] [↓] keys.

Print Setup screen

⇔	Set Printer	
Toler.value	OFF	
BAC	OFF	
ADC	OFF	
V-scale	AUTO	
H-scale	AUTO	
SelectPrint.	PT-2	
🏠		

4 Set the printer type.

Pressing the [Enter/Menu] key cycles through the available settings, PT-1 and PT-2.

TIP • Press the [Esc/Guide] key to return to the previous screen.

• The screen returns to the Home screen when the "Home" ([Blue] key) is pressed.

10.3.3　Setting data output to save data

You can save calculation results and measurement data to the memory card when data output is set to "Data storage".
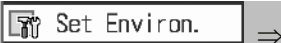
With this setting, calculation results and measurement data are saved to the memory card when the [POWER/DATA] key of the SJ-210 is pressed.

NOTE　• The factory default setting for data output is "SPC".

• After the power to the instrument is turned on, it may take more time than usual when the data is saved for the first time.

■ Operating procedure (Refer to "■ Accessing the Operating Environment Setup Menu screen" in Section 10.1.)

Home screen to Main Menu ⇒ | 🔧 Set Environ. | ⇒

Operating Environment
Setup menu screen
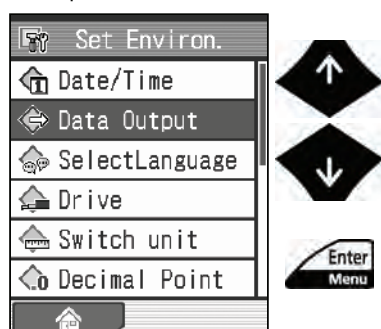
1　Select "Data Output" with the [↑] [↓] keys, and press the [Enter/Menu] key.

Operating Env
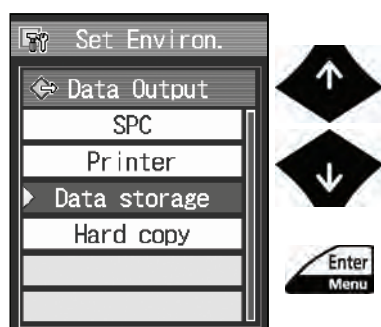
2　Select "Data storage" with the [↑] [↓] keys, and press the [Enter/Menu] key.

TIP　• Press the [Esc/Guide] key to return to the previous screen.

10.3.4 Setting the data output to hard copy

You can perform an image capture of displayed calculation results when data output is set to "Hard copy".

With this setting, graphical data of the displayed calculation results image is saved to the memory card when the [POWER/DATA] key of the SJ-210 is pressed.

NOTE • The factory default setting for data output is "SPC".

■ Operating procedure (Refer to "■ Accessing the Operating Environment Setup Menu screen" in Section 10.1.)

Home screen to Main Menu ⇒ | 📟 Set Environ. | ⇒

Operating Environment
Setup menu screen
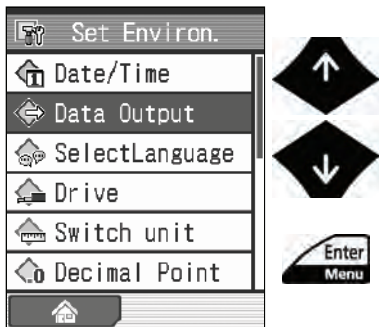
1 Select "Data Output" with the [↑] [↓] keys, and press the [Enter/Menu] key.

Data Output Setup screen
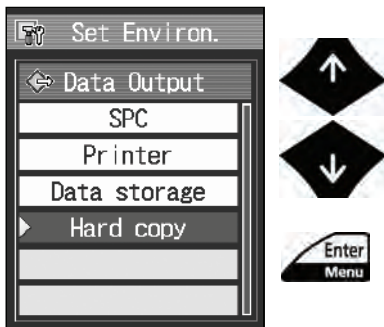
2 Select "Hard copy" with the [↑] [↓] keys, and press the [Enter/Menu] key.

> **TIP** • Press the [Esc/Guide] key to return to the previous screen.

10.4 Setting the Language Display

The SJ-210 supports the following languages.

・Japanese	・English	・German	・French
・Italian	・Spanish	・Portuguese	・Korean
・Chinese (traditional)	・Chinese (simplified)	・Czech	・Polish
・Hungarian	・Turkish	・Swedish	・Dutch

■ Operating procedure (Refer to "■ Accessing the Operating Environment Setup Menu screen" in Section 10.1.)

Home screen to Main Menu ⇒ [Set Environ.] ⇒

Operating Environment
Setup menu screen
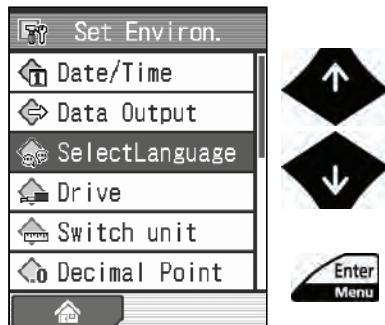
1 Select "SelectLanguage" with the [↑] [↓] keys, and press the [Enter/Menu] key.

Language Selection screen
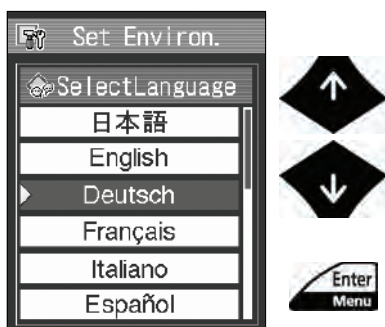
2 Select the display language with the [↑] [↓] keys, and press the [Enter/Menu] key.
To cancel the selection, press the [Esc/Guide] key instead of the [Enter/Menu] key.

Operating Environment
Setup menu screen

➢ The display switches to the selected language.

> **TIP** • Press the [Esc/Guide] key to return to the previous screen.

10.5 Calibrating Drive Unit Speed and Settings

Other than the standard drive unit, the SJ-210 also supports the detector retracting type drive unit as well as the transverse tracing type drive unit. As specifications such as start-up distance and maximum traversal distance differ depending on the drive unit used, the drive unit must be set up.

IMPORTANT • When the drive unit is exchanged, traversing speed calibration must be performed. There is a possibility that calculation results may be affected.

This is an explanation of the drive unit settings on the display unit.

TIP • For information about changing the drive unit refer to 3.2, "Attaching and Detaching the Drive/Detector Unit".

• To perform traversing speed calibration, the instrument must be calibrated using the included roughness specimen.
For the placement of the roughness specimen and the SJ-210, refer to 6.1, "Calibration Preparation".

■ Operating procedure (Refer to "■ Accessing the Operating Environment Setup Menu screen" in Section 10.1.)

Home screen to Main Menu ⇒ [🔧 Set Environ.] ⇒

Operating Environment
Setup menu screen
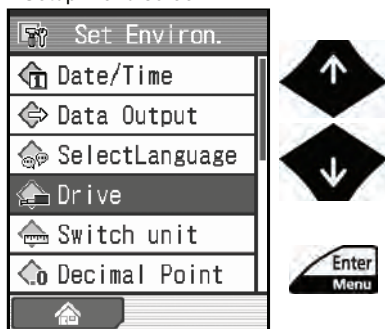
1 Select "Drive" with the [↑] [↓] keys, and press the [Enter/Menu] key.

Drive Unit Setup screen
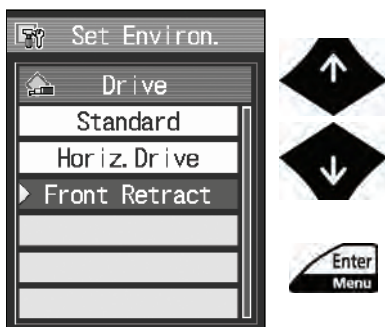
2 Select a drive unit type with the [↑] [↓] keys, and press the [Enter/Menu] key.
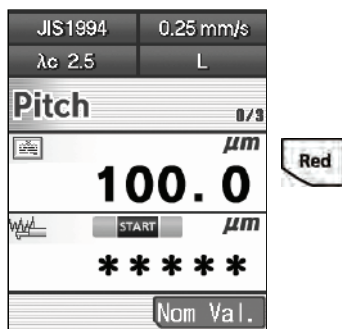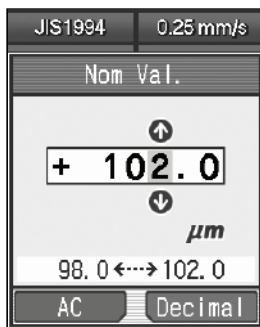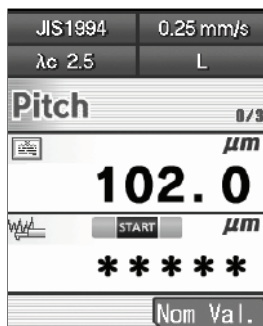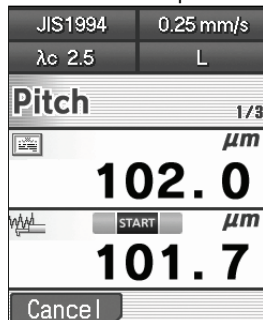
3 Set the nominal value for traversing speed calibration.

Calibration Setup screen

| JIS1994 | 0.25 mm/s |
| λc 2.5 | L |

Pitch   0/3

μm

100.0

START   μm

★ ★ ★ ★ ★

Nom Val.

Red

a On the Calibration Setup screen, press the "Nom Val." ([Red] key).

NOTE • Use the included roughness specimen for calibration. Confirm the placement of the drive unit with the roughness specimen.

TIP • To cancel calibration, press the [Esc/Guide] key. Return to the Operating Environment Setup menu.

Nominal Value Setup screen

| JIS1994 | 0.25 mm/s |

Nom Val.

⬆

+ 102.0

⬇

μm

98.0 ←···→ 102.0

AC   Decimal

b Input the nominal value.

IMPORTANT • The nominal value must be set to 100μm (3937 μin) when using the included roughness specimen.

TIP • Pressing the "AC" ([Blue] key) sets the value to 0. To change the position of decimal point, place the cursor at the desired position and press the "Decimal" ([Red] key).

• For information about numeric value entry, refer to 2.5, "Entering Numeric Values/Characters".

c Press the [Enter/Menu] key.

➤ The entered nominal value is displayed on the Calibration Setup screen.

Calibration Setup screen

| JIS1994 | 0.25 mm/s |
| λc 2.5 | L |

Pitch   0/3

μm

102.0

START   μm

★ ★ ★ ★ ★

Nom Val.

4 Press the [START/STOP] key to begin measurement.

➤ After measurement the pitch result is displayed. To cancel the displayed result, press the "Cancel" ([Blue] key).

Calibration Setup screen

| JIS1994 | 0.25 mm/s |
| λc 2.5 | L |

Pitch   1/3

μm

102.0

START   μm

101.7

Cancel

Calibration Setup screen

JIS1994	1.0 mm/s
λc 2.5	L

Pitch 3/3

µm
102.0

µm
101.7

Cancel   Update

Red
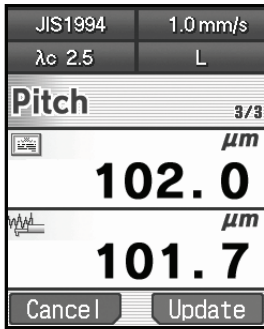
5   Three measurements need to be made, from 0.25mm/s to 0.75 mm/s (0.010 in/s to 0.030 in/s).

6   Press the "Update" ([Red] key).

   ➢   The traversing speed of the calibration result is changed.

7   Press the [Enter/Menu] key.

   TIP • Press the [Esc/Guide] key to return to the previous screen.

10.6 Switching the Measurement Units

When necessary, change the unit for the data such as the measurement results shown on the display. The units can be set to "mm" or "inch".

■ Operating procedure (Refer to "■ Accessing the Operating Environment Setup Menu screen" in Section 10.1.)

Home screen to Main Menu ⇒ [🖹 Set Environ.] ⇒

Operating Environment
Setup menu screen
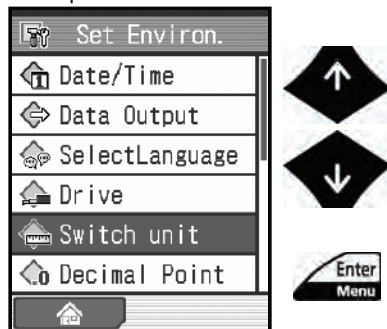
1 Select "Switch unit" with the [↑] [↓] keys, and press the [Enter/Menu] key.

Unit Selection screen

2 Select the unit of measurement to use with the [↑] [↓] keys, and press the [Enter/Menu] key.

TIP • Press the [Esc/Guide] key to return to the previous screen.

10.7 Setting the Decimal Point

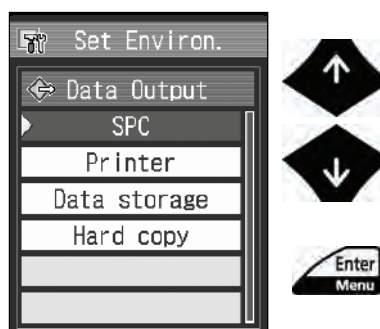You can change the character used as a decimal point in measurement displays, etc. The character can be a period, or a comma.

■ Operating procedure (Refer to "■ Accessing the Operating Environment Setup Menu screen" in Section 10.1.)

Home screen to Main Menu ⇒ [🔧 Set Environ.] ⇒

Operating Environment
Setup menu screen
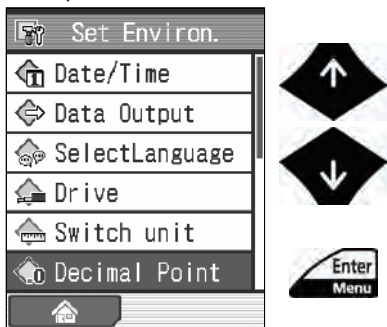
1 Select "Decimal Point" with the [↑] [↓] keys, and press the [Enter/Menu] key.

Decimal Point selection
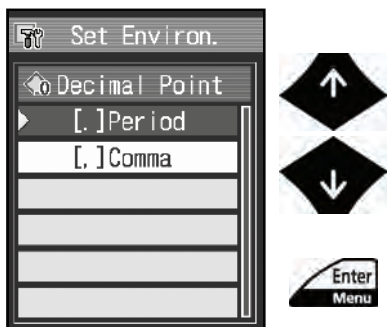
2 Select the decimal point to use with the [↑] [↓] keys, and press the [Enter/Menu] key.

> **TIP** • Press the [Esc/Guide] key to return to the previous screen.

10.8   Adjust the Volume of Indicator Sounds

You can adjust the volume of the buzzer that sounds when the operation keys are pressed.

■ Operating procedure (Refer to "■ Accessing the Operating Environment Setup Menu screen" in Section 10.1.)

Home screen to Main Menu ⇒ Set Environ. ⇒

Operating   Environment
Setup menu screen
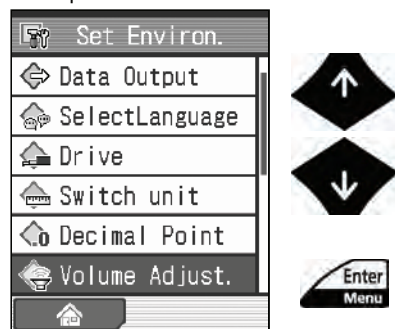
1   Select "Volume Adjust." with the [↑] [↓] keys, and press the [Enter/Menu] key.

Volume Adjustment screen
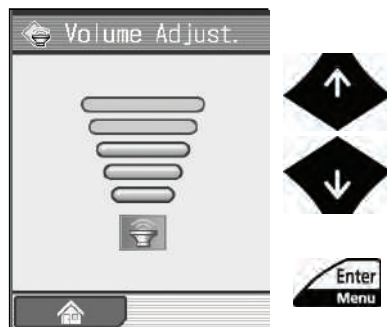
2   Select the volume level with the [↑] [↓] keys, and press the [Enter/Menu] key.

TIP   • Press the [Esc/Guide] key to return to the previous screen.

   • The screen returns to the Home screen when the "Home" ([Blue] key) is pressed.

10.9 Restricting Operation Functions (Customization)

You can restrict the access of certain screens from the Main Menu screen with a password. The password is a 4-digit number.

IMPORTANT • If you forget the password, you will not be able to navigate beyond the Main Menu screen. In such cases, you can access the Operating Environment Setup menu by using the fixed password "210*". Display the Function Restriction Setup screen and enter a new password.

■ Operating procedure (Refer to "■ Accessing the Operating Environment Setup Menu screen" in Section 10.1.)

Home screen to Main Menu ⇒ [🕅 Set Environ.] ⇒

Operating Environment
Setup menu screen
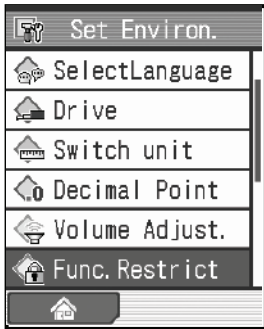
1 Select "Func. Restrict" with the [↑] [↓] keys, and press the [Enter/Menu] key.

Function Restriction
Setup screen
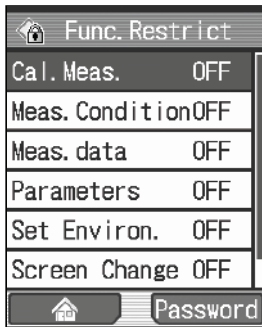
2 Press the "Password" ([Red] key).

Password Setup screen

3 Enter a 4-digit numeric password, and press the [Enter/Menu] key.

NOTE • When no password is entered and "****" is displayed when the [Enter/Menu] key is pressed, the password is set to "****".

TIP • For information about numeric value entry, refer to 2.5, "Entering Numeric Values/Characters".

Function Restriction Setup screen
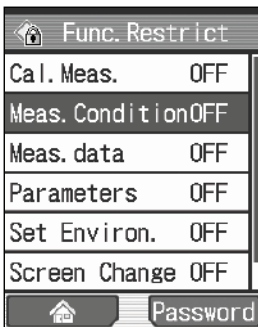
4 Select the item for password restriction with the [↑] [↓] keys, and press the [Enter/Menu] key.
Pressing the [Enter/Menu] key cycle through the available settings, "ON" and "OFF".
"ON": Password restricted.
"OFF": No password restriction.

Function Restriction Setup screen

➢ The selected items displayed as "ON" are restricted.
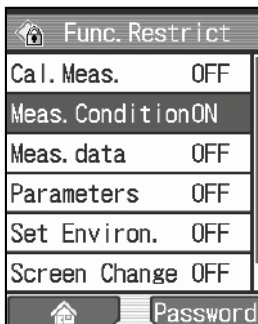
5 Carry out step 4 for all items that you want to restrict with passwords.

TIP • Press the [Esc/Guide] key to return to the previous screen.

• The screen returns to the Home screen when the "Home" ([Blue] key) is pressed.

10.10 Memory Card Formatting and File Management

You can format the memory card using the SJ-210. You can also delete individual files from the memory card.

IMPORTANT
- You must use the SJ-210 to format the memory card. The SJ-210 cannot save to or read data from a card that was not formatted using the SJ-210. In such cases, the memory card icon is not be displayed. Also, when you try to access the Memory Card Setup screen, "Memory card error!" is displayed.

- When using the formatted memory card on a machine other than the SJ-210 (such as PCs), card access may be slow.

Here are the various procedures explained.

10.10.1   Formatting the memory card

IMPORTANT
- When the memory card is formatted, all of its contents are erased.

■ Operating procedure (Refer to "■ Accessing the Operating Environment Setup Menu screen" in Section 10.1.)

Home screen to Main Menu ⇒ [🔧 Set Environ.] ⇒

Operating Environment
Setup menu screen

🔧 Set Environ.
⌂ Drive
⊟ Switch unit
.0 Decimal Point
≋ Volume Adjust.
🔒 Func. Restrict
🔲 Memory Card
⌂

1 Select "Memory Card" with the [↑] [↓] keys, and press the [Enter/Menu] key.
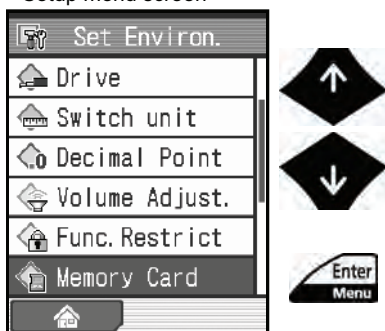
Memory Card Setup screen

🔲 Memory Card	
microSD	Unformatted
Use Cond.	0%
Text file	OFF
Save10Data	OFF
Backup	
⌂	
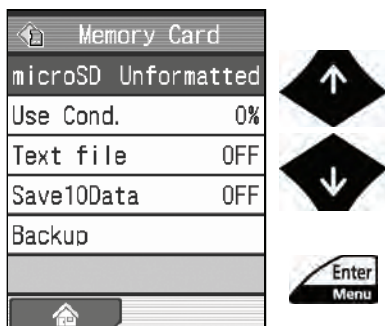
2 Select "microSD" with the [↑] [↓] keys, and press the [Enter/Menu] key.

3 Press the [Enter/Menu] key.

Memory Card Setup screen

➢ "Initialization" is displayed and the memory card is formatted.

NOTE • The format may take several minutes.

TIP • Press the [Esc/Guide] key to return to the previous screen.

• The screen returns to the Home screen when the "Home" ([Blue] key) is pressed.
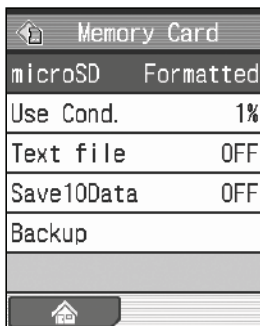
10.10.2 Checking the save status of the memory card

You can confirm the number of saved items on the memory card.

■ Operating procedure (Refer to "■ Accessing the Operating Environment Setup Menu screen" in Section 10.1.)

Home screen to Main Menu ⇒ [Set Environ.] ⇒
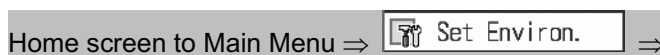
Operating Environment Setup menu screen
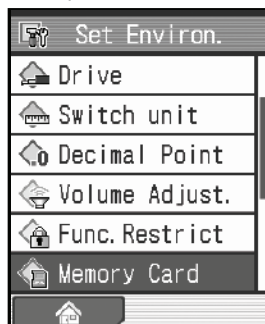
1 Select "Memory Card" with the [↑] [↓] keys, and press the [Enter/Menu] key.

Memory Card Setup screen
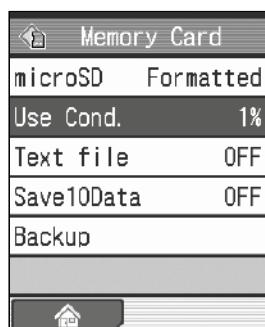
2 Select "Use Cond." with the [↑] [↓] keys, and press the [Enter/Menu] key.

Usage Condition screen

Use Cond.	
Meas. Cond.	1
Meas. data	11
Image data	0
Text data	1
Save10Data	0
Delete	

3 Confirm the number of saved items on the memory card.
You can delete data saved on the memory card by type.
To delete data, follow the procedures below.

NOTE • When you belete the measurement data, the text data is also deleted at the same time.

Usage Condition screen

Use Cond.	
Meas. Cond.	1
Meas. data	11
Image data	0
Text data	1
Save10Data	0
Delete	

↑
↓

Blue

a Select the desired type of data to be deleted with the [↑] [↓] keys, and press the "Delete" ([Blue] key).

b Press the [Enter/Menu] key.

➢ The date of the selected type is deleted, and the number of saved items becomes 0.

NOTE • When many files are being deleted, the process may take several minutes.

Usage Condition screen

Use Cond.	
Meas. Cond.	1
Meas. data	11
Image data	0
Text data	0
Save10Data	0
Delete	

TIP • Press the [Esc/Guide] key to return to the previous screen.

• The screen returns to the Home screen when the "Home" ([Blue] key) is pressed.

10.10.3 Saving text data to the memory card

Measurement data can be saved in text format to the memory card.

■ Operating procedure (Refer to "■ Accessing the Operating Environment Setup Menu screen" in Section 10.1.)

Home screen to Main Menu ⇒ | 📠 Set Environ. | ⇒

Operating   Environment
Setup menu screen
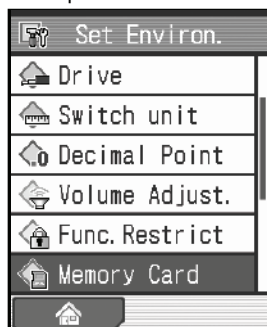
1   Select "Memory Card" with the [↑] [↓] keys, and press the [Enter/Menu] key.

Memory Card Setup screen
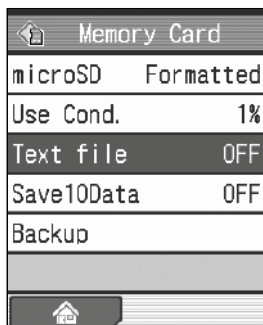
2   Select "Text file" with the [↑] [↓] keys, and press the [Enter/Menu] key.

Text File Saving Setup screen
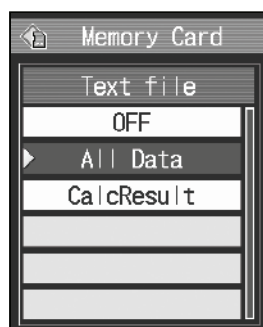
3   Select the type of data to be saved as text with the [↑] [↓] keys, and press the [Enter/Menu] key.
"OFF": Sets the save as text function to OFF.
"All Data": All data is saved as text.
"CalcResult": Only calculation results are saved as text.

Memory Card Setup screen

```
⌂  Memory Card
microSD    Formatted
Use Cond.        1%
Text file  All Data
Save10Data      OFF
Backup

⌂
```
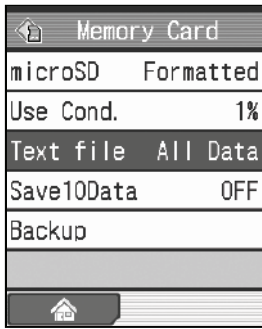
➢ The selected item is set and the Memory Card Setup screen is displayed.

TIP • Press the [Esc/Guide] key to return to the previous screen.

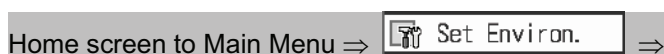• The screen returns to the Home screen when the "Home" ([Blue] key) is pressed.
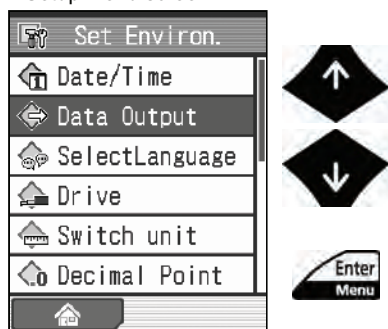
10.10.4 Setting the Save 10 function

The instrument can be set to automatically save the latest 10 measurements to the memory card.

This function is called "Save 10". Note that when more than 10 total items are saved, the older data is then deleted.

NOTE • After the power to the instrument is turned on, it may take more time than usual when the data is saved for the first time.

■ Operating procedure (Refer to "■ Accessing the Operating Environment Setup Menu screen" in Section 10.1.)
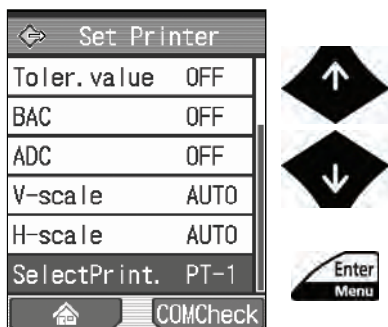
Home screen to Main Menu ⇒ | 🖩 Set Environ. | ⇒

Operating Environment
Setup menu screen

🖫 Set Environ.
⬆ Drive
🖽 Switch unit
🜚o Decimal Point
🖙 Volume Adjust.
🔒 Func. Restrict
🗎 Memory Card
🏠

1 Select "Memory Card" with the [↑] [↓] keys, and press the [Enter/Menu] key.
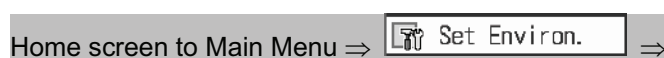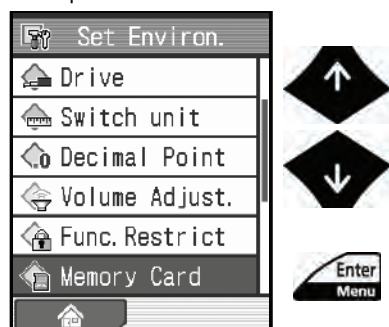
Memory Card Setup screen

🗎 Memory Card	
microSD	Formatted
Use Cond.	1%
Text file	OFF
Save10Data	OFF
Backup	
🏠	
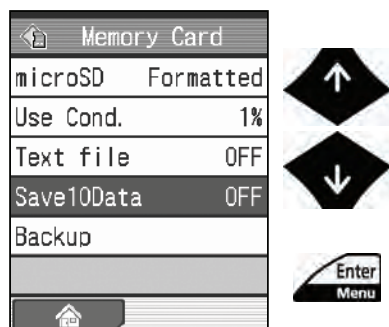
2 Select "Save10Data" with the [↑] [↓] keys.

Memory Card Setup screen

Memory Card	
microSD	Formatted
Use Cond.	1%
Text file	OFF
Save10Data	ON
Backup	
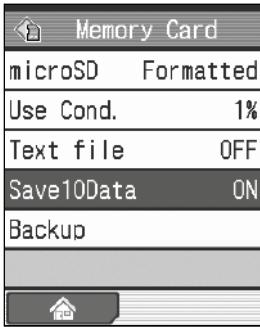
Enter
Menu

3 Setting the Save 10 function to ON or OFF.

Pressing the [Enter/Menu] key cycles through the available settings, "ON" and "OFF".

"ON": Sets the Save 10 function to ON.

"OFF": Sets the Save 10 function to OFF.

TIP • Press the [Esc/Guide] key to return to the previous screen.

• The screen returns to the Home screen when the "Home" ([Blue] key) is pressed.

10.10.5 Backing up the memory card and restoring backup data

You can back up 10 measurement conditions from the internal memory to the memory card.　Also, you can restore the backed up data from the memory card.

■ Operating procedure (Refer to "■ Accessing the Operating Environment Setup Menu screen" in Section 10.1.)

Home screen to Main Menu ⇒ 🔧 Set Environ. ⇒
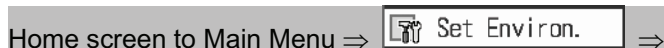
Operating Environment
Setup menu screen
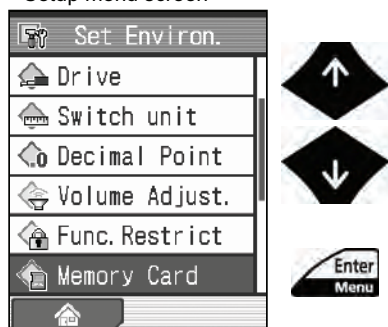
1 Select "Memory Card" with the [↑] [↓] keys, and press the [Enter/Menu] key.

Memory Card Setup screen
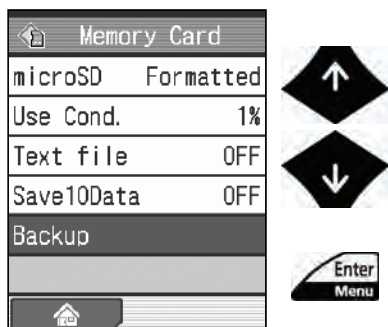
2 Select "Backup" with the [↑] [↓] keys, and press the [Enter/Menu] key.
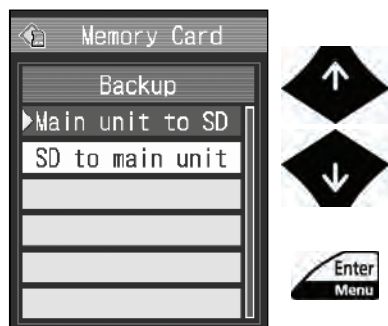
Backup screen

3 Select "Main unit to SD" with the [↑] [↓] keys, and press the [Enter/Menu] key.

Memory Card Setup screen

Memory Card	
microSD	Formatted
Use Cond.	1%
Text file	OFF
Save10Data	OFF
Backup	09/10/14
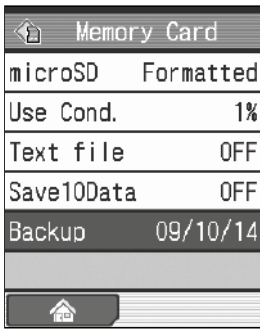
➢ The backup is performed, and the date of the backup is displayed on the Memory Card Setup screen.

TIP • Press the [Esc/Guide] key to return to the previous screen.

• The screen returns to the Home screen when the "Home" ([Blue] key) is pressed.

■ Operating procedure (Refer to "■ Accessing the Operating Environment Setup Menu screen" in Section 10.1.)

Home screen to Main Menu ⇒ [🔧 Set Environ.] ⇒

Operating Environment Setup menu screen

🔧 Set Environ.
🔼 Drive
🔼 Switch unit
🔼 Decimal Point
🔼 Volume Adjust.
🔼 Func. Restrict
🔼 Memory Card

1 Select "Memory Card" with the [↑] [↓] keys, and press the [Enter/Menu] key.

Memory Card Setup screen

Memory Card	
microSD	Formatted
Use Cond.	1%
Text file	OFF
Save10Data	OFF
Backup	09/10/14

2 Select "Backup" with the [↑] [↓] keys, and press the [Enter/Menu] key.

Backup screen

Memory Card
Backup
Main unit to SD
▶SD to main unit

3 Select "SD to main unit" with the [↑] [↓] keys, and press the [Enter/Menu] key.

➢ The backed up data is restored.

TIP • Press the [Esc/Guide] key to return to the previous screen.

• The screen returns to the Home screen when the "Home" ([Blue] key) is pressed.

10.11 Setting the Auto-sleep Function

The SJ-210 has an auto-sleep function for when the built-in battery is being used.

NOTE • When the AC adapter is used, auto-sleep does not function irrespective of the setting of the auto-sleep function. To turn off the SJ-210 power, press and hold the [Esc/Guide] key.

■ Operating procedure (Refer to "■ Accessing the Operating Environment Setup Menu screen" in Section 10.1.)

Home screen to Main Menu ⇒ Set Environ. ⇒
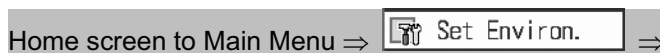
Operating Environment
Setup menu screen
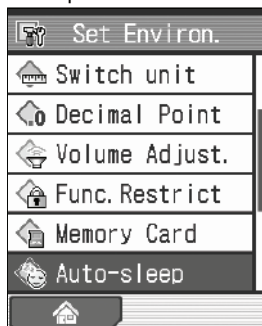
1 Select "Auto-sleep" with the [↑] [↓] keys, and press the [Enter/Menu] key.

Auto-Sleep Setup screen
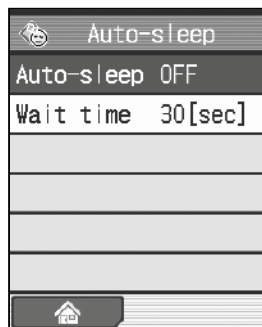
2 Set the auto-sleep function to ON or OFF.
Pressing the [Enter/Menu] key cycles through the available settings, "ON" and "OFF".
"ON": Sets the auto-sleep function to ON.
"OFF": Sets the auto-sleep function to OFF.

Auto-Sleep Setup screen
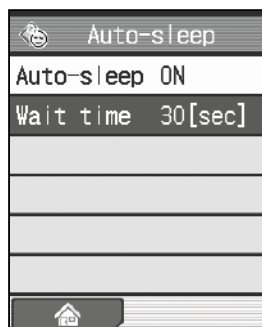
3 Select "Wait time" with the [↑] [↓] keys, and press the [Enter/Menu] key.

Waiting Time Setup screen
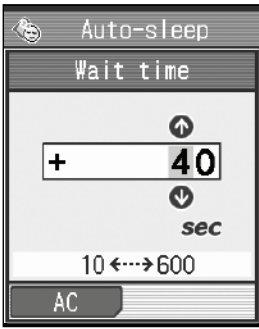
Auto-Sleep Setup screen
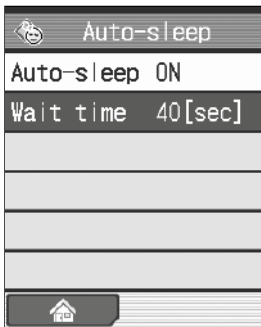
4   Set the amount of time to pass until auto-sleep.

> **TIP** • To clear the set time, press the "AC" ([Blue] key).
>
> • For information about numeric value entry, refer to 2.5, "Entering Numeric Values/Characters".

5   Press the [Enter/Menu] key.

> ➢ The wait time is set and and displayed on the Auto-Sleep Setup screen.
>
> **TIP** • To cancel settings input, press the [Esc/Guide] key instead of the [Enter/Menu] key.
>
> • Press the [Esc/Guide] key to return to the previous screen.
>
> • The screen returns to the Home screen when the "Home" ([Blue] key) is pressed.

10.12 Setting the Self-timer

You can set measurement to begin after an amount of time has passed from pressing the [START/STOP] key.

■ Operating procedure (Refer to "■ Accessing the Operating Environment Setup Menu screen" in Section 10.1.)

Home screen to Main Menu ⇒ ⌷ Set Environ. ⇒

Operating Environment
Setup menu screen
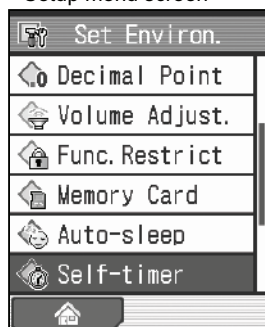
**1** Select "Self-timer" with the [↑] [↓] keys, and press the [Enter/Menu] key.

Self-Timer Setup screen
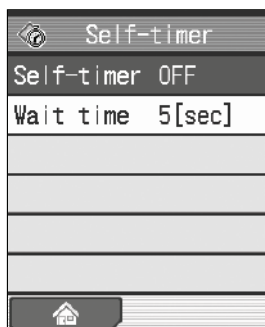
2 Set the self-timer function to ON or OFF.
Pressing the [Enter/Menu] key cycles through the available settings, "ON" and "OFF".
"ON": Sets the self-timer function to ON.
"OFF": Sets the self-timer function to OFF.

Self-Timer Setup screen

3 Select "Wait time" with the [↑] [↓] keys, and press the [Enter/Menu] key.

Waiting Time Setup screen
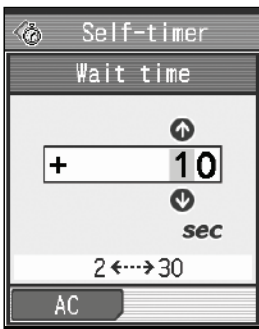
4 Set the amount of time before measurement is to begin.

> **TIP** • To clear the set time, press the "AC" ([Blue] key).
>
> • For information about numeric value entry, refer to 2.5, "Entering Numeric Values/Characters".

5 Press the [Enter/Menu] key.
To cancel settings input, press the [Esc/Guide] key instead of the [Enter/Menu] key.

Self-Timer Setup screen

➢ The wait time is set and and displayed on the Self-Timer Setup screen.

> **TIP** • Press the [Esc/Guide] key to return to the previous screen.
>
> • The screen returns to the Home screen when the "Home" ([Blue] key) is pressed.

10.13 Setting PC Communication Conditions

This is an explanation of setting the RS-232C interface to communicate with a PC.

NOTE • The SJ-210's RS-232C connector is used for both printer and PC connectivity.
The RS-232C communication settings here are for PC communication only. Printer communication conditions are internally fixed.

■ Operating procedure (Refer to "■ Accessing the Operating Environment Setup Menu screen" in Section 10.1.)

Home screen to Main Menu ⇒ [🛠 Set Environ.] ⇒

Operating Environment
Setup menu screen

1 Select "PC communicat." with the [↑] [↓] keys, and press the [Enter/Menu] key.

PC Communication
Setup screen
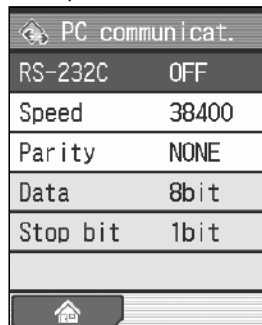
2 Setting the RS-232C communication function to ON or OFF.
Pressing the [Enter/Menu] key cycles through the available settings, "ON" and "OFF".
"ON": Sets RS-232C communication to ON.
"OFF": Sets RS-232C communication to OFF.

NOTE • When "RS-232C" is set to ON, communication to the PC is prioritized even when data output is set to "Printer".

PC Communication
Setup screen
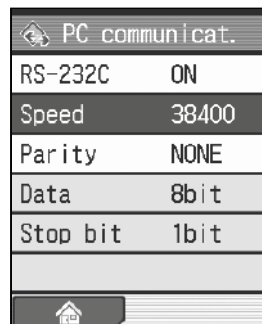
3 Select "Speed" with the [↑] [↓] keys, and press the [Enter/Menu] key.

Communication Speed Setup screen

PC communicat.

Speed	
	9600
▶	19200
	38400

↑

↓
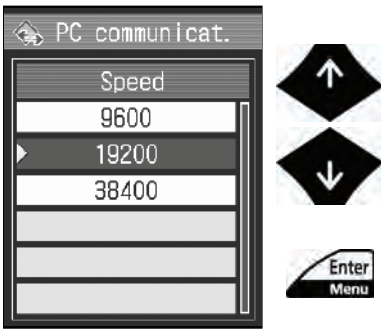
Enter
Menu

4 Select a communication speed with the [↑] [↓] keys, and press the [Enter/Menu] key.
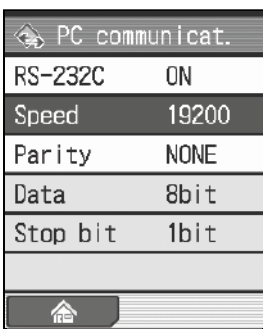
PC Communication Setup screen

PC communicat.

RS-232C	ON
Speed	19200
Parity	NONE
Data	8bit
Stop bit	1bit

🏠

➤ The selected item is displayed on the PC Communication Setup screen.

PC Communication Setup screen

PC communicat.

RS-232C	ON
Speed	19200
Parity	NONE
Data	8bit
Stop bit	1bit

🏠

↑

↓
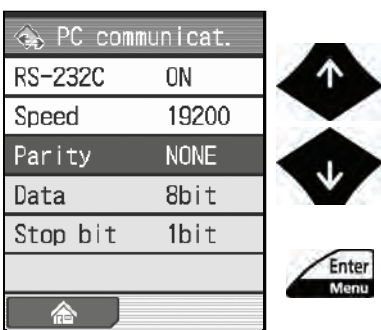
Enter
Menu

5 Select "Parity" with the [↑] [↓] keys, and press the [Enter/Menu] key.

Parity Setup screen

PC communicat.

Parity	
	ODD
▶	EVEN
	NONE

↑

↓
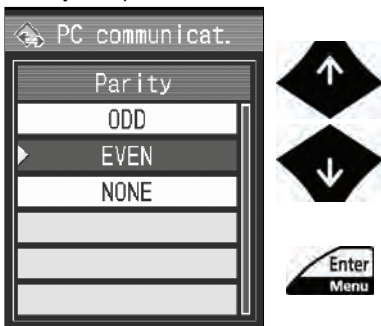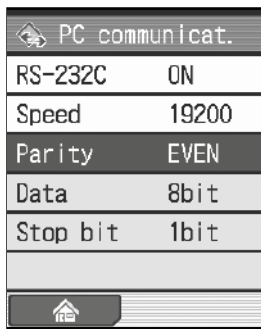
Enter
Menu

6 Select a parity with the [↑] [↓] keys, and press the [Enter/Menu] key.

PC Communication Setup screen

PC communicat.	
RS-232C	ON
Speed	19200
Parity	EVEN
Data	8bit
Stop bit	1bit

➢ The selected item is displayed on the PC Communication Setup screen.

TIP • Press the [Esc/Guide] key to return to the previous screen.

• The screen returns to the Home screen when the "Home" ([Blue] key) is pressed.

10.14 Displaying the Position of the Detector

You can confirm the current position of the detector.

■ Operating procedure (Refer to "■ Accessing the Operating Environment Setup Menu screen" in Section 10.1.)

Home screen to Main Menu ⇒ [🔧 Set Environ.] ⇒

Operating Environment
Setup menu screen

| 🔧 Set Environ. |
| 🔒 Func. Restrict |
| 🗂 Memory Card |
| 🔄 Auto-sleep |
| ⏱ Self-timer |
| 🔌 PC communicat. |
| 📐 Detect. Pos. |
| 🏠 |
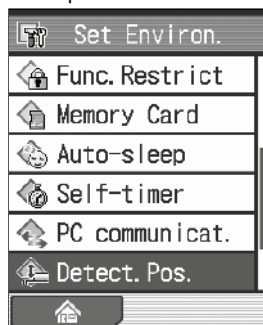
1 Select "Detect Pos." with the [↑] [↓] keys, and press the [Enter/Menu] key.

Detector Position
Display screen

| 📐 Detect. Pos. |
| **0.000** |
| *μm* |
| 🏠 |

2 Confirm the position of the detector.

TIP • Press the [Esc/Guide] key to return to the previous screen.

• The screen returns to the Home screen when the "Home" ([Blue] key) is pressed.

10.15 Testing the Display and Operation Keys

You can confirm that the display's colors are correct and that the operation keys are responding correctly.

■ Operating procedure (Refer to "■ Accessing the Operating Environment Setup Menu screen" in Section 10.1.)

Home screen to Main Menu ⇒ [🔩 Set Environ.] ⇒

Operating Environment
Setup menu screen

1 Select "LCD/key test" with the [↑] [↓] keys, and press the [Enter/Menu] key.

2 Confirm that the red color is displayed properly, and press the [Enter/Menu] key.

3 Confirm that the green color is displayed properly, and press the [Enter/Menu] key.

4 Confirm that the blue color is displayed properly, and press the [Enter/Menu] key.

LCD/Key Test screen

5 Press each key to confirm that they are responding correctly.
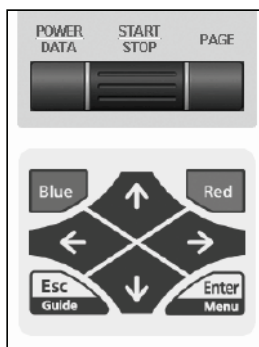
> **TIP** • Press the [Esc/Guide] key to return to the Operating Environment Setup screen. Test all the keys except for the [Esc/Guide] key.

10.16 Restoring Factory Default Settings

You can reset all settings in the SJ-210 to their original values (factory default settings).

IMPORTANT
- Care must be taken when resetting to the factory-set defaults. When the SJ-210 is reset, all of your set measurement conditions, etc. are be lost.

- Drive unit type settings, calibration information, decimal point settings and language settings remain unchanged.
  For information about the contents of the factory default settings, refer to 10.16.1, "Items restored to original values when restoring factory default settings".

■ Operating procedure (Refer to "■ Accessing the Operating Environment Setup Menu screen" in Section 10.1.)

Home screen to Main Menu ⇒ | 🔧 Set Environ. | ⇒

Operating Environment
Setup menu screen
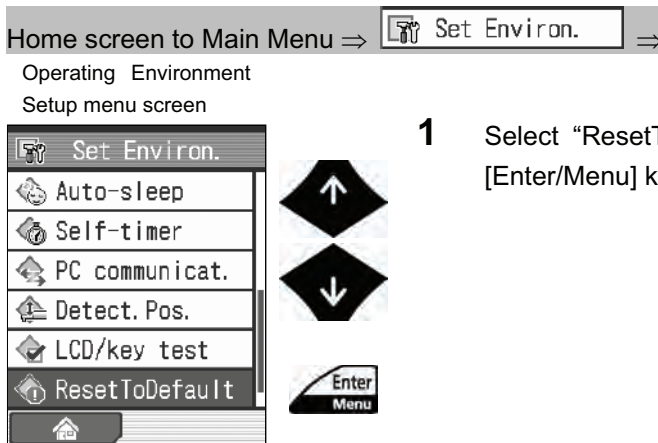
1 Select "ResetToDefault" with the [↑] [↓] keys, and press the [Enter/Menu] key.

2 Press the [Enter/Menu] key.

➢ All initial settings are restored.

TIP
- Press the [Esc/Guide] key to return to the previous screen.

- The screen returns to the Home screen when the "Home" ([Blue] key) is pressed.

10.16.1 Items restored to original values when restoring factory default settings

- Measurement data: all data is cleared.

- Measurement conditions, parameter detail settings, GO/NG judgment result tolerance values

Measurement conditions

Standard	Profile	Parameter	Filters	λc	λs	Number of sampling lengths	Pre-travel Post-travel	Traversal speed	Range
ISO1997	R	3 (Ra, Rq, Rz)	GAUSS	0.8	0.25	5	ON	0.5	AUTO

Parameter detail settings

Parameter	Definition	Unit	Number of sections	Height of the slice level	Slice level	Reference line	Slice depth
Sm/Pc/Ppi/Rc	Zp/Zv	%	—	10.0	—	—	—
HSC	Peak	%	—	10.0	—	—	—
mr	N	—	1	—	—	0%	0.1μm (3.9 μin)
mr(c)	Peak	%	2	—	10%, 15%	—	—
σc	—	—	1	—	25%	10%	—
AnnexA	ON	—	—	—	—	—	—

GO/NG judgment: the mean and tolerance values are all 0.

- Calibration measurement nominal values, calibration conditions, calibration history (except for the last calibration performed)
  Nominal value: 2.95 (standard type, retractable type), 1.00 (transverse tracing type)
  Calibration history: to be cleared.

Calibration conditions (standard type, retractable type)

Standard	Filters	λc	Number of sampling lengths	Traversal speed	Range
JIS1994	GAUSS	2.5	5	0.75	AUTO

Calibration conditions (transverse tracing type)

Standard	Filters	λc	Number of sampling lengths	Traversal speed	Range
JIS1994	GAUSS	0.8	5	0.5	AUTO

- Stylus alarm cumulative distance and threshold: to be cleared.

- Volume setting: level 3

- Auto-sleep setting
  Auto-sleep: ON
  Wait time: 30 sec

- Self-timer setting
  Self-timer: OFF
  Wait time: 5 sec

- PC communication setup

RS-232C	Speed	Parity	Data	Stop
OFF	38400	NONE	8 bit	1 bit

- Screen setup

Calculation results	Evaluation profiles	Graphs	Condition Lists	Set conditions	Display direction
One vertical column	Vertical display	Vertical display	Vertical display	Display	Rightward

- 10 conditions files: to be cleared.

10.17 Checking the Version

You can check the installed software version of the SJ-210.

■ Operating procedure (Refer to "■ Accessing the Operating Environment Setup Menu screen" in Section 10.1.)

Home screen to Main Menu ⇒ [🔧 Set Environ.] ⇒

Operating Environment
Setup menu screen
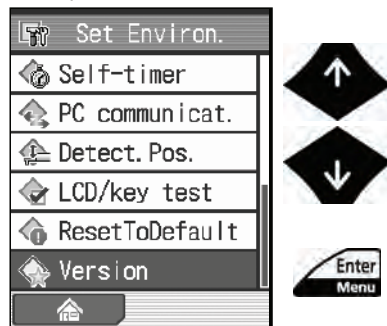
1 Select "Version" with the [↑] [↓] keys, and press the [Enter/Menu] key.

Version information
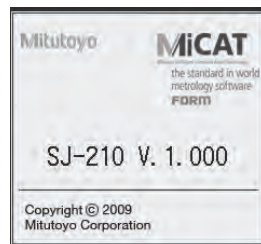
2 Confirm the version information, and press the [Enter/Menu] key.

TIP • Press the [Esc/Guide] key to return to the previous screen.

MEMO

11

SWITCHING THE CALCULATION RESULTS SCREEN

The S-210 can modify the display direction (vertical, horizontal) or the number of the parameters to display on the screen.
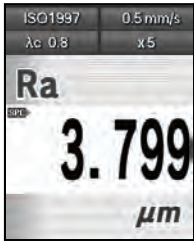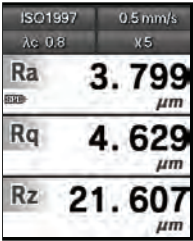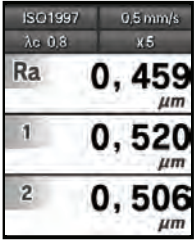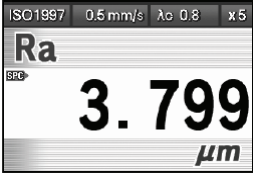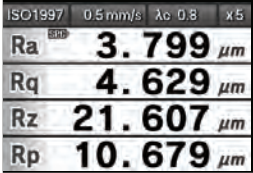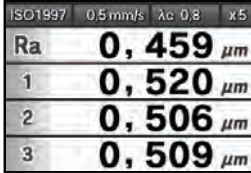
Display screen can be switched as follow.

- Switching the Calculation Results screen: The Calculation Results display can be selected from 6 types of display.

- Switching the Evaluation Profile screen: The display can be selected from the Vertical display/Horizontal display/Non-display.

- Switching the Graph Display screen: The display can be selected from the Vertical display/Horizontal display/Non-display.

- Switching the Condition List screen: The display can be selected from the Vertical display/Horizontal display/Non-display.

- Setting the display of the setting conditions: Display/Non-display the setting conditions can be selected when turning the power on.

- Switching the display direction: Display direction can be selected as desired.

11.1   Screen Display
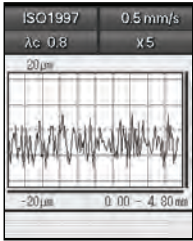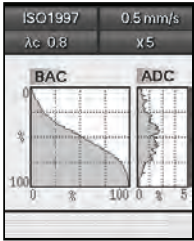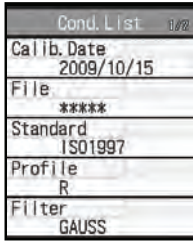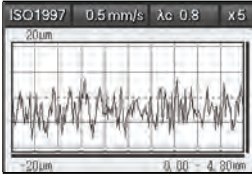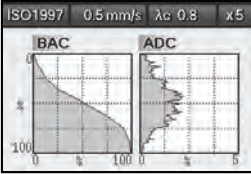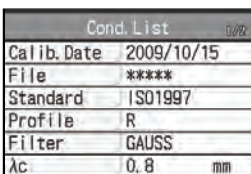
■ Calculation Result display

Display can be selected from 6 types as follow.

	1 Parameter	3/4 Parameter	Trace
Vertical display	ISO1997 0.5mm/s λc 0.8 x5 Ra 3.799 µm	ISO1997 0.5mm/s λc 0.8 x5 Ra 3.799 µm Rq 4.629 µm Rz 21.607 µm	ISO1997 0.5mm/s λc 0.8 x5 Ra 0,459 µm 1 0,520 µm 2 0,506 µm
Horizontal display	ISO1997 0.5mm/s λc 0.8 x5 Ra 3.799 µm	ISO1997 0.5mm/s λc 0.8 x5 Ra 3.799 µm Rq 4.629 µm Rz 21.607 µm Rp 10.679 µm	ISO1997 0.5mm/s λc 0.8 x5 Ra 0,459 µm 1 0,520 µm 2 0,506 µm 3 0,509 µm

■ Evaluation profile/Graph/Condition list display

The display can be selected from the Vertical display/Horizontal display/Non-display.

	Evaluation profiles	Graphs	Condition Lists
Vertical display	ISO1997 0.5mm/s λc 0.8 x5	ISO1997 0.5mm/s λc 0.8 x5 BAC ADC	Cond. List 1/2 Calib. Date 2009/10/15 File ***** Standard ISO1997 Profile R Filter GAUSS
Horizontal display	ISO1997 0.5mm/s λc 0.8 x5	ISO1997 0.5mm/s λc 0.8 x5 BAC ADC	Cond. List 1/2 Calib. Date 2009/10/15 File ***** Standard ISO1997 Profile R Filter GAUSS λc 0.8 mm

■ Switching the display direction

11-3

It is effective on the horizontal display.
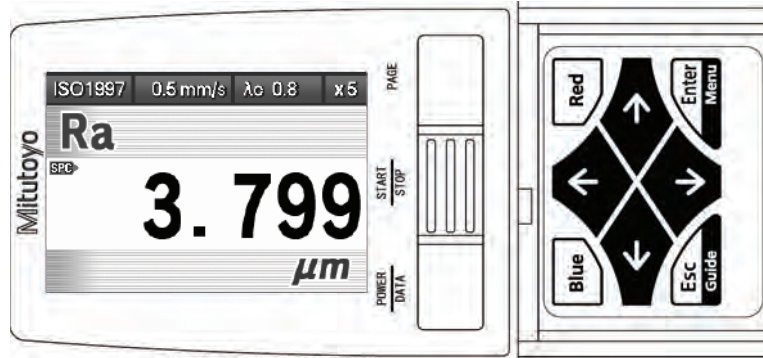
Rightward example
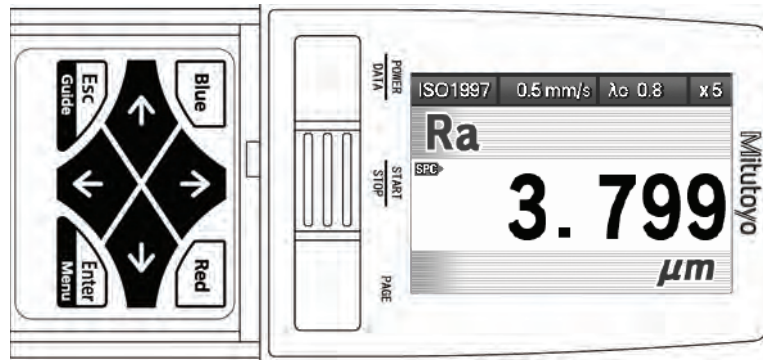
Leftward example

11.2 Switching the Calibration Results Screens Guide

■ Screens guide

1

Home screen

ISO1997	0.5 mm/s
λc 0.8	x5

Ra
SPC

3.799

μm

[Enter/Menu] →

← [Esc/Guide]

2

Main Menu screen

Main menu
- Calib. Meas.
- Meas. Condition
- Measured Data
- Parameters
- Set Environ.
- Screen Change

[Enter/Menu] →

← [Esc/Guide]

3

Screen Change Menu screen

Screen Change

Calc. Result	1Vertic.
Eval-Prof.	V-Disp.
Graph	V-Disp.
Cond. List	V-Disp.
SetCondit.	Display
Disp. Dir	R-hand
🏠	Initial.

[Esc/Guide] ↑   ↓ [Enter/Menu]

4

Calculation Result Display Setup screen

Screen Change

Calc. Result
- ▸ 1Vertic.
- 3Vertic.
- V. Trace
- 1 Horiz.
- 4 Horiz.
- H. Trace

Refer to 11.3

Evaluation Profile Display Setup screen

Screen Change

Eval-Prof.
- ▸ V-Disp.
- H-Disp.
- No Disp.

Refer to 11.4

Graph Display Setup screen

Screen Change

Graph
- ▸ V-Disp.
- H-Disp.
- No Disp.

Refer to 11.5

Condition List Display Setup screen

Screen Change

Cond. List
- ▸ V-Disp.
- H-Disp.
- No Disp.

Refer to 11.6

Condition Display Setup screen

Screen Change

Set Cond.
- ▸ Display
- No Disp.

Refer to 11.7

Display Direction Setup screen

Screen Change

Disp. Dir
- ▸ R-hand
- L-hand

Refer to 11.8

■ Accessing the Screen Change Menu screen   *11-5*
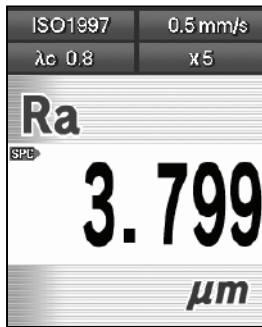
Home screen

1   Press the [Enter/Menu] key on the Home screen to display the Main Menu screen.

Main Menu screen
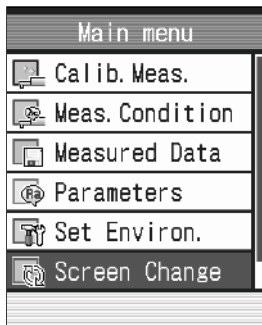
2   Select "Screen Change" with the [↑] [↓] keys, and press the [Enter/Menu] key.

11.3 Switching Calculation Results Screen

The display can be set up to display the calculated results vertically/horizontally on the screens. It can also be set up to display multiple numbers of parameter on one screen.

■ Operating procedure (Refer to "■ Accessing the Screen Change Menu screen" in Section 11.2.)

Home screen to Main Menu ⇒ [🖫 Screen Change] ⇒

Screen Change Menu screen

🖫 Screen Change	
Calc.Result	1Vertic.
Eval-Prof.	V-Disp.
Graph	V-Disp.
Cond.List	V-Disp.
SetCondit.	Display
Disp.Dir	R-hand
🏠	Initial.
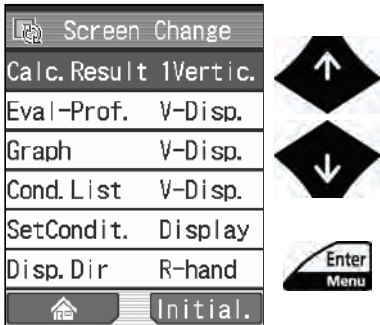
1 Select "Calc. Result" with the [↑] [↓] key, and press the [Enter/Menu] key.

Calculation Result Display Setup screen

🖫 Screen Change
Calc.Result
1Vertic.
▶ 3Vertic.
V.Trace
1 Horiz.
4 Horiz.
H. Trace
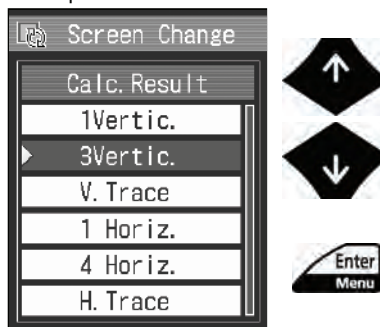
2 Select Calculation Result Setup screen with the [↑] [↓] key, and press the [Enter/Menu] key.

The following table shows the setup item and content of the setup screen.

Setup item	Description	
	Display direction	Display parameters
1Verticac.	Vertical	1
3Verticac.		3
V. Trace		1
1 Horiz.	Horizontal	1
4 Horiz.		4
H. Trace		1

> **TIP** • For information about displaying the vertical/horizontal trace, refer to 5.1.6, "Trace display".
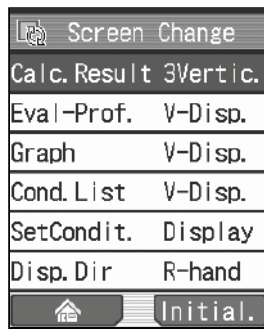
Screen Change Menu screen

```
Screen Change
Calc.Result  3Vertic.
Eval-Prof.   V-Disp.
Graph        V-Disp.
Cond.List    V-Disp.
SetCondit.   Display
Disp.Dir     R-hand
   ⌂          Initial.
```

➢ The setup items appear on the Screen Change Menu screen.

TIP
• For information about display after setup has been completed, refer to 11.1, "Screen Display".

• Press the [Esc/Guide] key to return to the previous screen.

• The screen returns to the Home screen when the "Home" ([Blue] key) is pressed.

11.4　Switching Evaluation Profile Screen

This section explains how to set the display direction and non-display of the evaluation profile.

■ Operating procedure (Refer to "■ Accessing the Screen Change Menu screen" in Section 11.2.)

Home screen to Main Menu ⇒　[🔄 Screen Change]　⇒

Screen Change Menu screen

🔄 Screen Change	
Calc.Result	1Vertic.
Eval-Prof.	V-Disp.
Graph	V-Disp.
Cond.List	V-Disp.
SetCondit.	Display
Disp.Dir	R-hand
🏠	Initial.
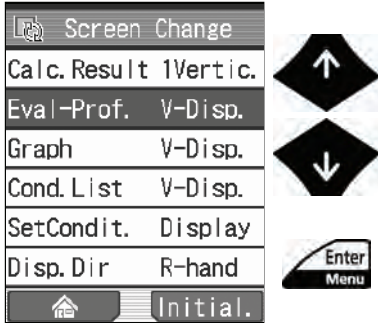
1　Select "Eval-Prof." with the [↑] [↓] keys, and press the [Enter/Menu] key.

Evaluation Profile Display
Setup screen
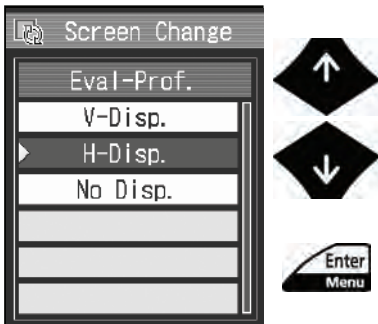
🔄 Screen Change
Eval-Prof.
V-Disp.
▶ H-Disp.
No Disp.

2　Select the display direction of the evaluation profile with the [↑] [↓] key, and press the [Enter/Menu] key.
The setup item is as follows.
"V-Disp.": Set the display direction of the evaluation profile to vertical.
"H-Disp.": Set the display direction of the evaluation profile to horizontal.
"No Disp.": The evaluation profile is not displayed.

Screen Change Menu screen
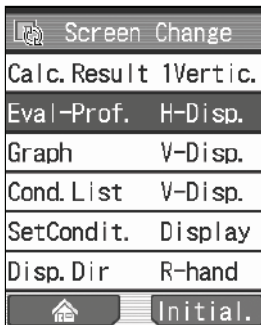
🔄 Screen Change	
Calc.Result	1Vertic.
Eval-Prof.	H-Disp.
Graph	V-Disp.
Cond.List	V-Disp.
SetCondit.	Display
Disp.Dir	R-hand
🏠	Initial.

➢　The setup items appear on the Screen Change Menu screen.

> **TIP**　• For information about display after setup has been completed, refer to 11.1, "Screen Display".
>
> • Press the [Esc/Guide] key to return to the previous screen.
>
> • The screen returns to the Home screen when the "Home" ([Blue] key) is pressed.

11.5   Switching Graph Display Screen

This section explains how to set the display direction or select the non-display of the graphs (BAC/ADC graphs) after measurement.

■ Operating procedure (Refer to "■ Accessing the Screen Change Menu screen" in Section 11.2.)

Home screen to Main Menu ⇒ | Screen Change | ⇒

Screen Change Menu screen
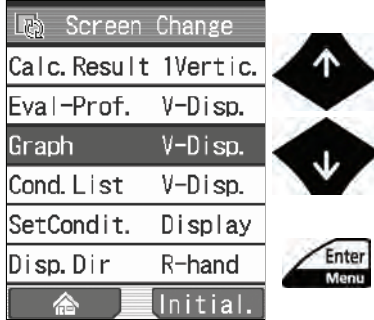
1   Select "Graph" with the [↑] [↓] keys, and press the [Enter/Menu] key.

Graph Display Setup screen
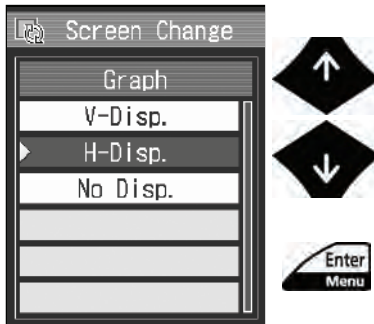
2   Select the display direction of the graph with the [↑] [↓] key, and press the [Enter/Menu] key.
The setup item is as follows.
"V-Disp.": Set the display direction of the graph to vertical.
"H-Disp.": Set the display direction of the graph to horizontal.
"No Disp.": The graph is not displayed.

Screen Change Menu screen
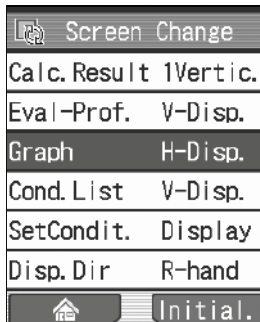
➢   The setup items appear on the Screen Change Menu screen.

TIP • For information about display after setup has been completed, refer to 11.1, "Screen Display".

• Press the [Esc/Guide] key to return to the previous screen.

• The screen returns to the Home screen when the "Home" ([Blue] key) is pressed.

11.6 Switching Measurement Conditions List Screen

This section explains how to set the display direction and select non-display of the current measurement conditions list.

■ Operating procedure (Refer to "■ Accessing the Screen Change Menu screen" in Section 11.2.)

Home screen to Main Menu ⇒ 🔲 Screen Change ⇒

Screen Change Menu screen

🔲 Screen Change	
Calc.Result	1Vertic.
Eval-Prof.	V-Disp.
Graph	V-Disp.
Cond.List	V-Disp.
SetCondit.	Display
Disp.Dir	R-hand
🏠	Initial.
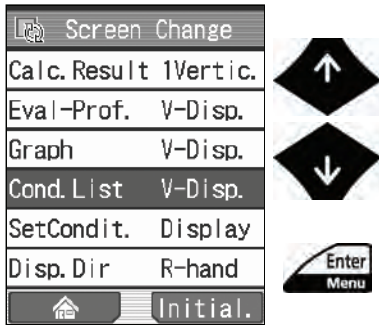
1 Select "Cond.List" with the [↑] [↓] keys, and press the [Enter/Menu] key.

Condition List Display Setup screen
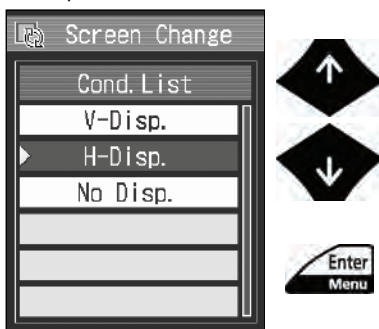
🔲 Screen Change
Cond.List
V-Disp.
▶ H-Disp.
No Disp.

2 Select the display direction of the evaluation profile with the [↑] [↓] key, and press the [Enter/Menu] key.
The setup item is as follows.
"V-Disp.": Set the display direction of the conditions list to vertical.
"H-Disp.": Set the display direction of the conditions list to horizontal.
"No Disp.": The conditions list is not displayed.

Screen Change Menu screen
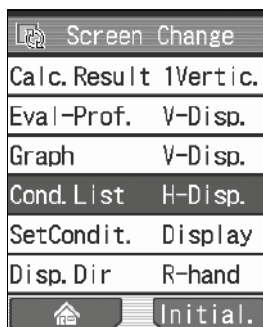
🔲 Screen Change	
Calc.Result	1Vertic.
Eval-Prof.	V-Disp.
Graph	V-Disp.
Cond.List	H-Disp.
SetCondit.	Display
Disp.Dir	R-hand
🏠	Initial.

➢ The setup items appear on the Screen Change Menu screen.

TIP • For information about display after setup has been completed, refer to 11.1, "Screen Display".

• Press the [Esc/Guide] key to return to the previous screen.

• The screen returns to the Home screen when the "Home" ([Blue] key) is pressed.

11.7 Setting the Display of the Setting Conditions

This section explains the setup whether to display the settings such as the calibration date, cumulative distance and data output when turning the power on.

■ Operating procedure (Refer to "■ Accessing the Screen Change Menu screen" in Section 11.2.)

Home screen to Main Menu ⇒ 🔲 Screen Change ⇒

Screen Change Menu screen

🔲 Screen Change	
Calc.Result	1Vertic.
Eval-Prof.	V-Disp.
Graph	V-Disp.
Cond.List	V-Disp.
SetCondit.	Display
Disp.Dir	R-hand
🏠	Initial.
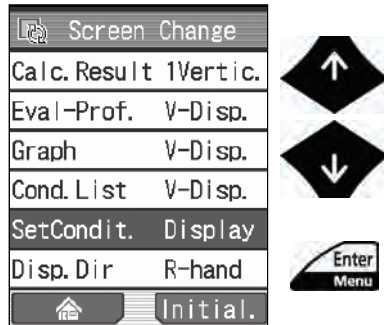
1 Select "SetCondit." with the [↑] [↓] keys, and press the [Enter/Menu] key.

Condition Display Setup screen

🔲 Screen Change
Set Cond.
Display
▶ No Disp.
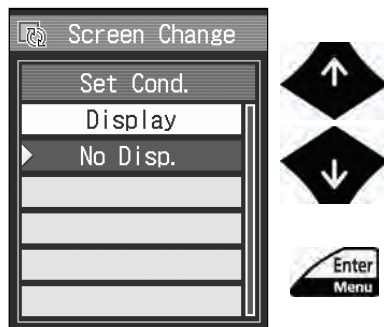
2 Select the setting conditions display with the [↑] [↓] key, and press the [Enter/Menu] key.
The setup item is as follows.
"Display": Displays the setting conditions.
"Non Disp.": The setting conditions are not displayed.

Screen Change Menu screen

🔲 Screen Change	
Calc.Result	1Vertic.
Eval-Prof.	V-Disp.
Graph	V-Disp.
Cond.List	V-Disp.
SetCondit.	No Disp.
Disp.Dir	R-hand
🏠	Initial.
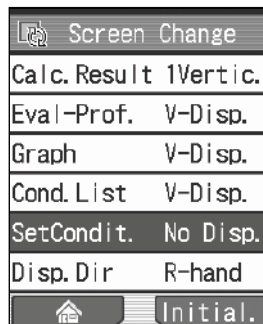
➢ The setup items appear on the Screen Change Menu screen.

TIP • Press the [Esc/Guide] key to return to the previous screen.

• The screen returns to the Home screen when the "Home" ([Blue] key) is pressed.

11.8 Switching the Display Direction

When displaying the screen to the horizontal, operation key position can be switched to the rightward or leftward.

■ Operating procedure (Refer to "■ Accessing the Screen Change Menu screen" in Section 11.2.)

Home screen to Main Menu ⇒ 🔄 Screen Change ⇒

Screen Change Menu screen
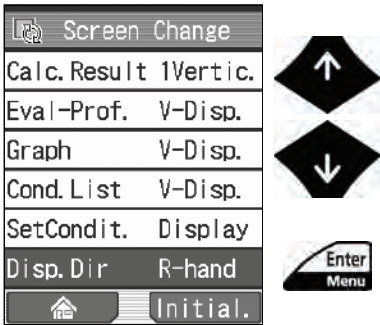
1 Select "Disp. Dir" with the [↑] [↓] keys, and press the [Enter/Menu] key.

Display Direction Setup screen
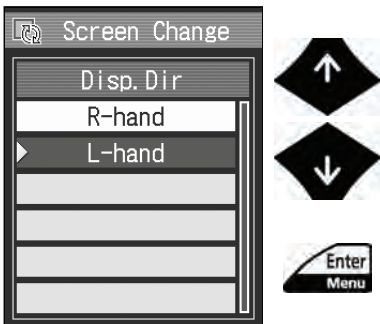
2 Select display direction with the [↑] [↓] keys, and press the [Enter/Menu] key.
The setup item is as follows.
"R-hand": Set the operation key position to the rightward on the screen.
"L-hand": Set the operation key position to the leftward on the screen.

Screen Change Menu screen
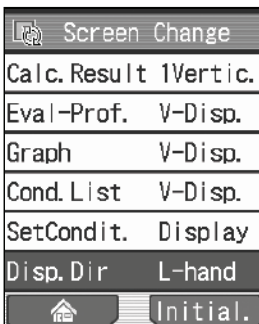
➤ The setup items appear on the Screen Change Menu screen.

TIP • For information about display after setup has been completed, refer to 11.1, "Screen Display".

• Press the [Esc/Guide] key to return to the previous screen.

• The screen returns to the Home screen when the "Home" ([Blue] key) is pressed.

12

USEFUL FEATURES OF THE SJ-210

This chapter describes features of the SJ-210 to make it more useful.

The SJ-210 provides following features.

For information about details and the settings, see the reference sections.

12.1 Shortcut Key

Shortcut keys for accessing the "Measurement Conditions screen" and "Measurement Conditions Files Register screen" are on the Home screen.

The cutoff lengths of the measurement conditions can be modified directly by pressing the [←] key. Likewise, the number of sampling lengths of the measurement conditions can be modified directly by pressing the [→] key.

Shortcut keys are as follows.

Shortcut Key	Description
[←] key	Changes the cutoff length (λc) to the INC.
[→] key	Changes the number of sampling lengths to the INC.
[Blue] key	Displays the screen to load 10 measurement conditions which are saved in the memory of the SJ-210.
[Red] key	Displays the Measurement Conditions screen.
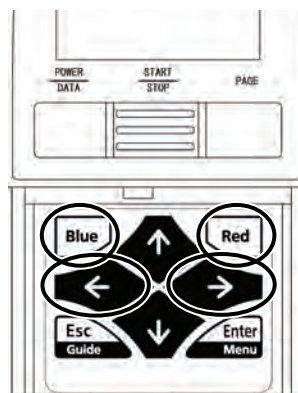
Assignment of the shortcut keys

12.2 Guidance Screen

Description for functions of the operating keys can be checked using the guidance functions.
For information about the guidance functions, refer to 2.4, "Displaying the Guide Screen".
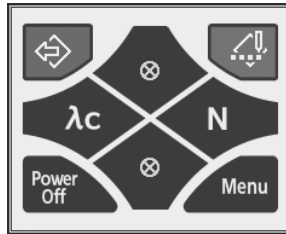
Guide screen

12.3 Indicating Contact State of the Detector

Whether the position of the detector is on the measurable range can be checked on this screen.

Check the color here.
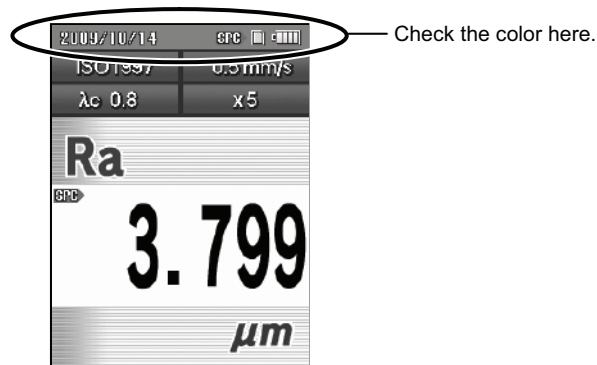
Indicating contact state of the detector

- When the item "Date" is blue, the detector tip is in the measurable position indicating it's in the measurable state.

- When the item "Date" is red, the detector tip is not in the measurable position indicating it's not in the measurable state.

NOTE · This function is effective other than the retracting type drive unit.

12.4 Displaying Calculation Results of the Continuous Measurement (Vertical Trace/Horizontal Trace)

The SJ-210 can save measurement results of the last 10 measurements for every customized parameter.

The measurement results are displayed in the chronological order. The latest measurement result is displayed in the highest column on the screen. The older measurement results are displayed in the lower columns in the chronological order.

The [↑] [↓] keys can be used to switch the displays shown in the lower columns than the second highest column.

Only the latest measurement result can be saved in the memory card, printed, and outputted as SPC data.

Trace screen

NOTE • The result data of the measurements performed before the last 10 measurements are deleted in order from the oldest data.

• The trace data is cleared when the Trace screen is freshened.

• The trace data may be cleared when the measurement conditions are changed.

TIP • For information about setting the Trace screen, refer to 11.3, "Switching Calculation Results Screen".

12.5 Loading/Saving 10 Measurement Conditions

Measurement conditions can be set in the memory of the SJ-210 up to 10. To load the measurement conditions saved in the memory of the SJ-210, just press the [Blue] key on the Home screen.

Select measurement conditions to load with the [↑] [↓] keys, and press the [Enter/Menu] key.

Home screen   Internal Memory Load screen

[Blue]
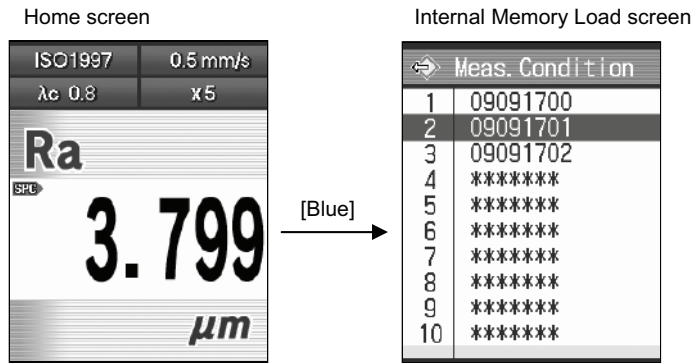
Displaying the SJ-210 Memory Load screen

NOTE • Measurement conditions saved in the memory of the SJ-210 will be deleted if power supply from both the AC adapter and battery is cut off.

TIP • For information about saving measurement conditions in the memory of the SJ-210, refer to 7.13.2, "Saving measurement conditions".

Ten measurement conditions saved in the memory of the SJ-210 can be backed up collectively when power supply is cut off due to occasions such as replacing the battery. You can load measurement conditions that have been backed up in the memory of the SJ-210.
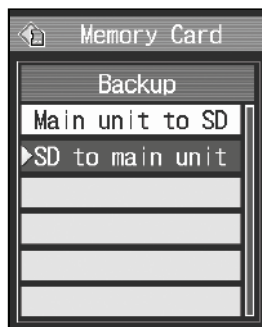
Backup screen

TIP • For more information about backing up to the memory card from the memory of the SJ-210, or restoring backup data from the memory card, refer to 10.10.5, "Backing up the memory card and restoring backup data".

12.6   Saving Measurement Results Automatically

When the Save 10 function is enabled, measurement results can be saved on the memory card automatically.

Measurement results are saved in the memory card's Save 10 folder. To load the measurement results, select the "Read10Data" on the Measurement Result Menu screen.
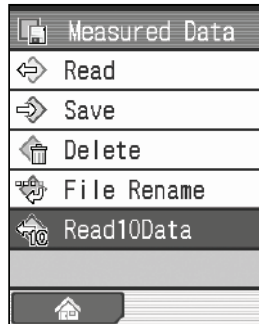
Measurement Result Menu screen

You can save, print and recalculate the loaded results in the same way as the usual measurement results.

NOTE • This function is available only when a memory card (optional) is inserted.

• The result data of the measurements performed before the last 10 measurements are deleted in order from the oldest data.

• After the power to the instrument is turned on, the first time data is saved may take more time than usual.

TIP • For information about setting the Save 10 function, refer to 10.10.4, "Setting the Save 10 function".

• For information about loading measurement results which has been saved using the Save 10 function, refer to 9.4, "Loading Measurement Results".

12.7   Hard Copying the Screen

The displayed screen image can be saved as BMP data to the memory card.
The image data is saved in the "IMG" folder on the memory card.

The image data can be transferred to a personal computer using communication software or a third-party SD card reader.

TIP • For information about setting the hard copying the screen, refer to 10.3.4, "Setting the data output to hard copy".

• The camera icon （) appears on the upper screen during hard copy screen mode.

12.8 Automatic Printing After Completing Measurement

When the auto-print function is enabled, a measurement result can be printed when a measurement is completed.

TIP ・ For information about setting the Auto-print, refer to 10.3.2, "Setting the data output to a printer".

12.9 Stylus Alarm

The stylus alarm function cumulates the measured lengths, and displays the message when designated threshold value exceeds the cumulative distance.

TIP ・ For information about setting the Stylus Alarm, refer to 6.7, "Setting the Stylus Alarm".

・ A message is displayed every time the power is turned on. Set the setting of the threshold to 0.0 when you do not want the message displayed.

12.10 Function Restriction

To prevent the settings (such as measurement conditions) from being modified, operations for each setup item on the Main Menu can be disabled.   To disable these operations, set the password.

The setup items which the operation functions can be restricted are as follows.

- Calibration measurement

- Measurement conditions

- Measured data

- Parameter

- Operating environment setup

- Screen change

- N (sampling lengths) result

TIP ・ For information about setting the function restriction, refer to 10.9, "Restricting Operation Functions (Customization)".

12.11 Foot Switch

It is possible to start measurement using the foot switch. The foot switch is an optional accessory. Please purchase it if necessary.

Foot switch connector
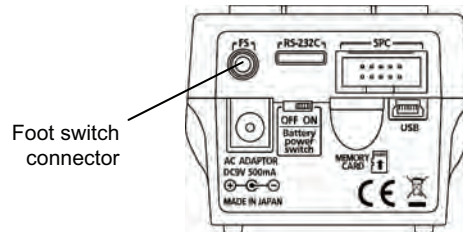
Rear view of the display unit (the rear cover is removed)

12.12 Self-timer

You can set measurement to begin after an amount of time has passed from pressing the [START/STOP] key with the Self-timer function.

TIP • For information about setting the self-timer, refer to 10.12, "Setting the Self-timer".

MEMO

13

SAVE / OUTPUT RESULTS USING [POWER/DATA] KEY

You can output or save measurement results to a connected optional accessory by pressing the [POWER/DATA] key.

By pressing the [POWER/DATA] key, you can save or output the selected function's measurement results.
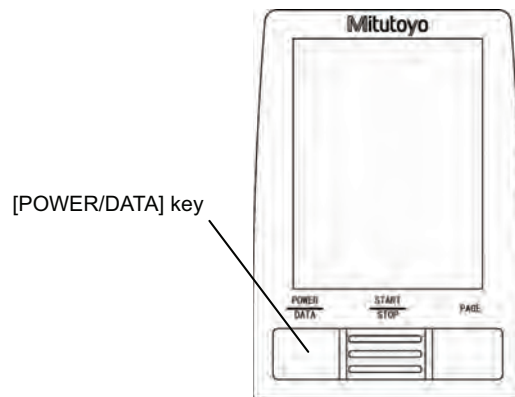
Operation key ([POWER/DATA] key)

SPC:	You can output measurement results to a data processor. A data processor (e.g., DP-1VR) must be connected in advance.
Printer:	You can output measurement results to a printer. Perform a communications check to set communications conditions.
Saving data:	Measurement results can be saved on the memory card. (The file name is automatically generated.)
Hard copy:	The currently displayed screen image is saved as image data to the memory card. (The file name is automatically generated.)

NOTE
- A DP-1VR (optional accessory) must be purchased for SPC output.

- For printer output from the SJ-210, an external printer (optional accessory) and proprietary RS-232C cable (optional accessory) must be purchased.

- To save data or create hard copies, a memory card (optional accessory) must be purchased.

13.1 SPC Data Output

By connecting the SJ-210 to a DP-1VR Digimatic data processor (optional accessory) with an SPC cable (optional accessory), calculation results are output using SPC and can be statistically processed and printed. Apart from recent measurements, data saved to the memory card can be loaded and output with SPC for statistical processing and printing.

IMPORTANT
- Only the calculation results of parameters with the SPC mark (**SPC**) can be output as SPC data. Parameter names, etc., are not output.

- When outputting parameter calculation results for statistical processing, take care to not include data obtained with differing parameters.
  An error may occur when multiple pieces of parameter data with differing units and decimal place positions are output to the Digimatic data processor.

The operation flow of outputting SPC data is described below.

Connect the DP-1VR
→ 13.1.1, "Connecting the SJ-210 and the DP-1VR"

Set calculation result output to "SPC"
→ 10.3.1, "Setting data output to SPC"

When outputting

When outputting saved data

Executing the actual measurement of the roughness specimen
→ Chapter 4, "MEASUREMENT OPERATION"

Loading saved data for output
→ 9.4, "Loading Measurement Data"

Selecting parameters to output
→ 13.1.2, "Selecting Parameters"

Outputting calculation results
→ 13.1.3, "Outputting SPC Data"
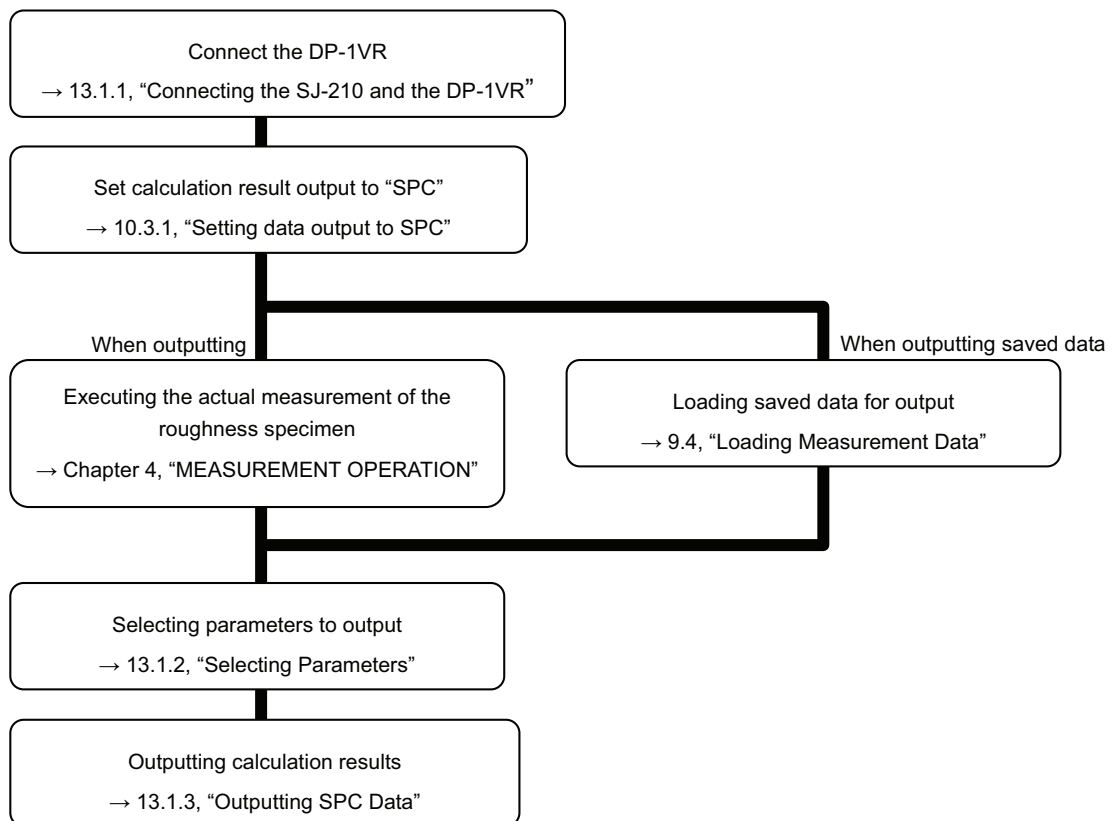
13.1.1   Connecting the SJ-210 and DP-1VR

IMPORTANT • Before connecting the SJ-210 to the DP-1VR, turn off the DP-1VR's unit settings. For information about DP-1VR unit settings, see the DP-1VR User's Manual.

Connect the SJ-210 and DP-1VR using the SPC cable according to the following procedure.

1   Place your nail on the hollow provided on the rear cover, and push the rear cover in the direction indicated by the arrow (1).

2   Pull the rear cover in the direction indicated by the arrow (2) and remove it.
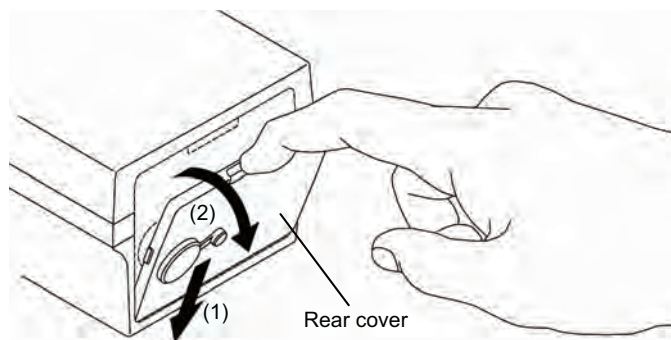
Detaching the rear cover

3   Use the proprietary SPC cable to connect the SJ-210 to the DP-1VR.
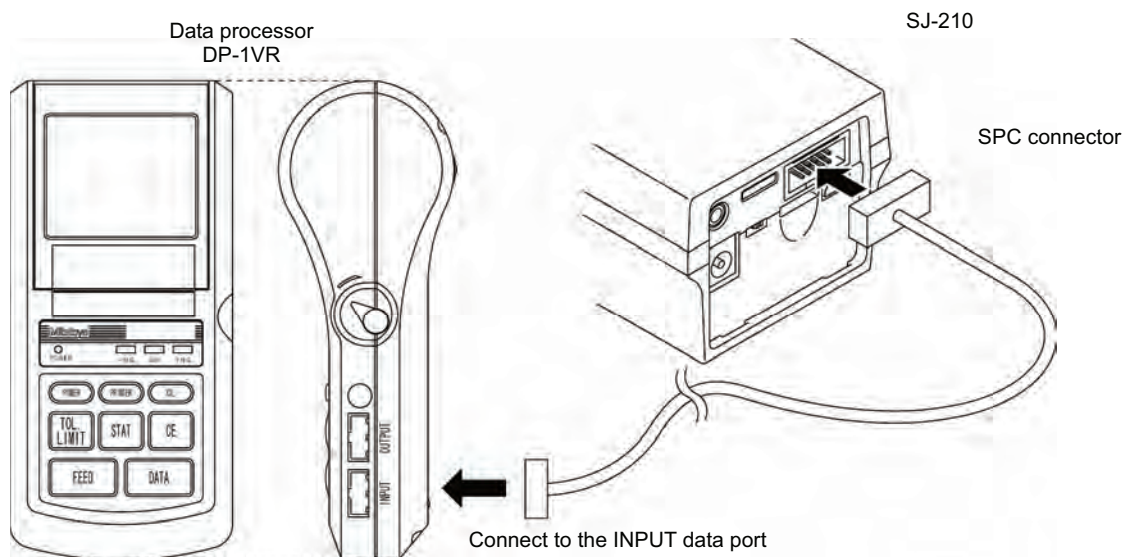
Connecting the SPC cable

4 Turn on the DP-1VR.

Data processor
DP-1VR

Turn ON the power.
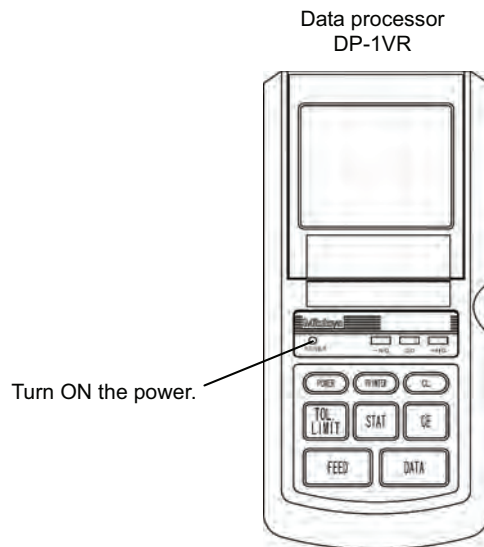
Turning ON the DP-1VR

5 Set the SPC output.

NOTE • The DP-1VR's tolerances cannot be set with the SJ-210.

TIP • For information about setting SPC output, refer to 10.3.1, "Setting data output to SPC".

13.1.2 Selecting parameters

Select the parameters for SPC output.

Only the calculation results of parameters displayed on the Home screen with the SPC mark (SPC) can be output as SPC data.

1 Press the [PAGE] key of the SJ-210 until the parameters you want to output are displayed.
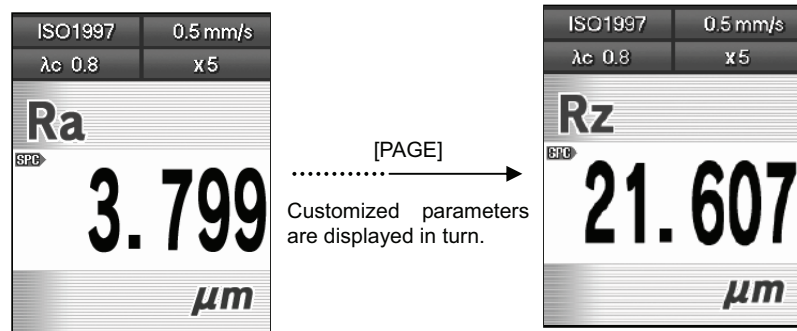
Parameter display

2 When multiple parameters are displayed on the same screen, use the [↑] [↓] keys to move the SPC mark, and select calculation result parameters to output.
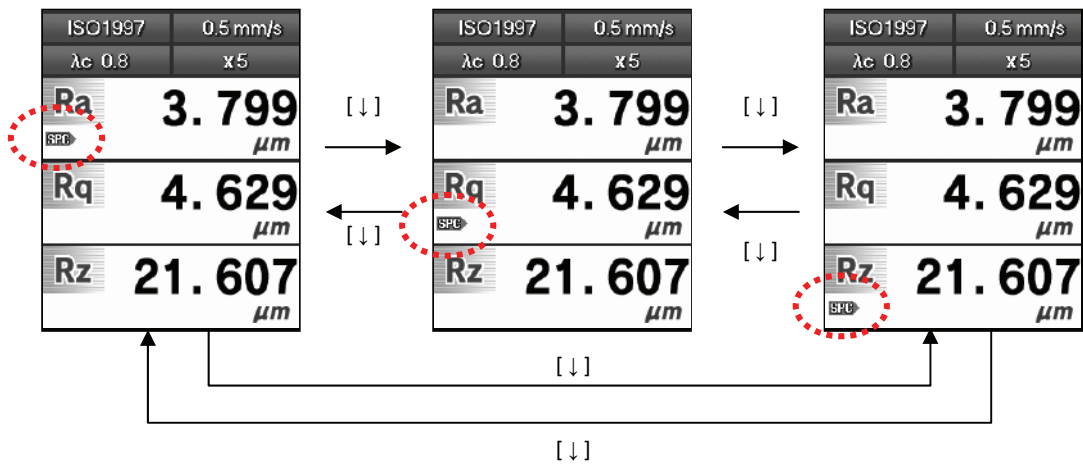
Parameter selection (multiple parameters on 1 screen)

13.1.3　Outputting SPC data

You can output calculation results from the SJ-210 to a DP-1VR when data output is set to "SPC".

With this setting made, calculation results are output when the [POWER/DATA] key on the SJ-210, or the [DATA] key on the DP-1VR is pressed.

TIP • For information about the connection of the SJ-210 and DP-1VR, refer to 13.1.1, "Connecting the SJ-210 and DP-1VR".

• For information about setting SPC output, refer to 10.3.1, "Setting the data output to SPC".

• You can load saved measurement data and output the calculation results. For information about loading measurement data, refer to 9.4, "Loading Measurement Results".

■ Operation procedure

1　Perform the measurement.

TIP • For information about measurement, refer to Chapter 4, "MEASUREMENT OPERATION".

2　Press the [POWER/DATA] key of the SJ-210 or the [DATA] button on the DP-1VR.

> ➢　Calculation results are output from the SJ-210 to the DP-1VR.

TIP • For information on the statistical processing of measurement results, see the DP-1VR User's Manual.

13.2 Printing to an External Printer

By connecting the SJ-210 to the printer (optional accessory) using the RS-232C printer cable (optional accessory), you can print measurement conditions, calculation results, evaluation profiles, and BAC or ADC contents.

NOTE • Two types of printers are available to use with the SJ-210, but apart from the printer cable and individual printer settings, you can print using similar operation procedures.

TIP • You can load saved measurement data and print the results.
For information about loading measurement data, refer to 9.4, "Loading Measurement Results".

The operation flow for printing measurement results is described below.
There are two types of operations: general operations and operations on demand. The former is performed regularly and the latter is performed as required. In the flow chart below, solid lines indicate general operations and dotted line indicates operations on demand.

```
        ┌─────────────────────────────────────┐
        │      Connecting the printer          │
        │  → 13.2.1, "Connecting the SJ-210    │
        │         and the printer"             │
        └─────────────────────────────────────┘
        ┌─────────────────────────────────────┐
        │  Setting the printer communication   │
        │             conditions               │
        │  → 13.2.2, "Setting the Printer      │
        │     Communication Conditions"        │
        └─────────────────────────────────────┘
        ┌─────────────────────────────────────┐
        │  Set calculation result output to    │
        │            "Printer"                 │
        │  → 10.3.2, "Setting data output      │
        │            to Printer"               │
        └─────────────────────────────────────┘
        ┌─────────────────────────────────────┐
        │       Setting the print items        │
        │  → 10.3.2.1 "Setting the print item  │
        └─────────────────────────────────────┘
        ┌─────────────────────────────────────┐
        │  omized parameters are displayed in  │
        │                                      │
        └─────────────────────────────────────┘
```

When printing   When printing saved data

```
┌─────────────────────────────┐   ┌─────────────────────────────┐
│ Executing the actual         │   │ Loading saved data for        │
│ measurement of the           │   │ printing                      │
│ roughness specimen           │   │ → 9.4, "Loading Measurement   │
│ → Chapter 4, "MEASUREMENT    │   │         Data"                 │
│   OPERATION"                 │   │                               │
└─────────────────────────────┘   └─────────────────────────────┘

        ┌─────────────────────────────────────────────┐
        │  → 13.2.3, "Printing calculation results     │
        │       and measurement conditions"           │
        └─────────────────────────────────────────────┘
```

13.2.1 Connecting the SJ-210 and printer

In order to print, the SJ-210 must be connected to the printer with the RS-232C printer cable.

The following optional printers are supported.

Printer Type	Printer Model
PT-1	178-421
PT-2	—

1 Place your nail on the hollow provided on the rear cover, and push the rear cover in the direction indicated by the arrow (1).

2 Pull the rear cover in the direction indicated by the arrow (2) and remove it.
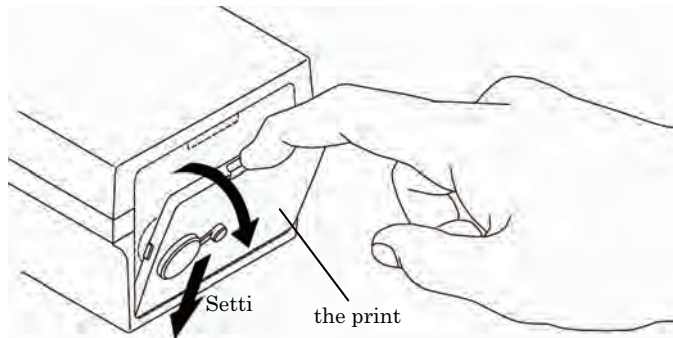
Detaching the rear cover

3 Connect the RS-232C communication port on the rear of the SJ-210 with the RS-232C port on the printer using the optional RS-232C printer cable.
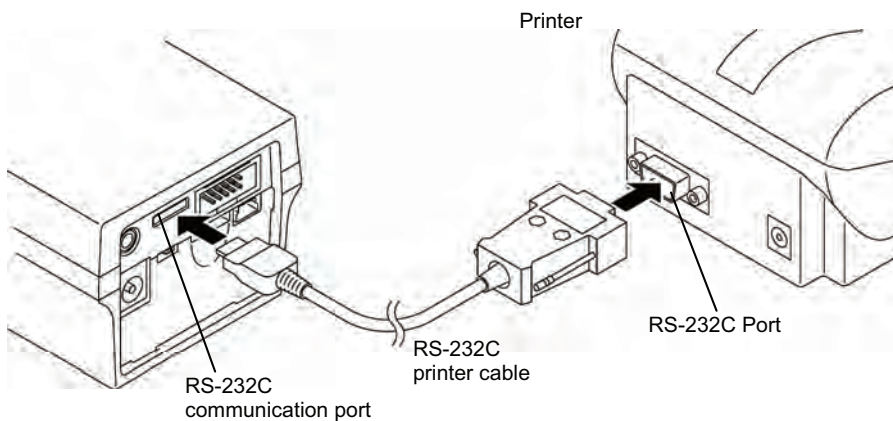
Connecting to the printer

4 Turn ON the printer power.

13.2.2   Setting the printer communication conditions

Printer communication conditions are set at the time of purchase. By connecting the SJ-210 to the printer and performing a communication check, the printer's communication settings are automatically configured, and printing can then be performed.

NOTE • Only PT-1 printers support the communication check automatic configuration function.

TIP • For information about connecting the SJ-210 and printer, refer to 13.2.1, "Connecting the SJ-210 and printer".

■ Operating procedure (Refer to "■ Accessing the Operating Environment Setup Menu screen" in Section 10.1.)

Home screen to Main Menu ⇒ | Set Environ. | ⇒
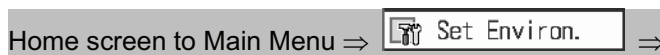
Operating Environment Setup menu screen
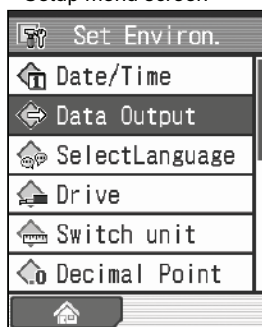
1 Select "Data Output" with the [↑] [↓] keys, and press the [Enter/Menu] key.

Data Output Setup screen
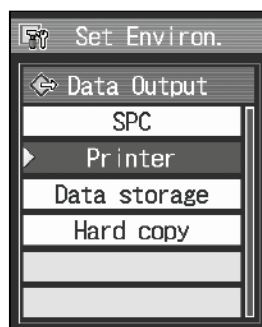
2 Select "Printer" with the [↑] [↓] keys, and press the [Enter/Menu] key.

NOTE • The factory default setting for data output is "SPC". when using a printer for data output, be sure to change the output setting to "Printer".

Print Setup screen
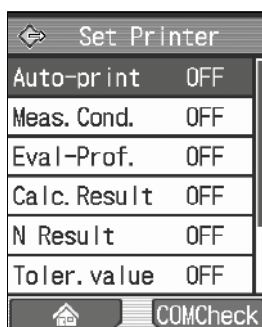
3 Press the "COMCheck" ([Red] key).

➢ A confirmation message is displayed.

Confirmation message
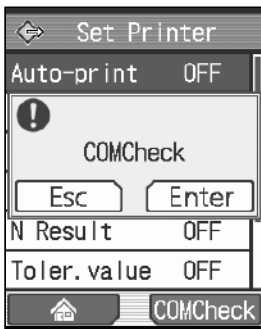
4 Press the [Enter/Menu] key.

➢ The communication check is performed, and the printer's communication settings are automatically configured.
When the communication check and the printer configuration are complete, the message "Restart Printer" is displayed.

NOTE • When an error message is displayed during the communication check, manually set the printer's communication conditions according to the below table. For information on how to set the printer, see the printer's user manual.

Setup item	Setting value
COMMAND MODE	MODE A
BAUD RATE	38400 bps
BIT LENGTH	8 bit
PARITY	NON
BUSY CONTROL	RTS/CTS

Confirmation message
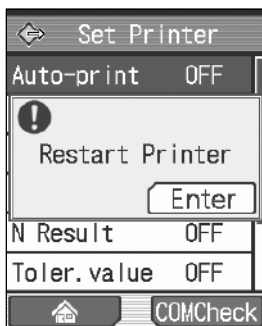
5 Press the [Enter/Menu] key.

6 Turn OFF, and then turn ON the printer power.

➢ The printer can now be used.

13.2.3   Printing calculation results and measurement conditions

You can print out calculation results or measurement conditions from the SJ-210 when data output is set to "Printer".

Calculation results or measurements conditions are printed when the [POWER/DATA] key is pressed.

TIP • For information about connecting the SJ-210 and printer, refer to 13.2.1, "Connecting the SJ-210 and printer".

• For information about setting data output, refer to 10.3.2, "Setting the data output to a printer".

• You can load saved measurement data and print the calculation results.For information about loading measurement data, refer to 9.4, "Loading Measurement Results".

1   Perform the measurement.

NOTE • For information about measurement, refer to Chapter 4, "MEASUREMENT OPERATION".

2   Display the calculation result to output.

3   Press the [POWER/DATA] key.

  ➢   Calculation results are printed.

■ Printout examples

Printout examples from the SJ-210 are shown below.

Mitutoyo **SURFTEST SJ-210**

```
Date
Time
      Meas. Condition
Standard      IS01997
Profile       R
Filter        GAUSS
λc            0.25mm
λs            2.5μm
N             5
Pre/Post      ON
M-Speed       0.5mm/s
Range         AUTO
Tol. Judge    Mean

      Calc. Result
Ra            0.014    μm
Ra[1]         0.015    μm
Ra[2]         0.013    μm
Ra[3]         0.013    μm
Ra[4]         0.014    μm
Ra[5]         0.013    μm
Rq            0.017    μm
Rq[1]         0.015    μm
Rq[2]         0.017    μm
Rq[3]         0.016    μm
Rq[4]         0.018    μm
Rq[5]         0.016    μm
Rz            0.092    μm
Rz[1]         0.090    μm
Rz[2]         0.096    μm
Rz[3]         0.095    μm
Rz[3]         0.095    μm
              0.086    μm
```

```
R        Profile

           x100K
  x200
V-Scale   0.10    μm/cm
H-Scale   50.00   μm/cm
```

```
Depth[%]
100              0

mr(c)[%]      BAC

Depth[%]
100              0

Ampl. Dens 5.0[%]   ADC
```

Print examples of measurement results and measurement conditions

13.2.4 Printing operating environment settings

You can print out operating environment setting items from the SJ-210 when data output is set to "Printer".

When the [POWER/DATA] key is pressed while the Operating Environment Menu screen is displayed, the setting items are printed.

TIP • For information about connecting the SJ-210 and printer, refer to 13.2.1, "Connecting the SJ-210 and printer".

• For information about setting data output, refer to 10.3.2, "Setting the data output to a printer".

■ Operation procedure
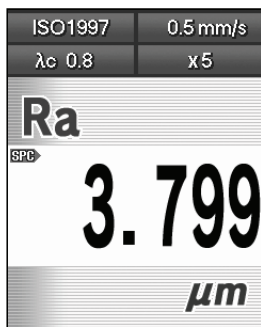
Home screen

1 Press the [Enter/Menu] key on the Home screen to display the Main Menu screen.
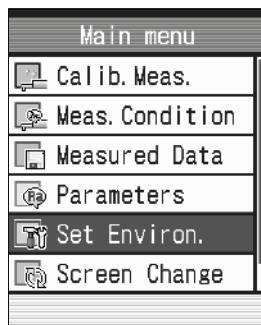
Main Menu screen

2 Select "Set Environ." with the [↑] [↓] keys, and press the [Enter/Menu] key.
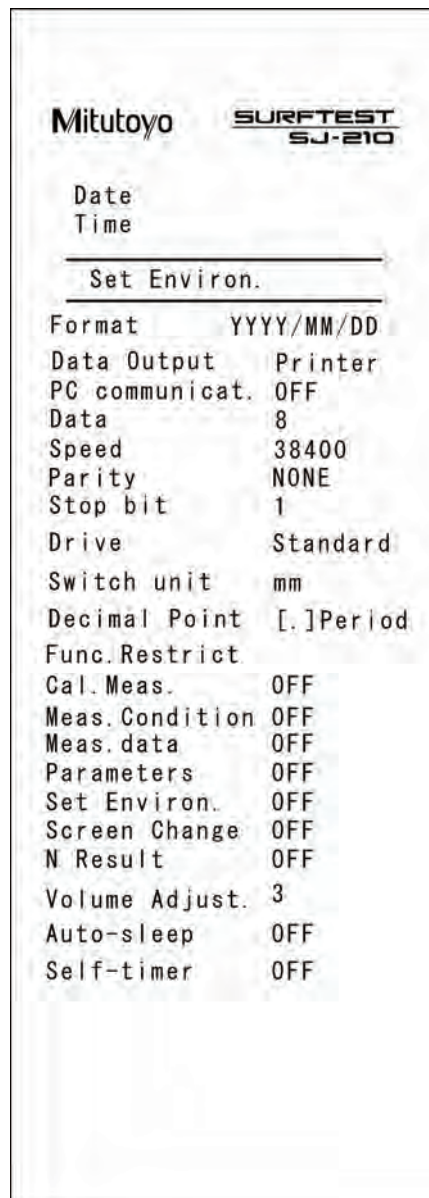
3 Press the [POWER/DATA] key from the Operating Environment Menu screen.

➢ The contents of the operating environment settings are printed.

■ Printout examples

Printout examples from the SJ-210 are shown below.

Print example of operating environment setting items

13.3 Saving Data to the Memory Card

You can save measurement data or screen images to the memory card by pressing the [POWER/DATA] key.

13.3.1 Saving measurement results to the memory card

You can save measurement data to the memory card when data output is set to "Data storage".

With this setting, measurement data is saved to the memory card when the [POWER/DATA] key of the SJ-210 is pressed. Measurement data is saved in a designated folder in the main folder.

NOTE • After the power to the instrument is turned on, the first time data is saved may take more time than usual.

TIP • The "*" displayed to the left of a folder means that it is the main folder.
For information about designating the main folder, refer to 9.3.2, "Specifying the main folder".
For information about setting data output, refer to 10.3.3, "Setting the data output to save data".

Main folder display

■ Operation procedure

1 Perform the measurement.

TIP • For information about measurement, refer to Chapter 4, "MEASUREMENT OPERATION".

2 Press the [POWER/DATA] key.

➢ Measurement data is saved in a designated folder in the main folder.

13.3.2   Saving screen images to the memory card

You can perform a screen capture to save as image data (BMP format) of a displayed calculation to the memory card. The image data is saved in the "IMG" folder on the memory card.

The image data can be transferred to a personal computer using communication software or a third-party SD card reader.

TIP ・ For information about setting data output, refer to 10.3.4, "Setting the data output to hard copy".

■ Operation procedure

1   Display the screen to capture.

2   Press the [POWER/DATA] key.

➢   The screen image is saved as image data (BMP format) to the memory card.

14 INSTALLING THE SJ-210 WITH OPTIONAL ACCESSORIES

This chapter explains the optional accessories for the easy setting of workpieces.

Various optional accessories are offered for the SJ-210 so that it can measure a curved (cylindrical, etc.) workpiece or a workpiece with a measured surface smaller than the size of the SJ-210.
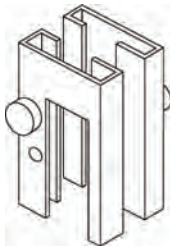
Support feet
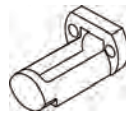
Nosepiece for flat surface
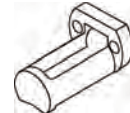
Nosepiece for cylinder

Adapter for vertical application
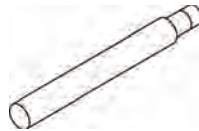
Extension rod

Adapter for magnetic stand
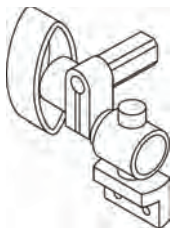
Adapter for height gage

NOTE • The following optional accessories explained in this chapter cannot be used for transverse tracing type drive/detector units:
Support feet, nosepiece for flat surface, nosepiece for cylinder, adapter for vertical application, and extension rod

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■ Support feet

Used to measure a workpiece that is smaller than the drive/detector unit.

- Dimensions and application example
  Use the support feet on the drive/detector unit to adjust it to the required height as shown below.
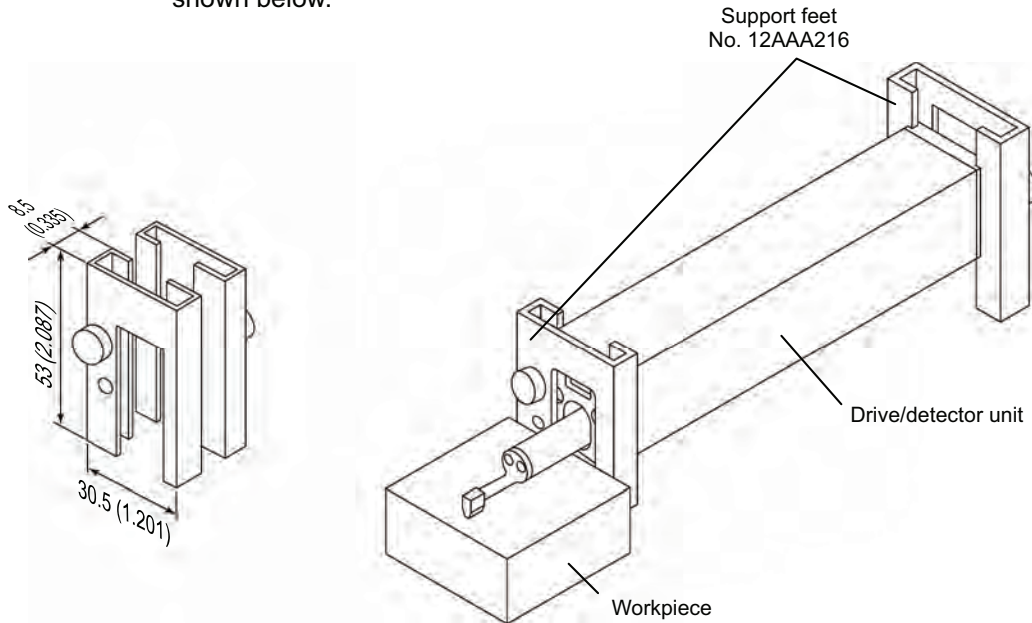
Dimensions and application example of the support feet

- Attaching the support feet

  1 Fit the two support feet in the grooves on the edges of the drive unit.

  2 Adjust the height of the drive/detector unit so that it is parallel to the measured surface.

  3 After adjustment, fix the support feet by tightening the clamp screw clockwise.

TIP • For information about setting of drive/detector unit, refer to 4.3.1, "Setting the workpiece and SJ-210".
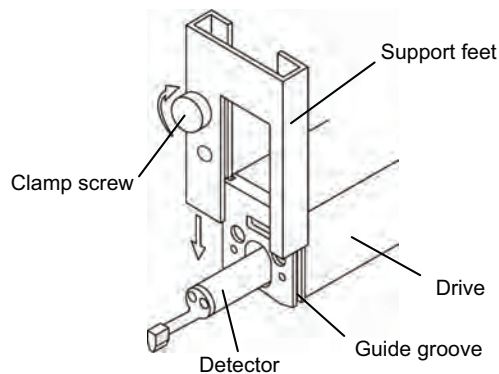
Attaching the support feet

■ Nosepiece for flat surface

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Used to protect the detector when measuring a flat workpiece that is smaller than the SJ-210.

- Dimensions and application example
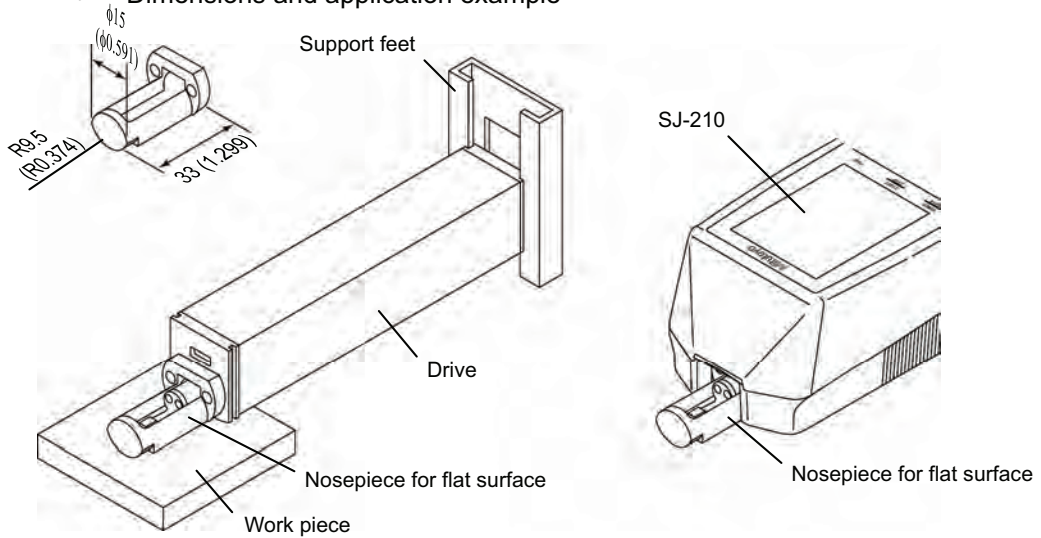
Dimensions and application example of the nosepiece for flat surface

- Attaching the nosepiece for flat surface

NOTE • When attaching the nosepiece to the drive/detector unit, exercise care so that it does not interfere with the detector body.

1 Fit the SJ-210 detector into the slot of the nosepiece.

2 Using the supplied Allen wrench, tighten the two screws shown in the following figure.
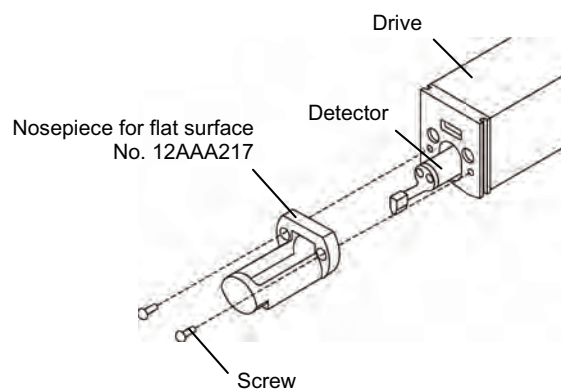
Attaching the nosepiece for flat surface

■ Nosepiece for cylinder

Used to protect and guide the detector when measuring a cylindrical workpiece that the drive/detector unit can not be placed.

- Dimensions and application example
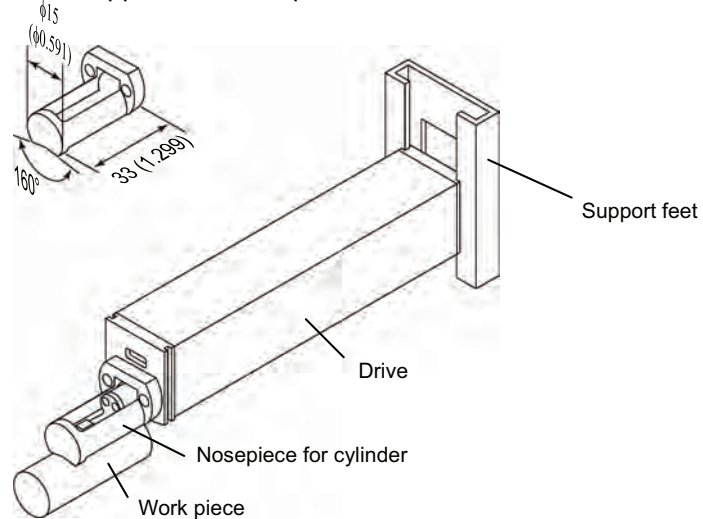
Dimensions and application example of the nosepiece for cylinder

- Attaching the nosepiece for cylinder

NOTE • When attaching the nosepiece to the drive/detector unit, exercise care so that it does not interfere with the detector body.

1 Fit the SJ-210 detector into the slot of the nosepiece.

2 Using the supplied Allen wrench, tighten the two screws shown in the following figure.
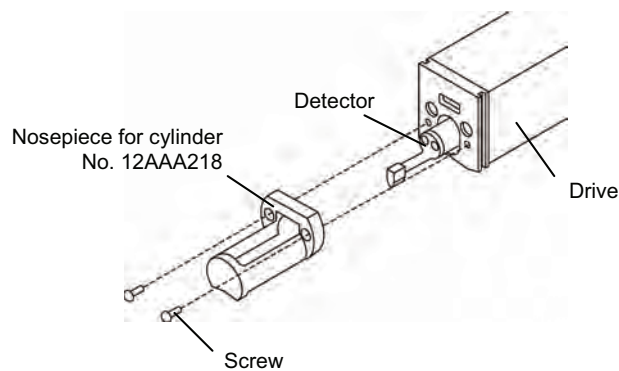
Attaching the nosepiece for cylinder

■ Adapter for vertical application   *14-5*

Used to support the drive/detector unit for measuring a vertical groove in which the drive/detector unit can not be placed.

• Dimensions and application example
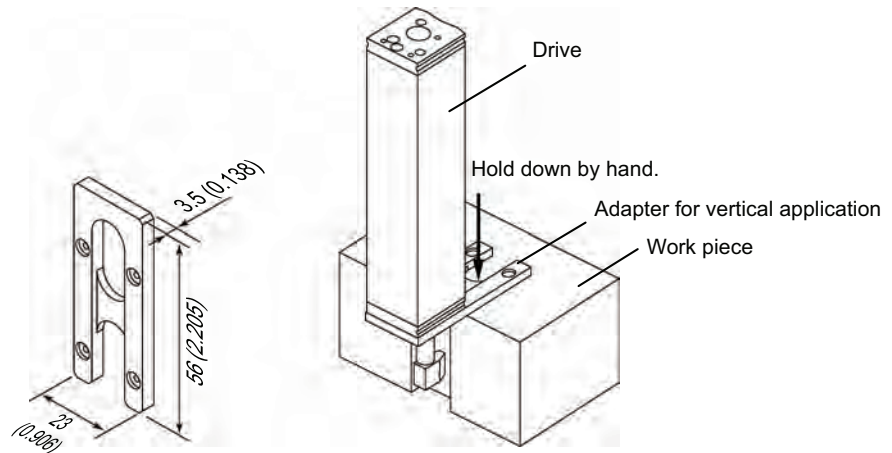
Dimensions and application example of the adapter for vertical application

• Attaching the adapter for vertical application

1   Put the SJ-210 detector through the hole of the adapter.

2   Using the supplied Allen wrench, tighten the two screws shown in the following figure.
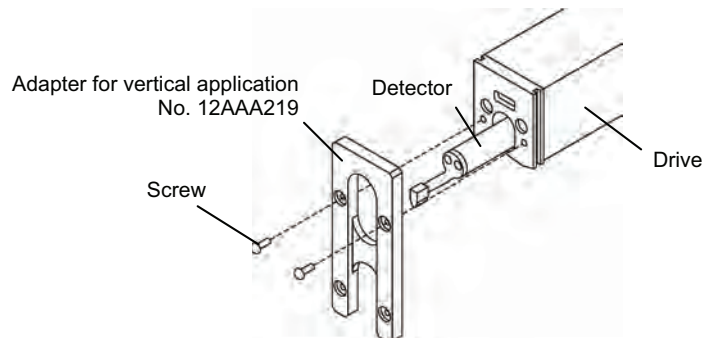
Attaching the adapter for vertical application

■ Extension rod

Used to measure the inside surface of a deep hole.

IMPORTANT • Be sure to perform calibration when an extension rod is attached or removed.

• When an extension rod is installed, measurement is not possible to perform with the stylus facing up.
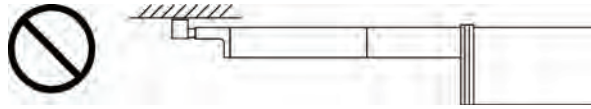
Example of prohibiting the use of the extension rod

• Dimensions and application example
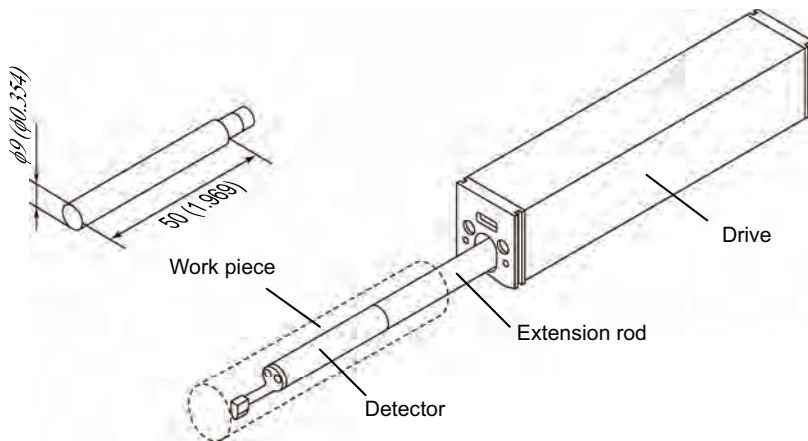
Dimensions and application example of the extension rod

• Attaching the extension rod

1 Insert the extension rod into the drive unit.

2 Attach the detector to the extension rod.
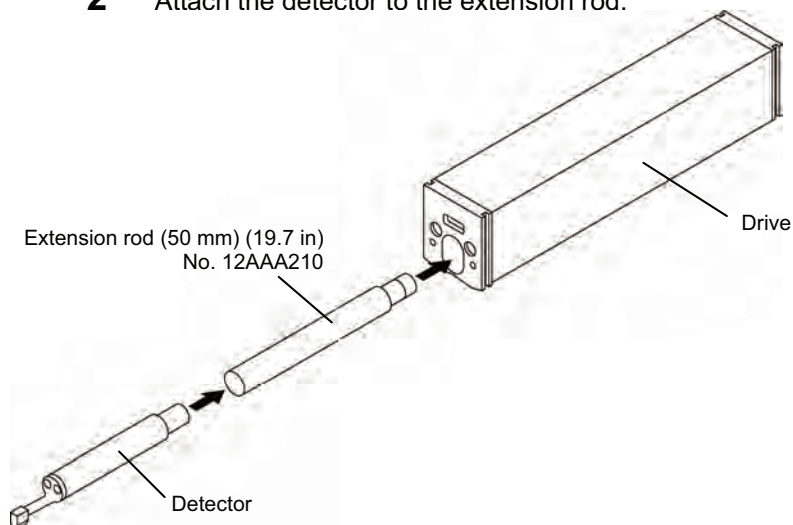
Attaching the extension rod

■ Adapter for magnetic stand

Used to secure the drive/detector unit to the magnetic stand.

This adapter is useful when there is insufficient space for the SJ-210 (or the drive/detector unit) or when the drive/detector unit cannot be held by hand.

- Dimensions and application example

A: 8 mm (0.315 in)/ 9.5 mm (3/8in)
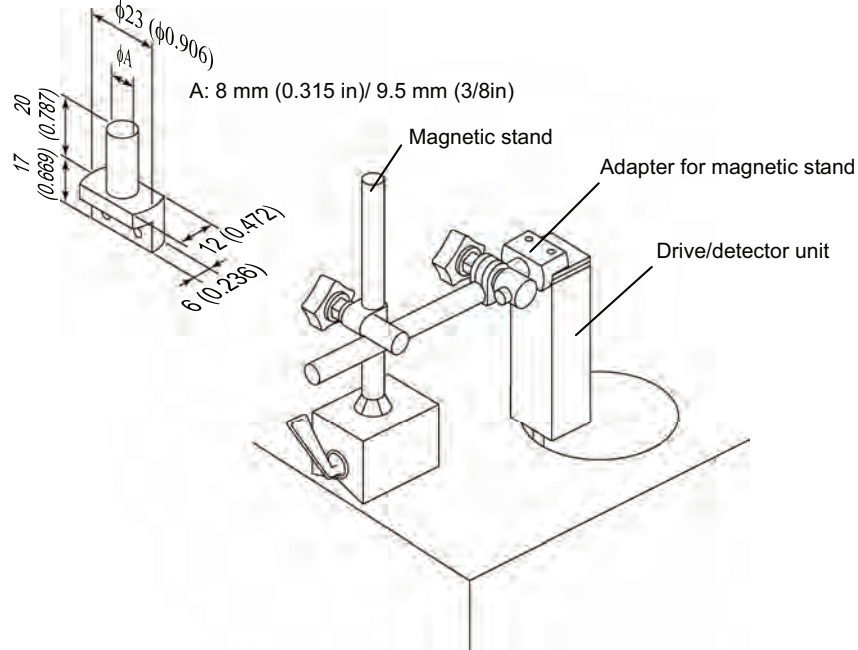
Dimensions and application example of the adapter for magnetic stand

- Attaching the adapter for magnetic stand

    1 Attach the adapter for magnetic stand to the rear of the SJ-210 drive/detector unit.

    2 Using the supplied Allen wrench, tighten the two screws shown in the following figure.
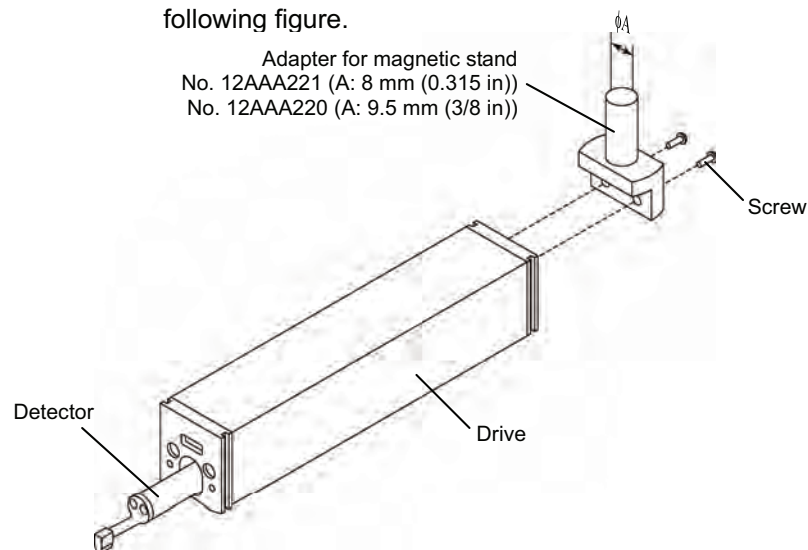
Attaching the adapter for magnetic stand

■ Adapter for height gage

Used to secure the drive/detector unit to the height gage.

The height gage is used to set the height of the measuring position manually or when the drive/detector unit cannot be held by hand.
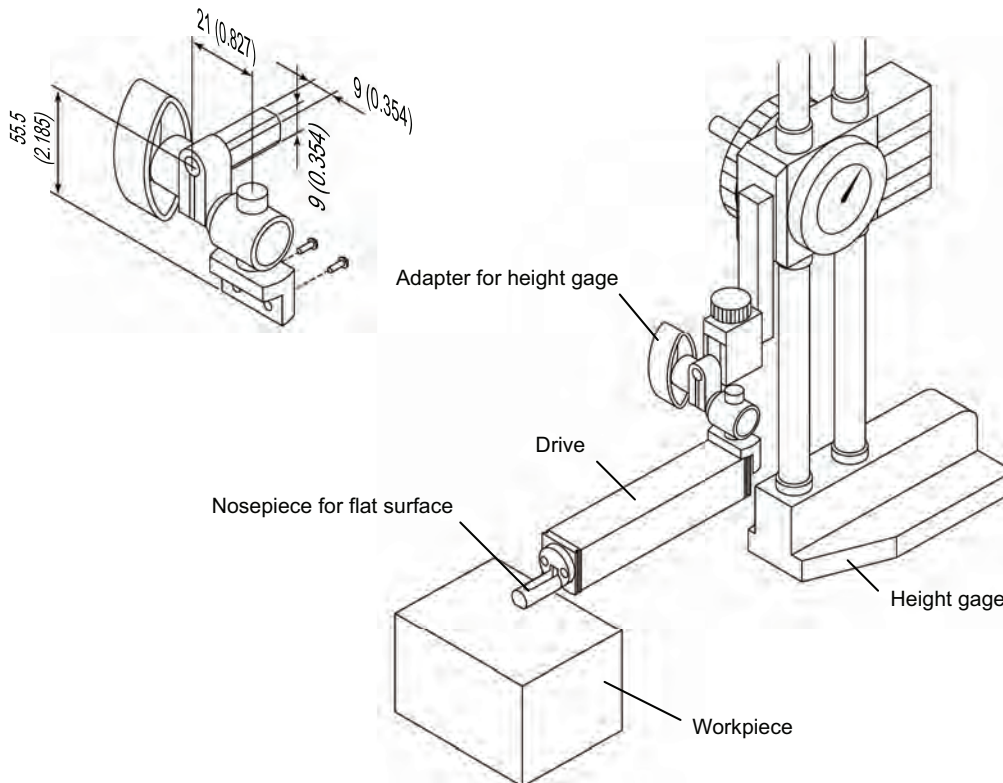
- Dimensions and application example

Dimensions and application example of the adapter for the height gage

- Attaching the adapter for the height gage

    1 Attach the adapter to the rear of the SJ-210 drive unit.

    2 Using the supplied Allen wrench, tighten the two screws shown in the following figure.
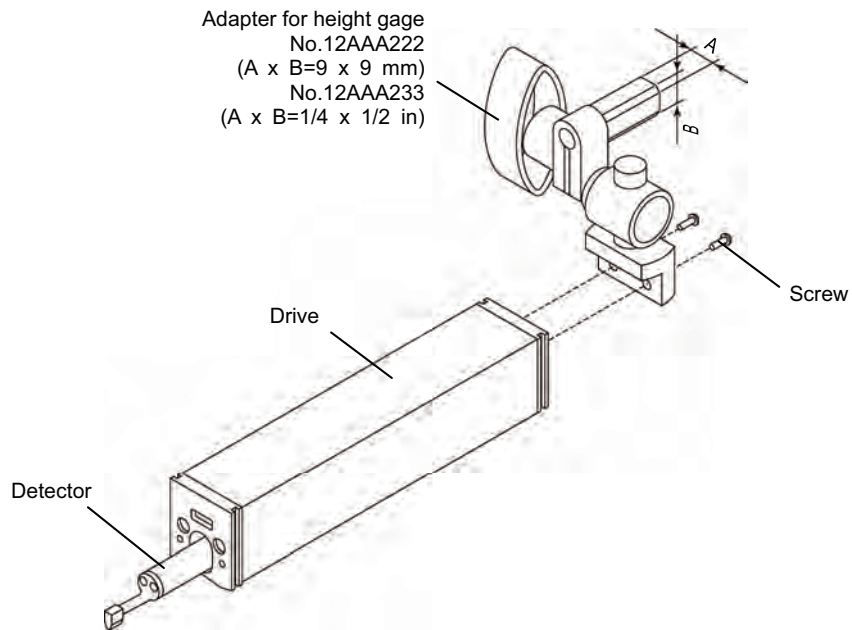
Attaching the adapter for the height gage

MEMO

15

MAINTENANCE AND INSPECTION OF SJ-210

15.1 Daily Care

■ Checking for normal operation

To judge whether the SJ-210 is in normal operation, after calibrating it with the supplied roughness specimen (Order No.178-601, 178-605), check that the dispersion of Ra values is within ±0.05 μm, which is obtained from repeated measurements of the same point.

However, when the measured point on the supplied roughness specimen (Order No.178-601, 178-605) is changed during repeated measurement, the dispersion of ±0.09 μm (±3% of the nominal value) included in the roughness specimen is added to that of the Ra values. Care should be exercised.

NOTE • This dispersion in the roughness specimen is a value obtained under the conditions that there are no dent and abrasion on the detector stylus tip and no scratch and abrasion on the specimen surface.

■ Detaching the drive/detector unit

After a measurement task has been completed, store all the SJ-210 components and its accessories in cases to keep out dust and moisture.

NOTE • Keep the built-in battery switch on unless the SJ-210 will not be used for a long period of time (more than 2 to 3 weeks). With the built-in battery switch on, measurement results obtained immediately before the SJ-210 is turned off by the auto-sleep function are saved and displayed on the LCD the next time the instrument is used.
However, when the built-in battery switch is off, the measurement results will be lost.

TIP • For information on how to detach the drive/detector unit and the separation of the two, refer to 3.2, "Attaching and Detaching the Drive/Detector Unit".

■ Selecting a suitable storage place

Store the SJ-210 in a suitable place where the temperature can be maintained in a range between −10 °C and +40 °C. The service life of the built-in battery varies a substantial amount depending on the ambient temperature conditions, etc.

■ Cleaning the surface of the SJ-210

When the SJ-210 is soiled, wipe it using a soft, dry cloth. Do not use thinner or benzene for cleaning.

15.2 Retracting the Detector

When moving the SJ-210 or not using it for a long period of time, retract the detector to prevent damage to the detector or work piece caused by the detector tip interfering with the work piece.

IMPORTANT
- Do not perform detector retraction when an extension rod (optional) is installed. The extended detector is subject to an external force: This may cause breakage of the drive unit.

- Remove the AC adapter and activate the unit by internal battery.

■ Detector retraction of the SJ-210 standard type

Detector retraction
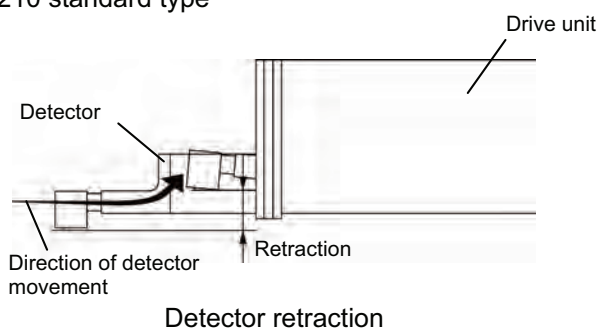
■ Retraction procedure of the detector of SJ-210 standard type

NOTE
- In the SJ-210 retracting type and transverse tracing drive type, the detector escapes all the way to the front with the detector tip down.

1 When the power is off, press the [POWER/DATA] key while holding down the [START/STOP] key.

> This retracts the detector. During retraction, "Retraction in progress" is displayed.

> The power turns off, upon completion of retraction.

■ Canceling the detector retraction state of the SJ-210 standard type

1 Press the [POWER/DATA] key to turn on the power.

2 Press the [START/STOP] key.

➢ The detector returns to the position it was in before retraction started. While the detector is being moved, "Being returned" is displayed.

➢ The Home screen is displayed after the extended out state has been released.

■ Detector retraction status of the SJ-210 retracting type

The SJ-210 retracting type detector is always extended to the front before starting measurement. When the [START/STOP] key is pressed, the SJ-210 drives the detector from the extended out position and starts measurement after passing the extension range.

1

2 (Escaping range)
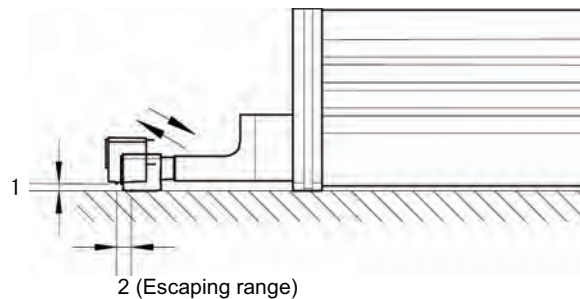
Detector retraction status (SJ-210 retracting type)

NOTE • In the SJ-210 retracting type and transverse tracing drive type, the detector escapes all the way to the front with the detector tip down.

15.3 Replacing the Built-in Battery Pack

■ Replacing procedure of the built-in battery pack

IMPORTANT	• Follow the directions given below and exercise care when replacing the built-in battery pack not to break or damage the PCB or cable.

NOTE	• The built-in battery pack replacement should be done where there is as little dust and other shop contamination as possible. In addition, exercise care so that dust or oil mist does not penetrate the display unit. During the built-in battery pack replacement, the circuit board in the SJ-210 is temporarily exposed. A malfunction may result if dust or shop contamination soils the circuit board.

1   Separate the drive/detector unit from the display unit.

2   Remove the two tapping screws at the bottom of the display unit using a Phillips screwdriver.
Do not lose the tapping screws and drive/detector unit retaining plate during this operation.
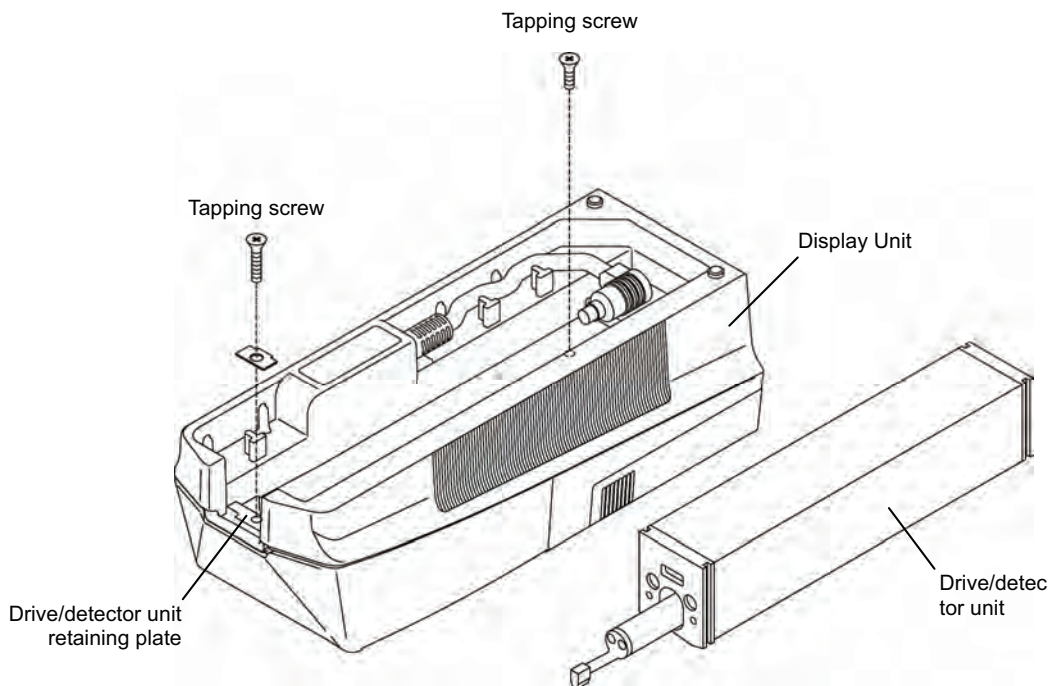
Detaching the tapping screws

3   Gently remove the bottom section of the display unit.

IMPORTANT   • Exercise care when removing the bottom section of the display unit. The top and bottom sections of the display unit are connected with cables, which, including the connectors, may be damaged when excessively strained.

Display unit bottom section

Display unit top section
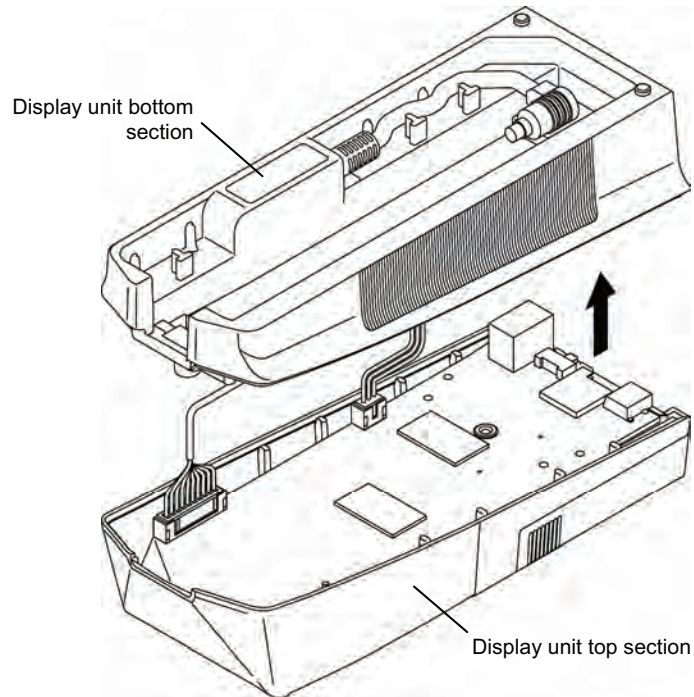
Detaching the bottom section of the display unit.

4 Disconnect the two connectors from the circuit board inside the display unit: One connects the top and bottom sections of the display unit, and the other is connected to the built-in battery pack.

Circuit board
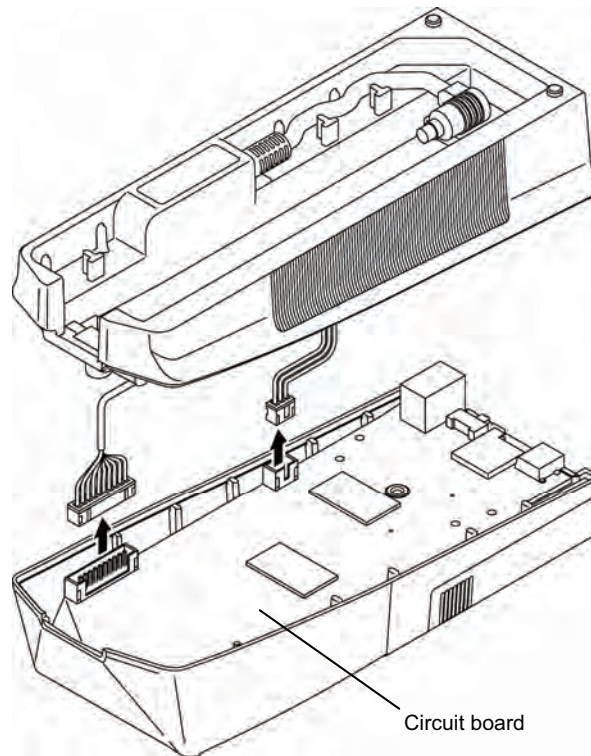
Detaching the connector

5 Detach the cable of the built-in battery pack from the cable support plate.

IMPORTANT • Never remove the cable support plate. Otherwise, the spring of the drive/detector unit retaining pin comes out.

• When detaching the cable of the built-in battery pack, make sure not to break the cable support plate's hooks. Otherwise, cables might be stuck and damaged by the inside of the display unit.
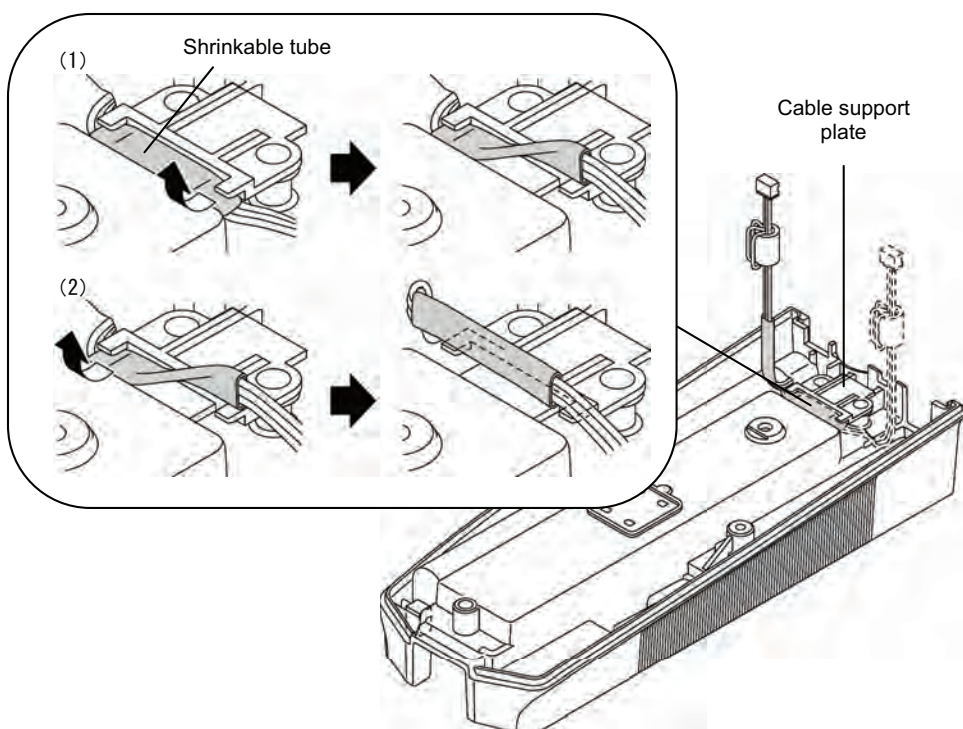
Detaching the cable

6   Remove the built-in battery pack from the display unit.

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Built-in battery pack   (2)

(1)
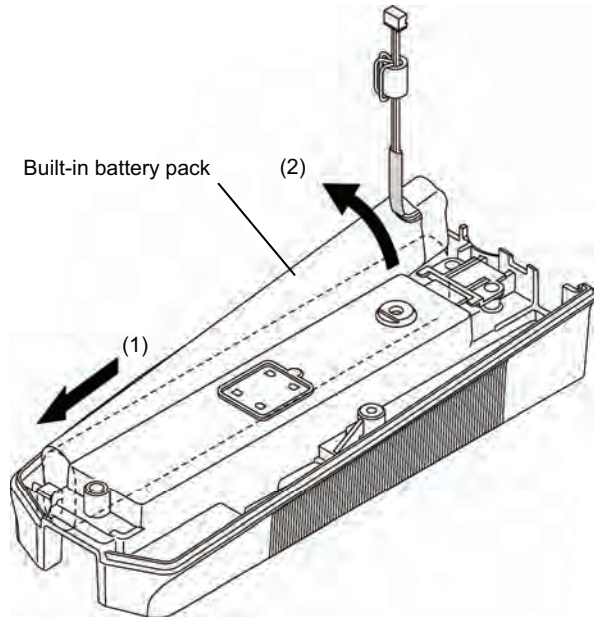
Removing the built-in battery pack

7   Place a new built-in battery pack properly inside the display unit.

(2)

(1)
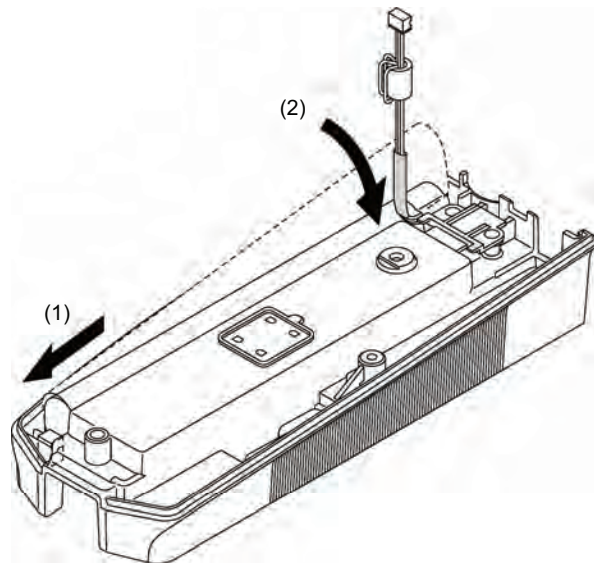
Placing the built-in battery pack

8 Fix the cable into the cable support plates.

Fix the cable with the hook (1) at the built-in battery side, and the hook (2) at other side.

IMPORTANT • When fixing the cable of the built-in battery pack, do not use any pointed tools such as driver. Otherwise, the coating of cable might be torn and then the built-in battery might be shorted.

• When fixing the cable of the built-in battery pack to the cable support plate, make sure to fix the part that is covered with shrinkable tube.

• Never remove the cable support plate. Otherwise, the spring of the drive/detector unit retaining pin comes out.
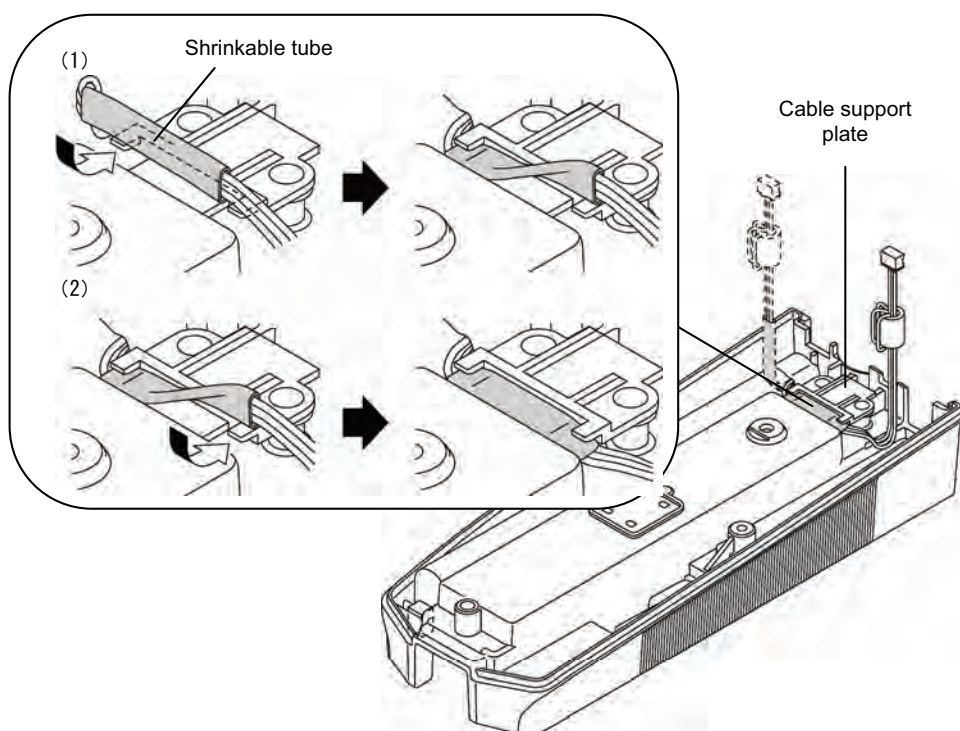
Fixing the cable

9   Check that the cable of built-in battery pack is fastened and are wired securely as shown below.

IMPORTANT   • Make sure to fix the cable of the built-in battery pack to the cable support plate. Otherwise, the cable might be damaged by the protrusion inside the display unit, and then the built-in battery might be shorted.
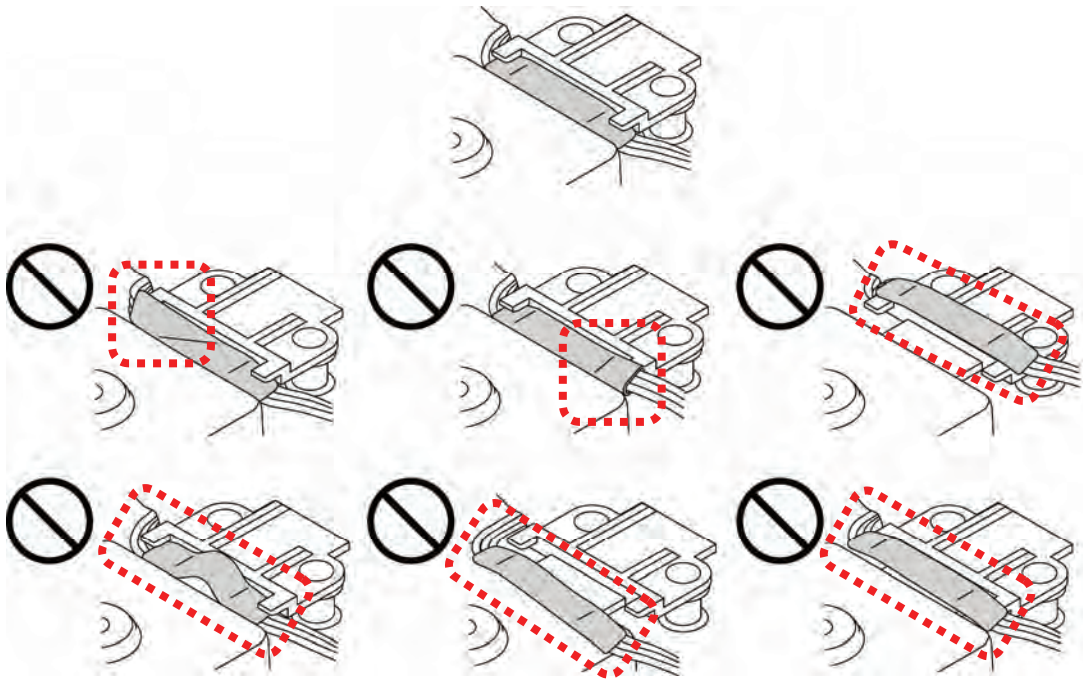
Confirming the cable wiring condition

10 Reconnect the connector, which connects the top and bottom sections of the display unit, and built-in battery pack connector to the board in the display unit.

NOTE • When reconnecting the two connectors, note their location and orientation. Firmly connect them. When the connectors are not firmly connected, the instrument may not operate properly.
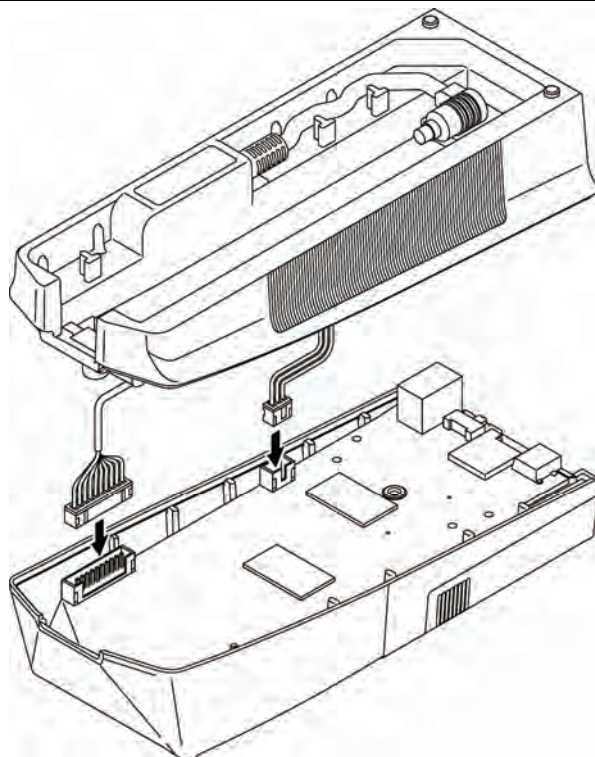
Connector connection

11 Couple the bottom section of the display unit with the top section.

IMPORTANT • Exercise care not to have the cable pinched by the PCBs or by the upper and lower sections of the display unit when fitting the lower section to the upper section. Cable disconnection or display unit breakage may result.

12 While confirming that the hooks on the drive/detector unit retaining plate are correctly aligned, tighten the two tapping screws on the bottom face of the display unit.

NOTE • The tapping screws must not be tightened to more than 29.4 N·cm (3 kgf·cm). Otherwise, the display unit may be damaged.

Drive/detector unit retaining plate
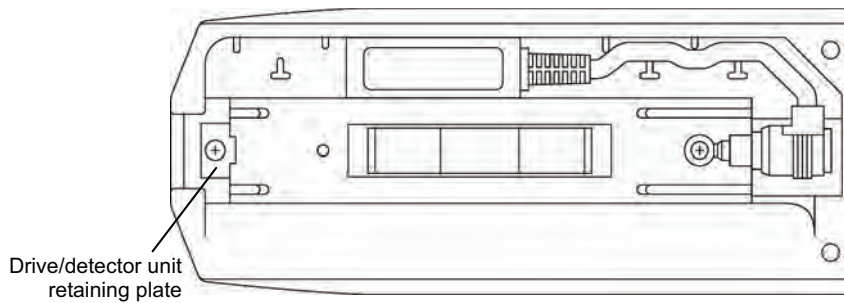
Drive/detector unit retaining plate

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16 TROUBLESHOOTING

In this chapter, check point and what to do when you have trouble with the instrument are described.

16.1 System Operation

■ System operation

Symptom/Error display	Possible causes	Remedies
SJ-210 can not be turned on when is powered by the built-in battery (and with the AC adapter disconnected).	Remaining battery voltage is low.	Recharge the battery.
	Built-in battery switch is set to OFF.	Set the built-in battery switch to ON.
SJ-210 can not be turned on when the AC adapter is connected.	Poor connection of the AC adapter.	Connect the AC adapter properly.
	Other than the above.	Contact your dealer or the nearest Mitutoyo sales office.
Built-in battery can not be recharged. Recharge sign is not displayed.	Built-in battery switch is set to OFF. The battery has deteriorated.	Set the built-in battery switch to ON. Replace the battery pack.
	The built-in battery is fully charged.	Recharge the battery when the display of remaining battery power moves to a low level.
	An AC adapter other than the one supplied with the SJ-210 was used.	Use the supplied AC adapter only.
The display goes off unexpectedly.	The power was turned off by the Auto-sleep function.	Press the [POWER/DATA] key to turn off the power.
The power does not turn off.	The AC adapter is used. The Auto-sleep function has been set to OFF.	Keep holding down the [Esc/Guide] key for more than 3 seconds.
Cumulative distance is over the limit!	Result of cumulative distance measurement exceeds the display range.	The error display is cleared when the cumulative distance is deleted or the measurement range is set to a wider range. Refer to 6.7, "Setting the Stylus Alarm".
The buzz function does not work properly.	Volume adjustment is set to minimum.	Adjust the volume. Refer to 10.8, "Adjusting the Volume of Indicator Sounds".

16.2   Measuring Operation

■ Measuring operation

Symptom/Error display	Possible causes	Remedies
Over-range error!	The result exceeds the measurement range.	・ Properly connect the detector to the drive unit. When a red light flashes in upper display, an over-range error occurs. ・ When the measurement range has been fixed, set it to Auto.
Aborting!	The [START/STOP] key is pressed during measurement is performed.	Perform measurement again.
No measurement is performed right after the [START/STOP] key is pressed.	Self-timer function has been set to ON.	Set the self-timer function to OFF. Refer to 10.12, "Setting the Self-timer".

16.3   Calculation Results

■ Calculation results

Symptom/Error display	Possible causes	Remedies
Abnormal calibration value!	The result of calibration measurement exceeds the possible range of calibration.	Check the value of the precision roughness specimen and the inputted nominal value. Also, check the calibration measurement setup conditions.
L 3,000 um	Measurement result under a condition of insufficient number of peaks and valleys.	
E 0110	Parameter can not be calculated due to insufficient number of peaks and valleys.	
E 0116	Equivalent line can not be calculated.	
E 0117	Roughness motif can not be calculated as more than 2 local peaks which have required height do not exist.	
E 0118	The first roughness motif exceeds upper limit of the length A.	
E 0121	Parameter can not be calculated as more than 3 motifs do not exist.	
Calculation result is abnormal. (Value is large/Value is small/Value remain the same irrespective of workpiece.)	Detector is not properly connected to the drive unit.	Properly connect the detector to the drive unit.
	Connecting cable between drive unit and display unit is not properly connected.	Properly connect the drive unit to the display unit.
	Calibration measurement was not performed correctly due to improper setup of the SJ-210.	Re-calibrate the SJ-210.
	Stylus is worn. Or other than the above.	Contact your dealer or the nearest Mitutoyo sales office.
The GO/NG Judgment result indicator does not appear.	The GO/NG Judgment parameter has not been set.	Select desired parameter for setting the GO/NG Judgment. Refer to 8.3, "Setting the GO/NG Judgment Function".
	Upper limit/lower limit is set to minimum.	Set the upper limit or lower limit. Refer to 8.3, "Setting the GO/NG Judgment Function".

16.4 Outputting Measurement Results

■ Outputting measurement results

Symptom/Error display	Possible causes	Remedies
SPC data can not be outputted.	Data output is not set to "SPC". **SPC**	Set the data output to "SPC". Refer to 10.3.1, "Setting the data output to SPC".
	SPC cable connection problem.	Connect the SPC cable properly.
	Power to the Digimatic Processor is off.	Turn on the Digimatic Processor.
	When printout is started, no recording paper is loaded on the Digimatic Processor.	Load the recording paper on the Digimatic Processor.
Printing-out to the external printer can not be performed.	Data output is not set to "Printer".	Set the data output to "Printer". Refer to 10.3.2, "Setting the data output to a printer".
	The SJ-210 is not properly connected with the printer.	Connect the printer properly with the SJ-210.
	When printout is started, no recording paper is loaded on the printer.	Load the recording paper on the printer.
	The printer head unit was raised.	Position the printer head unit properly.
	The settings of the SJ-210 baud rate and printer baud rate are not identical.	Set the printer baud rate to the same numeric value as that of the SJ-210 baud rate. (Set environment to "Printer", and then perform" Checking communication".) Next, turn off the power to the printer and SJ-210 (put the SJ-210 in the auto-sleep mode), and then turn on the both power again.
	Abnormal temperature was generated on the printer head.	Turn off the power to the printer once, and then turn it on again after a while.
	Abnormal power was supplied to the printer.	Use the AC adapter supplied with the printer. If the error still occurs, contact your dealer or the nearest Mitutoyo sales office.

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Symptom/Error display	Possible causes	Remedies
Inaccessible to the memory card.	Data output is not set to "Saving data". ⇒》	Set the data output to "Saving data". Refer to 10.3.3, "Setting data output to save data".
	Data output is not set to "Hard copy". 〔◎〕	Set the data output to "Hard copy". Refer to 10.3.4, "Setting the data output to hard copy".
	Memory card is not compatible with the SPI mode. (SJ-210 gains access to the memory card in the SPI mode.)	Memory card available in the market may not be compatible with the SPI mode, so purchase the memory card designated by Mitutoyo.
	Card is inserted or removed while SJ-210 is gaining access.	Insert or remove card while the power is turned off.
	File for the memory card has been edited by PC. Memory card has not been formatted for the SJ-210.	When using memory card for the first time, be sure to format for the SJ-210. Do not edit file using PC or other device.
RS-232C Out of communication.	PC-to-PC communication has been turned off.	Turn on the pc-to-pc communication. Refer to 10.13, "Setting PC Communication Conditions".
	Communication baud rate does not match the PC.	Set the communication baud rate to the same numeric value as that of the PC. Refer to 10.13, "Setting PC Communication Conditions".

MEMO

17 PRODUCT SPECIFICATIONS

17.1 Detector

Detection method Differential inductance method

Measurement range   360 µm (-200 µm to +160 µm)
                        14400 µin (-8000 µm to +6400 µin)

Stylus material   Diamond

Tip radius   5 µm (200 µin)/[2 µm (80 µin)]

Measuring force   4 mN (0.4 gf)/[0.75 mN (0.075gf)]

Radius of skid curvature   40 mm (1.575 in)

* [   ] indicates 0.75 mN detector (178-395, 178-387).

17.2 Drive

Detector drive range   21 mm (0.827 in)/[5.6 mm (0.221 in)]

Traversal speed   Measurement   : 0.25 mm/s, 0.5 mm/s, 0.75 mm/s
                                            (0.01 in/s, 0.02 in/s, 0.03 in/s)

                            Return   : 1 mm/s (0.04 in/s)

Detector retraction function   Stylus UP/[No]

Bottom configuration: V-shaped trough

* [   ] indicates transverse tracing type.

17.3 Display Unit

17.3.1 Compatible roughness standard

JIS B 0601-2001
JIS B 0601-1994
JIS B 0601-1982
ISO 1997
ANSI
VDA
Free (nonstandard)

17.3.2 Condition settings

● Standard, measured profiles and filters

Profile filter is automatically switched according to the roughness standard when it is switched.

Roughness standard	Profile			
	P	R	DF	R-Motif
JIS1982	NONE	2CR75	-	-
JIS1994	-	GAUSS	-	-
JIS2001	GAUSS	GAUSS	GAUSS	GAUSS
ISO1997	GAUSS	GAUSS	GAUSS	GAUSS
ANSI	-	PC75 GAUSS	-	-
VDA	(NONE[*1]) GAUSS	GAUSS	GAUSS	-
Free	(NONE[*1]) 2CR75 PC75 GAUSS	2CR75 PC75 GAUSS	GAUSS	(NONE[*1]) 2CR75 PC75 GAUSS

*1:When "λs" is set to "NONE".

17.3.3 Cutoff lengths/sampling lengths, number of sampling lengths, and sampling interval

Cutoff length (λc) [1]	Sampling length (ℓ)	λs	Sampling interval	Number of pieces of data in a sampling lengths	Number of sampling lengths
0.08 mm (0.003in)	0.08 mm (0.003 in)	2.5 μm (100 μin)	0.5 μm (19.69 μin)	160	1-10
0.25 mm (0.01in)	0.25 mm (0.01 in)	2.5 μm (100 μin)	0.5 μm (19.69 μin)	500	1-10
0.8 mm (0.03 in)	0.8 mm (0.03 in)	2.5 μm (100 μin)	0.5 μm (19.69 μin)	1600	1-8
2.5 mm (0.1 in)	2.5 mm (0.1 in)	8 μm (320μin)	1.5 μm (59.1 μin)	1666	1-5

*1: These cutoff lengths (λc) are applied when the R profile is specified.

17.3.4 Upper limit of motif lengths/evaluation lengths, number of sampling lengths, and sampling interval

Upper limit of motif length (A) [mm (in)]	Evaluation length (L) [mm (in)]	Cutoff length (λs) [μm (μin)]	Sampling pitch Δx [μm (μin)]
0.02 (0.001)	0.3 ≤ L ≤ 0.64 (0.0118 ≤ L ≤ 0.0252)	2.5 (100)	0.5 (19.685)
0.1 (0.004)	0.65 ≤ L ≤ 3.2 (0.0256 ≤ L ≤ 0.126)	2.5 (100)	0.5 (19.685)
0.5 (0.02)	3.3 ≤ L ≤ 16 (0.130 ≤ L ≤ 0.630)	8 (320)	1.5 (59.055)

17.3.5 Parameters and roughness standards/evaluation profiles

Roughness standard	Evaluation profile	Parameter
JIS1982	P	Rz, Rmax
	R	Ra
JIS1994	R	Ra, Rz, Ry, Pc, Sm, S, mr(c)
JIS2001	P	Pa, Pq, Pz, Pp, Pv, Pt, Psk, Pku, Pc, PSm, PzJIS, PΔq, Pmr, Pmr(c), Pδc, Rk, Rpk, Rvk, Mr1, Mr2, A1, A2
	R	Ra, Rq, Rz, Rp, Rv, Rt, Rsk, Rku, Rc, RSm, RzJIS, RΔq, Rmr, Rmr(c), Rδc, Rk, Rpk, Rvk, Mr1, Mr2, A1, A2
	DF	Ra, Rq, Rz, Rp, Rv, Rt, Rsk, Rku, Rc, RSm, RzJIS, RΔq, Rmr, Rmr(c), Rδc, Rk, Rpk, Rvk, Mr1, Mr2, A1, A2
	R-Motif	R, Rx, AR
ISO1997	P	Pa, Pq, Pz, Pp, Pv, Pt, Psk, Pku, Pc, PSm, Pz1max, PΔq, Pmr, Pmr(c), Pδc, Rk, Rpk, Rvk, Mr1, Mr2, A1, A2
	R	Ra, Rq, Rz, Rp, Rv, Rt, Rsk, Rku, Rc, RSm, Rz1max, RΔq, Rmr, Rmr(c), Rδc, Rk, Rpk, Rvk, Mr1, Mr2, A1, A2
	DF	Ra, Rq, Rz, Rp, Rv, Rt, Rsk, Rku, Rc, RSm, Rz1max, RΔq, Rmr, Rmr(c), Rδc, Rk, Rpk, Rvk, Mr1, Mr2, A1, A2
	R-Motif	R, Rx, AR
ANSI	R	Ra, Rq, Rz, Rp, Rv, Rt, Rsk, Rku, RPc, RSm, Rmax, RΔa, RΔq, tp, Htp, Rpm
VDA	P	Pa, Pq, Pz, Pp, Pv, Pt, Psk, Pku, Pc, PSm, Pmax, PΔq, Pmr, Pmr(c), Pδc, Rk, Rpk, Rvk, Mr1, Mr2, A1, A2
	R	Ra, Rq, Rz, Rp, Rv, Rt, Rsk, Rku, Rc, RSm, Rmax, RΔq, Rmr, Rmr(c), Rδc, Rk, Rpk, Rvk, Mr1, Mr2, A1, A2
Free	P	Pa, Pq, Pz, Py, Pp, Pv, Pt, P3z, Psk, Pku, Pc, PPc, PSm, S, HSC, PzJIS, Pppi, PΔa, PΔq, Plr, Pmr, Pmr(c), Pδc, Rk, Rpk, Rvk, Mr1, Mr2, A1, A2, Vo, Ppm
	R	Ra, Rq, Rz, Ry, Rp, Rv, Rt, R3z, Rsk, Rku, Rc, RPc, RSm, S, HSC, RzJIS, Rppi, RΔa, RΔq, Rlr, Rmr, Rmr(c), Rδc, Rk, Rpk, Rvk, Mr1, Mr2, A1, A2, Vo, Rpm
	DF	Ra, Rq, Rz, Ry, Rp, Rv, Rt, R3z, Rsk, Rku, Rc, RPc, RSm, S, HSC, RzJIS, Rppi, RΔa, RΔq, Rlr, Rmr, Rmr(c), Rδc, Rk, Rpk, Rvk, Mr1, Mr2, A1, A2, Vo, Rpm
	R-Motif	R, Rx, AR

17.3.6   Measurement range and resolution

Measurement range	Resolution
Auto	depending on the measurement range 0.0016 µm to 0.0256 µm (0.0630 µin to 1 µin)
360 µm (14400 µin)	0.0256 µm (1 µin)
100 µm (4000 µin)	0.0064 µm (0.25 µin)
25 µm (1000 µin)	0.0016 µm (0.0630 µin)

17.3.7   Traversal length

Conditions	Pre-travel/post travel length	Remark
When P (Primary profile) and Motif are selected	Pre-travel length = 0 mm (0 in), Post-travel length = 0 mm (0 in)	Approach length (approx. 0.5 mm/0.02 in) and λs with pre-travel/post-travel length
When the R (Roughness) and the 2CR are selected	Pre-travel length = λc, Post-travel length = 0mm (0 in)	
When the R (Roughness) and the PC75 are selected	Pre-travel length = λc, Post-travel length = λc	
When the R (Roughness), the GAUSS and the DF are selected	Pre-travel length = λc/2, Post-travel length = λc/2	

17.4   Power Supply

- AC adapter

Rating   : 9 V   1.3 A

Supply voltage   : 100 V

- Built-in battery (Ni-H battery)

Charging hours   : 4 hours maximum

Number of measurements per charge   : Approx. 1000 (with full charge)

Charging temperature   : 5 °C to 40 °C

17.5   Temperature/Humidity Range

Operation temperature   : 5 °C to 40 °C

Storage temperature   : -10 °C to 50 °C

Operation/Storage humidity   : 85% or below (when no condensation detected）

17.6   External Dimensions and Mass

Unit: mm (in)

71.5 (2.816)

61 (2.402)

10.5 (0.413)

16.4 (0.646)

$\phi 9$ ($\phi 0.354$)

$\phi 6.6$ ($\phi 0.260$)

Mass: 7.8 g

4.8 (0.189)

2.4 (0.095)

115 (4.528)

Mass: 180 g

26 (1.023)

23 (0.906)

52.1 (2.051)

160 (6.299)

Mass: 310 g

65.8 (2.591)

14.1 (0.555) [34.4 (1.355)]

[   ] indicates transverse tracing type.
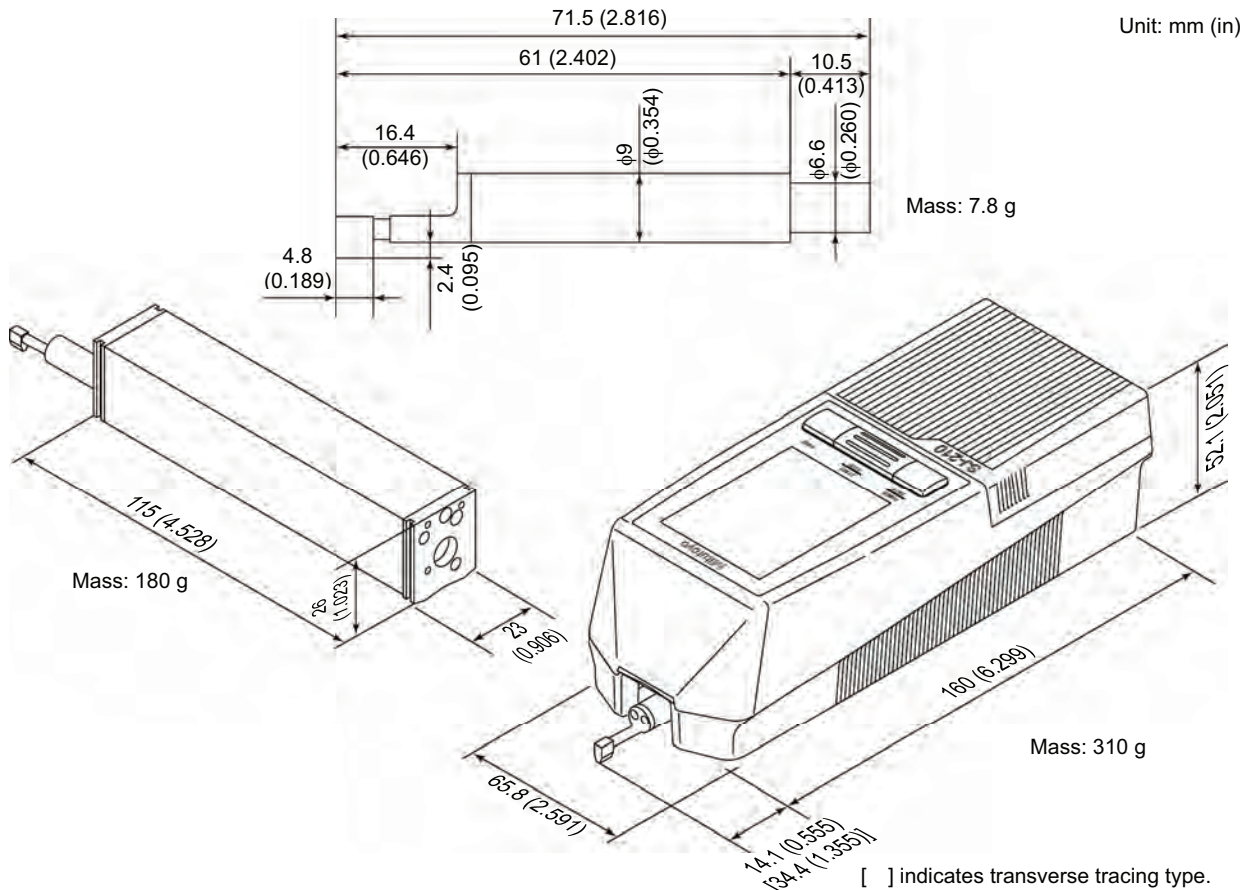
17.7 Optional Accessories

Part No.	Name
178-390	Standard detector: Measuring force 4 mN, Stylus tip radius 5 µm (200 µin)
178-296	Standard detector: Measuring force 0.75 mN, Stylus tip radius 2 µm (80 µin)
178-391	SR10 detector: Measuring force 4mN, Stylus tip radius 10 µm (400 µin)
178-392	Small hole detector: Measuring force 4 mN, Stylus tip radius 5 µm (200 µin)
178-383	Small hole detector: Measuring force 0.75 mN, Stylus tip radius 2 µm (80 µin)
178-393	Extra small hole detector: Measuring force 4 mN, Stylus tip radius 5 µm (200 µin)
178-384	Extra small hole detector: Measuring force 0.75 mN, Stylus tip radius 2 µm (80 µin)
178-394[1]	Deep groove detector: Measuring force 4mN, Stylus tip radius 5 µm (200 µin)
178-385[1]	Deep groove detector: Measuring force 0.75 mN, Stylus tip radius 2 µm (80 µin)
178-398	Gear tooth surface detector: Measuring force 4 mN, Stylus tip radius 5 µm (200 µin)
178-388	Gear tooth surface detector: Measuring force 0.75 mN, Stylus tip radius 2 µm (80 µin)
178-230-2	Standard drive unit
178-235	R-Drive unit
178-233-2	S-Drive unit
178-234-2	S-Drive unit set
178-386[2]	Standard detector for S-Drive unit: Measuring force: 4 mN, Stylus tip radius 5 µm (200 µin)
178-387[2]	Standard detector for S-Drive unit: Measuring force 0.75 mN, Stylus tip radius 2 µm (80 µin)
178-033[1]	Setting attachment V type
178-034[1]	Setting attachment slider type
178-035[1]	Setting attachment Inside diameter type
12AAA210[1]	Extension rod 50 mm (19.7 in)
12AAA216[1]	Support feet set
12AAA217[1]	Nosepiece for flat surface
12AAA218[1]	Nosepiece for cylinder
12AAA219[1]	Adapter for vertical application
12AAA220	Adapter for magnetic stand φ9.5 mm (3/8 in dia.)
12AAA221	Adapter for magnetic stand φ8 mm (0.315 in dia.)
12AAA222	Adapter for height gage (mm: 9 x 9 mm)
12AAA233	Adapter for height gage (inch: 1/4 in x 1/2 in)

Part No.	Name
12AAJ088	Foot switch
12BAA303	Connection cable for extension 1 m [39.4 in]
178-421A	Printer (With connecting cable) for North America
178-421D	Printer (With connecting cable) for European countries
12AAA222	Adapter for height gage (mm: 9 mm x 9 mm)
12AAL067	Connection cable (for printer, RS-232C）
12AAA876	Printer paper (High endurance paper 5 pieces)
12AAL069	Memory card
12AAL068[*3]	Communication cable for USB
-	Digimatic data processor DP-1VR Code No.: 264-504, 264-504-5A, 264-504-5D, 264-504-5E, 264-504-1K, 264-504-5F
936937	Digimatic connecting cable 1 m
965014	Digimatic connecting cable 2 m
264-012-10	Input tool for USB：IT-012U
264-013-10	Input tool for USB-Type D：IT-013UD
264-014-10	Input tool for USB-Type T ：IT-014UT

*1: Option not usable with transverse tracing type

*2: Detector only for transverse tracing type

*3: Used when using this company's software to send data to a PC.

External Dimensions of Detectors
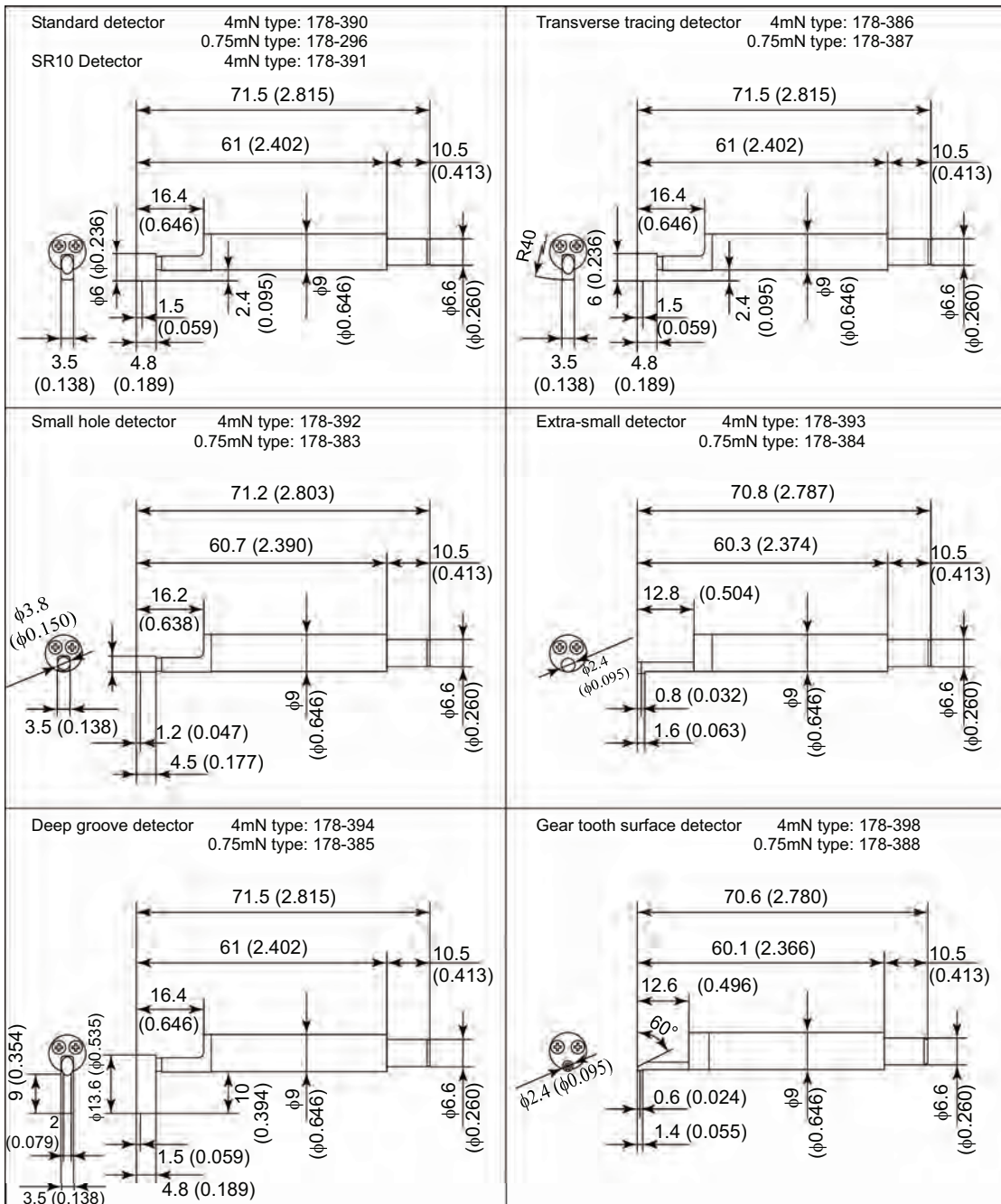
17.8 Consumables

Consumables	Part No.
Replacement battery	12AAL272
Display protection sheet (1 sheet)	12BAK820
Display protection sheet (5 sheets)	12AAL066

17.9 SPC Output Specifications

■ Connector pin assignment

It can be connected to an instrument which has digimatic I/F depending on a setting.

From the Main Menu screen, select "Set. Environ." → "Data Output" → "SPC" before connecting the instrument.

```
2   4   6   8   10
O   O   O   O   O
O   O   O   O   O
1   3   5   7   9
```

Front view
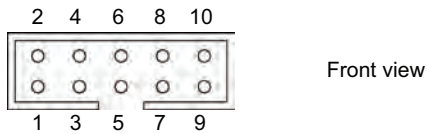
Pin No.	Name	Description
1	GND	Ground
2	DATA	
3	CK	Open collector output
4	$\overline{\text{READY}}$	
5	$\overline{\text{REQUEST}}$	Pull up to Vpp (5 V)
6 to 10	N.C to N.C	—

17.10 Contact Connector Specifications

The following figure shows the connection between the SJ-210 and a foot switch.
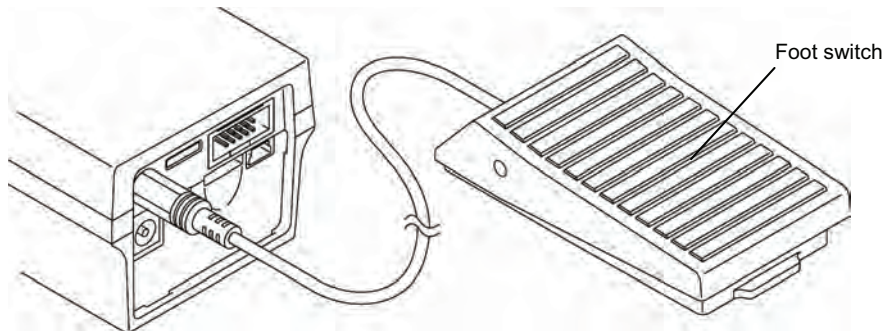
Foot switch connection

17.11 Connection Specifications with a Personal Computer

■ Communication conditions

Pin assignment of the connector between the SJ-210 and a personal computer

SJ-210		Personal computer side	
RS-232C connector		D-SUB connector, 9-pin	
1		DCD	1
2		RXD	2
3		TXD	3
4		DTR	4
5		GND	5
6		DSR	6
7		RTS	7
8		CTS	8
9		RI	9
10			
11			
12			
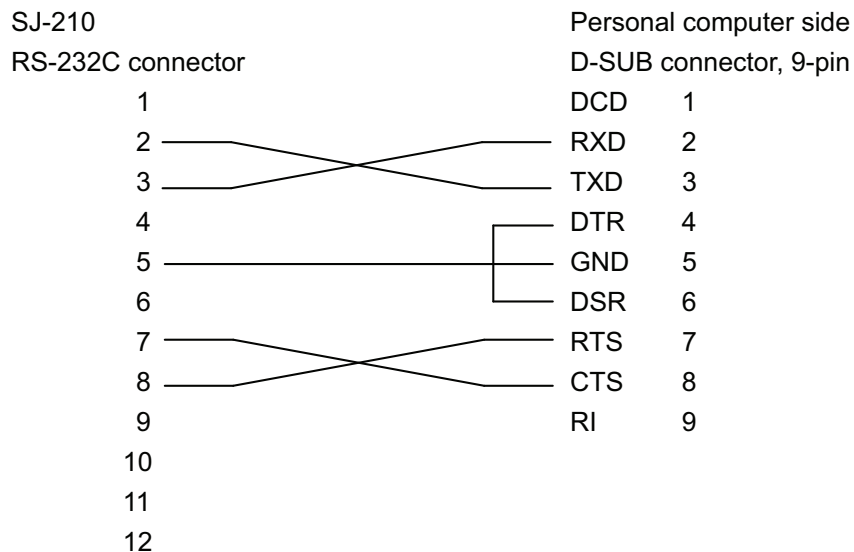
● Communication flow control and transmission/reception processing between the SJ-210 and a personal computer

Here, communication is performed by a hardware control method using two RTS and CTS lines.

When the RTS at the personal computer side is turned off during transfer, the transfer is interrupted. Transmission is resumed after waiting for the RTS at the SJ-210 to be turned on.

When the data can not be received at the SJ-210 side, the RTS is turned off.

17.12 RS-232C Communication Specifications

■ Communication conditions

Setup item	Description
Baud rate	9600, 19200, 38400
Parity	NON, EVEN, ODD
Data bits	8 bits (fixed)
Stop bit	1 bit (fixed)

● Command form

Communication command form consists of 2 bytes header section, 3 bytes sub-field section, data section and EM (end mark) section.

Header (2 bytes)	Sub-field (3 bytes)	Data^{*1}	EM (1 byte)
* *	* * *	* * * * _	CR

EM: End mark

CR: Carriage return code

*1: Data section can be omitted.

● Response form

Following form is returned when processing has normally/abnormally completed.

Header (2 bytes)	Data	EM (1 byte)		
OK	* * * * _	CR	→	Successful termination
NG	Error code	CR	→	Abnormal termination

■ Command

● Control command

● Control command basic configuration

Header	Sub-field	Data*1	EM
(2 bytes)	(3 bytes)		(1 byte)
CT	* * *	* * * * ₋	CR

*1: Data section can be omitted.

● Control command

Sub-field	Data	Meaning
STA	None	Start measurement/Interrupt processing while measurement in progress
OFF	00 - 02 (2 bytes)	Power off/Setting the auto-sleep function
ESP	None	Detector retraction
RTN	None	Reposition the detector to the start position.

STA command

[START/STOP] button operation and start/abort measurement are performed.

* Measurement is aborted when this command is issued during measurement.

● Command

Header	Sub-field	EM
CT	STA	CR

● Response (normal)

Header	EM
OK	CR

● Response (abnormal)

Header	Sub-field	EM	Meaning
NG	* * *	CR	* * *: Refer to "● Error codes".

OFF command

Turns the power off or sets the auto-sleep function.

- Command

Header	Sub-field	Data	EM
CT	OFF	* *	CR

00: Turns the power off immediately after accepting the command
    (power is off while charging in progress).
01: Prohibits processing the auto-sleep function.
02: Accepts processing the auto-sleep function.

- Response (normal)

Header	EM
OK	CR

ESP command

Puts the detector in the retraction state.

- Command

Header	Sub-field	EM
CT	ESP	CR

- Response (normal)

Header	EM
OK	CR

RTN Command

Reposition the detector to the original position. This command is used for processes such as returning from the extended out status.

- Command

Header	Sub-field	EM
CT	RTN	CR

- Response (normal)

Header	EM
OK	CR

● Write command

• Write command basic configuration

Header (2 bytes)	Sub-field (3 bytes)	Data[*1]	EM (1 byte)
WR	* * *	* * * * _	CR

*1: Data section can be omitted.

• Write command

Sub-field	Data	Meaning
CON	* * * * * * ● ● ●	Modification of the measurement conditions or evaluating conditions

CON command

Command to modify measurement/evaluating conditions

Data section   Bytes: number of bytes from the tip of data

Bytes	Settings	Description
0	* (standard)	0: JIS1982, 1: JIS1994, 2: JIS2001, 3: ISO1997, 4: ANSI, 5: VDA, 6: Free
1	* (Profile)	0: P, 1: R, 2: DF, 3: R-MOTIF
2	* (Cutoff length λc)	0: 0.08, 1: 0.25, 2: 0.8, 3: 2.5 λs is set according to λc.
3	* * (Number of sampling lengths)	00 - 10
5	* *. * * (Arbitrary evaluation length)	0.10 - 16.00 (When the number of sampling length is 00) Unit [mm]
10	* (Upper limit of motif length A)	1: 0.02, 2: 0.1, 3: 0.5 Upper limit of motif length B is set according to A.
11	* （Filters）	0:2CR75、1:PC75、2:GAUSS、3:None

• Response (normal)

Header	EM
OK	CR

• Response (abnormal)

Header	Sub-field	EM	Meaning
NG	* * *, * *	CR	* * * : Refer to "● Error codes". * * : Bytes with error code

● Read command

  • Read command basic configuration

Header (2 bytes)	Sub-field (3 bytes)	Data[*1]	EM (1 byte)
RD	* * *	* * * * _	CR

*1: Data section can be omitted.

  • Read command

Sub-field	Data	Meaning
STU	00 - 01 (2 bytes)	Reading status information
SJ_	00 - 01 (2 bytes)	Model name information/Reading F/W version
CON	None	Reading measurement conditions and evaluating conditions
PAR	None	Customized parameter
RES	* *, * *, * * (8 bytes)	Reading calculation results
PSA	None	Reading detector position information

STU command

Reads status information.

  • Command

Header	Sub-field	Data	EM
RD	STU	* *	CR

1) 00: Reading operation status

  • Response

Header	Data	EM
OK	* * *	CR

000: Detector is idling
001: Measurement in progress
002: Detector is being returned
003: Detector is being retracted
004: Detector is retracted
005: Status other than Detector is in the origin/being retracted

2) 01: Reading battery status

• Response

Header	Data	EM
OK	* * *	CR

000: Normal battery voltage (more than 60%)

001: Voltage reduction (below 60%)

002: Abnormal battery (temperature, voltage, no battery)

003: charging

SJ_Command

Reads instrument status information.

• Command

Header	Sub-field	Data	EM
RD	SJ_	* *	CR

_: Space

1) 00: Reading SJ drive unit type

• Response

Header	Data	EM
OK	* * *	CR

000: Standard type

001: Transverse tracing type

002: Retracting type

2) 01: Reading SJ F/W version

• Response

Header	Data	EM
OK	* * * * * ● ● ●	CR

CON command

Reads measurement/evaluating conditions. Shares a common format with the write command.

- Command

Header	Sub-field	EM
RD	CON	CR

- Response

Header	Data	EM
OK	* * * * * ● ● ●	CR

Data   Bytes: number of bytes from the tip of data

Bytes	Settings	Description
0	* (standard)	0: JIS1982, 1: JIS1994, 2: JIS2001, 3: ISO1997, 4: ANSI, 5: VDA, 6: Free
1	* (Profile)	0: P, 1: R, 2: DF, 3: R-MOTIF
2	* (Cutoff length λc)	0: 0.08, 1: 0.25, 2: 0.8, 3: 2.5 λs is set according to λc.
3	* * (Number of sampling lengths)	00 - 10
5	* *. * * (Arbitrary evaluation length)	0.10 - 16.00 (When the number of sampling length is 00) Unit [mm]
10	* (Upper limit of motif length A)	1: 0.02, 2: 0.1, 3: 0.5 Upper limit of motif length B is set according to A.
11	* （Filters）	0:2CR75、1:PC75、2:GAUSS、3:None

PAR command

Reads number of parameters currently customized.

- Command

Header	Sub-field	EM
RD	PAR	CR

- Response

Header	Data	EM
OK	* *	CR

* * : Number of pieces

RES command

Calculation results read command

- Command

Header	Sub-field	Data	EM
RD	RES	* *, * *, * *	CR

1) 00, aa, bb: Calculated results only

    aa: Customized parameter number is shown.

    bb: Multiple values with the same parameter, 00-11, or results for each sampling length

- Response

Header	Data	EM
OK	* * * * * * * (calculated results 7 digits)	CR

2) 01, aa, bb: Reading GO/NG judgment

    aa: Customized parameter number is shown.

    bb: Multiple values with the same parameter

- Response

Header	Data	EM
OK	*	CR

 0: GO/NG judgment OK

 1: Upper limit NG

 2: Lower limit NG

 3: No GO/NG judgment

3) 02, aa, bb: Parameter name, results, reading units

    aa: Customized parameter number is shown.

    bb: Multiple values with the same parameter, 00-11, or results for each sampling length

- Response

Header	Data	EM
OK	* * * * * * (Parameter name 6 digits), * * * * * * * (Calculated results 7 digits), * * * (Unit 3 digits) right-justified	CR

[Example]   Ra   3.123 μm CR

PSA command

Reads current detector position information.　Unit [μ m]

- Command

Header	Sub-field	EM
RD	PSA	CR

- Response

Header	Data	EM
OK	* * *. * * *	CR

● Error codes

Error No.	Error description	Remedies
003	Origin limit cannot be detected within a given period of time.	Checking the drive unit
004	Retraction limit cannot be detected within a given period of time.	Checking the drive unit
005	When detected at the origin limit even after an amount of time has passed.	Checking the drive unit
006	When detected at the retraction limit even after an amount of time has passed.	Checking the drive unit
007	Detector over-range	Checking the measuring point
011	Request while performing operation	
012	Control timeout	
013	Buffer overflow	
014	Flash memory erase error	
015	Flash memory write error	
016	Program error	
017	System error	
018	Measurement start position error	Reset the setup
019	Incorrect settings error	
030	Illegal command	
031	Command format error	
032	Command value error	
033	Processing command	
101	No calculation results	
102	Calculated results are out of the range	
103	Aborts the measurement due to calculation results over-range	
110	Cannot be calculated due to insufficient number of peaks and valleys（Less Peak Valley）	
111	Rz: Less Peak Valley	
112	No sufficient data	
113	Range error	
114	No profile element	
115	Cannot be calculated for the BAC/ADC due to insufficient peaks and	

Error No.	Error description	Remedies
	valleys	
116	Cannot be calculated due to Rk calculation error	
117	R.MOTIF which has less than 2 local peaks of the required height	
118	Initial R.MOTIF which exceeds A	
121	W.MOTIF which can not be calculated as the number of motif is less than 3.	
130	Other calculation error	
150	Memory card initialization error	
151	Memory card format error	
152	Memory card write error	
153	Memory card read error	
154	Memory card deletion error	
155	A memory card is not inserted	
156	No file	
157	Not properly formatted or unformatted	
158	Insufficient file capacity	
159	File access error	
160	File version different	
161	No measurement data	
162	Number of files exceeds	
180	Paper out	
181	Platen position error	
182	Printer anomaly	
183	Printer busy	
184	Printer access timeout	
190	Insufficient battery power	
191	Abnormal temperature	
200	CPU failure	
225	Error other than that	

18 REFERENCE INFORMATION

In this chapter, the surface texture standard and the surface texture parameters are explained.

18.1 Roughness Standard

18.1.1 Evaluating based on JIS B0601-1982

■ Standard cut-off values and evaluation lengths for Ra (Use the 2CR filter.)

Ra Range				Cut-off value (λc)		Evaluation length (ℓn)	
	Ra	≤	12.5 µm	0.8	mm	2.4	mm or more
12.5	< Ra	≤	100.0 µm	2.5	mm	7.5	mm or more

■ Standard cut-off values and evaluation lengths for Ry

Ry Range				Sampling length (ℓ)	
	Ry	≤	0.8 µm	0.25	mm
0.8	< Ry	≤	6.3 µm	0.8	mm
6.3	< Ry	≤	25.0 µm	2.5	mm
25.0	< Ry	≤	100.0 µm	8	mm
100.0	< Ry	≤	400.0 µm	25	mm

■ Standard cut-off values and evaluation lengths for Rz

Rz range				Sampling length (ℓ)	
	Ry	≤	0.8 µm	0.25	mm
0.8	< Ry	≤	6.3 µm	0.8	mm
6.3	< Ry	≤	25.0 µm	2.5	mm
25.0	< Ry	≤	100.0 µm	8	mm
100.0	< Ry	≤	400.0 µm	25	mm

18.1.2   Evaluating based on JIS B0601-1994

■ Standard cut-off values and evaluation lengths for Ra

Ra Range					Cut-off value (λc)		Sampling length (ℓ)		Evaluation length (ℓn)	
(0.006)	<	Ra	≤	0.02	μm	0.08	mm	0.08	mm	0.4	mm
0.02	<	Ra	≤	0.1	μm	0.25	mm	0.25	mm	1.25	mm
0.1	<	Ra	≤	2.0	μm	0.8	mm	0.8	mm	4	mm
2.0	<	Ra	≤	10.0	μm	2.5	mm	2.5	mm	12.5	mm
10.0	<	Ra	≤	80.0	μm	8	mm	8	mm	40	mm

■ Standard cut-off values and evaluation lengths for Ry

Ry Range					Cut-off value (λc)		Sampling length (ℓ)		Evaluation length (ℓn)	
(0.025)	<	Ry	≦	0.10	μm	0.08	mm	0.08	mm	0.4	mm
0.10	<	Ry	≦	0.50	μm	0.25	mm	0.25	mm	1.25	mm
0.50	<	Ry	≦	10.0	μm	0.8	mm	0.8	mm	4	mm
10.0	<	Ry	≦	50.0	μm	2.5	mm	2.5	mm	12.5	mm
50.0	<	Ry	≦	200.0	μm	8	mm	8	mm	40	mm

■ Standard cut-off values and evaluation lengths for Rz

Rz range					Cut-off value (λc)		Sampling length (ℓ)		Evaluation length (ℓn)	
(0.025)	<	Rz	≦	0.10	μm	0.08	mm	0.08	mm	0.4	mm
0.10	<	Rz	≦	0.50	μm	0.25	mm	0.25	mm	1.25	mm
0.50	<	Rz	≦	10.0	μm	0.8	mm	0.8	mm	4	mm
10.0	<	Rz	≦	50.0	μm	2.5	mm	2.5	mm	12.5	mm
50.0	<	Rz	≦	200.0	μm	8	mm	8	mm	40	mm

■ Standard cut-off values and evaluation lengths for Sm

Sm Range					Cut-off value (λc)		Sampling length (ℓ)		Evaluation length (ℓn)	
0.013	<	Sm	≦	0.04	μm	0.08	mm	0.08	mm	0.4	mm
0.04	<	Sm	≦	0.13	μm	0.25	mm	0.25	mm	1.25	mm
0.13	<	Sm	≦	0.4	μm	0.8	mm	0.8	mm	4	mm
0.4	<	Sm	≦	1.3	μm	2.5	mm	2.5	mm	12.5	mm
1.3	<	Sm	≦	4.0	μm	8	mm	8	mm	40	mm

18.1.3   Evaluating based on VDA

Shown below are the standard cut-off values, sampling lengths, and evaluation lengths for evaluation based on VDA.

NOTE • With the SJ-210, when the VDA standard is selected, the λs filter automatically changes to (NONE). To enable the λs filter, refer to 7.6, "Modifying Items Related to Cut-off".

• Be aware that with the VDA standard, there are some differences with JIS B0601-2001 and ISO, such as λs not being set by default.

■ Standard sampling lengths and evaluation lengths for the measurement of Ra and Rq from non-periodic roughness profiles

Ra Range						Sampling length (ℓ)		Evaluation length (ℓn)	
（0.006）	<	Ra	≦	0.02	μm	0.08	mm	0.4	mm
0.02	<	Ra	≦	0.1	μm	0.25	mm	1.25	mm
0.1	<	Ra	≦	2.0	μm	0.8	mm	4	mm
2.0	<	Ra	≦	10.0	μm	2.5	mm	12.5	mm
10.0	<	Ra	≦	80.0	μm	8	mm	40	mm

■ Standard sampling lengths and evaluation lengths for measurement of Rz, Rp, and Rt from non-periodic roughness profiles

Rz range						Sampling length (ℓ)		Evaluation length (ℓn)	
(0.025)	<	Rz	≦	0.10	µm	0.08	mm	0.4	mm
0.10	<	Rz	≦	0.50	µm	0.25	mm	1.25	mm
0.50	<	Rz	≦	10.0	µm	0.8	mm	4	mm
10.0	<	Rz	≦	50.0	µm	2.5	mm	12.5	mm
50.0	<	Rz	≦	200.0	µm	8	mm	40	mm

■ Standard sampling lengths and evaluation lengths for the measurement of roughness parameters from periodic profiles, and for the measurement of RSm from both periodic and non-periodic profiles

RSm Range						Sampling length (ℓ)		Evaluation length (ℓn)	
0.013	<	RSm	≦	0.04	µm	0.08	mm	0.4	mm
0.04	<	RSm	≦	0.13	µm	0.25	mm	1.25	mm
0.13	<	RSm	≦	0.4	µm	0.8	mm	4	mm
0.4	<	RSm	≦	1.3	µm	2.5	mm	12.5	mm
1.3	<	RSm	≦	4.0	µm	8	mm	40	mm

18.1.4　Evaluation based on JIS B0601-2001 and ISO

Shown below are the standard sampling lengths and evaluation lengths for evaluation based on JIS B0601-2001 and ISO.

■ Standard sampling lengths and evaluation lengths for the measurement of roughness parameters from periodic profiles, and for the measurement of RSm from both periodic and non-periodic profiles

RSm Range						Sampling length (ℓ)		Evaluation length (ℓn)	
0.013	<	RSm	≦	0.04	µm	0.08	mm	0.4	mm
0.04	<	RSm	≦	0.13	µm	0.25	mm	1.25	mm
0.13	<	RSm	≦	0.4	µm	0.8	mm	4	mm
0.4	<	RSm	≦	1.3	µm	2.5	mm	12.5	mm
1.3	<	RSm	≦	4.0	µm	8	mm	40	mm

■ Standard sampling lengths and evaluation lengths for the measurement of Ra and Rq from non-periodic roughness profiles

Ra Range					Sampling length (ℓ)		Evaluation length (ℓn)	
(0.006)	<	Ra	≦	0.02 μm	0.08	mm	0.4	mm
0.02	<	Ra	≦	0.1 μm	0.25	mm	1.25	mm
0.1	<	Ra	≦	2.0 μm	0.8	mm	4	mm
2.0	<	Ra	≦	10.0 μm	2.5	mm	12.5	mm
10.0	<	Ra	≦	80.0 μm	8	mm	40	mm

■ Standard sampling lengths and evaluation lengths for measurement of Rz, Rp, and Rt from non-periodic roughness profiles

Rz range					Sampling length (ℓ)		Evaluation length (ℓn)	
(0.025)	<	Rz	≦	0.10 μm	0.08	mm	0.4	mm
0.10	<	Rz	≦	0.50 μm	0.25	mm	1.25	mm
0.50	<	Rz	≦	10.0 μm	0.8	mm	4	mm
10.0	<	Rz	≦	50.0 μm	2.5	mm	12.5	mm
50.0	<	Rz	≦	200.0 μm	8	mm	40	mm

18.1.5 Evaluating based on ANSI

Shown below are the standard cut-off values and evaluation lengths for evaluation based on ANSI.

■ Standard cut-off lengths and evaluation lengths for measuring roughness parameters from periodic profiles

Sm Range						Cut-off value (λc)		Evaluation length (ℓn)	
0.013 (0.0005)	<	Sm	≤	0.04 (0.0016)	mm (in)	0.08 (0.003)	mm (in)	0.4 (0.016)	mm (in)
0.04 (0.0016)	<	Sm	≤	0.13 (0.005)	mm (in)	0.25 (0.01)	mm (in)	1.25 (0.05)	mm (in)
0.13 (0.005)	<	Sm	≤	0.4 (0.016)	mm (in)	0.8 (0.03)	mm (in)	4 (0.16)	mm (in)
0.4 (0.016)	<	Sm	≤	1.3 (0.05)	mm (in)	2.5 (0.1)	mm (in)	12.5 (0.5)	mm (in)

To select a cut-off value from the previous table, you must estimate the Sm value from an unfiltered-profile chart.

■ Standard cut-off lengths and evaluation lengths for measuring roughness parameters from non-periodic profiles

Ra Range						Cut-off value (λc)		Evaluation length (ℓn)	
		Ra	≤	0.02 (0.8)	μm (μin)	0.08 (0.003)	mm (in)	0.4 (0.016)	mm (in)
0.02 (0.8)	<	Ra	≤	0.10 (4)	μm (μin)	0.25 (0.01)	mm (in)	1.25 (0.05)	mm (in)
0.10 (4)	<	Ra	≤	2.0 (80)	μm (μin)	0.8 (0.03)	mm (in)	4 (0.16)	mm (in)
2.0 (80)	<	Ra	≤	10.0 (400)	μm (μin)	2.5 (0.1)	mm (in)	12.5 (0.5)	mm (in)

18.2   Evaluation Profiles and Filters   *18-7*

18.2.1   Evaluation profiles

■ Unfiltered profile P

> This profile represents the cross-section obtained by intersecting the measuring surface with a flat plane at a right angle. The profile is a representation of the actual profile obtained by tracing the surface with a surface-roughness measuring device.
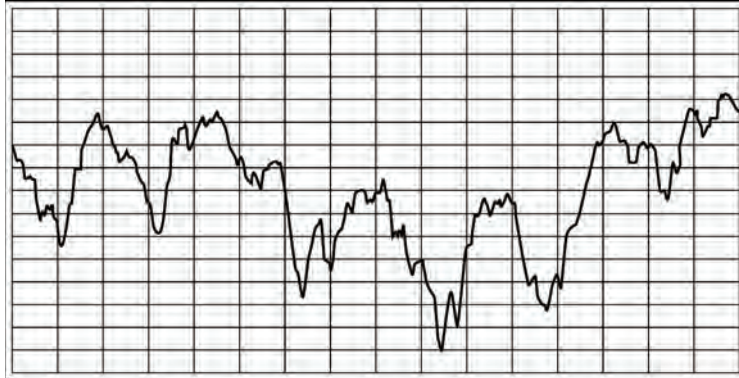
Unfiltered profile P

■ Roughness profile R

> This profile is obtained by filtering the unfiltered profile with a long-wavelength cut-off filter (high-pass filter) to remove long wavelength segments.
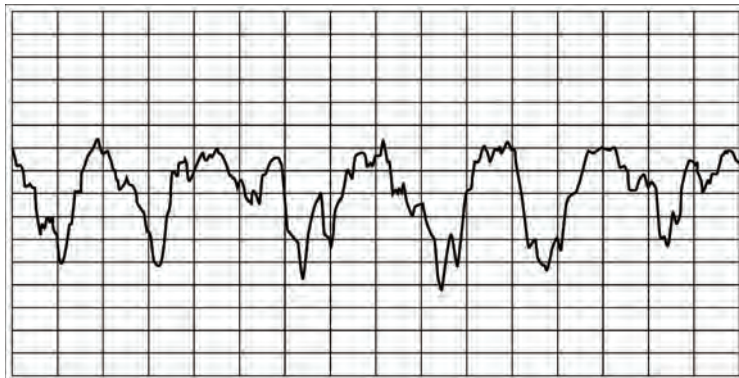
Roughness profile R

■ Motif

Normally, when wave segments are removed from an evaluation profile, the evaluation profile becomes distorted. The motif method is designed to remove waviness without causing distortion.

With this method, an evaluation profile is divided into units called "motifs", which are based on the wavelength of a component to be removed, and parameters to evaluate the profile are calculated from each motif.
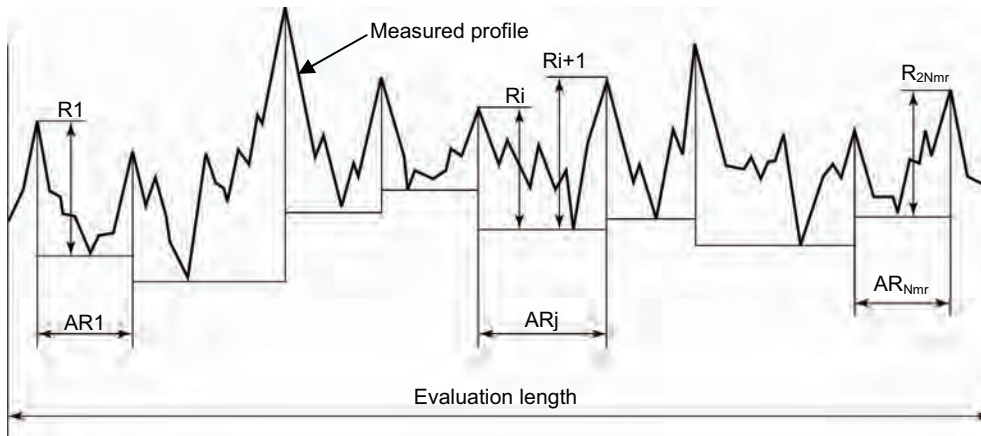
Parameters calculated from the motif analysis

■ DIN4776 profile

For measured surfaces that have deep valleys relative to the irregularity of the surface, the position of a mean line that is calculated with these deep valleys is inappropriate for evaluating the true roughness of the surface. However, with this procedure, those negative effects can be avoided to a certain extent. The procedure is shown below.

1. The initial mean line is obtained with respect to the input data.
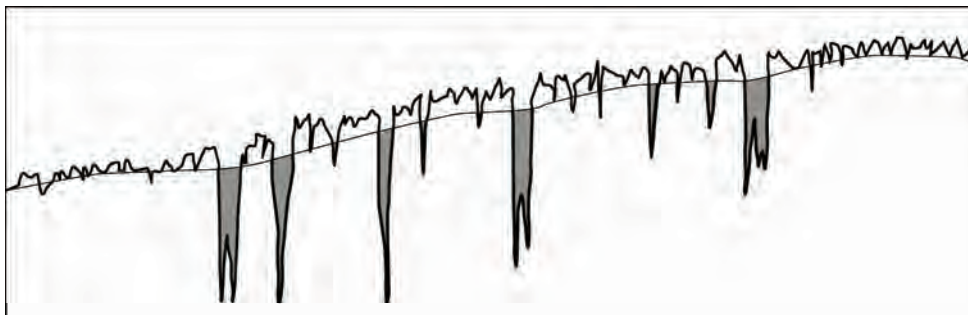
Initial mean line

2.   Valleys below the mean line are removed.
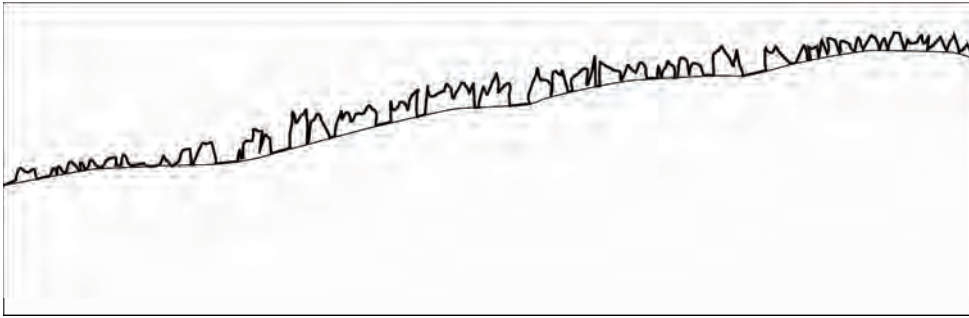
Removal of valleys

3.   The second mean line is obtained with respect to the data obtained in step 2.
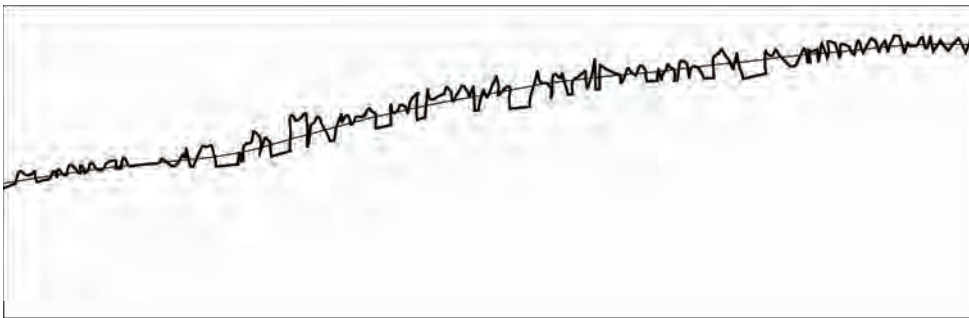
Second mean line

4.   The original input data is adjusted according to the second mean line.
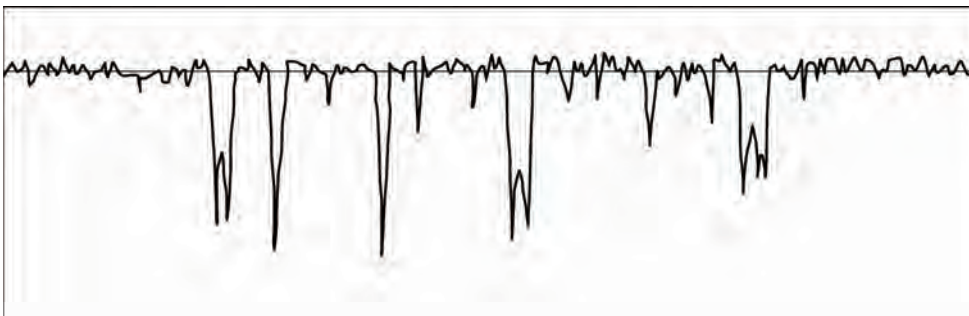
Adjustment of original data

18.2.2 Filters

■ Types of filters

The following 3 types of filters are available.

Filter	Amplitude characteristics	Phase characteristics	Amplitude transmission at the cut-off value
2CR	2CR	Without phase correction	75%
PC75	2CR	Phase correction	75%
GAUSS	Gaussian	Phase correction	50%

The characteristics of each filter are explained below.

The attenuation characteristic of each filter is represented by the characteristics of a high-pass filter.

- 2CR

   This filter has the same attenuation characteristic as 2 C-R circuits that are connected in series and that have identical time constants.

   The attenuation characteristic is -12 dB/oct, and the amplitude transmission at the cut-off value is 75%, as shown in figure below.
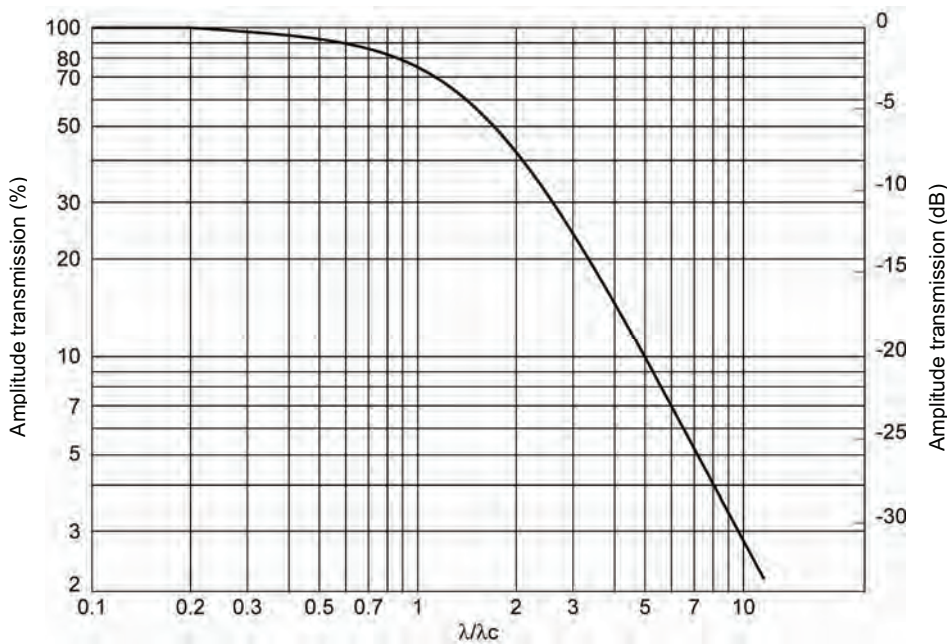
Attenuation characteristic of 2CR filter

Attenuation characteristic: $H(\lambda) = \dfrac{1}{1 + \left(\dfrac{\lambda}{\sqrt{3}\,\lambda c}\right)^2}$

- GAUSS (Gaussian)

  The amplitude characteristic is approximately -11.6 dB/oct, and the amplitude transmission at the cut-off value is 50%. The attenuation characteristic is shown in the figure below.
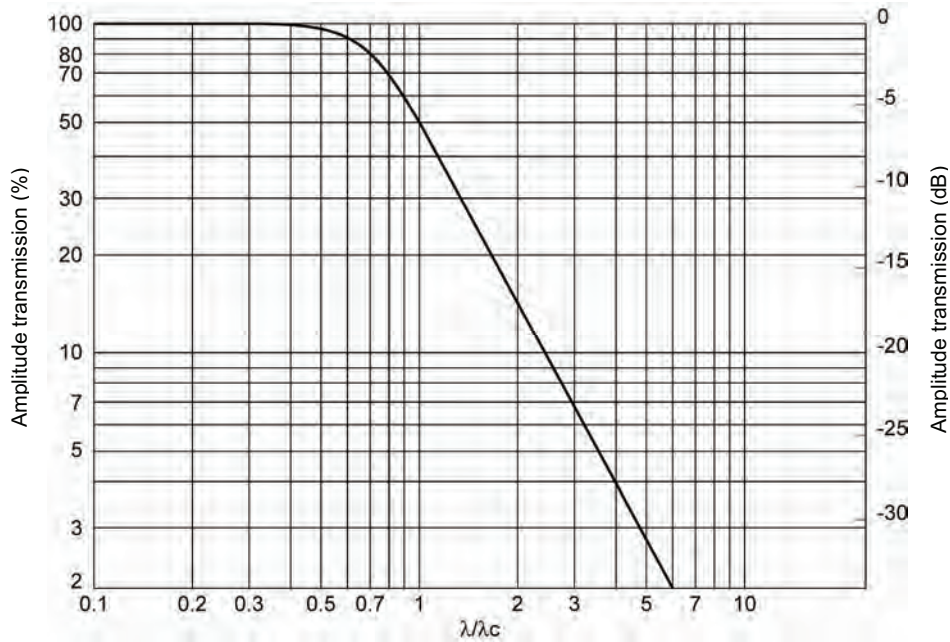
Attenuation characteristic of the GAUSS (Gaussian) filter

Attenuation characteristic: $H(\lambda) = 1 - e^{-\pi\left(\frac{a\lambda c}{\lambda}\right)^2}$

where $a = \left(\dfrac{\ln 2}{\pi}\right)^{\frac{1}{2}} \fallingdotseq 0.4697$

Using this filter results in a simple equation:

unfiltered profile = roughness profile + waviness profile

Therefore, the low-pass filter is characterized by:

Attenuation characteristic: $H(\lambda) = e^{-\pi\left(\frac{a\lambda c}{\lambda}\right)^2}$

- About the phase compensation filter
  For the regular 2CR filter, output waveforms may be distorted due to phase deviations that vary with each wavelength.
  Shown below are the responses of both a low-pass filter and a high-pass filter to square wave input.

Input signal (square wave)

0.20 μm/cm (×50000)

500.00 μm/cm (×20)

Input wave form

LPF: PC

0.20 μm/cm (×50000)

500.00 μm/cm (×20)

LPF: 2CR

0.20 μm/cm (×50000)

500.00 μm/cm (×20)

Low-pass filter

HPF: PC

0.50 μm/cm (×20000)

500.00 μm/cm (×20)

HPF: 2CR

0.20 μm/cm (×50000)

500.00 μm/cm (×20)

High-pass filter
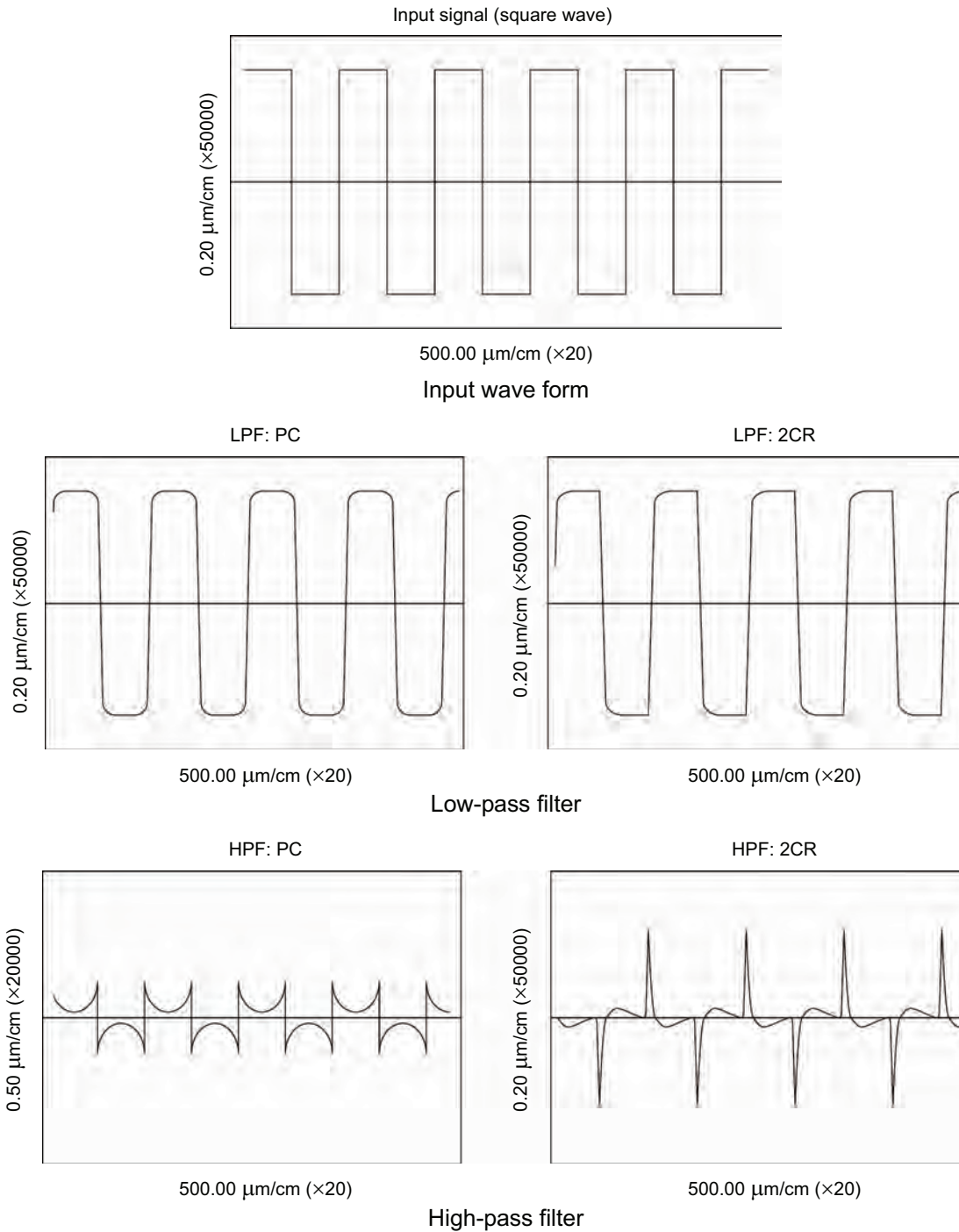
18.2.3   Differences in filter characteristics   *18-13*

- The difference of the amplitude transmission factor for the cut-off value of 2CR and PC

  They are both the same filter, but the definition of the cut-off value is the only difference.

  The differences between the two are shown in the figures below.
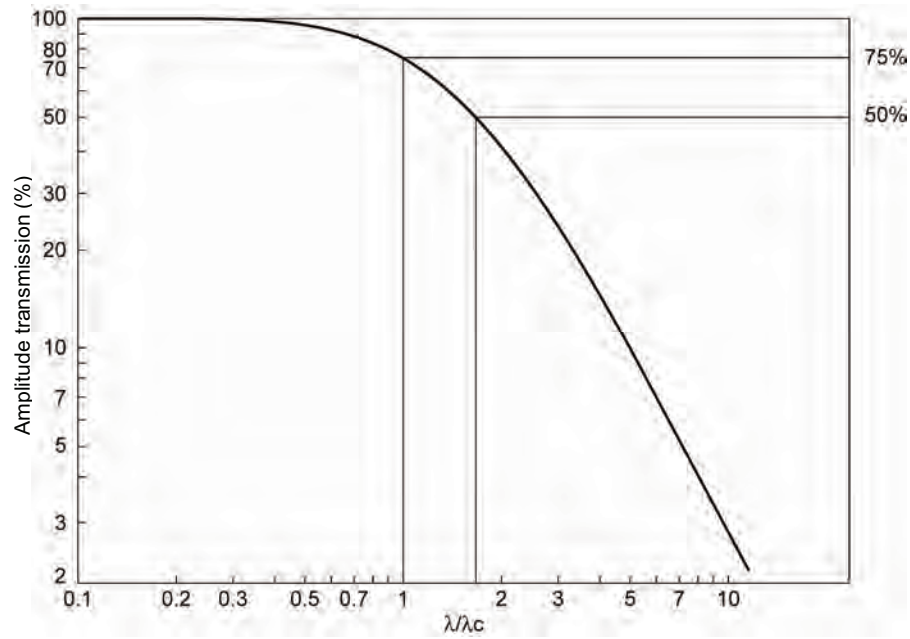
Different cut-off values with the same filter
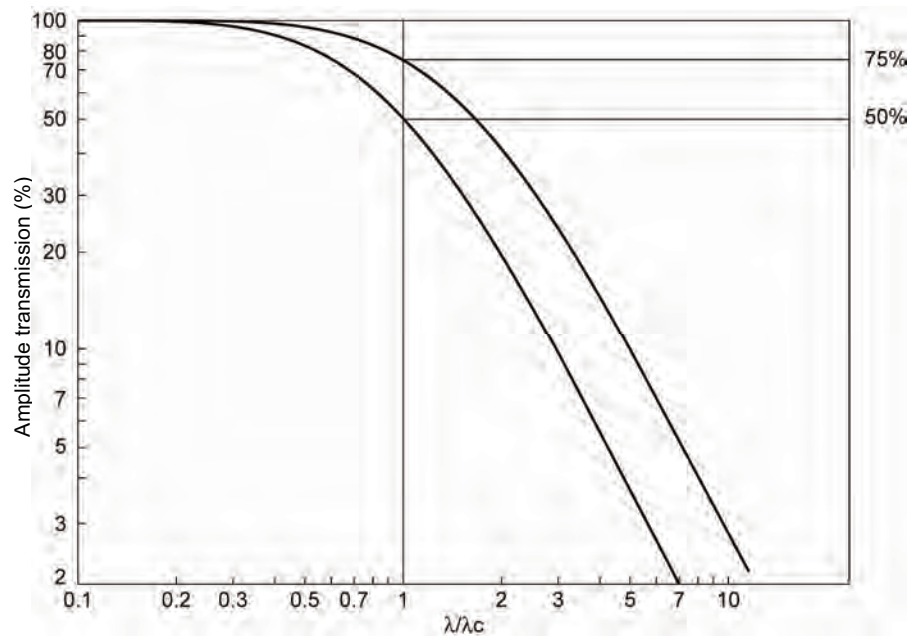
Comparison of two filters at the same cut-off value

18.2.4 Amplitude characteristics of 2CR and GAUSS (Gaussian) filters

- About the amplitude characteristics of the 2CR and GAUSS (Gaussian) filters
  The differing amplitude characteristics of the 2CR and GAUSS (Gaussian) filters are detailed below.
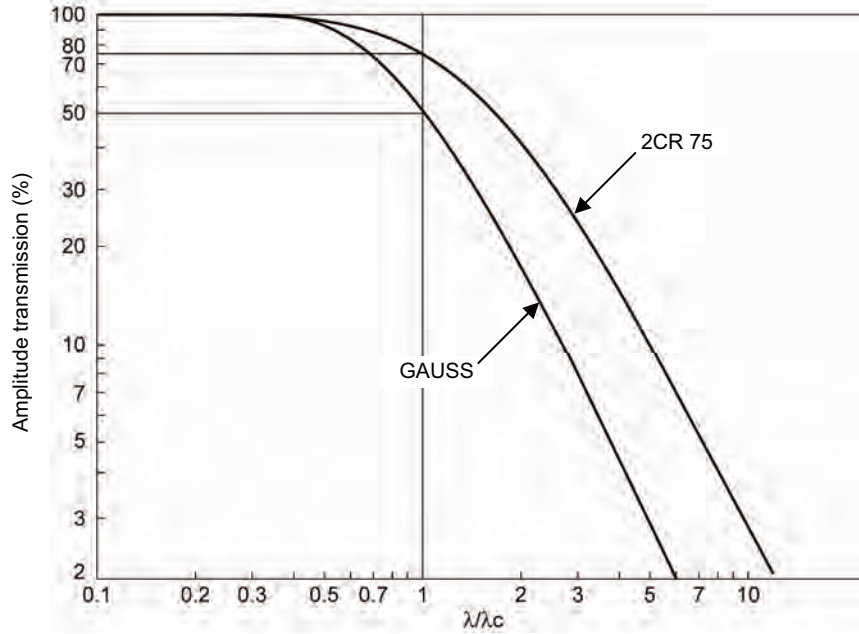
Difference in amplitude characteristics of 2CR and GAUSS filters

■ Filters and relevant standards

The following table lists the correspondence between each filter and its corresponding standards.

Filters	JIS	ISO	ANSI/ASME	VDA (DIN)
2CR	B0601-1982 B0610-1987 B0651-1976	3274 (1975)	B46.1-1985	DIN4762
PC 75				
GAUSS	B0601-1994 B0651-1996 B0601-2001 B0651-2001	11562 (1996)	B46.1-1995	DIN4777

18.3 Mean Line Compensation

18-15

The following table shows the relationships in the SJ-210 between the profiles, the filters, and the mean line.

Profile	Filters	Mean line	
Unfiltered profile	-	Arbitrary length	A line calculated by the least-squares method over the entire evaluation length
	-	Sampling length	A line calculated by the least-squares method over each sampling segment
Roughness profile	2CR	A line calculated by the least-squares method over the entire evaluation length	
	PC 75	A line calculated by the least-squares method over the entire evaluation length	
	GAUSS	Calculated during filtering.	
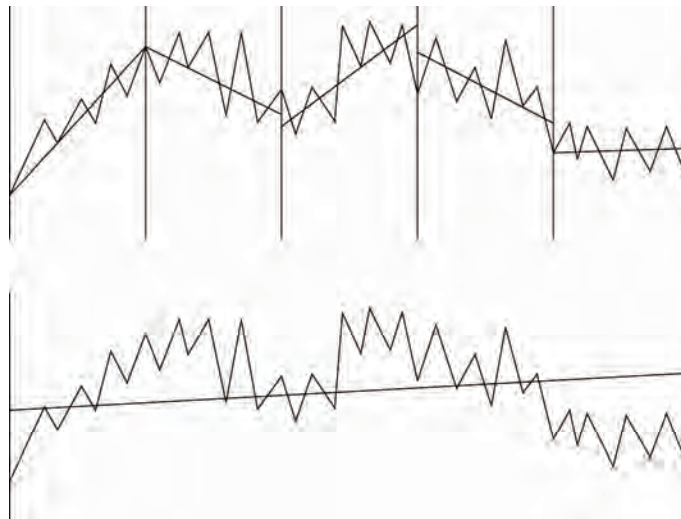
A line calculated by the least-squares method over each sampling segment

A line calculated by the least-squares method over the entire evaluation length

Mean line compensation

18.4 Traversal Length

In the SJ-210, the traversal length is the sum of the measured length, the approach travel length, the pre-travel length, and the post-travel length.

NOTE • The pre-travel length and the post-travel length vary depending on the filter used. When the pre-travel and post-travel settings are set to NO, the traversal length is reduced by the pre-travel length and the post-travel length. For details about enabling/disabling the pre-travel and post-travel, refer to 7.9, "Setting Pre-travel/Post-travel".

Measuring operation

1 Cycle   Reciprocal motion   ⟶ ⟵   1 mm/s (0.02 in/s)
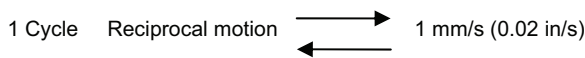
Measurement starts from the origin position. When measurement has been completed, the detector returns to the origin.

■ Traversal length

  • When the 2CR filter is selected
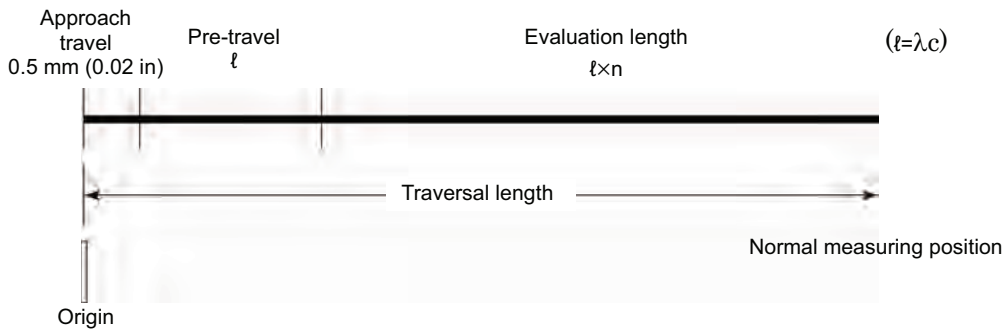
Traversal length (When 2CR filter is selected)
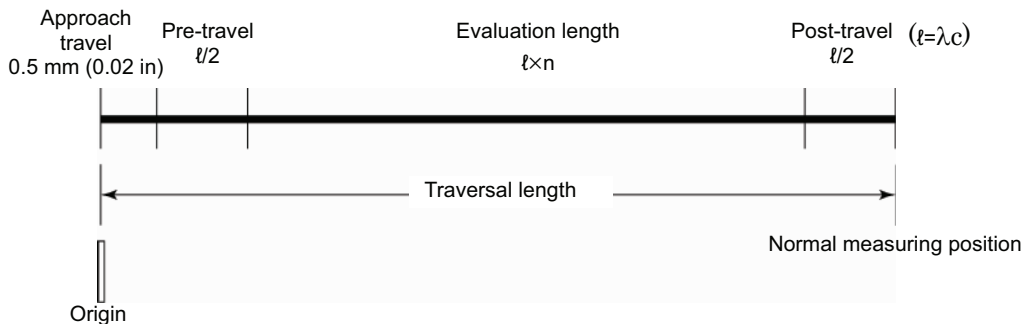
  • When GAUSS filter is selected

Traversal length (When GAUSS filter is selected)

Data from the pre-travel length and the post-travel length are calculated assuming that their lengths are $\ell/2$.

• When the PC75 filter is selected
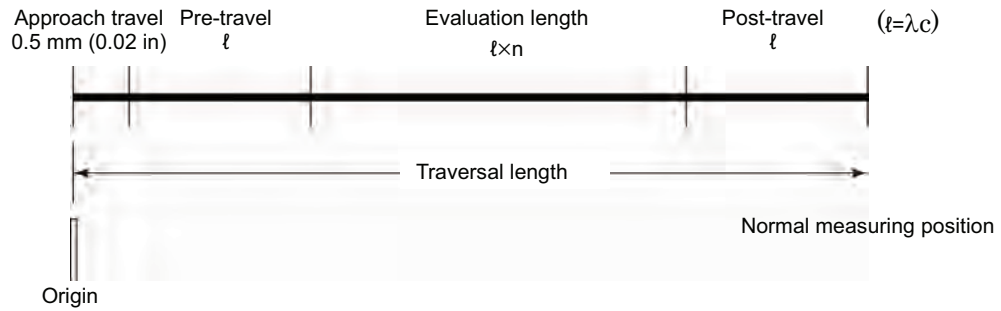
Approach travel | Pre-travel | Evaluation length | Post-travel | $(\ell=\lambda c)$
0.5 mm (0.02 in) | ℓ | $\ell\times n$ | ℓ

Traversal length

Normal measuring position

Origin

Traversal length (When PC75 filter is selected)

Data from the pre-travel length and the post-travel length are calculated assuming that their lengths are ℓ.

• When measuring with the unfiltered profile (P)

Approach travel | Evaluation length
0.5 mm (0.02 in) | $\ell\times n$

Traversal length

Normal measuring position

Origin
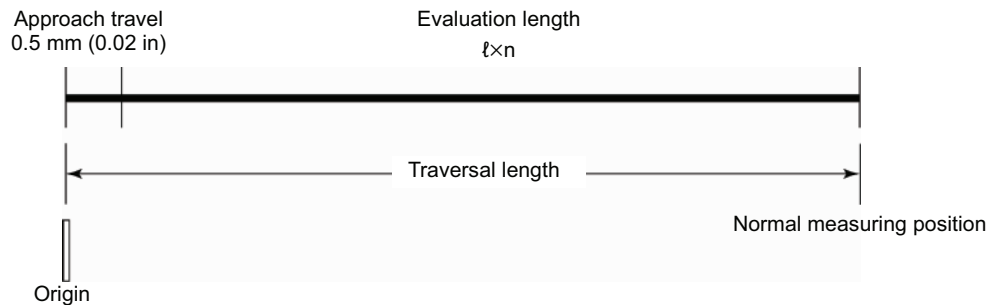
Traversal length (when measuring with the unfiltered profile (P))

TIP • When measuring the roughness profile with pre-travel and post-travel lengths disabled, the calculation is performed with the pre-travel and post-travel data folded (nulled).

■ Traversal length when using a detector retracting type drive unit

• When the 2CR75 filter is selected

Escape range
2 mm (0.079 in)

Approach travel | Pre-travel | Evaluation length
2.5 mm (0.098 in) | ℓ | $\ell\times n$

Traversal length

Normal measuring position

Origin
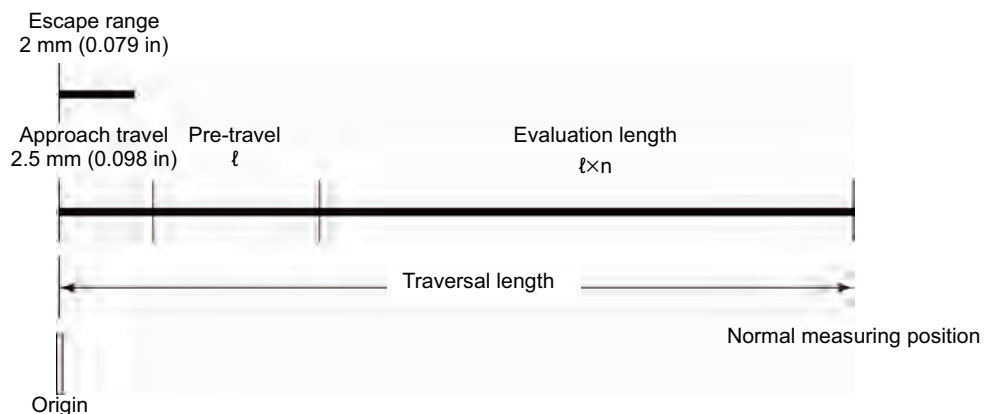
Traversal length (When 2CR75 filter is selected)

- When GAUSS filter is selected

Escape range
2 mm (0.079 in)

Approach travel
2.5 mm (0.098 in)

Pre-travel
$\ell/2$

Evaluation length
$\ell \times n$

Post-travel
$\ell/2$

Traversal length

Normal measuring position

Origin
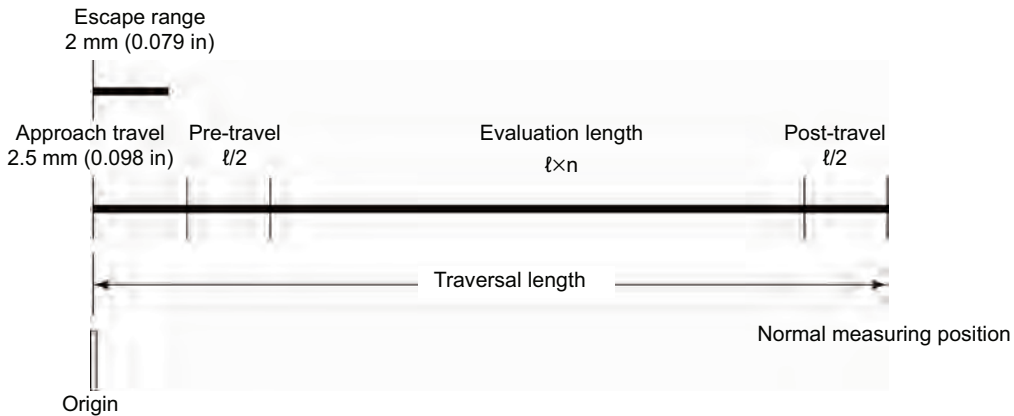
Traversal length (When GAUSS filter is selected)

- When the PC75 filter is selected

Escape range
2 mm (0.079 in)

Approach travel
2.5 mm (0.098 in)

Pre-travel
ℓ

Evaluation length
$\ell \times n$

Post-travel
ℓ

Traversal length

Normal measuring position

Origin
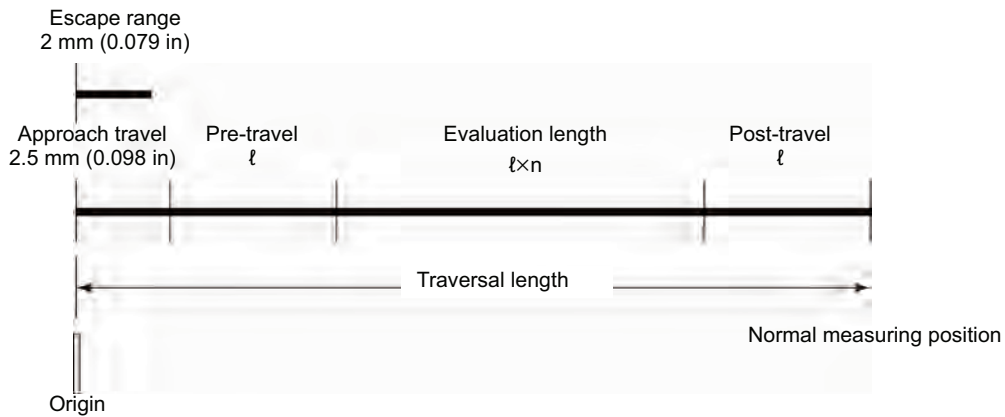
Traversal length (When PC75 filter is selected)

- When measuring with the unfiltered profile (P)
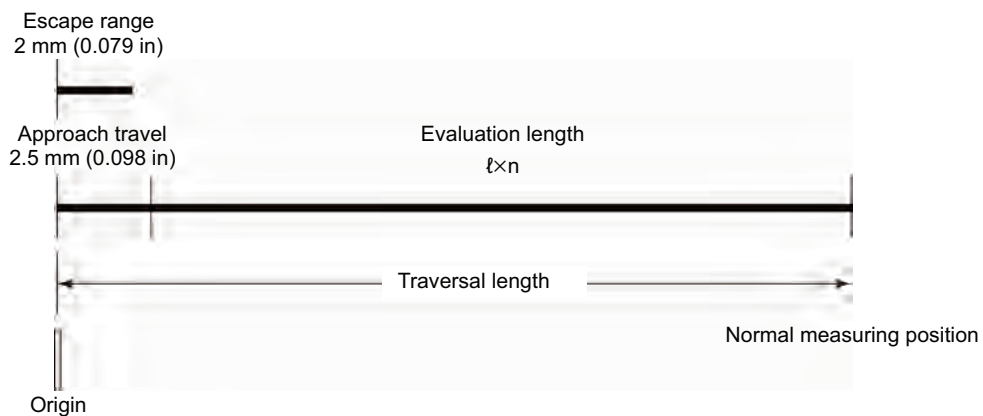
Escape range
2 mm (0.079 in)

Approach travel
2.5 mm (0.098 in)

Evaluation length
$\ell \times n$

Traversal length

Normal measuring position

Origin

Traversal length (when measuring with the unfiltered profile (P))

TIP • When measuring the roughness profile with pre-travel and post-travel lengths is disabled, the calculation is performed with the pre-travel and post-travel data folded (nulled).

18.5 Definitions of the SJ-210 Roughness Parameters

This section explains the definitions (calculation methods) of the roughness parameters that can be measured with the SJ-210.

Sampling length ℓ

Evaluation length ℓn=ℓ×n
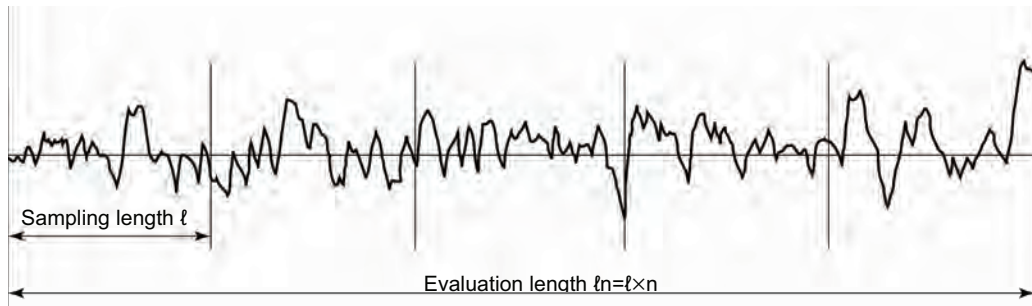
Sampling length and evaluation length

The following explanations show how the parameters are calculated based on the sampling length. Parameters that are calculated based on the evaluation length are noted as such.

18.5.1 Ra (JIS1994, JIS2001, ISO1997, ANSI, VDA, Free): Arithmetic mean of roughness, Ra (JIS1982): Arithmetic mean deviation of roughness

Ra is the arithmetic mean of the absolute values of the evaluation profile deviations (Yi) from the mean line.

$$Ra = \frac{1}{n}\sum_{i=1}^{n}|Yi|$$

- For ANSI, Ra is defined over the entire evaluation length.

18.5.2 Rq (JIS2001, ISO1997, ANSI, VDA, Free): Mean square of roughness

Rq is the square root of the arithmetic mean of the squares of the deviations (Yi) from the mean line to the evaluation profile.

$$Rq = \left(\frac{1}{n}\sum_{i=1}^{n}Yi^2\right)^{\frac{1}{2}}$$

- For ANSI, Rq is defined over the entire evaluation length.

18.5.3 Rz (JIS2001, ISO1997, ANSI, VDA, Free), Rmax (JIS1982), Ry (JIS1994, Free): Maximum height

Divide the evaluation profile into segments based on the sampling length. Then, for each segment, obtain the sum (Zi) of the highest point from the mean line (Pi) and the lowest point from the mean line (Vi). The average of these sums is Rz, Rmax (for JIS1982), or Ry (for JIS1994).

$$Rz = \frac{Z1 + Z2 + Z3 + Z4 + Z5}{5}$$ (When n=5, where n is the number of segments)
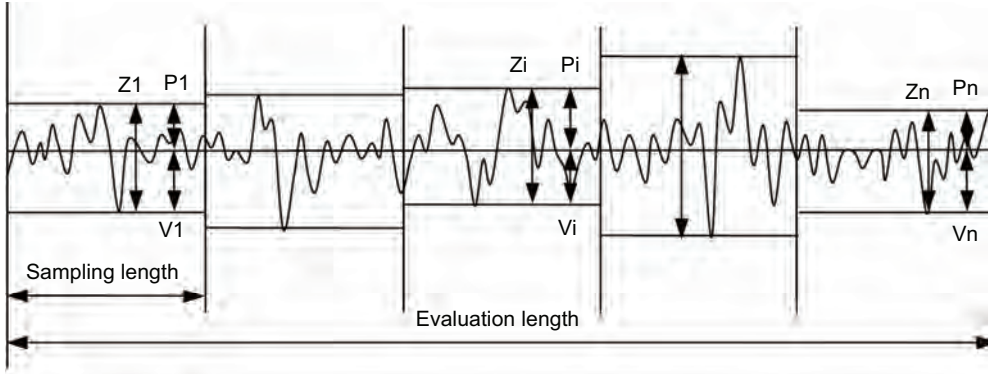
Rz maximum height

- Evaluation profile mountains/peaks and valleys/floors
  When the evaluation profile contains a mean line, portions of the profile that project above the mean line are called "mountains", and portions of the profile that project below the mean line are called "valleys". The highest point of each mountain is called the "peak", and the deepest point of each valley is called the "floor".

18.5.4 Rp (JIS2001, ISO1997, ANSI, VDA, Free), Rpm (ANSI): Tallest peak

Divide the evaluation profile into segments of based on the sampling length. Then, for each segment, obtain the distance of the highest point (Rpi) from the mean line. Rp is the mean of the Rpi values that were obtained from the segments.

$$Rp = \frac{Rp1 + Rp2 + Rp3 + Rp4 + Rp5}{5}$$ (When n=5, where n is the number of segments)

- Rp (ANSI) is defined as the maximum peak height over the evaluation length.

18.5.5 Rv (JIS2001, ISO1997, ANSI, VDA, Free): Maximum valley depth

Divide the evaluation profile into segments based on the sampling length. Then, for each segment, obtain the distance of the lowest point (Rvi) from the mean line. Rv is the mean of the Rvi values that were obtained from the segments.

$$Rv = \frac{Rv1 + Rv2 + Rv3 + Rv4 + Rv5}{5}$$ (When n=5, where n is the number of segments)

- Rv (ANSI) is defined as the maximum floor depth over the evaluation length.

18.5.6 Rt (JIS2001, ISO1997, ANSI, VDA, Free): Maximum roughness

Rt is the sum of the distance from the mean line to the highest peak and the distance from the mean line to the deepest floor, for the entire evaluation length.

18.5.7 R3z (Free): Third-level height

Divide the evaluation profile into segments based on the sampling length. Then, for each segment, obtain the sum (3Zi) of the distance of the 3rd highest peak from the mean line and the distance of the 3rd deepest floor from the mean line. R3z is the mean of the 3Zi values obtained from the segments.

- Evaluation profile mountains/peaks and valleys/floors
  When the evaluation profile contains a mean line, portions of the profile that project above the mean line are called "mountains", and portions of the profile that project below the mean line are called "valleys". The highest point of each mountain is called the "peak", and the deepest point of each valley is called the "floor". However, when the distance of a peak or valley floor from the mean line is less than 10% of the Ry value, the peak/floor is not regarded as a peak or floor.

18.5.8　Rsk (JIS2001, ISO1997, ANSI, VDA, Free): Skewness (degree of asymmetry)

Rsk represents the degree of bias either in the upward or downward direction of an amplitude distribution curve[*1].

$$Rsk = \frac{1}{Rq^3} \cdot \frac{1}{n} \sum_{i=1}^{n} Yi^3$$

*1: For details about amplitude distribution curves, refer to 18.5.35, "ADC: Amplitude distribution curve".
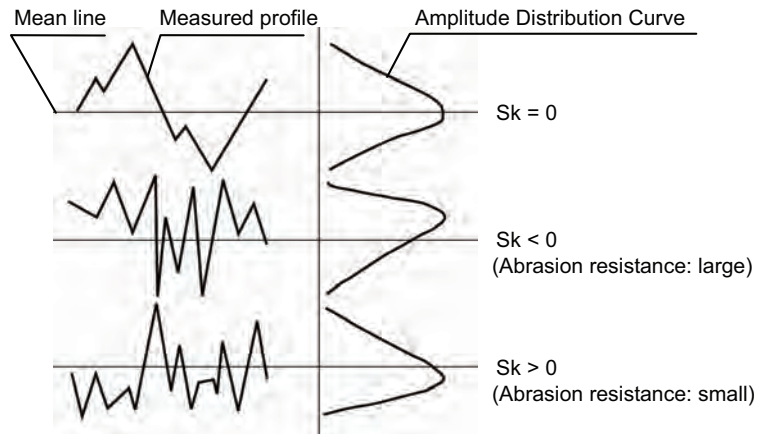
Amplitude distribution curve

- For ANSI, Rsk is defined over the entire evaluation length.

18.5.9   Rku (JIS2001, ISO1997, ANSI, VDA, Free): Kurtosis

Ku represents the degree of concentration around the mean line of an amplitude distribution curve[1].

$$Rku = \frac{1}{Rq^4} \cdot \frac{1}{n} \sum_{i=1}^{n} Yi^4$$

*1: For details about amplitude distribution curves, refer to 18.5.35, "ADC: Amplitude distribution curve".

Amplitude distribution curve
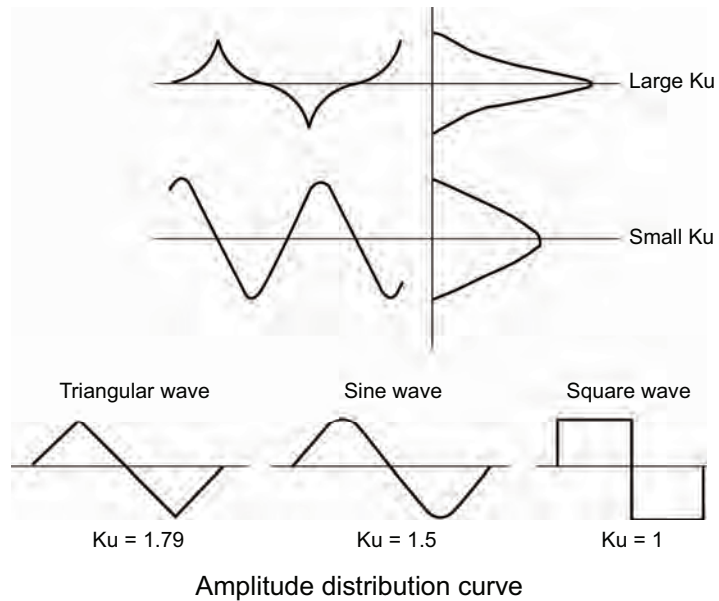
- For ANSI, Ku is defined over the entire evaluation length.

18.5.10   Rc (JIS2001, ISO1997, ANSI, VDA, Free): Average height

Portions of the evaluation profile that project upwards are called "profile element mountains", and portions of the profile that project downwards are called "profile element valleys". A mountain followed by a valley is called a "profile element". Rc is the arithmetic mean of the height (Zt) of each profile element.

$$Rc = \frac{1}{n}\sum_{i=1}^{n} Zti$$

- Depending on the calculation definition in the parameter-conditions settings, the calculation method differs.

(2) Zt: Zt > Zmin   (Example: Zmin = 10% of Rz)
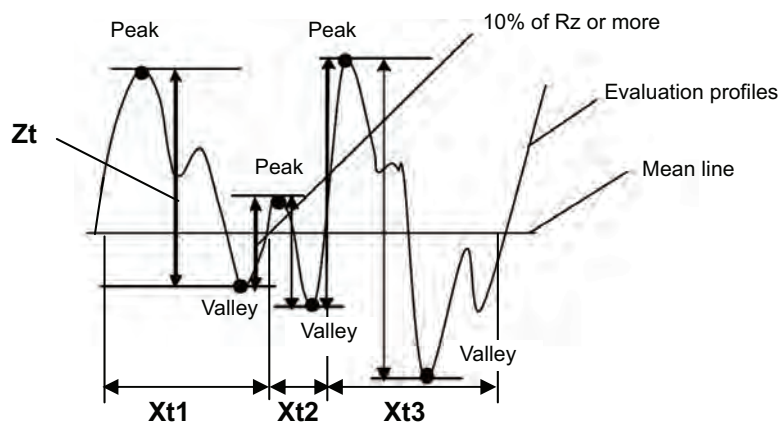
Rc Average height

Zt > Zmin Mountains and valleys that do not meet the condition "Zmin = Rz for slice-level height (% or µm)" are not considered profile elements and are excluded from the calculation.

- When the value for Xs, shown in the previous graph, is less than 1% of the sampling length, the section of the profile is not considered a profile element and is excluded from the calculation.

18.5.11   Pc (JIS1994, Free), RPc (ANSI): Peak count

Pc is the reciprocal of the mean width of the mountains and valleys (SM).

Pc = Unit length/Sm (Unit length = 1 cm (0.4 in))

- For ANSI, Pc is defined over the evaluation length.

18.5.12 RSm (JIS1994/2001, ISO1997, ANSI, VDA, Free): Mountain and valley mean width

Portions of the evaluation profile that project upwards are called "profile element mountains", and portions of the profile that project downwards are called "profile element valleys". A mountain followed by a valley is called a "profile element". The value of this parameter is the arithmetic mean of the width (Xs) of each profile element.

$$Rsm = \frac{1}{n} \sum_{i=1}^{n} Xsi$$

• Definition of profile element restrictions
As in the following graph, 1 profile element is 1 pair of mountains and valleys. There are the following 2 types of setting conditions for profile elements.

(1) Zp / Zv: Zp > Zmin, Zv > Zmin   (Example: Zmin = 10% of Rz)

Profile element (Zp/Zv)
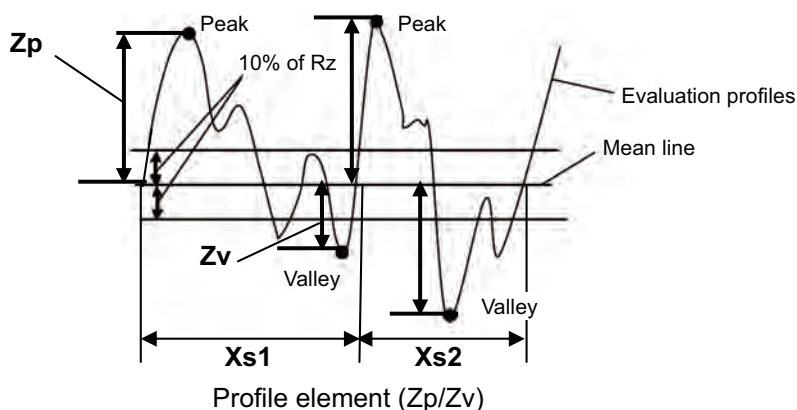
Zp > Zmin, Zv > Zmin Mountains and valleys that do not meet the condition "Zmin = Rz for slice-level height (% or µm)" are not considered profile elements and are excluded from the calculation.

(2) Zt: Zt > Zmin   (Example: Zmin = 10% of Rz)
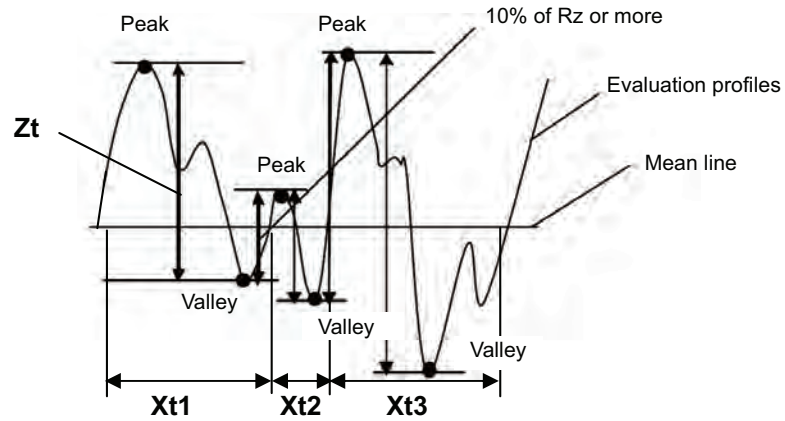
Profile element (Zt)

Zt > Zmin Mountains and valleys that do not meet the condition "Zmin = Rz for slice-level height (% or µm)" are not considered profile elements and are excluded from the calculation.

- When the value for Xs, shown in the previous graph, is less than 1% of the sampling length, the section of the profile is not considered a profile element and is excluded from the calculation.

- For ANSI, Rsm is defined over the entire evaluation length.

18.5.13 S (JIS1994, Free): Mean width of local peak

S is the arithmetic mean of the peak-to-peak distances (Si) of local peaks.
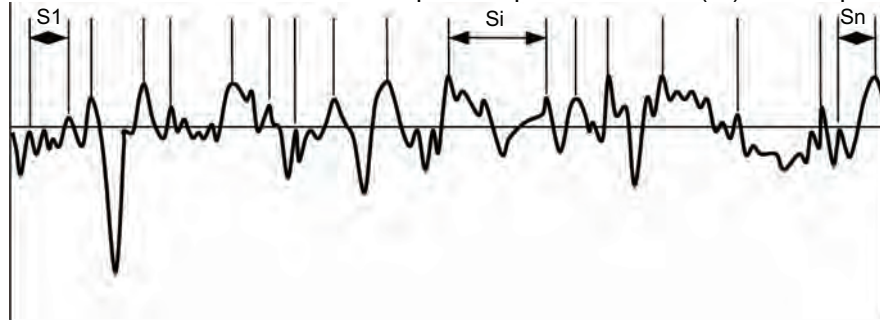
Mean spacing, S, of local peaks of profile

- When an upward convex portion of an evaluation profile has concavities on both sides, the highest point of the convex portion is called a local peak. However, when the distance (in the sampling direction) between adjacent convexities is less than 1% of sampling length, or when the depth of the concavities is less than 10% of Ry, the convex portion does not qualify as a local peak.

Local peaks

18-27
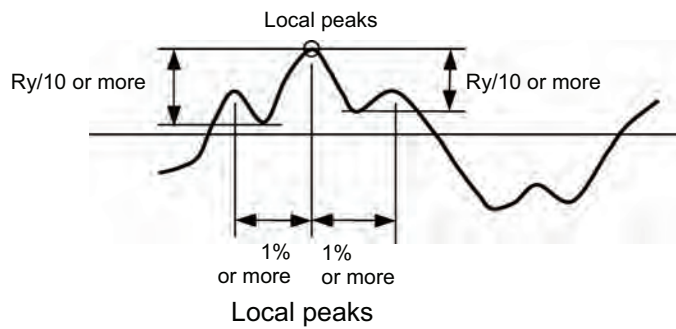
18.5.14 HSC (Free): High-spot count

On the evaluation profile, provide a line[*1] that is parallel to and located above the mean line. A peak that projects above the line and is a local peak[*2] is called a "peak for high spot count". The number of these peaks per centimeter is called the "high spot count (HSC)".
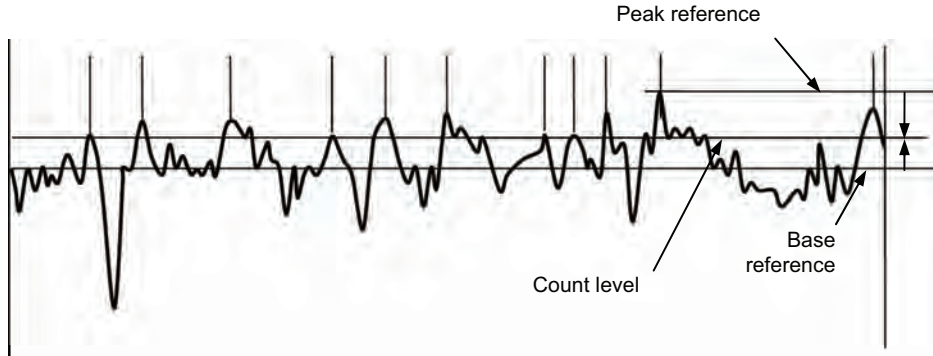
High-spot count (HSC)

There are 2 ways of setting the count-level: peak reference and base reference.

- Peak reference peak: Set the count-level based on the depth of the highest peak[*3] of the evaluation profile. The peak depth can be set either as a percentage of Ry or as an absolute numeric value (μm).

- Base reference: Set the count level based on distance from the mean line. The distance from the mean line can be set either as a percentage of Ry or as an absolute numeric value (μm).

  *1: This parallel line to the mean line is called the "count level".

  *2: For an explanation of the local peak, refer to 18.5.13, "S (JIS1994, Free): Mean width of local peak".

  *3: For an explanation of peaks on the evaluation profile, refer to 18.5.16, "RzJIS (JIS2001, Free), Rz (JIS1982, 1994): 10-point mean roughness".

18.5.15 Rmax (ANSI, VDA), Rz1max (ISO1997): Maximum height

Rmax is the sum of the height (Yp) of the highest point from the mean line and the depth (Yv) of the lowest point from the mean line. (Maximum height)

Divide the evaluation profile into segments based on the sampling length. Then, for each segment, obtain the sum (Zi) of the highest point from the mean line (Pi) and the lowest point from the mean line (Vi). Rmax (ANSI, VDA) is the maximum value from among Zi (Zn in the figure below).

$R\max = Z4$ (In the following figure, the 4th segment, Z4 is the maximum)
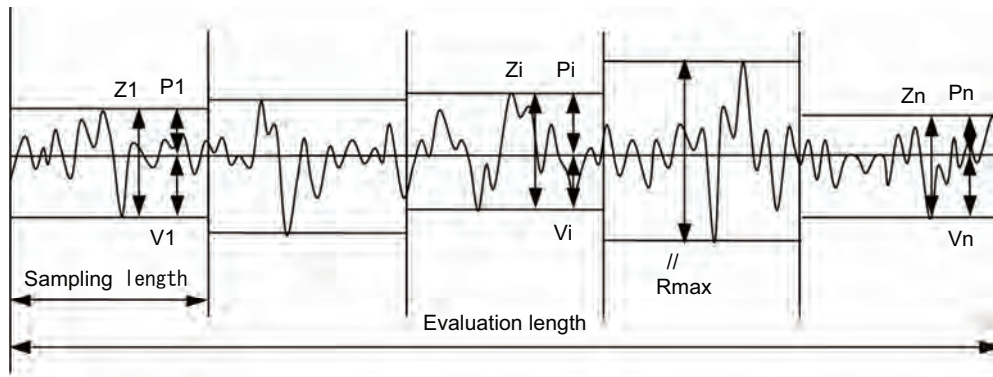
Maximum height of Rmax

18.5.16 RzJIS (JIS2001, Free), Rz (JIS1982, 1994): 10-point mean roughness

Rz (JIS) is the sum of the mean height of the 5 highest peaks and the mean depth of 5 deepest valleys, as measured from a line parallel to the mean line.

$$Rz = \frac{1}{5}\sum_{i=1}^{5} Ypi + \frac{1}{5}\sum_{i=1}^{5} Yvi$$
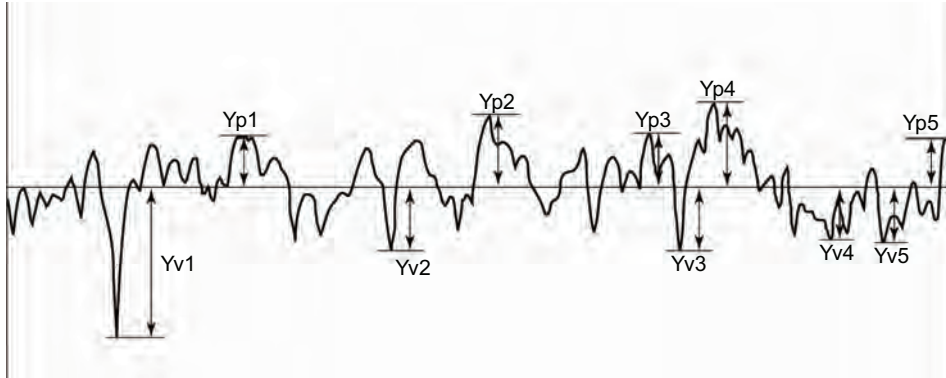
Rz 10-point mean roughness

- Evaluation profile mountains/peaks and valleys/floors
  When the evaluation profile contains a mean line, portions of the profile that project above the mean line are called "mountains", and portions of the profile that project below the mean line are called "valleys". The highest point of each mountain is called the "peak", and the deepest point of each valley is called the "floor". However, when the distance of a peak or floor from the mean line is less than 10% of the Ry value, the peak/floor is not regarded as a peak or a floor.

18.5.17 Ppi (Free): Peak count

Ppi is the value obtained by calculating the number of peaks that occur in 25.4 mm (1 in) of Pc.

TIP • The unit for Ppi is displayed as /E (E = 25.4 mm (1 in)).

18.5.18 Δa (ANSI, Free): Slope of the arithmetic mean (angle of the mean slope)

Δa is the arithmetic mean of the absolute values of the local slopes (dz/dx) of the evaluation profile. The local slope (dz/dx) of the evaluation profile is given by the following formula:

$$\Delta a = \frac{1}{n}\sum_{i=1}^{n}\left|\frac{dzi}{dx}\right|$$

$$\frac{dzi}{dx} = \frac{1}{60\Delta x}\left(z_{i+3} - 9z_{i+2} + 45z_{i+1} - 45z_{i-1} + 9z_{i-2} - z_{i-3}\right)$$

Zi is the height of the i'th point, and Δx is the distance to the adjacent data point.

- For ANSI, RΔa is defined over the entire evaluation length.

18.5.19 RΔq (ISO1997, JIS2001, ANSI, VDA, Free): Mean square slope (angle of the mean square slope)

Δq is the square root of the arithmetic mean of the squares of the local slope (dz/dx) of the evaluation profile.

$$R\Delta q = \sqrt{\frac{1}{n}\sum_{i=1}^{n}\left(\frac{dZi}{dX}\right)^2}$$

- For ANSI, RΔq is defined over the entire evaluation length.

18.5.20 lr (Free): Expansion length ratio

lr is the ratio of the expansion length (Lo) and the sampling length (l), and this ratio describes the degree of depression in the evaluation profile. (Expansion length ratio)

$$lr = \frac{Lo}{l}$$

18.5.21 mr (JIS2001, ISO1997, ANSI, VDA, Free): Material-ratio-length rate

Let a slice line whose mr[c] value falls between 0% and 99% (in 1% increments) be the reference line, and provide more slice lines at constant increments (in μm) below the reference line. mr[c] values at each slice level are referred to as mr values.

Material-ratio-length rate, mr
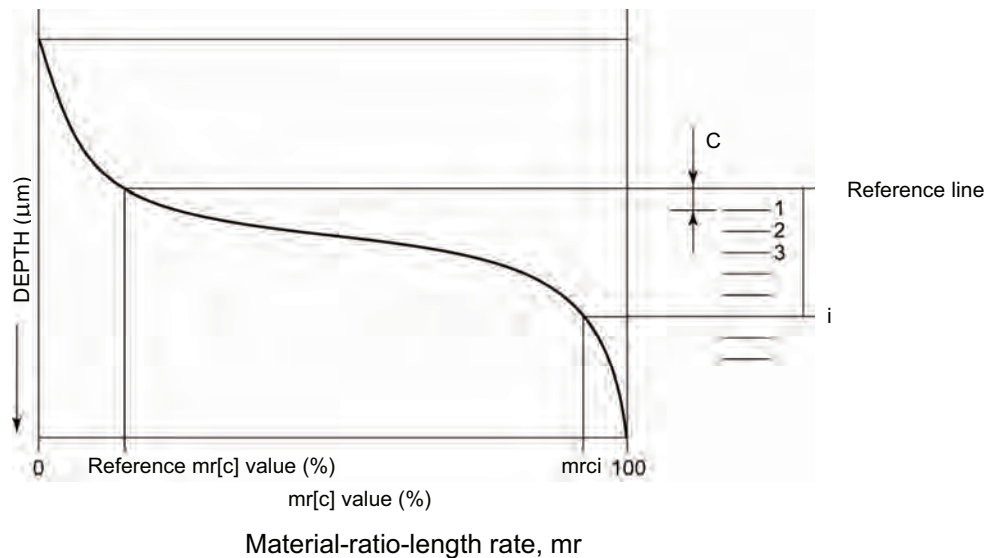
There are the following 3 modes for specifying slice lines.

Normal	Length (μm)
Rz	Percentage of Rz (%)
Rt	Percentage of Rt (%)

18.5.22 mr[c] (ISO1997, JIS1994, 2001, VDA, Free), tp (ANSI): Material-ratio length rate

When you add a parallel line (called a slice line) above the mean line, the mr[c] value for that slice level is the ratio (%) between the sum of the base lengths of the sections that protrude above the slice line (the length between where the evaluation profile and the slice line intersect) and the evaluation length. The slice level is defined as the depth from the highest peak, and is called a "peak reference". The slice level is determined by the ratio (0 to 100%) of the depth to the Rt value.

$$mr(c) = \frac{\eta p}{ln} \times 100 (\%) \quad \eta p = \sum_{i=1}^{n} bi$$
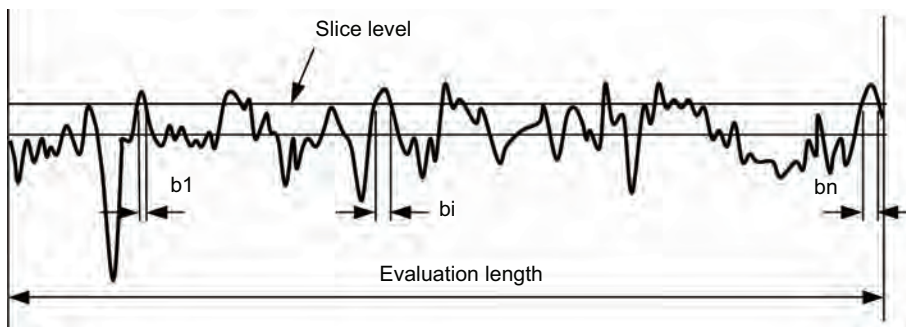
Material-ratio length rate, mr[c]

There are 2 ways of setting the slice level: peak reference and base reference.

- Peak reference
  The slice level is specified by the depth from the highest point on the evaluation profile. The depth from this point can be set either as a percentage of Rt or as an absolute numeric value.

- Base reference
  The slice level is specified by the distance from the mean line. The distance from the mean line can be set either as a percentage of Rt or as an absolute numeric value. Therefore, when adding the slice line above (+) the mean line, enter a positive number, and when adding the slice line below (-) the mean line, enter a negative number.

18.5.23 δc (JIS2001, ISO1997, VDA, Free), Htp (ANSI): Slice-level difference (plateau ratio)

With the slice level that is set from the mr[c] value as the reference line, δc is the height (or depth), in μm, from the reference line to slice levels obtained from changing the value of mr[c]. When the slice level used to obtain the height (or depth) is higher than the reference line, the value of δc is negative. When the slice level used to obtain the height (or depth) is lower than the reference line, the value of δc is positive.

δc slice-level difference
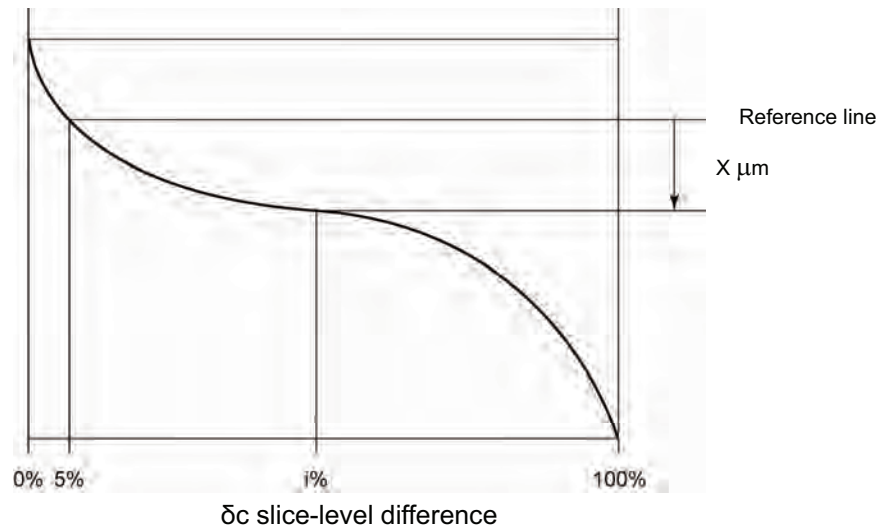
18.5.24 tp (ANSI): Material-ratio length rate

Refer to 18.5.22, "mr[c] (ISO1997, JIS1994, 2001, VDA, Free), tp (ANSI): Material-ratio length rate".

18.5.25 Htp (ANSI): Slice-level difference (plateau ratio)

Refer to 18.5.23, "δc (JIS2001, ISO1997, VDA, Free), Htp (ANSI): Slice-level difference (plateau ratio)".

18.5.26 Rk (JIS2001, ISO1997, VDA, Free): Enabled-material-ratio roughness (center height)

From the lines that are obtained by selecting 2 points (point A and point B) on the BAC (material-ratio profile) that differ in mr value by 40%, obtain the line with the smallest inclination. Set point C and point D to be the points where the obtained line intersects the lines at mr = 0 and mr = 100. Rk is the difference along the vertical axis (slice level) between point C and point D.

Rk
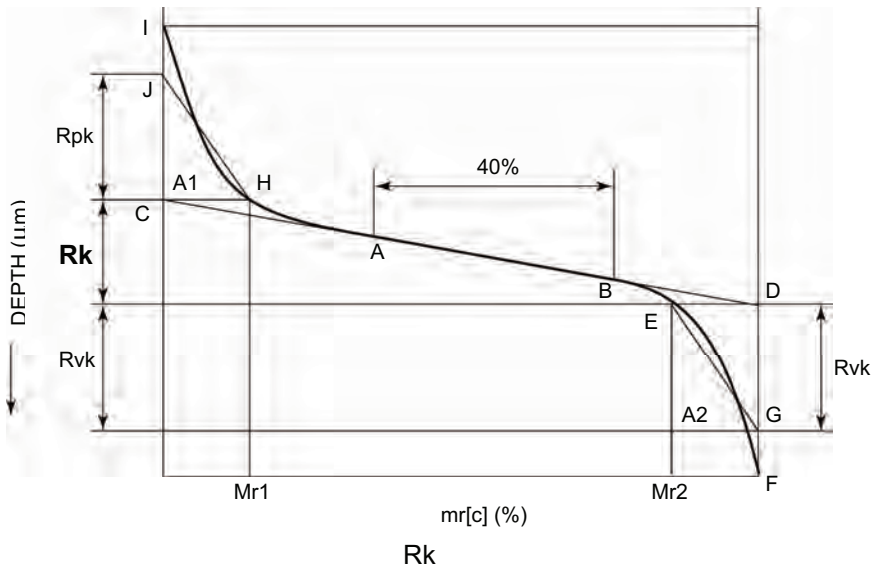
18.5.27 Rpk (JIS2001, ISO1997, VDA, Free): Initial abrasion height (peak height)

From the lines that are obtained by selecting 2 points (point A and point B) on the BAC (material-ratio profile) that differ in mr value by 40%, obtain the line with the smallest inclination. Set point C and point D to be the points where the obtained line intersects the lines at mr = 0 and mr = 100. Set point H to the point on the BAC with the same slice level as point C, and then set point I to the point were the BAC profile and the slice level at mr = 0 intersect. Next, set point J along mr = 0, so that the area enclosed by line segment CH, line segment CI, and curve HI and the area of triangle CHJ are the same. Rpk is the distance between point C and point J. (Initial abrasion height)

Rpk
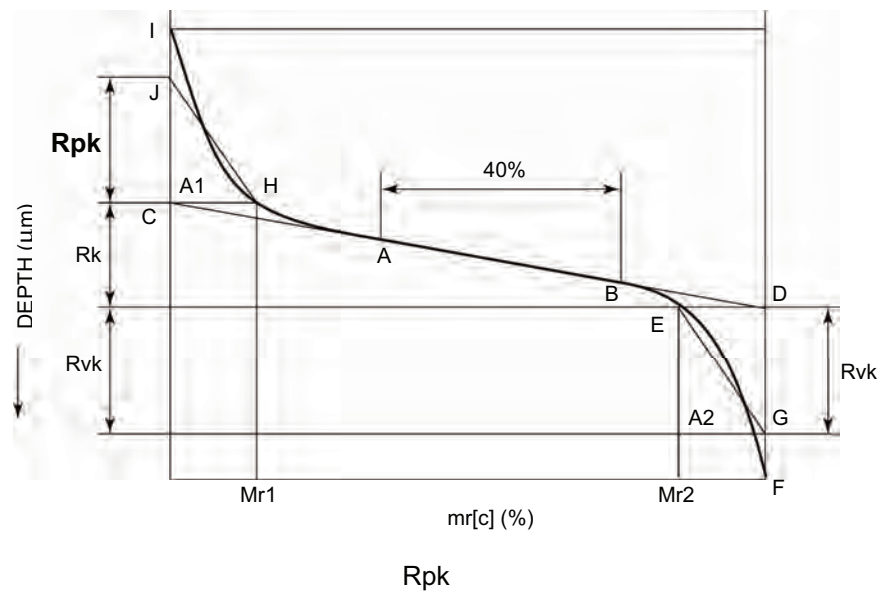
18.5.28   Rvk (JIS2001, ISO1997, VDA, Free): Valley depth

From the lines that are obtained by selecting 2 points (point A and point B) on the BAC (material-ratio profile) that differ in mr value by 40%, obtain the line with the smallest inclination. Set point C and point D to be the points where the obtained line intersects the lines at mr = 0 and mr = 100. Set point E to the point on the BAC with the same slice level as point D, and then set point F to the point were the BAC and the slice level at mr = 100 intersect. Next, set point G along mr = 100, so that the area enclosed by line segment DE, line segment DF, and curve EF and the area of triangle DEG are the same. Rvk is the distance between point D and point G. (Valley depth)

Rvk
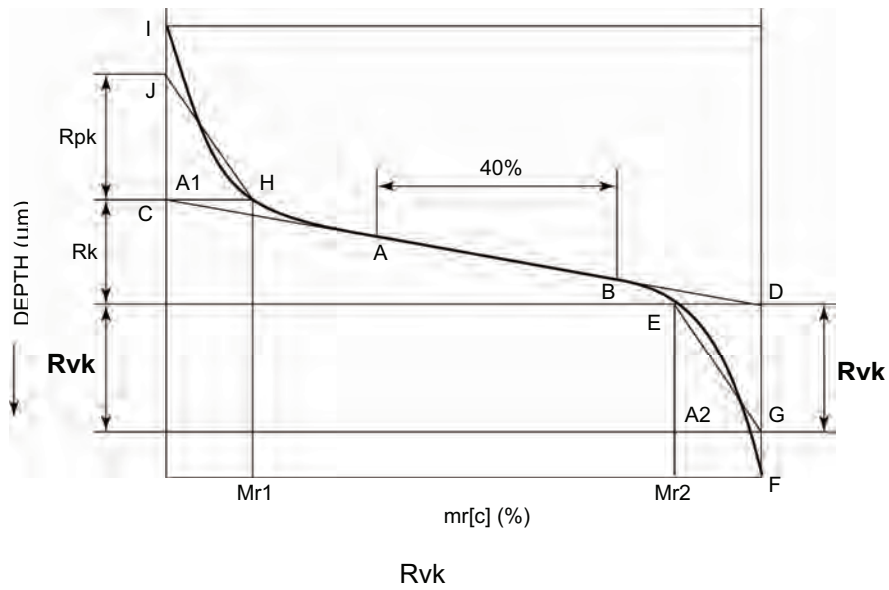
18.5.29 Mr1 (JIS2001, ISO1997, VDA, Free): Material-ratio length rate 1 (upper relative-material-ratio length)

From the lines that are obtained by selecting 2 points (point A and point B) on the BAC (material-ratio profile) that differ in mr value by 40%, obtain the line with the smallest inclination. Set point C and point D to be the points where the obtained line intersects the lines at mr = 0 and mr = 100. Set point H to the point on the BAC with the same slice level as point C. Mr1 is the mr value at point H. (Material-ratio length rate 1)

Mr1

18.5.30 Mr2 (JIS2001, ISO1997, VDA, Free): Material-ratio length rate 2 (lower relative-material-ratio length)

From the lines that are obtained by selecting 2 points (point A and point B) on the BAC (material-ratio profile) that differ in mr value by 40%, obtain the line with the smallest inclination. Set point C and point D to be the points where the obtained line intersects the lines at mr = 0 and mr = 100. Set point E to the point on the BAC with the same slice level as point D. Mr2 is the mr value at point E. (Material-ratio length rate 2)

Mr2

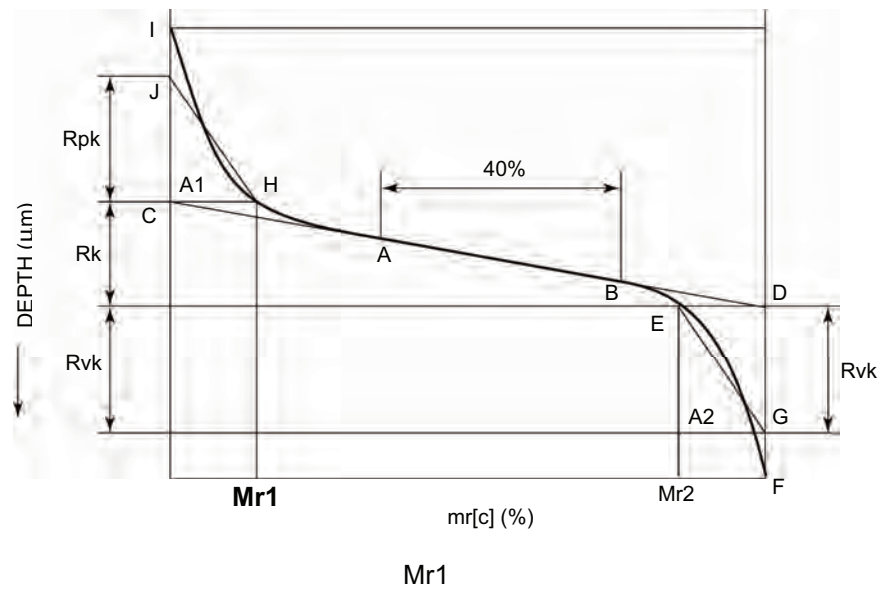### 18.5.31 A1 (JIS2001, ISO1997, VDA, Free): Peak area

From the lines that are obtained by selecting 2 points (point A and point B) on the BAC (material-ratio profile) that differ in mr value by 40%, obtain the line with the smallest inclination. Set point C and point D to be the points where the obtained line intersects the lines at mr = 0 and mr = 100. Set point H to the point on the BAC with the same slice level as point C, and then set point I to the point were the BAC profile and the slice level at mr = 0 intersect. Next, set point J along mr = 0, so that the area enclosed by line segment CH, line segment CI, and curve HI and the area of triangle CHJ are the same. A1 is the area of triangle CHJ. (Peak area)

Peak area A1

18.5.32   A2 (JIS2001, ISO1997, VDA, Free): Valley area

From the lines that are obtained by selecting 2 points (point A and point B) on the BAC (material-ratio profile) that differ in mr value by 40%, obtain the line with the smallest inclination. Set point C and point D to be the points where the obtained line intersects the lines at mr = 0 and mr = 100. Set point E to the point on the BAC with the same slice level as point D, and then set point F to the point were the BAC and the slice level at mr = 100 intersect. Next, set point G along mr = 100, so that the area enclosed by line segment DE, line segment DF, and curve EF and the area of triangle DEG are the same. A2 is the area of triangle DEG. (Valley area)
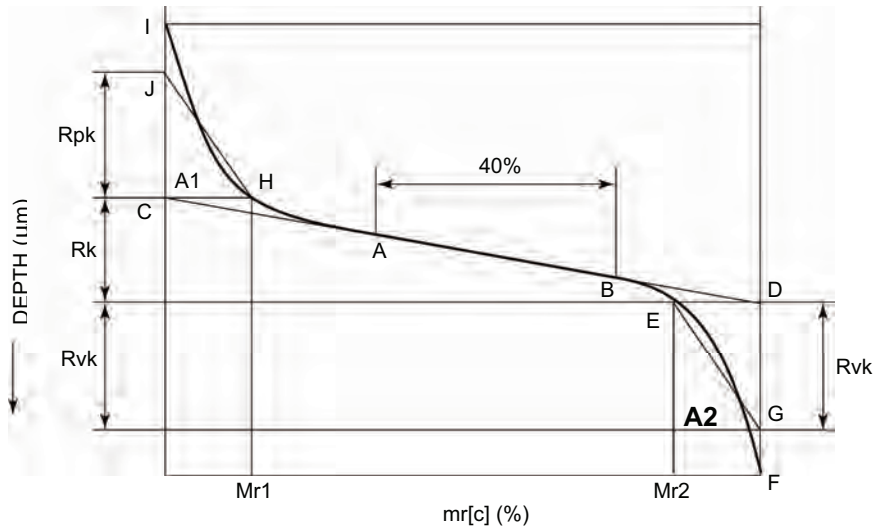
Valley area A2

## 18.5.33 Vo (Free): Volume measure

From the lines that are obtained by selecting 2 points (point A and point B) on the BAC (material-ratio profile)[1] that differ in Rmr[c] value by 40%, obtain the line with the smallest inclination. Set points C and D to to where the obtained line intersects with the lines for Rmr[c] = 0 and Rmr[c] = 100, respectively. Rk is the difference along the vertical axis (slice level) between point C and point D.

Set point H to the point on the BAC with the same slice level as point C, and then set point I to the point were the BAC profile and the slice level at Rmr[c] = 0 intersect. Next, set point J along Rmr[c] = 0, so that the area enclosed by line segment CH, line segment CI, and curve HI and the area of triangle CHJ are the same. Rpk is the distance between point C and point J. M1 is the Rmr[c] value at point H. A1 is the area of triangle CHJ.

In the same way, set point E to the point on the BAC with the same slice level as point D, and then set point F to the point were the BAC profile and the slice level at Rmr[c] = 100 intersect. Next, set point G along Rmr[c] = 100, so that the area enclosed by line segment DE, line segment DF, and curve EF and the area of triangle DEG are the same. Rvk is the distance between point D and point G. Mr2 is the Rmr[c] value at point E. A2 is the area of triangle DEG.

Vo is the area, S, of the space bounded on the bottom by the BAC (material-ratio profile) and on the top by the slice line on the BAC where Rmr[c] is Mr2. The value of this parameter is converted from the volume (mm^3) of the concave portion below the slice level to a volume per area (cm^2) when viewed from the top of a work piece, when the evaluation profile and slice level are assumed as a plane in a 3-dimensional space.

Volume Vo
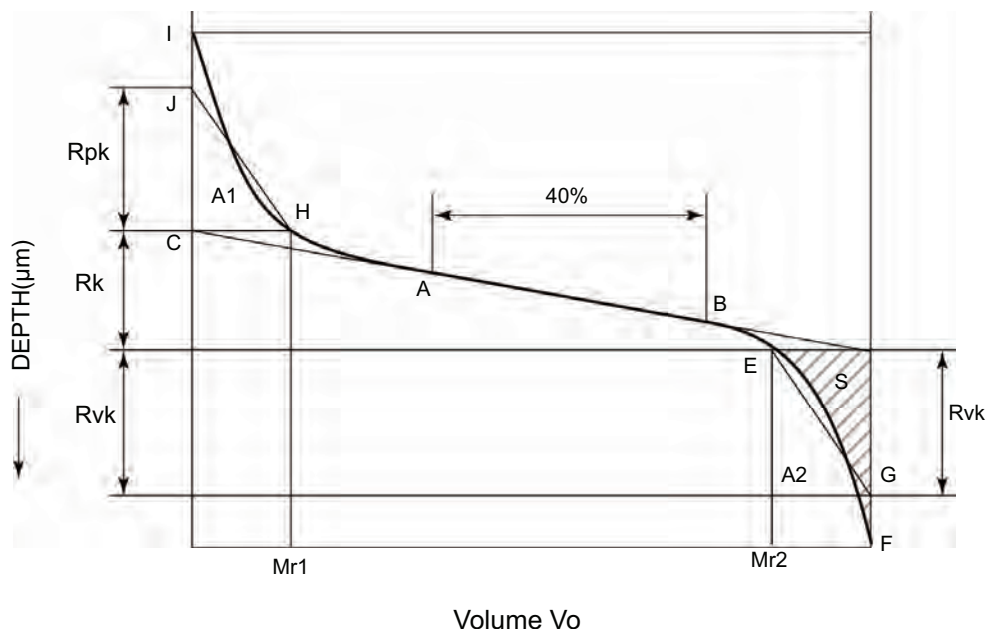
*1: The horizontal axis of the BAC represents Rmr[c] values; the vertical axis represents slice levels (μm).

18.5.34 BAC: Material-ratio profile

BAC is a curve that represents the material ratio of the evaluation profile, where the mr values are plotted on the abscissa while the slice levels are on the ordinate. The BAC is a curve where the horizontal axis represents mr values and the vertical axis represents slice levels.

There are 2 types of BAC depending on how the slice levels were obtained.

- This is based on the BAC reference peak[1] and consists of making mr values obtained from the slice levels (vertical axis) of the percentage (0 to 100%) against the Rt value[2] on the horizontal axis, and making the range of the vertical axis 0 to 100%.

Material-ratio profile (BAC)
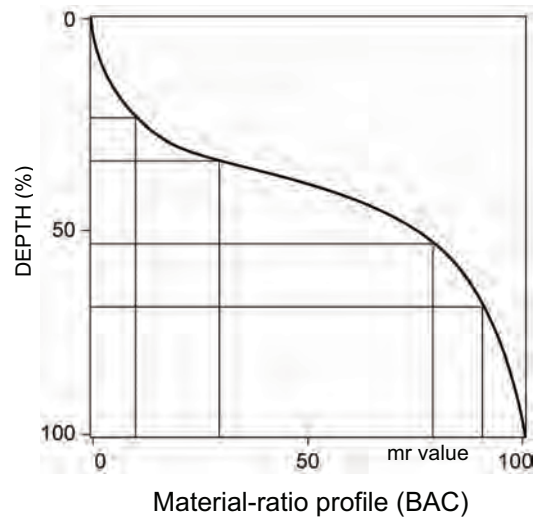
*1: For details about the peak/base reference, refer to 18.5.21, "mr (JIS2001, ISO1997, VDA, Free): Material-ratio length rate".

*2: For details about Rt, refer to 18.5.6, "Rt (JIS2001, ISO1997, ANSI, VDA, Free): Maximum roughness".

18.5.35 ADC: Amplitude distribution curve

Add a slice line to the evaluation curve over the evaluation length. Add a second slice line that is the unit distance below the first slice line. The amplitude density is the ratio (expressed as a percentage) of the sum of the horizontal lengths of the sections of the evaluation profile that fall between the 2 slice levels and the evaluation length.

The amplitude distribution curve (ADC) is plotted by using the depth of the first slice level as the ordinate value and the amplitude density for that slice level as the abscissa.

Amplitude density (%)

Amplitude distribution curve (ADC)
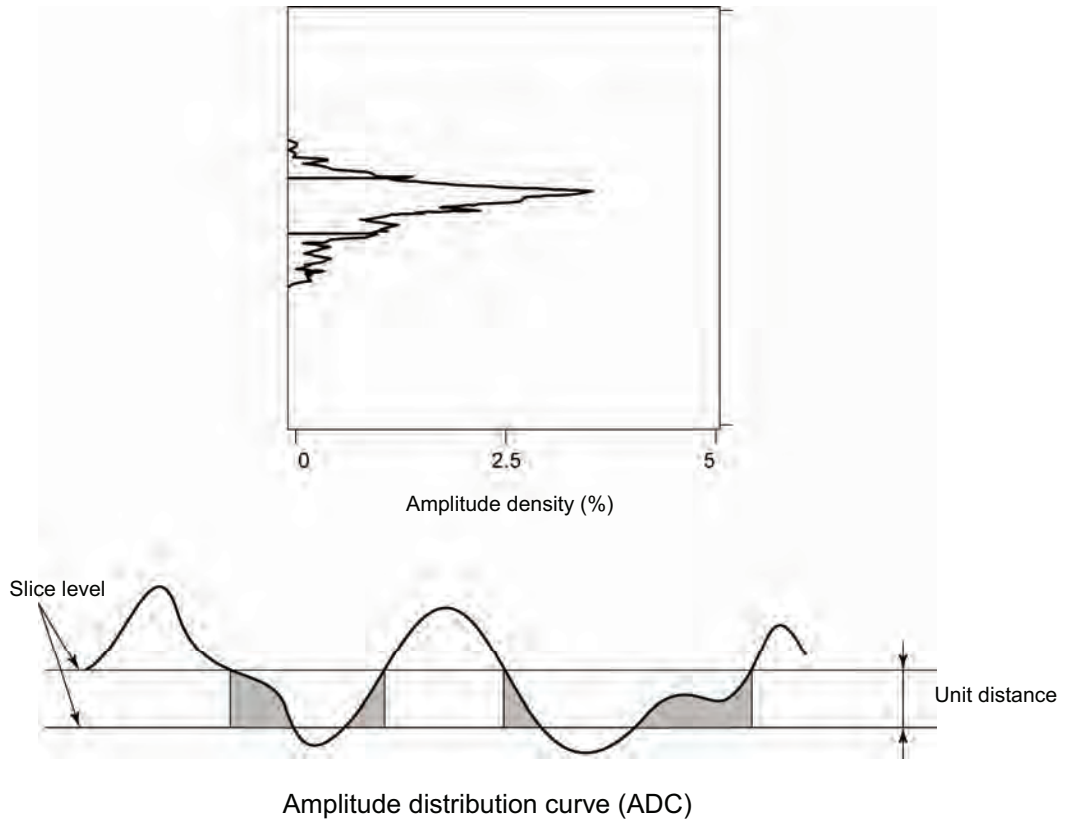
18.6 Motif-related Parameters

The motif method is a French standard for evaluating surface roughness. This method was adopted as an ISO standard (ISO12085-1996) in 1996.

Normally, when wave segments are removed from an evaluation profile, the evaluation profile becomes distorted. This method is designed to remove waviness without causing distortion.

With this method, an evaluation profile is divided into units called "motifs", which are based on the wavelength of a component to be removed, and parameters to evaluate the profile are calculated from each motif. This section briefly explains how to obtain the motif parameters.

18.6.1 How to obtain roughness motifs

Use the following procedure to obtain roughness motifs.

1. In order to prevent small bumps from influencing the procedure, obtain the minimum height (Hmin) used to determine peaks.
   Divide the evaluation data into segments that are half the length of the roughness-motif maximum length, A. For each segment, determine the distance between the maximum point and the minimum point, and set the minimum height as 5% of the average of these distances.
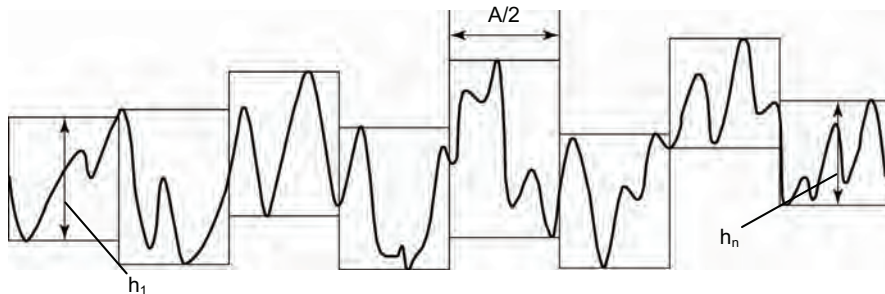

Minimum height for determining a peak

$$H\min = 0.05 \times \frac{1}{n}\sum_{i=1}^{n} hi$$

n: Number of measured set lengths

2. Obtain all of the peaks and valleys for the entire evaluation length.
    Peaks are defined as the highest point between two valleys whose height is Hmin or greater. Valleys are the lowest point between two peaks. These peaks and valleys are used for the entire evaluation length.

P: Peak
V: Valley

Peak, valley
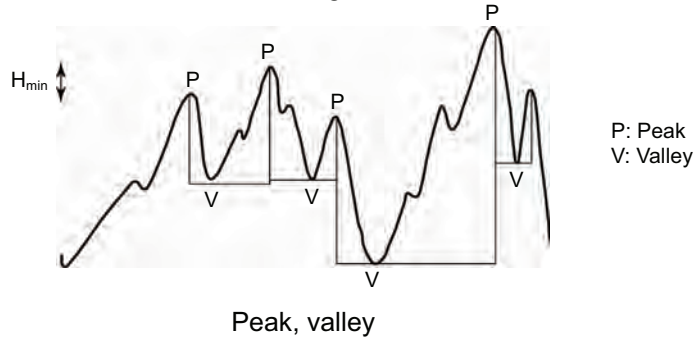
The space between two peaks is treated as 1 motif. Motifs appear based on the following lengths and depths. The horizontal length of the unfiltered profile (motif length ARi), the vertical distances from the 2 peaks to the floor (motif depth Hj and Hj + 1), and the shallower of the 2 motif depths, T. (In the following figure, Hj+1 is T.)
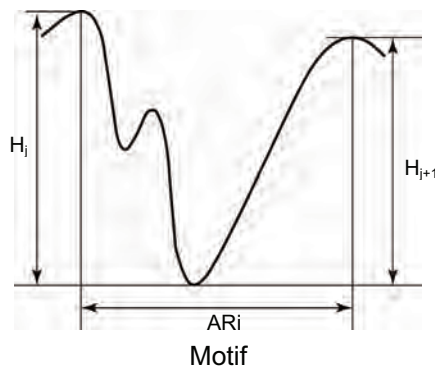
Motif

3. Compare and combine consecutive roughness motifs.
    Combining motifs is subject to the following 4 conditions. Motifs can be combined only when they meet all of the conditions. Repeat this operation until no more motifs can be combined.

(Condition 1)
Among adjacent peaks, keep the tallest one. (If the center peak is taller than both those on the right and left, do not combine motifs.)

Combining roughness motifs
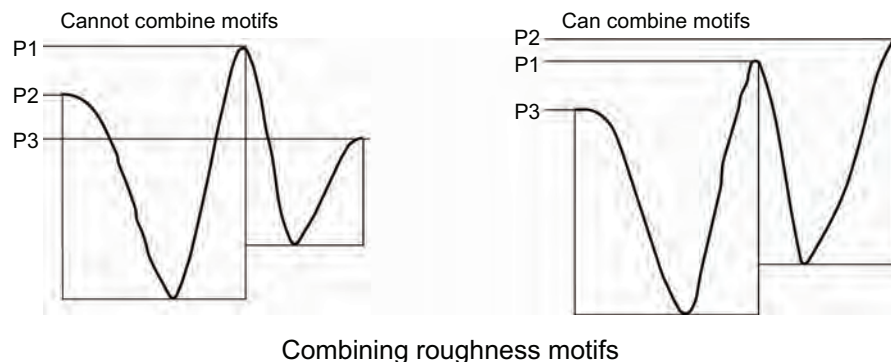
(Condition 2)

After combining, the length of the new motif cannot exceed the upper length limit.

After combining, ARi value ≤ A

Motif length
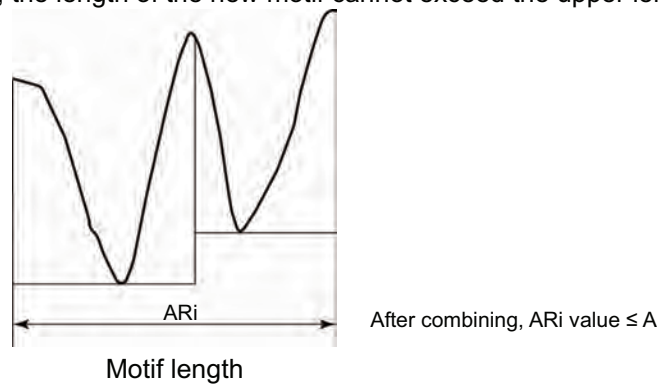
(Condition 3)

After combining, the T height of the motif must be greater than or equal to than the T heights of the motifs (T1 and T2) before combining.
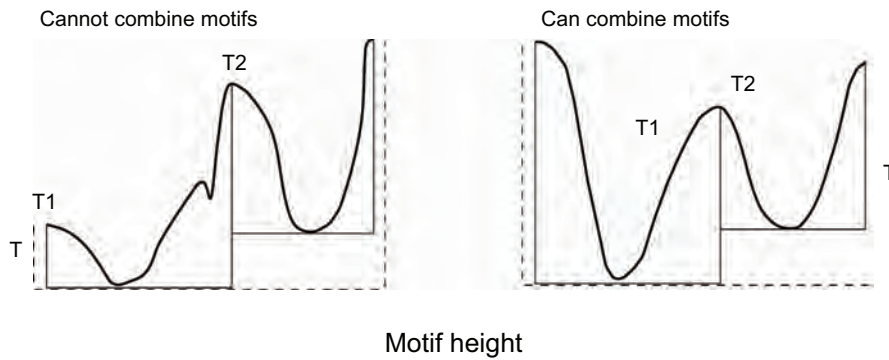
Motif height

(Condition 4)

At least 1 of the motif depths in the center must be 60% or less of the T height of the combined motif.

Motif depth

4. Modify the height (or depth) of tall peaks or deep valleys that stand out.
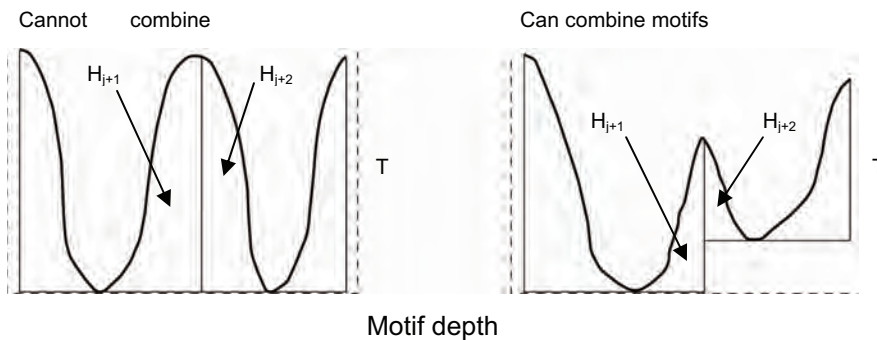   Calculate the mean depth and the standard deviation from the combined motifs.

$$H = \overline{Hj} + 1.65\sigma Hj$$

$\overline{Hj}$ Mean depth for motifs σHj Standard deviation for motif depth

From the above formulas, obtain the maximum value H.

Peaks and valleys in motifs whose motif depth is greater than H are modified so their height or depth is H.

In the following figures, Zj+1 is modified to Zj+1'.

Modifying a tall peak   Modifying a deep valley
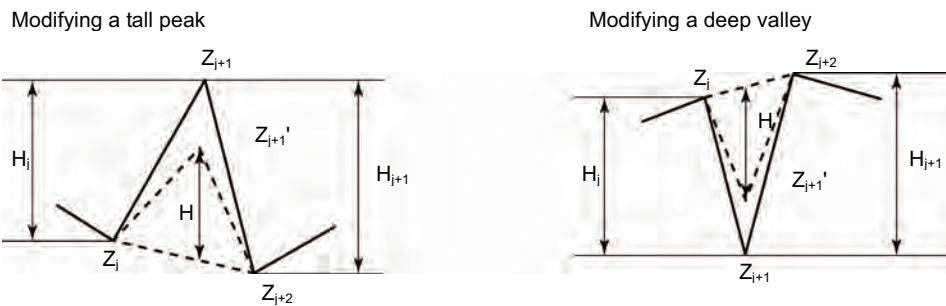
Replacing the H level

5. Calculate the parameters defined for roughness motifs.

   Note 1. Certain parameters are calculated before the processing described in step 4 is performed.

18.6.2   Roughness motif parameters

Roughness motif parameters

18.6.2.1   R (JIS2001, ISO1997): Roughness motif mean depth

R is the arithmetic mean of the roughness motif depths Hj obtained over the evaluation length.

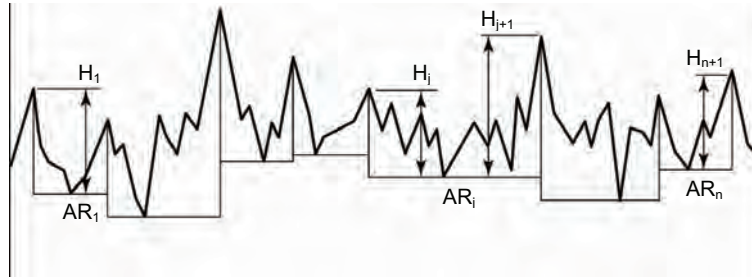$$R = \frac{1}{m}\sum_{j=!}^{m} Hj$$

m: Number of Hj (twice the number of roughness motifs, n: m = 2n)

18.6.2.2   Rx (JIS2001, ISO1997): Roughness motif maximum depth

Rx is the maximum depth among motif depths Hj obtained over the evaluation length.

18.6.2.3   AR (JIS2001, ISO1997): Roughness motif mean length

AR is the arithmetic mean of the roughness motif lengths ARi obtained over the evaluation length.

$$AR = \frac{1}{n}\sum_{i=!}^{n} ARi$$

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