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INSTRUCTIONS

GARDCO DISTRIBUTED PRODUCTS



SJ-301

Surface Roughness Tester

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 USER'S MANUAL

Safety Precautions

To operate the instrument correctly and safely, Mitutoyo manuals use various safety signs (Signal Words and Safety Alert Symbols) to identify and warn against hazards and potential accidents.

The following signs indicate **general** warnings:



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



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



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 USER'S MANUAL

On Various Types of Notes

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

-
- IMPORTANT**
- An *important note* is a type of note that 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. A note supplies information that may only apply in special cases (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 their specific needs.
It also provides reference information associated with the topic being discussed.

Mitutoyo assumes no liability to any party for any loss or damage, direct or indirect, caused by use of this instrument not conforming to this manual.
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PRECAUTIONS

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-301 and SJ-301R.

"SJ-301" is used in almost all descriptions of this user's manual.

If using model SJ-301R read this manual assuming "SJ-301" as "SJ-301R".

Unless otherwise noted, the manual gives common information about the SJ-301 and SJ-301R.

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



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 5°C and 40°C(RH: 85% maximum without 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 40°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.
 - The stylus tip is machined precisely. Take care not to break it.
 - Before measurement, wipe off oil or dust on the workpiece surface to be measured.
 - Do not apply any load and impact onto the touch panel by placing or hitting with foreign material. Touch panel may brake.
 - Do not press the touch panel with sharp object such as a ball-point pen. Touch panel may brake. Be sure to operate the touch panel with a finger or the provided touch pen.
-

WARRANTY

This instrument has been manufactured, adjusted, and inspected under rigorous quality control system of Mitutoyo. In the event that this instrument should fail within one year from the original date of purchase through normal use conforming to the User's Manual provided with the product, we will repair or replace it, at our option, free of charge, upon its prepaid return to Mitutoyo.

This warranty shall not apply if the product has been subject to fair wear and tear, abuse through misuse or improper use/handling/storage/maintenance/service/repair or through adaptation/modification by the original purchaser or any third party without prior written consent of Mitutoyo or as a result of damage by an actual disaster or circumstances beyond the control of Mitutoyo.

This warranty is not transferable and is only valid within the country of the original purchase.

CONTENTS

CONVENTIONS USED IN USER'S MANUAL	i
PRECAUTIONS	iii
WARRANTY	iv
1 SJ-301 OVERVIEW	1-1
1.1 Outline of the SJ-301	1-1
1.2 Standard SJ-301 Configuration	1-3
1.3 Nomenclature	1-6
2 SHEET KEYS AND TOUCH PANEL OF SJ-301	2-1
2.1 Function of Sheet Keys	2-1
2.2 Outline of the Touch Panel	2-5
2.3 Home Screen of the Touch Panel	2-10
2.4 Screen Hierarchy in the Touch Panel	2-13
2.5 List of Icons	2-16
3 SETTING UP THE SJ-301	3-1
3.1 SJ-301 Setting	3-1
3.2 Attaching and Detaching the Drive/Detector Unit	3-2
3.2.1 Attaching and Detaching the Detector	3-2
3.2.2 Connecting the Drive/Detector unit with the Display unit	3-5
3.3 Loading Printer Paper	3-6
3.4 Applying the Touch Panel Protection Sheet	3-10
3.5 Turning On/Off the Power Supply	3-12
3.5.1 Turning the power on/off	3-12
3.5.2 Setting the auto-sleep function in use of the built-in battery	3-16
3.6 Setting Language, Date, and Unit	3-18
3.7 Carrying Case	3-25
4 MEASUREMENT OPERATION	4-1
4.1 Overall Measurement Flow	4-1
4.2 Calibration	4-3
4.2.1 Calibration preparation	4-3
4.2.2 Performing calibration	4-6
4.3 Measurement	4-10
4.3.1 Setting the workpiece and SJ-301	4-10
4.3.2 Starting measurement	4-12
4.4 Switching the measured results display	4-13
4.4.1 Switching displayed parameters	4-13
4.4.2 Displaying a measured profile	4-14
4.5 Printing Measured Results	4-22
4.5.1 Print method	4-22
4.5.2 Applying a memo to printed matter	4-26
4.5.3 Changing print conditions	4-27

5	MODIFYING THE MEASUREMENT CONDITIONS	5-1
5.1	Switching the Surface Texture Standard	5-3
5.2	Switching the Measured Profile	5-6
5.3	Switching the Profile filters	5-9
5.4	Switching the Cutoff length (lc)	5-12
5.5	Modifying the Number of Sampling Lengths	5-18
5.6	Setting the Evaluation Length to an Arbitrary Length	5-21
5.7	Modifying the Measuring Range	5-24
5.8	Modifying the Traversing Speed	5-27
5.9	Setting the Pre-Travel/Post-Travel to "OFF"	5-30
5.10	Selecting the Display Parameters (Parameter Customization)	5-33
5.10.1	Parameter Customization	5-33
5.10.2	Setting the calculation conditions when Sm, Pc, or Ppi is selected	5-39
5.10.3	Setting the calculation conditions if mr[c] is selected	5-42
5.10.4	Setting the calculation conditions if mr is selected	5-45
5.10.5	Setting the calculation conditions if dc is selected	5-49
5.10.6	Setting the calculation conditions if HSC is selected	5-53
5.10.7	Setting the calculation conditions when selecting a profile motif (MOTIF.R/MOTIF.W)	5-56
5.11	Setting the GO/NG Judgment Function	5-59
5.12	Setting the Drive Unit	5-65
5.13	Deleting Unnecessary Data	5-68
5.14	Modifying the Tilt Compensation Specification	5-73
5.15	Modifying the Calibration Conditions	5-80
5.16	Resetting to the default settings	5-86
6	RECALCULATION WITH THE MODIFIED MEASUREMENT CONDITIONS	6-1
7	STATISTICAL PROCESSING OF MEASUREMENTS	7-1
7.1	Overview of Statistical Processing	7-1
7.2	Execution of Statistical Processing	7-2
7.3	Settings Related to Statistical Processing	7-7
7.4	Displaying the Frequency Histogram and Printing the Statistical Data	7-11
7.5	Saving and Reading Statistical Data	7-13
8	SAVE/READ OF MEASUREMENTS, MEASUREMENT CONDITIONS AND STATISTICAL DATA	8-1
8.1	Data To Be Saved and Storage Media	8-2
8.2	Saving/Recalling the Measurement Conditions	8-5
8.2.1	Saving the measurement conditions	8-5
8.2.2	Recalling the measurement conditions	8-15
8.3	Saving/Reading Measured Profile Data	8-23
8.3.1	Saving the measured profile data	8-23
8.3.2	Reading the measured profile data	8-30
8.4	Saving/Reading the Statistical Data	8-32
8.4.1	Saving the statistical data	8-32
8.4.2	Reading the statistical data	8-35
8.5	Memory Card Formatting and File Deletion	8-38
8.5.1	Formatting the memory card	8-38
8.5.2	Deleting a file stored in the memory card	8-41

9	SPC OUTPUT AND DATA COMMUNICATION	9-1
9.1	SPC Output	9-1
9.2	Communicating with a PC	9-6
10	INSTALLING THE SJ-301 WITH OPTIONAL ACCESSORIES	10-1
11	MAINTENANCE AND INSPECTION OF SJ-301	11-1
11.1	Daily Care	11-1
11.2	Detector Retraction Procedure and Cancellation	11-4
11.3	Recharging the Battery	11-8
11.4	Replacing the Battery Pack	11-12
11.5	Testing the Touch Panel	11-15
12	TROUBLESHOOTING	12-1
13	SPECIFICATIONS	13-1
13.1	Detector	13-1
13.2	Drive Unit	13-1
13.3	Display Unit	13-2
13.3.1	Compatible surface texture standard	13-2
13.3.2	Measured profiles and applicable filters	13-2
13.3.3	Cutoff length/Sampling length, Number of sampling lengths, and Sampling interval	13-2
13.3.4	Roughness parameters and display range	13-3
13.3.5	Evaluation length	13-4
13.3.6	Measuring range and resolution	13-4
13.3.7	Pre-travel/Post-travel length	13-4
13.4	Power Supply	13-5
13.5	Temperature/Humidity Range	13-5
13.6	External Dimensions and Mass	13-6
13.7	Optional Accessories	13-7
13.8	Consumables	13-8
13.9	SPC Output Specifications	13-8
13.10	RS-232C Communication Specifications	13-10
14	REFERENCE INFORMATION	14-1
14.1	Surface Texture Standard	14-1
14.1.1	Evaluation according to JIS B0601-1982	14-1
14.1.2	Evaluation according to JIS B0601-1994	14-2
14.1.3	Evaluation according to DIN	14-3
14.1.4	Evaluation according to JIS B0601-2001 and ISO	14-4
14.1.5	Evaluation according to ANSI	14-5
14.2	Measured Profile and Filters	14-6
14.2.1	Measured profile	14-6
14.2.2	Filters	14-9
14.2.3	Difference of filter characteristics	14-12
14.2.4	Amplitude characteristic of 2RC and Gaussian filters	14-13
14.3	Mean line compensation	14-14
14.4	Traversing Length	14-15

14.5 Definitions of the SJ-301 Roughness Parameters	14-18
14.5.1 Arithmetic mean deviation of the profile, Ra	14-18
14.5.2 Root-mean-square deviation of the profile, Rq	14-18
14.5.3 Maximum height of the profile, Ry (JIS'82, JIS'94)	14-19
14.5.4 Ten-point height of irregularities, Rz (JIS'82, JIS'94)	14-20
14.5.5 Maximum height of the profile, Ry (DIN, ANSI)	14-21
14.5.6 Maximum height of the profile, Rz (DIN, ISO, ANSI, JIS'01)	14-21
14.5.7 Maximum profile height, Rp (DIN, ISO, JIS'94, JIS'01)	14-21
14.5.8 Maximum profile valley depth, Rv (DIN, ISO, JIS'94, JIS'01)	14-22
14.5.9 Total height of the profile, Rt	14-22
14.5.10 Skewness of the profile, Sk	14-22
14.5.11 Kurtosis of the profile, Ku	14-23
14.5.12 Arithmetic mean slope of the profile, Da	14-23
14.5.13 Root-mean-square slope of the profile, Dq	14-23
14.5.14 Mean width of the profile elements, Sm (JIS, ISO, DIN)	14-24
14.5.15 Peak count, Pc (JIS, ISO, DIN)	14-24
14.5.16 Peak count, Ppi (JIS, ISO, DIN)	14-24
14.5.17 Material ratio of the profile, mr[c] (tp= material ratio of the profile)	14-25
14.5.18 Material ratio of the profile, mr	14-25
14.5.19 Profile section height difference (plateau ratio), dc	14-26
14.5.20 Material ratio curve of the profile (Abbott Firestone curve), BAC	14-26
14.5.21 Profile height amplitude curve, ADC	14-27
14.5.22 Core roughness depth, Rk (Depth of the roughness core profile)	14-28
14.5.23 Reduced peak height, Rpk (Average height of the protruding peaks above the roughness core profile)	14-28
14.5.24 Reduced valley depth, Rvk (Average depth of the profile valleys projecting through the roughness core profile)	14-28
14.5.25 Material portion, Mr1	14-28
14.5.26 Material portion, Mr2	14-28
14.5.27 Peak area, A1	14-28
14.5.28 Valley area, A2	14-28
14.5.29 Measuring volume Vo	14-29
14.5.30 Mean peak-to-valley height points, R3z	14-29
14.5.31 Mean spacing of local peaks of profile, S	14-30
14.5.32 Developed profile length Lo	14-30
14.5.33 High spot count, HSC	14-31
14.6 Parameters Related With Motif	14-32
14.6.1 How to obtain roughness motifs	14-32
14.6.2 Roughness motif parameters	14-35
14.6.2.1 R	14-35
14.6.2.2 AR	14-35
14.6.2.3 Rx	14-35
14.6.3 How to obtain waviness motifs	14-35

14.6.4	Waviness motif parameters	14-36
14.6.4.1	Wte	14-36
14.6.4.2	Wx	14-36
14.6.4.3	W	14-36
14.6.4.4	AW	14-36

SERVICE NETWORK

1

SJ-301 OVERVIEW

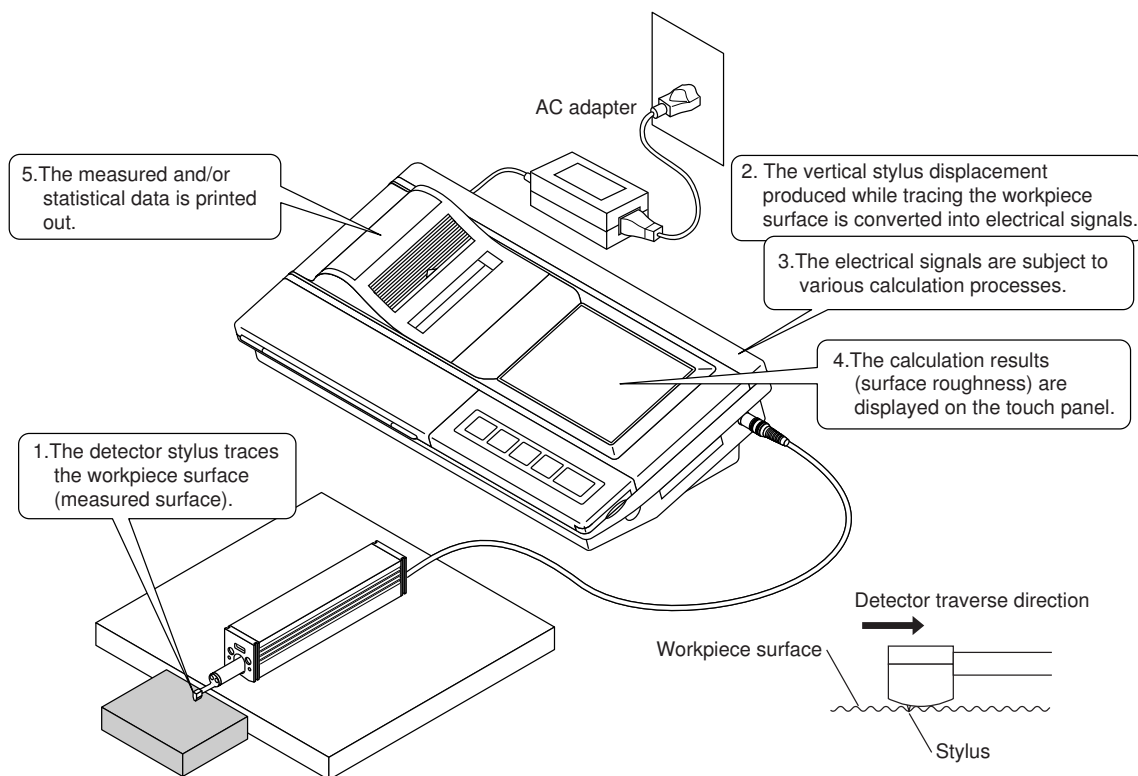
1.1 Outline of the SJ-301

The Surftest SJ-301 is a stylus type surface roughness measuring instrument developed for shop floor use. The SJ-301 is capable of evaluating surface textures with a variety of parameters according to various national standards and international standard. The measurement results are displayed digitally/graphically on the touch panel, and output to the built-in printer.

This section explains the surface roughness measurement principle and the features of the SJ-301.

■ SJ-301 surface roughness measurement principle

The stylus of the SJ-301 detector unit traces the minute irregularities of the workpiece surface. Surface roughness is determined from the vertical stylus displacement produced during the detector traversing over the surface irregularities. The measurement results are displayed digitally/graphically on the touch panel.



■ Features of SJ-301

- **Lightweight and portable**

The SJ-301 is lightweight (1.4kg approx.), and has excellent portability. It is about the size of a notebook computer. With the supplied carrying case, the SJ-301 can be slung over the shoulder. Furthermore, the built-in battery will facilitate roughness measurement on the shop floor or at other sites where there may be no AC power supply.

- **Wide measuring range and a long list of roughness parameters**

The SJ-301 has a maximum measuring range of 350 μm (-200 to +150 μm) or 14000 μin (-8000 to +6000 μin) and supports various surface parameters for evaluating surface texture.

- **Auto-sleep function for power conservation**

With auto-sleep set to ON under operation on the built-in battery, the SJ-301 automatically turns the power off (enters the auto-sleep state) if it is not in operation for 5 minutes even when the power is on. The SJ-301 still retains the set measurement conditions in memory even if the power is turned off.

- **Measured profile display on the touch panel**

The SJ-301 can display a measured profile on the touch panel.

- **Easy-to-operate touch panel**

Measurement conditions can be set up with the touch panel. The touch panel displays various menus, etc., clearly and according to procedure. This makes the SJ-301 easy to operate.

- **Internal memory and memory card facilitate storage of measurement conditions and data**

Five sets of measurement conditions can be stored in the internal memory. An additional 20 sets of measurement conditions and measurement data can be stored in a memory card.

- **Built-in printer facilitates record of measurement results**

The built-in printer can operate manually or automatically for printing the measurement conditions, measurement results, and measured profile.

- **Includes statistical processing function**

A histogram, etc., can be created with the statistical processing function.

- **Compatible with various surface texture standards**

The SJ-301 is capable of performing surface roughness measurement according to various standards that include JIS-B-0601-2001, JIS-B-0601-1994, JIS-B-0601-1982, DIN, ISO, and ANSI.

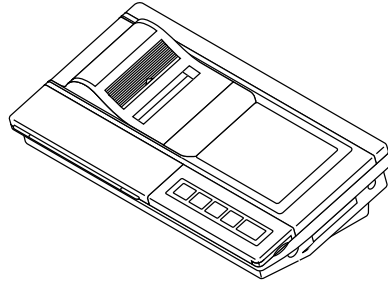
1.2 Standard SJ-301 Configuration

This section explains the standard configuration, the standard sets, and the typical use of an optional accessories.

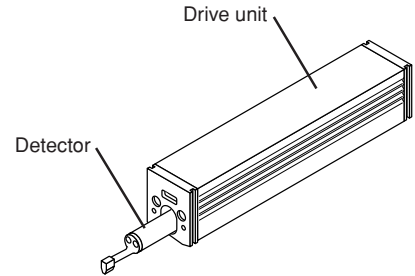
Standard SJ-301 configuration

After unpacking, confirm that all items given below are present in your SJ-301 package.

Display unit



Drive/Detector unit



Model No.	(Measuring force: 4mN)	(Measuring force: 0.75mN)
Set No.	178-953-3*(for mm) 178-954-3*(for inch/mm)	178-952-3*(for mm) 178-955-3*(for inch/mm)
Detector unit	178-390	178-296
Drive unit	178-230-2	
Display unit	178-241-3	

*: One of the suffixes below is added to the No. according to the AC voltage used.

None: 100VAC, A: 120VAC, C: 110VAC, D: 230(220)VAC, DC: 220VAC, E: 240VAC

Model No.	SJ-301R (Measuring force: 4mN)	SJ-301R (Measuring force: 0.75mN)
Set No.	178-980*(for mm) 178-987*(for inch/mm)	178-990*(for mm) 178-997*(for inch/mm)
Detector unit	178-390	178-296
Drive unit	178-235	
Display unit	178-241-3	

*: One of the suffixes below is added to the No. according to the AC voltage used.

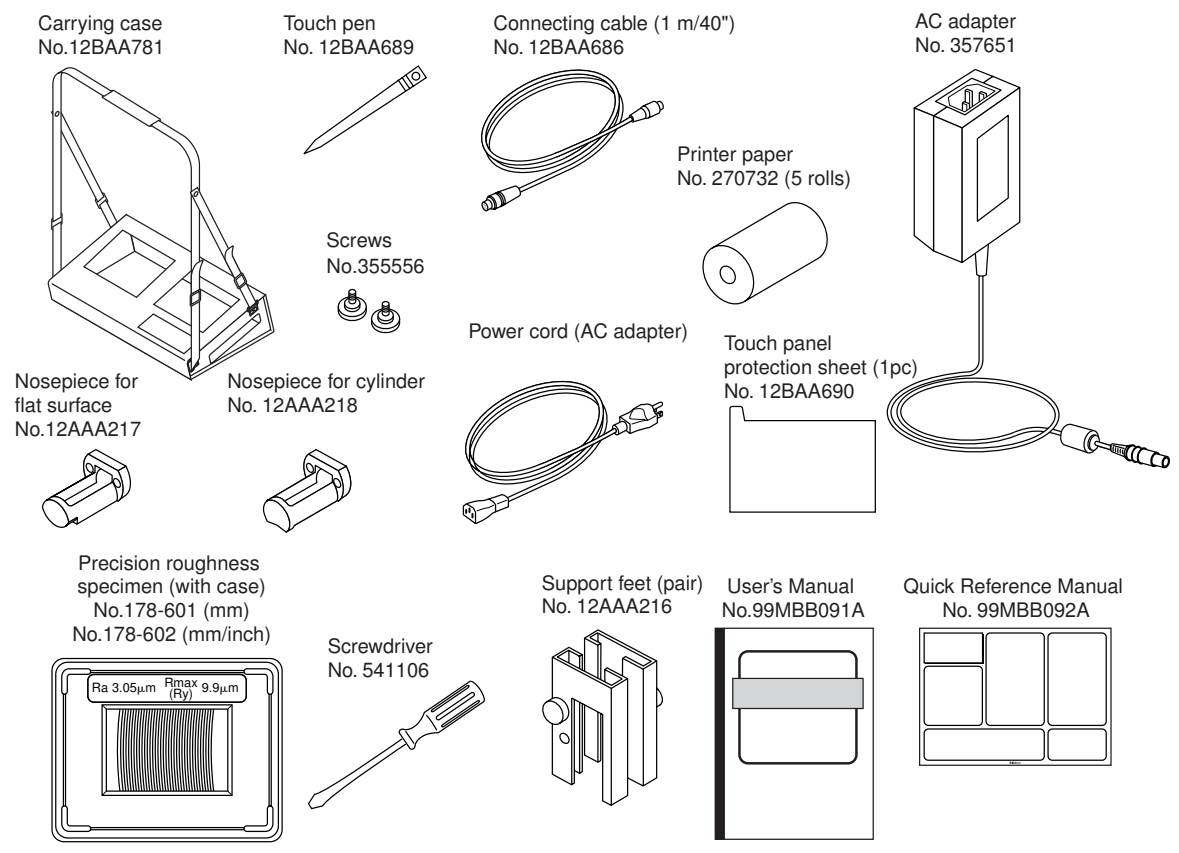
None: 100VAC, A: 120VAC, C: 110VAC, D: 230(220)VAC, DC: 220VAC, E: 240VAC

Standard SJ-301 for MAC configuration

Model No.	SJ-301R for MAC (Measuring force: 4mN)
Set No.	178-993A(for inch/mm)
Detector unit	178-280
Drive unit	178-235
Display unit	178-241-3

IMPORTANT Only use the supplied AC adapter for this instrument. Otherwise, not only the adapter but that equipment it is used with may be damaged.

Standard accessories



IMPORTANT Only use the supplied AC adapter for this instrument. Otherwise, not only the adapter but that equipment it is used with may be damaged.

■ SJ-301 standard set No.

SJ-301(Measuring force:4mN)		SJ-301(Measuring force: 0.75mN)		Power cord	Line voltage
Set No.		Set No.			
mm	mm/inch	mm	mm/inch		
178-953-3C	178-954-3	178-952-3C	178-955-3	930965	110 (100) VAC
178-953-3A	178-954-3A	178-952-3A	178-955-3A	930966	120 VAC
178-953-3D	178-954-3D	178-952-3D	178-955-3D	930967	230 (220) VAC
178-953-3DC	178-954-3DC	178-952-3DC	178-955-3DC	12BAF799	220VAC
178-953-3E	178-954-3E	178-952-3E	178-955-3E	998614	240 VAC
178-953-3K	-	178-952-3K	-	12BAF834	220VAC

■ SJ-301R set No.

SJ-301R(Measuring force:4mN)		SJ-301R(Measuring force: 0.75mN)		Power cord	Line voltage
Set No.		Set No.			
mm	mm/inch	mm	mm/inch		
178-980C	178-987	178-990C	178-997	930965	110 (100) VAC
178-980A	178-987A	178-990A	178-997A	930966	120 VAC
178-980D	178-987D	178-990D	178-997D	930967	230 (220) VAC
178-980DC	178-987DC	178-990DC	178-997DC	12BAF799	220VAC
178-980E	178-987E	178-990E	178-997E	998614	240 VAC
178-980K	-	178-990K	-	12BAF834	220VAC

■ SJ-301R for MAC set No.

SJ-301R for MAC (Measuring force: 4mN)	Power cord	Line voltage
Set No.		
mm/inch		
178-993A	930966	120VAC

■ Consumables

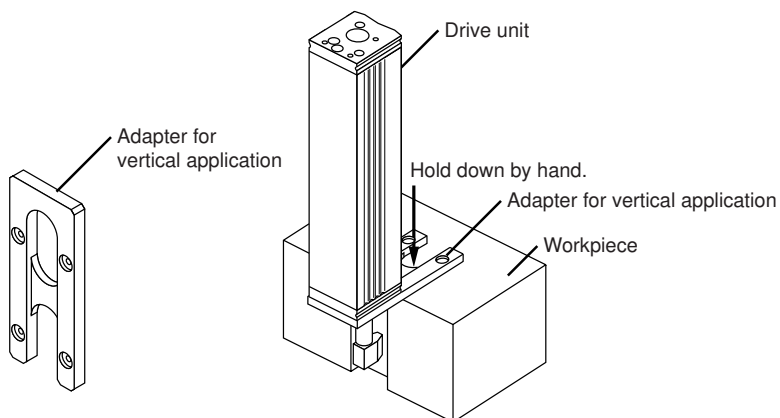
SJ-301 consumables include the following items:

Consumables	Qty	Part No.
Printer paper	5	270732
Built-in battery pack	1	12BAA688
Touch panel protection sheet	1	12BAA690
Touch panel protection sheet	10	12AAA896

■ Optional accessories

Depending on the shape of the part features to be measured, it may be necessary to use optional accessories to set up the SJ-301. Consider the shape of the workpiece when purchasing optional accessories.

The following illustrates an application of optional accessories.



TIP For details of optional accessories refer to “Chapter 10 INSTALLING THE SJ-301 WITH OPTIONAL ACCESSORIES”.

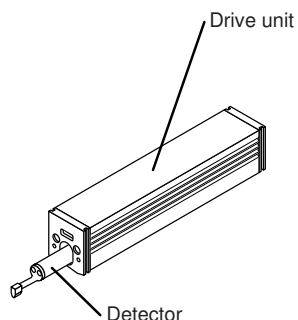
1.3 Nomenclature

This section gives the name of each part of the Drive/Detector unit and Display unit.

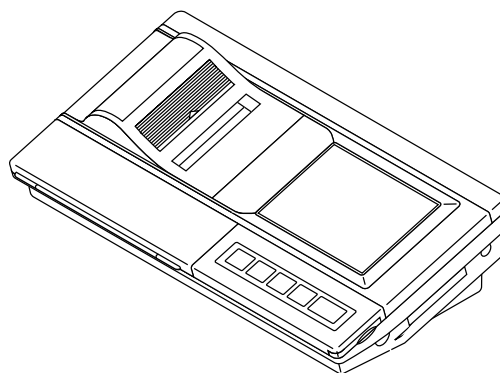
■ Drive/Detector unit and Display unit

The SJ-301 consists of the display unit and drive/detector unit. The drive/detector unit can be safely stored in the compartment inside the display unit.

Drive/Detector unit



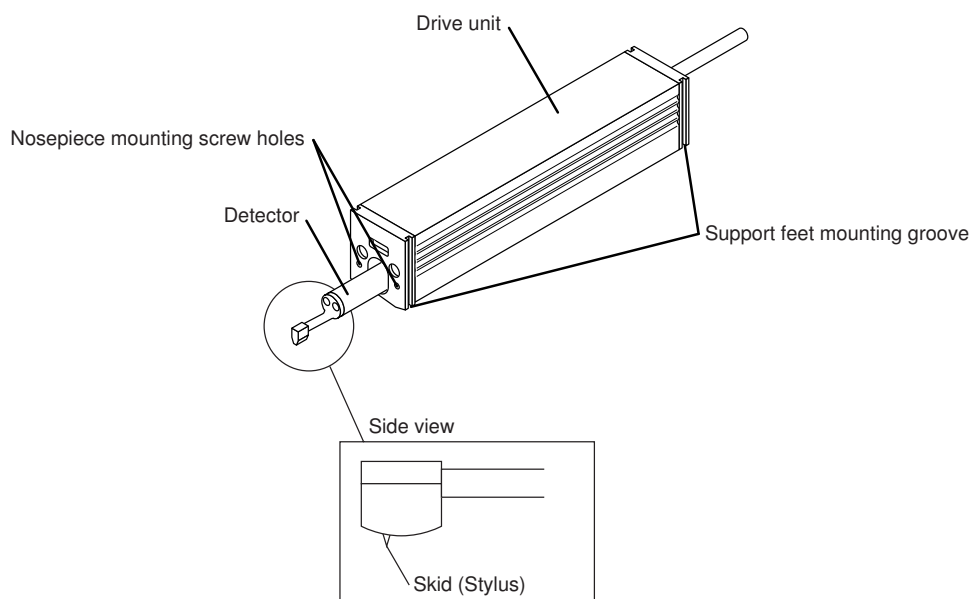
Display unit



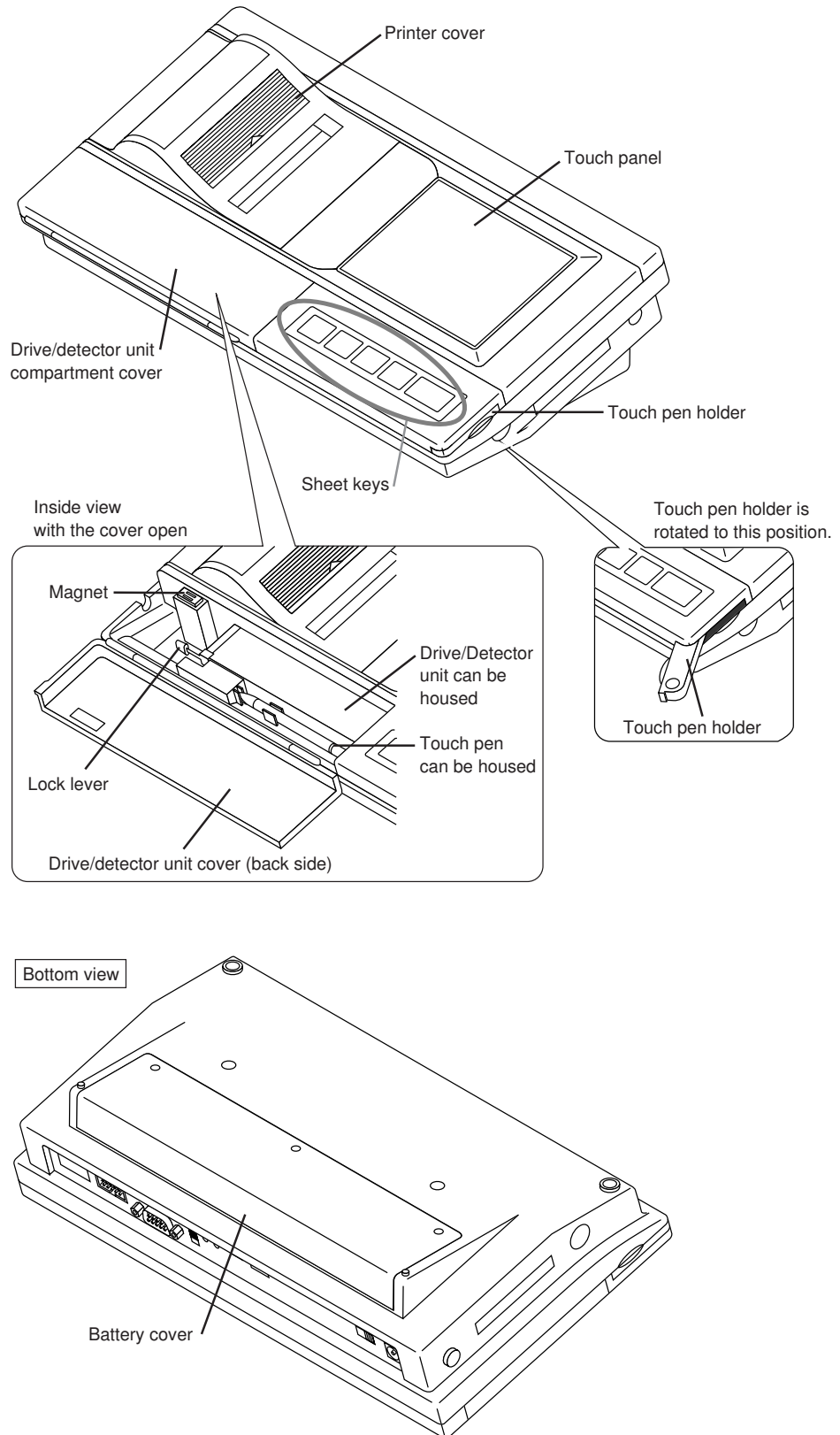
TIP For information about connection between the Drive/Detector unit and Display unit refer to “3.2 Attaching and Detaching the Drive/Detector Unit”.

NOTE Check the drive unit used and the drive unit settings in the display unit before using the unit. If there is an error in setting the drive unit, an error message such as “DRIVE ERROR 1” and “OVERRANGE” may appear, disabling measurement. For information about the drive unit setting, refer to “5.12 Setting the Drive Unit”.

■ Drive/Detector unit nomenclature

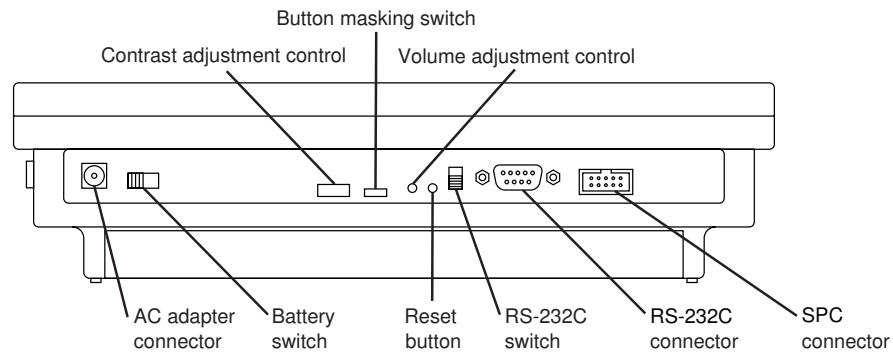


■ Display unit nomenclature



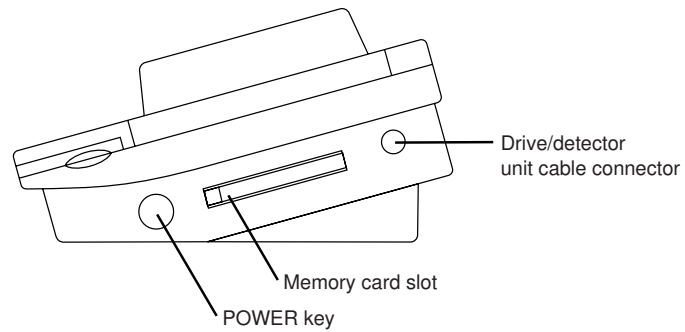
■ Nomenclature and function of the Display unit connectors

● Display unit rear view



- AC adapter connector
Connects the AC adapter cable for power supply.
- Battery switch
Turns on/off the battery power to the circuit. Leave it on normally.
- Contrast adjustment control
Adjusts the contrast of the touch panel.
- Button masking switch
Restricts some of the functions of the touch panel.
- Reset button
Restores the factory-set default conditions.
- Volume adjustment control
Adjusts the volume of the beep generated when the touch panel is pushed. To adjust the volume, turn the control with a small flat-blade screwdriver.
- RS-232C switch
Switches between the normal mode and the communication mode.
- RS-232C connector
Connects the RS-232C cable.
- SPC connector
Connects the SPC cable.

● Display unit side view



- **POWER key**
Turns the power supply of the SJ-301 on/off.
- **Memory card slot (with protection cover)**
Slot to insert a memory card (option) into.
First remove the protection cover to insert the card.
- **Driver/detector unit connector**
Connects the cable of the Driver/Detector unit.

■ SJ-301 Functions

Table Major functions of the SJ-301

Function	Reference
Measuring condition setup	Chap. 5
Calibration	4.2
Roughness measurement	4.3
GO/NG judgment	5.11
Recalculation of measurement result	Chap. 6
Statistical processing of parameter values	Chap. 7
Print out of measurements	4.5
Save/call of measurement conditions	Chap. 8
Save/call of profile data points	Chap. 8
Save/call of statistical data	Chap. 7 & 8
Detector escape	11.2
Language selection	3.6
SPC data output	9.1
RS-232C communication	9.2
Measurement condition initialization (Reset to default values)	5.16
Ruler function	4.4.2
Data delete function	5.13

■ Major specifications of the SJ-301

Table Major specifications of SJ-301 including measured profiles, parameters, etc.

Item	Descriptions
Measured profile	P, R, DIN4776, MOTIF.R, MOTIF.W
Parameter	Ra, Ry, Rz, Rq, Rt, Rp, Rv, Sm, S, Pc, mr, R3z, δc, HSC, mrd, Δa, Lo, Ppi, Sk, Ku, Δq, Rx, Rpk, Rvk, Rk, Mr1, Mr2, A1, A2, R, AR, W, AW, Wx, Wte, Vo
Filter	2RC, PC75, GAUSS
Cutoff length	0.08, 0.25, 0.8, 2.5, 8 mm (.003, .01, .03, .1, .3 in)
Number of sampling length	1, 3, 5, and L (arbitrary length)
Resolution	0.01 μm (10 bits)
Statistical data item	Mean, Maximum, Minimum, Standard deviation (one parameter per profile), GO/NG judgment (UL/LL, three parameters per profile)
Internal memory capacity	Up to 5 measurement condition files
External I/O	RS-232C, SPC output, Memory card (option)
Power supply	AC adapter, Built-in battery pack (nickel-hydrogen)

2

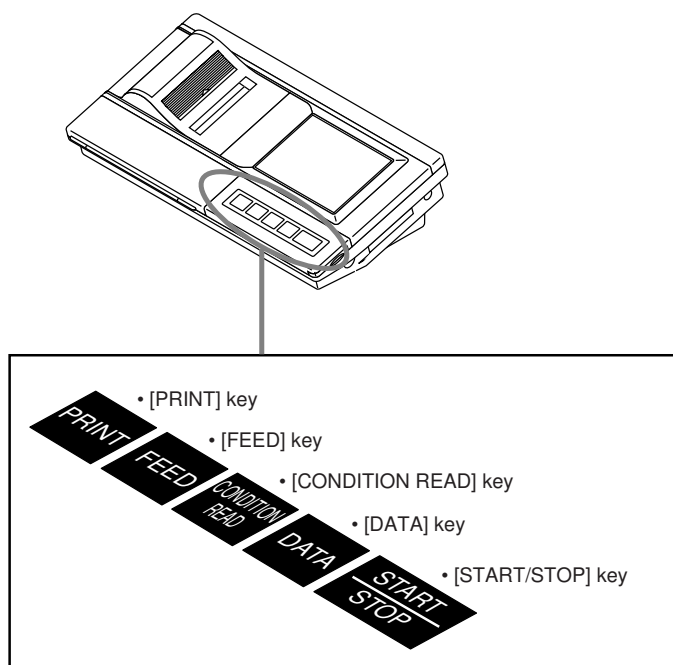
SHEET KEYS AND TOUCH PANEL OF SJ-301

The SJ-301 is operated with the sheet keys on the Display unit and the touch panel. This chapter explains the basic functions of the sheet keys and the touch panel, and the screens, and icons displayed on the touch panel.

2.1 Function of Sheet Keys

The measurement start/stop, print, measurement condition call, data output, and other SJ-301 operations are performed with the sheet keys. Each sheet key function is explained here.

■ Sheet keys on the Display unit



■ Function of each key

[PRINT] key

Starts and stops printing. Pressing this key starts printing. Pressing this key again stops printing.

TIP For information about printing, refer to section 4.5, “Printing Measured Results”.

[FEED] key

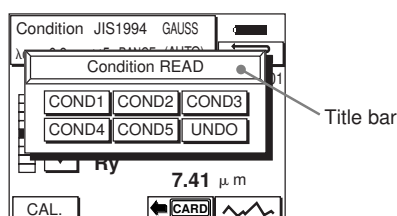
Feeds the printer paper.

[CONDITION READ] key

Calls the measurement conditions stored as a file in the internal memory of the Display unit. This key functions also in force charging.

- **Measurement conditions call**

Pressing this key displays the file selection window on the touch panel. Touch the title bar in the window to select the file to be called after the desired one has been selected.



TIP A measurement condition file can also be called from the Measurement Condition Setup screen. For information about calling the measurement condition file, refer to section 8.2, “Saving/Recalling the Measurement Conditions”.

- **Force charging**

Force charging is initiated by pressing the [POWER] key while holding down the [CONDITION READ] key.

IMPORTANT Force charging is required only with the excessively discharged internal battery. The internal battery may be excessively discharged if the SJ-301 has been left unused for more than a half year. In case the battery can not be charged during normal usage, avoid force charging. There may be other reasons than battery excess discharging.

TIP For details of force charging, refer to section 11.3 Recharging the Battery ■ Force charging.

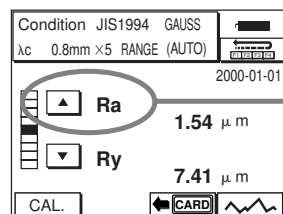
[DATA] key

Outputs SPC data to a data processor, etc., and stores the data in a memory card. It is also used to switch languages.

- **SPC data output**

Connect the data processor to the SJ-301 beforehand. Also, set the function of the [DATA] key for SPC data output.

If the [DATA] key is pressed after the parameter to be outputted has been displayed in the upper part of the Home-Screen, SPC data output is performed.



The parameter to be outputted is displayed in the upper part of the Home-Screen. (Pressing the [DATA] key in this state outputs SPC data of Ra value.)

TIP For information about SPC data output, refer to section 9.1, “SPC Output”.

- **Measured profile data storage in a memory card**

Insert a memory card in the SJ-301 beforehand. Also, set the function of the [DATA] key to output data to the memory card.

Data is stored in the memory card when the [DATA] key is pressed.

TIP For information about data storage in a memory card, refer to chapter 8, “SAVE/READ OF MEASUREMENTS, MEASUREMENT CONDITIONS AND STATISTICAL DATA”.

- **Language change**

The language setup window is displayed in the touch panel by pressing the [POWER] key while holding down the [DATA] key. Touch the [Enter] button after selecting a language, then the desired language can be selected.

TIP For information about changing the language, refer to section 3.6, “Setting Language, Date, and Unit”.

[START/STOP] key

Starts/stops measurement. It is also used for detector escape.

- **Measurement**

Measurement starts if this key is pressed. If the key is pressed again during measurement, measurement is stopped.

NOTE Check the drive unit used and the drive unit settings in the display unit before using the unit. If there is an error in setting the drive unit, an error message such as “DRIVE ERROR 1” and “OVERRANGE” may appear, disabling measurement. For information about the drive unit setting, refer to “5.12 Setting the Drive Unit”.

TIP For information about the measurement, refer to section 4.3, “Measurement”.

- **Detector escape and release**

The Detector escapes into the Drive unit if the [POWER] key is pressed while the [START/STOP] key is held down. The Detector is released if the [START/STOP] key is pressed in the escape state.

TIP For information about detector escape and release, refer to section 11.2, “Detector Retraction Procedure and Cancellation”.

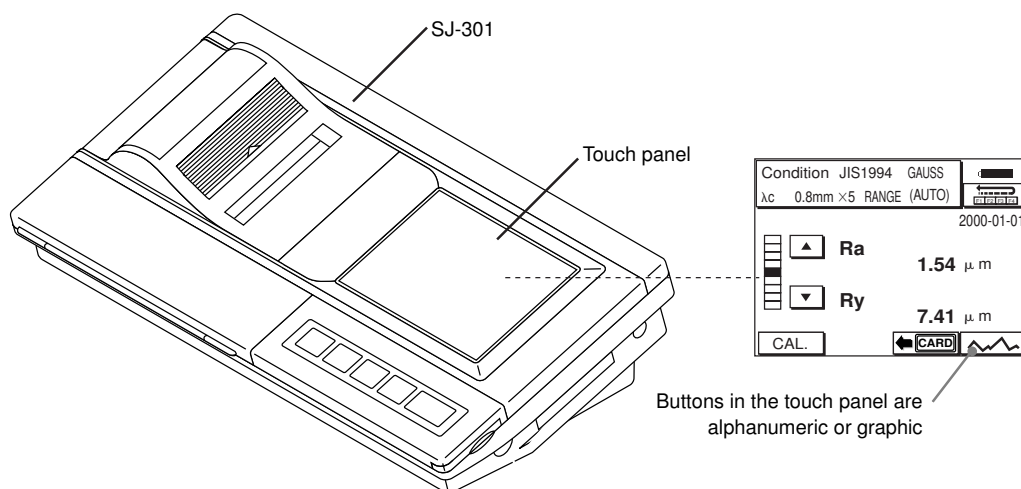
NOTE If the Front Escape function type drive unit is used, the Retract function is not available.

2.2 Outline of the Touch Panel

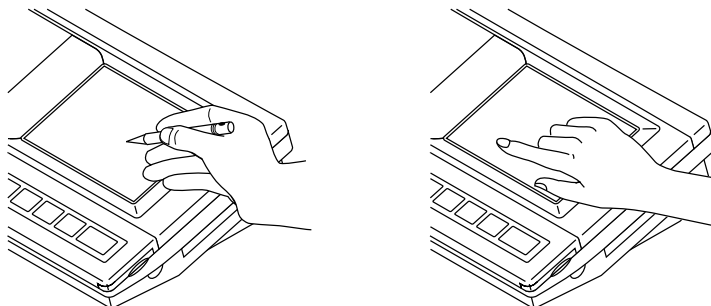
The settings for measurement conditions, statistical processing conditions, print conditions, and other settings are set up via the touch panel. The functions of the main buttons displayed in the touch panel and the operating procedure for inputting alphanumeric characters are explained here.

■ Using the touch panel (About the touch pen)

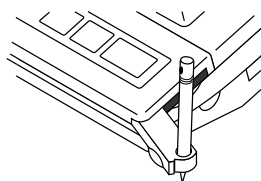
The buttons for operating the various functions of the SJ-301 are displayed in the touch panel.



Use your finger or the touch pen to operate the buttons.



Put the touch pen in the holder as shown when not in use.



NOTE Safe-keep the touch pen in the drive/detector unit compartment if it is not used for an extended period. See section 11.1 for details.

IMPORTANT Observe the following precautions when operating the touch panel. Otherwise, the touch panel might be damaged.

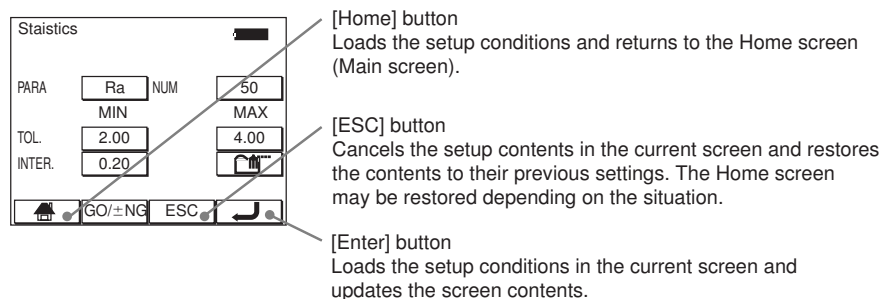
- Do not push the touch panel too hard.
- Do not operate the touch panel using a sharp-tipped object such as a ball-point pen.
- Do not touch the touch panel with contaminated fingers. To avoid contamination on the touch panel, use the touch pen. Insert the touch pen in the pen holder when not in use. Also, safe keep the touch pen in the compartment inside the Display unit if it may not be used for long.

■ Buttons that load or cancel the setup content

The following types of screens and windows are displayed in the touch panel. The buttons used to load or cancel the setup content of each screen/window are also explained.

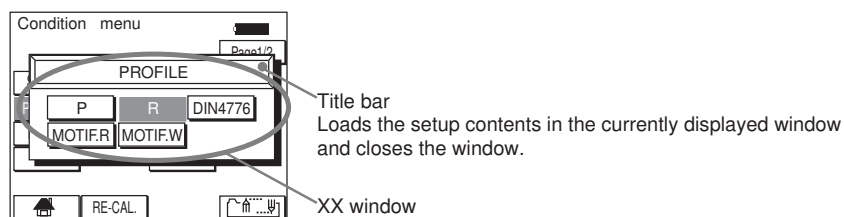
● “XX screen”

The setup contents are loaded or cancelled with the [Enter] and [ESC] buttons.



● “XX window”

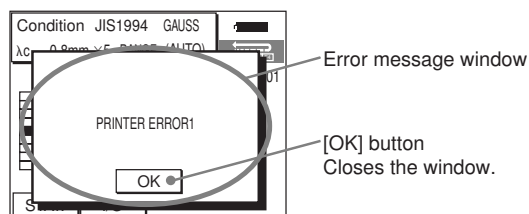
The setup contents are loaded by touching the title bar in the upper portion of the pop-up window.



● “Error message window”

An error message is displayed if an error occurs during processing.

To close the error message window, touch the [OK] button.



■ Inputting numeric values

With the SJ-301, numeric value entry may be required for such as measurement condition setup.

For example, numeric values include the reference specimen roughness, date/time, etc..

The procedure for changing the numeric value “3.00” to “2.95” on the Reference Specimen Roughness Value Input screen is given as an example.

< Reference Specimen Roughness
Value Input screen >

Roughness value input field

Reference specimen			
Ra	3.00		μ m
(0.01 ~ 999.9 μ m)			
BS	7	8	9
	4	5	6
	1	2	3
	0	.	
AC		ESC	

The screen is ready to enter a numeric value in the Roughness value input field.

TIP Displayed below the input field is the data range (e.g. 0.01-999.9 μ m) available for entry.

1

Reference specimen			
Ra	3.00		μ m
(0.01 ~ 999.9 μ m)			
BS	7	8	9
	4	5	6
	1	2	3
	0	.	
AC		ESC	

Touch the [2], [.] , [9], and [5] buttons in this order.

⇒ The value displayed in the input field becomes “2.95”.

TIP The [BS] button deletes one digit each time it is touched, while the [AC] button deletes all digits at a time it is touched. This permits the deletion of incorrect digits.

2

Reference specimen			
Ra	2.95		μ m
(0.01 ~ 999.9 μ m)			
BS	7	8	9
	4	5	6
	1	2	3
	0	.	
AC		ESC	

[Enter]

Confirm that the numeric value input is correct, then touch the [Enter] button.

⇒ The inputted numeric value is loaded, and the Calibration screen is restored.

NOTE The permissible range of data input is specific to the data item concerned (e.g., arbitrary evaluation length: 0.3 mm to 12.5 mm). The [Enter] button will not load the input value if it is out of the specified range.

TIP Touching the [ESC] button instead cancels the input value and the Calibration screen is restored, retaining the previous numeric value.

■ Inputting characters (alphabets)

In the SJ-301, a string of characters such as file name to be registered and comment to be printed are inputted in the respective screen.

The procedure for inputting the file name “ST-1” in the Statistical Data File Name Input screen is given as an example.

- NOTE**
- Filename can not include (*).(¥), nor(.).
 - The number of characters permitted to input is as follows:
 Measurement condition file name: up to 8 characters
 Comment about the measurement condition file: up to 25 characters
 Measured profile data file name: up to 8 characters (up to 5 characters when the DATA key is used)
 Comment about the measured profile data file: up to 25 characters
 Statistical data file name: up to 8 characters
 Comment about the statistical data file: up to 25 characters
 Memo appended to document: up to 10 characters

< Statistical Data File Name Input screen >

File name input field

Statistics Save

File name: ????????

(max 8 char.)

BS	ABC/7	MNO/8	YZ/9
→	DEF/4	PQR/5	-/6
A	GHI/1	STU/2	*/3
1	JKL/0	VWX/. ¥	
AC	C.IN	ESC	↵

[Alphabet]

The screen is ready for input of the file name.

- NOTE**
- Shown under the input field is the number of characters or data range that can be inputted for the item concerned. For example, “max 8 chara” on the screen left indicates the file name allows up to 8 characters to be entered.

1

Statistics Save

File name: ????????

(max 8 char.)

BS	ABC/7	MNO/8	YZ/9
→	DEF/4	PQR/5	-/6
A	GHI/1	STU/2	*/3
1	JKL/0	VWX/. ¥	
AC	C.IN	ESC	↵

[→] [STU/2]

- NOTE**
- Multiple characters are assigned to each character button. The number of key-strokes needed to input a character depends on its position on the button.

Touch the [STU/2] button once, then touch the [→] button.

⇒ “S” is inputted in the field, and the next character can be entered.

2

Statistics Save

File name: ????????

(max 8 char.)

BS	ABC/7	MNO/8	YZ/9
→	DEF/4	PQR/5	-/6
A	GHI/1	STU/2	*/3
1	JKL/0	VWX/. ¥	
AC	C.IN	ESC	↵

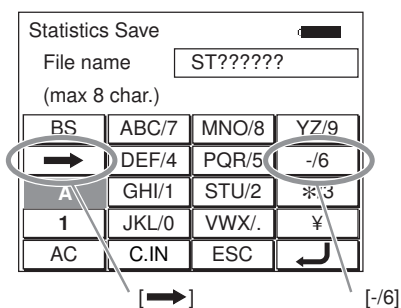
[→] [STU/2]

- TIP**
- Characters inputted can be deleted one by one by touching the [BS] button.
 - The [AC] button deletes all the characters at a time.

Touch the [STU/2] button twice, then touch the [→] button.

⇒ “T” is inputted in the field, and the next character can be entered.

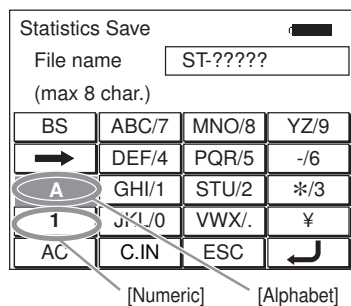
3



Touch the [-/6] button once, then touch the [→] button.

⇒ “-” is inputted in the field, and the next character can be entered.

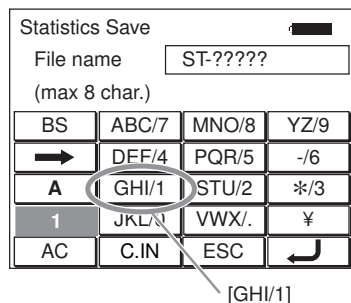
4



Touch the [Numeric] button once.

⇒ Digits can be entered.

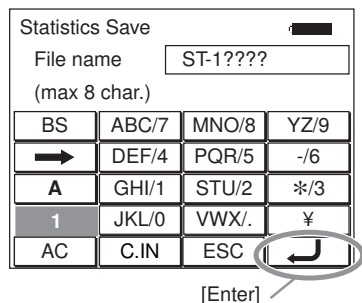
5



Touch the [GHI/1] button once.

⇒ “1” is inputted.

6



Check that the inputted file name is correct, then touch the [Enter] button.

⇒ The statistical data is saved and the Statistical Processing Results screen will be restored.

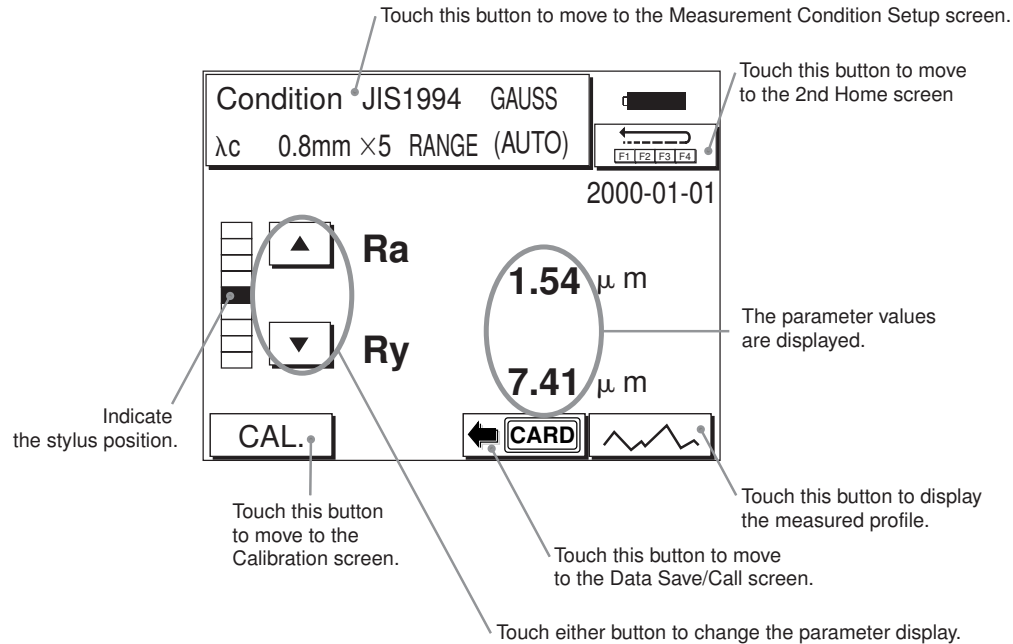
TIP

Touching the [ESC] button cancels the contents so far inputted and the Statistical Processing Results screen is restored, retaining the previous numeric value.

2.3 Home Screen of the Touch Panel

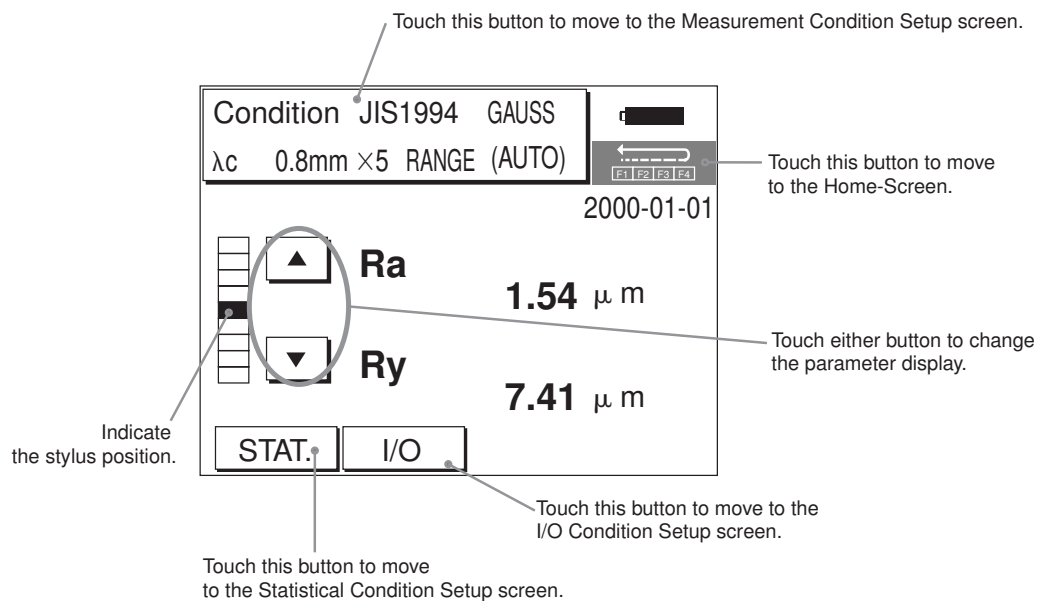
When the power to the SJ-301 is turned on, the Home screen is displayed in the touch panel. The function of each button and icon displayed on the Home screen is explained here.

■ Function of the Home screen



■ Function of the 2nd Home screen

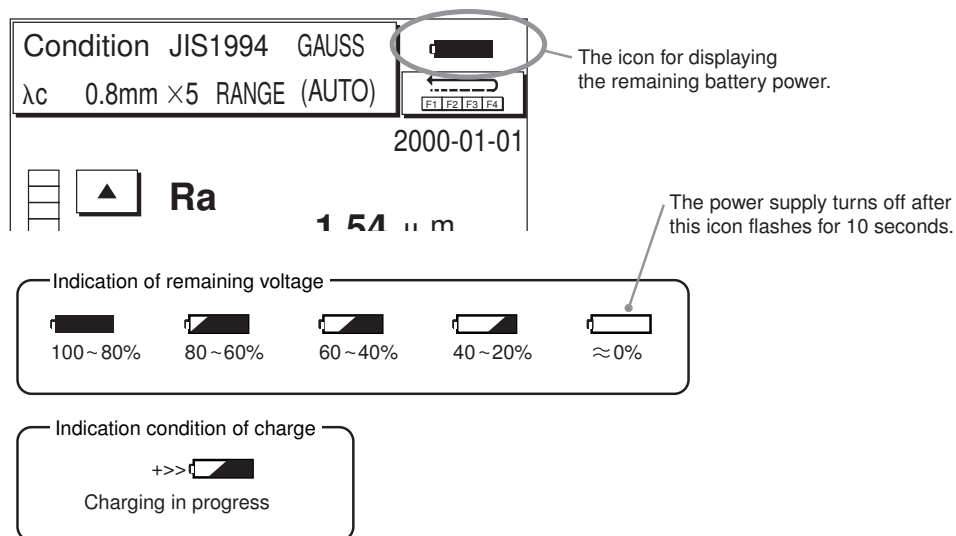
If the  (SHIFT) button in the Home screen is touched, a modified screen called 2nd Home screen appears where the button configuration is as shown in the figure below.



■ Displaying the remaining battery power

The icon for displaying the remaining battery power is displayed in the touch panel. 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.



IMPORTANT Observe the following if the SJ-301 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. The battery will start charging.
- Connect the AC adapter immediately when the remaining battery power is closer to 0%. The measurement data may be lost.

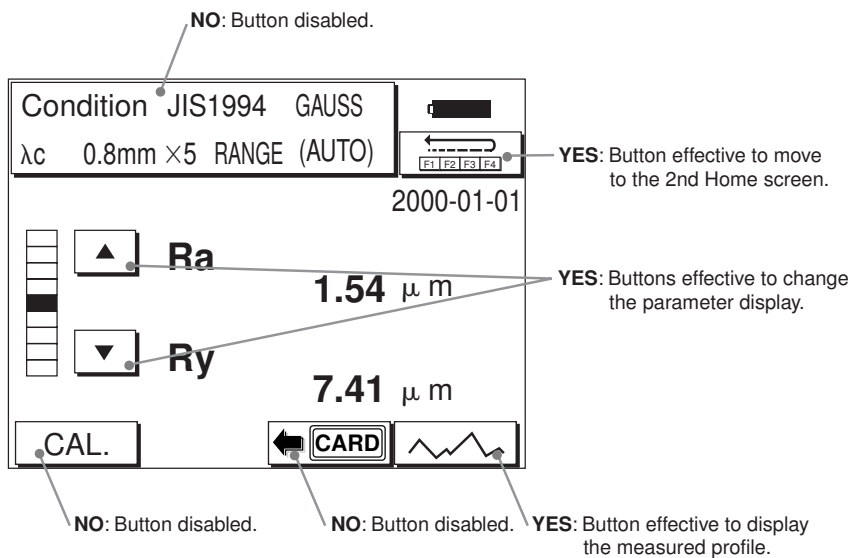
TIP For information about the charging procedure, refer to section 11.3, "Recharging the Battery".

■ Restricting the functions of the Home screen and the 2nd Home screen (button masking)

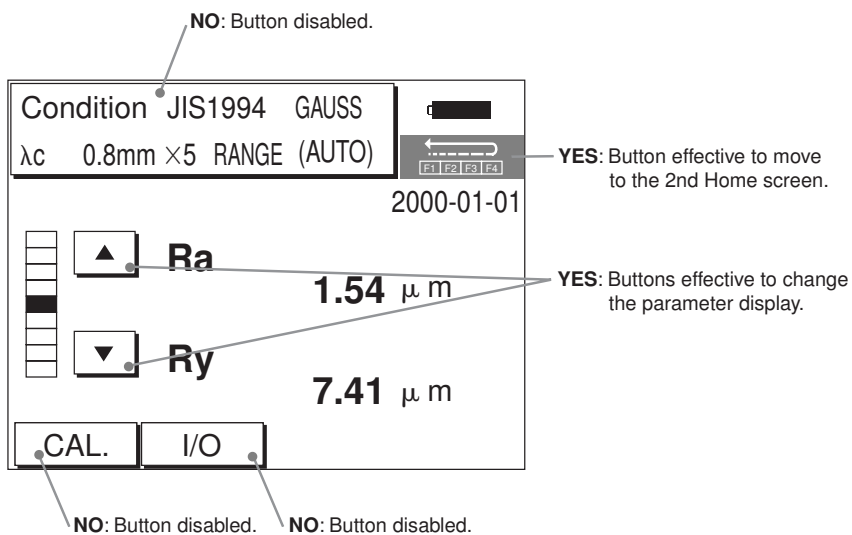
To prevent the measurement conditions and other settings from being accidentally changed, the functions of the Home screen can be restricted (button masking).

For button masking, turn on the Button Masking switch on the rear of the Display unit.

<Home screen>



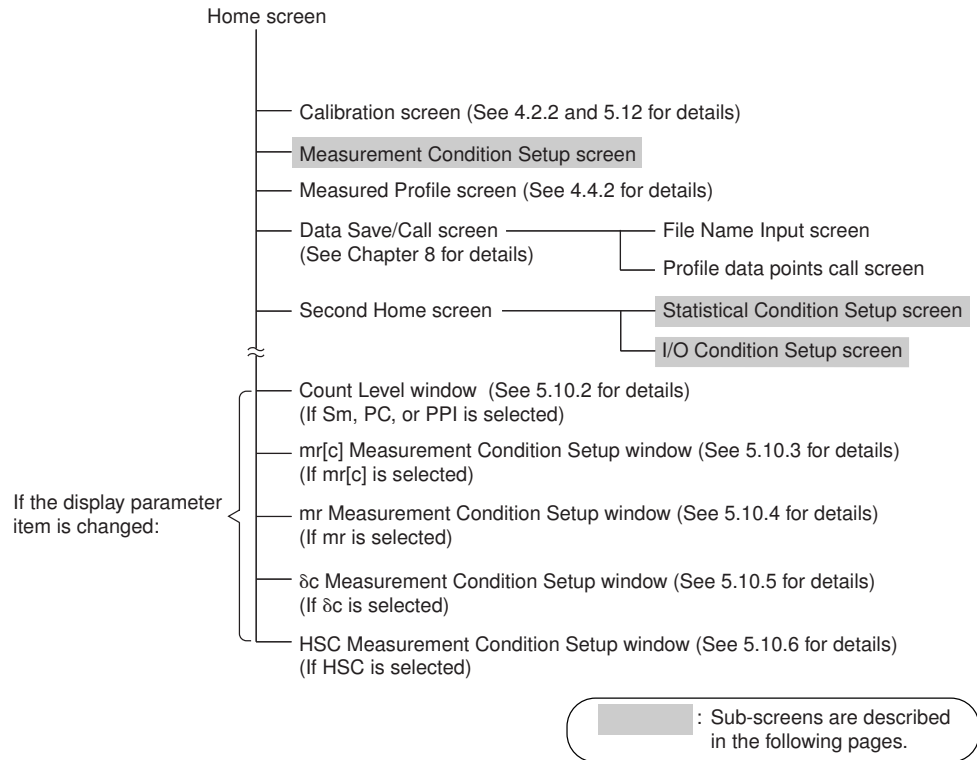
<2nd Home screen>



2.4 Screen Hierarchy in the Touch Panel

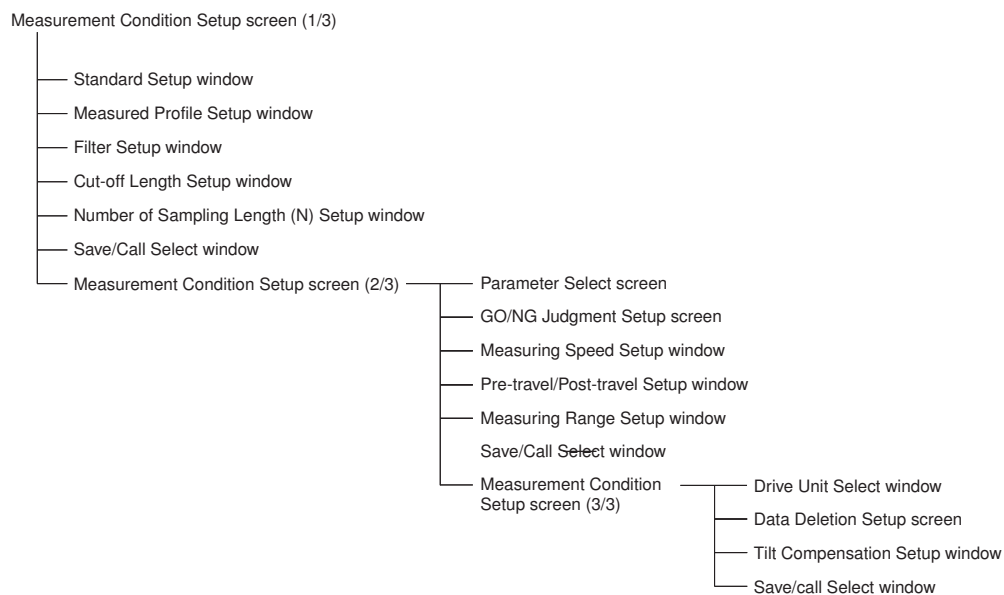
The hierarchy of the screens displayed in the touch panel is shown in the following pages.

■ Home screen sub-screens



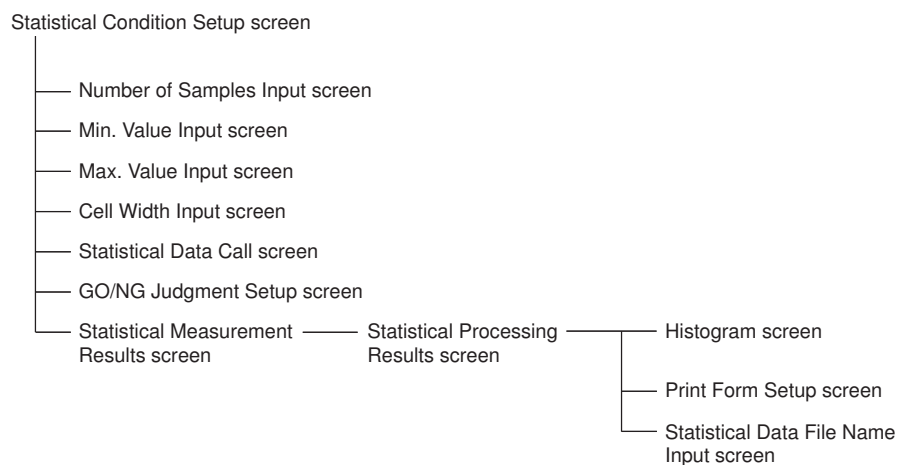
■ Measurement Condition Setup screen sub-screens

TIP See also “Chapter 5 MODIFYING THE MEASUREMENT CONDITIONS” for details.

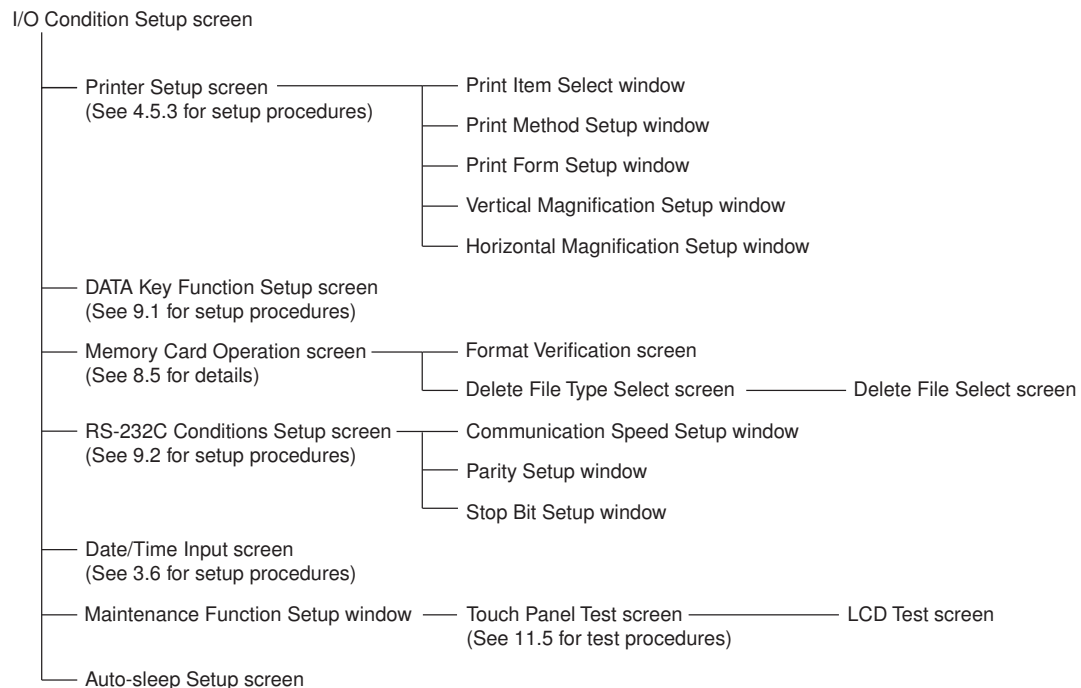


■ Statistical Conditions Setup screen sub-screens

TIP See also “Chapter 7 STATISTICAL PROCESSING OF MEASUREMENTS” for details.



■ I/O Conditions Setup screen sub-screens



2.5 List of Icons

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

■ List of icons to be displayed (1/2)

Icon	Function (The description enclosed by parentheses implies the state.)
	(Indicates the extent the built-in battery discharged.)
	(Indicates the state of the built-in battery being charged.)
	(SHIFT)key. Moves to the 2nd Home screen.
	(SHIFT)key. Moves to the Home screen.
	Changes the display of parameters.
	Accesses to a memory card to save or call data.
	Moves to the Measured Profile screen.
	Moves to the Home screen.
	Saves or calls the measurement conditions.
	Sets a measuring speed.
	Sets pre-travel/ post-travel.
	Saves data.
	Calls data.
	Selects the internal memory as a medium for saving or calling data.
	Feeds digits for character input on the character input screen.
	Alphabet Input button
	Numeric Input button
	Loads the setup contents.
	Cancels the setup contents.
	Changes the display magnification of a measured profile.
	Scrolls a measured profile display.
	Uses the ruler function for partial analysis of a measured profile.
	Displays the entire measured profile.

■ List of icons to be displayed (2/2)

Icon	Function (The description enclosed by parentheses implies the state.)
	Changes the vertical display magnification of a measured profile.
	Changes the horizontal display magnification of a measured profile.
	Performs centering of a measured profile display.
	Scrolls a measured profile display leftward.
	Scrolls a measured profile display rightward.
	Moves the cursor leftward when the ruler function is used.
	Moves the cursor rightward when the ruler function is used.
	Moves to the Histogram screen.
	Sets the print conditions.
	Moves to the Statistical Result screen.
	Sets date/time.
	DATA key function setup
	RS-232C condition setup
	Selects the Maintenance function.
	Auto-sleep Setup button
	Sets the Print Save Mode.
	Sets the print direction on paper to "portrait".
	Sets the print direction on paper to "landscape".
	Prints a measured profile on the printer paper.
	Formats a memory card.
	Deletes a file in a memory card.
	LCD test
	Front Escape Drive Unit Select button
	Front Escape Release button

MEMO

3

SETTING UP THE SJ-301

3.1 SJ-301 Setting

The following settings must be made before making measurements with the SJ-301.

- Installing the Drive/Detector unit and the Detector
The SJ-301 is shipped with the Display unit, Detector, and Drive unit packed separately.
Connect the three units with connecting cables.
This section also explains how to attach and detach the Drive/Detector unit.
- Loading a roll of printer paper
Load a roll of printer paper in the Display unit.
This section also explains how to attach and detach the printer cover.
- Applying the touch panel protection sheet
Apply the protection sheet on the touch panel of the Display unit, following the procedures given in section 3.4.
- Turning on the power supply (turning on the battery switch and the power supply)
Turn on the battery switch on the Display unit.
This section also explains turning the power on/off during usual operations.
- Setting the language, date, and unit of measurement
Set the display language from among Japanese, English, German, French, Italian, and Spanish and the date/time. English is the default display language.
The unit of measurement for the SJ-301 can be set to either “mm” or “inch”. Change the unit as necessary.
- Installing the SJ-301 in the carrying case
For safe use of the SJ-301, especially on the shop floor, put the Display unit in the carrying case, following the procedures given at the end of this chapter.

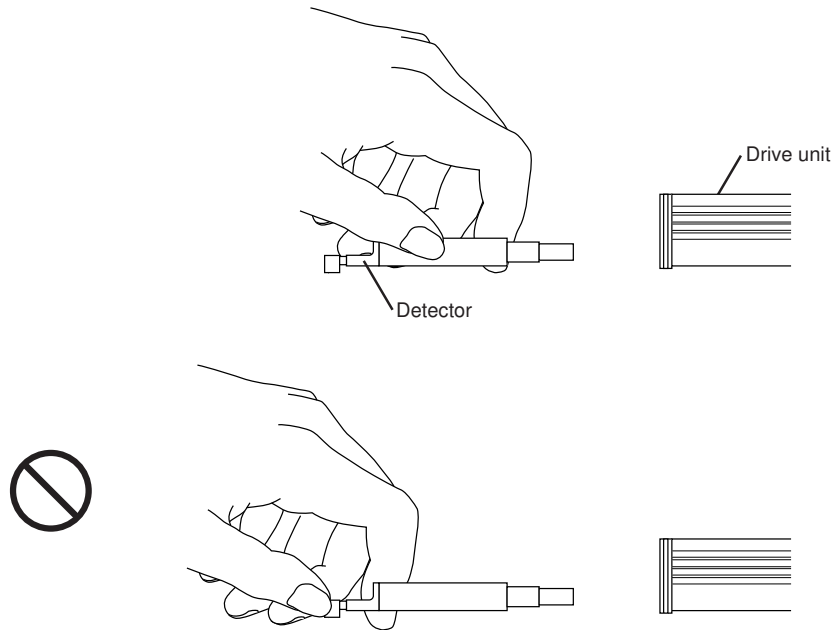
3.2 Attaching and Detaching the Drive/Detector Unit

3.2.1 Attaching and Detaching the Detector

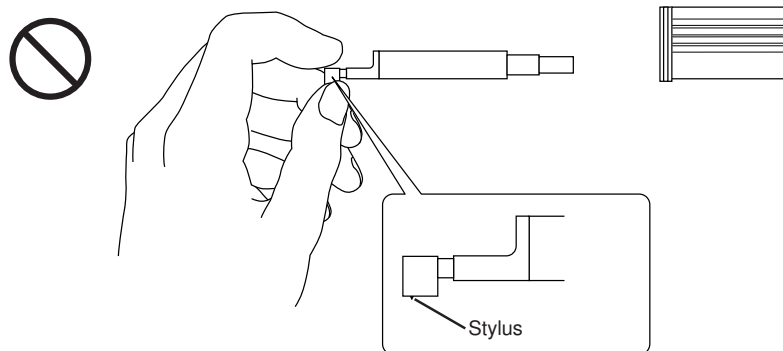
The SJ-301 is shipped with the Display unit, the Drive unit, and the Detector packed separately. Connect the three units with connecting cables as directed on the following pages.

The Display unit has a compartment to accommodate safe keep of the Drive/Detector assembly unit.

IMPORTANT Always hold the Detector body if it is being attached or detached. If the tip or stylus is held during attachment/detachment, the Detector may be damaged.

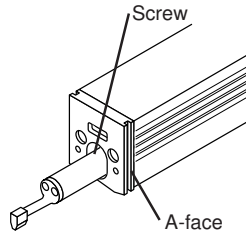


IMPORTANT Never touch the stylus. It can be damaged.



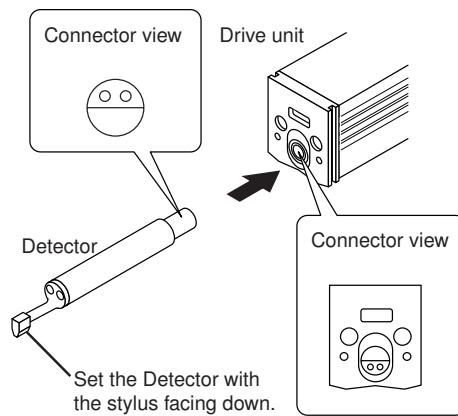
■ Attaching the Detector

- IMPORTANT**
- If fitting the Detector into the Drive unit, do not force the Detector. Doing so may cause instrument failure.
 - The Detector moves smoothly at first being fitted in the guide way inside the Drive unit, then connector pins of each unit must be fitted to each other. After the Detector is felt rather tight in the guide of the Drive unit, further push in the Detector until it stops with the connector pins fitted. If the Detector is firmly fitted in the Drive unit, the screw on the top of the Detector is aligned with the A-face shown.



- If using the standard drive unit, do not attach the detector in the detector retract state. The connector at the recess of the detector guide way in the Drive unit may not be located with the inserted Detector. Release the detector-retraction-state in this case referring to section “11.2 Detector retraction and release”.

Confirm the connector positions on both the Detector and Drive unit sides, then insert the Detector straightforward in the Drive unit.

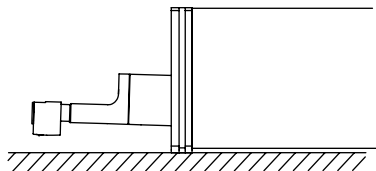


■ Detaching the Detector

Gently pull the Detector straightforward from the Drive unit.

● Procedure when using the front escape type drive unit

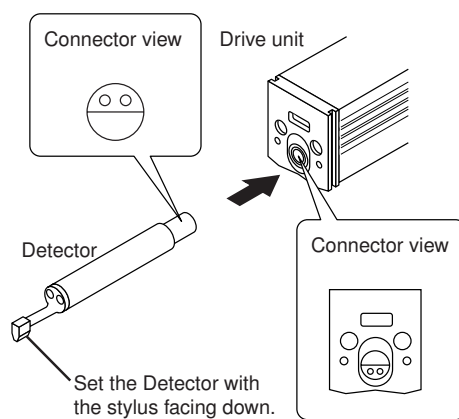
1. Check that the detector is in the front escape state.



If the detector is escaped all the way to the front, advance to step 2.

Otherwise, turn on the power, press the [START/STOP] key to restore the front escape state of the detector, and then turn off the power.

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.



■ Detaching the detector

Gently pull the detector straightforward from the drive unit.

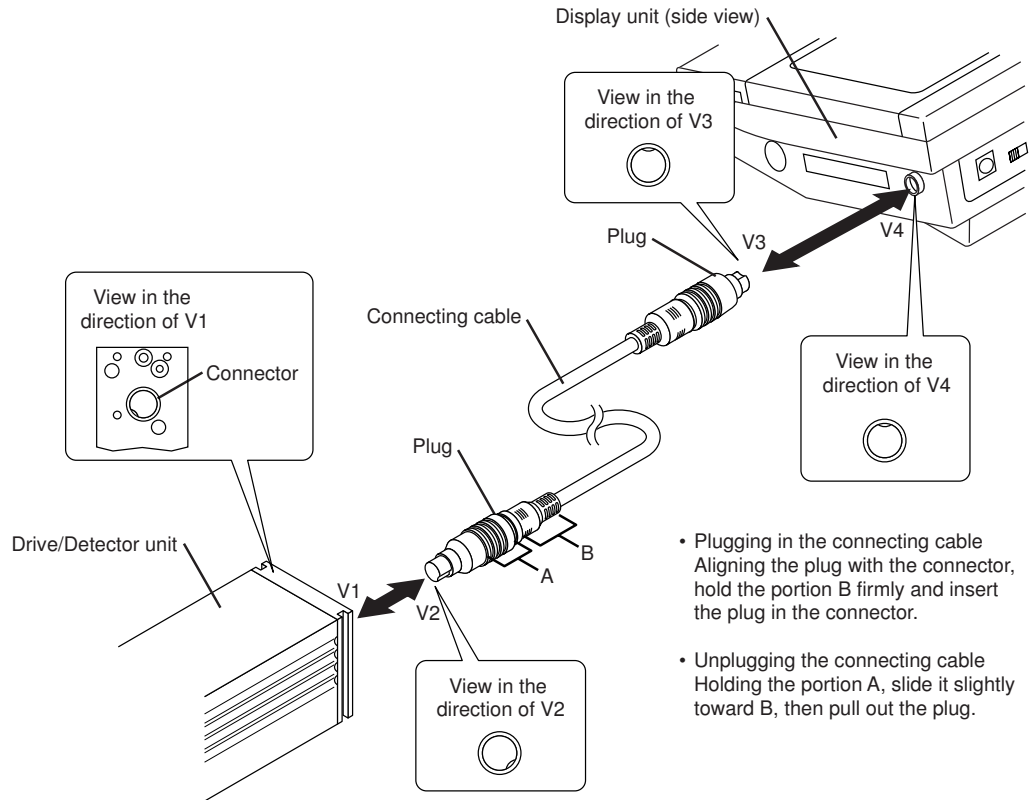
3.2.2 Connecting the Drive/Detector unit with the Display unit

IMPORTANT Be sure to connect or disconnect the connecting cables only when the SJ-301 is turned off or in auto-sleep state.

In setting up the SJ-301, link the Drive/Detector unit to the Display unit with a connecting cable.

■ Plugging in and unplugging the connecting cable

Plug in and unplug the connecting cable as shown below.



IMPORTANT Set the drive unit type to Standard if using the standard drive unit, and be sure to set the drive unit type to Front Escape if using the Front Escape function type drive unit. For information about the drive unit setting, refer to “5.12 Setting the Drive Unit”.

NOTE Check the drive unit used and the drive unit settings in the display unit before using the unit. If there is an error in setting the drive unit, an error message such as “DRIVE ERROR 1” and “OVERRANGE” may appear, disabling measurement. For information about the drive unit setting, refer to “5.12 Setting the Drive Unit”.

3.3 Loading Printer Paper

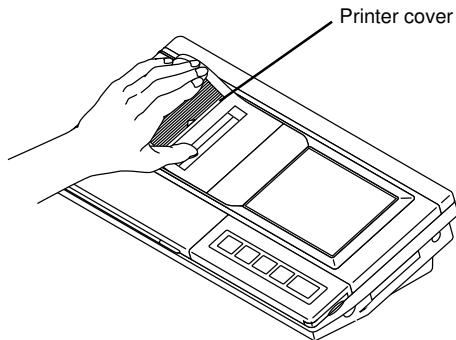
The printer, which is used to print out measured results, etc., is built into the SJ-301. A roll of printer paper must be installed in the SJ-301 to use this printer.

■ Loading a roll of printer paper

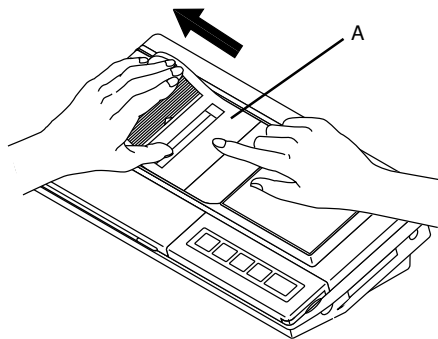
● Detaching the printer cover

Detach the printer cover on the Display unit to load a roll of printer paper.

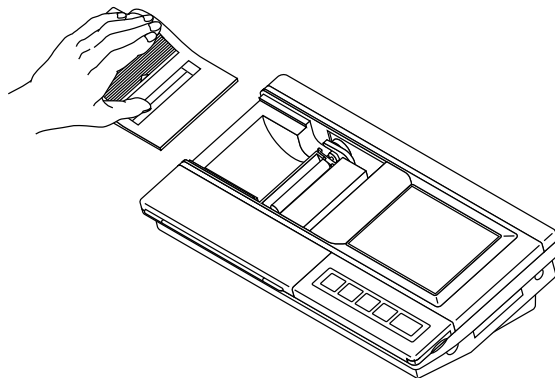
1. Turn the Display unit power to off.
2. Hold the printer cover lightly as shown in the figure.



3. Slide the printer cover in the direction of the arrow while lightly pushing the portion A in the figure.



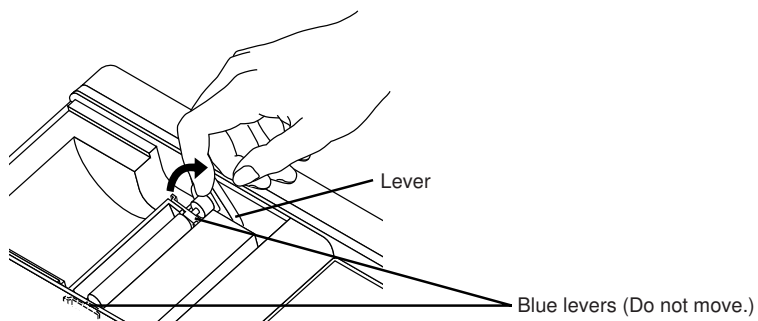
The printer cover will come off.



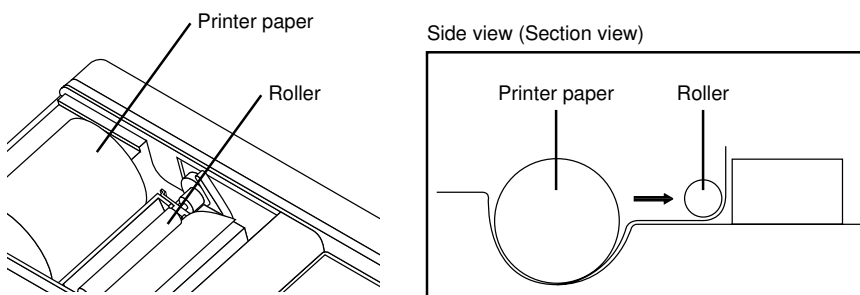
● Loading printer paper

1. To load a new roll of printer paper, remove the printer paper remaining in the SJ-301 Display unit. Pull up on the lever when taking out the paper, as shown in the figure.

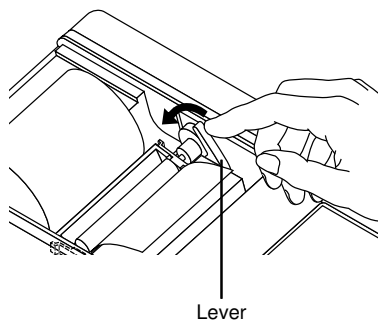
IMPORTANT Do not move the blue levers. The roller is disengaged if either lever is moved.



2. After feeding one end of the printer paper through the roller, set the paper roll in the Display unit as shown in the figure.

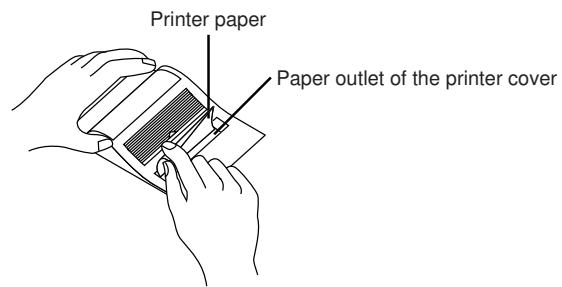


3. Reposition the lever, as shown below, after setting the printer paper.

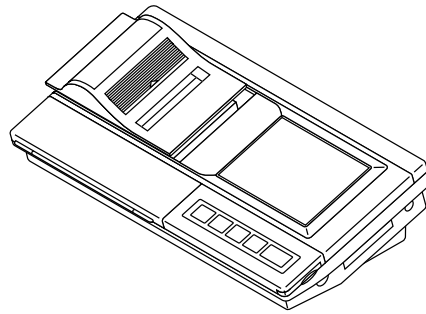


● Attaching the printer cover

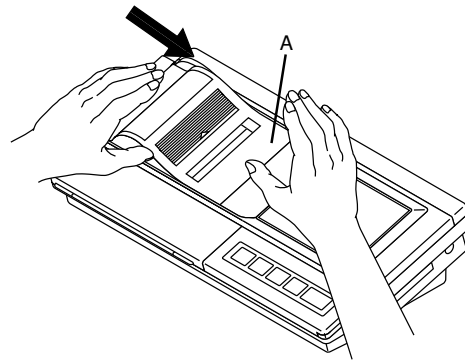
1. Pass the end of the printer paper through the paper outlet of the printer cover as shown in the figure.



2. After passing the end of the paper through the paper outlet, position the printer cover as shown in the figure.

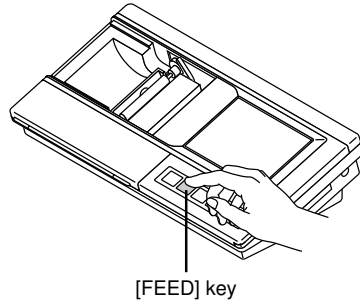


3. Push the printer cover in the direction indicated by the arrow while lightly pressing on the portion A in the figure.



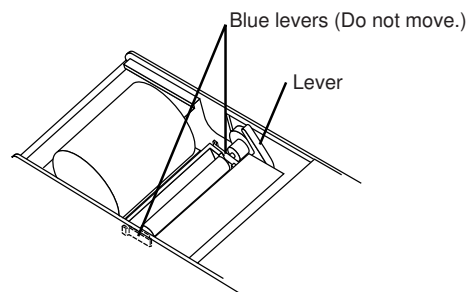
TIP While power is being supplied to the SJ-301, a roll of printer paper can be loaded by using the auto-feed function following the procedures below.

1. Turn on the power supply.
2. Detach the printer cover.
3. Hold down the [FEED] key until the unwanted (remaining) strip of printer paper is out.

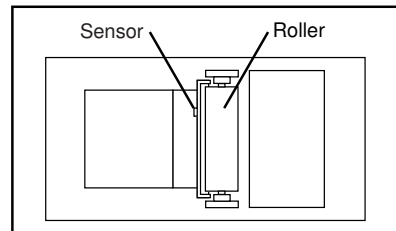


4. After lifting the lever, insert the end of the printer paper to the sensor under the roller and set the paper roll.

IMPORTANT Do not move the blue levers. The roller is disengaged if either lever is moved.

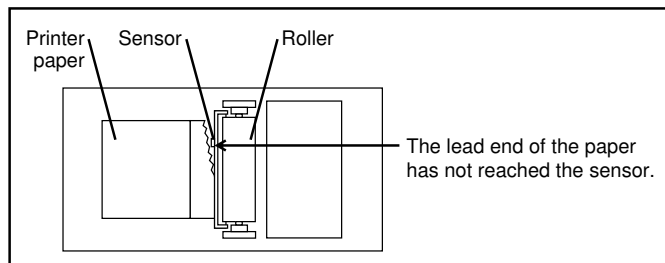


Top view



5. Push the lever down when the lead end of the paper has reached the sensor, as shown in the above figure.
The printer paper is automatically fed into place.
6. Press the [FEED] key to feed the printer paper if the lead end of the paper does not reach the sensor, as shown in the figure below.

Top view



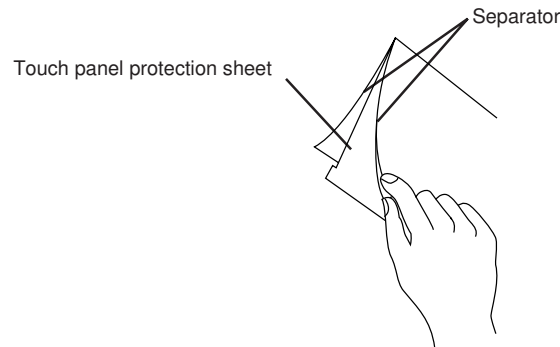
7. Attach the printer cover.

3.4 Applying the Touch Panel Protection Sheet

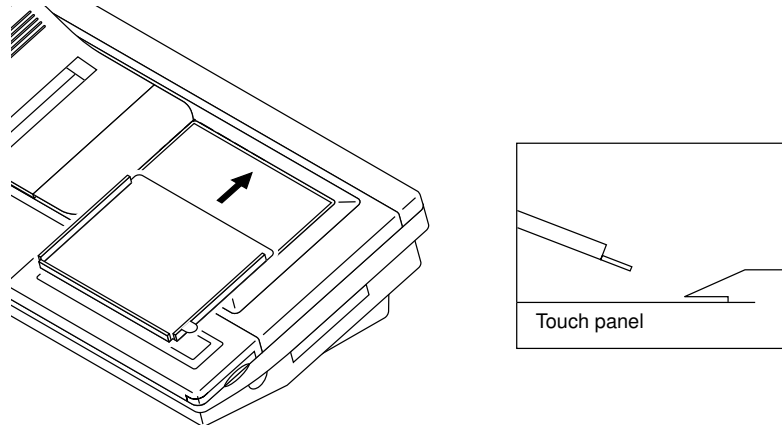
■ Applying the touch panel protection sheet

NOTE First of all, wipe the touch panel clean using a dry cloth.

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



2. Fit the straight edge, the one not bent, into the gap between the touch panel and the display unit cover as shown below.



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

NOTE

- Do not put the protection sheet in a wrong direction. If the display unit is put in the carrying case in this state, the protruded part of the protection sheet may be pressed by the carrying case, the touch panel may response, then malfunction will be resulted.
- If the protruded part of the protection sheet or the bent edge is pressed strongly, the touch panel could respond to it.

■ Replacing the touch panel protection sheet

A soiled or distorted touch panel protection sheet may lead to miss operation of the SJ-301.

Check the condition of the protection sheet daily after use. Replace the protection sheet if it is heavily soiled or if the display cannot be viewed easily.

A replacement touch panel protection sheet can be purchased from your SJ-301 dealer.

- Touch panel protection sheet

Part No.	Qty
12BAA690	1
12AAA896	10

3.5 Turning On/Off the Power Supply

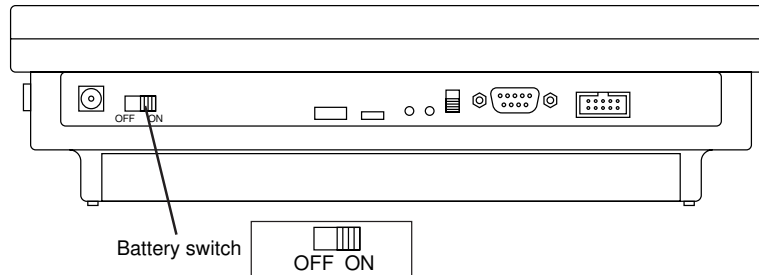
The AC adapter and a built-in battery are used to supply power to the SJ-301.
If an AC outlet is available, connect the AC adapter and turn on the SJ-301.
To operate the SJ-301 powered with the built-in battery, turn on the SJ-301 without connecting the AC-adapter.

3.5.1 Turning the power on/off

- Turn on the battery switch first.

IMPORTANT Do not connect the AC adapter and turn on/off the battery switch. Otherwise, the battery may be overcharged.

The SJ-301 has been shipped with the battery switch turned to off. First, turn on the battery switch.

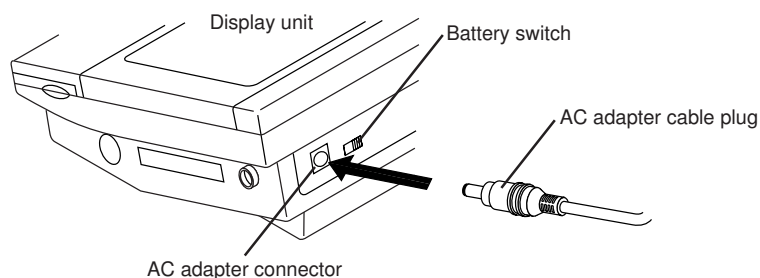


NOTE The built-in battery is used to retain the measured results and other data while the SJ-301 is in the auto-sleep state. Therefore, while the AC adapter is supplying power, it is still necessary for the battery switch to be on.

■ Turning on the power with the AC adapter

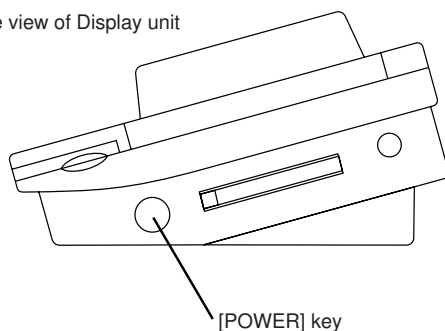
IMPORTANT Avoid connecting the AC adapter to an outlet suffering from interference noise. Although this instrument is designed to be resistant to line noise, measurement repeatability may be degraded if the SJ-301 is connected to an outlet with significant interference noise.

1. Confirm that the battery switch is turned on.
2. Connect the AC adapter to the outlet.
3. Connect the AC adapter cable plug to the Display unit.



4. Press the [POWER] key.

Side view of Display unit

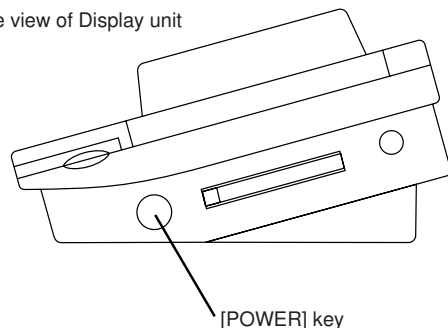


NOTE If the AC adapter is used, auto-sleep will not function irrespective of the setup for the auto-sleep function. To turn off the SJ-301 power, press the [POWER] key.

■ Turning on the power to operate with the built-in battery

1. Confirm that the battery switch is turned on.
2. Press the [POWER] key.

Side view of Display unit



NOTE The icon indicating the remaining battery power in the built-in battery is displayed in the touch panel.

Charge the battery if the filled portion of the icon indicating the remaining battery power is less than that in the figure below.



60 ~ 40%

The power cannot be turned on if there is very little remaining battery power. The power can be turned on once the battery has been recharged.

-
- TIP**
- For information about charging the built-in battery, refer to section 11.3, “Recharging the Battery”.
 - In case the battery can not be charged for the first use of the SJ-301 after purchase, force charge the battery as it may be excessively discharged. For details of force charging, refer to section 11.3, “Recharging the Battery”
■ Force charging
-

NOTE **Normally, the battery switch should be left on.** If the SJ-301 will not be used for an extended period (2 to 3 weeks or more) it should be turned off. If the battery switch is turned off, the measured results and conditions will not be saved.

■ Turning off the power

There are two ways to turn off the power supply.

- With the [POWER] key
- With the auto-sleep function

● Turning off the power with the [POWER] key

The SJ-301 has a function that automatically turns off the power. However, in general the power should be turned off manually with the [POWER] 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, if the SJ-301 is not operated for more than a constant time after power-on, the power is automatically turned off with the auto-sleep function. The Auto-sleep function prevents battery consumption due to forgotten power -off.

NOTE If the AC adapter is used, auto-sleep will not function irrespective of the setup for the auto-sleep function. To turn off the SJ-301 power, press the [POWER] key.

The measurement conditions still remain in memory even if the power is turned off with the Auto-sleep function. Also, measured results are stored in memory if the built-in battery switch was turned on, and will be displayed next time the power is turned on.

TIP The display indicating that the battery is being charged is also displayed during auto sleep. Refer to section 11.3, "Recharging the Battery" for more information.

The relationship between the state of the SJ-301 and the auto-sleep function is as follows.

SJ-301 state	Auto-sleep function
Normal	If no key is touched within approximately 5 minutes, the power is automatically turned off.
RS-232C communication	The auto-sleep function is not activated. Allow 5 minutes or more after communication has been completed by turning off the RS-232C selection switch, or turn off the power with the communication command.
Detector retract execution	The auto-sleep function is not activated during detector retract operation. If no key is touched within 5 minutes after completing the detector retract operation, the power is automatically turned off.
During statistical processing	Auto-sleep will not take place during statistical processing.

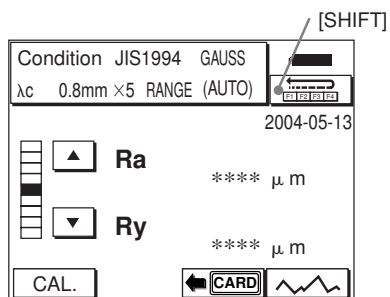
3.5.2 Setting the auto-sleep function in use of the built-in battery

The JS-301 is capable of setting the auto-sleep function in use of the built-in battery.

NOTE If the AC adapter is used, auto-sleep will not function irrespective of the setup for the auto-sleep function. To turn off the SJ-301 power, press the [POWER] key.

● Operating procedure

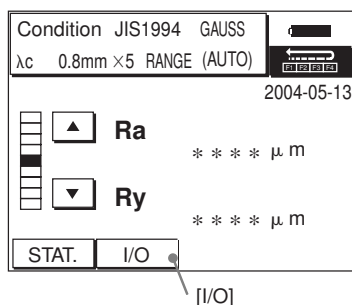
1 <Home screen>



Touch the [SHIFT] button in the Home screen.

⇒ The 2nd Home screen will appear.

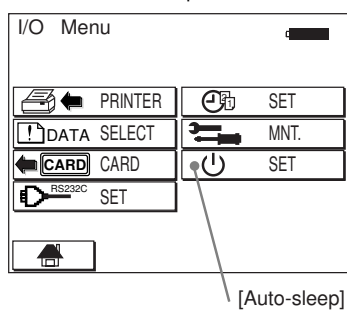
2 <2nd Home screen>



Touch the [I/O] button.

⇒ The I/O Condition Setup screen will appear.

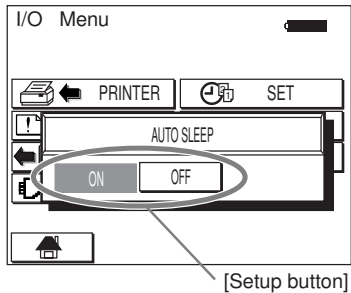
3 <I/O Condition Setup screen>



Touch the [Auto-sleep] button.

⇒ The Auto-sleep Setup window will appear.

4 <Auto-sleep Setup windows>



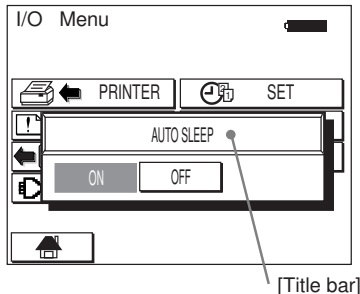
Touch the [ON] or [OFF] button on the Auto-sleep Setup window.

⇒ The touched setup button is highlighted.

[ON]: The auto-sleep function is enabled.

[OFF]: The auto-sleep function is disabled.

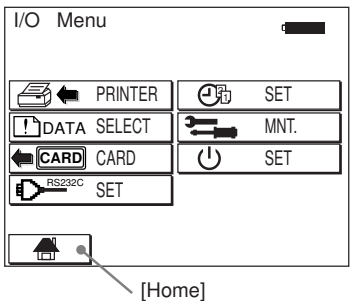
5 <Auto-sleep Setup windows>



Touch the title bar on the Auto-sleep Setup window to accept the auto-sleep setting.

⇒ The Auto-sleep Setup window will be closed.

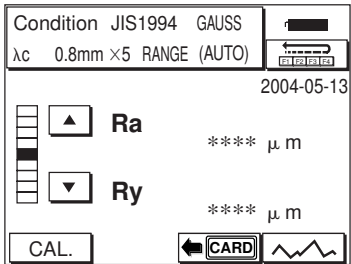
6 <I/O Condition Setup screen>



Touch the [Home] button.

⇒ The Home screen is restored.

<Home screen>



3.6 Setting Language, Date, and Unit

English, Japanese, German, French ,Italian, or Spanish can be specified as the language displayed on the touch panel. Set an appropriate language.

Also, set date and time accurately. The date/time is included in the record of the measurement conditions and is useful for record management.

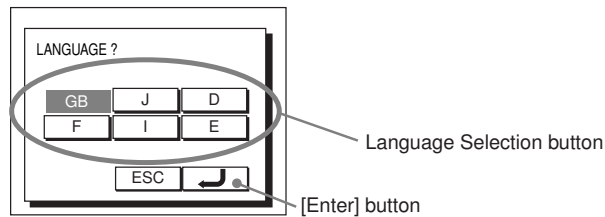
The unit of roughness measurement on the SJ-301 is factory-set to “mm” or “inch”. Either unit can be selected.

■ Setting the display language

Turn the SJ-301 power off to set the display language.

1. Turn the [POWER] key on while holding down the [DATA] key on the SJ-301 Display unit.

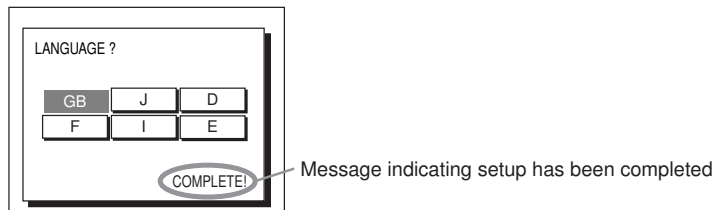
The power will be turned on, and the Language Setup window is displayed on the touch panel.



Language	Display sign
English	GB
Japanese	J
German	D
French	F
Italian	I
Spanish	E

2. Touch the [Enter] button after touching the Language Selection button in the Language Setup window.

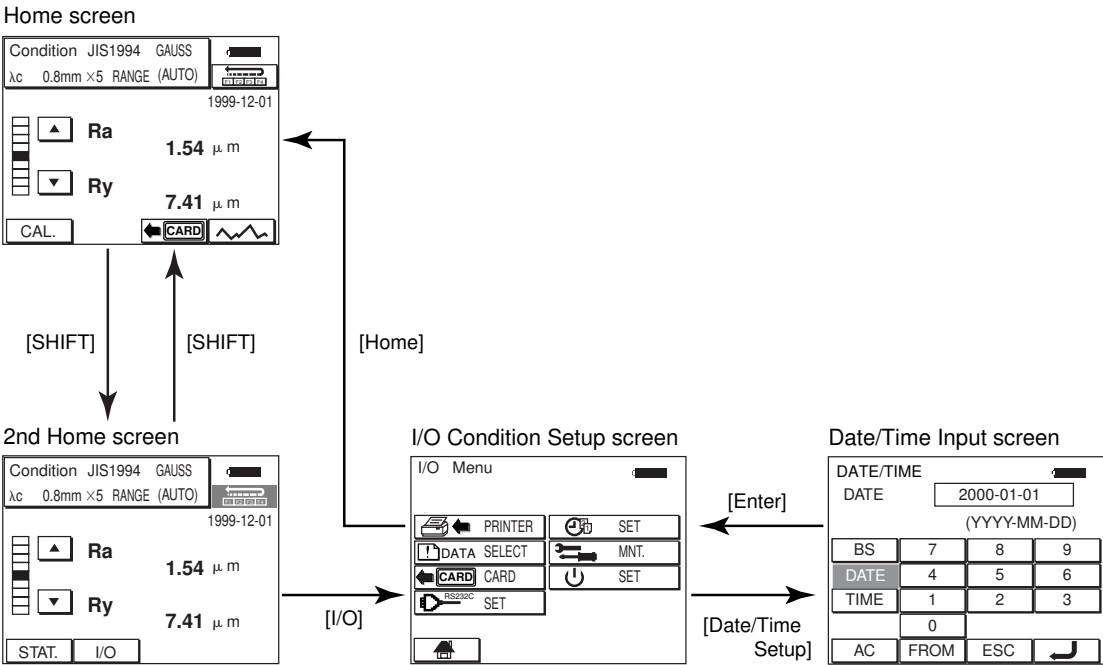
The message indicating that setup has been complete is displayed.



3. Press the [POWER] key to turn off the power, then turn it on again.

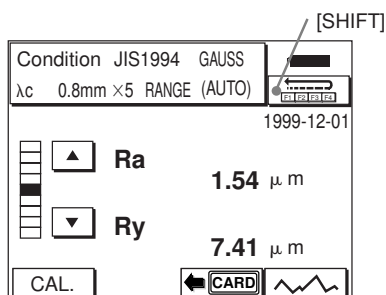
You can confirm that display contents are in the language selected in the Language Setup window.

- Setting the date and time
- Screen transition to set the date and time



● Date/time setting procedure

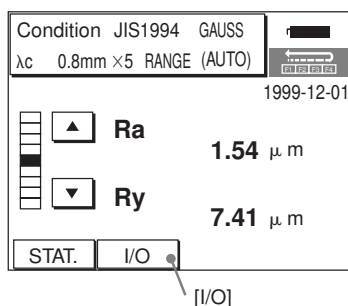
1 <Home screen>



Touch the [SHIFT] button in the Home screen.

⇒ The 2nd Home screen is displayed.

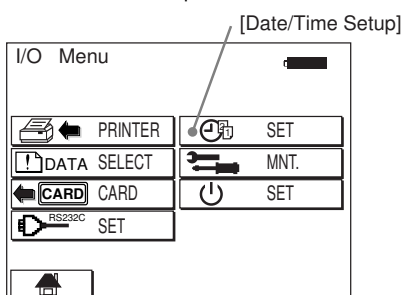
2 <2nd Home screen>



Touch the [I/O] button in the 2nd Home screen.

⇒ The I/O Condition Setup screen is displayed.

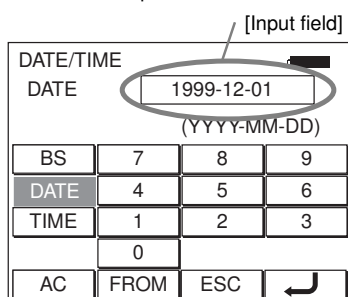
3 <I/O Condition Setup screen>



Touch the [Date/Time Setup] button in the I/O Condition Setup screen.

⇒ The Date/Time Setup screen is displayed. The screen can be used to change the date.

4 <Date/Time Input screen>



Enter the date in the Input field in the Date/Time Input screen.

TIP

- For information about inputting numerical values, refer to section 2.2, "Outline of the Touch Panel ■ Inputting numeric values".
- The date format (input order of year, month, and day) can be modified. The input order of year, month, and day differs depending on the format.
Each time the [FORM] button is touched, the format is changed to either of the following.
MM, DD, and YYYY indicate month, day, and year, respectively.
YYYY-MM-DD
MM-DD-YYYY
DD-MM-YYYY

5 <Date/Time Input screen>

DATE/TIME
DATE 2000-01-01
(YYYY-MM-DD)

BS	7	8	9
DATE	4	5	6
TIME	1	2	3
	0		
AC	FROM	ESC	[Enter]

[Time]

Touch the [TIME] button.

⇒ The screen can be used to change the time.

6 <Date/Time Input screen>

DATE/TIME
DATE 00:00:00
(Input field)

BS	7	8	9
DATE	4	5	6
TIME	1	2	3
	0		
AC	FROM	ESC	[Enter]

Enter a time in the Input field, then touch the [Enter] button to load the time.

TIP For information about inputting numerical values, refer to section 2.2, "Outline of the Touch Panel ■ Inputting numeric values".

⇒ The program returns to the I/O Condition Setup screen.

7 <I/O Condition Setup screen>

I/O Menu

PRINTER	SET
DATA SELECT	MNT.
CARD	SET
RS232C	

[Home]

Touch the [Home] button.

⇒ The program returns to the Home screen.

<Home screen>

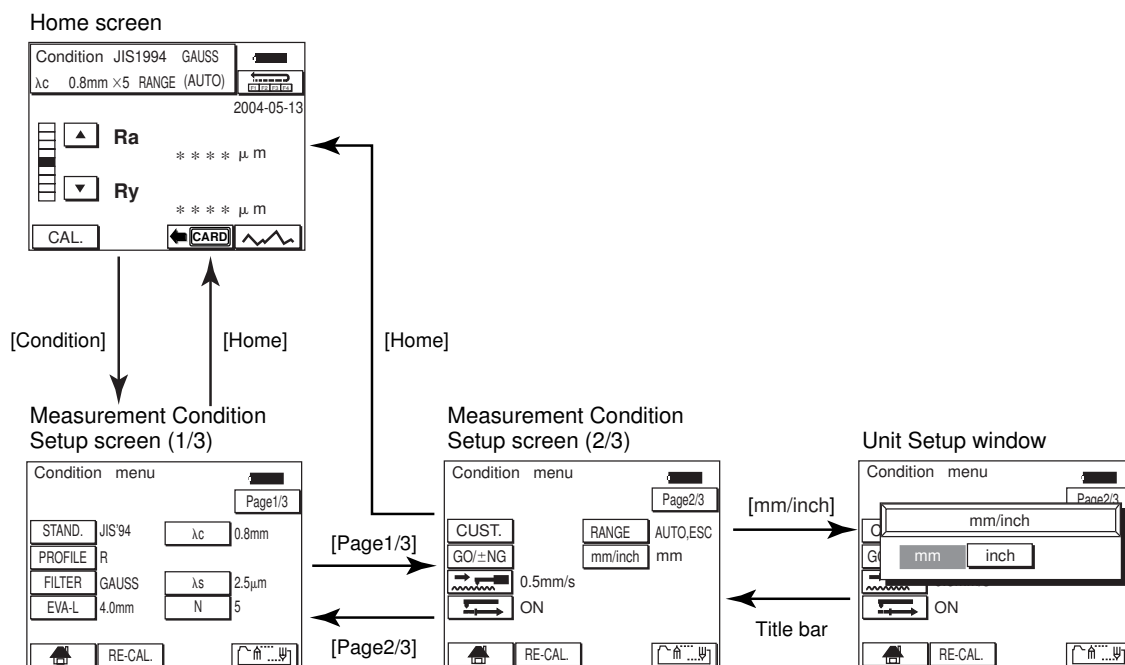
Condition JIS1994 GAUSS
λc 0.8mm x5 RANGE (AUTO)
2000-01-01

Ra 1.54 μm
Ry 7.41 μm

CAL. [CARD] [Waveform]

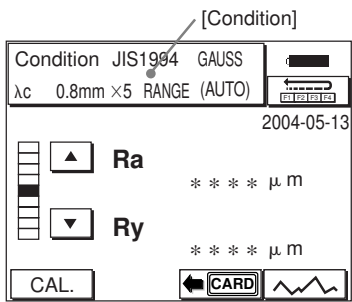
■ Setting the unit

- Screen transition to set the unit



● Unit setting procedure

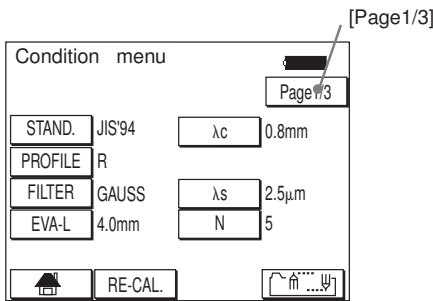
1 <Home screen>



Touch the [Condition] button in the Home screen.

⇒ The Measurement Condition Setup screen (1/3) is displayed.

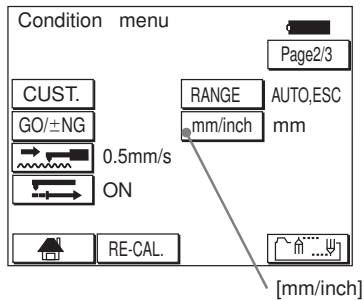
2 <Measurement Condition Setup screen (1/3)>



Touch the [Page1/3] button.

⇒ The Measurement Condition Setup screen (2/3) is displayed.

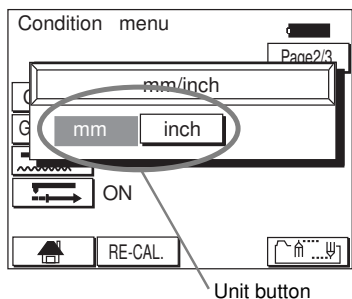
3 <Measurement Condition Setup screen (2/3)>



Touch the [mm/inch] button.

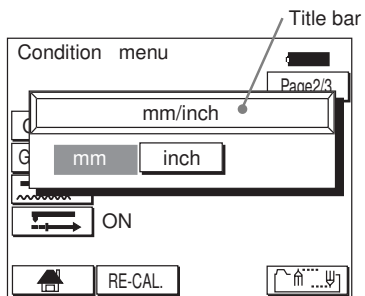
⇒ The Unit Setup window is opened.

4 <Unit Setup window>



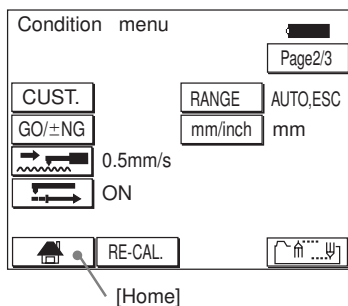
Touch the appropriate unit button.

5 <Unit Setup window>



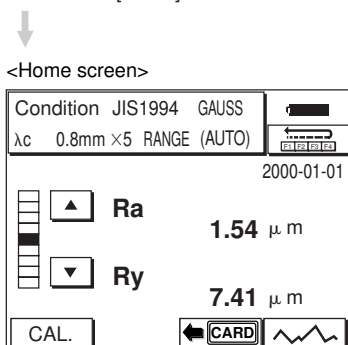
Touch the title bar in the Unit Setup window to load the unit.
The Unit Setup window is closed.

6 <Measurement Condition Setup screen (2/3)>



Touch the [Home] button.

⇒ The program returns to the Home screen.



3.7 Carrying Case

The Carrying case supplied is convenient for safekeeping and carrying the SJ-301.

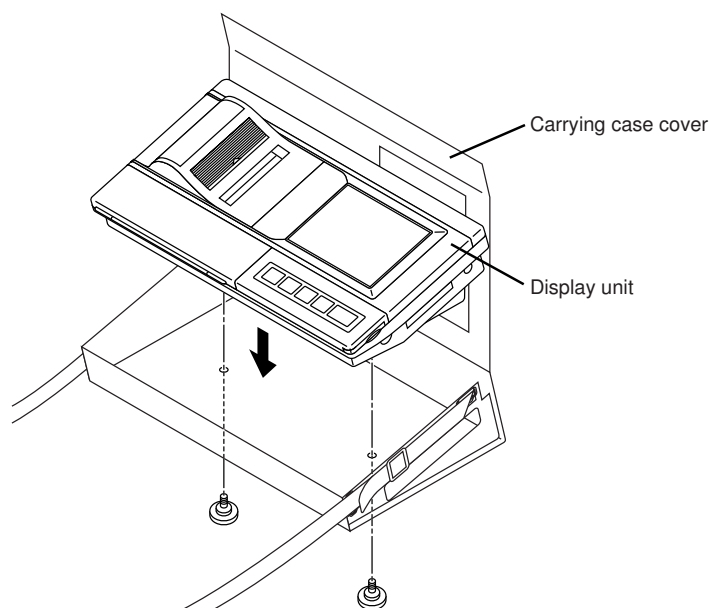
It is also possible to perform measurement with the Drive/Detector unit being connected to the Display unit housed in the case.

■ Put the Display unit in the carrying case

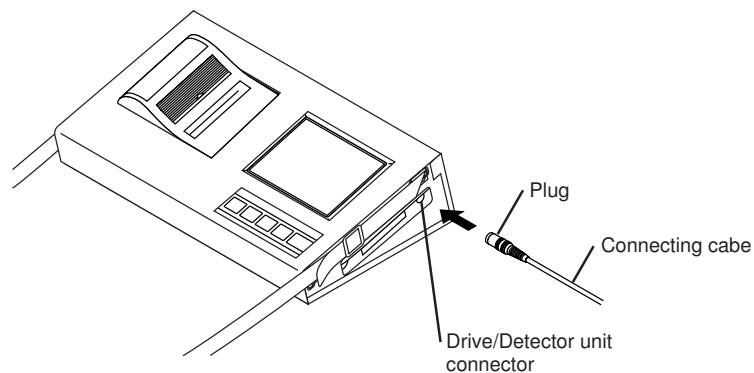
Use the following procedure to put the Display unit in the carrying case.

NOTE To avoid the fall of the Display unit onto the floor during putting it in the carrying case, handle the two on a bench.

1. Open the carrying case cover.
2. Put the Display unit in the carrying case.
3. Fix the Display unit with two screws through the holes on the bottom of the carrying case.



4. Close the carrying case cover.
5. Connect the Drive/Detector unit connecting cable to the connector on the Display unit through the window at the right of the carrying case.

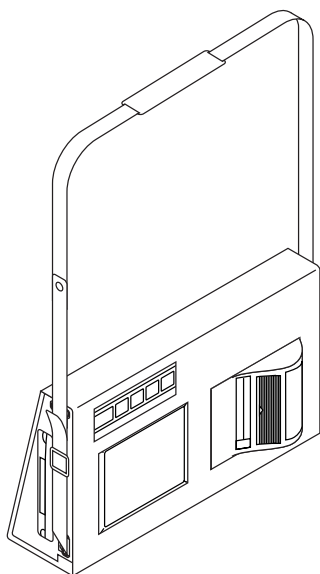


■ Operating the SJ-301 in the carrying case

When handing the SJ-301 in the carrying case, refer to the notes below.

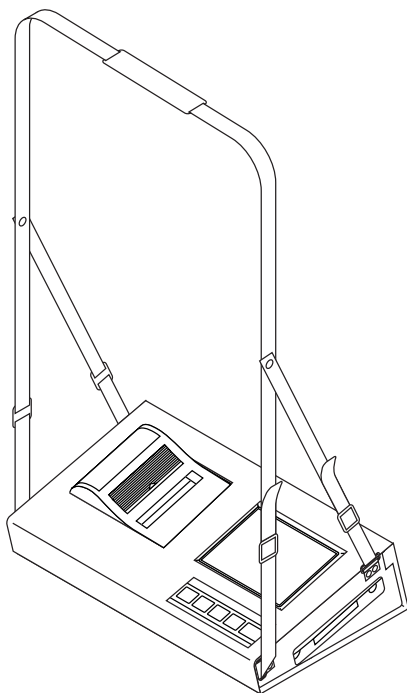
● When carrying the SJ-301

Extend the belt as shown below so that the Display unit is set erect when hanged on the shoulder.



● When performing measurement

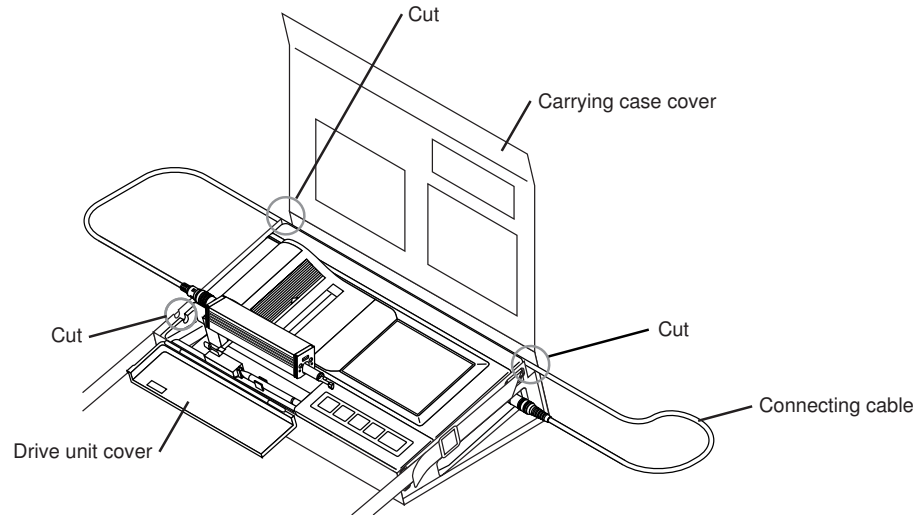
Reduce the belt on one side as shown below so that the Display unit is level facing up.



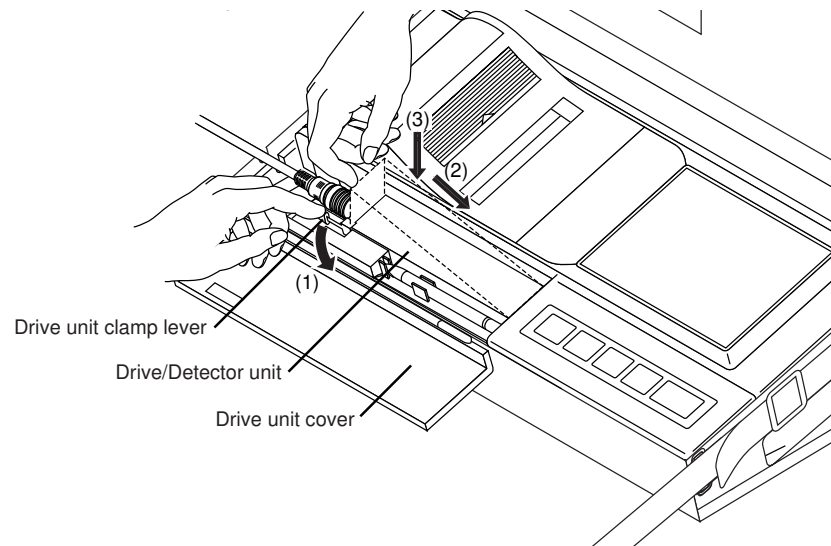
■ Storing the Drive/Detector unit inside the Display unit

The Drive/Detector unit can be stored inside the Display unit without disconnecting the connecting cable.

1. Open the carrying case cover.
2. Open the drive unit cover of the Display unit.
3. Pass the connecting cable through the cuts provided on both rear edges of the carrying case.
4. Hitch the connecting cable on the cut at the front left side of the carrying case.



5. Store the Drive/Detector unit inside the Display unit without disconnecting the cable.



TIP See Chapter 11 for details of storing the Drive/Detector unit inside the Display unit.

6. The sag of the cable can be stacked in the recess between the carrying case and the Display unit.
7. Close the drive unit cover.
8. Close the carrying case cover.

MEMO

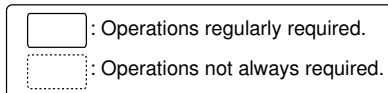
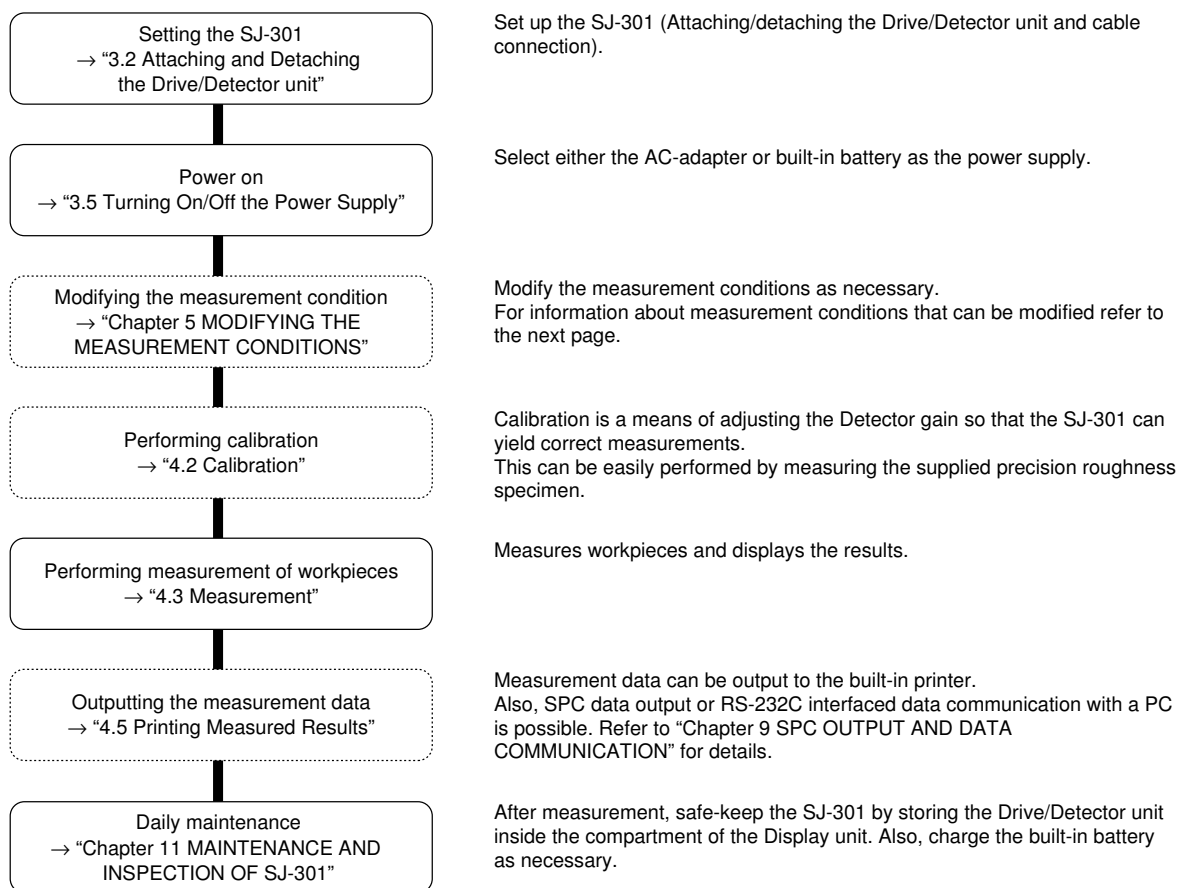
4

MEASUREMENT OPERATION

In this chapter the basic surface texture measurement with the SJ-301 is described.

4.1 Overall Measurement Flow

The flow below overviews the basic operation of the SJ-301.



■ Measurement conditions that can be modified according to the requirements

Measurement conditions that can be modified with the SJ-301 are tabulated below. The SJ-301 has been set to the default values in the table before shipped.

Measurement conditions	Default values	Remarks	Ref.
Cutoff length (sampling length)	0.8 mm (.03")		"5.4"
λ_s	2.5 μm		"5.4"
Number of sampling lengths	$\times 5$		"5.5"
Arbitrary evaluation length	-	Applies to measurement with evaluation lengths other than those specified in the SJ-301.	"5.6"
Surface texture standards	JIS2001	Set to desired one.	"5.1"
Measuring range	Auto		"5.7"
Measured profile	R-profile		"5.2"
Filter	GAUSS		"5.3"
GO/NG judgment	-	Set the UL and LL according to the workpiece if GO/NG judgment is required.	"5.11"
Roughness parameters	Ra, Rz, Rq	Parameters to be displayed can be specified.	"5.10"
Traversing speed	0.5 mm/s (.02"/s)	Can be switched to 0.25mm/s (.01"/s) as necessary.	"5.8"
Pre-travel/Post-travel	ON	The SJ-301 is default set to include pre-travel and post-travel lengths in the traversing length according to the relevant standards. This, however, can be reset to exclude the pre-travel and post-travel if the limited measured space does not allow them to be included.	"5.9"
Drive unit	Standard	Standard has been default-set for SJ-301.	"5.12"
Calibration value	3.00 μm (118 μin)	Set up according to the value of the precision roughness specimen being used.	"5.12"
Baud rate	9600 bps	Set as required to either 9600, 19200, or 28800 bps according to the personal computer connected.	"9.2"
Parity bit	ON	Set as required to either EVEN, ODD, or NON.	
Stop bit	1 bit	2 bit is also available.	
Print item	Measurement conditions, calculation results, evaluation curve	Item to be printed out can be selected.	"4.5"
Print save mode	Yet-to-be-set	Only prints out calculation results and waveform. Print out of company name, model name, date, time, measured profile, evaluation curve, evaluation length and λ_c can be omitted.	
Print method	Manual	Either or manual, automatic or hard copy can be selected.	
Print form	Vertical print	Orientation of characters (Vertical or horizontal) to be printed out can be selected.	
Vertical magnification	Automatic	Vertical print magnification of evaluation curve can be selected.	
Horizontal magnification	Automatic	Horizontal print magnification of evaluation curve can be selected.	
Auto sleep setup mode	ON	Sets the auto-sleep function to ON/OFF in use of the built-in battery.	"3.5"

4.2 Calibration

Calibration of a surface roughness measuring instrument is performed by measuring (called “calibration measurement”) a reference workpiece (precision roughness specimen) and adjust the difference (gain adjustment), if any between the measured value and reference value (precision roughness specimen). With the SJ-301, adjustment of the difference between the measured value and reference value (gain adjustment) can be easily achieved by calibration measurement.

Calibration should be performed periodically according to how frequently and in which conditions the SJ-301 is used. If the instrument is used for the first time or if the Detector is mounted/replaced, calibration is essential.

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

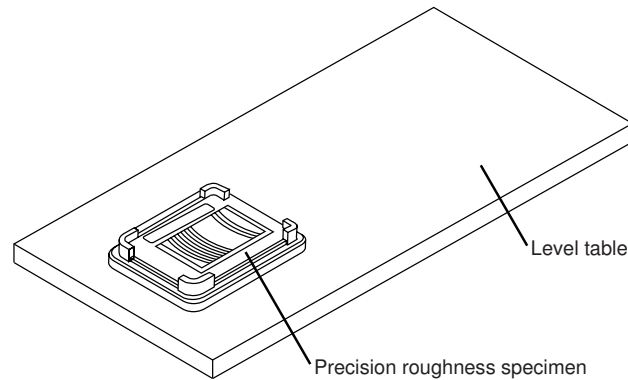
4.2.1 Calibration preparation

Use the supplied precision roughness specimen for calibration.

NOTE If 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 calibrating conditions refer to “5.15 Modifying the Calibration Conditions”.

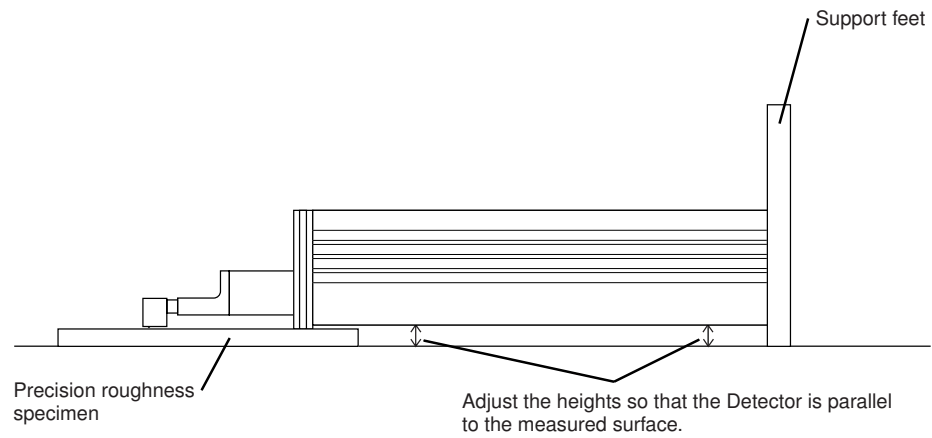
■ Setting up the precision roughness specimen and SJ-301

1. Place the precision roughness specimen on a level table.

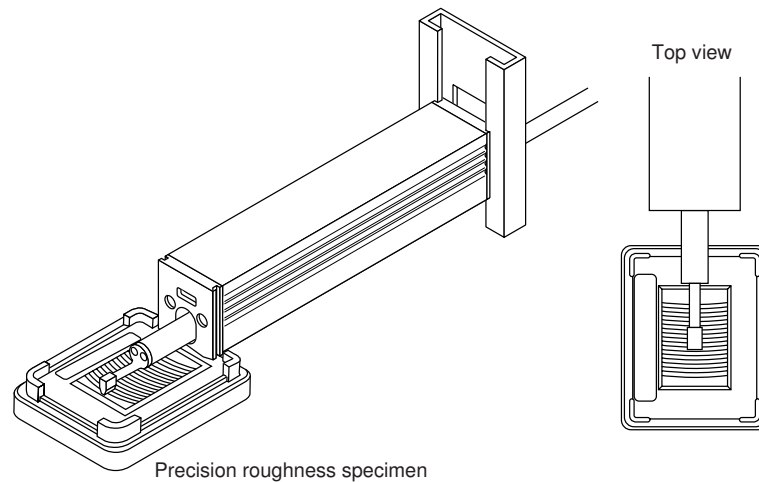


-
2. Attach a support foot to the rear of the Drive unit as shown.
 3. Level the Drive/Detector unit by adjusting the foot height.
-

TIP For information about adjusting the support foot height, refer to “Chapter 10 INSTALLING THE SJ-301 WITH OPTIONAL ACCESSORIES ■ Support feet”.

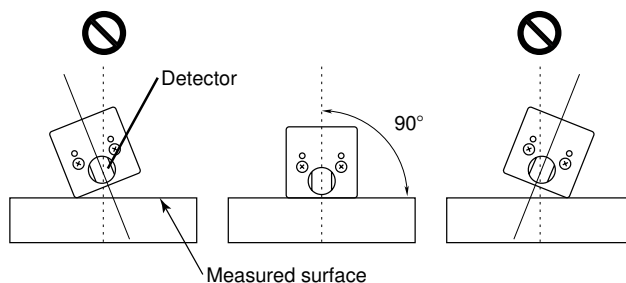


4. Set the SJ-301 so that the Detector traversing direction is perpendicular to the cutter mark of the precision roughness specimen.

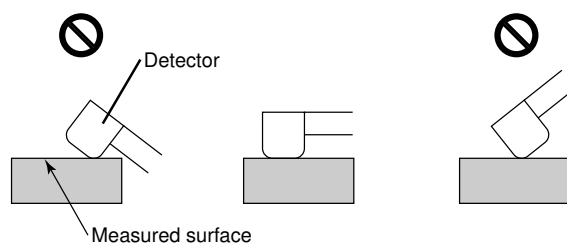


5. Confirm that the Detector is parallel to the measured surface.

• Front view of the Detector



• Side view of the Detector



NOTE If using the Front Escape function type drive unit, release the detector from the front escape state and check whether the detector is parallel with a measuring surface. For information about releasing from the front escape state, refer to “11.2 Escaping the Detector and Releasing It from Escape”.

4.2.2 Performing calibration

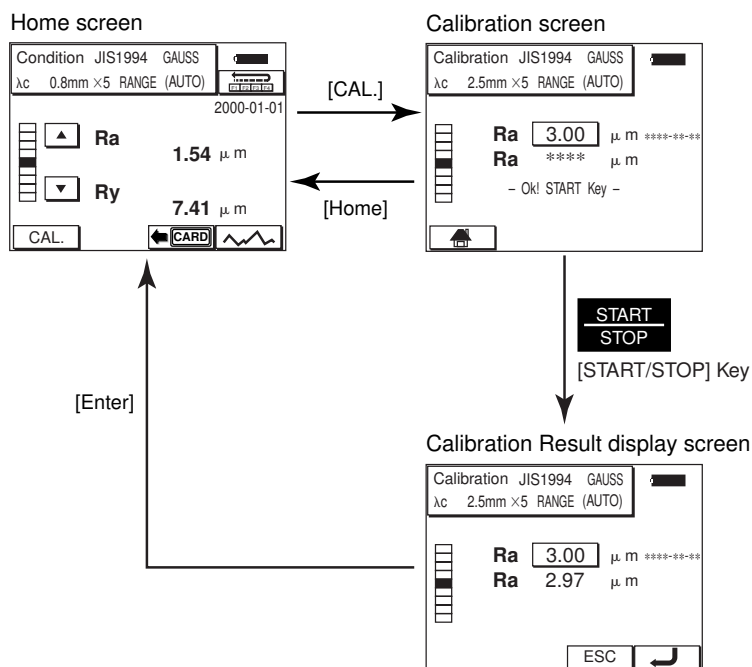
■ Calibrating with the default values

If calibrating the SJ-301 with the roughness specimen supplied, be sure to calibrate with the default values shown below that have been used for calibrating the roughness specimen.

Calibration condition items	Default value
Parameter	Ra
Cutoff length	2.5 mm (.1")
Number of sampling lengths	5
Measuring range	Auto
Measured profile	R-profile
Filter	GAUSS
Pre-travel/post-travel	Included

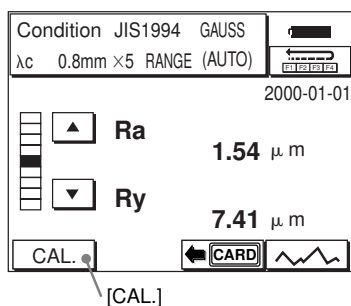
NOTE If the SJ-301 needs to be calibrated with a standard other than the supplied one, the default calibration conditions must be modified for the roughness specimen to be used. For information about the procedure used to modify the calibration conditions refer to “5.15 Modifying the Calibration Conditions”.

■ Screen transition during calibration



■ Calibration procedure

1 <Home screen>



Touch the [CAL.] button on the Home screen.

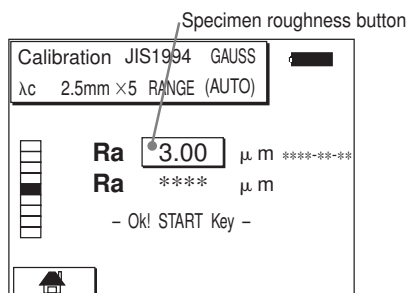
⇒ The Calibration screen will appear.

Displayed on the Calibration screen is the set calibration value.

TIP

- If the SJ-301 is being calibrated for the first time, “3.00 μm (118 μin)”, that is the nominal value of the precision roughness specimen, will be displayed.
- See “5.15 Modifying the Calibration Conditions” if changing the calibration value or calibration conditions.
- Calibration value to be set is the Ra value marked on the precision roughness specimen.

2 <Calibration screen>



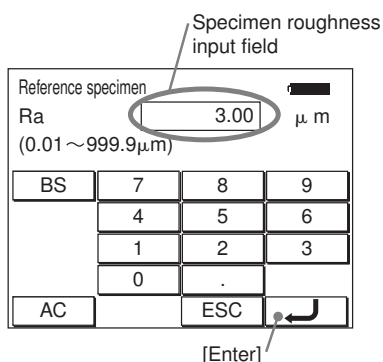
If the displayed value is different from that marked on the precision roughness specimen, modify the calibration value.

If the calibration value does not require modification, proceed to step 4.

Touch the Specimen roughness button.

⇒ The Specimen Roughness Input screen will appear.

3 <Specimen Roughness Input screen>



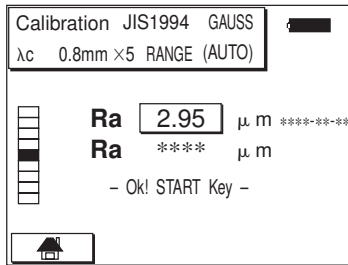
Enter the specimen roughness in the field and touch the [Enter] button.

TIP

Refer to “2.2 Outline of the Touch Panel
■ Inputting numeric values”.

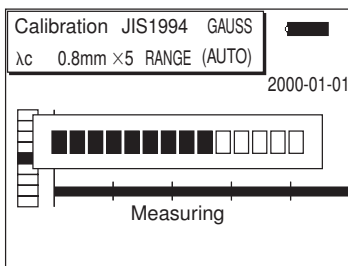
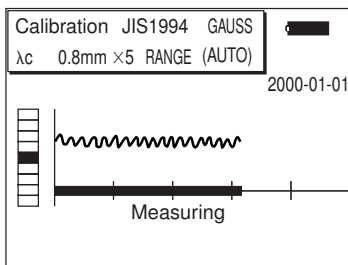
⇒ The Calibration screen will be restored.

4 <Calibration screen>



START
STOP

[START/STOP] Key



Press the [START/STOP] key.

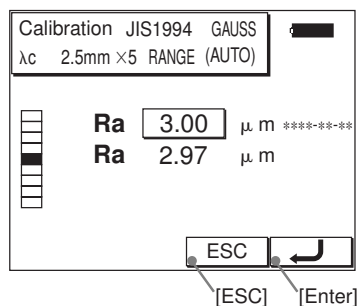
NOTE If a calibration error results, retry the calibration measurement. If the error persists, refer to "Chapter 12 TROUBLESHOOTING".

⇒ Calibration measurement of the roughness specimen is performed and a bar is displayed indicating the progress.

⇒ After the calibration measurement has been completed, a bar is being displayed indicating the calculation is in progress. The Detector returns to its original position.

⇒ Upon completion of the calculation, the measured result is displayed.

5 <Measured Results screen>

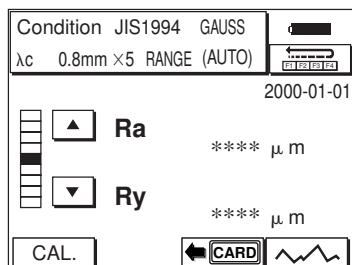


Touch the [Enter] button.

⇒ The calibration factor is updated. This completes the calibration of the SJ-301, and the Home screen will be restored.

NOTE To discard the calibration result just acquired, touch the [ESC] button. The previous calibration factor is retained unchanged and the Home screen is restored.

<Home screen>



4.3 Measurement

To perform measurement, set the SJ-301 on a workpiece and press the [START/STOP] key. After measurement has been completed, the measured results will be displayed on the touch panel.

4.3.1 Setting the workpiece and SJ-301

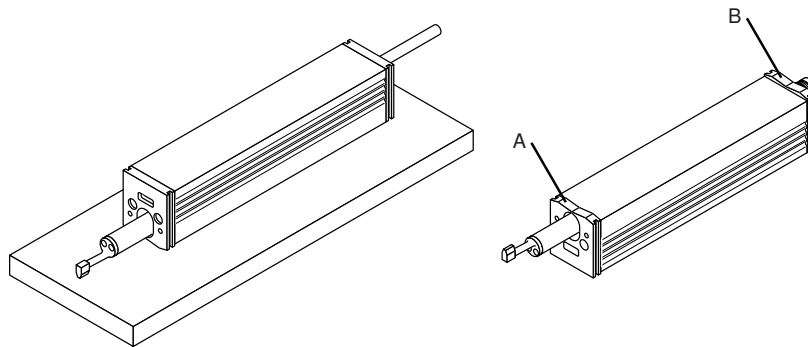
■ Placing the workpiece and SJ-301

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

TIP In cases where the measured surface is smaller than the SJ-301 bottom or where the surface is curved (cylindrical, etc.), install the SJ-301 using an appropriate optional accessory. See also “Chapter 10 INSTALLING THE SJ-301 WITH OPTIONAL ACCESSORIES”.

1. Position the workpiece so that the measured surface is level.
2. Place the SJ-301 on the workpiece.

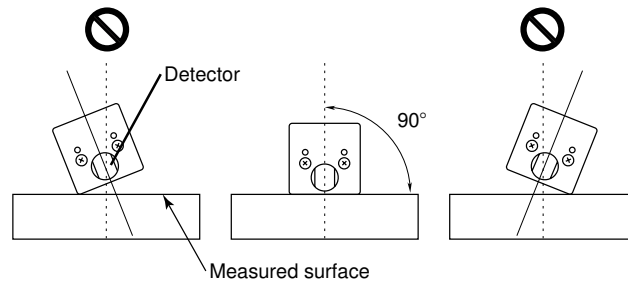
In this operation support the SJ-301 by the reference surfaces A and B, as shown below.



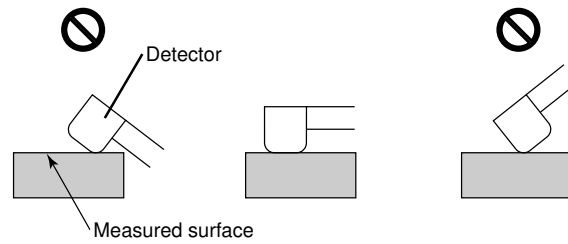
3. Confirm that the stylus properly contacts the measured surface.

In addition, confirm that the Detector is parallel to the measured surface.

• Front view of the Detector



• Side view of the Detector

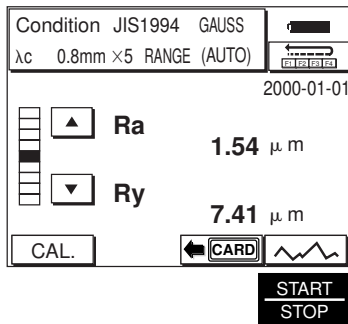


4.3.2 Starting measurement

■ Measurement procedure

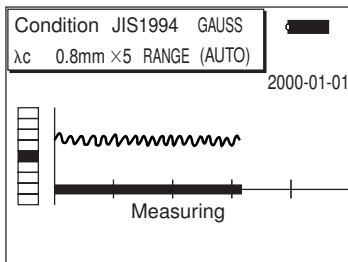
1

<Home screen>

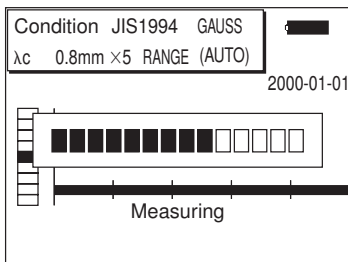


[START/STOP] Key

Press the [START/STOP] key at the display of the Home screen.



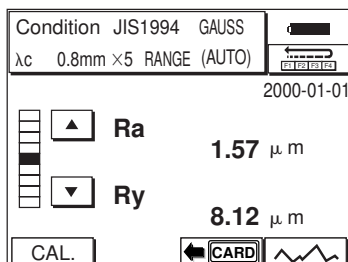
⇒ The Detector traverses, performing measurement. A bar is displayed indicating the measurement is in progress.



⇒ After the measurement has been completed, a bar appears indicating the calculation is in progress, during which the Detector returns to the origin point.



<Home screen>



⇒ Upon completion of calculation, measured results will be displayed. The display of the measurement data can be switched to that of the measured profile. Also, the display parameter can be switched.

TIP

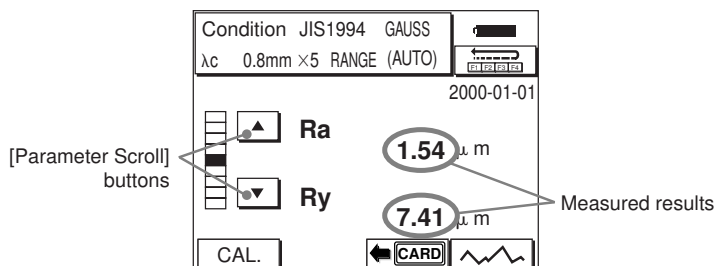
Refer to "4.4 Switching the measured results display" if displaying the measured profile or switching the parameters.

4.4 Switching the measured results display

While measured results are displayed on the Home screen, the measurements of other parameters can be switched to, or the measured profile can be displayed.

4.4.1 Switching displayed parameters

While measured results are displayed on the Home screen, the display of the parameters can be switched by touching the parameter scroll button.



Each time the [Parameter Scroll] button is touched, the parameters that have been selected using the measurement condition parameter customizing function are switched in the following order: “Ra” → “Ry” → “Rz” → ---.

Only customized parameters can be displayed.

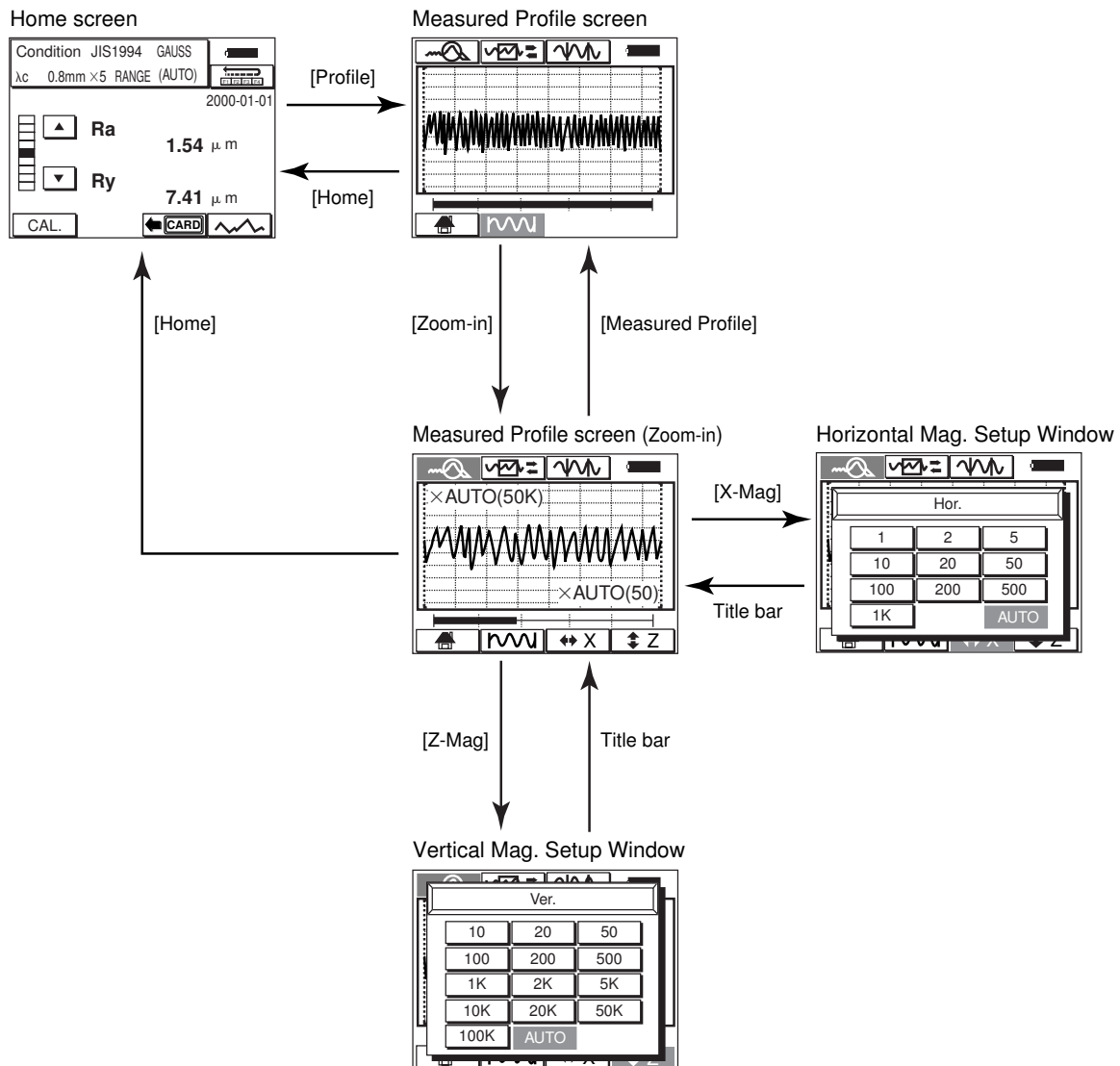
- TIP**
- For information about changing the parameter display setting, refer to section 5.10 “Selecting the Display Parameters (Parameter Customization)”.
 - Rz (JIS) is calculated and displayed even if the number of peaks and valleys is less than that specified by the standard. If this is the case, “#” is appended to the calculated values. If there is no peak and valley, only “L - P” is displayed.
 - If an over-range results during measuring, the measurement data will be displayed with a star ☆ attached at the left.

4.4.2 Displaying a measured profile

A measured result can be displayed in a measured profile.

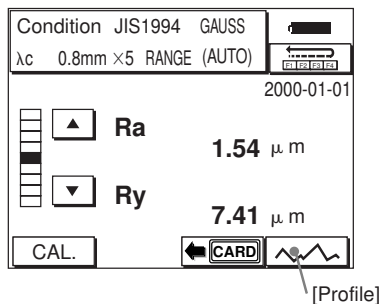
The display (print preview) of the measured profile can be horizontally/vertically expanded. The display magnification can be changed. An expanded display of the measured profile can be scrolled in the horizontal direction.

- Screen transition to display a measured profile



■ Switching to the screen of a measured profile

<Home screen>

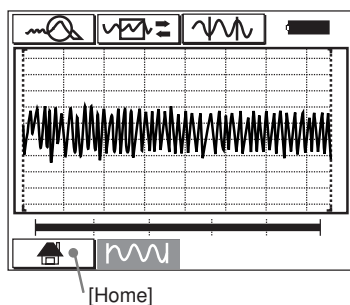


Touch the [Profile] button in the Home screen.

⇒ The Measured Profile screen is displayed.



<Measured Profile screen>



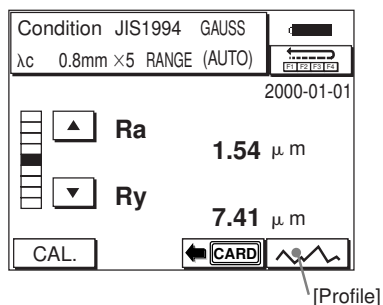
TIP

- Touch the [Home] button in the Measured Profile screen to return to the Home screen.
- In the Measured Profile screen, the measured profile can be zoomed in and scrolled.

■ Print-previewing (zoom-in) a measured profile

An image of how the measured profile will be printed can be previewed on the screen.

1 <Home screen>

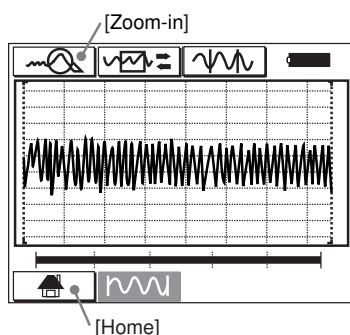


Touch the [Profile] button on the Home screen.

⇒ The Measured Profile screen is displayed.

At this time, the display magnification is set so that the entire measured profile can be displayed on the screen.

2 <Measured Profile screen>



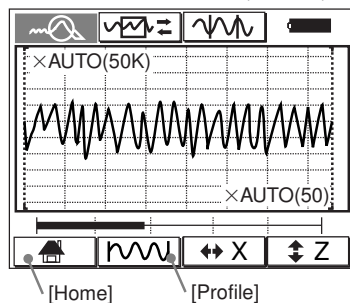
Touch the [Zoom-in] button.

⇒ The measured profile zoomed in according to the print magnification is displayed.

TIP Touching the [Home] button restores the Home screen.



<Measured Profile screen (zoom-in)>



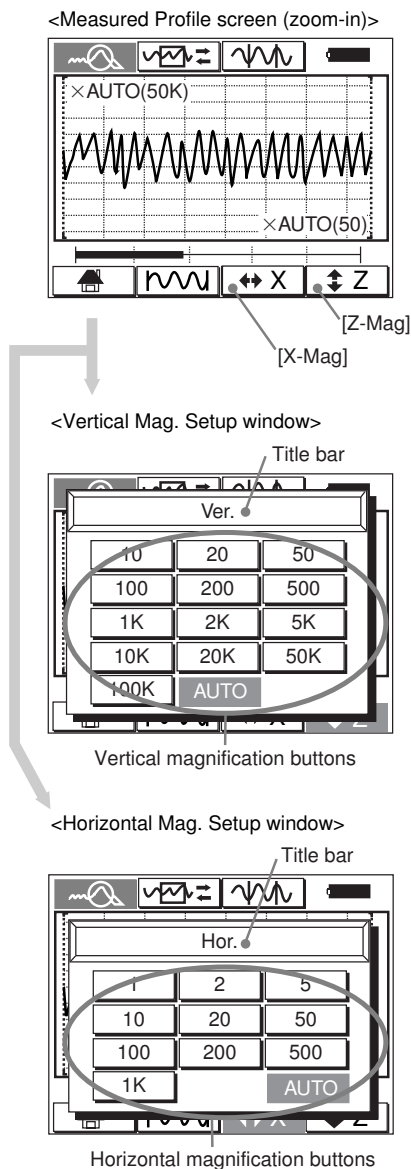
TIP

- The display magnification (Z and X) can be changed. Refer to the following “■ Setting the display magnification (vertical and horizontal) of a measured profile”.
- The measured profile that has been zoomed in can be scrolled. Refer to the following “■ Scrolling the measured profile”.
- Touch the [Profile] button to return to the normal profile display.
- Touch the [Home] button to return to the Home screen.

■ Setting the display magnification (vertical and horizontal) of a measured profile

The display magnification of a measured profile can be set. It is convenient to compare the measured profiles of multiple workpieces if the magnification is fixed.

NOTE The display magnification setting is synchronized with the printing magnification. If the magnification setting is changed here, the printing magnification is also changed.



Touch the [Z-Mag] button in the zoomed-in display to open the Vertical Mag. Setup window.

Touch the [X-Mag] button to open the Horizontal Mag. Setup window.

After touching the desired vertical magnification button, touch the title bar to load the magnification.

⇒ The Vertical Mag. Setup window closes, and the display magnification in the Measured Profile screen (zoom-in) is updated.

TIP If the [AUTO] button has been selected, a vertical magnification suitable for printing is automatically set up.

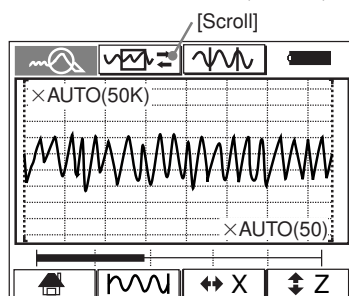
After touching the desired horizontal magnification button, touch the title bar to load the magnification.

⇒ The Horizontal Mag. Setup window is closed and the display magnification in the Measured Profile screen (zoom-in) is updated.

TIP If the [AUTO] button has been selected, a horizontal magnification suitable for printing is automatically set up.

■ Scrolling a measured profile

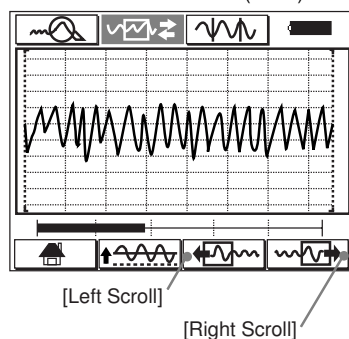
<Measured Profile screen (zoom-in)>



Touch the [Scroll] button in the Measured Profile screen (zoom-in) to display the [Left Scroll] and [Right Scroll] buttons at the bottom right of the screen.



<Measured Profile screen (scroll)>



Touch either the [Left Scroll] or [Right Scroll] button to view the corresponding region of the displayed measured profile.

[Left Scroll] button: Moves the measured profile right.

[Right Scroll] button: Moves the measured profile left.

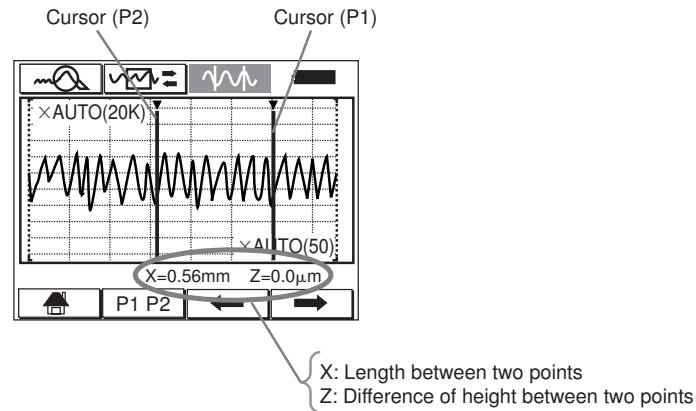
■ Using the ruler function

The SJ-301 is provided with the “ruler function (cursor display function)” that can numerically display the difference between two points by specifying two arbitrary points on a zoomed-in measured profile.

● Screen in use of the ruler function

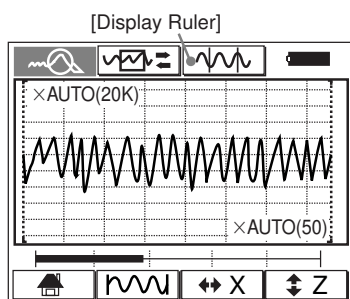
During use of the ruler function two cursors (vertical lines) are displayed on the screen. Also, two horizontal lines are displayed with the intersections between each cursor and the measured profile being the starting points.

“X = ...” displayed at the bottom right of the screen indicates the length of the section determined by the two cursors. Also, “Z = ...” indicates the difference (absolute value) of height between the two points determined by the two cursors.



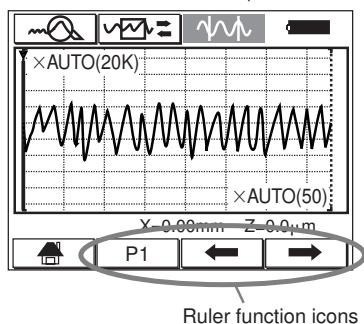
● Ruler display procedure

1 <Measured Profile screen (zoom-in)>



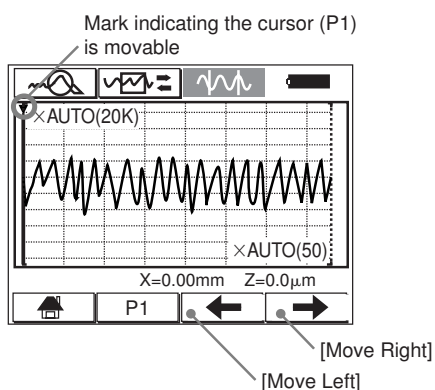
Touch the [Display Ruler] button in the Measured Profile screen (zoom-in).

<Measured Profile screen (ruler function)>



⇒ The ruler function icons are displayed on the bottom of the screen.

2 <Measured Profile screen (ruler function)>

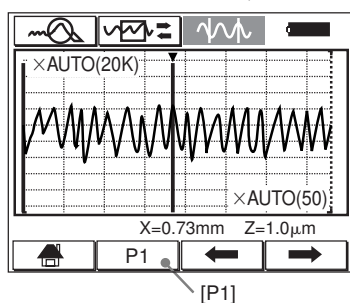


Touch the [Move Right] button to move the cursor (P1) right.

TIP

- The [Move Left] button can also be used.
- Holding the [Move Right] or [Move Left] button touched will increase the moving rate of the cursor (P1).

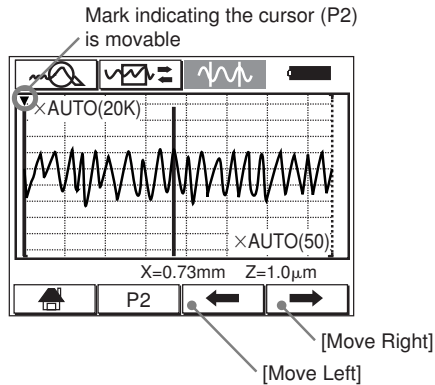
3 <Measured Profile screen (ruler function)>



Touch the [P1] button.

⇒ The icon on the button changes to [P2], allowing the cursor (P2) to be moved.

4 <Measured Profile screen (ruler function)>

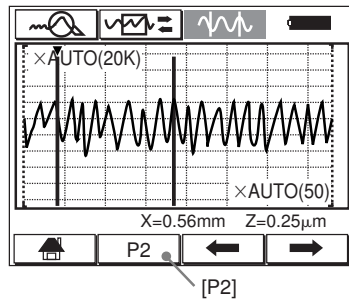


Touch the [Move Right] button to move the cursor (P2) right.

TIP

- The [Move Left] button can also be used.
- Holding the [Move Right] or [Move Left] button touched will increase the moving rate of the cursor (P2).

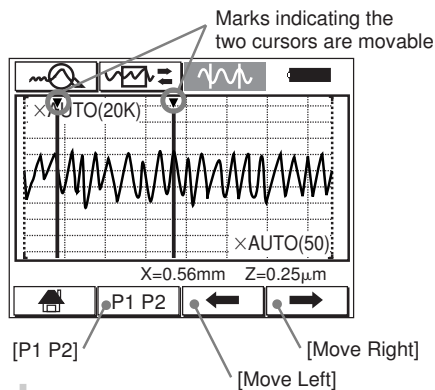
5 <Measured Profile screen (ruler function)>



Touch the [P2] button.

⇒ The icon on the button changes to [P1 P2], allowing both cursor (P1) and cursor (P2) to be moved.

6 <Measured Profile screen (ruler function)>

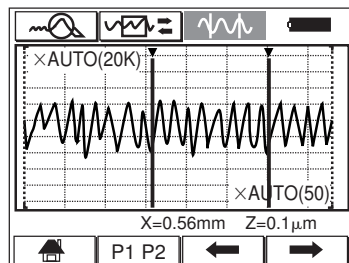


Touch the [Move Right] button to move the cursor (P1) and cursor (P2) right.

TIP

- The [Move Left] button can also be used.
- Holding the [Move Right] or [Move Left] button touched will increase the moving rate of the cursor (P1) and cursor (P2).

<Measured Profile screen (ruler function)>



4.5 Printing Measured Results

Measured results can be printed out on the built-in printer in portrait or in landscape.

A screen displayed in the touch panel can be printed, in addition to measured results.

4.5.1 Print method

The SJ-301 is capable of automatic print out and manual print out of the measured results. Print out of the screen image is also possible with the SJ-301.

TIP For information about setting automatic print out, manual print out, and screen image print out, refer to section 4.5.3 “Changing print conditions”.

■ Automatic print

The measured results are automatically printed under the preset condition when measurement is complete.

■ Manual print

Press the [PRINT] key on the Display unit to print out the measured results under the preset condition.

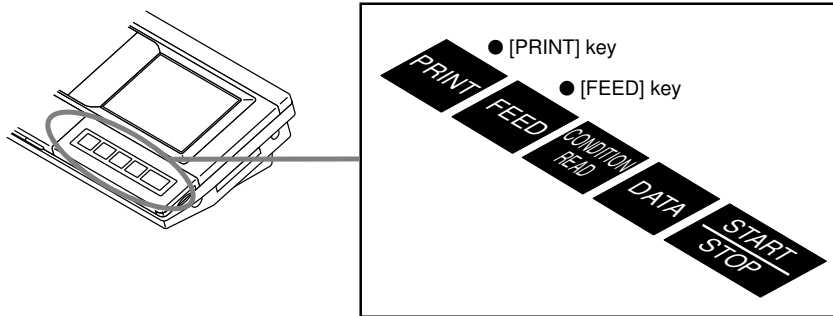
■ Hard copy of a screen image

Press the [PRINT] key to print out a screen image of the touch panel.

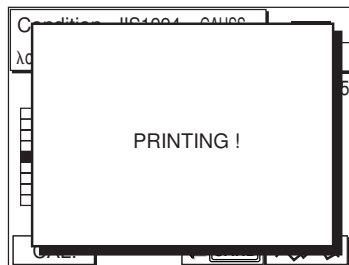
These images can be used as memos of display contents, for making operation explanatory materials, etc.

■ Related keys

The [PRINT] key and [FEED] key are on the sheet panel on the display unit.



TIP A message indicating that the printer is printing appears.



■ Print format with the SJ-301

- Print in the form of portrait

<Measurement Condition>

Mitutoyo		Surftest SJ-301
DATE	2000-01-01	
TIME	10:02:16	
STANDARD	JIS1994	
PROFILE	R	
FILTER	GAUSS	
EVA-L	4.0mm	
N	5	
λ_c	0.8mm	
λ_s	2.5 μ m	
TILT-COMP	ALL	
GO / $\pm$ NG	AVERAGE	
Ra		
+NG	2.00 μ m	
-NG	1.00 μ m	
Ry		
+NG	5.00 μ m	
-NG	3.00 μ m	
Rz		
+NG	5.00 μ m	
-NG	3.00 μ m	
PARAMETER		
Rmr[c]		
STANDARD	PEEK	
C.LEVEL	10%	
RPc, RSm, Rppi		
STANDARD	Zp/Zv	
LEVEL	10%	
SPEED	0.5mm/s	
RANGE	AUTO	
	ESC	
PRE / POST	ON	

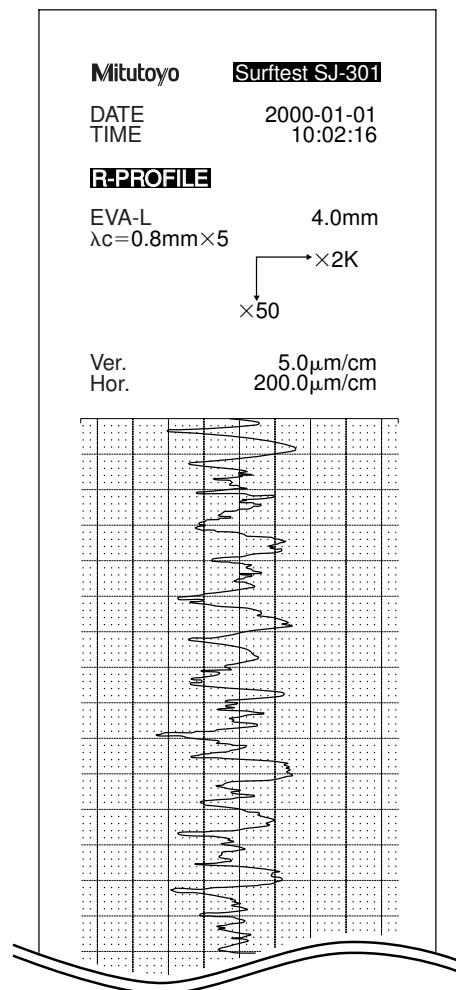
Note1

<Measurement data>

Mitutoyo		Surftest SJ-301
DATE	2000-01-01	
TIME	10:02:16	
R-PROFILE		
EVA-L	4.0mm	
λ_c	0.8mm x 5	
Ra	1.66 μ m	○
Ry	6.60 μ m	↓
Rz	#4.66 μ m	○
Rq	1.92 μ m	
RSm(Zp/Zv,10%)	160 μ m	
RS	110 μ m	
RPc(Zp/Zv,10%)	62.5/cm	
Rmr[c](P,10%)	5.9%	
Rppi(Zp/Zv,10%)	158.72/E	

Note2

<Measured Profile>



Note1: "PRE/POST" specifies "ON" or "OFF" of the pre-travel and post-travel length setup. For more information about pre-travel/post-travel, refer to section 5.9, "Setting the Pre-Travel/Post-Travel to "OFF" ".

Note2: For numeric values with # mark, calculation is performed using the less number of peaks and valleys that defined in the standard.

<Measurement Condition>

Mitutoyo	Surftest SJ-301	TILT-COMP	ALL	PARAMETER	
DATE	2000-01-01	GO / ±NG	AVERAGE	Rmr[c]	PEEK
TIME	10:02:16	Ra		STANDARD	10%
		+NG	2.00μm	C.LEVEL	
		-NG	1.00μm	RPc, RSm, Rppi	
STANDARD	JIS1994	Ry		STANDARD	Zp/Zv
PROFILE	R	+NG	5.00μm	LEVEL	10%
FILTER	GAUSS	-NG	3.00μm		
EVA-L	4.0mm	Rz		SPEED	0.5mm/s
N	5	+NG	5.00μm	RANGE	AUTO
λc	0.8mm	-NG	3.00μm		ESC
λs	2.5μm			PRE / POST	ON

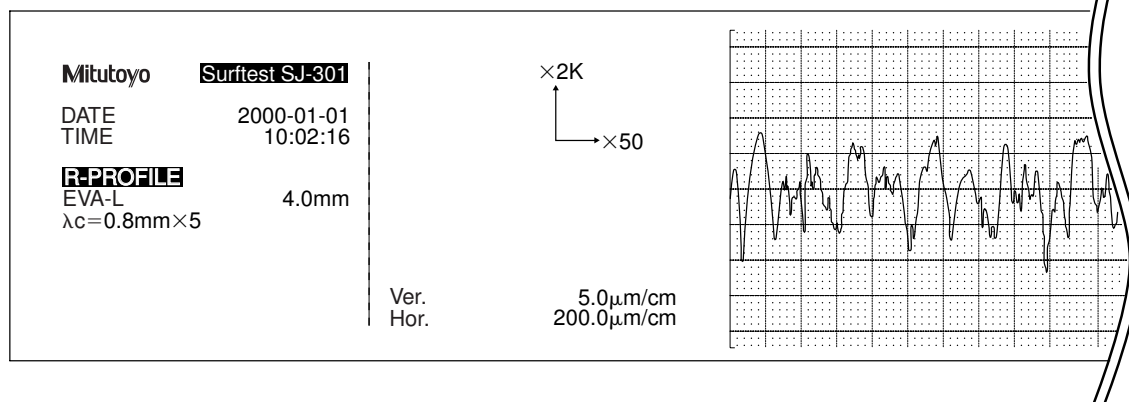
<Measurement data>

Mitutoyo	Surftest SJ-301	Rq	1.92μm
DATE	2000-01-01	RSm(Zp/Zv, 10%)	160μm
TIME	10:02:16	RS	110μm
		RPc(Zp/Zv, 10%)	62.5/cm
R-PROFILE		Rmr[c](P, 10%)	5.9%
EVA-L	4.0mm	Rppi(Zp/Zv, 10%)	158.72/E
λc	0.8mm x 5		
Ra	1.66μm ○		
Ry	6.60μm ↓		
Rz	#4.66μm ○		

Note1: "PRE/POST" defines "ON" or "OFF" of the pre-travel and post-travel length setup. For more information about pre-travel/post-travel, refer to section 5.9, "Setting the Pre-Travel/Post-Travel to "OFF" ".

Note2: For numeric values with # mark, calculation is performed using the less number of peaks and valleys that defined in the standard.

<Measured Profile>



- Print in the form of save mode

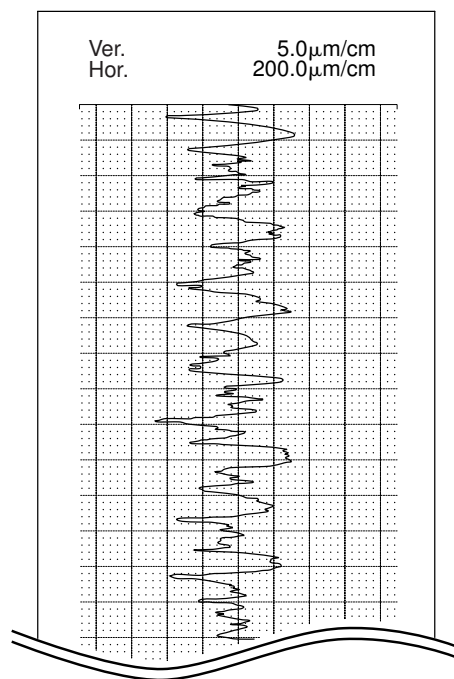
<Measurement data>

Ra	1.66μm	○
Ry	6.60μm	↓
Rz	#4.66μm	○
Rq	1.92μm	
RSm(Zp/Zv,10%)	160μm	
RS	110μm	
RPc(Zp/Zv,10%)	62.5/cm	
Rmr[c](P,10%)	5.9%	
Rppi(Zp/Zv,10%)	158.72/E	

Note1: The designation of the print save mode is effective only for the measurement data print and measured profile print.

Note2: The designation of the print save mode is effective when the portrait print form is selected.

<Measured Profile>



4.5.2 Applying a memo to printed matter

A memo of up to ten characters can be applied to the head of a print form when it is printed.

NOTE A memo cannot be applied to the print of a screen image.

■ Operating procedure

1. Select [MEMO] as a print item in the print conditions beforehand.

TIP For information about the print condition setup, refer to section 4.5.3 “Changing print conditions”.

2. Press the [PRINT] key on the display unit.

The Memo Input screen is displayed in the touch panel.

PRINTER			
MEMO :			
????????			
BS	ABC/7	MNO/8	YZ/9
→	DEF/4	PQR/5	-/6
A	GH I/1	STU/2	*/3
1	JKL/0	VWX/.	¥
AC	C.IN	ESC	

[Enter]

3. Input a memo in the MEMO text box.

TIP For information about character input, refer to section 2.2 “Outline of the Touch Panel”.

4. Touch the [Enter] button.

Printing will start.

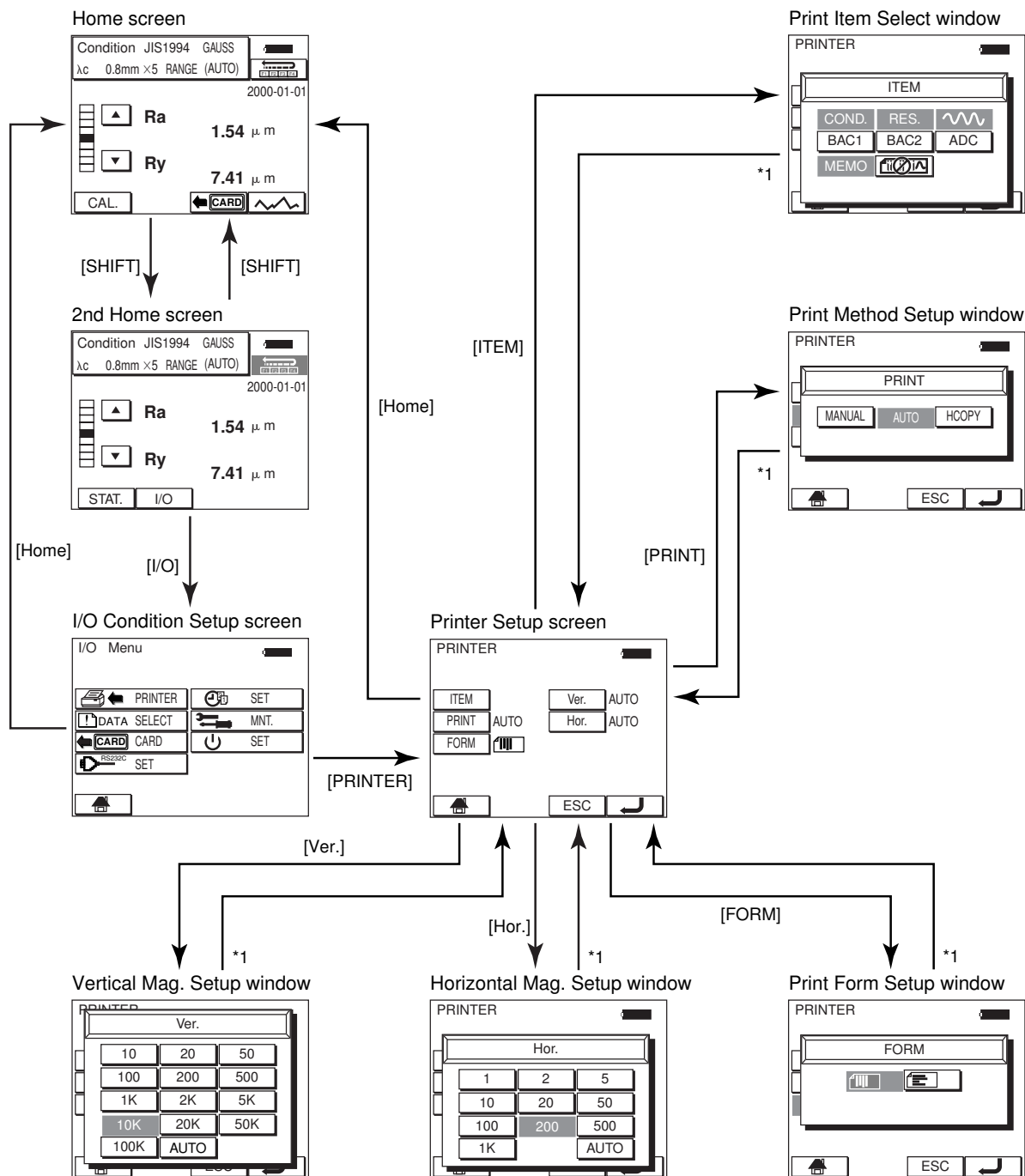
TIP Touch the [ESC] button to print out without a memo.

4.5.3 Changing print conditions

To print with the SJ-301, it is necessary to set the print conditions beforehand. Set up print conditions, other than the memo input, before print execution.

To change a print condition, bring up the Printer Setup screen and select the print condition from the menus displayed on the screen.

■ Screen transition to change print conditions

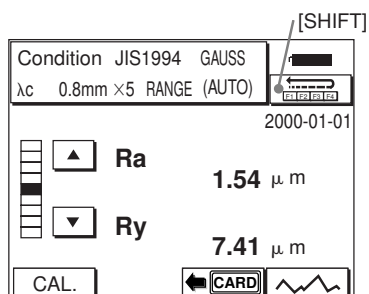


*1: Touch the title bar on each window to return to the Printer Setup screen.

■ Displaying the Printer Setup screen

If changing print conditions, display the Printer Setup screen.

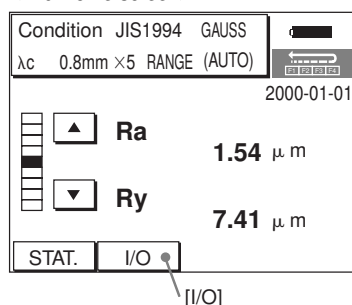
1 <Home screen>



Touch the [SHIFT] button on the Home screen.

⇒ The 2nd Home screen is displayed.

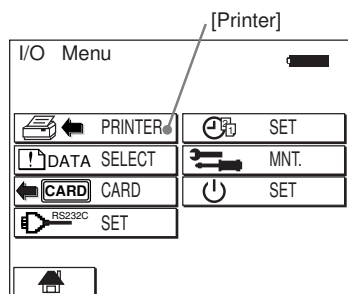
2 <2nd Home screen>



Touch the [I/O] button.

⇒ The I/O Condition Setup screen is displayed.

3 <I/O Condition Setup screen>



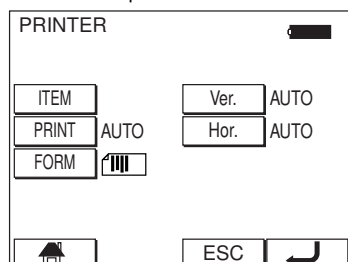
Touch the [Printer] button.

⇒ The Printer Setup screen is displayed. The print conditions which can be set in this screen are shown below.

- Print item (items to be printed)
- Print method (automatic print, manual print, and hard copy)
- Print form (Portrait or Landscape).
- Vertical and horizontal magnifications (print magnification of a measured profile)



<Printer Setup Screen>

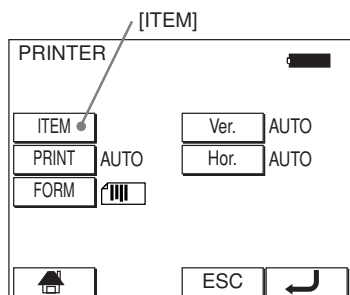


The setting procedures are explained in the following pages.

NOTE If the print magnification (vertical and horizontal) of a measured profile has been set, the display magnification is updated to the same value when the measured profile is displayed in the touch panel.

■ Selecting print items

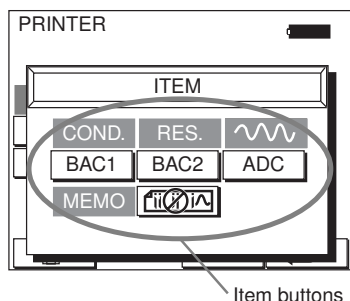
1 <Printer Setup screen>



Touch the [ITEM] button of the Printer Setup screen.

⇒ The Print Item Selection window is displayed.

2 <Print Item Select window>



Touch the button of the item to be set.

The definition of each item is given below.

COND.: Measurement condition RES.: Measured result

MEMO: A memo, etc., appended to the printed matter. (Input prior to printing.)

BAC1: BAC1 curve ADC: ADC curve

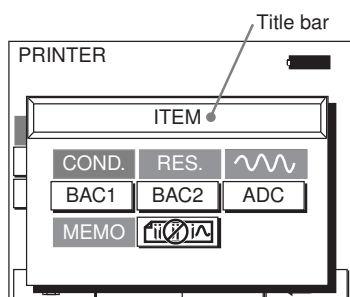
BAC2: BAC2 curve

: Print save mode

TIP

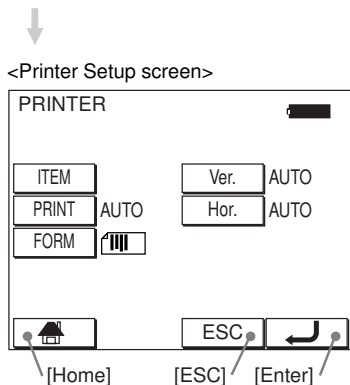
For an example of printout in the save mode, refer to "■ Print format with the SJ-301 ● Print in the print save mode" in section 4.5.1, "Print method".

3 <Print Item Select window>



Touch the title bar on the Print Item Selection window to load the selected items.

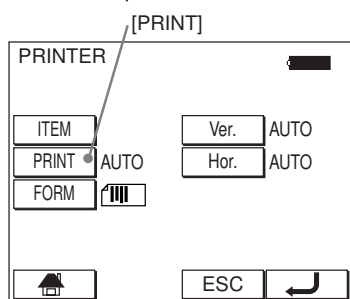
⇒ The Print Item Selection window closes.



- Touching the [Home] button updates the print items and the Home screen is restored.
- Touching the [Enter] button updates the print items and the I/O Condition Setup screen is restored.
- Touching the [ESC] button cancels the new print items and the I/O Condition Setup screen is restored.

■ Changing the print method

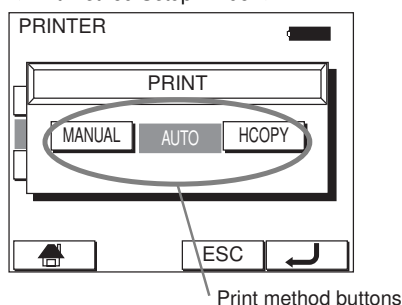
1 <Printer Setup screen>



Touch the [PRINT] button in the Printer Setup screen.

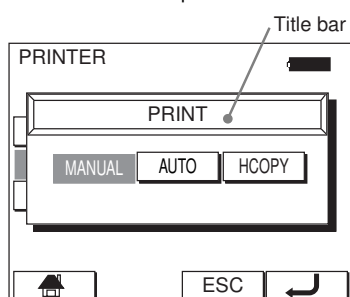
⇒ The Print Method Setup window is displayed.

2 <Print Method Setup window>



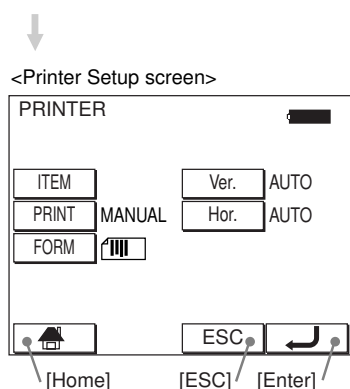
Touch the button of the print method to be set.

3 <Print Method Setup window>



Touch the title bar on the Print Method Setup window to load the print method.

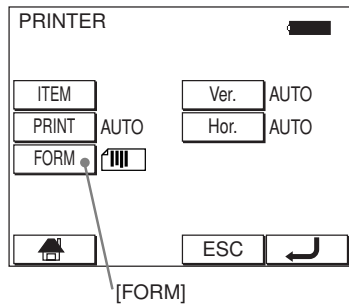
⇒ The Print Method Setup window closes.



- Touching the [Home] button updates the print method and Home screen is restored.
- Touching the [Enter] button updates the print method and the I/O Condition Setup screen is restored.
- Touching the [ESC] button cancels the new print method and the I/O Condition Setup screen is restored.

■ Changing the print form

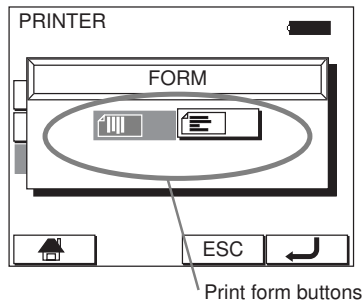
1 <Printer Setup screen>



Touch the [FORM] button in the Printer Setup screen.

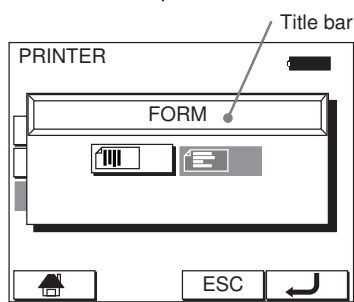
⇒ The Print Form Setup window is displayed.

2 <Print Form Setup window>



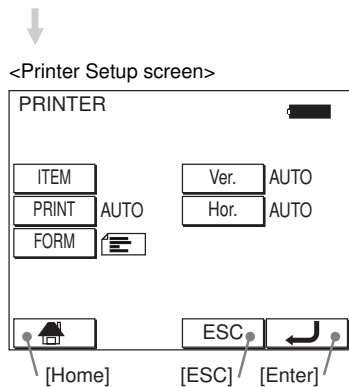
Touch the button of the print form to be set.

3 <Print Form Setup window>



Touch the title bar on the Print Form Setup window to load the print form.

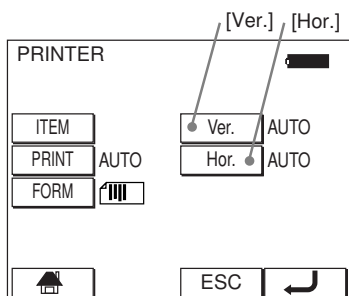
⇒ The Print Form Setup window closes.



- Touching the [Home] button updates the print form and the Home screen is restored.
- Touching the [Enter] button updates the print form and the I/O Condition Setup screen is restored.
- Touching the [ESC] button cancels the new print form and the I/O Condition Setup screen is restored.

■ Changing the print magnification

<Printer Setup screen>



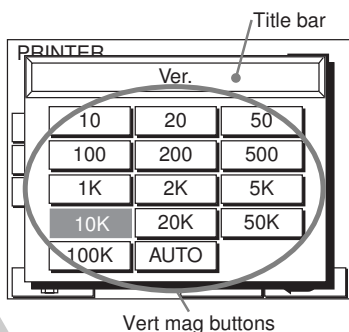
Touch the [Ver.] button in the Printer Setup screen to bring up the Vertical Magnification Setup window.

Touch the [Hor] button to display the Horizontal Magnification Setup window.

TIP

If the print magnification (vertical and horizontal) of a measured profile is set to [AUTO], the entire profile is printed. It is convenient to compare measured profiles of multiple workpieces if the magnification is fixed.

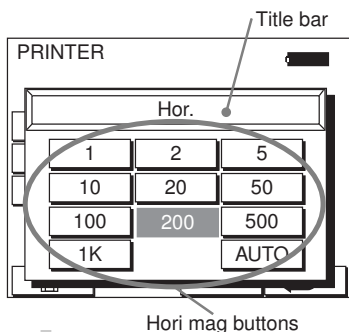
<Vertical Mag. Setup window>



Touch the title bar after touching the button of the vertical magnification to be set.

⇒ The print magnification is changed, and the Vertical Magnification Setup window closes.

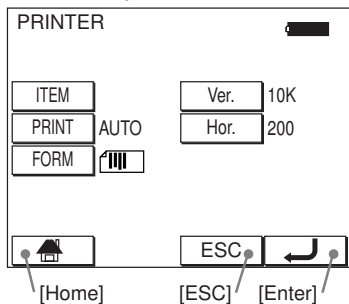
<Horizontal Mag. Setup window>



Touch the title bar after touching the button of the horizontal magnification to be set.

⇒ The print magnification is changed, and the Horizontal Magnification Setup window closes.

<Printer Setup screen>



- Touching the [Home] button updates the print magnification and the Home screen is restored.
- Touching the [Enter] button updates the print magnification and the I/O Condition Setup screen is restored.
- Touching the [ESC] button cancels the new print magnification and the I/O Condition Setup screen is restored.

5

MODIFYING THE MEASUREMENT CONDITIONS

Measurement conditions must be set up or modified according to the object roughness parameters, the degree of roughness, the conditions on the measured position, etc.

The SJ-301 is compatible with various national/international surface texture standards including JIS2001, JIS1994, JIS1982, DIN, ISO, and ANSI.

Referring to Chapter 14, “REFERENCE INFORMATION”, set up the measurement conditions according to the surface texture standard to be complied with.

■ About modifying the measurement conditions

Since measurement condition items to be set according to the surface texture standard are interrelated, setting a condition item will also determine some other relevant items within the SJ-301.

Also, if a measurement condition selection option is not permitted, that item will not be activated even if the corresponding icon/button on the touch panel is touched.

For information about the relationship between the measurement condition items refer to “■ Relationship between the measurement condition items” described later in this manual.

TIP Measurement conditions can be restored to their previous settings even after modification. For more information refer to “■ How to read measurement conditions with the [CONDITION READ] key” and “● About the [UNDO] function” in section 8.2.2, “Recalling the measurement conditions”.

■ Relationship between the measurement condition items

● Measured profile and applicable filter

×: Available -: Unavailable

Measured profile	Filter		
	2RC	PC75	GAUSS
P	-	-	-
R	×	×	×
DIN4776	×	×	×
MOTIF.R	-	-	-
MOTIF.W	-	-	-

● Restriction if MOTIF.R/MOTIF.W is selected

The number of sampling lengths cannot be selected.

● Relationship between filters and other measurement conditions

Standard	Measured profile				
	P	R	DIN4776	MOTIF.R	MOTIF.W
JIS'01		GAUSS	GAUSS		
ISO'97		GAUSS	GAUSS		
DIN'90		GAUSS	GAUSS		
JIS'94		GAUSS	GAUSS		
ANSI'95		GAUSS	GAUSS		
JIS'82		2RC	2RC		

● Relationship between the number of sampling lengths and the measured profile

The number of sampling lengths will be modified according to the measured profile being switched to.

Measured profile	Number of sampling lengths
P	1
R	5
DIN4776	5
MOTIF.R	Arbitrary (independent of the measured profile)
MOTIF.W	Arbitrary (independent of the measured profile)

● Cutoff length and traversing speed

λ_c mm(in)	Traversing speed mm/s(in/s)
0.08(.003)	0.25(.01)
0.25(.01)	0.25(.01)
0.8(.03)	0.25(.01), 0.5(.02)
2.5(.1)	0.5(.02)
8(.3)	0.5(.02)

Upper limit length A mm(in)	Upper limit length B mm(in)	L (Evaluation length mm(in))	Traversing speed mm/s(in/s)
0.02(.001)	0.1(.004)	$0.3(.012) \leq L \leq 0.64(.025)$	0.25(.01)
0.1(.004)	0.5(.02)	$0.7(.028) \leq L \leq 3.2(.126)$	0.25(.01), 0.5(.02)
0.5(.02)	2.5(.1)	$3.3(.130) \leq L \leq 16(.63)$	0.5(.02)

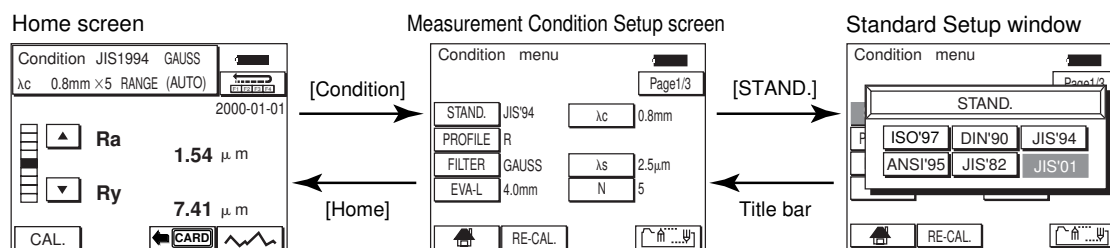
5.1 Switching the Surface Texture Standard

The SJ-301 is compatible with each of the following surface texture standards: JIS2001, JIS1994, JIS1982, DIN, ISO, and ANSI.

TIP A currently specified standard is indicated on the Home screen.

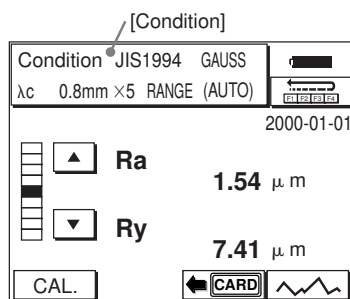
NOTE If surface texture standard is switched, the profile filter will also be automatically switched corresponding to the standard specification.

■ Screen displays when switching the surface texture standard



■ Switching the standard

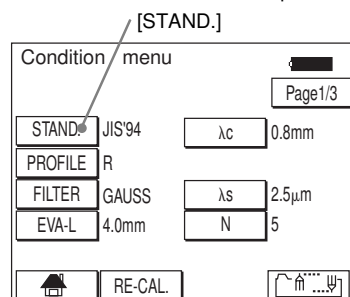
1 <Home screen>



Touch the [Condition] button

⇒ The Measurement Condition Setup screen will appear.

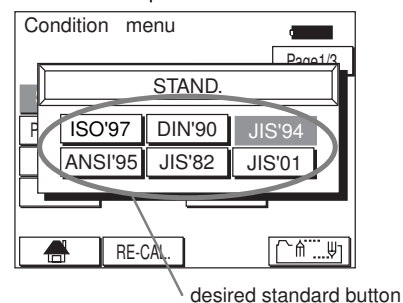
2 <Measurement Condition Setup screen>



Touch the [STAND.] button.

⇒ The Standard Setup screen will appear.

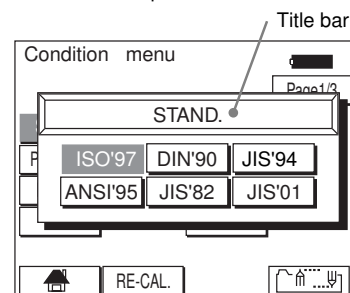
3 <Standard Setup window>



Touch the desired standard button.

⇒ Touched standard button is highlighted.

4 <Standard Setup window>



Touch the title bar of the Standard Setup window to accept the selected standard.

⇒ The Standard Setup window closes.

5 <Measurement Condition Setup screen>

Condition menu  Page1/3

STAND.	ISO'97	λc	0.8mm
PROFILE	R		
FILTER	GAUSS	λs	2.5 μm
EVA-L	4.0mm	N	5

 RE-CAL. 

[Home]

Touch the [Home] button.

⇒ The Home screen will be returned to.

↓

<Home screen>

Condition ISO1997 GAUSS 

λc 0.8mm $\times$ 5 RANGE (AUTO) 

2000-01-01

 Ra * * * * μm

 Ry * * * * μm

CAL.  

5.2 Switching the Measured Profile

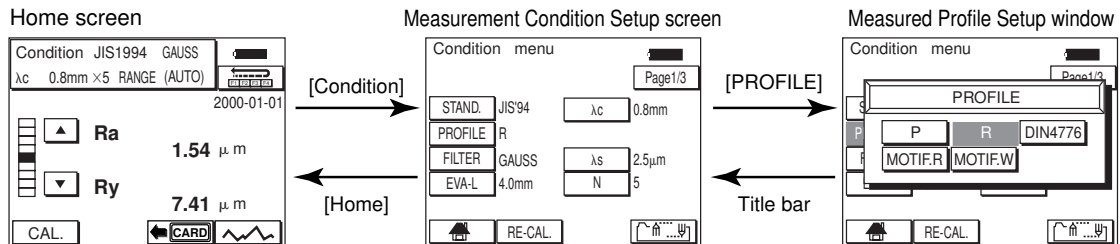
TIP For definitions of the measured profile and profile filter, refer to section 14.2, “Measured Profile and Filters”.

■ Measured profile and profile filter

Profile filter available to each of the measured profile is as follow:

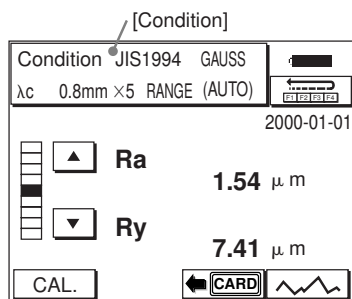
Measured profile	Filter		
	2RC	PC75	GAUSS
P	-	-	-
R	×	×	×
DIN4776	×	×	×
MOTIF.R	-	-	-
MOTIF.W	-	-	-

■ Screen displays during switching measured profiles



■ Switching the measured profile

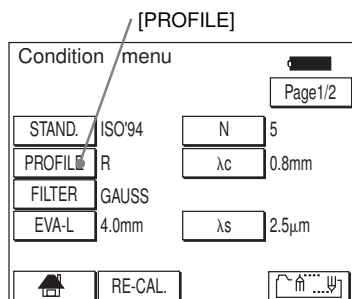
1 <Home screen>



Touch the [Condition] button.

⇒ The Measurement Condition Setup screen will appear.

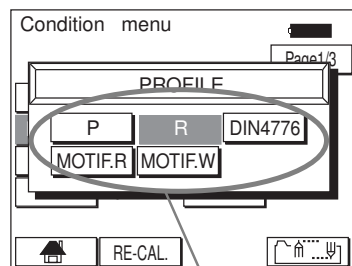
2 <Measurement Condition Setup screen>



Touch the [PROFILE] button.

⇒ The Measured Profile Setup window will appear.

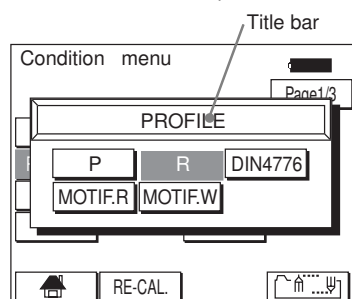
3 <Measured Profile Setup window>



Touch the desired measured profile button.

⇒ The touched button will be highlighted.

4 <Measured Profile Setup window>



Touch the title bar to accept the selected measured profile.

⇒ The Measured Profile Setup window closes.

5 <Measurement Condition Setup screen>

Condition menu Page1/3

STAND.	JIS'94	L	0.8mm
PROFILE	P		
FILTER	λs	2.5μm	
EVA-L	0.8mm	N	1

[Home] RE-CAL. ...

Touch the [Home] button.

⇒ The Home screen will be returned to.



<Home screen>

Condition JIS1994 ...

L 0.8mm x5 RANGE (AUTO) ...

2000-01-01

▲	Pa	***** μm
▼	Py	***** μm

CAL. CARD ...

5.3 Switching the Profile filters

Profile filters can be switched to either of 2RC, PC75, or GAUSS according to the set surface texture standard.

NOTE Profile filter is automatically switched according to the surface texture standard if it is switched.

■ Profile filter, surface texture standard, and measured profile

Profile filters will be automatically set according to the surface texture standard and measured profile selected as tabulated below.

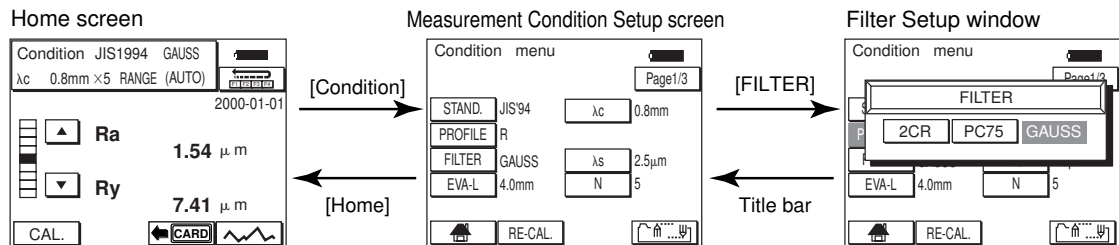
Standard	Measured profile				
	P	R	DIN4776	MOTIF.R	MOTIF.W
ISO'97		GAUSS	GAUSS		
DIN'90		GAUSS	GAUSS		
JIS'01		GAUSS	GAUSS		
JIS'94		GAUSS	GAUSS		
ANSI'95		GAUSS	GAUSS		
JIS'82		2RC	2RC		

Profile filters can be switched as necessary according to the procedure explained on the following page.

■ Measured profile and profile filter notion on the screen

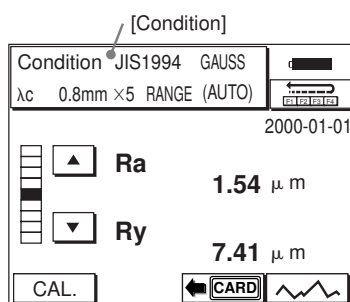
Measured profile	Filter characteristics	Notation
R-profile DIN4776-profile	Gaussian filter	GAUSS
	2RC (Phase corrected)	PC75
	2RC (Phase not-corrected)	2CR
P-profile	Unfiltered	-
MOTIF.R	Unfiltered	-
MOTIF.W	Unfiltered	-

■ Screen displays during switching profile filters



■ Switching the profile filters

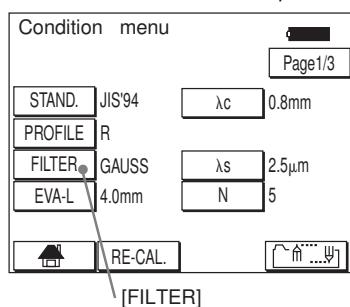
1 <Home screen>



Touch the [Condition] button.

⇒ The Measurement Condition Setup screen appears.

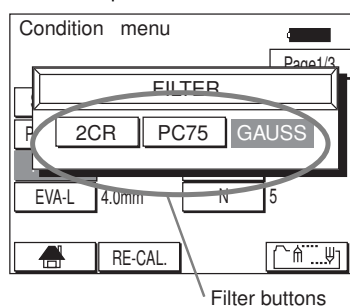
2 <Measurement Condition Setup screen>



Touch the [FILTER] button.

⇒ The Filter Setup window appears.

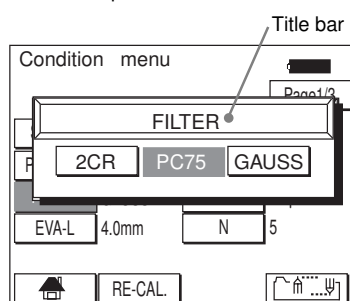
3 <Filter Setup window>



Touch the button of the desired profile filter.

⇒ The touched filter button is highlighted.

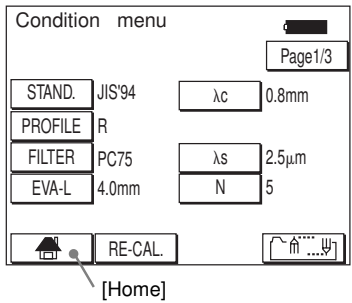
4 <Filter Setup window>



Touch the title bar of the Filter Setup window.

⇒ The Filter Setup window closes.

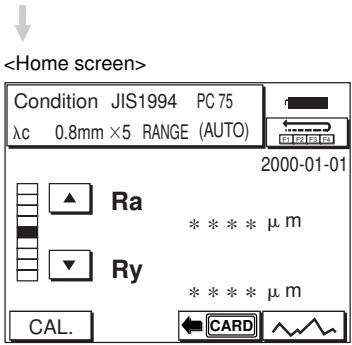
5 <Measurement Condition Setup screen>



The screen displays various measurement parameters in a grid. At the top, it says 'Condition menu' and 'Page1/3'. The parameters are: STAND. JIS'94, λc 0.8mm, PROFILE R, FILTER PC75, λs 2.5μm, EVA-L 4.0mm, N 5. At the bottom, there is a home icon with a label '[Home]' pointing to it, a 'RE-CAL.' button, and a small icon on the right.

Touch the [Home] button.

⇒ The Home screen will be returned to.



The screen shows the home interface. At the top, it says 'Condition JIS1994 PC 75' and 'λc 0.8mm × 5 RANGE (AUTO)'. Below this is the date '2000-01-01'. There are two main sections: one for 'Ra' with an up arrow and another for 'Ry' with a down arrow, both followed by 'μ m'. At the bottom, there is a 'CAL.' button, a 'CARD' button with a left arrow, and a waveform icon.

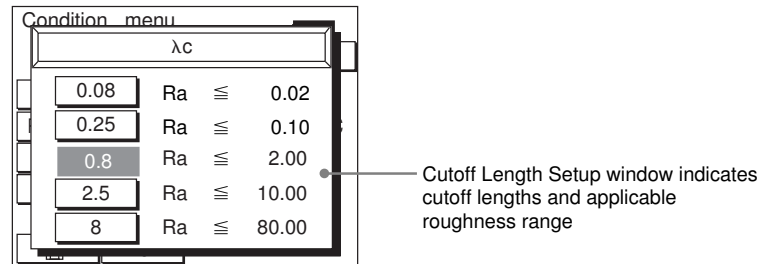
5.4 Switching the Cutoff length (λ_c)

The cutoff length can be switched according to the roughness value to be measured.

■ Displaying the roughness range classification

To select an optimal cutoff length according to the roughness value to be measured, set up the Ra, Ry, Rz, and Rsm parameters in addition to the required one. After this setup has been made, select a cutoff length appropriate to the roughness range being displayed according to the selected standard.

This is helpful for selecting a cutoff length as appropriate for the given roughness value.

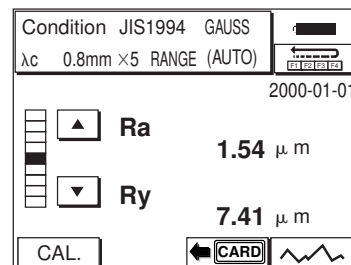


Parameters for which the roughness ranges are displayed with appropriate cutoff lengths are as follow:

Standard	Parameter
JIS'82	Ra, Ry, Rz
JIS'94	Ra, Ry, Rz, RSm
DIN'90	Ra, Rz, RSm
ANSI'95	Ra, RSm
JIS'01/ISO'97	RSm, Ra, Rz

To have the roughness ranges displayed with appropriate cutoff lengths on the screen, have the desired parameter displayed upper region on the Home screen by scrolling the parameter display up or down.

Example: If the cutoff length appropriate to a certain Ra value is required, have the Ra indicated on the upper region as shown below.



5. MODIFYING THE MEASUREMENT CONDITIONS

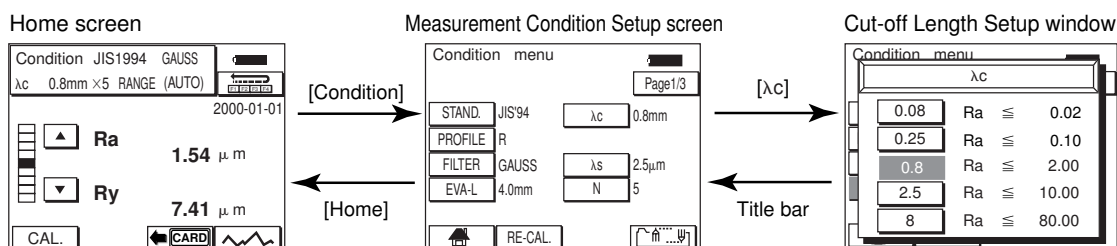
■ Cutoff length (λ_c) and traversing speed

The following traversing speeds can be selected for the cutoff lengths.

λ_c	Traversing speed
0.08mm(.003")	0.25mm/s(.01"/s)
0.25mm(.01")	0.25mm/s(.01"/s)
0.8mm(.03")	0.25mm/s(.01"/s), 0.5mm/s(.02"/s)
2.5mm(.1")	0.5mm/s(.02"/s)
8mm(.3")	0.5mm/s(.02"/s)

TIP If the cutoff length is set to 0.8 mm, either 0.5 mm/s or 0.25 mm/s can be selected as the traversing speed. For more information refer to section 5.8, "Modifying the Traversing Speed".

■ Transition of screens if the cutoff length (λ_c) is switched

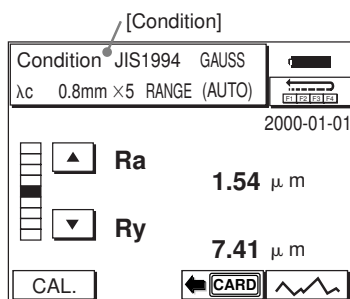


- TIP**
- If "MOTIF.R" is selected as the measured profile, the icon indicating the cutoff length changes from [λ_c] to [A].
 - If "MOTIF.W" is selected as the measured profile, the icon indicating the cutoff length changes from [λ_c] to [B].
 - If assessed profile MOTIF.R/MOTIF.W is selected, the display content changes from icon [N] that indicates the number of sampling lengths to icon [L] that sets the evaluation length to an arbitrary length.

NOTE Only if the R profile in JIS '94 Standard is selected, λ_s can be set to None.

■ Setting the cutoff length

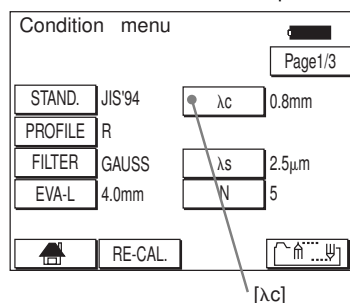
1 <Home screen>



Touch the [Condition] button in the Home screen.

⇒ The Measurement Condition Setup screen will appear.

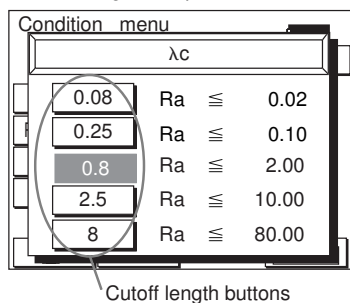
2 <Measurement Condition Setup screen>



Touch the [λ_c] button.

⇒ The Cutoff Length Setup window will appear.

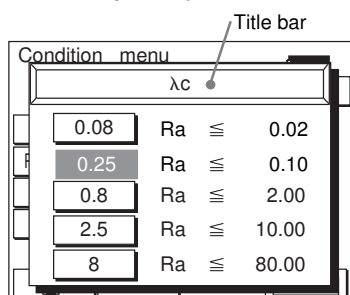
3 <Cutoff Length Setup window>



Touch the button of a cutoff length to be set.

⇒ The touched cutoff length button will be highlighted.

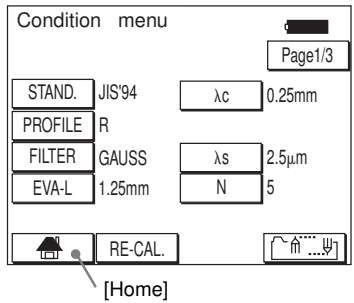
4 <Cutoff Length Setup window>



Touch the title bar in the Cutoff Length Setup window to accept the selected cutoff length.

⇒ The Cutoff Length Setup window will be closed.

5 <Measurement Condition Setup screen>



Condition menu Page1/3

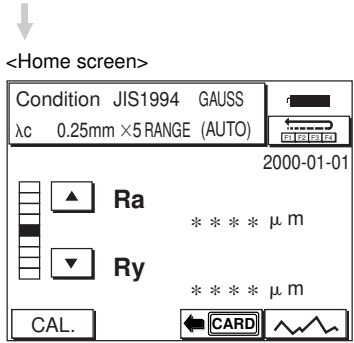
STAND.	JIS'94	λc	0.25mm
PROFILE	R		
FILTER	GAUSS	λs	2.5 μ m
EVA-L	1.25mm	N	5

 RE-CAL. 

[Home]

Touch the [Home] button.

⇒ The Home screen is restored



<Home screen>

Condition JIS1994 GAUSS 2000-01-01

λc 0.25mm $\times$ 5 RANGE (AUTO)

 **Ra** * * * * μ m

 **Ry** * * * * μ m

CAL.  

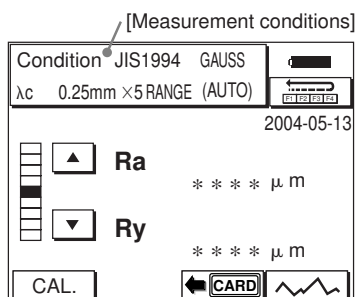
■ Procedure for setting λ_s to None

The SJ-301 allows the λ_s filter to be set to None, only if the roughness standard has been set to “JIS1994” and the measured profile has been set to “R profile”.

NOTE If the roughness standard is other than “JIS1994” and if the measured profile is other than “R profile”, the setup and settings are automatically determined.

● Operating procedure

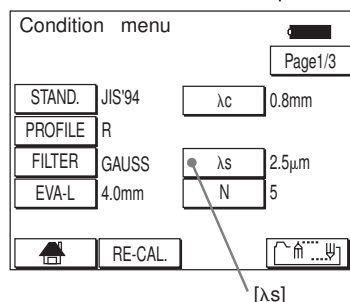
1 <Home screen>



Touch the [Measurement Conditions] button in the Home screen.

⇒ The Measurement Condition Setup screen will appear.

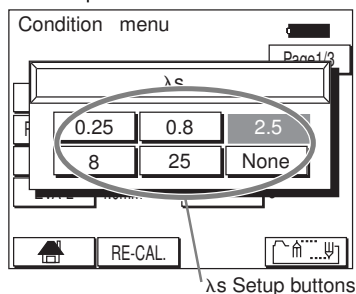
2 <Measurement Condition Setup screen>



Touch the [λ_s] button.

⇒ The λ_s Setup window will appear.

3 < λ_s Setup window>

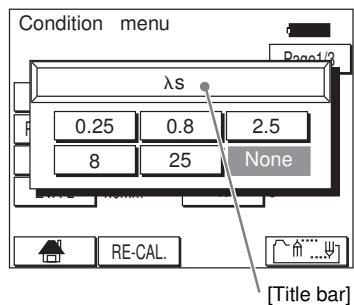


Touch one of the buttons to be set on the λ_s Setup window.

⇒ The touched setup button is highlighted.

None: The λ_s filter is set to None.

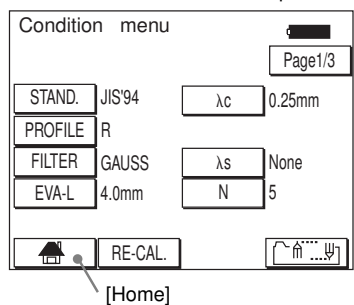
4 <λs Setup window>



Touch the title bar on the λs Setup window to accept the λs setting.

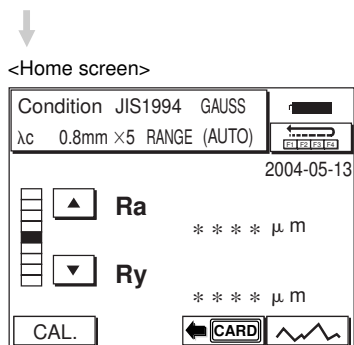
⇒ The λs Setup window will be closed.

5 <Measurement Condition Setup screen>



Touch the [Home] button.

⇒ The Home screen is restored.



5.5 Modifying the Number of Sampling Lengths

The SJ-301 sets up an evaluation length ($\lambda_c \times n$) by specifying the number of sampling lengths to either 1, 3, 5, or L. If L is specified for the number of sampling lengths, the evaluation length can be set as desired within the range from 0.3 mm(.01") to 12.5mm (.49").

TIP If the profile MOTIF.R/MOTIF.W is selected, the number of the sampling lengths can not be specified.

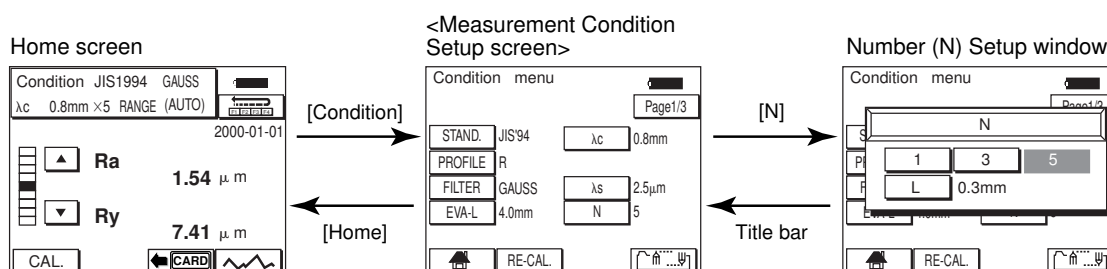
■ Measured profile and the number of sampling lengths

Unless otherwise specified, the SJ-301 sets the number of sampling lengths according to the table below.

Measured profile	Number of sampling lengths (N)
P	1
R	5
DIN4776	5
MOTIF.R	Arbitrary (independent of the measured profile)
MOTIF.W	Arbitrary (independent of the measured profile)

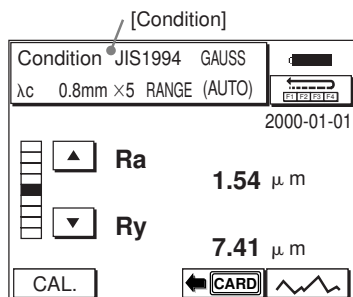
The number of sampling lengths can be changed as explained on the following pages.

■ Screen displays during changing the number (N) of sampling lengths



■ Modifying the number of sampling length

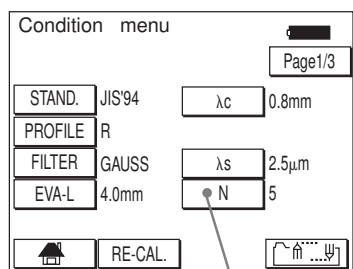
1 <Home screen>



Touch the [Condition] button on the Home screen.

⇒ The Measurement Condition Setup screen will appear.

2 <Measurement Condition Setup screen>

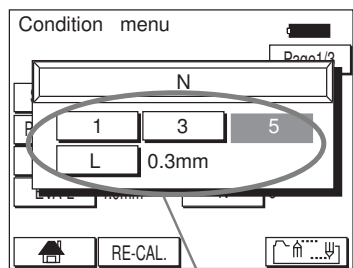


[N] (the number of sampling lengths)

Touch the [N] button.

⇒ The Number (N) Setup window will appear.

3 <Number (N) Setup window>



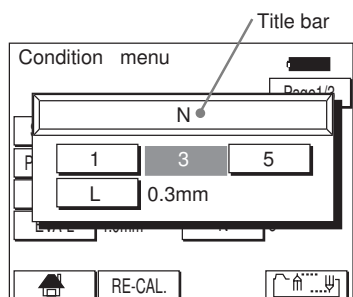
Number (N) button

Touch the button of the desired number.

⇒ The touched button will be highlighted.

TIP If the [L] button is touched, an arbitrary evaluation length can be set. Refer to section, 5.6 “Setting the Evaluation Length to an Arbitrary Length” for details.

4 <Number (N) Setup window>



Touch the title bar of the Number (N) Setup window to accept the selected number of sampling lengths.

⇒ The Number (N) Setup window closes.

5 <Measurement Condition Setup screen>

Condition menu

Page1/3

STAND. JIS'94 λc 0.8mm

PROFILE R

FILTER GAUSS λs 2.5μm

EVA-L 4.0mm N 3

[Home] RE-CAL.

Touch the [Home] button.

⇒ The Home screen will be returned to.

<Home screen>

Condition JIS1994 GAUSS

λc 0.8mm ×3 RANGE (AUTO)

2000-01-01

Ra

Ry

CAL.

CARD

5.6 Setting the Evaluation Length to an Arbitrary Length

The SJ-301 is capable of setting the evaluation length to an arbitrary length in a range between 0.3 mm and 12.5 mm (.01" and .49").

- NOTE**
- The setting range of an arbitrary evaluation length depends on a cutoff value and a filter setting. When performing measurement at an arbitrary evaluation length, set the length after determining a cutoff value and a filter setting.
 - Note that the procedure for setting the evaluation length to an arbitrary length for assessed profile MOTIF.R/MOTIF.W is different from that for other assessed profiles. For information about the setting procedure, refer to "■ Operating procedure if assessed profile (MOTIF.R/MOTIF.W) is specified" described later.

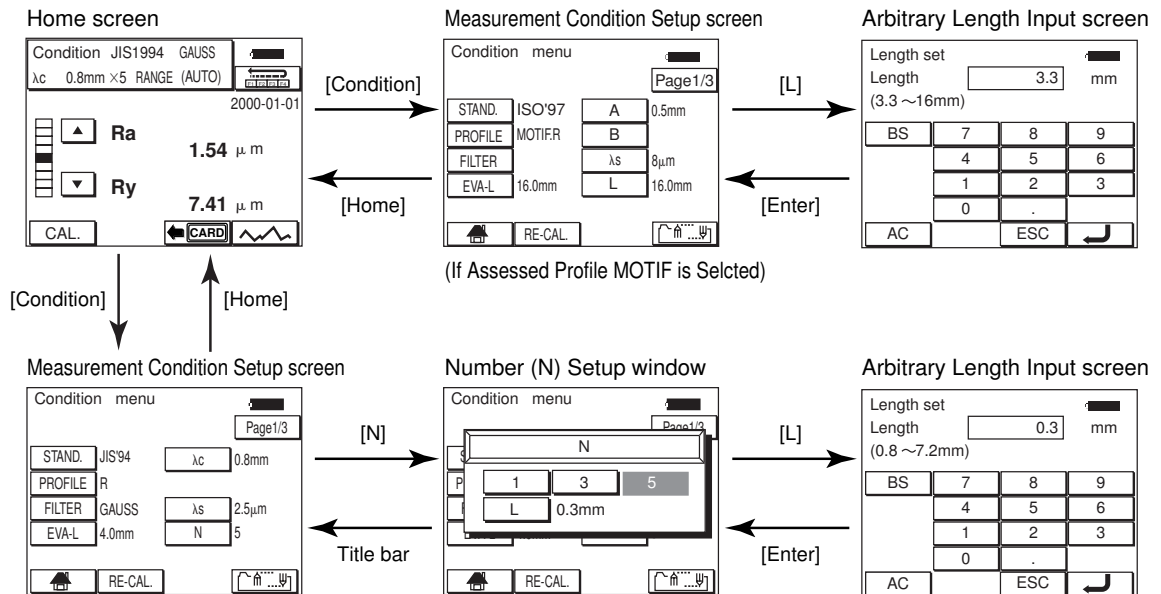
■ Evaluation length and cutoff length

In the JS-301, for the R profile and a profile compatible with DIN4776, the settable range of evaluation length is determined by the cutoff value and the filter type that have been set. the relationship between the upper limit length and the evaluation length in assessed profile MOTIF.R/MOTIF.W is indicated as shown below.

Upper limit length A mm(inch)	Upper limit length B mm(inch)	Evaluation length mm(inch)
0.02(.001)	0.1(.004)	0.3(.012) L 0.64(.025)
0.1(.004)	0.5(.02)	0.7(.028) L 3.2(.126)
0.5(.02)	2.5(.1)	3.3(.130) L 16(.63)

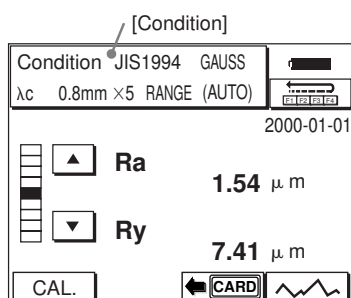
If the primary profile is specified, the evaluation length L will be 0.3mm or greater.

■ Screen displays during setting the evaluation length to an arbitrary length



■ Operating procedure if a profile other than assessed profile MOTIF is specified

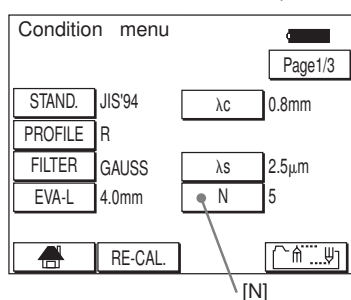
1 <Home screen>



Touch the [Condition] button on the Home screen.

⇒ The Measurement Condition Setup screen will appear.

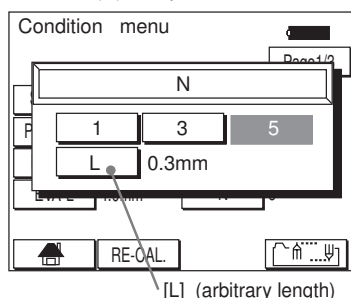
2 <Measurement Condition Setup screen>



Touch the [N] button.

⇒ The Number (N) Setup window will appear.

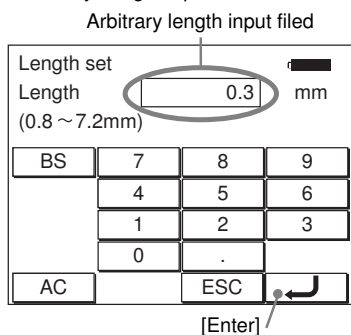
3 <Number (N) Setup window>



Touch the [L] button on the Number (N) Setup window.

⇒ The Arbitrary Length Setup screen will appear.

4 <Arbitrary Length Input screen>



Enter an arbitrary length in the filed, then touch the [Enter] button.

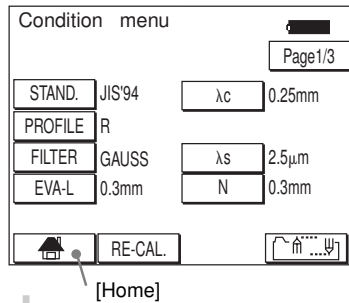
An arbitrary length can be specified between 0.3 mm (.01") and 12.5 mm (.49") with 0.1 mm (.01") increments. Specification outside this range is invalid.

TIP For numerical data specification in input filed, refer to section 2.2, "Outline of the Touch Panel ■ Inputting numeric values".

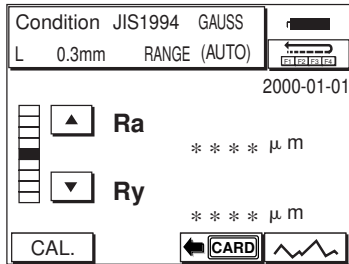
NOTE Set an arbitrary evaluation length after determining a cutoff value and a filter setting. The enterable range of evaluation lengths is changed if the cutoff value or the filter is changed.

⇒ The Measurement Condition Setup screen will be returned to.

5 <Measurement Condition Setup screen>



<Home screen>



Touch the title bar in the Number (N) Setup window to accept the selected number of sampling lengths.

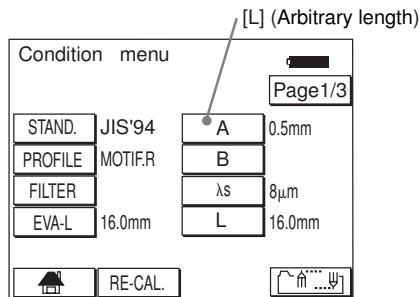
⇒ The Number (N) Setup window closes.

Touch the [Home] button.

⇒ The Home screen will be returned to.

■ Operating procedure if assessed profile (MOTIF.R/MOTIF.W) is specified

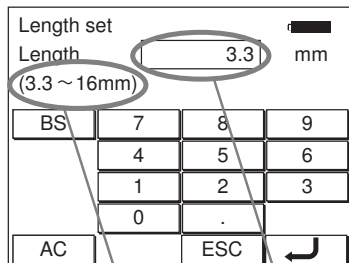
1 <Measurement Condition Setup screen>



Touch [L] (Arbitrary length) on the Measurement Condition Setup screen.

⇒ The Arbitrary Length Input screen is displayed.

2 <Arbitrary Length Input screen>



Arbitrary length input field
Range that can be set

Input an arbitrary length in the arbitrary length input field, then touch the [Enter] button.

Even if a numeric value outside the range that can be set is inputted, the input content will not be loaded.

TIP For information about the numeric value input procedure, refer to “2.2 Outline of the Touch Panel ■ Inputting numeric values”.

⇒ The Measurement Condition Setup screen will be restored.

NOTE An evaluation length is stored with respect to the upper limit length (A). Therefore, if the upper limit length (A) is changed, the system will set the evaluation length that has been previously stored at the changed upper limit length (A).

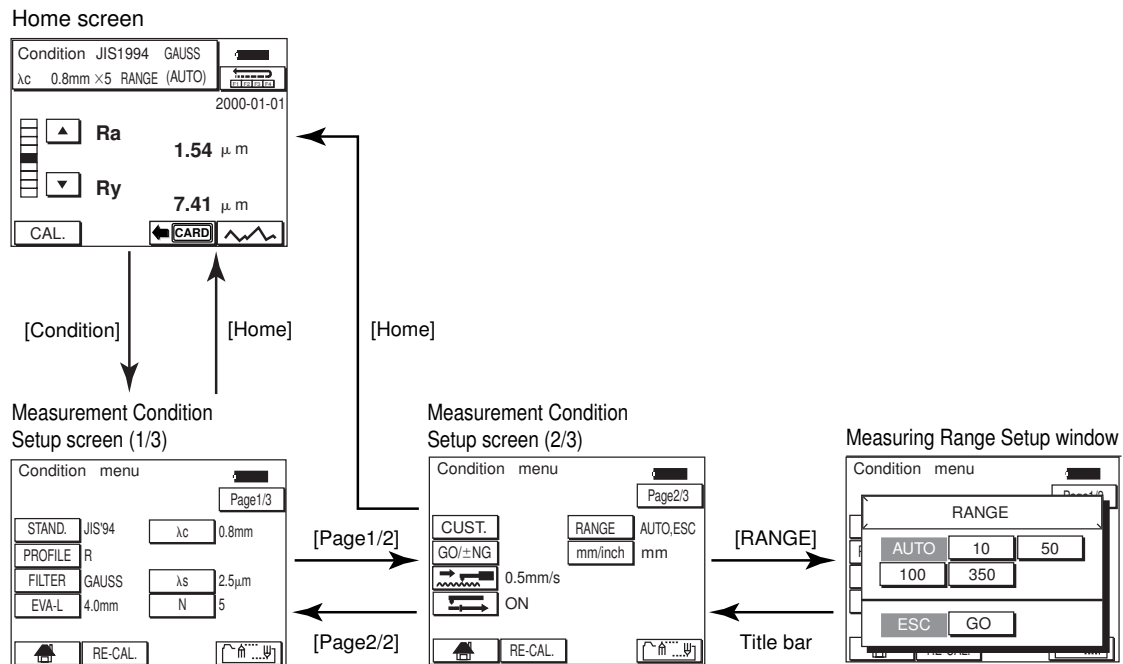
5.7 Modifying the Measuring Range

The SJ-301 can perform measurement in one of the following measuring ranges: 10, 50, 100, 350 μm (400, 2000, 4000, 14000 μin), and Auto. Use the Auto range unless a specific range is specified: a narrow range is sensitive and is apt to lead to an over-range.

The operator can also select a counteraction whether the measurement is continued or aborted, if an over-range error occurs.

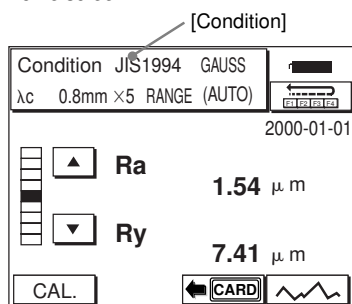
TIP If the measuring range is changed, the resolution will also change.

■ Transition of screens if the measuring range is modified



■ Modifying the measuring range

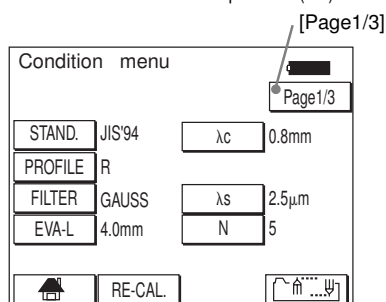
1 Home screen



Touch the [Condition] button in the Home screen.

⇒ The Measuring Condition Setup screen(1/3) will appear.

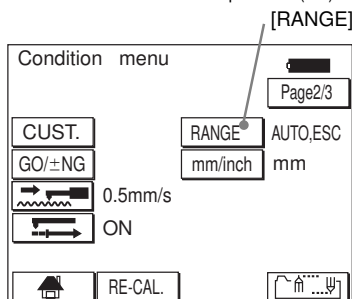
2 Measurement Condition Setup screen (1/3)



Touch the [Page 1/3] button.

⇒ The Measuring Condition Setup screen(2/3) will appear.

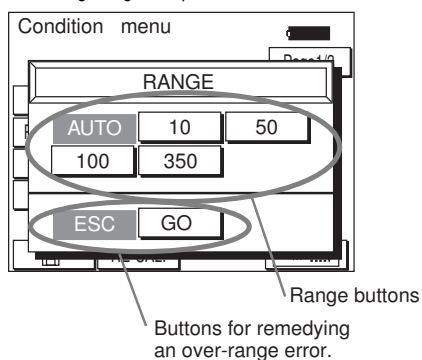
3 Measurement Condition Setup screen (2/3)



Touch the [RANGE] button.

⇒ The Measuring Range Setup screen will appear.

4 Measuring Range Setup window



Touch the button of the range to be set.

⇒ The touched range button will be highlighted.

Touch the button for remedying an over-range error.

[ESC] :

Aborts the measurement if an over-range error occurs.

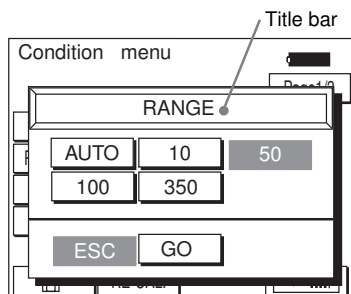
[GO] :

Continues the measurement if an over-range error occurs.

TIP

If the [GO] button is selected, measurement can continue even if an over-range error occurs during measurement. However, the calculation result may not be correct. Should an over-range error occur, ☆ will be displayed next to the resultant data.

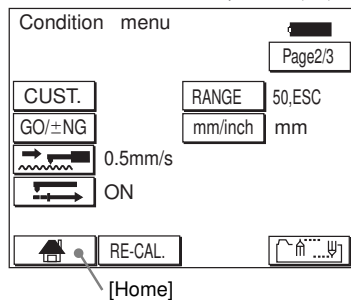
5 Measuring Range Setup window



Touch the title bar in the Measuring Range Setup window to accept the selected measuring range.

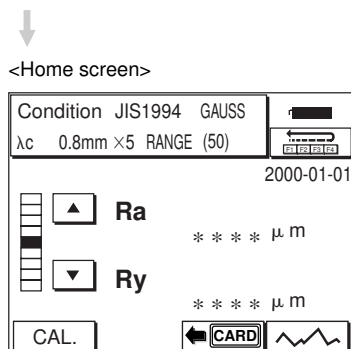
⇒ The Measuring Range Setup window will be closed.

6 Measurement Condition Setup screen (2/3)



Touch the [Home] button.

⇒ The Home screen is restored.



5.8 Modifying the Traversing Speed

For measurement with the cutoff length (sampling length) of 0.8mm(.03"), the traversing speed can be set to either 0.25 mm/s or 0.5 mm/s (.01"/s or .02"/s).

The factory default value for this setting is 0.5 mm/s (.02"/s).

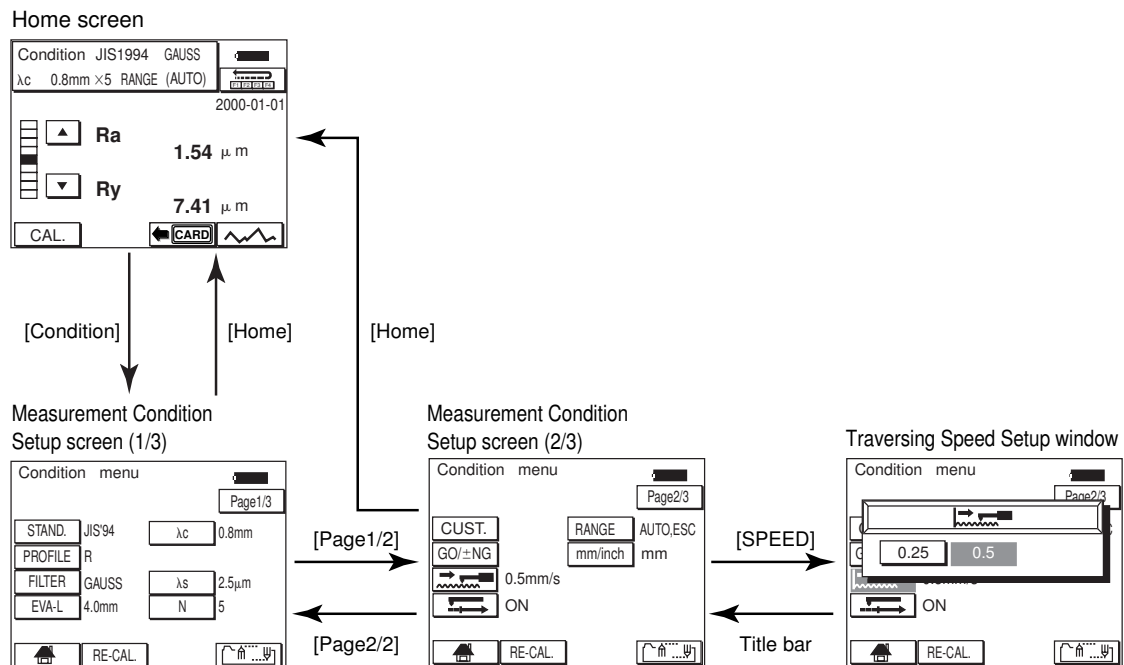
■ The cutoff length (sampling length) and the traversing speed

The SJ-301 will automatically set the traversing speeds according to the cutoff length (λ_c) or evaluation length set as shown below.

NOTE If the cutoff length of 0.8 mm, A of 0.10 mm is specified, traversing speed can be set to either 0.25 mm/s or 0.5 mm/s.

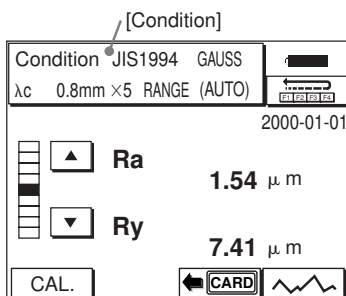
Cutoff length (sampling length)	A (case of MOTIF.R)	B (case of MOTIF.W)	Traversing speed mm/s(inch/s)
0.08mm(.003")	-	-	0.25(.01)
0.25mm(.01")	0.02mm(.001")	0.10mm(.004")	0.25(.01)
0.8mm(.03")	0.10mm(.004")	0.5mm(.02")	Select either 0.25(.01) or 0.5(.02)
2.5mm(.1")	0.5mm(.02")	2.5mm(.1")	0.5(.02)
8mm(.3")	-	-	0.5(.02)

■ Transition of screens if the traversing speed is modified



■ Modifying the traversing speed

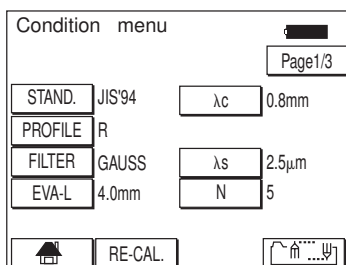
1 <Home screen>



Touch the [Condition] button in the Home screen.

⇒ The Measurement Condition Setup screen(1/3) will appear.

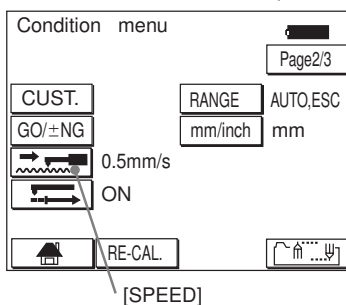
2 <Measurement Condition Setup screen (1/3)>



Touch the [Page 1/3] button.

⇒ The Measurement Condition Setup screen(2/3) will appear.

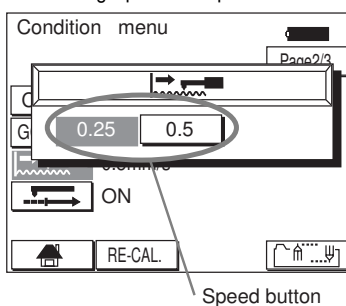
3 <Measurement Condition Setup screen (2/3)>



Touch the [SPEED] button.

⇒ The Traversing Speed Setup window will appear.

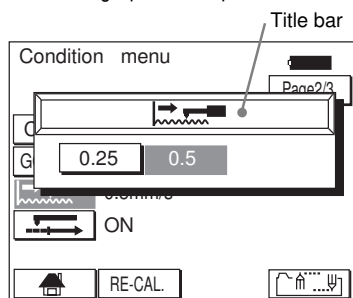
4 <Traversing Speed Setup window>



Touch the button of the traversing speed to be set.

⇒ The touched speed button will be highlighted.

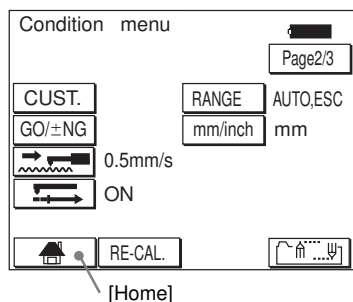
5 <Traversing Speed Setup window>



Touch the title bar in the Traversing Speed Setup window to accept the selected speed.

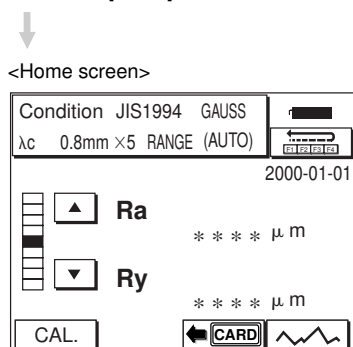
⇒ The Traversing Speed Setup window will be closed.

6 <Measurement Condition Setup screen (2/3)>



Touch the [Home] button.

⇒ The Home screen is restored.



5.9 Setting the Pre-Travel/Post-Travel to “OFF”

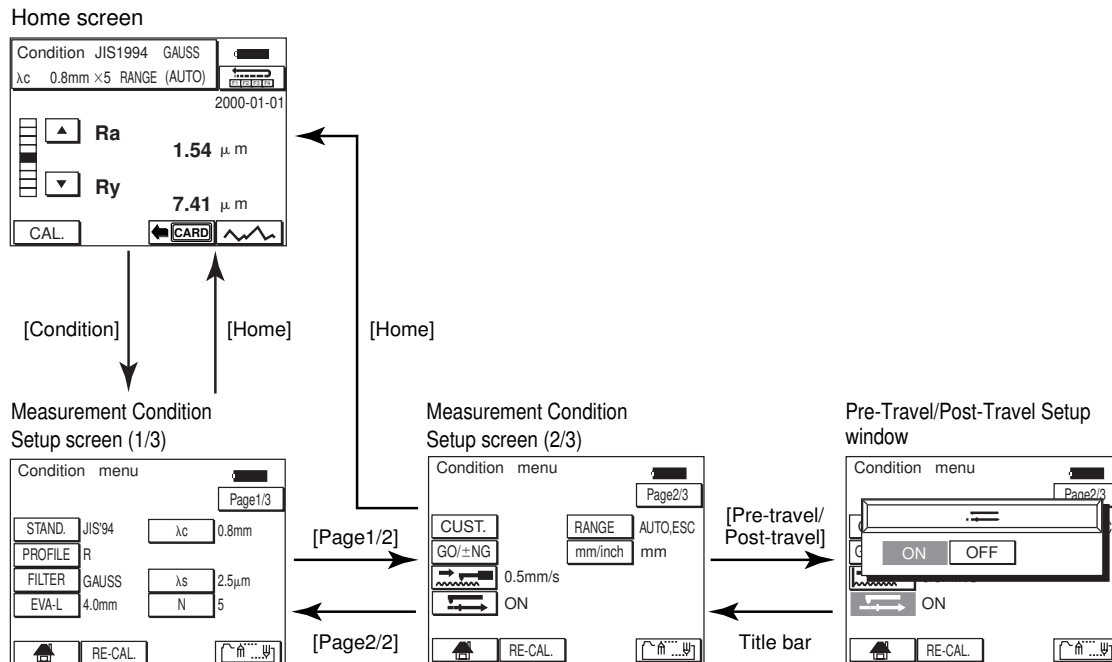
If measuring the objective surface for a roughness profile (R-profile) within an extremely limited area, the operator is permitted to set the pre-travel and post-travel to “OFF”. With this setting, the traversing length can be reduced by as much as the length of the pre-travel and post-travel lengths, thus making it possible to measure the narrow surface.

The factory-set default of the pre-travel and post-travel has been set to “ON”.

- IMPORTANT**
- Set the pre-travel and post-travel to “ON” unless otherwise required. Setting to “OFF” may lead to erroneous measurements depending on the surface texture standard applied.
 - If P-profile, MOTIF.R-profile, or MOTIF.W-profile is selected for measuring (L), the pre-travel and post-travel setting is fixed to “OFF”.

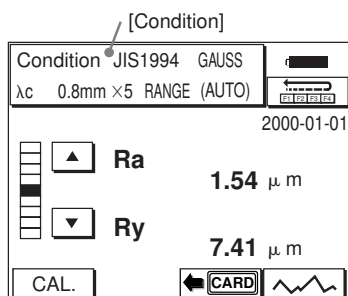
TIP For more information about the traversing length, refer to section 14.4, “Traversing Length”.

■ Transition of screens if the pre-travel and post-travel is set to OFF



■ Setting the pre-travel/post-travel to off.

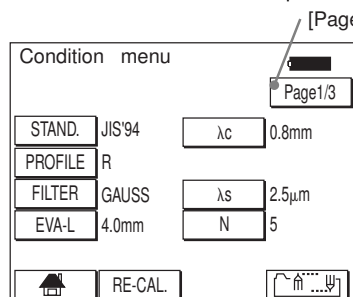
1 <Home screen>



Touch the [Condition] button in the Home screen.

⇒ The Measurement Condition Setup screen(1/3) will appear.

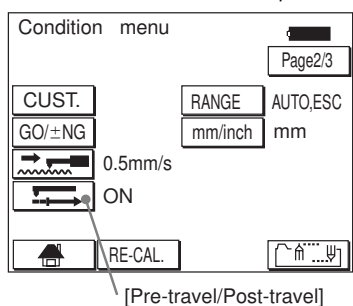
2 <Measurement Condition Setup screen (1/3)>



Touch the [Page 1/3] button in the Home screen.

⇒ The Measurement Condition Setup screen(2/3) will appear.

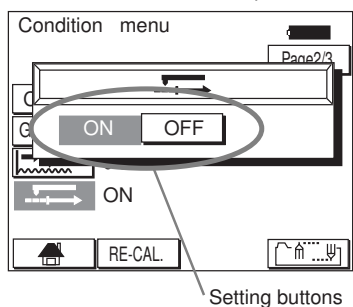
3 <Measurement Condition Setup screen (2/3)>



Touch the [Pre-travel/Post-travel] button.

⇒ The Pre-travel/Post-travel Setup window will appear.

4 <Pre-travel/Post-travel Setup window>



Touch the appropriate button to make a setting.

⇒ The button touched will be highlighted.

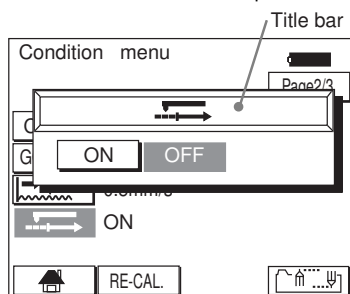
[ON] :

Traversing length includes the pre-travel/post-travel lengths

[OFF] :

Traversing length does not include the pre-travel/post-travel lengths

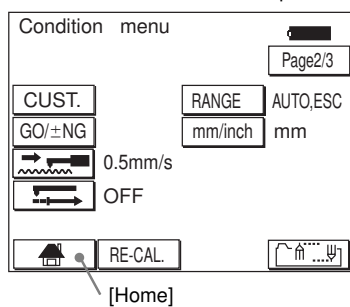
5 <Pre-travel/Post-travel Setup window>



Touch the title bar in the Pre-travel/Post-travel Setup window to accept the selected pre-travel and post-travel setting.

⇒ The Pre-travel/Post-travel Setup window will be closed.

6 <Measurement Condition Setup screen>

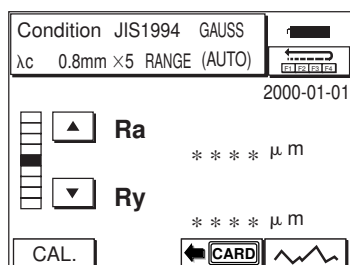


Touch the [Home] button.

⇒ The Home screen is restored.



<Home screen>



5.10 Selecting the Display Parameters (Parameter Customization)

Parameters other than Ra, Ry, Rz, and Rq are available on the display with this function.

5.10.1 Parameter Customization

■ Overview of the parameter customization function

At the factory the SJ-301 has been set up so that only the most popular four parameters Ra, Ry, Rz, and Rq among others, can be calculated and displayed to save time and button operations otherwise involved in calculating/displaying unnecessary parameters. If other parameters than the four above need to be calculated and displayed on the screen, the operator simply specify the required parameters with the customization function.

Standard	JIS'82		JIS'94		JIS'01		ISO		ANSI		DIN		ALL		
Parameter	P	R	P	R	P	R	P	R	P	R	P	R	DIN 4776	MOTIF .R	MOTIF .W
Ra	Ra	Ra	Pa	Ra	Pa	Ra	Pa	Ra	Pa	Ra	Pa	Ra	-	-	-
Ry	Ry	Ry	Py	Ry	-	-	-	-	Py	Ry	Py	Ry	-	-	-
Rz	Rz	Rz	Pz	Rz	Pz	Rz	Pz	Rz	Pz	Rz	Pz	Rz	-	-	-
Rq	Rq	Rq	Pq	Rq	Pq	Rq	Pq	Rq	Pq	Rq	Pq	Rq	-	-	-
Rt	Rt	Rt	Pt	Rt	Pt	Rt	Pt	Rt	Pt	Rt	Pt	Rt	-	-	-
Rp	Rp	Rp	Pp	Rp	Pp	Rp	Pp	Rp	Pp	Rp	Pp	Rp	-	-	-
Rv	Rv	Rv	Pv	Rv	Pv	Rv	Pv	Rv	Pv	Rv	Pv	Rv	-	-	-
Sm	Sm	Sm	PSm	RSm	PSm	RSm	PSm	RSm	PSm	RSm	PSm	RSm	-	-	-
S	S	S	PS	RS	PS	RS	PS	RS	PS	RS	PS	RS	-	-	-
Pc	Pc	Pc	PPc	RPc	PPc	RPc	PPc	RPc	PPc	RPc	PPc	RPc	-	-	-
mr[c]	mr[c]	mr[c]	Pmr[c]	Rmr[c]	Pmr[c]	Rmr[c]	Pmr[c]	Rmr[c]	Ptp	Rtp	Pmr[c]	Rmr[c]	-	-	-
R3z	R3z	R3z	P3z	R3z	P3z	R3z	P3z	R3z	P3z	R3z	P3z	R3z	-	-	-
δc	δc	δc	Pδc	Rδc	Pδc	Rδc	Pδc	Rδc	PHtp	RHtp	Pδc	Rδc	-	-	-
HSC	HSC	HSC	Phsc	Rhsc	Phsc	Rhsc	Phsc	Rhsc	Phsc	Rhsc	Phsc	Rhsc	-	-	-
mr	mr	mr	Pmr	Rmr	Pmr	Rmr	Pmr	Rmr	Pmr	Rmr	Pmr	Rmr	-	-	-
Δa	Δa	Δa	PΔa	RΔa	PΔa	RΔa	PΔa	RΔa	PΔa	RΔa	PΔa	RΔa	-	-	-
Sk	Sk	Sk	Psk	Rsk	Psk	Rsk	Psk	Rsk	Psk	Rsk	Psk	Rsk	-	-	-
Ku	Ku	Ku	Pku	Rku	Pku	Rku	Pku	Rku	Pku	Rku	Pku	Rku	-	-	-
Δq	Δq	Δq	PΔq	RΔq	PΔq	RΔq	PΔq	RΔq	PΔq	RΔq	PΔq	RΔq	-	-	-
Lo	Lo	Lo	PLo	RLo	PLo	RLo	PLo	RLo	PLo	RLo	PLo	RLo	-	-	-
Ppi	Ppi	Ppi	Pppi	Rppi	Pppi	Rppi	Pppi	Rppi	Pppi	Rppi	Pppi	Rppi	-	-	-
Rk	-	-	-	-	-	-	-	-	-	-	-	-	Rk	-	-
Rpk	-	-	-	-	-	-	-	-	-	-	-	-	Rpk	-	-
Rvk	-	-	-	-	-	-	-	-	-	-	-	-	Rvk	-	-
Mr1	-	-	-	-	-	-	-	-	-	-	-	-	Mr1	-	-
Mr2	-	-	-	-	-	-	-	-	-	-	-	-	Mr2	-	-
A1	-	-	-	-	-	-	-	-	-	-	-	-	A1	-	-
A2	-	-	-	-	-	-	-	-	-	-	-	-	A2	-	-
Vo	-	-	-	-	-	-	-	-	-	-	-	-	Vo	-	-
W	-	-	-	-	-	-	-	-	-	-	-	-			W
AW	-	-	-	-	-	-	-	-	-	-	-	-		-	AW
R	-	-	-	-	-	-	-	-	-	-	-	-		R	-
AR	-	-	-	-	-	-	-	-	-	-	-	-		AR	-
Rx	-	-	-	-	-	-	-	-	-	-	-	-		Rx	-
Wx	-	-	-	-	-	-	-	-	-	-	-	-		-	Wx
Wte	-	-	-	-	-	-	-	-	-	-	-	-		-	Wte

P-parameter: parameter calculated from the primary profile

R-parameter: parameter calculated from the roughness profile

-
- NOTE**
- The definition of each parameter is given in section 14.5, “Definitions of the SJ-301 Roughness Parameters”.
 - If the Sm, Pc, or Ppi parameter is selected, the count level must also be set. For setting procedure refer to section 5.10.2, “Setting the calculation conditions when Sm, Pc, or Ppi is selected”.
 - If the mr[c] parameter is selected, the section level must also be set. For setting procedure refer to section 5.10.3, “Setting the calculation conditions if mr[c] is selected”.
 - If the mr parameter is selected, the number of sections, reference line, and section level must also be set. For setting procedure refer to section 5.10.4, “Setting the calculation conditions if mr is selected”.
 - If the δc parameter is selected, the reference line and section level must also be set. For setting procedure refer to section 5.10.5, “Setting the calculation conditions if δc is selected”.
 - If the HSC parameter is selected, the count level must also be set. For setting procedure refer to section 5.10.6, “Setting the calculation conditions if HSC is selected”.
-

■ The parameters and the measured profiles

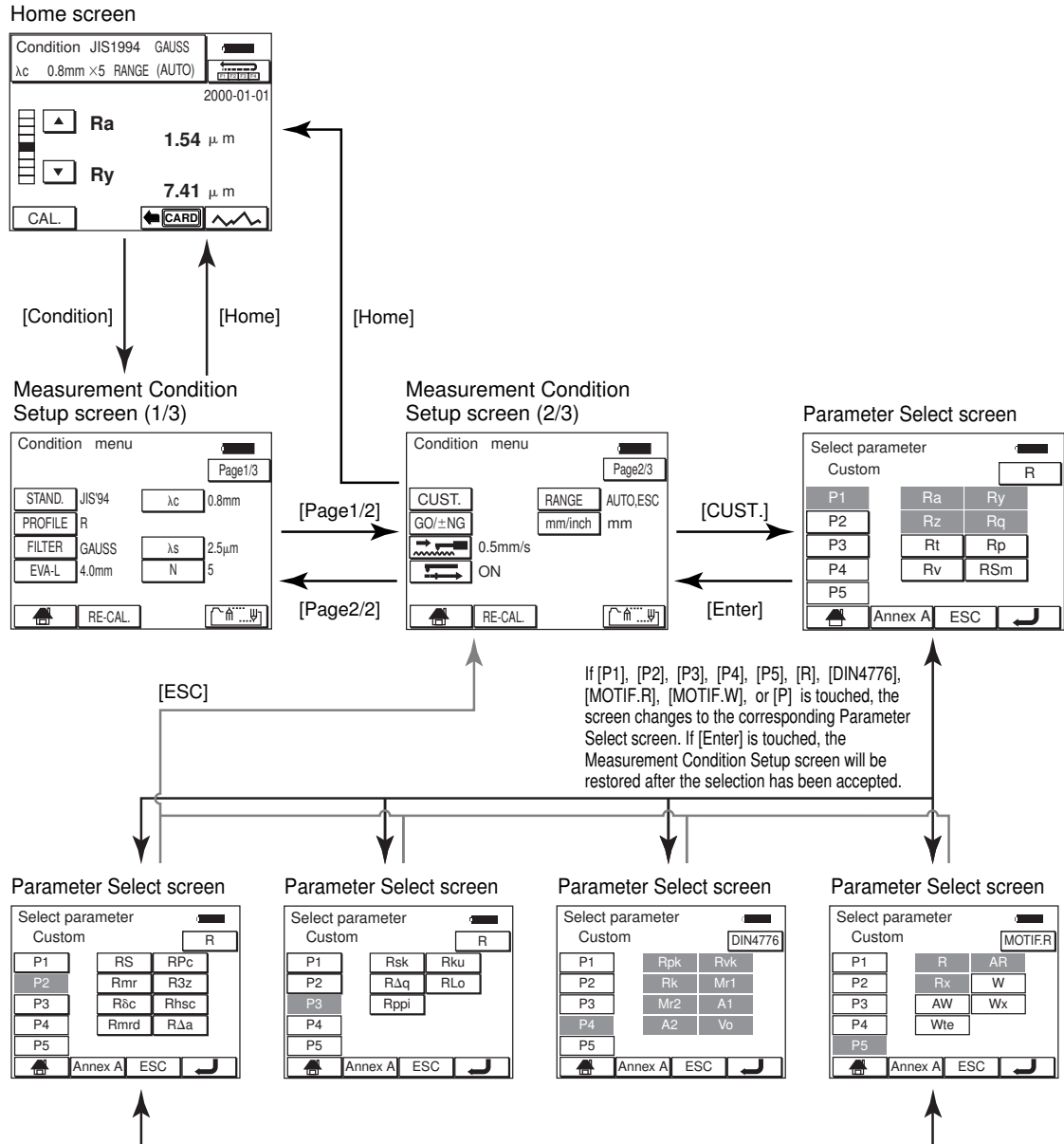
- Surface texture parameters must be specified for each measured profile. The parameters specified for a measured profile can be saved and called later by specifying the profile.
- These parameters are divided into five groups P1 through P5.
P1: Parameters (group 1)
P2: Parameters (group 2)
P3: Parameters (group 3)
P4: DIN4776 parameters
P5: Motif parameters

The parameters that can be selected for each measured profile are given in the following table.

Parameter group Measured profile	P1	P2	P3	P4	P5
P	Pa, Py Pz, Pq Pt, Pp Pv, PSm	PS, PPc Pmr[c], P3z Pδc, Phsc Pmr, PΔa	Psk, Pku PΔq, PLo Pppi		
R	Ra, Ry Rz, Rq Rt, Rp Rv, RSm	RS, RPc Rmr[c], R3z Rδc, Rhsc Rmr, RΔa	Rsk, Rku RΔq, RLo Rppi		
DIN4776				Rpk, Rvk Rk, Mr1 Mr2, A1 A2, Vo	
MOTIF.R					R, AR Rx
MOTIF.W					W, WA Wx, Wte

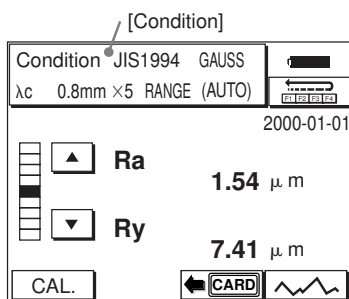
5. MODIFYING THE MEASUREMENT CONDITIONS

■ Transition of screens if the display parameters are selected



■ Selecting the parameter to be displayed

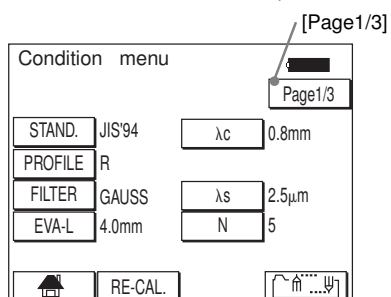
1 <Home screen>



Touch the [Condition] button in the Home screen.

⇒ The Measurement Condition Setup screen (1/3) will appear.

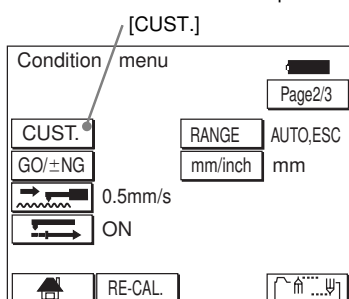
2 <Measurement Condition Setup screen>



Touch the [Page 1/3] button.

⇒ The Measurement Condition Setup screen (2/3) will appear.

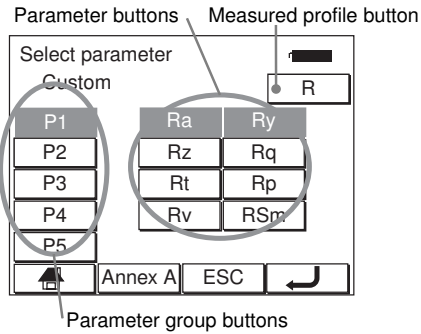
3 <Measurement Condition Setup screen (2/3)>



Touch the [CUST.] button.

⇒ The Parameter Select screen will appear.

4 <Parameter Select screen>



Touch the measured profile button as required until the desired profile appears in the button.

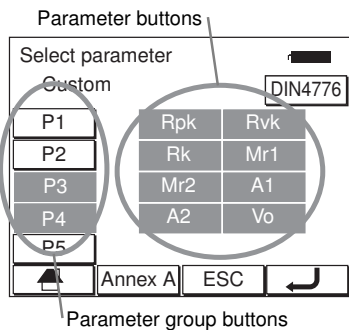
⇒ Each time the button is pressed, the measured profile is switched, the parameter group button corresponding to the profile is highlighted, and the parameter button display will also be switched.

- Parameters can be selected for each measured profile. If a measured profile is specified the parameters selected for that measured profile will be recalled.
- These parameters are divided into five groups P1 through P5.

P1: Parameters (group 1)
P2: Parameters (group 2)
P3: Parameters (group 3)
P4: DIN4776 parameters
P5: Motif parameters

TIP The screen shown in step 5 at the left is an example of a DIN4776-profile.

5 <Parameter Select screen>



Touch the button of a desired parameter

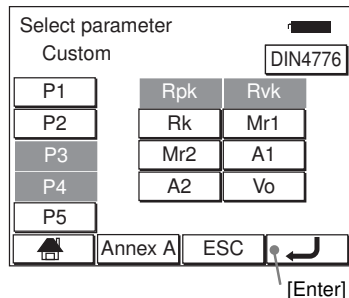
⇒ The touched parameter button will be highlighted. If it is touched again, it will be de-highlighted.

TIP Parameter groups can be switched by touching the parameter group buttons.

⇒ If the parameter group is switched over, the parameters available in the selected group will be displayed on the parameter buttons.

For more information refer to "■ The parameters and the measured profiles".

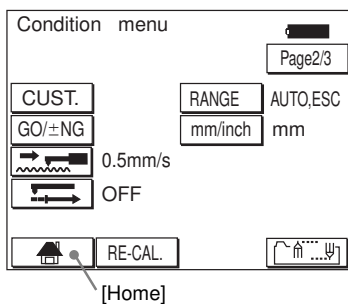
6 <Parameter Select screen>



If all the parameters to be set are highlighted, touch the [Enter] button to accept the selected parameters.

⇒ The Measurement Condition Setup screen (2/3) is restored.

7 <Measurement Condition Setup screen (2/3)>

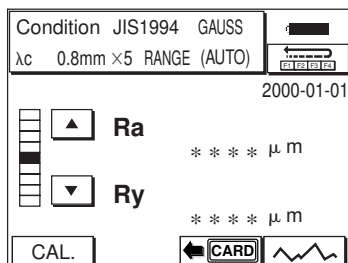


Touch the [Home] button.

⇒ The Home screen is restored.



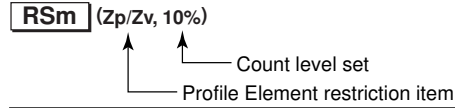
<Home screen>



5.10.2 Setting the calculation conditions when Sm, Pc, or Ppi is selected

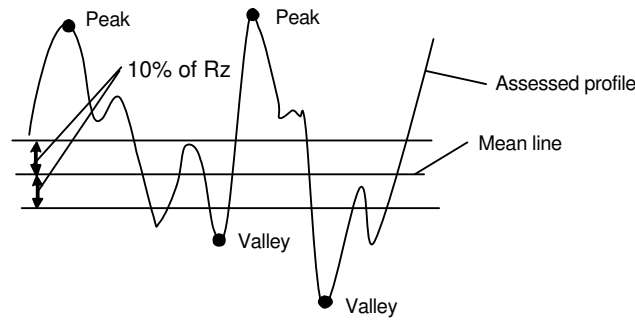
If the Sm, Pc, or Ppi parameter is selected, it is necessary to set the count level.
Also, it is possible to set the definition of Profile Element restriction items.

TIP The set calculation condition such as a count level is displayed on the Home screen as illustrated below.

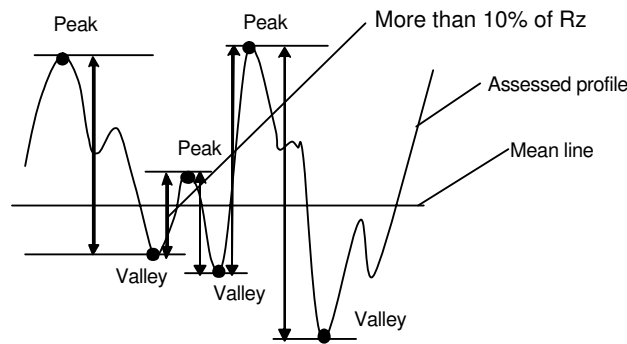


Definition of Profile Element restriction items

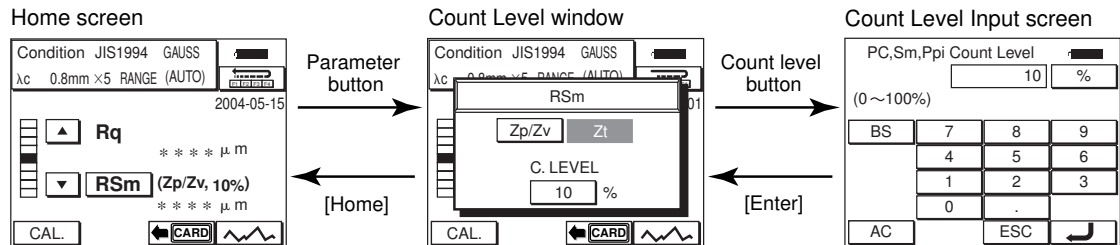
(1) Z_p/Z_v : $Z_p > Z_{min}$, $Z_v > Z_{min}$ $Z_{min} = 10\%$ of R_z



(2) Z_t/Z_t : $Z_t > Z_{min}$ $Z_{min} = 10\%$ of R_z

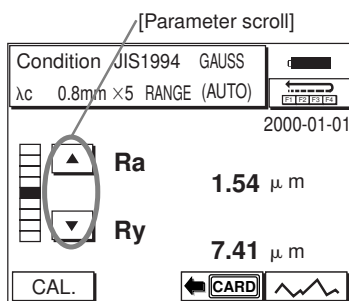


■ Transition of screens if the calculation conditions are set for Sm, Pc, or Ppi



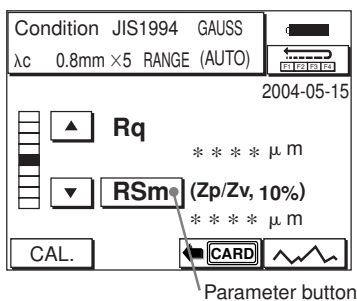
■ Count Level Setup procedure

1 <Home screen>



Touch the [Parameter scroll] button in the Home screen several times until the parameter (Sm, Pc or Ppi) appears in the button, for which the calculation condition is to be set.

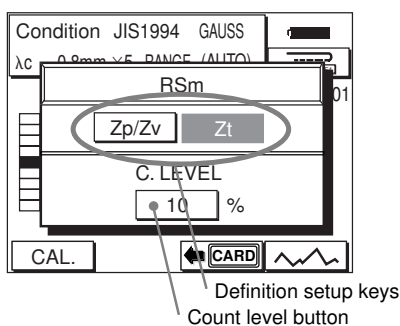
2 <Home screen>



Touch the displayed parameter button.

⇒ The Count Level Setup window will appear.

3 <Count Level window>

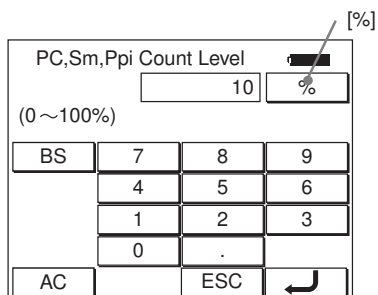


To change the definition of a Profile Element restriction item, touch the Definition Setup key on the touch panel.

To set a count level, touch the Count Level key.

⇒ The Count Level Input screen will appear.

4 <Count Level Input screen>



To modify the count level unit, touch the [%] button. Each time this button is touched, the unit will toggle between [%] and [μm].

The explanation given here assumes that the [%] unit is used.

5 <Count Level Input screen>

Count level input field

[Enter]

Enter the count level in the count level input field, and touch the [Enter] button.

The input range is as follows:

0 to 100% (in 1% increments)

0.0 to 999.9 μm (in 0.1 μm increments)

TIP For information about inputting numeric values refer to “■ Inputting numeric values” in section 2.2, “Outline of the Touch Panel”.

⇒ Returns to the Count Level Display window.

6 <Count Level window>

Title bar

Touch the title bar in the Count Level Display window to accept the selected calculation condition.

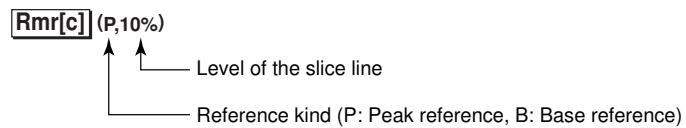
⇒ The Home screen will be restored.

<Home screen>

5.10.3 Setting the calculation conditions if mr[c] is selected

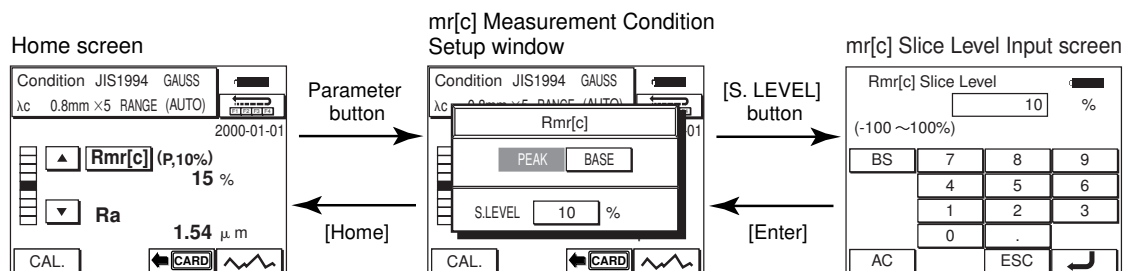
If the parameter mr[c] is selected, the slice level must also be set as a calculation condition.

TIP The set calculation condition is displayed on the Home screen as illustrated below.



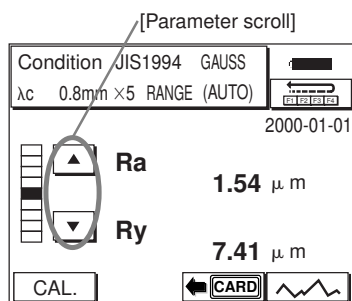
NOTE For the peak reference, set the slice level between 0 and 100% or 0 and 999.9 μ m. If the minus value is entered, the slice level is automatically set at 0% or 0 μ m.

■ Transition of screens if the calculation conditions are set for mr[c]



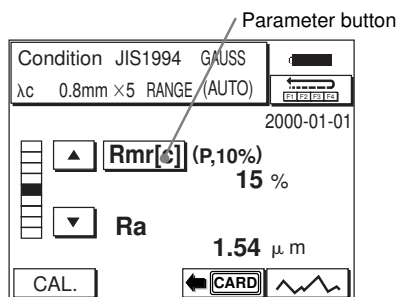
■ Setting up mr calculation condition

1 <Home screen>



Touch the [Parameter scroll] button in the Home screen one or more times until the parameter (mr[c]) appears in the button, for which the calculation condition is to be set.

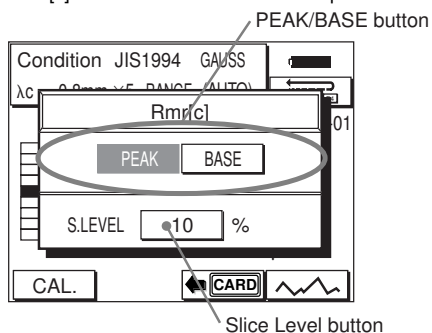
2 <Home screen>



Touch the displayed parameter button.

⇒ The mr Measurement Condition Setup window will appear.

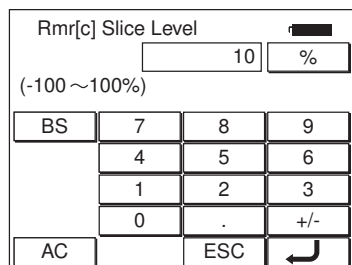
3 <mr[c] Measurement Condition Setup window>



If using the peak reference, touch the [PEAK] button, then touch the [S.LEVEL] button. (To use the base reference, touch the [BASE] button, then touch the [S.LEVEL] button.)

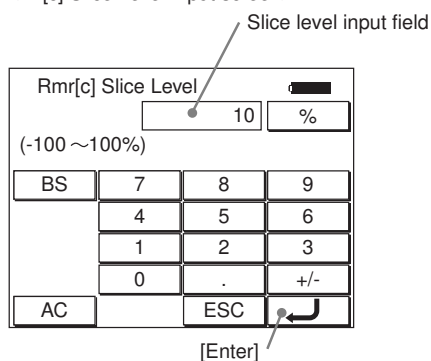
⇒ The mr Slice Level Input screen will appear.

4 < (mr[c] Measurement Condition) Slice Level Input screen>



To change the unit of cutoff levels, touch the [%] key. Each time the key is touched, the unit is switched to either [%] or [mm]. This section is described assuming that [%] is specified as the unit.

5 <mr[c] Slice Level Input screen>



Enter a value in the slice level input field, and touch the [Enter] button.

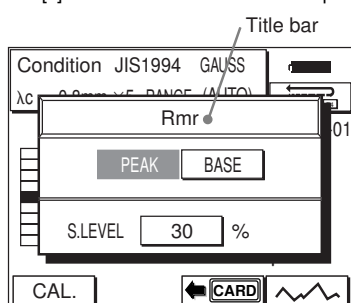
The input range is as follows:

- 100 to 100% (in 1% increments)
- 999.9 to 999.9 μ m (in 0.1 μ m increments)

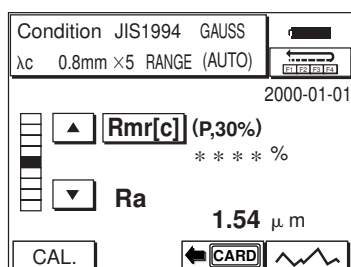
TIP For information about inputting numeric values refer to “■ Inputting numeric values” in section 2.2, “Outline of the Touch Panel”.

NOTE For the peak reference, set the slice level between 0 and 100% or 0 and 999.9 μ m. If the minus value is entered, the slice level is automatically set at 0% or 0 μ m.

6 <mr[c] Measurement Condition Setup window>



<Home screen>



⇒ Returns to the mr[c] Measurement Condition Setup window.

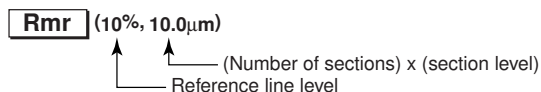
Touch the title bar in the mr[c] Measurement Condition Setup window to accept the selected calculation condition.

⇒ The Home screen will be restored.

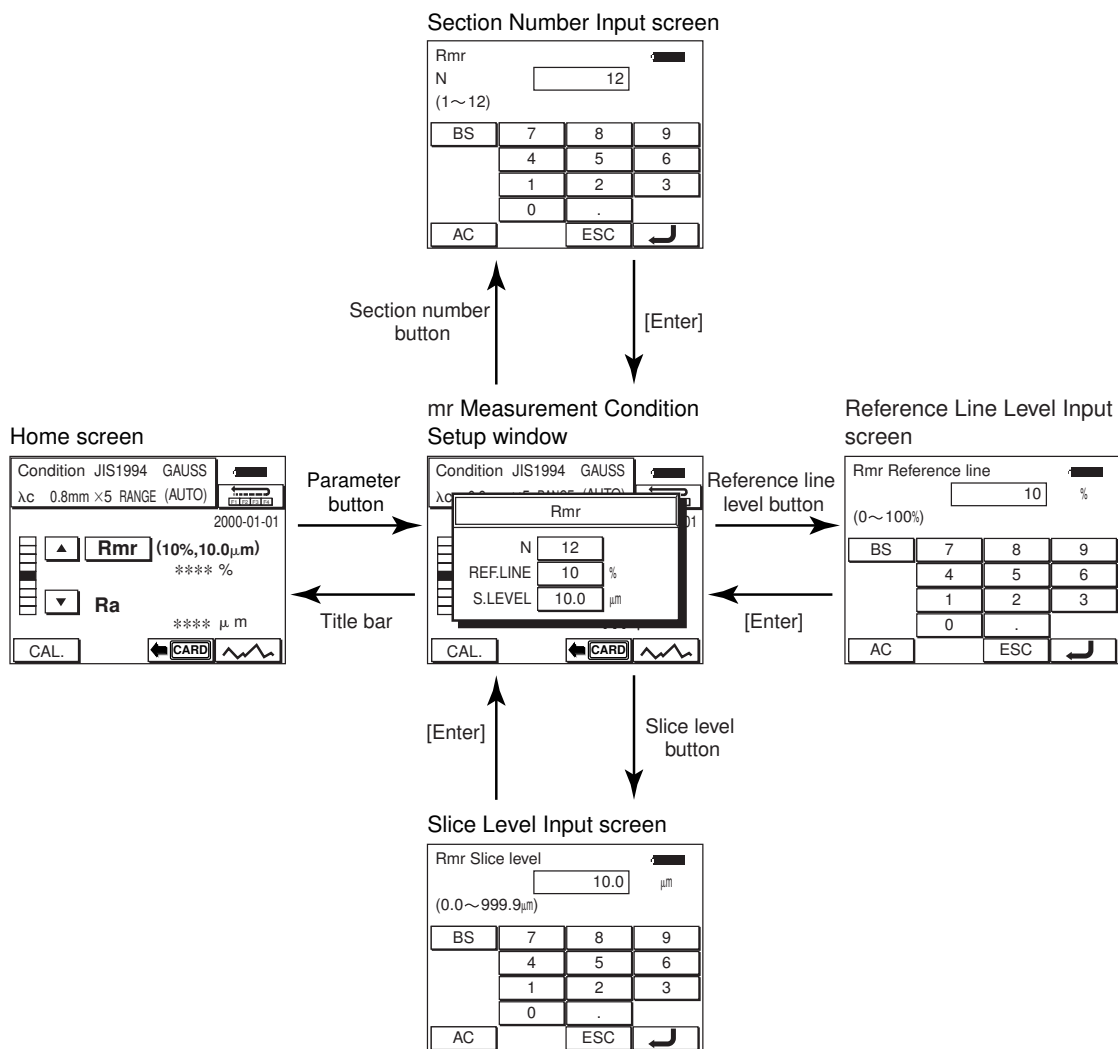
5.10.4 Setting the calculation conditions if mr is selected

If the parameter mr is selected, the number of sections, reference line, and section level must also be set.

TIP Parameter mr can be displayed for the number of sections that has been set. Also, the set calculation conditions are displayed on the Home screen as illustrated below.

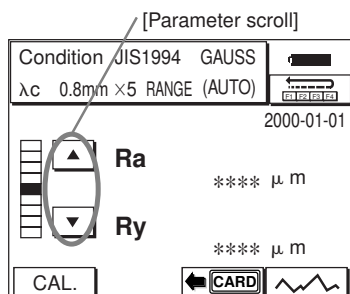


■ Transition of screens if the calculation conditions are set for mr



■ Setting up mrd calculation condition

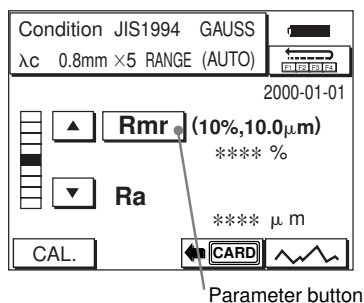
1 <Home screen>



Touch the [Parameter scroll] button in the Home screen one or more times until the parameter (mr) appears in the button, for which the calculation condition is to be set.

Multiple number of parameters (mr) are displayed. If the calculation condition is set for one mrd, it will be applied to all mr parameters.

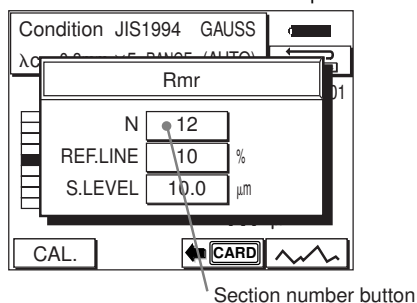
2 <Home screen>



Touch the displayed parameter button.

⇒ The mr Measurement Condition Setup window will appear.

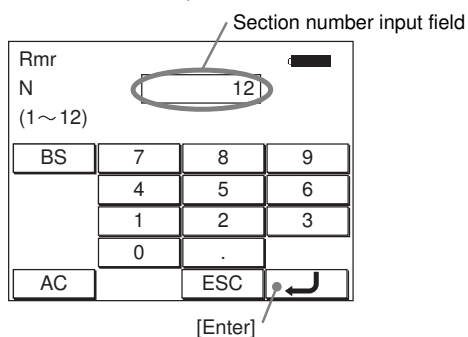
3 <mr Measurement Condition Setup window>



Touch the section number button.

⇒ The Section Number Input screen will appear.

4 <Section Number Input screen>



Enter the number of sections in the section number input field, then touch the [Enter] button.

The input range is as follows:

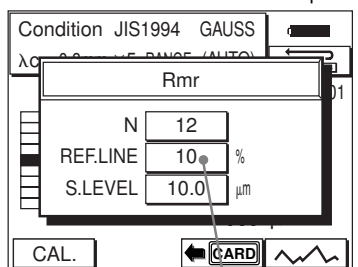
1 to 12

TIP

For information about inputting numeric values refer to "■ Inputting numeric values" in section 2.2, "Outline of the Touch Panel".

⇒ Returns to the mr Measurement Condition Setup window.

5 <mr Measurement Condition Setup window>

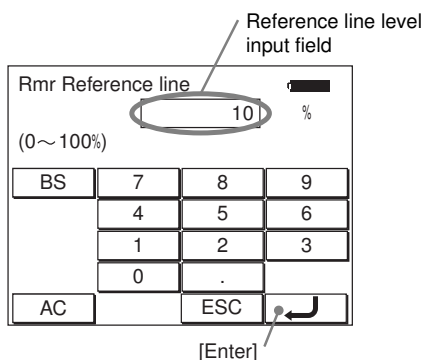


Reference line level button

Touch the reference line level button.

⇒ The Reference Line Level Input screen will appear.

6 <Reference Line Level Input screen>



Enter the reference line level in the reference line level input field, then touch the [Enter] button.

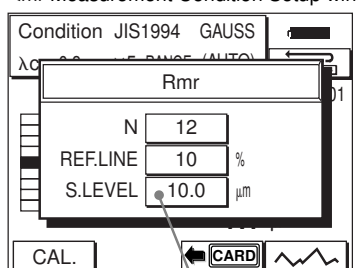
The input range is as follows:

0 to 100% (in 1% increments)

TIP For information about inputting numeric values refer to “■ Inputting numeric values” in section 2.2, “Outline of the Touch Panel”.

⇒ Returns to the mr Measurement Condition Setup window.

7 <mr Measurement Condition Setup window>

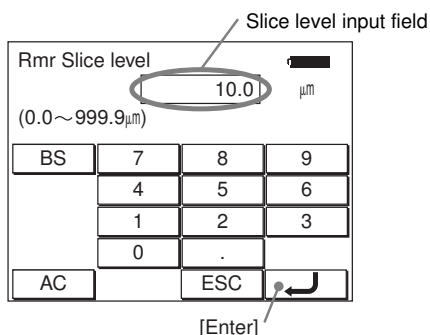


Slice level button

Touch the slice level button.

⇒ The Slice Level Input screen will appear.

8 <Slice Level Input screen>



Enter the slice level in the Slice level input field, then touch the [Enter] button.

The input range is as follows:

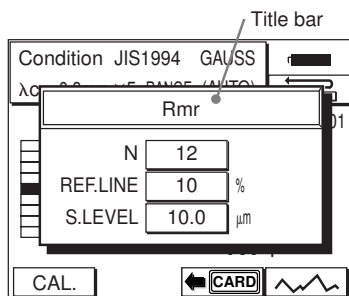
0.0 to 999.9μm (in 0.1μm increments)

0 to 9999μm (in 1μm increments)

TIP For information about inputting numeric values refer to “■ Inputting numeric values” in section 2.2, “Outline of the Touch Panel”.

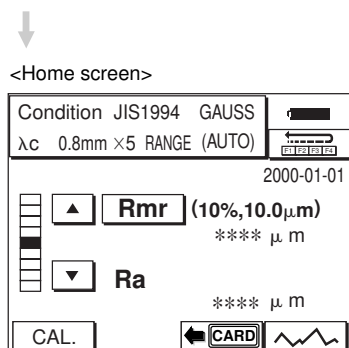
⇒ Returns to the mr Measurement Condition Setup window.

9 <mr Measurement Condition Setup window>



Touch the title bar in the mr Measurement Condition Setup window to accept the selected calculation condition.

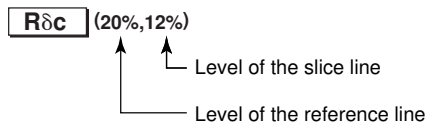
⇒ The Home screen will be restored.



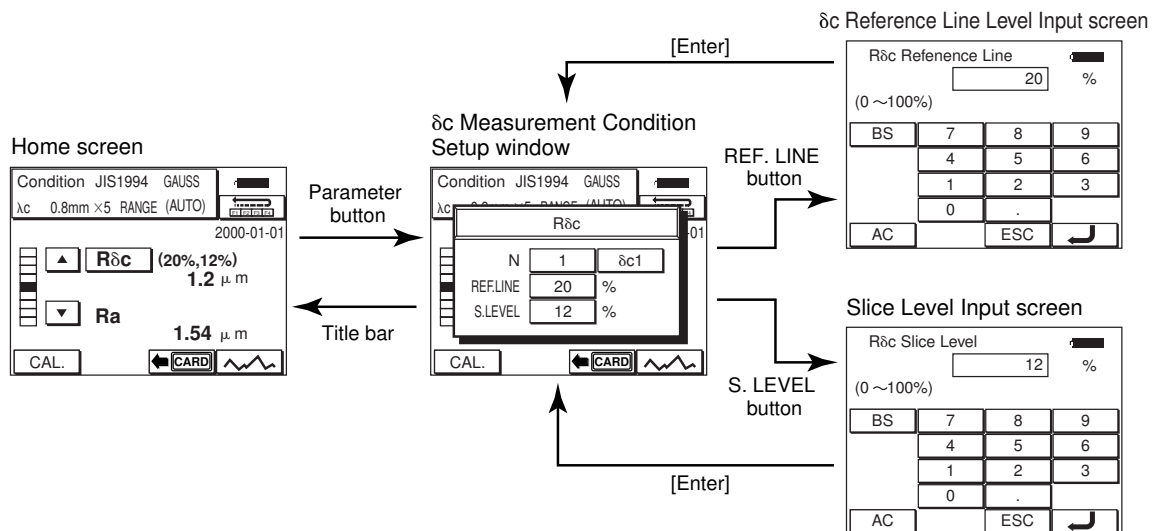
5.10.5 Setting the calculation conditions if δc is selected

If the parameter δc is selected, the reference line and section level, must also be set.

TIP The calculation conditions specified are displayed on the Home screen as illustrated below.

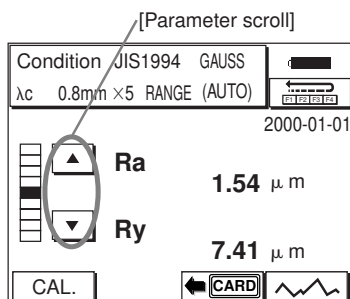


■ Transition of screens during setting the calculation conditions for δc



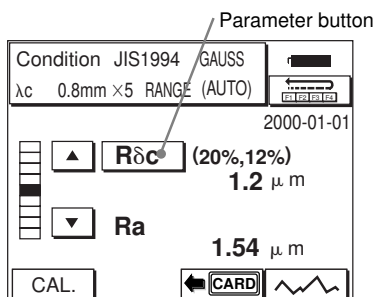
■ Setting up δc calculation conditions

1 <Home screen>



Touch the [Parameter scroll] button in the Home screen one or more times until the parameter $R\delta c$ appears in the button, for which the calculation condition is to be set.

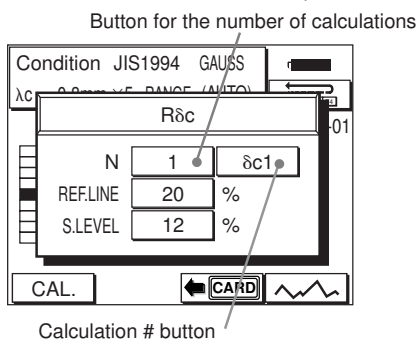
2 <Home screen>



Touch the displayed parameter button.

⇒ The δc Measurement Condition Setup window will appear.

3 < δc Measurement Condition Setup window>

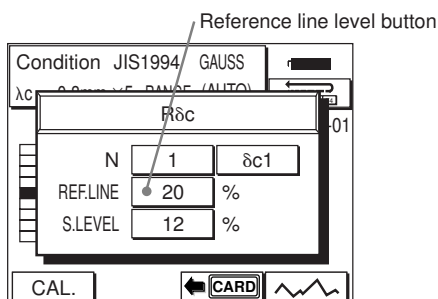


Touch the N button until the desired number of calculations appears. Each time the button is touched, the number will increase by one. A maximum of three calculation results can be set.

TIP

- If multiple (2 or 3) calculation results are specified, set the reference line and section level for each.
- Each calculation condition specified is represented by the calculation # button ($\delta c1$, $\delta c2$, $\delta c3$) next to the number of calculation (1, 2, 3) button.
- If multiple (2 or 3) calculation results are specified, set the reference line and section level starting with $\delta c1$.

4 < δc Measurement Condition Setup window>



Touch the REF. LINE level button.

⇒ The δc Reference Line Level Input screen will appear.

5 <δc Reference Line Level Input screen>

Reference line level input field

Rδc Reference Line %
(0 ~100%)

BS	7	8	9
	4	5	6
	1	2	3
	0	.	
AC		ESC	

[Enter]

Enter the level of the reference line in the reference line level input field, and touch the [Enter] button.

The input range is as follows:

0 to 100% (in 1% increments)

TIP For information about inputting numeric values refer to “■ Inputting numeric values” in section 2.2, “Outline of the Touch Panel”.

⇒ Returns to the δc Measurement Condition Setup for window.

6 <δc Measurement Condition Setup window>

Condition JIS1994 GAUSS

λC 0.000000 RANGE (AUTO)

Rδc

N δc1

REF.LINE %

S.LEVEL %

CAL.

S. LEVEL button

Touch the S. LEVEL button.

⇒ The Slice Level Input screen will appear.

7 <Slice Level Input screen>

Slice level input field

Rδc Slice Level %
(0 ~100%)

BS	7	8	9
	4	5	6
	1	2	3
	0	.	
AC		ESC	

[Enter]

Enter the slice level in the slice level input field, and touch the [Enter] button.

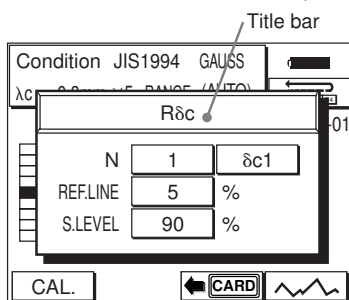
The input range is as follows:

0 to 100% (at 1% increments)

TIP For information about inputting numeric values refer to “■ Inputting numeric values” in section 2.2, “Outline of the Touch Panel”.

⇒ Returns to the δc Measurement Condition Setup window.

8 <δc Measurement Condition Setup window>

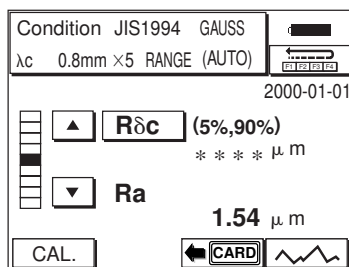


Touch the title bar in the δc Measurement Condition Setup window to accept the selected calculation condition.

⇒ The Home screen will be restored.



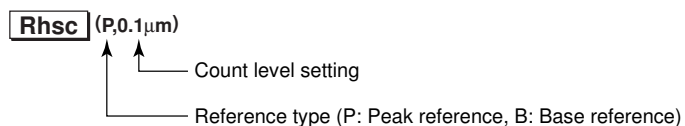
<Home screen>



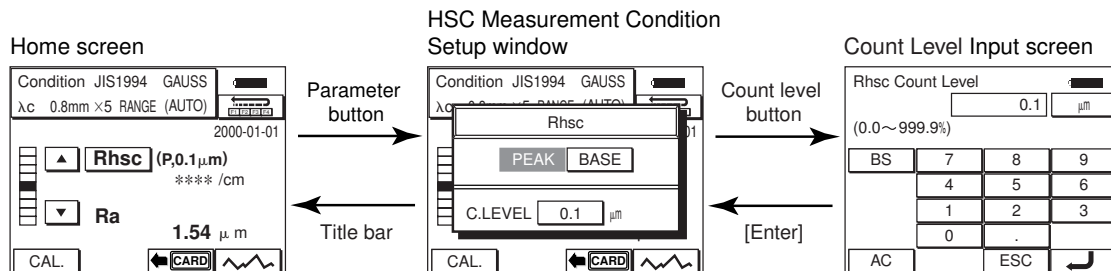
5.10.6 Setting the calculation conditions if HSC is selected

If the parameter HSC is selected, the count level must also be set as a calculation condition.

TIP The set calculation condition is displayed on the Home screen as illustrated below.

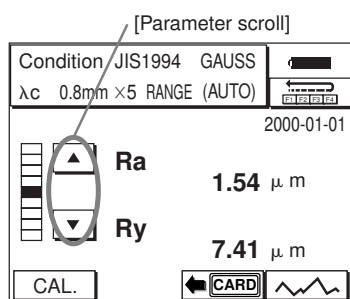


■ Transition of screens if the calculation conditions are set for HSC



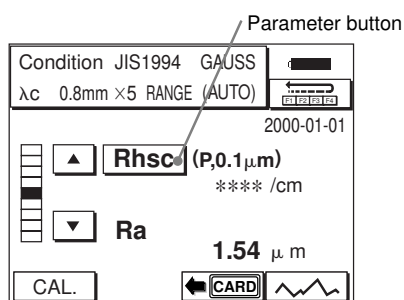
■ Setting up HSC calculation condition

1 <Home screen>



Touch the [Parameter scroll] button in the Home screen one or more times until the parameter (HSC) appears in the button, for which the calculation condition is to be set.

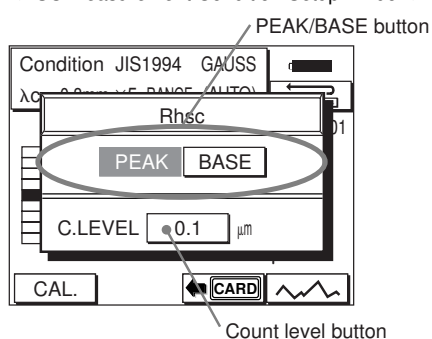
2 <Home screen>



Touch the displayed parameter button.

⇒ The HSC Measurement Condition Setup window will appear.

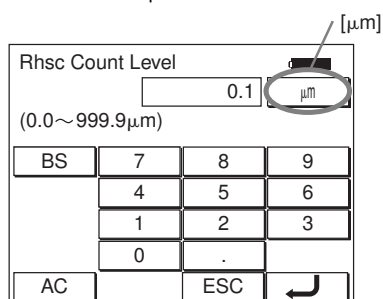
3 <HSC Measurement Condition Setup window>



If using the peak reference, touch the [PEAK] button, then touch the count level button. (To use the base reference, touch the [BASE] button, then touch count level button.)

⇒ The Count Level Input screen will appear.

4 <Count Level Input screen>



If the unit of count level is to be changed, touch the [μm] ([μin]) button. Each time this button is touched, the unit is toggled between [μm] ([μin]) and [%].

Here, the procedure is explained using [μm] ([μin]) for the unit of count level.

5 <Count Level Input screen>

Count level input field

Rhsc Count Level

0.1 μm

(0.0~999.9 μm)

BS	7	8	9
	4	5	6
	1	2	3
	0	.	

AC ESC

[Enter]

Enter a value in the count level input field, and touch the [Enter] button.

The input range is as follows:

- 0 to 100% (in 1% increments)
- 0.0 to 999.9 μm (in 0.1 μm increments)
- 0 to 99999 μin (in 1 μin increments)

TIP For information about inputting numeric values refer to “■ Inputting numeric values” in section 2.2, “Outline of the Touch Panel”.

⇒ Returns to the HSC Measurement Condition Setup window.

6 <HSC Measurement Condition Setup window>

Title bar

Condition JIS1994 GAUSS

λc 0.8mm x5 RANGE (AUTO)

Rhsc

PEAK BASE

S.LEVEL 0.5 μm

CAL. CARD

Touch the title bar in the HSC Measurement Condition Setup window to accept the selected calculation condition.

⇒ The Home screen will be restored.

↓

<Home screen>

Condition JIS1994 GAUSS

λc 0.8mm x5 RANGE (AUTO)

2000-01-01

▲ Rhsc (P,0.5 μm) **** /cm

▼ Ra 1.54 μm

CAL. CARD

5.10.7 Setting the calculation conditions when selecting a profile motif (MOTIF.R/MOTIF.W)

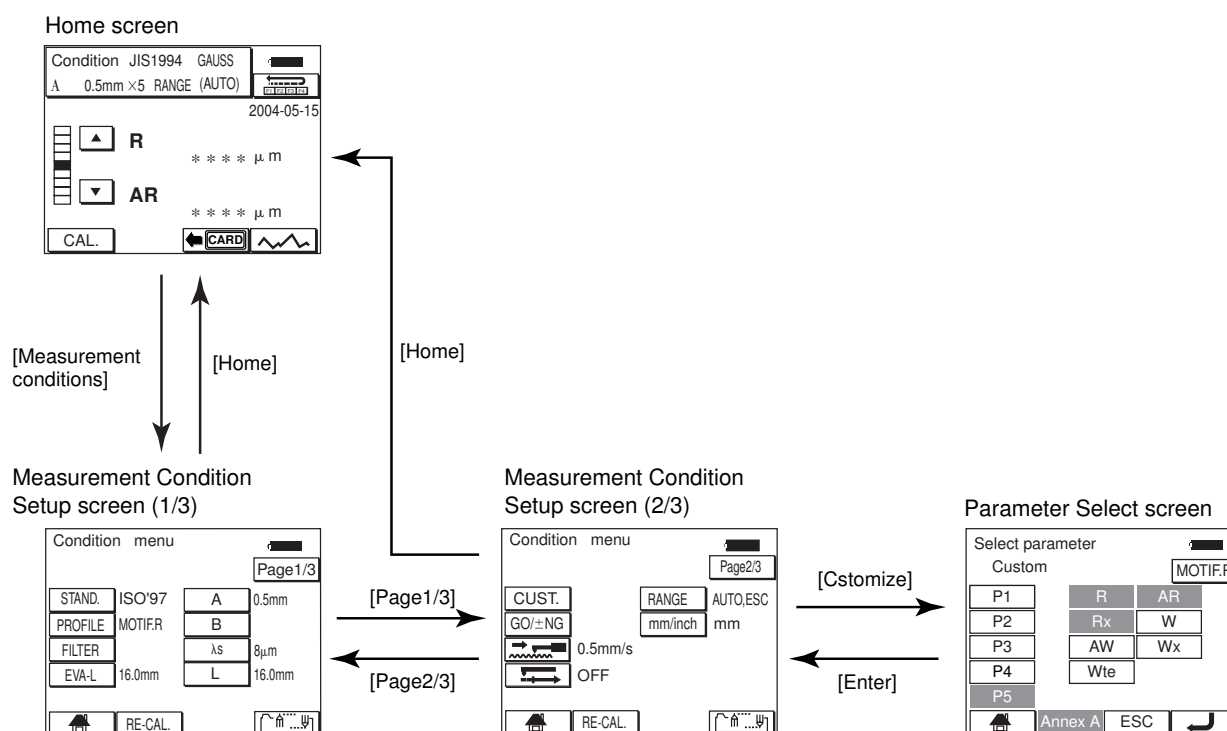
The SJ-301 can use either ISO 12085 Main Body compatible method or ISO 12085 Annex A compatible method for the motif connection method when selecting a profile motif (MOTIF.R/MOTIF.W).

TIP Setting-up of the motif connection method is made in the Parameter Select screen. If other than a profile motif is selected, the connection method setup is invalidated.

Annex A : ISO 12085 Standard Annex A compatible connection method

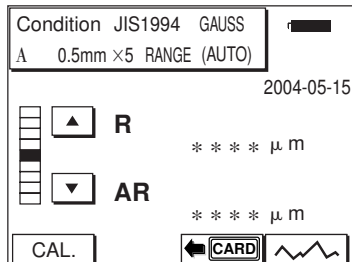
Annex A : ISO 12085 Standard Body compatible connection method

■ Screens displayed when setting the motif connection method



■ Operating procedure

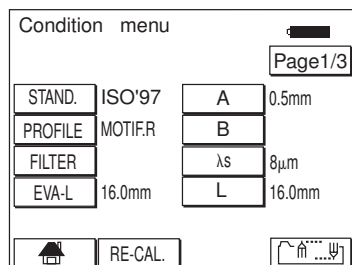
1 <Home screen>



Touch the [Measurement Conditions] button in the Home screen.

⇒ The Measurement Condition Setup screen (1/3) will appear.

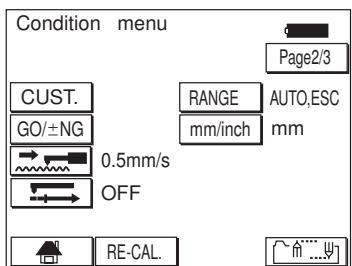
2 <Measurement Condition Setup screen (1/3) >



Touch the [Page 1/3] button.

⇒ The Measurement Condition Setup screen (2/3) will appear.

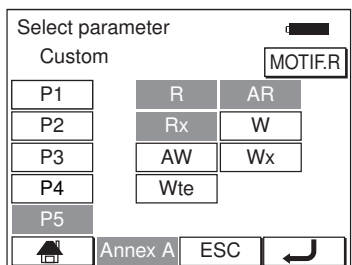
3 <Measurement Condition Setup screen (2/3) >



Touch the [Customize] button.

⇒ The Parameter Select screen will appear.

4 <Parameter Select screen>



Touch the [Connection Method Setup] button on the Parameter Setup window.

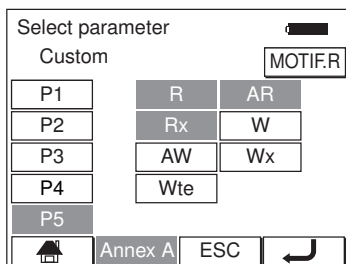
⇒ The connection method will be set.

Annex A : ISO 12085 Standard Annex A compatible connection method

Annex A : ISO 12085 Standard Body compatible connection method

NOTE If a measured profile is other than a motif, the connection method setup will be invalidated.

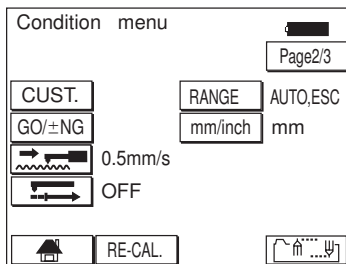
5 <Parameter Select screen>



Touch the [Enter] button to accept the setting.

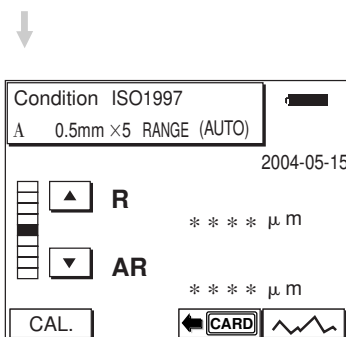
⇒ After the parameter and the motif connection method have been entered, the Measurement Condition Setup screen (2/3) is restored.

6 <Measurement Condition Setup screen (1/3) >



Touch the [Home] button.

⇒ The Home screen is restored.



5. MODIFYING THE MEASUREMENT CONDITIONS

5.11 Setting the GO/NG Judgment Function

The SJ-301 is capable of performing GO/NG judgment on the surface texture of the objective workpiece.

One of the three patterns: Mean/16%/Max rules can be selected as the tolerancing rule of the GO/NG judgment function.

A maximum of three parameters can be specified for the GO/NG judgment function.

■ GO/NG judgment result display

If the GO/NG judgment function is operating, the measurement data will be compared with its upper and lower tolerance limits. If the measurement falls outside the limits, it is highlighted and indicated with either "↑" (above the upper limit) or "↓" (below the lower limit). If the measurement is within the tolerance limits, a 'O' will be displayed.

The screenshot shows the measurement interface of the SJ-301. At the top, it displays 'Condition JIS1994 GAUSS' and 'λc 0.8mm X5 RANGE (AUTO)'. Below this, the date '2000-01-01' is shown. The main display area shows two parameters: 'Ra' with a value of '1.54 μm' and 'Ry' with a value of '7.41 μm'. Both values are followed by a circle 'O'. To the left of these values are vertical bar indicators with up and down arrows. At the bottom, there are buttons for 'CAL.' and 'CARD', along with a waveform icon.

The circle indicates that the measurement is within the tolerance limits.
("↑": Above the UL, "↓": Below the LL)

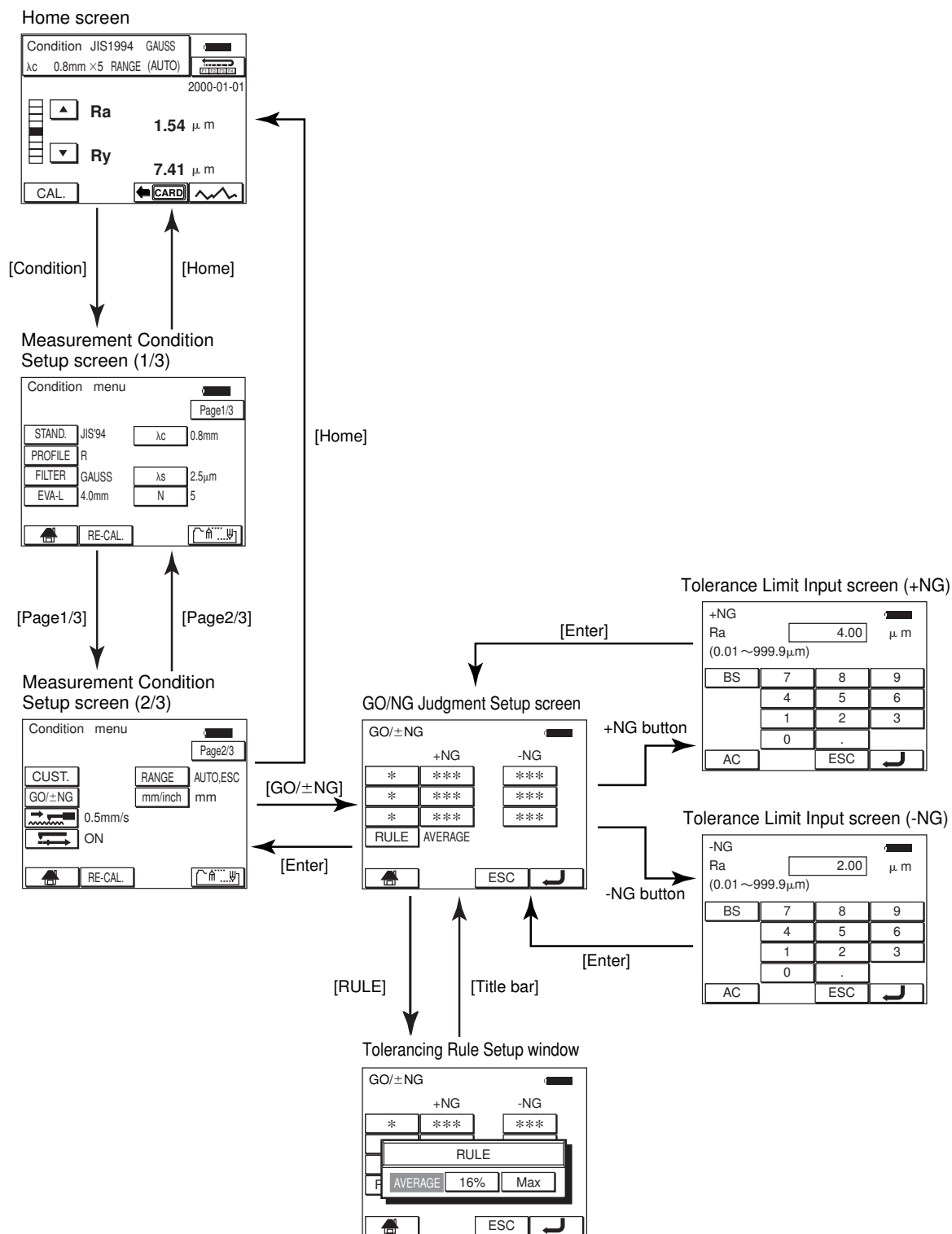
■ Tolerancing rule for GO/NG judgment

The SJ-301 can set the tolerancing rule of the GO/NG judgment function to either of Mean rule, 16% rule, or Max rule.

IMPORTANT The tolerancing rules of the GO/NG judgment function apply only to the parameters for which to obtain measurements for each sampling length within the evaluation range or determine an arithmetic mean of those measurements.

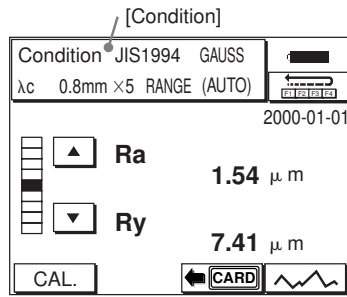
- Mean rule:** This rule decides Go or No-Go judgment through size comparison between a parameter value, determined as an arithmetic mean of measurements obtained for each sampling length within the evaluation range, and the upper/lower limit value.
- 16% rule:** For this rule, measurements are obtained for each sampling length within the evaluation range and compared with the upper/lower limit value. The probability of out-of-tolerance is obtained by dividing the number of out-of-tolerance measurements by the number of measurements obtained for each sampling length. This rule assumes as GO if the obtained probability is 16% or less and NG if the probability exceeds 16%.
- Max rule:** For this rule, measurements are obtained for each sampling length within the evaluation range and compared with the upper limit value. This rule assumes as NG if there is any measurement that exceeds the upper limit value. According to this rule, the lower limit value setting is invalidated.

■ Transition of screens if the GO/NG judgment function is set



■ GO/NG judgement setting up procedure

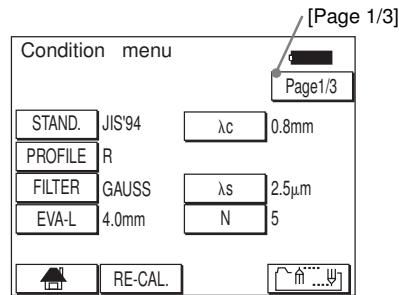
1 <Home screen>



Touch the [Condition] button in the Home screen.

⇒ The Measurement Condition Setup screen (1/3) will appear.

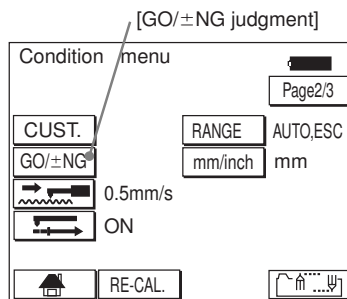
2 <Measurement Condition Setup screen (1/3) >



Touch the [Page 1/3] button.

⇒ The Measurement Condition Setup screen (2/3) will appear.

3 <Measurement Condition Setup screen (2/3)>



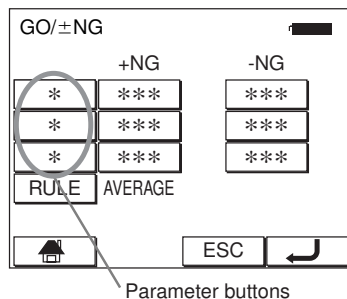
Touch the [GO/±NG judgment] button.

⇒ The GO/NG Judgment Function Setup screen will appear.

NOTE

- If the GO/NG judgment function has already been set, the objective parameter name and its setting values will be displayed.
- If “*” is displayed for a parameter button, nothing has been set for it.
- If “***” is displayed for either the upper limit value (+NG) or lower limit value (-NG) button, nothing has been set for it.

4 <GO/NG Judgment Setup screen>



Switch the current parameters to parameters for which the tolerance limits are to be set. Touch any parameter button to switch to the corresponding parameter (customized parameter).

If the parameters for which the tolerance limits are to be set are being displayed, proceed directly to step 5.

5 <GO/NG Judgment Setup screen>

Tolerance limit buttons

Touch the tolerance limit buttons. Touch the +NG button or -NG button to set the upper limit or lower limit, respectively.

⇒ The Tolerance Limit Input screen will appear.

6 <Tolerance Limit Input screen (+NG)>

[Enter]

Input the UL or LL in the tolerance limit input field, then touch the [Enter] button.

TIP For information about inputting numeric values refer to “■ Inputting numeric values” in section 2.2, “Outline of the Touch Panel”.

⇒ Returns to the GO/NG Judgment Function Setup screen.

7 <GO/NG Judgment Setup screen>

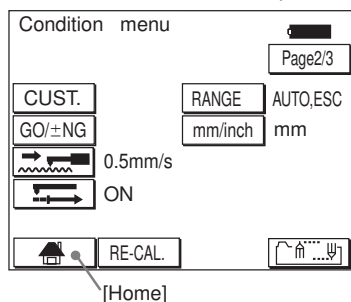
[Enter]

If the tolerance limit setting operation is to be continued for other parameters, repeat from step 4 on the previous page.

To terminate the GO/NG judgment function setting operation, touch the [Enter] button to accept the GO/NG judgment criteria.

⇒ Returns to the Measurement Condition Setup screen.

8 <Measurement Condition Setup screen>

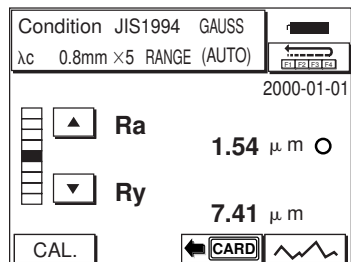


Touch the [Home] button.

⇒ The Home screen restores.



<Home screen>

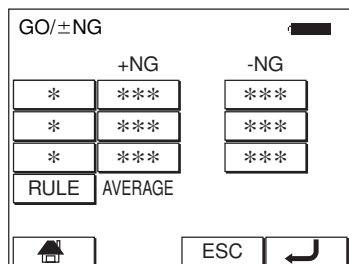


● How to cancel the GO/NG judgment function

Repeatedly touch any of the parameter buttons in the GO/NG Judgment Function Setup screen until “*” is displayed. The tolerance limits for the corresponding parameter will be canceled.

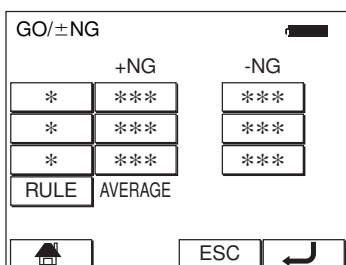
If a “*” is displayed for all the three parameter buttons, the GO/NG judgment function is not set.

<GO/NG Judgment Setup screen>



● Setting a tolerancing rule

1 <GO/NG judgment Setup screen>

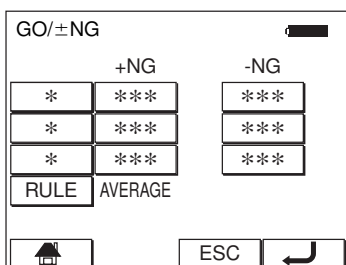


The screen displays a table for setting tolerancing rules. The title is "GO/±NG". Below the title, there are two columns: "+NG" and "-NG". Each column has three rows of asterisks (*). Below the asterisks, there are two buttons: "RULE" and "AVERAGE". At the bottom, there are three buttons: a home icon, "ESC", and a right arrow.

Touch the [Rule] button.

⇒ The Tolerancing Rule Setup window will appear.

2 <Tolerancing Rule Setup window>

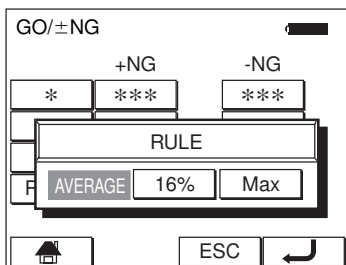


The screen displays the Tolerancing Rule Setup window. It has the same layout as the previous screen, with the title "GO/±NG", two columns of asterisks for "+NG" and "-NG", and buttons for "RULE" and "AVERAGE". At the bottom, there are three buttons: a home icon, "ESC", and a right arrow.

Touch a tolerancing rule button to be set.

⇒ The touched tolerancing rule button is highlighted.

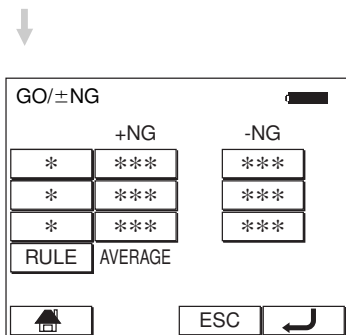
3 <Tolerancing Rule Setup window>



The screen displays the Tolerancing Rule Setup window. A selection box is shown over the "RULE" button. The selection box contains the text "RULE" and "AVERAGE 16% Max". At the bottom, there are three buttons: a home icon, "ESC", and a right arrow.

Touch the title bar on the Tolerancing Rule Setup window to accept the selected tolerancing rule.

⇒ The Tolerancing Rule Setup window will be closed.



The screen displays the GO/NG judgment Setup screen after the rule selection. The layout is the same as the first screen, with the title "GO/±NG", two columns of asterisks for "+NG" and "-NG", and buttons for "RULE" and "AVERAGE". At the bottom, there are three buttons: a home icon, "ESC", and a right arrow.

5.12 Setting the Drive Unit

The SJ-301 can use the front escape type drive unit and lateral type drive unit in addition to the standard drive unit. The lateral type drive unit can be used under the standard settings. Since these drive units have different approach lengths, perform the drive unit setup (the entrance length) as follows.

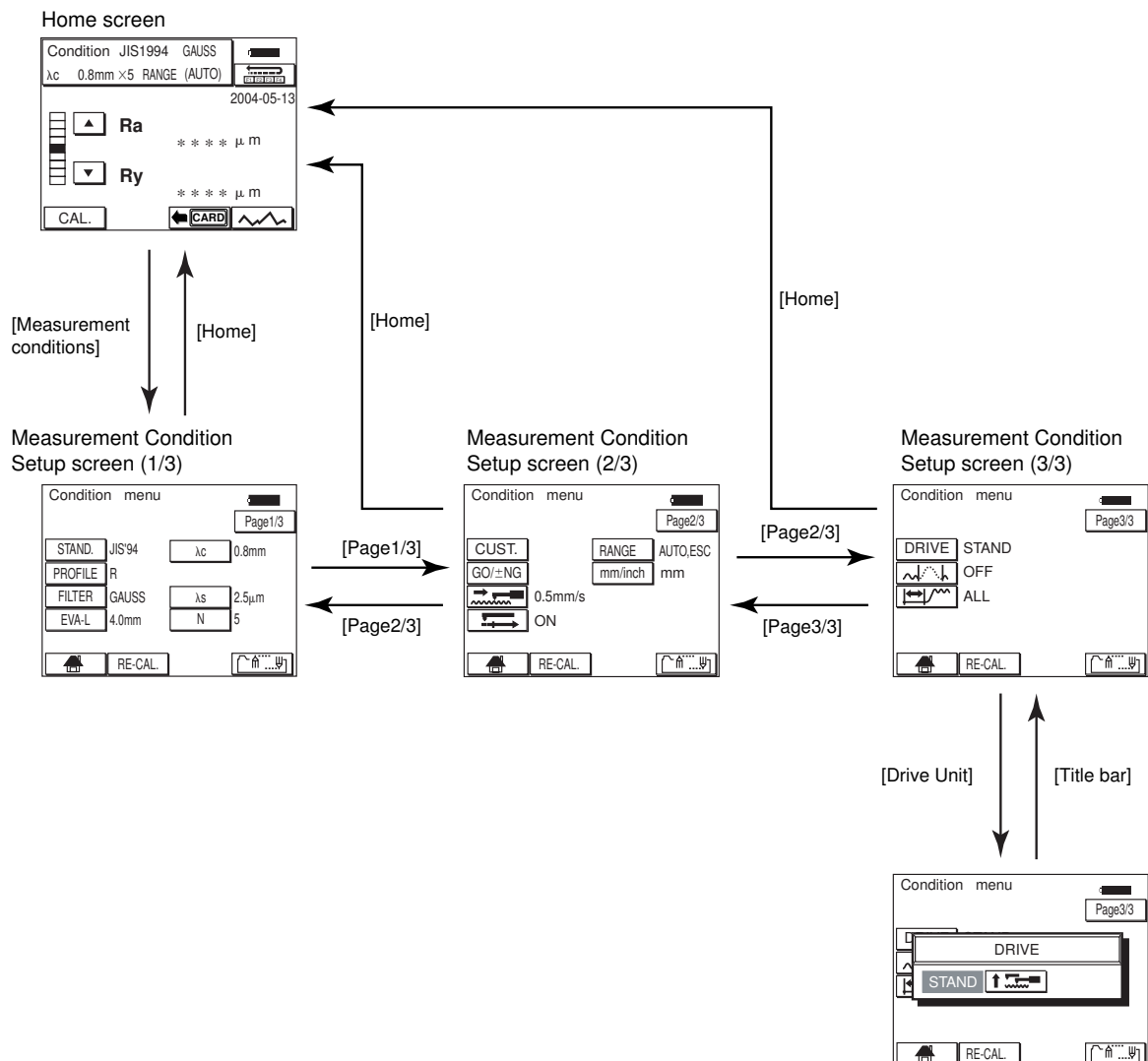
Standard drive unit :  (approach length 0.5mm)

Lateral type drive unit :  (approach length 0.5mm)

Front escape type drive unit :  (approach length 2.5mm)

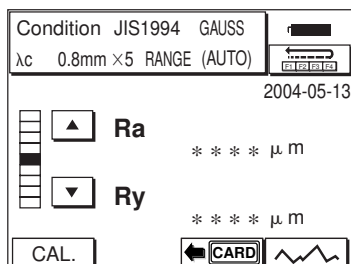
NOTE If there is an error in setting the drive unit, an error message such as “DRIVE ERROR 1” and “OVERRANGE” may appear, disabling measurement.

■ Screens displayed when changing the drive unit setup



■ Operating procedure

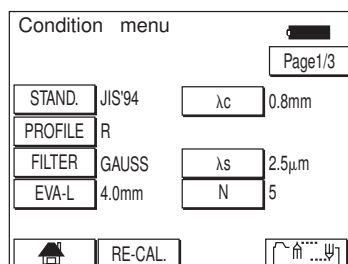
1 <Home screen>



Touch the [Measurement Conditions] button in the Home screen.

⇒ The Measurement Condition Setup screen (1/3) will appear.

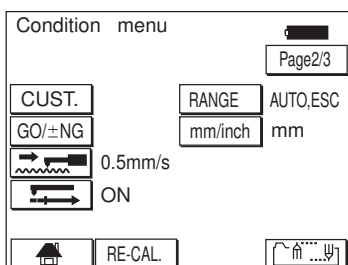
2 <Measurement Condition Setup screen (1/3) >



Touch the [Page 1/3] button.

⇒ The Measurement Condition Setup screen (2/3) will appear.

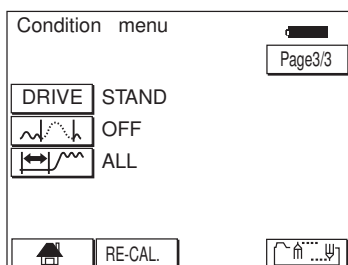
3 <Measurement Condition Setup screen (2/3) >



Touch the [Page 2/3] button.

⇒ The Measurement Condition Setup screen (3/3) will appear.

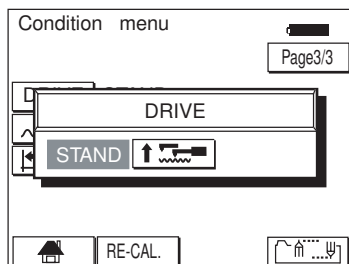
4 <Measurement Condition Setup screen (3/3) >



Touch the [Drive Unit] button.

⇒ The Drive Unit Setup window will appear.

5 <Drive Unit Setup windows>



Touch the [Drive Unit Setup] button to be set.

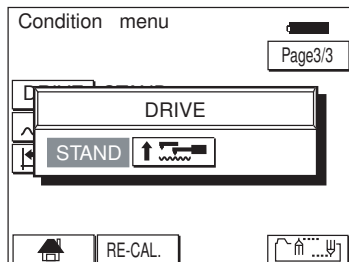
⇒ The touched setup button is highlighted.

Standard drive unit : **STAND** (approach length 0.5mm)

Lateral type drive unit : **STAND** (approach length 0.5mm)

Front escape type drive unit : **↑** (approach length 2.5mm)

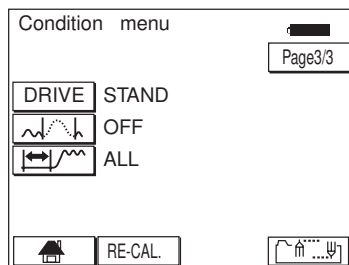
6 <Drive Unit Setup windows>



Touch the title bar on the Drive Unit Setup window to accept the drive unit setting.

⇒ The Measurement Condition Setup screen is restored.

7 <Measurement Condition Setup screen (3/3) >

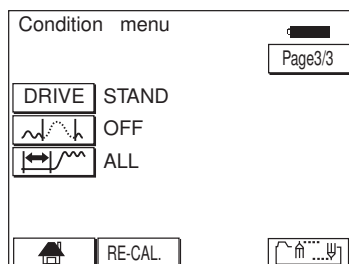


Touch the [Home] button.

⇒ The Home screen is restored.



<Home screen>



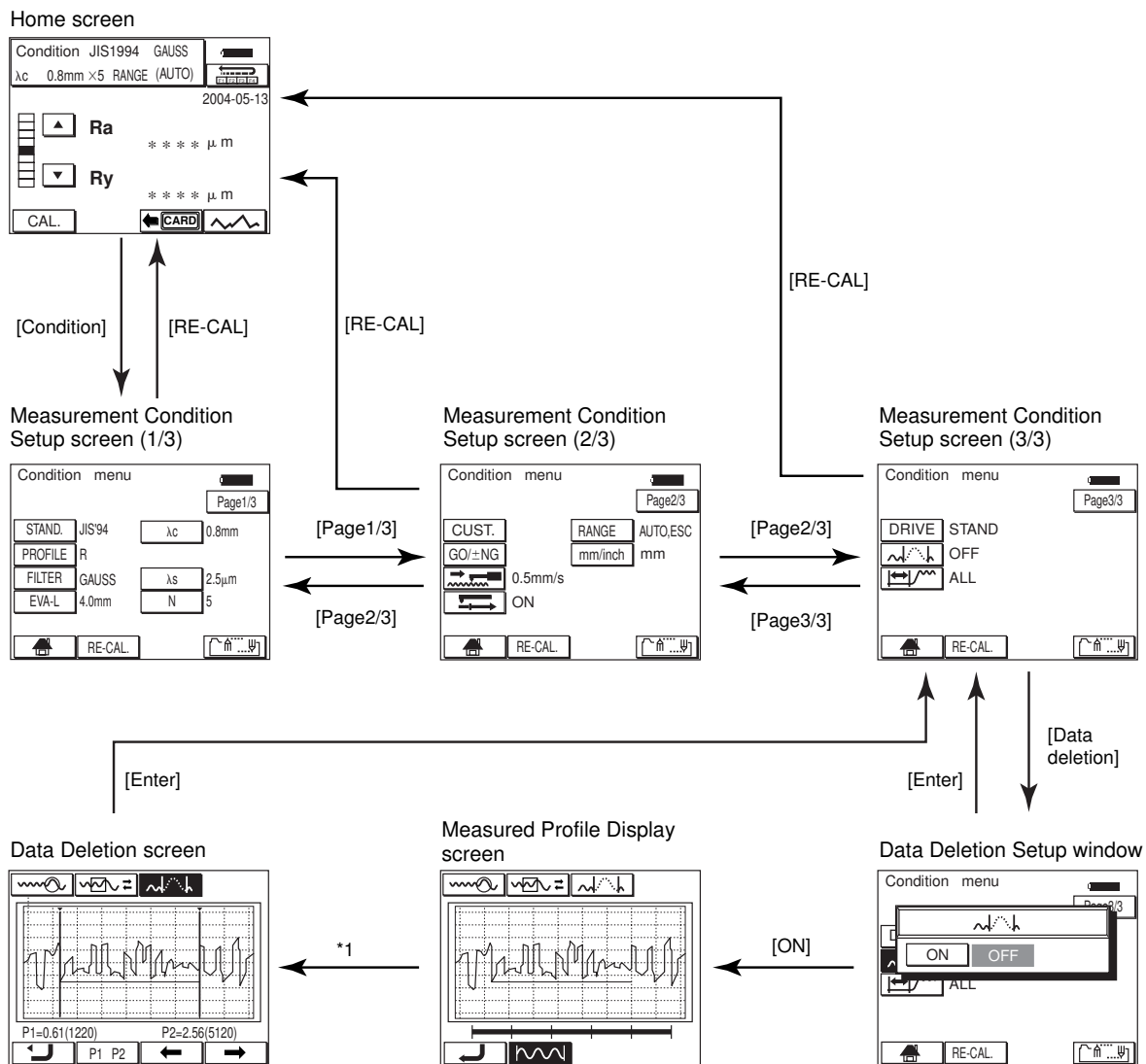
5.13 Deleting Unnecessary Data

The SJ-301 is capable of deleting unnecessary data and performing recalculation for the reason of outlier removal, etc.

IMPORTANT If unnecessary data is deleted, the calculation result is not correct because it is not obtained from continuous data. In this case, “Δ” is appended to the displayed calculation result.

NOTE For information about recalculation after deletion of unnecessary data, refer to “6. RECALCULATION WITH THE MODIFIED MEASUREMENT CONDITIONS”.

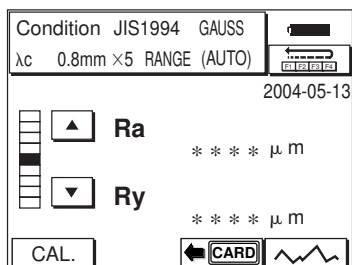
■ Transition of screens if recalculation is performed after deletion of unnecessary data



*1 After the Measured Profile Display screen is displayed, the Data Deletion screen will appear automatically.

■ Operating procedure

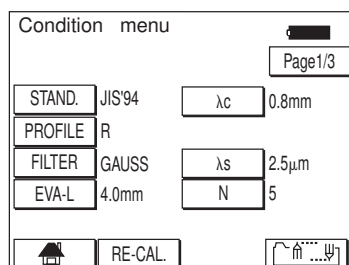
1 <Home screen>



Touch the [Measurement Conditions] button in the Home screen.

⇒ The Measurement Condition Setup screen (1/3) will appear.

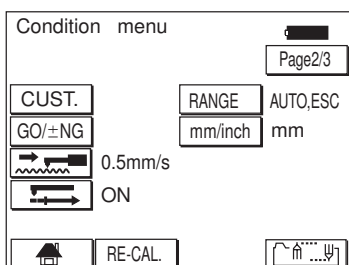
2 <Measurement Condition Setup screen (1/3) >



Touch the [Page 1/3] button.

⇒ The Measurement Condition Setup screen (2/3) will appear.

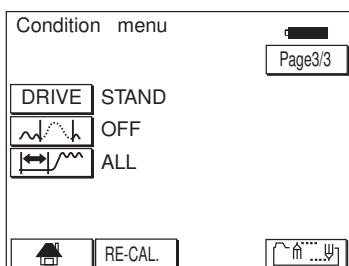
3 <Measurement Condition Setup screen (2/3) >



Touch the [Page 2/3] button.

⇒ The Measurement Condition Setup screen (3/3) will appear.

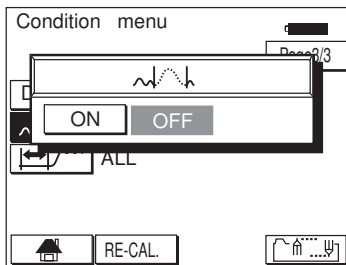
4 <Measurement Condition Setup screen (3/3) >



Touch the [Data deletion] button.

⇒ The Data Deletion Setup window will appear.

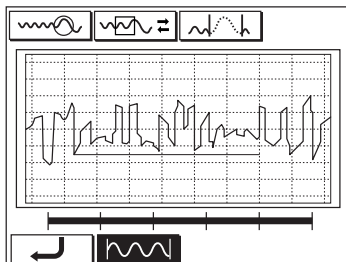
5 <Data Deletion Setup window>



Touch the [ON] button.

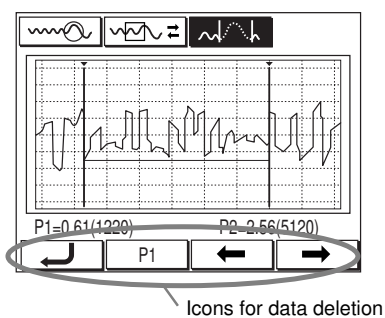
⇒ The Measured Profile Display screen will appear.

6 <Measured Profile Display screen>



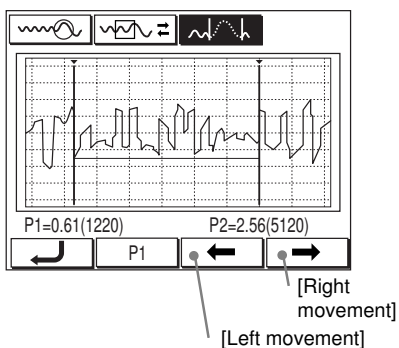
⇒ After the Measured Profile Display screen is displayed, the Data Deletion screen will appear automatically.

7 <Data Deletion screen>



⇒ The icons for data deletion are displayed on the bottom of the screen.

8 <Data Deletion screen>

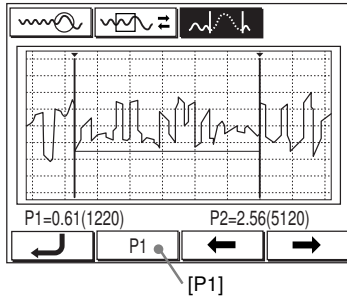


Touch the [Right movement] button to move cursor P1 to the right.

TIP

- The [Left movement] button is also available.
- If touching and holding the [Right movement] or [Left movement] button, the displacement of cursor P1 increases.

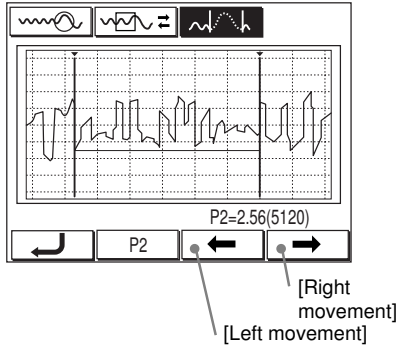
9 <Data Deletion screen>



Touch the [P1] button.

⇒ The icon on the button changes to [P2], enabling cursor P2 to move.

10 <Data Deletion screen>

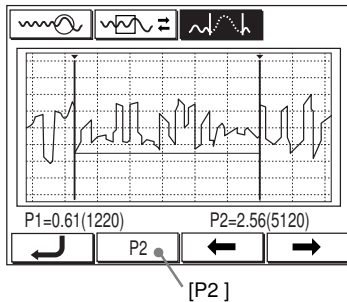


Touch the [Right movement] button to move cursor P2 to the right.

TIP

- The [Left movement] button is also available.
- If touching and holding the [Right movement] or [Left movement] button, the displacement of cursor P2 increases.

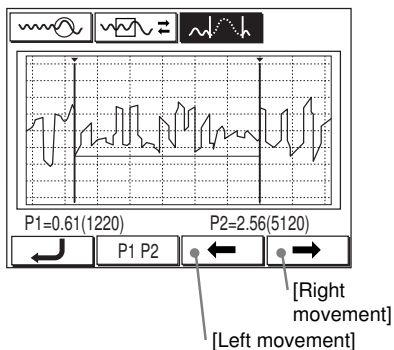
11 <Data Deletion screen>



Touch the [P2] button.

⇒ The icon on the button changes to [P1P2], enabling cursor P1 and cursor P2 to move concurrently.

12 <Data Deletion screen>

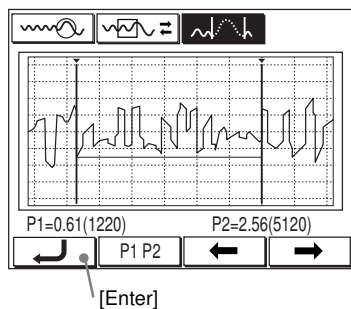


Touch the [Right movement] button to move cursor P1 and cursor P2 to the right.

TIP

- The [Left movement] button is also available.
- If touching and holding the [Right movement] or [Left movement] button, the displacement of cursor P1 and cursor P2 increases.

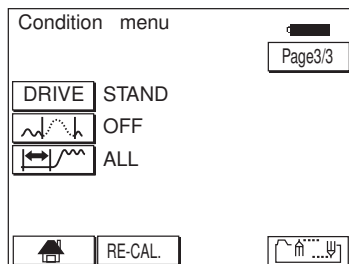
13 <Measurement Condition Setup screen>



Touch the [Enter] button.

⇒ The data deleting range (area between cursor P1 and cursor P2) is loaded and the Measurement Condition Setup screen is restored.

14 <Measurement Condition Setup screen>

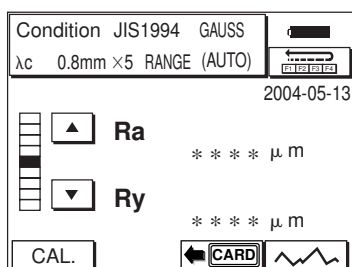


Touch the [RE-CAL.] button.

⇒ The SJ-301 performs recalculation after deleting the data within the specified range, and then restores the Home screen.



<Home screen>



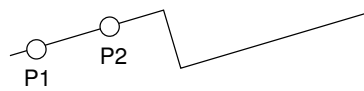
5.14 Modifying the Tilt Compensation Specification

The SJ-301 provides the after-measurement setup of tilt compensation for the entire measured profile, an arbitrary section of a measured profile, or two arbitrary points on a measured profile, and also allows the tilt compensation function to be disabled.

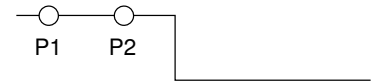
NOTE Unless otherwise required, usually select the tilt compensation for the entire measured profile.

■ Description of tilt compensation

To perform tilt compensation for an arbitrary section, enter the P1 and P2 values to determine a compensation reference section (datum segment). If tilt compensation is performed in this state, a measured profile is compensated so that the datum segment becomes horizontal.

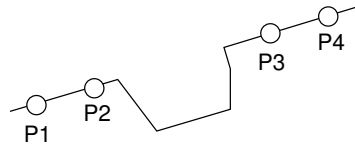


Measured profile before tilt compensation



Measured profile after tilt compensation

To perform tilt compensation for two arbitrary sections, enter the P1, P2, P3 and P4 values to determine compensation reference sections (datum segments). If tilt compensation is performed in this state, a measured profile is compensated so that the two datum segments become horizontal.

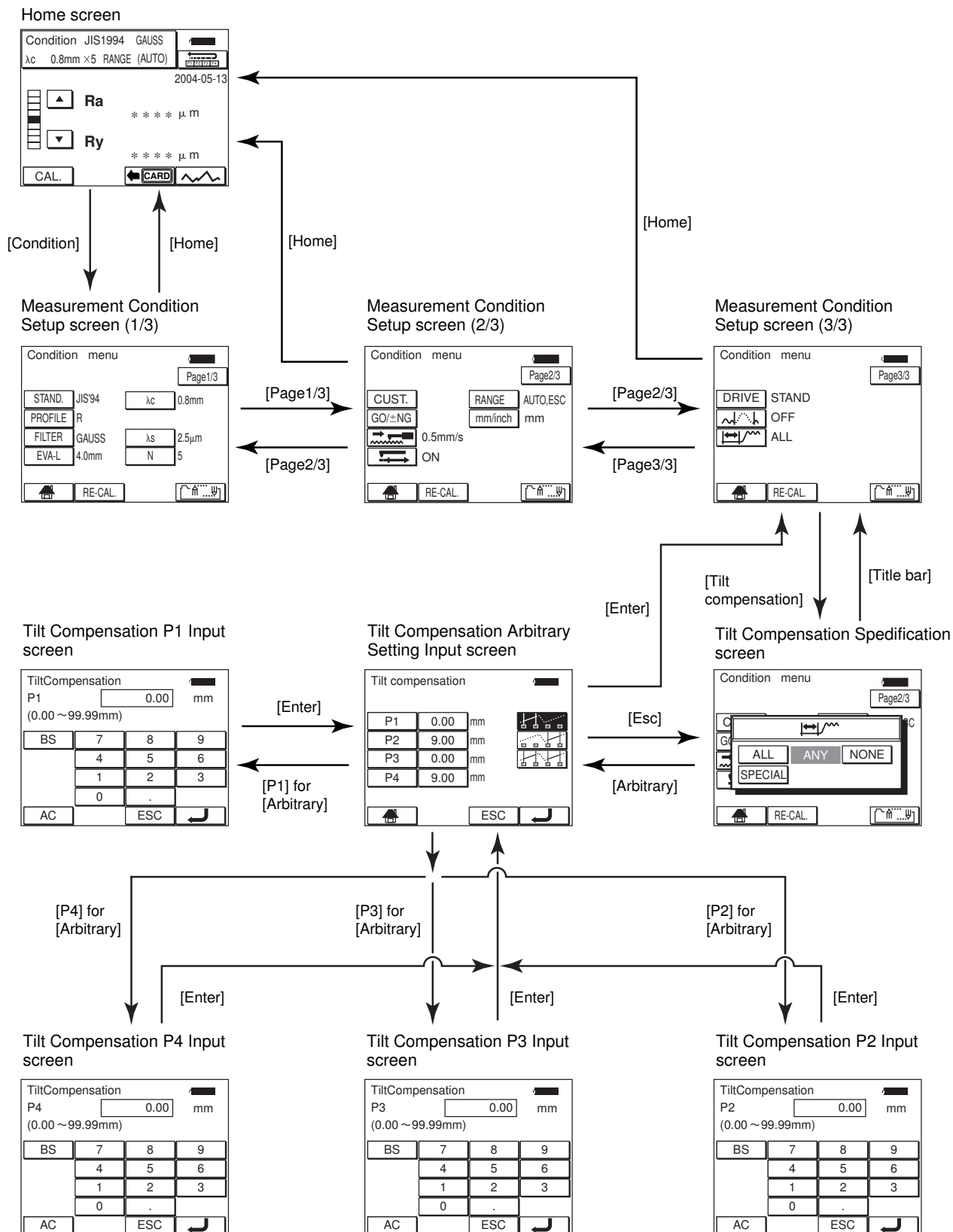


Measured profile before tilt compensation



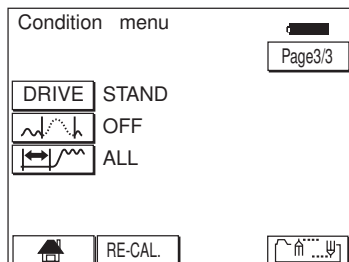
Measured profile after tilt compensation

■ Transition of screens when modifying the tilt compensation specification



■ Operating procedure

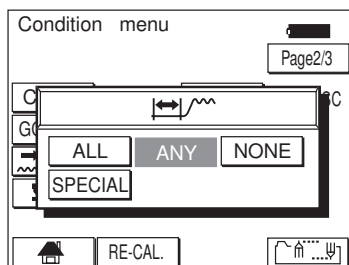
1 <Measurement Condition Setup screen (3/3) >



Touch the [Tilt compensation] button in the Measurement Condition Setup screen (3/3).

⇒ The Tilt Compensation Specification window will appear.

2 <Tilt Compensation Specification window>



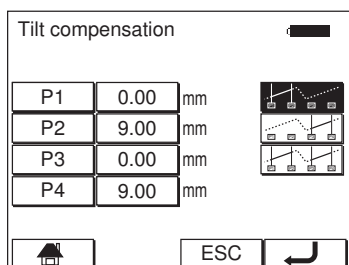
Touch the [Tilt Comp. specification] button to be set.

⇒ The touched specification button is highlighted.

Advance to step 13 if the [Entire] button has been selected, advance to step 3 if the [Arbitrary] button has been selected, and advance to step 13 if the [None] button has been selected.

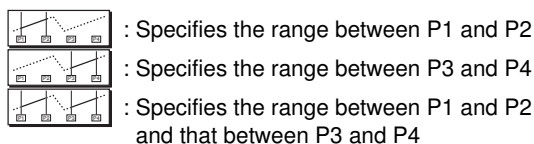
NOTE For information about the [Special] button, refer to "■ Special range specification" described later.

3 <Tilt Compensation Arbitrary Setting Input screen>



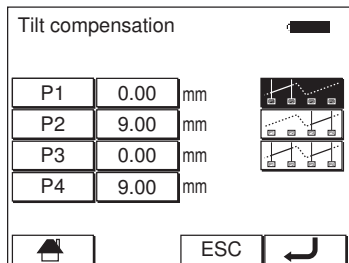
Touch the [Range specification] button to be set.

⇒ The touched specification button is highlighted.



NOTE Tilt compensation is performed within the specified range(s). If an incorrect value is entered for the specified range, an error message is displayed at the lower right of the screen. Referring to the message, reenter a value.

4 <Tilt Compensation Arbitrary Setting Input screen>



Touch the [P1] button.

⇒ The Tilt Compensation P1 Input screen will appear.

5 <Tilt Compensation P1 Input screen>

TiltCompensation			
P1	0.00		mm
(0.00 ~ 99.99mm)			
BS	7	8	9
	4	5	6
	1	2	3
	0	.	
AC	ESC		

Enter the 1st point in the tilt compensation range in the Tilt Compensation P1 Input field, and then touch the [Enter] key.

The P1 enterable range is as shown below.
0.00 to 99.99mm (in the units of 0.01mm)

TIP

- When the P1 value is set to 0.00mm, the beginning of a measured profile becomes the start point of the tilt compensation range.
- For information about how to enter a numeric value, refer to “2.2 Outline of the Touch Panel ■ Inputting numeric values”.

6 <Tilt Compensation Arbitrary Setting Input screen>

Tilt compensation			
P1	0.00	mm	
P2	9.00	mm	
P3	0.00	mm	
P4	9.00	mm	
	ESC		

⇒ The Tilt Compensation Arbitrary Setting Input screen is restored.

Touch the [P2] button.

⇒ The Tilt Compensation P1 Input screen will appear.

7 <Tilt Compensation P2 Input screen>

TiltCompensation			
P2	0.00		mm
(0.00 ~ 99.99mm)			
BS	7	8	9
	4	5	6
	1	2	3
	0	.	
AC	ESC		

Enter the 2nd point in the tilt compensation range in the Tilt Compensation P2 Input field, and then touch the [Enter] key.
The P2 enterable range is as shown below.
0.00 to 99.99mm (in the units of 0.01mm) as tilt compensation setting

NOTE

The P2 value must not be less than the P1 value.

TIP

- If the P2 value is larger than the evaluation length, the end of a measured profile becomes the end point of tilt compensation.
- For information about how to enter a numeric value, refer to “2.2 Outline of the Touch Panel ■ Inputting numeric values”.

⇒ The Tilt Compensation Input screen is restored.

8 <Tilt Compensation Arbitrary Setting Input screen>

Tilt compensation		
P1	0.00	mm
P2	9.00	mm
P3	0.00	mm
P4	9.00	mm

ESC

Advance to step 9 if tilt compensation is performed in two sections, and advance to step 13 if it is not performed in two sections.

Touch the [P3] button.

⇒ The Tilt Compensation P3 Input screen will appear.

9 <Tilt Compensation P3 Input screen>

TiltCompensation			
P3	0.00	mm	
(0.00 ~ 99.99mm)			
BS	7	8	9
	4	5	6
	1	2	3
	0	.	
AC		ESC	

Enter the 3rd point in the tilt compensation range in the Tilt Compensation P3 Input field, and then touch the [Enter] key. The P3 enterable range is as shown below.

0.00 to 99.99mm (in the units of 0.01mm) as tilt compensation setting

NOTE The P3 value must not be less than the P2 value.

TIP For information about how to enter a numeric value, refer to “2.2 Outline of the Touch Panel ■ Inputting numeric values”.

⇒ The Tilt Compensation Input screen is restored.

10 <Tilt Compensation Arbitrary Setting Input screen>

Tilt compensation		
P1	0.00	mm
P2	9.00	mm
P3	0.00	mm
P4	9.00	mm

ESC

Touch the [P4] button.

⇒ The Tilt Compensation P4 Input screen will appear.

11 <Tilt Compensation P4 Input screen>

TiltCompensation			
P2	0.00		mm
(0.00 ~ 99.99mm)			
BS	7	8	9
	4	5	6
	1	2	3
	0	.	
AC		ESC	↩

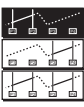
Enter the 4th point in the tilt compensation range in the Tilt Compensation P4 Input field, and then touch the [Enter] key. The P4 enterable range is as shown below. 0.00 to 99.99mm (in the units of 0.01mm) as tilt compensation setting

NOTE The P4 value must not be less than the P3 value.

TIP

- If the P2 value is larger than the evaluation length, the end of a measured profile becomes the end point of tilt compensation.
- For information about how to enter a numeric value, refer to “2.2 Outline of the Touch Panel ■ Inputting numeric values”.

12 <Tilt Compensation Arbitrary Setting Input screen>

Tilt compensation		
P1	0.00	mm
P2	9.00	mm
P3	0.00	mm
P4	9.00	mm
		
		ESC ↩

⇒ The Tilt Compensation Input screen is restored.

Touch the [Enter] button.

⇒ The tilt compensation range is loaded, and the Measurement Condition Setup screen is restored.

13 <Measurement Condition Setup screen>

Condition menu		Page3/3
DRIVE	ON	
	OFF	
	0.00-09.00m	
	90.0-99.00mm	
	RE-CAL.	

Touch the [RE-CAL] button.

⇒ Recalculation is performed and the Home screen is restored.

■ Special range specification

This icon button is used to perform tilt compensation processing of a mean line throughout the sampling length when the special P profile or W profile (without specification of $\lambda f/fL$) is selected. Do not usually select this specification unless otherwise necessary.

TIP When the [Special] button is selected, tilt compensation is performed throughout the sampling length.

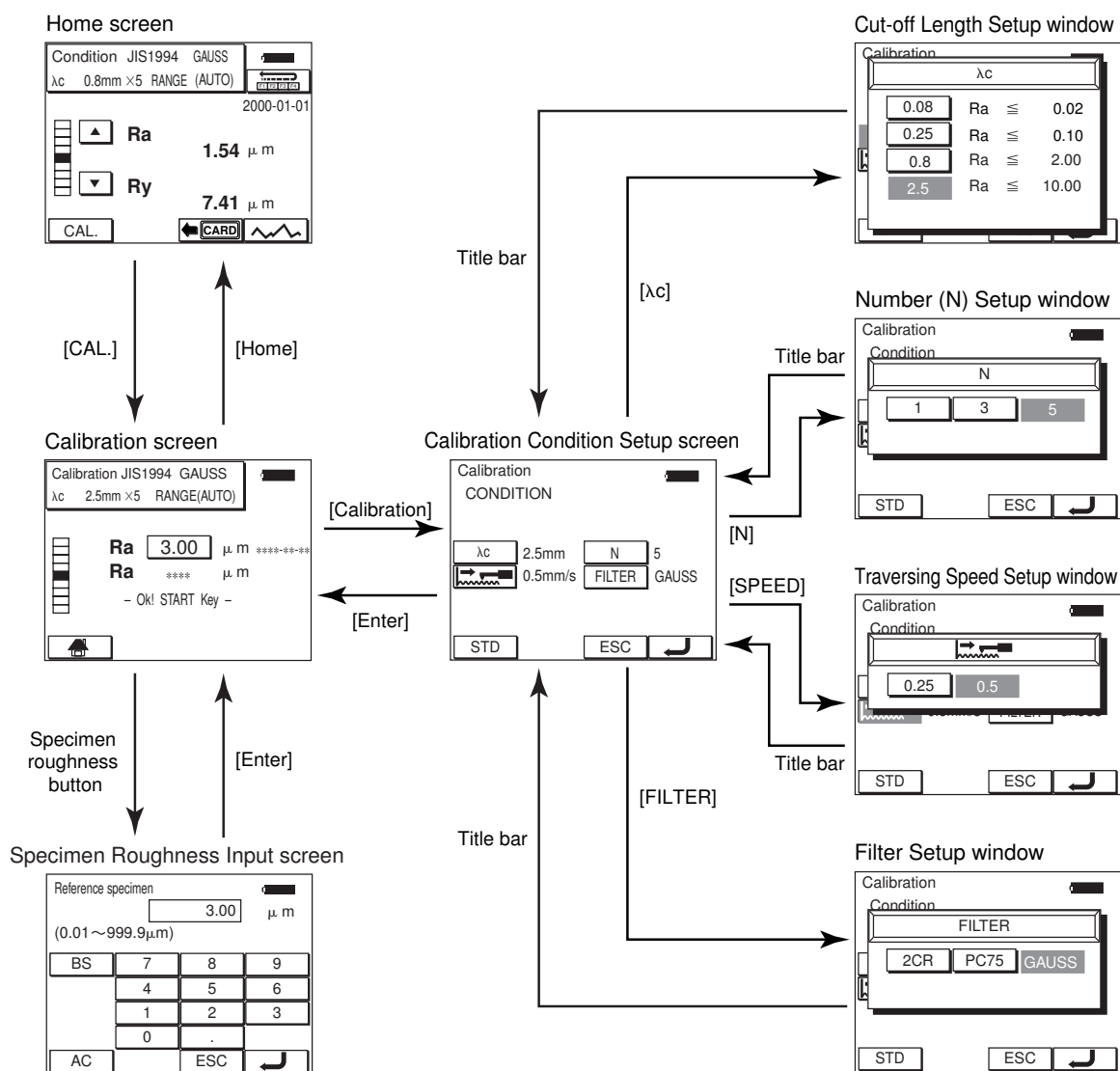
5.15 Modifying the Calibration Conditions

If the roughness specimen for calibration is replaced, the calibration conditions must be modified to those that applied to calibrate the replacement roughness specimen.

Calibration conditions to be modified are the roughness value of the specimen, cutoff length, the number of sampling lengths or “Filter” values, as required.

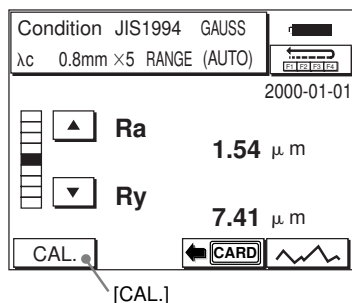
IMPORTANT Do not modify calibration conditions unless it is essential. The roughness specimen supplied as the standard accessory has been calibrated to the factory standard traceable to the national standard.

■ Transition of screens if the calibration conditions are modified



■ Calibration Condition Setup procedure

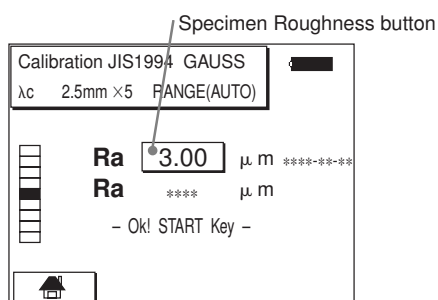
1 <Home screen>



Touch the [CAL.] button in the Home screen.

⇒ The Calibration Condition Setup screen will appear.

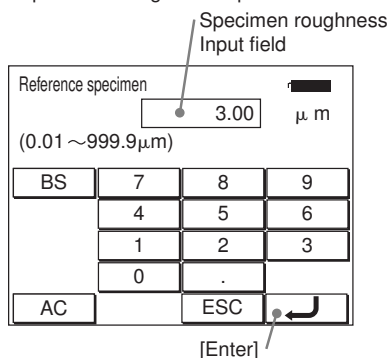
2 <Calibration screen>



Touch the specimen roughness button.

⇒ The Specimen Roughness Input screen will appear.

3 <Specimen Roughness Input screen>

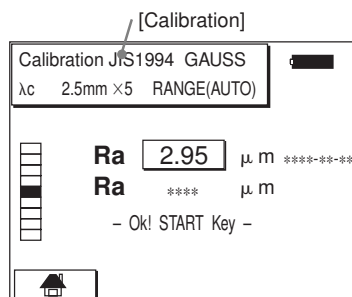


Enter the specimen roughness value in the input field, then touch the [Enter] button.

TIP For information about inputting numeric values refer to “■ Inputting numeric values” in section 2.2, “Outline of the Touch Panel”.

⇒ Returns to the Calibration screen.

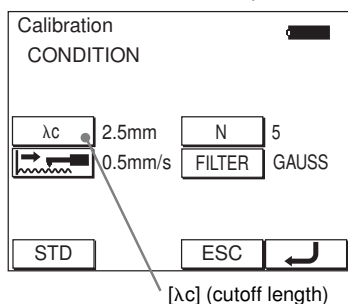
4 <Calibration screen>



Touch the [Calibration] button.

⇒ The Calibration Condition Setup screen will appear.

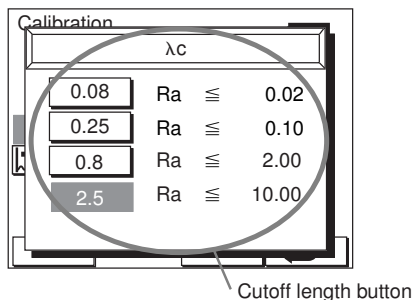
5 <Calibration Condition Setup screen>



Touch the [λc] (cutoff length) button.

⇒ The Cutoff Length Setup window will appear.

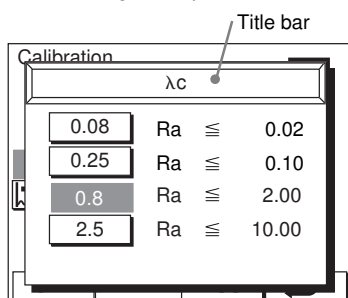
6 <Cut-off Length Setup window>



Touch the appropriate button to set a cutoff length.

⇒ The touched cutoff length button will be highlighted.

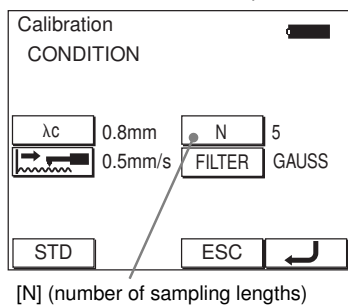
7 <Cut-off Length Setup window>



Touch the title bar in the Cutoff Length Setup window.

⇒ The Cutoff Length Setup window will be closed.

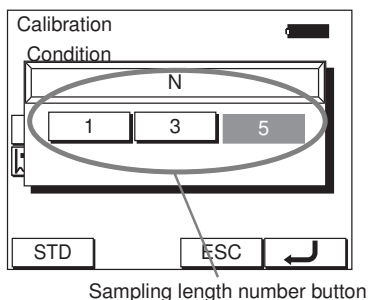
8 <Calibration Condition Setup screen>



Touch the [N] (number of sampling lengths) button.

⇒ The Number (N) Setup window will appear.

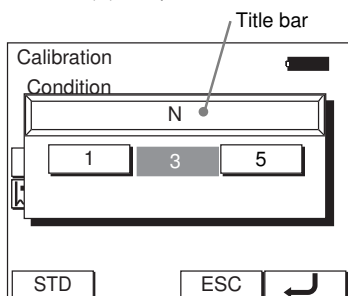
9 <Number (N) Setup window>



Touch the desired number button to specify the number of sampling lengths.

⇒ The button touched will be highlighted.

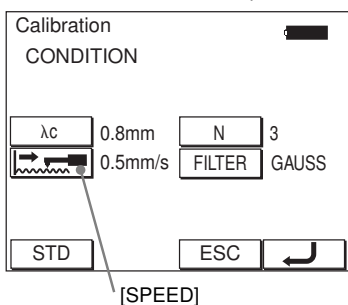
10 <Number (N) Setup window>



Touch the title bar in the Number (N) Setup window.

⇒ The Number (N) Setup window will be closed.

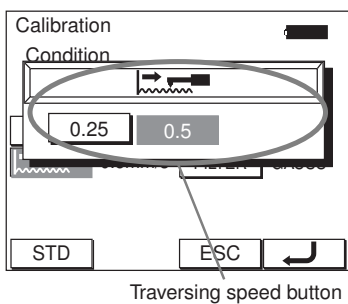
11 <Calibration Condition Setup Screen>



Touch the [Speed] button.

⇒ The Traversing Speed Setup window will appear.

12 <Traversing Speed Setup window>



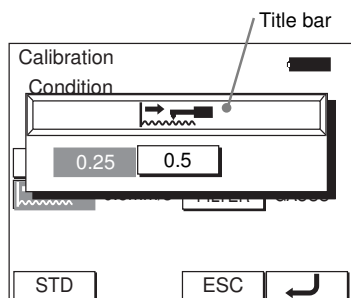
Touch the traversing speed button to be set.

⇒ The touched traversing speed button will be highlighted.

NOTE If the cutoff length (λ_c) is set to either of the following values, the traversing speed is fixed.

- If the cutoff length is 0.08 mm:
Traversing speed is 0.25 mm/s.
- If the cutoff length is 0.25 mm:
Traversing speed is 0.25 mm/s.
- If the cutoff length is 2.5 mm:
Traversing speed is 0.5 mm/s.

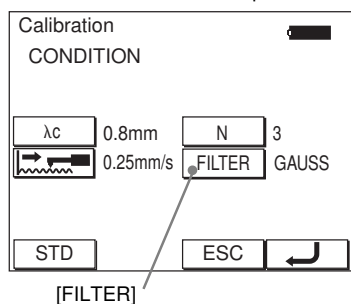
13 <Traversing Speed Setup window>



Touch the title bar in the Traversing Speed Setup window.

⇒ The Traversing Speed Setup window will be closed.

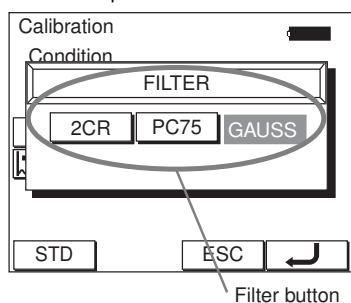
14 <Calibration Condition Setup Screen>



Touch the [FILTER] button.

⇒ The Filter Setup window will appear.

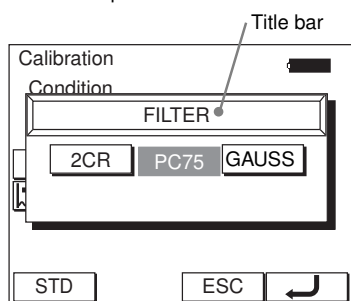
15 <Filter Setup window>



Touch the filter button to be set.

⇒ The touched filter button will be highlighted.

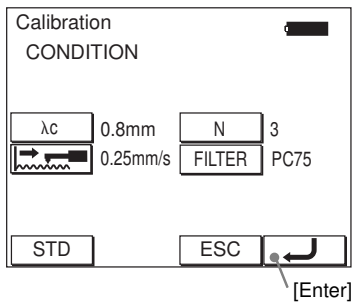
16 <Filter Setup window>



Touch the title bar in the Filter Setup window.

⇒ The Filter Setup window will be closed.

17 <Calibration Condition Setup screen>



Calibration
CONDITION

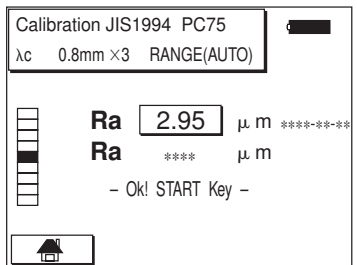
λ_c 0.8mm N 3
0.25mm/s FILTER PC75

STD ESC [Enter]

Touch the [Enter] button to accept the calibration conditions.

⇒ Returns to the Calibration screen.

18 <Calibration screen>



Calibration JIS1994 PC75

λ_c 0.8mm x3 RANGE(AUTO)

Ra 2.95 μm *****
Ra **** μm

- Ok! START Key -

[Home]

Calibration measurement can now be performed. Press the [START/STOP] key on the Display Unit to start calibration measurement.

TIP For information about the subsequent procedure refer to section 4.2.2, "Performing calibration".

5.16 Resetting to the default settings

The SJ-301 has a function to reset the measurement condition settings to the factory-set defaults.

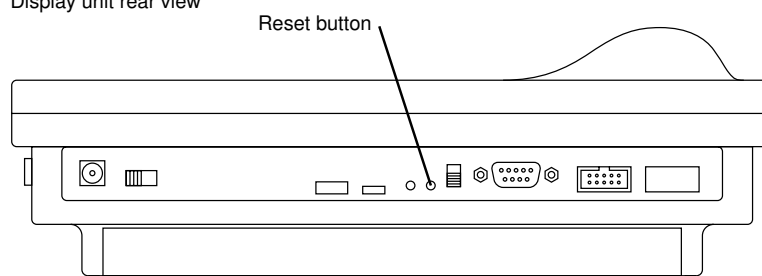
NOTE Care must be exercised when resetting to the factory-set defaults. If the SJ-301 is reset, all of the previous settings will be lost.

TIP For information about the default setup contents refer to “■ Measurement conditions that can be modified according to the requirements” in section 4.1, “Overall Measurement Flow”.

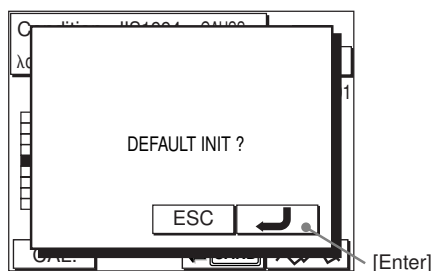
■ Operation procedure

1. With the instrument on, press the reset button at the rear of the Display Unit.

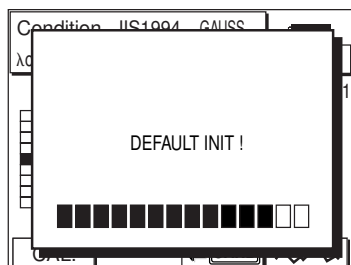
Display unit rear view



A window will be displayed on the touch panel to confirm whether the setup contents can be reset to the default values.



2. If there was no problem in resetting to the default values, touch the [Enter] button.
All the settings of the SJ-301 will be reset to the default values. While the contents are being reset, a progress bar (“- - - - -”) will be displayed.



6

RECALCULATION WITH THE MODIFIED MEASUREMENT CONDITIONS

The SJ-301 has a function to recalculate the measurement data by modifying the measurement conditions after performing a roughness measurement. If this recalculation function is on, measurement data is recalculated with the modified measurement conditions and displayed on the touch panel.

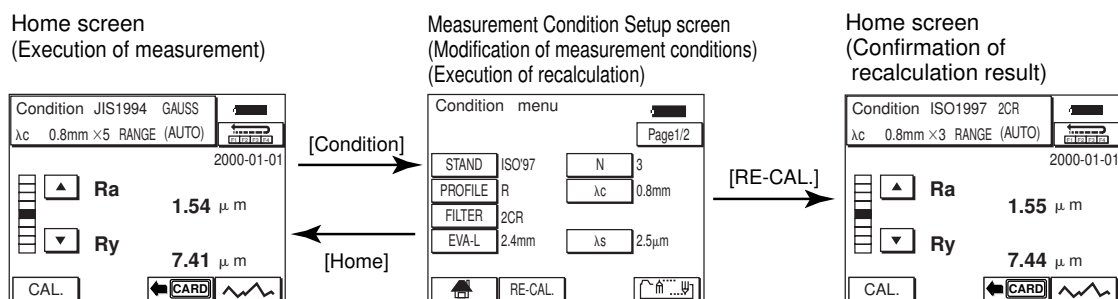
■ Measurement conditions that can be modified

The SJ-301 can perform recalculation after modifying the following measurement conditions:

- Surface texture standard
- Measured profile
- Filter
- Number of sampling lengths (can be reduced)
- Parameters
- Unit
- Deletion of the required data

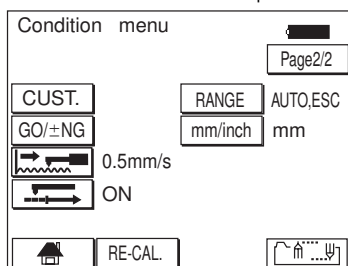
- NOTE**
- This recalculation function cannot be used if MOTIF.R-profile or MOTIF.W-profile is specified.
 - The recalculation function cannot be used if the number of sampling length is increased.
 - The SJ-301 does not support recalculation with a modified cutoff length.
 - The recalculation function may not be used due to mismatch of the pre-travel and post-travel conditions if the filter or measured profile is modified.

■ Transition of screens if recalculation is performed



■ Recalculation procedure

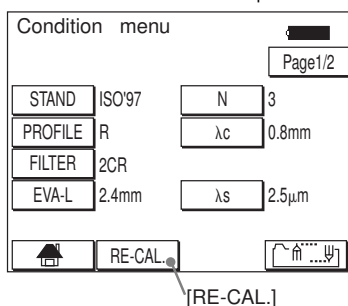
1 <Measurement Condition Setup screen>



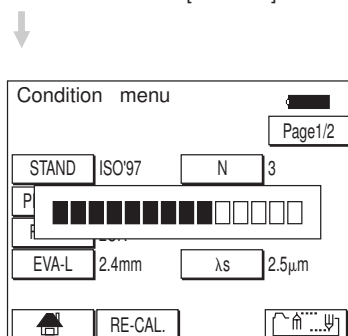
Measurement condition modification is possible in the Measurement Condition Setup screen after the measurement has been completed with the measured result being displayed on the touch panel.

TIP For information about modifying the measurement conditions, refer to chapter 5, "MODIFYING THE MEASUREMENT CONDITIONS".

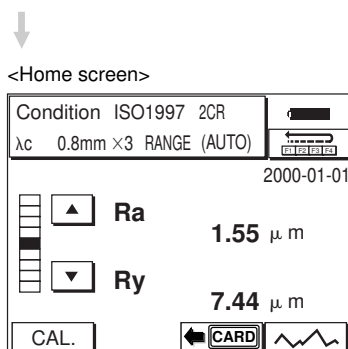
2 <Measurement Condition Setup screen>



Touch the [RE-CAL.] button in the Measurement Condition Setup screen after having modified the conditions.



⇒ A bar indicating the progress of recalculation will be displayed.



⇒ After recalculation has been completed, the Home screen is restored. The recalculated measurement data will be displayed in the Home screen.

7

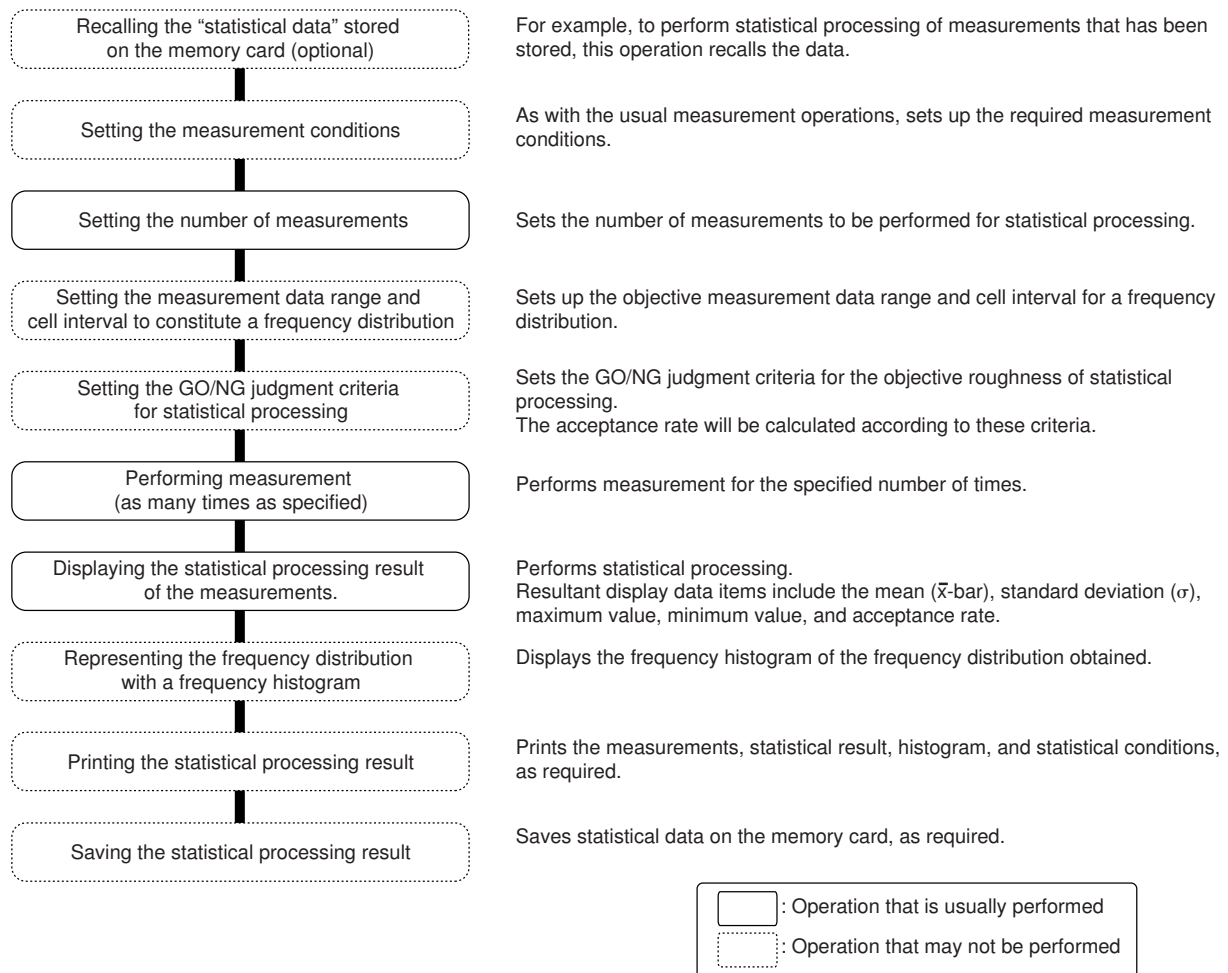
STATISTICAL PROCESSING OF MEASUREMENTS

The SJ-301 has the capability to statistically process the measurement data obtained with it. The statistical processing result can be, for instance, represented as a frequency histogram and printed out.

For statistical processing of measurements to be performed, specify the number of measurements before starting the measurement job. Statistical processing results can even be displayed before the specified number of measurements have been completed.

7.1 Overview of Statistical Processing

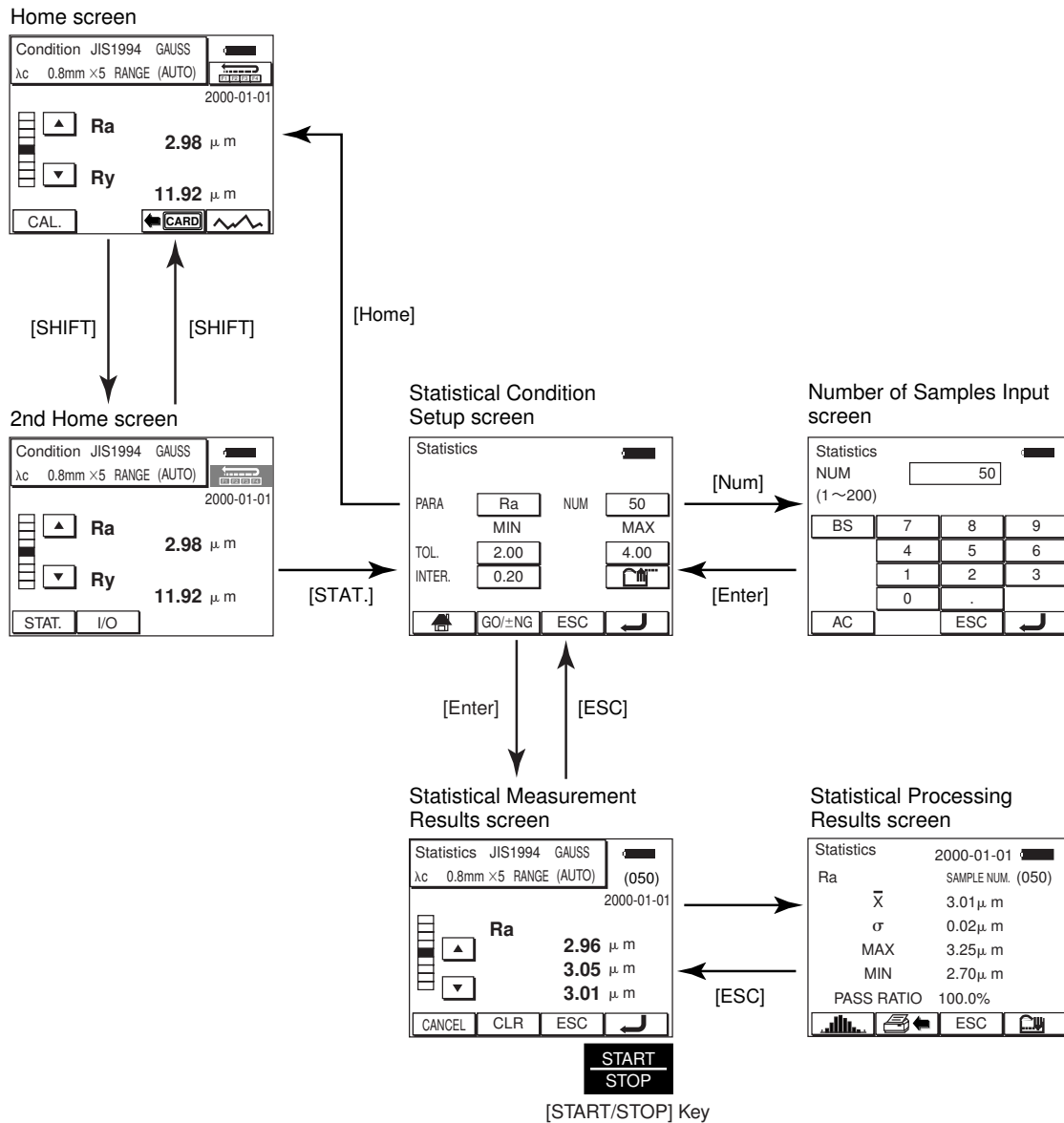
The overall flow of statistical processing is shown in the following chart.



7.2 Execution of Statistical Processing

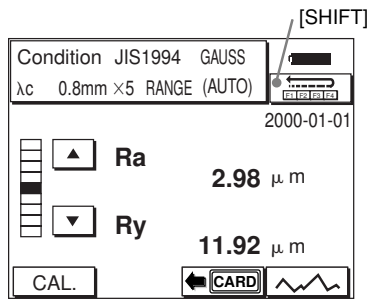
This section explains the procedure to execute statistical processing and confirm the result.

■ Transition of screens when statistical processing is executed



■ Operation of statistical processing

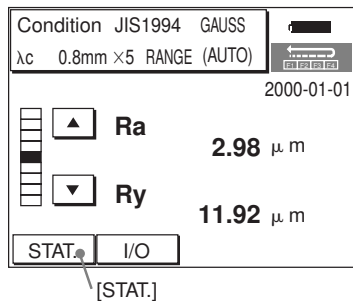
1 <Home screen>



Touch the [SHIFT] button on the Home screen.

⇒ The current screen is switched to the 2nd Home screen.

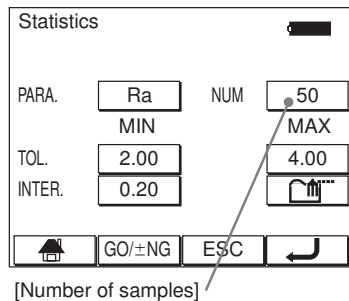
2 <2nd Home screen>



Touch the [STAT] button on the screen.

⇒ The Statistical Condition Setup screen will appear.

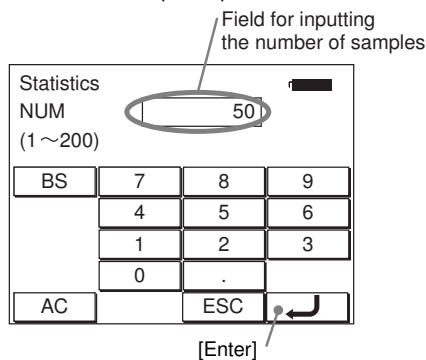
3 <Statistical Condition Setup screen>



Touch the [Number of samples] button.

⇒ The Number of Samples Input screen will appear.

4 <Number of Samples Input screen>



Enter the number of samples (objective number of measurements for statistical processing) in the field for inputting the number of samples, then touch the [Enter] button.

⇒ Returns to the Statistical Conditions Setup screen.

TIP

For information about inputting numeric values refer to “■ Inputting numeric values” in section 2.2, “Outline of the Touch Panel”.

5 <Statistical Condition Setup screen>

Statistics

PARA Ra NUM 50

MIN MAX

TOL. 2.00 4.00

INTER. 0.20

[HOME] [GO/±NG] [ESC] [Enter]

On the Statistical Condition Setup screen the operator can make modifications to any of the statistical conditions except the number of samples as required.

TIP For information about modifying the statistical conditions refer to section 7.3, “Settings Related to Statistical Processing”.

To accept the statistical conditions touch the [Enter] button.

⇒ The Statistical Measurement Results screen will appear.

6 <Statistical Measurement Results screen>

Statistics JIS1994 GAUSS

λc 0.8mm x5 RANGE (AUTO) (050)

2000-01-01

Ra

[CANCEL] [CLR] [ESC] [Enter]

START
STOP

[START/STOP] Key

7 <Statistical Measurement Results screen>

Statistics JIS1994 GAUSS

λc 0.8mm x5 RANGE (AUTO) (050)

2000-01-01

Ra

2.83 μm

3.00 μm

3.10 μm

[CANCEL] [CLR] [ESC] [Enter]

START
STOP

[START/STOP] Key

Perform measurement with this screen. Press the [START/STOP] key to start.

⇒ This operation performs measurement and displays the result on the screen.

Continue measurement by pressing the [START/STOP] key.

⇒ If the set number of sample data has been obtained, statistical processing will automatically take place and the Statistical Processing Results screen will appear.

NOTE

- Touching the [CANCEL] button erases the latest measurement data.
- Touching the [CLR] button displays a message to confirm whether to erase all the measurements so far obtained. Touch the [ENTER] button to execute erasing all the measurement data.
- If the [Enter] button is touched after at least one measurement session has been performed, statistical processing will be conducted based on the measurements results obtained up to that point in time, and the result will be displayed. If no measurement session has been performed yet, statistical processing will not be conducted.

8 <Statistical Processing Results screen>

Statistics		2000-01-01
Ra		SAMPLE NUM (050)
$\bar{X}$	3.01 μm	
σ	0.02 μm	
MAX	3.25 μm	
MIN	2.70 μm	
PASS RATIO	100.0%	

With the Statistical Processing Results screen the operator can print and save statistical data or display a frequency histogram, as required.

TIP

- For information about printing statistical data and displaying a frequency histogram refer to section 7.4, "Displaying the Frequency Histogram and Printing Statistical Data".
- For information about saving statistical data, refer to section 7.5, "Saving and Recalling Statistical Data".

9 <Statistical Processing Results screen>

Statistics		2000-01-01
Ra		SAMPLE NUM (050)
$\bar{X}$	3.01 μm	
σ	0.02 μm	
MAX	3.25 μm	
MIN	2.70 μm	
PASS RATIO	100.0%	

[ESC]

Touch the [ESC] button.

⇒ Returns to the Statistical Measurement Results screen.

10 <Statistical Measurement Results screen>

Statistics		JIS1994 GAUSS	
λc	0.8mm x5	RANGE (AUTO)	(050)
2000-01-01			
 	Ra		
	2.83 μm		
	3.00 μm		
3.10 μm			

[ESC]

Touch the [ESC] button.

⇒ Returns to the Statistical Condition Setup screen.

11 <Statistical Condition Setup screen>

Statistics

PARA Ra NUM 50

MIN MAX

TOL. 2.00 4.00

INTER. 0.20

[Home] GO/±NG ESC

Touch the [Home] button.

⇒ Returns to the Home screen.

<Home screen>

Condition JIS1994 GAUSS

λc 0.8mm x5 RANGE (AUTO)

2000-01-01

Ra 3.10 μm

Ry 12.03 μm

CAL. CARD

TIP

The operator can view the present statistical results even if the specified number of measurements has not been completed.

1. If necessary, touch the [Enter] button.

⇒ The Statistical Processing Results screen appears and the result obtained up to that point in time will be displayed in it.

2. Touch the [ESC] button.

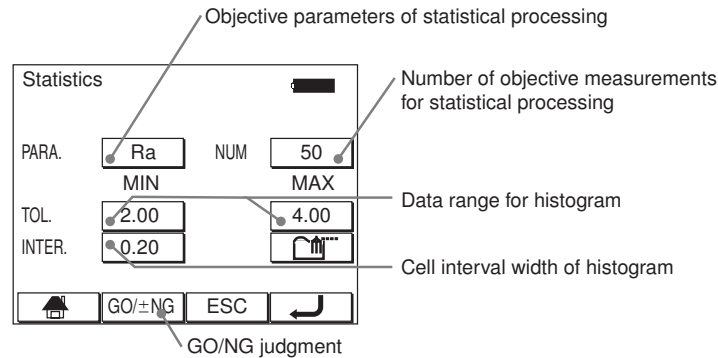
⇒ Returns to the Statistical Measurement Results screen.

To resume measurement press the [START/STOP] key.

7.3 Settings Related to Statistical Processing

Make the settings related to statistical processing in the Statistical Condition Setup screen.

■ Items that can be set with the Statistical Condition Setup screen

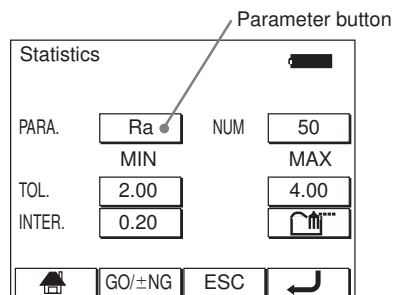


- TIP**
- For information about setting the number of samples refer to section 7.2, "Execution of Statistical Processing".
 - The GO/NG Judgment Setup screen operates in the same way as the Measurement Condition Setup screen. See Section 5.11, "Setting the GO/NG Judgment Function". The settings made in this screen will be reflected onto the GO/NG judgment settings which are made with the Measurement Condition Setup screen.

Information about how to set the parameters, data range for statistic, and cell interval of the histogram will be given in the following paragraphs.

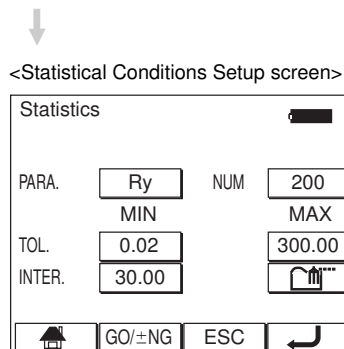
■ Procedure for selecting the objective parameters of statistical processing

1 <Statistical Condition Setup screen>



Touch the parameter button in the Statistical Condition Setup screen.

⇒ A parameter being displayed in the [Parameter] button will be switched to other. Parameters that can be displayed in the parameter button will be the ones specified in the process of setting the measurement conditions.



■ Procedure used to set the data range and cell interval

- IMPORTANT**
- Data range for creating a frequency histogram must be set with the maximum value being greater than the minimum value. Data that does not satisfy this rule is invalid. This rule also applies to modifying the data range previously set. Thus, the order of entering the maximum and minimum values varies with the data range to be set as follows:

Enter the maximum value and minimum value in this order if expanding the data range.

Enter the minimum value and maximum value in this order to reduce the data range.

- Cell interval must be specified within the range displayed in parentheses below the input field. A numeral value outside this range is assumed invalid.

The screenshot shows a screen titled 'Statistics' with a sub-header 'TOL MAX'. Below this, a text input field is shown with the value '(2.01 ~ 999.9 μm)' and a label 'μ m' to its right. An arrow points from the text 'Permissible range' to this input field. Below the input field is a numeric keypad with buttons labeled BS, 7, 8, 9, 4, 5, and 6.

- The cell interval will automatically be altered as appropriate according to the modified data range of the frequency histogram.
-

Here we have an example procedure where the maximum value, 4.00 μm , minimum value, 2.00 μm , and cell interval, 0.2 μm , are to be modified to 20.00 μm , 10.00 μm , and 1.00 μm respectively. Following the rule, the data range of the frequency histogram will be expanded starting with the modification of the maximum value.

1 <Statistical Condition Setup screen>

The screenshot shows a screen titled 'Statistics'. It has several input fields: 'PARA.' with 'Ry', 'TOL.' with '2.00', and 'INTER.' with '0.20'. To the right, there are 'NUM' and 'MAX' buttons. The 'MAX' button is highlighted with a grey background and has a small icon of a house with a plus sign. An arrow points from the text '[Max]' to the 'MAX' button. At the bottom, there are buttons for 'GO/±NG', 'ESC', and a return key.

Touch the [Max] button.

⇒ The Maximum Value Input screen will appear.

2 <Max. Value Input screen>

The maximum value input field

Statistics
TOL. MAX 4.00 μm
(2.01 ~ 999.9 μm)

BS	7	8	9
	4	5	6
	1	2	3
	0	.	+/-
AC	ESC [Enter]		

Enter the maximum value in the input field, then touch the [Enter] button.

⇒ Returns to the Statistical Condition Setup screen.

TIP For information about inputting numeric values refer to “■ Inputting numeric values” in section 2.2, “Outline of the Touch Panel”.

3 <Statistical Condition Setup screen>

Statistics
[Min]

PARA. Ry NUM 50
MIN MAX

TOL. 2.00 20.00

INTER. 1.20

GO/±NG ESC [Enter]

Touch the [Min] button.

⇒ The Minimum Value Input screen will appear.

4 <Min. Value Input screen>

The minimum value input field

Statistics
TOL. MIN 2.00 μm
(0.01 ~ 19.99 μm)

BS	7	8	9
	4	5	6
	1	2	3
	0	.	+/-
AC	ESC [Enter]		

Enter the minimum value in the appropriate field, then touch the [Enter] button.

⇒ Returns to the Statistical Condition Setup screen.

TIP For information about inputting numeric values refer to “■ Inputting numeric values” in section 2.2, “Outline of the Touch Panel”.

5 <Statistical Condition Setup screen>

Statistics
[Width]

PARA. Ry NUM 50
MIN MAX

TOL. 10.00 20.00

INTER. 1.20

GO/±NG ESC [Enter]

Touch the [Width] button on the Statistical Condition Setup screen.

⇒ The Cell Width Input screen will appear.

6 <Cell Width Input screen>

The cell width input field

Statistics			
INTER. 1.20			
(0.67 ~ 10 μ m)			
BS	7	8	9
	4	5	6
	1	2	3
	0	.	
AC		ESC	

[Enter]

↓

<Statistical Condition Setup Screen>

Statistics			
PARA.	Ry	NUM	50
	MIN		MAX
TOL.	10.00		20.00
INTER.	1.00		
	GO/±NG	ESC	

Enter the cell width of the histogram in the input field, then touch the [Enter] button.

⇒ Returns to the Statistical Condition Setup screen.

TIP For information about inputting numeric values refer to “■ Inputting numeric values” in section 2.2, “Outline of the Touch Panel”.

7.4 Displaying the Frequency Histogram and Printing the Statistical Data

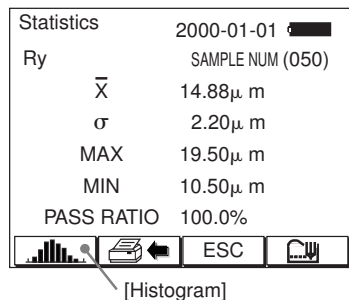
After the specified number of measurements have been conducted and statistical processing has been performed, the Statistical Processing Results screen will appear. With this screen the operator can set the print conditions for statistical data.

- TIP**
- An acceptance rate indicates the rate of measured results judged as GO with the GO/NG judgment function in individual measurements. (Acceptance rate $\div$ Number of samples)
 - $\bar{X}$ indicates the mean value of measured results obtained in individual measurements.
 - σ indicates the standard deviation of measured results obtained in individual measurements.
 - Max/Min indicates the maximum/minimum value of measured results obtained in individual measurements.

This section explains how to display a frequency histogram, set up the print conditions for statistical data, and print statistical data.

■ Displaying the histogram

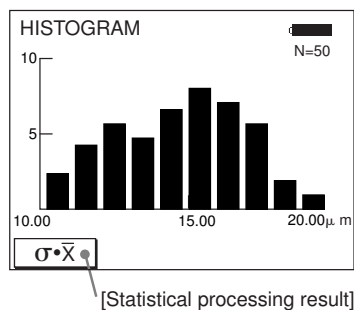
1 <Statistical Processing Results screen>



Touch the [Histogram] button in the Statistical Processing Results screen.

⇒ The Histogram screen will appear.

<Histogram screen>



TIP If the [Statistical processing result] button is touched at this stage, the Statistical Processing Results screen will be returned.

■ Setting the print conditions for the statistical processing results

1 <Statistical Processing Results screen>

Statistics	2000-01-01
Ry	SAMPLE NUM (050)
$\bar{X}$	14.88 μ m
σ	2.20 μ m
MAX	19.50 μ m
MIN	10.50 μ m
PASS RATIO 100.0%	

[Print setup]

Touch the [Print setup] button on the Statistical Processing Results screen.

⇒ The Print Form Setup screen will appear.

2 <Print Form Setup screen>

Print item ON/OFF button

PRINTER	(050)	
SAMPLE DATA	ON	OFF
RESULT	ON	OFF
HISTOGRAM	ON	OFF
CONDITION	ON	OFF

ESC [Enter]

Use the print item ON/OFF buttons to specify whether each of the following item is to be printed, then touch the [Enter] button.

- Sample data (measurements)
- Statistical result
- Histogram
- Conditions (measurement conditions)

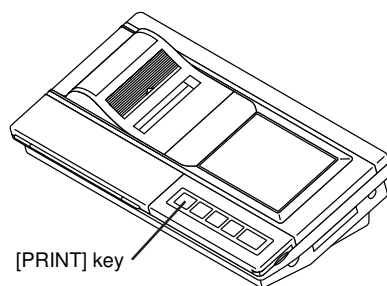
⇒ Returns to the Statistical Processing Results screen.

<Statistical Processing Results screen>

Statistics	2000-01-01
Ry	SAMPLE NUM (050)
$\bar{X}$	14.88 μ m
σ	2.20 μ m
MAX	19.50 μ m
MIN	10.50 μ m
PASS RATIO 100.0%	

■ Printing the statistical processing results

Press the [PRINT] key on the Display Unit while the Statistical Processing Results screen is active.



⇒ Items that have been set with the Print Form Setup screen will be printed.

7.5 Saving and Reading Statistical Data

Collected statistical data can be saved in the memory card. Saved data can also be retrieved before the next measurement begins so that the statistical processing continues.

TIP For information about saving and reading statistical data refer to section 8.4, "Saving/Reading the Statistical Data".

MEMO

8

SAVE/READ OF MEASUREMENTS, MEASUREMENT CONDITIONS AND STATISTICAL DATA

The SJ-301 has functions to save or read the measurements, measurement conditions, profile data points, and statistical data.

The above mentioned data can be saved on the following media: on the internal memory of the Display Unit and on a memory card (optional). However, only measurement conditions can be saved in the internal memory.

This chapter gives an overview and the procedure for saving/reading this data.

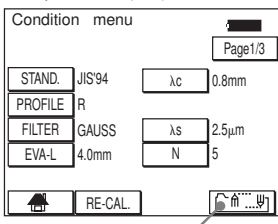
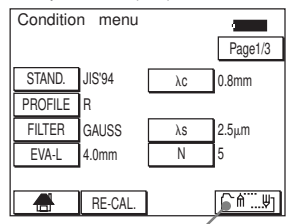
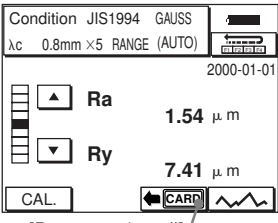
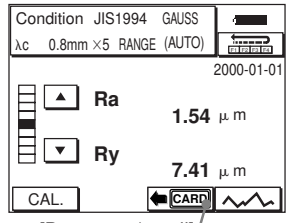
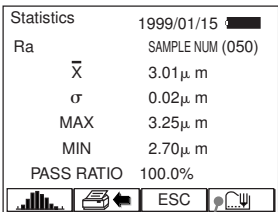
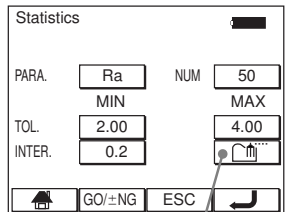
IMPORTANT The multiple files cannot be recalled from the memory at the same time.

NOTE Filename can not include (*). (¥), nor(.).

8.1 Data To Be Saved and Storage Media

■ Objective save/recall data and its media

Data saving and recalling is outlined below, where data is divided into three groups according to data handling. When each data group is saved, the print conditions and calibration conditions are saved as well.

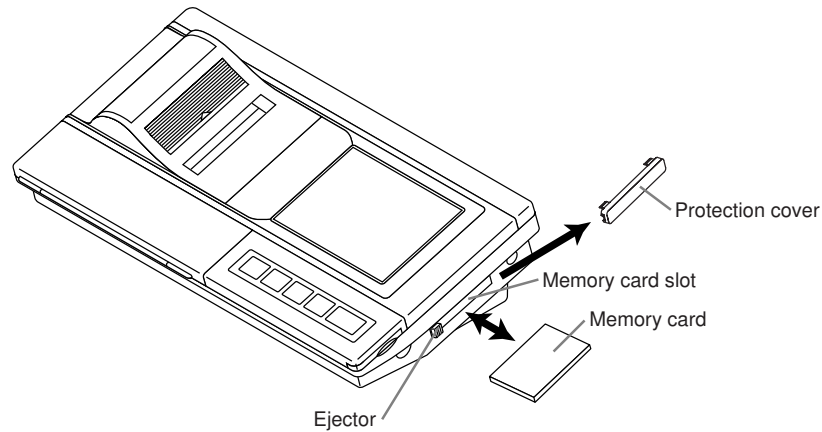
Data group	Stored contents	Storage media	Buttons and screens used for operation	
			Save	Recall
Measurement conditions	Measurement conditions, Print conditions, DATA key function setup, Calibration conditions	Internal memory (5 files max.), or Memory card, (20 files max.).	Measurement Condition Setup screen (1/3)  [Save/Recall]	Measurement Condition Setup screen (1/3)  [Save/Recall]
				[CONDITION READ] key on the Display Unit  [CONDITION READ] key Note: Only recall from the internal memory is permitted.
Measured profile	Measurements, Profile data points, Measurement conditions, Print conditions, DATA key function setup, Calibration conditions	Memory card only	Home screen  [Data save/recall]	Home screen  [Data save/recall]
			[DATA] key on the Display Unit  [DATA] key Note: DATA key function setup required.	
Statistical data	Statistical results, Profile data points Measurement conditions, Print conditions, DATA key function setup, Calibration conditions	Memory card only	Statistical Processing Results screen  [Save]	Statistical Condition Setup screen  [Recall]

NOTE When an objective data item is read, the existing SJ-301 main unit setup will be overwritten with the above described “storage contents” that are read together.

■ Handling the memory card

A memory card can be inserted in the slot on the right side of the SJ-301.

First, remove the protection cover fitted in the slot, then insert the memory card.



● 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 into the slot as far as it will go.

● Removing the memory card

IMPORTANT Do not remove the memory card while performing measurement with SJ-301 or while accessing the memory card.
It may adversely affect the SJ-301 or memory card

1. Push on the ejector.

The memory card will pop part of the way out of the slot.

2. Pull the memory card the rest of the way out of the slot.

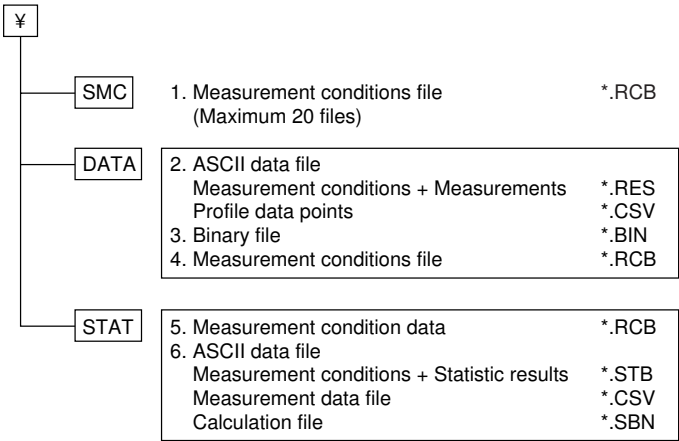
TIP Always use a genuine Mitutoyo memory card (Part No. 12AAA841).
It is CompactFlash™ memory card.

CompactFlash™ is a trademark of Sundisk Corporation of the United States and is licensed to CFA (CompactFlash™Asso).

■ Data saved in the memory card

If SJ-301 data is saved on the memory card, the following file will be created on the memory card.

● File type



● File format

Profile data points ASCII data form	
*.RES	*.CSV
" Comment of up to 25 characters. "	8000 (Data size)
DATE????/??/??,TIME ??:??:??	0.12
JIS1994	0.15
profile=R	.
.	.
Ra 3.01 μm	.

Measurement data form	
*.STB	*.CSB
" Comment of up to 25 characters. "	
DATE????/??/??,TIME ??:??:??	0.12
JIS1994	0.15
profile=R	.
.	.
AVERAGE (3.00 μm)	.

8.2 Saving/Recalling the Measurement Conditions

This section explains the procedure for saving and recalling the measurement conditions.

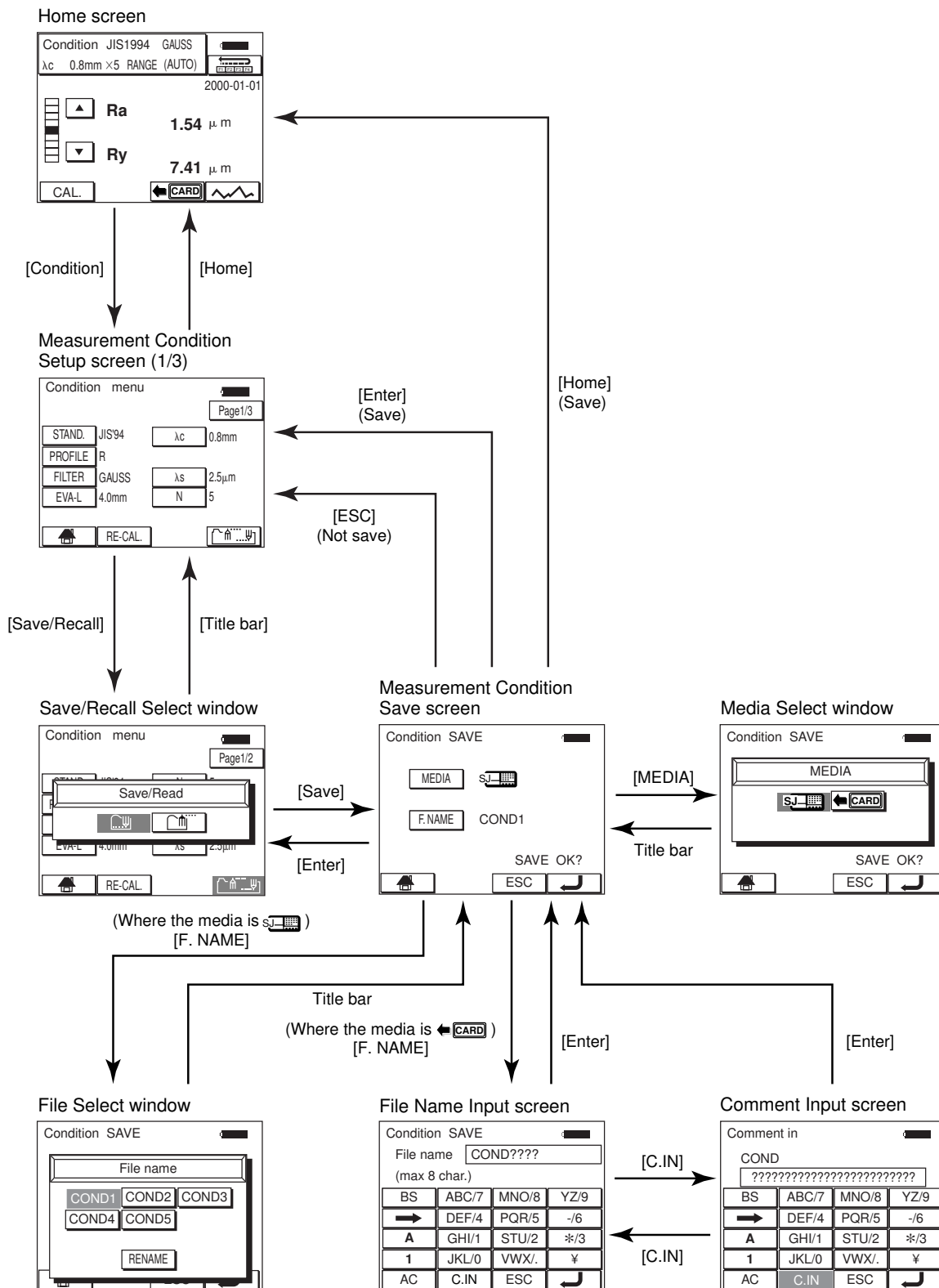
8.2.1 Saving the measurement conditions

Measurement conditions can be saved either in the internal memory or on the memory card (optional).

To save the measurement conditions, first bring up the Measurement Condition Save screen, and then select the save destination media (internal memory or memory card). Subsequently, select an appropriate file or input the file name.

Whether the internal memory or a memory card is being used as the storage media, the save screens are virtually identical. However, the screen for specifying a save destination file and the operations required in it will differ.

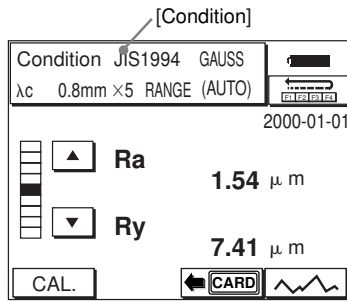
■ Screens displayed when saving the measurement conditions



8. SAVE/READ OF MEASUREMENTS, MEASUREMENT CONDITIONS AND STATISTICAL DATA

■ Invoking the Measurement Condition Save screen and selecting the media

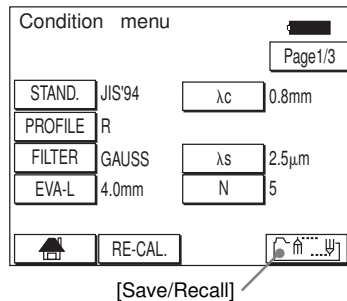
1 <Home screen>



Touch the [Condition] button in the Home screen.

⇒ The Measurement Condition Setup screen (1/3) will appear.

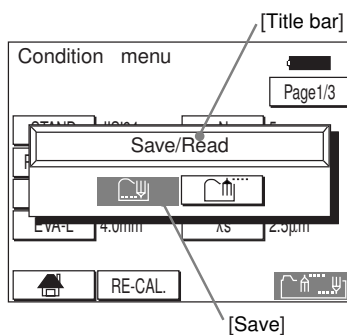
2 <Measurement Condition Setup screen (1/3)>



If there is no problem with the displayed measurement conditions, touch the [Save/Recall] button.

⇒ The Save/Recall select window will appear.

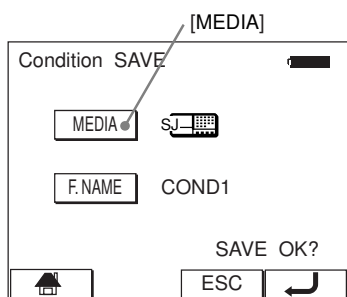
3 <Save/Recall Select window>



Touch the [Save] button, then touch the title bar.

⇒ The Measurement Condition Save screen will appear.

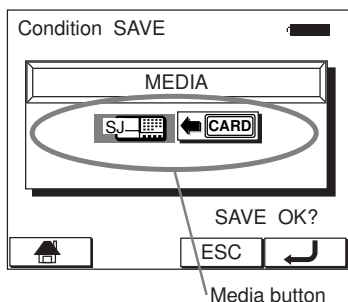
4 <Measurement Condition Save screen>



Touch the [MEDIA] button.

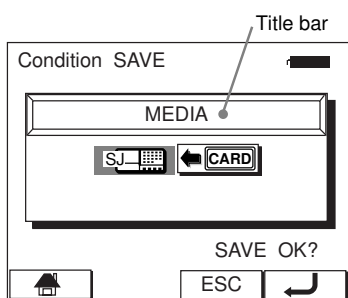
⇒ The Media Select window will appear.

5 <Media Select window>



Touch the button of the media to be used as the save destination.

6 <Media Select window>

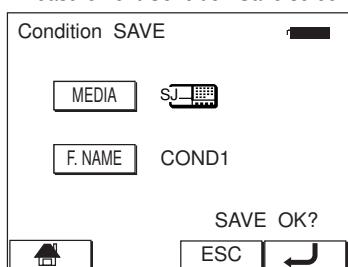


Touch the title bar.

⇒ The Media Select window will be closed.



<Measurement Condition Save screen>



TIP

Subsequent operations will differ according on the selected media.

If internal memory is selected, refer to “**■ Saving measurement conditions in internal memory**”.

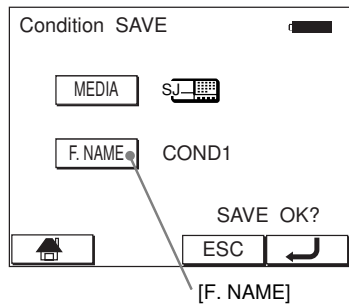
If the memory card is selected, refer to “**■ Saving measurement conditions in the memory card**”.

8. SAVE/READ OF MEASUREMENTS, MEASUREMENT CONDITIONS AND STATISTICAL DATA

■ Saving measurement conditions in internal memory

First select the media used as the save destination, then perform the following procedure.

1 <Measurement Condition Save screen>

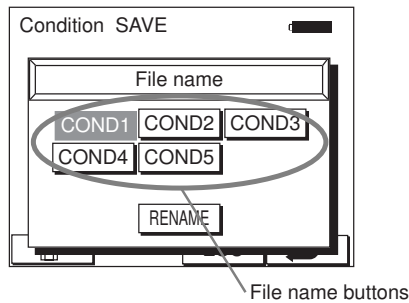


Touch the [F. NAME] button in the Measurement Condition Save screen.

⇒ The File Select window will appear.

Up to five files of measurement conditions will be displayed in this window.

2 <File Select window>



Touch the button of the file name used as the save destination.

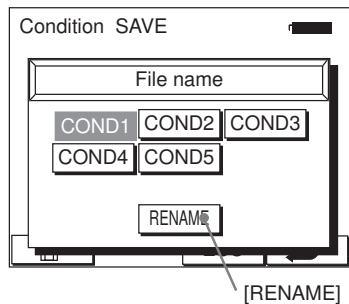
TIP

The existing file name can be modified to other than the current one.

If this is to be done, proceed to step 3.

To overwrite an existing file without modifying the current file name, proceed to step 5.

3 <File Select window>



Touch the [RENAME] button.

⇒ The File Name Input screen will appear.

4 <File Name Input screen>

File name input field

Condition SAVE

File name COND1???
(max 8 char.)

BS	ABC/7	MNO/8	YZ/9
→	DEF/4	PQR/5	-/6
A	GHI/1	STU/2	*/3
1	JKL/0	VWX./	¥
AC		ESC	↩

To erase the file name in the input field touch the [BS] or [AC] button on the screen.

[BS]: Each time this button is touched, each of the file name characters will be replaced by a question mark ("???"), one by one starting from the right.

[AC]: If this button is touched once, the entire file name will be replaced by eight question marks ("????????").

In the file name input field, enter a new file name of up to eight characters, then touch the [Enter] button.

TIP For information about inputting characters refer to section 2.2, "Outline of the Touch Panel".

5 <File Select window>

Title bar

Condition SAVE

File name

A1 COND2 COND3
COND4 COND5

RENAME

⇒ Returns to the File Name Select window.

Touch the title bar.

⇒ The File Select window will be closed.

6 <Measurement Condition Save screen>

Condition SAVE

MEDIA SJ

F. NAME A1

SAVE OK?

ESC ↩

[Enter]

Touch the [Enter] button.

⇒ The selected measurement conditions are saved and the Measurement Condition Setup screen (1/2) will be restored.

<Measurement Condition Save screen (save in progress)>

Condition SAVE

MEDIA SJ

F. NAME A1

SAVE OK?

ESC ↩

7 <Measurement Condition Setup screen (1/3)>

Condition menu Page1/3

STAND.	JIS'94	λc	0.8mm
PROFILE	R		
FILTER	GAUSS	λs	2.5 μ m
EVA-L	4.0mm	N	5

Home RE-CAL. ...

[Home]

Touch the [Home] button.

⇒ Returns to the Home screen.

↓

<Home screen>

Condition JIS1994 GAUSS 2000-01-01

λc 0.8mm $\times 5$ RANGE (AUTO) ...

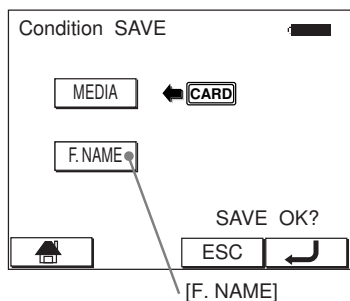
▲	Ra	1.54 μ m
▼	Ry	7.41 μ m

CAL. ← CARD ...

■ Saving measurement conditions in the memory card

Select the media to save the measurement conditions, then perform the following procedure.

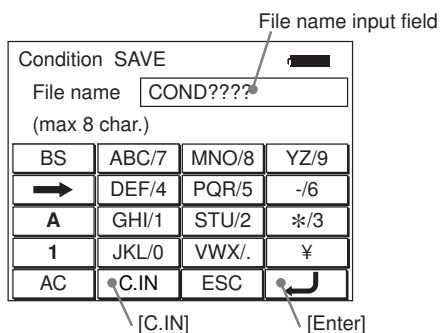
1 <Measurement Condition Save screen>



Touch the [F. NAME] button in the Measurement Condition Save screen.

⇒ The File Name Input screen will appear.

2 <File Name Input screen>



Input the file name in the file name input field with up to eight characters, then touch the [Enter] button.

TIP

- The operator can add a comment to the destination file. If this is done, first enter the file name, then touch the [C.IN] button before touching the [Enter] button. For more information refer to the “● Inputting a comment” description which follows.
- For information about inputting characters refer to section 2.2, “Outline of the Touch Panel”.

⇒ Returns to the Measurement Condition Save screen.

3 <Measurement Condition Save screen>

Condition SAVE

MEDIA ← CARD

F.NAME COND

SAVE OK?

HOME ESC [Enter]

Touch the [Enter] button.

⇒ The selected measurement conditions are saved and the Measurement Condition Setup screen (1/3) will be restored.



<Measurement Condition Save screen (save in progress)>

Condition SAVE

MEDIA ← CARD

F.NAME COND

SAVE OK?

HOME ESC

4 <Measurement Condition Setup screen (1/3)>

Condition menu

Page1/3

STAND. JIS'94 λc 0.8mm

PROFILE R

FILTER GAUSS λs 2.5μm

EVA-L 4.0mm N 5

HOME RE-CAL

[Home]

Touch the [Home] button.

⇒ Returns to the Home screen.



<Home screen>

Condition JIS1994 GAUSS

λc 0.8mm × 5 RANGE (AUTO)

2000-01-01

▲ Ra 1.54 μm

▼ Ry 7.41 μm

CAL. CARD

● Inputting a comment

A comment can be added to the destination file using the procedure below.

1 <File Name Input screen>

Condition SAVE

File name COND????
(max 8 char.)

BS	ABC/7	MNO/8	YZ/9
→	DEF/4	PQR/5	-/6
A	GHI/1	STU/2	*/3
1	JKL/0	VWX/.	¥
AC	C.IN	ESC	↵

[C.IN]

Touch the [C.IN] button in the File Name Input screen.

⇒ The Comment Input screen will appear.

2 <Comment Input screen>

Comment in

COND
????????????????

Comment input field

BS	ABC/7	MNO/8	YZ/9
→	DEF/4	PQR/5	-/6
A	GHI/1	STU/2	*/3
1	JKL/0	VWX/.	¥
AC	C.IN	ESC	↵

[Enter]

Enter a comment in the comment input field with up to twenty five characters, then touch the [Enter] button.

⇒ Returns to the Measurement Condition Save screen.

TIP

The objective file name can be modified by touching the [C.IN] button again before the [Enter] button is touched.

<Measurement Condition Save screen>

Condition SAVE

MEDIA ← CARD

F.NAME COND

SAVE OK?

ESC ↵

8.2.2 Recalling the measurement conditions

Measurement conditions saved in the internal memory or memory card (optional) can be read as necessary.

To read the measurement conditions first bring up the Measurement Condition Recall screen from the Measurement Condition Setup screen, then select the media (internal memory or memory card). Subsequently, perform appropriate operations such as file selection.

TIP In addition to the Measurement Condition Setup screen, the [CONDITION READ] key on the Display Unit can be used to recall measurement conditions from internal memory. For more information refer to “■ How to read measurement conditions with the [CONDITION READ] key”, which appears later in this manual.

Whether the internal memory or a memory card is being used as the storage media, the recall screens are virtually identical. However, the screen for specifying a source recall file and the operations involved will differ.

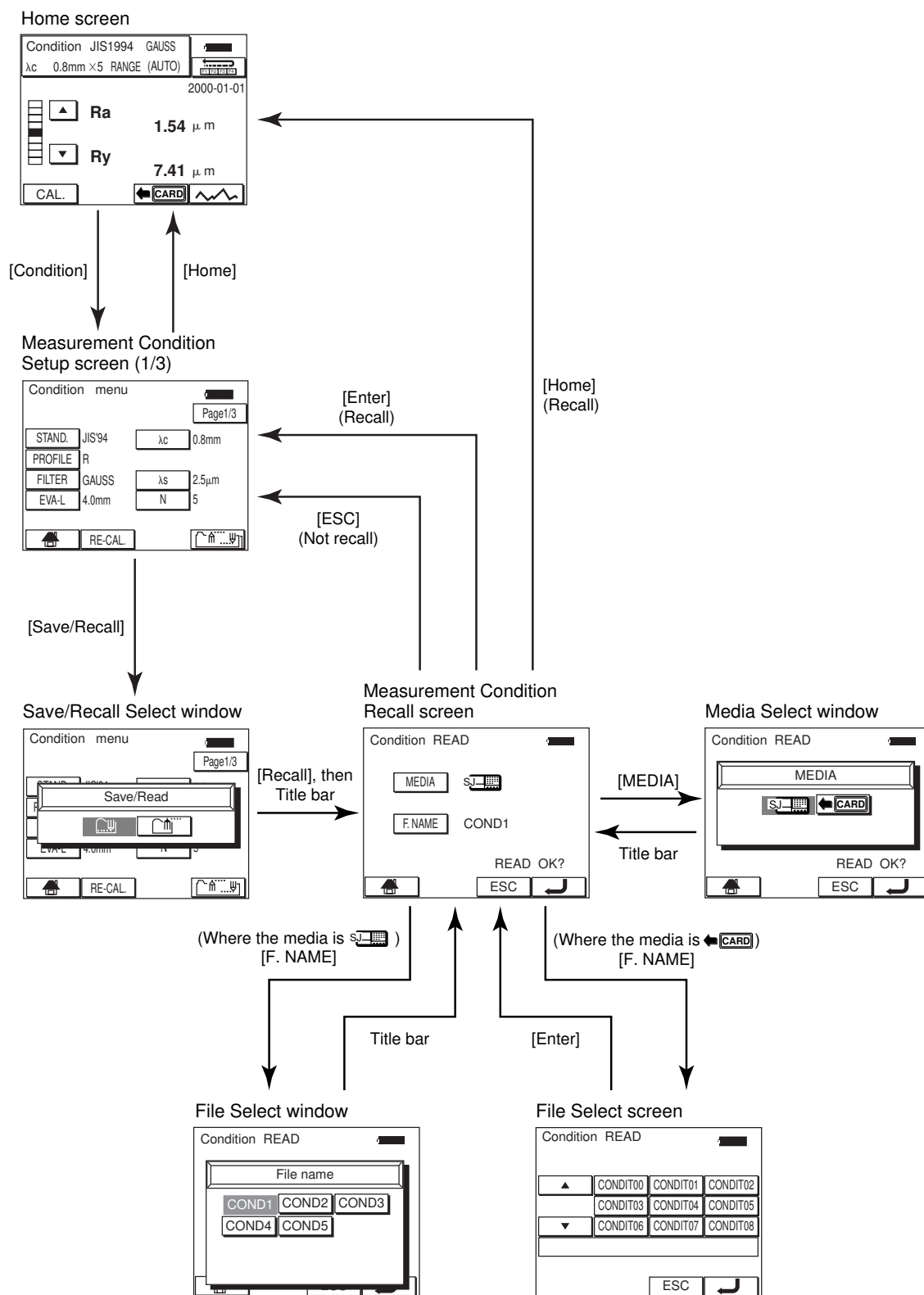
The following example uses screens that read the measurement conditions from internal memory.

IMPORTANT Multiple files stored cannot be recalled at the same time.

NOTE When the stored measurement conditions are read, the following conditions will also be read to replace the existing SJ-301 settings at the same time:
Print conditions, DATA key function setup, and calibration conditions.

■ How to recall measurement conditions with the Measurement Condition Setup screen

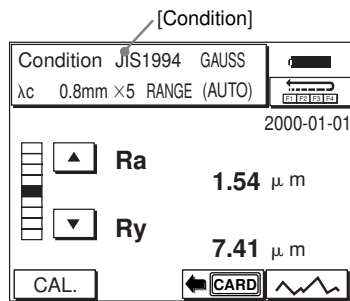
● Transition of screens



8. SAVE/READ OF MEASUREMENTS, MEASUREMENT CONDITIONS AND STATISTICAL DATA

● Recalling a measurement condition file from the internal memory

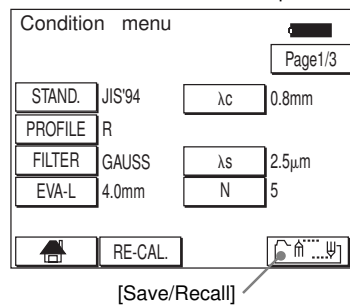
1 <Home screen>



Touch the [Condition] button in the Home screen.

⇒ The Measurement Condition Setup screen(1/3) will appear.

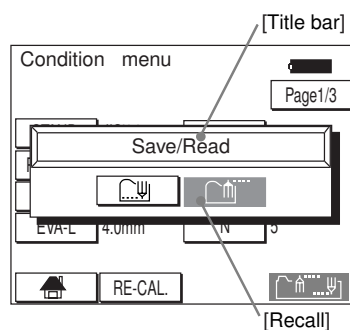
2 <Measurement Condition Setup screen (1/3)>



Touch the [Save/Recall] button.

⇒ The Save/Recall Select window will appear.

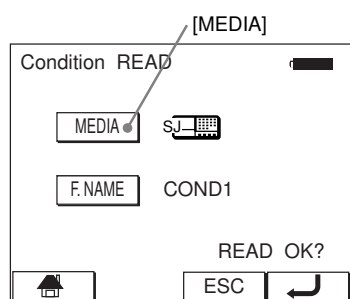
3 <Save/Recall Select window>



Touch the [Recall] button, then touch the title bar.

⇒ The Measurement Condition Recall screen will appear.

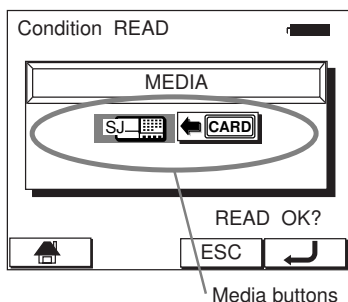
4 <Measurement Condition Recall screen>



Touch the [MEDIA] button.

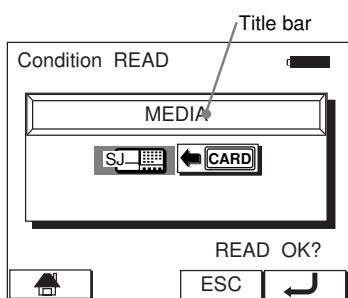
⇒ The Media Select window will appear.

5 <Media Select window>



Touch the button for media from which a file is recalled.
(Internal memory is specified in this case.)

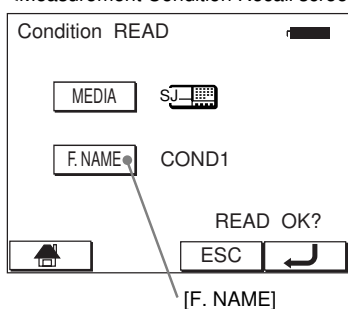
6 <Media Select window>



Touch the title bar.

⇒ Returns to the Measurement Condition Recall screen.

7 <Measurement Condition Recall screen>



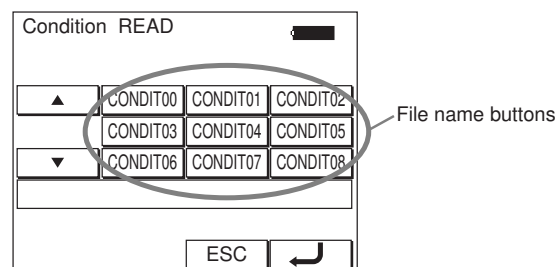
Touch the [F. NAME] button.

⇒ The File Select window will appear.

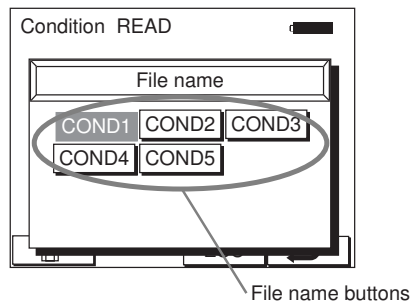
TIP

If the memory card is selected as the media, the File Select screen shown below will appear.

<File Select screen>

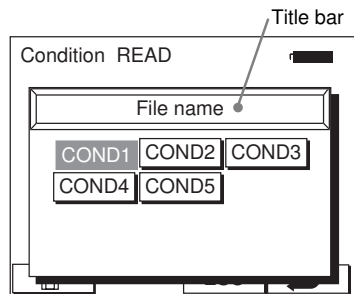


8 <File Select window>



Touch the button of the file to be recalled.

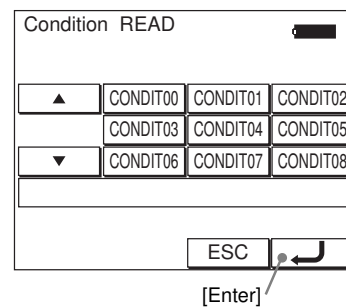
9 <File Select window>



Touch the title bar.

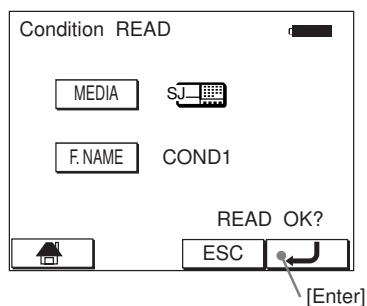
TIP If the memory card is selected as the media, touch the [Enter] button in the File Select screen.

<File Select screen>



⇒ Returns to the Measurement Condition Recall screen.

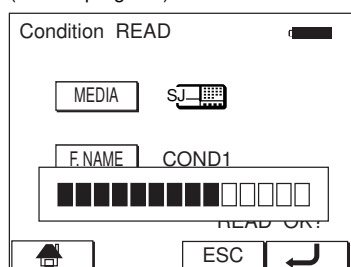
10 <Measurement Condition Recall screen>



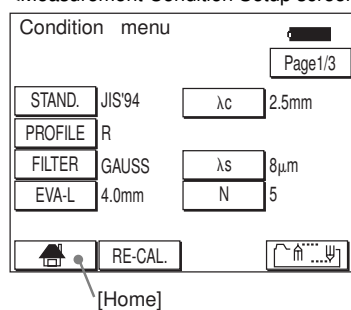
Touch the [Enter] button.

⇒ The specified measurement conditions will be read and the Measurement Condition Setup screen (1/3) will be restored.

↓
<Measurement Condition Recall screen (save in progress)>



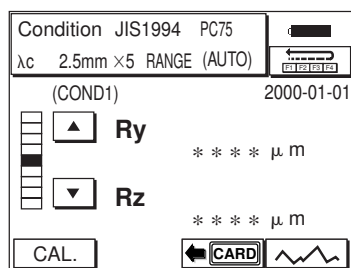
11 <Measurement Condition Setup screen (1/3)>



Touch the [Home] button.

⇒ Returns to the Home screen.

↓
<Home screen>

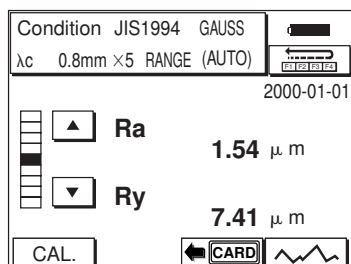


8. SAVE/READ OF MEASUREMENTS, MEASUREMENT CONDITIONS AND STATISTICAL DATA

■ How to read measurement conditions with the [CONDITION READ] key

Measurement conditions can also be read from internal memory using the [CONDITION READ] key.

1 <Home screen>

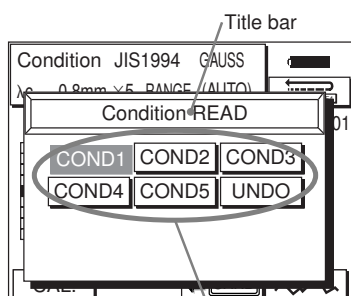


[CONDITION READ] key

If the Home screen is active, press the [CONDITION READ] key on the Display Unit.

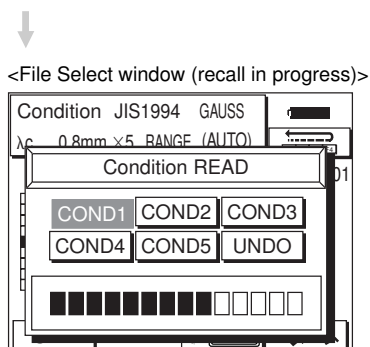
⇒ The File Select window will appear.

2 <File Select window>

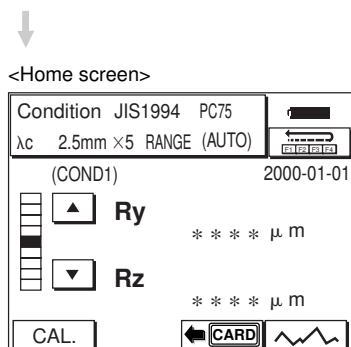


Touch the button of the file to be recalled, then touch the title bar.

⇒ The specified measurement conditions are recalled and the Home screen is restored.



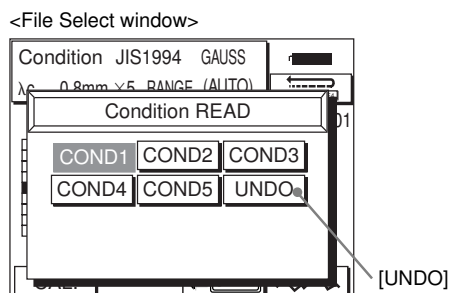
TIP While the measurement conditions are being read a progress bar is displayed.



TIP After the measurement conditions have been read, the screen can be restored to its previous condition. To do this, bring up the File Select window again (execute again steps 1 and 2 described above), then touch the [UNDO] button.

● About the [UNDO] function

The Select File window, which is displayed when the [CONDITION READ] key is pressed, features the [UNDO] button.



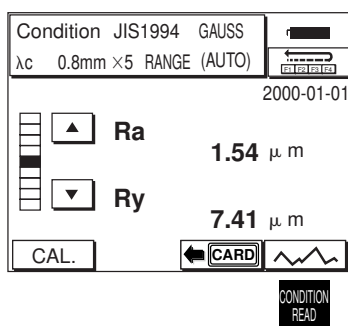
The [UNDO] button provides the following two functions.

- If the measurement conditions were read from the internal memory using the [CONDITION READ] key, this button restores the screen to its previous condition (condition before the measurement conditions were overwritten).

TIP Refer to “■ How to read measurement conditions with the [CONDITION READ] key” described previously.

- If any of the measurement conditions have been modified in the Measurement Condition Setup screen, perform the following procedure to restore the previous conditions.

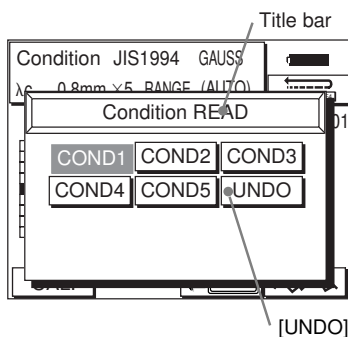
1 <Home screen>



When the Home screen is active, press the [CONDITION READ] key on the Display Unit.

⇒ The File Select window will appear.

2 <File Select window>



Touch the [UNDO] button then touch the title bar.

⇒ The measurement conditions before the modification are restored and then the Home screen is returned to.

8.3 Saving/Reading Measured Profile Data

This section explains the procedure for saving and reading the measured profile data.

8.3.1 Saving the measured profile data

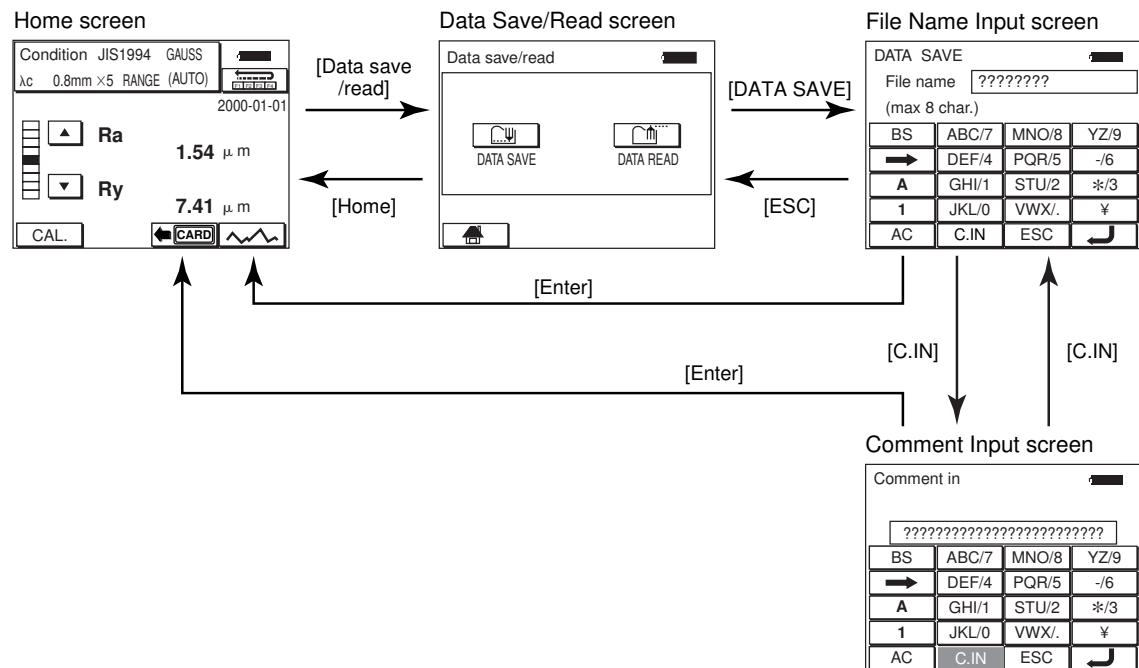
The profile data points can be saved on the memory card (optional) using the [Data save/read] button on the Home screen.

The profile data points can not be saved in internal memory.

TIP Profile data points saving can also be performed with the [DATA] key on the Display Unit. See “**■** Saving profile data points on the memory card using the [DATA] key” on the following page.

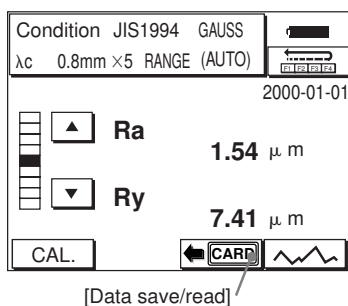
■ Saving profile data points using the [Data save/read] button

● Screens displayed when saving the profile data points



● Saving profile data points by specifying the file name

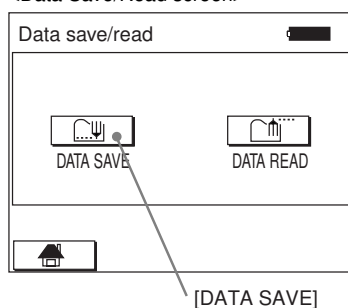
1 <Home screen>



Touch the [Data save/read] button in the Home screen.

⇒ The Data Save/Read screen will appear.

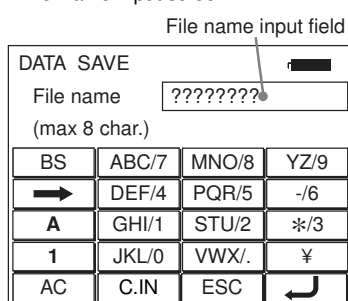
2 <Data Save/Read screen>



Touch the [DATA SAVE] button.

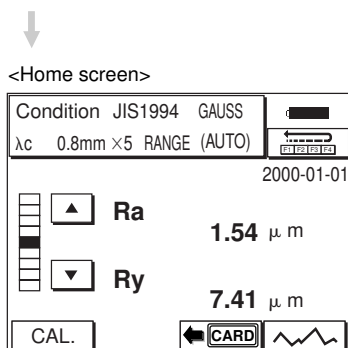
⇒ The File Name Input screen will appear.

3 <File Name Input screen>



In the file name input field, enter a new file name with up to eight characters, then touch the [Enter] button.

⇒ The profile data will be saved and the Home screen will be restored.



TIP

- A comment can be added to the specified file. To enter a comment, first enter the file name, then touch the [C.IN] button instead of the [Enter] button. You can proceed with the procedure “● Inputting a comment” given on the following page.
- For information about inputting characters refer to section 2.2, “Outline of the Touch Panel”.

8. SAVE/READ OF MEASUREMENTS, MEASUREMENT CONDITIONS AND STATISTICAL DATA

● Inputting a comment

A comment can be added to the specified file. Use the following procedure to input a comment after inputting the file name.

1 <File Name Input screen>

DATA SAVE

File name WORK????
(max 8 char.)

BS ABC/7 MNO/8 YZ/9
DEF/4 PQR/5 -/6
A GHI/1 STU/2 */3
1 JKL/0 VWX/. ¥
AC C.IN ESC

[C.IN]

After the input of the file name, touch the [C.IN] button in the File Name Input screen.

⇒ The Comment Input screen will appear.

2 <Comment Input screen>

Comment in

Comment input field

WORK
??

BS ABC/7 MNO/8 YZ/9
DEF/4 PQR/5 -/6
A GHI/1 STU/2 */3
1 JKL/0 VWX/. ¥
AC C.IN ESC

[Enter]

Input a comment in the comment input field with up to 25 characters, then touch the [Enter] button.

⇒ The profile data is saved under the specified file name and the Home screen will be restored.

TIP

- Touching the [C.IN] button instead of the [Enter] button restores the File Name Input screen.
- Touching the [ESC] button aborts profile data storage and restores the Data Save/Read screen.

<Home screen>

Condition JIS1994 GAUSS

λc 0.8mm ×5 RANGE (AUTO)

2000-01-01

Ra 1.54 μm

Ry 7.41 μm

CAL. CARD

8. SAVE/READ OF MEASUREMENTS, MEASUREMENT CONDITIONS AND STATISTICAL DATA

● Inputting a comment

A comment can be added to the specified file. Use the following procedure to input a comment after inputting the file name.

1 <File Name Input screen>

After the input of the file name, touch the [C.IN] button in the File Name Input screen.

⇒ The Comment Input screen will appear.

2 <Comment Input screen>

Input a comment in the comment input field with up to 25 characters, then touch the [Enter] button.

⇒ The profile data is saved under the specified file name and the Home screen will be restored.

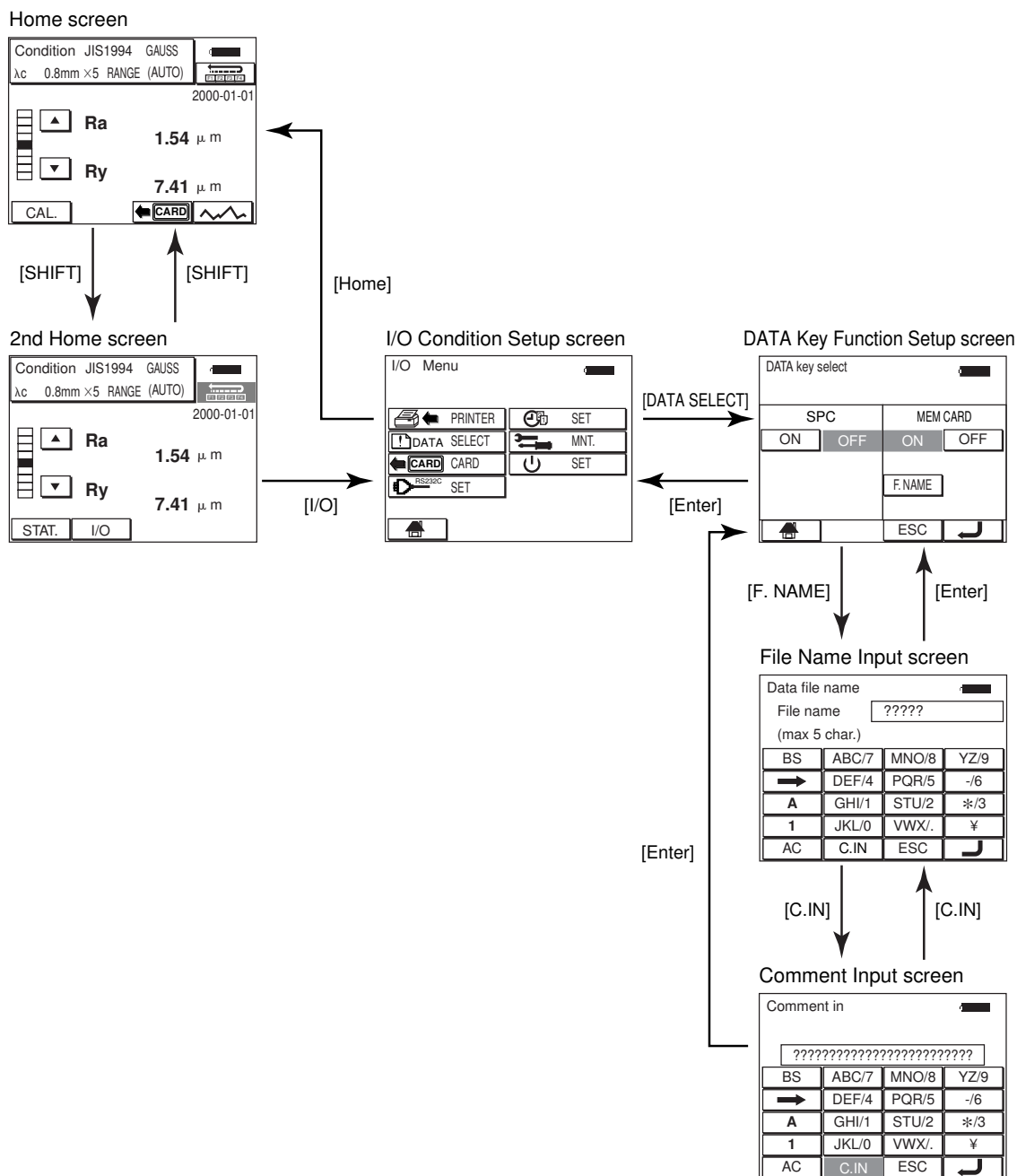
TIP

- Touching the [C.IN] button instead of the [Enter] button restores the File Name Input screen.
- Touching the [ESC] button aborts profile data storage and restores the Data Save/Read screen.

■ Saving profile data points on the memory card using the [DATA] key

To save profile data points using the [DATA] key, the key function must have been so set. At the same time, enter a generic name that applies to all files under the control of the [DATA] key. A comment can also be entered as described on the previous page.

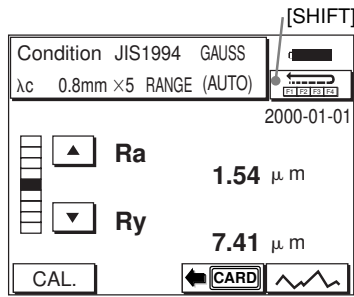
● Screen transition when changing the [DATA] key function.



8. SAVE/READ OF MEASUREMENTS, MEASUREMENT CONDITIONS AND STATISTICAL DATA

- Setting up the [DATA] key function and generic file name and save the measured profile data

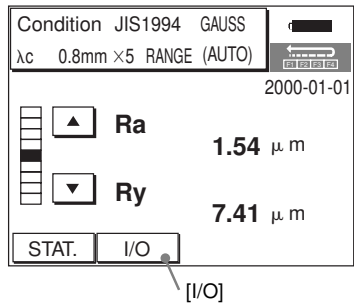
1 <Home screen>



Touch the [SHIFT] button in the Home screen.

⇒ 2nd Home screen will appear.

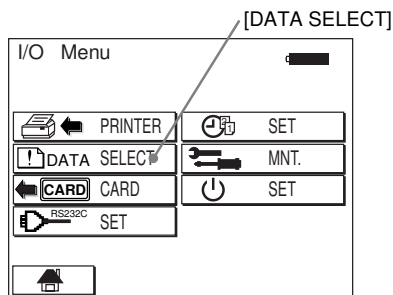
2 <2nd Home screen>



Touch the [I/O] key.

⇒ I/O Condition Setup screen will appear.

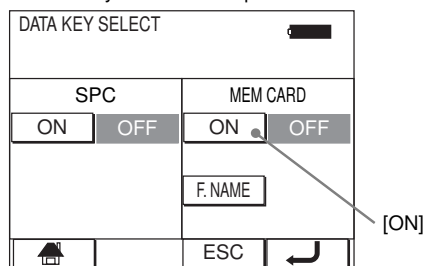
3 <I/O Condition Setup screen>



Touch the [DATA SELECT] button.

⇒ DATA Key Function Setup screen will appear.

4 <DATA Key Function Setup screen>



Touch the memory card [ON] button.

⇒ The [ON] button is highlighted.

5 <DATA Key Function Setup screen>

Touch the [F. NAME] button.

⇒ File Name Input screen will appear.

6 <File Name Input screen>

Input the file name in the file name input field with up to five characters, then touch the [Enter] button.

TIP

- A comment can be added to the specified file. To enter a comment, first enter the file name, then touch the [C.IN] button instead of the [Enter] button. The [C.IN] button brings up the Comment Input screen. You can proceed with the procedure “● Inputting a comment” given on the previous pages.
- See section 2.2 “Outline of the Touch Panel” about inputting characters.

⇒ The DATA Key Function Setup screen is restored.

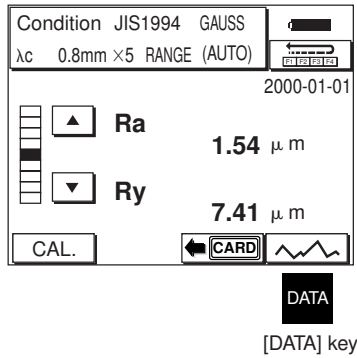
7 <DATA Key Function Setup screen>

Touch the [Home] button.

⇒ The Home screen is restored, where you can use the [DATA] key to save the measured profile data.

8. SAVE/READ OF MEASUREMENTS, MEASUREMENT CONDITIONS AND STATISTICAL DATA

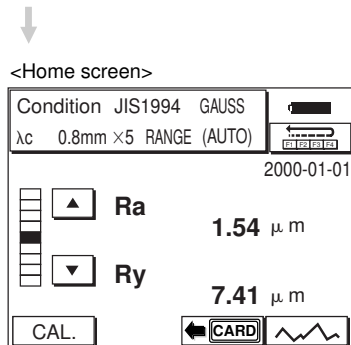
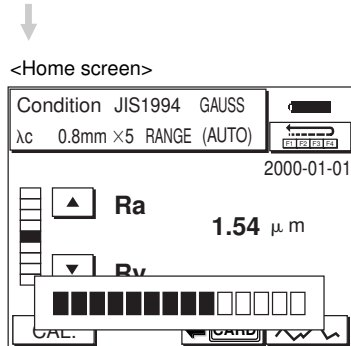
8 <Home screen>



Press the [DATA] key.

⇒ A bar appears indicating the storage in progress.

NOTE Each time the [DATA] key is pressed, measured profile data is stored in the memory card under the generic file name, which is automatically appended with running number starting from 001 up to 999.



⇒ The bar disappears upon completion of data storage, restoring the Home screen.

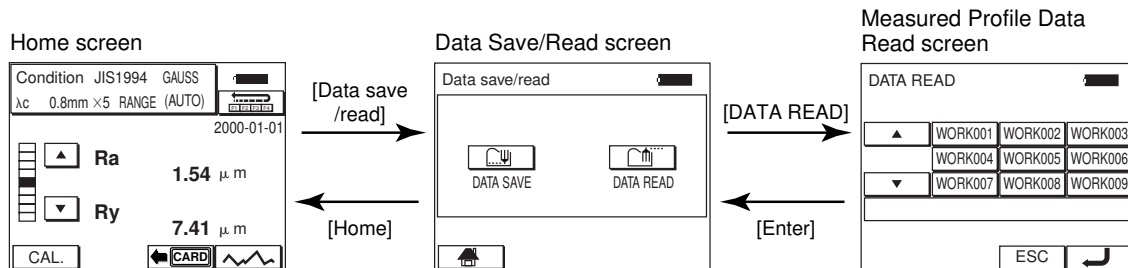
8.3.2 Reading the measured profile data

The file of profile data can only be read from the memory card (optional) in the Home screen.

IMPORTANT Multiple files cannot be recalled at the same time.

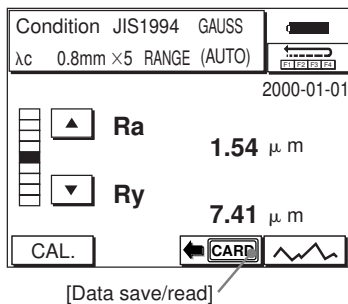
NOTE When the stored profile data is read, the following conditions will also be read to replace the existing SJ-301 settings at the same time.
Measurement conditions, Print conditions, DATA SEL, and Calibration conditions

■ Screens displayed when the profile data is read



■ Measured profile data read procedure

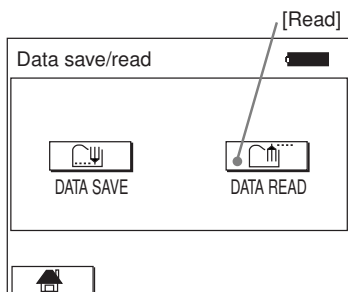
1 <Home screen>



Touch the [Data save/read] button in the Home screen.

⇒ The Save/Read Data screen will appear.

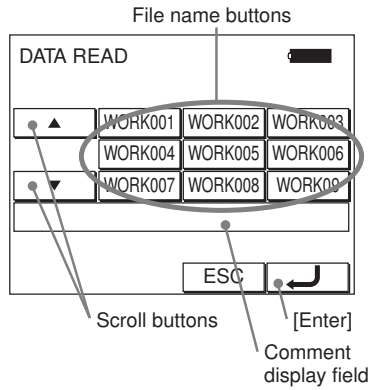
2 <Data Save/Read screen>



Touch the [Read] button.

⇒ The Measured Profile Data Read screen will appear.

3 <Measured Profile Data Read screen>



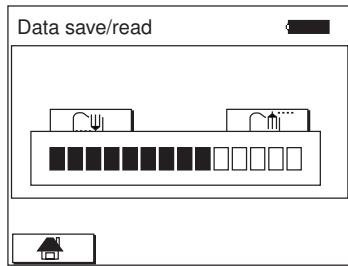
Touch the button of a file to be called, then touch the [Enter] button.

TIP

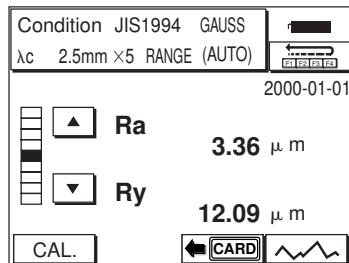
- If there are more than ten files, roll up/down the file name display by touching the scroll button.
- Comments appended to each file will be displayed in the comment display field.

⇒ The Data Save/Read screen is restored, where the bar appears indicating the process of reading the profile data, then the Home screen will be restored.

↓
<Data Save/Read screen (read in progress)>



↓
<Home screen>



8.4 Saving/Reading the Statistical Data

This section explains the procedure for saving and reading the statistical data.

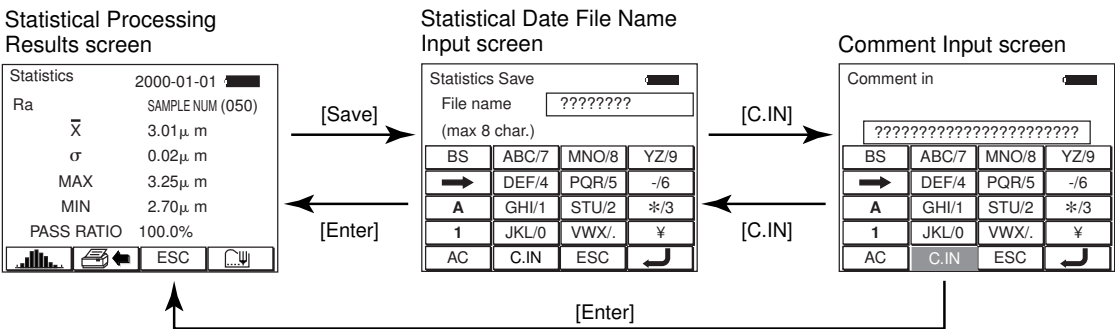
8.4.1 Saving the statistical data

The statistical data can be saved with the Statistical Processing Result screen.

The statistical data can only be stored in the memory card (optional) and not in internal memory.

TIP For the procedure of invoking the Statistical Processing Result screen, refer to section 7.2, “Execution of Statistical Processing”.

■ Screens displayed when saving the statistical data



■ Saving the statistical data

1 <Statistical Processing Result screen>

Statistics 2000-01-01

Ra SAMPLE NUM (050)

$\bar{X}$ 3.01 μ m

σ 0.02 μ m

MAX 3.25 μ m

MIN 2.70 μ m

PASS RATIO 100.0%

[Save]

Touch the [Save] button.

⇒ The Statistical Data File Name Input screen will appear.

2 <Statistical Data File Name Input screen>

File name input field

Statistics Save

File name ????????

(max 8 char.)

BS	ABC/7	MNO/8	YZ/9
→	DEF/4	PQR/5	-/6
A	GHI/1	STU/2	*/3
1	JKL/0	VWX/.	¥
AC	C.IN	ESC	↩

[C.IN] [Enter]

Input the file name to save the statistical data in the file name input field with up to eight characters, then touch the [Enter] button.

TIP

- A comment can be added to the file named. After inputting the file name, touch the [C.IN] button. For more information refer to the “● Inputting a comment” on the following page.
- For information about inputting characters refer to section 2.2, “Outline of the Touch Panel”.

<Statistical Processing Result screen>

Statistics 2000-01-01

Ra SAMPLE NUM (050)

$\bar{X}$ 3.01 μ m

σ 0.02 μ m

MAX 3.25 μ m

MIN 2.70 μ m

PASS RATIO 100.0%

[Save]

⇒ The specified statistical data will be saved, and the Statistical Processing Result screen will be restored.

● Inputting a comment

The operator can add a comment to the file. To do this, follow the procedure below.

1 <Statistical Data File Name Input screen>

Statistics Save

File name

(max 8 char.)

BS	ABC/7	MNO/8	YZ/9
	DEF/4	PQR/5	-/6
A	GHI/1	STU/2	*/3
1	JKL/0	VWX/.	¥
AC	C.IN	ESC	

[C.IN]

Touch the [C.IN] button in the Statistical Data File Name Input screen.

⇒ The Comment Input screen will appear.

2 <Comment Input Screen>

Comment input field

Comment in

STA

BS	ABC/7	MNO/8	YZ/9
	DEF/4	PQR/5	-/6
A	GHI/1	STU/2	*/3
1	JKL/0	VWX/.	¥
AC	C.IN	ESC	

[Enter]

Enter a comment in the comment input field with up to twenty five characters, then touch the [Enter] button.

⇒ The statistical data will be saved and the Statistical Processing Results screen is restored.

TIP Touching the [C.IN] button again rather than the [Enter] button restores the Processing Result screen.

<Statistical Processing Results screen>

Statistics 2000-01-01

Ra SAMPLE NUM (050)

$\bar{X}$ 3.01 μ m

σ 0.02 μ m

MAX 3.25 μ m

MIN 2.70 μ m

PASS RATIO 100.0%

ESC

8.4.2 Reading the statistical data

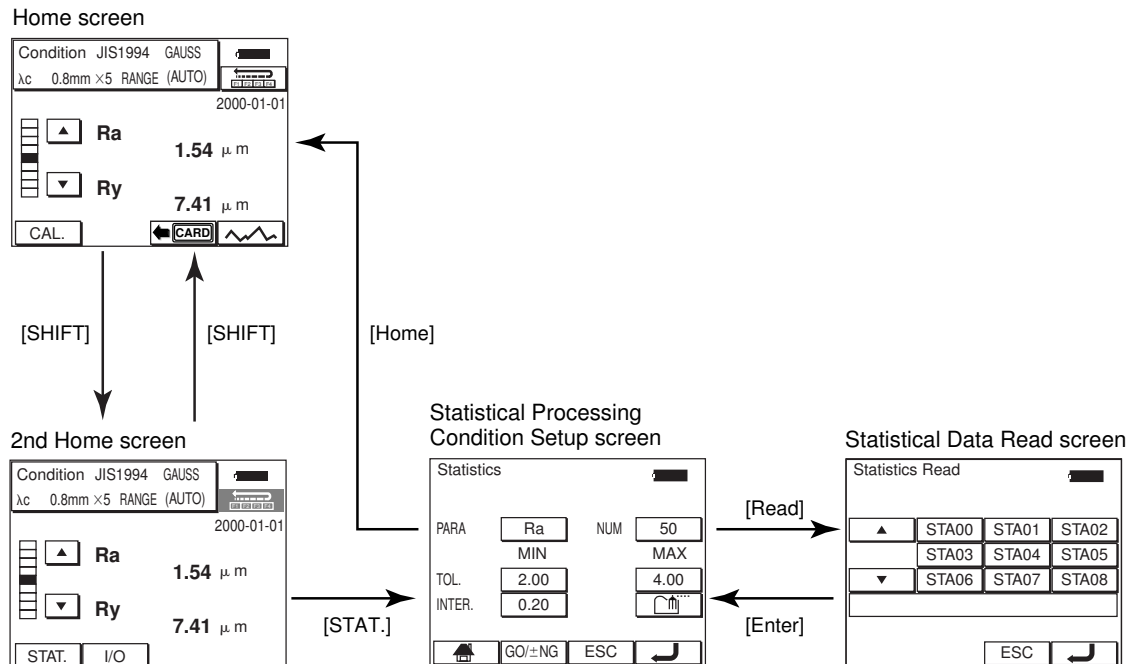
The statistical data can be read with the Statistical Processing Condition Setup screen.

The statistical data can only be read from the memory card (optional).

IMPORTANT Multiple files cannot be read at the same time.

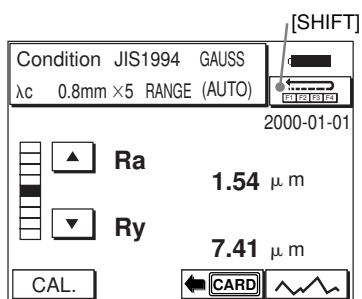
NOTE When the statistical data is read, the following conditions will also be read to overwrite the existing SJ-301 settings at the same time.
 Measurement conditions, Print conditions, DATA key function setup, and Calibration conditions

■ Screens displayed when the statistical data is read



■ Reading the statistical data

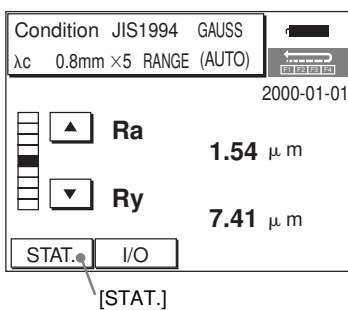
1 <Home screen>



Touch the [SHIFT] button in the Home screen.

⇒ The current screen is switched to the 2nd Home screen.

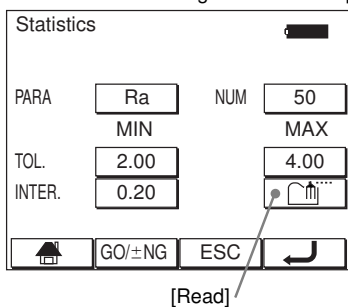
2 <2nd Home screen>



Touch the [STAT] button.

⇒ The Statistical Processing Condition Setup screen will appear.

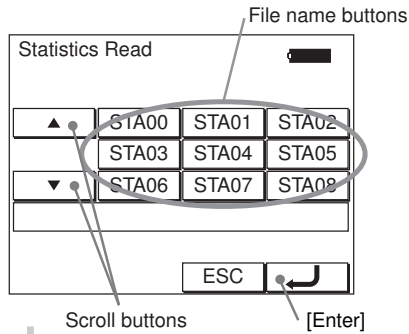
3 <Statistical Processing Condition Setup screen>



Touch the [Read] button.

⇒ The Statistical Data Read screen will appear.

4 <Statistical Data Read screen>

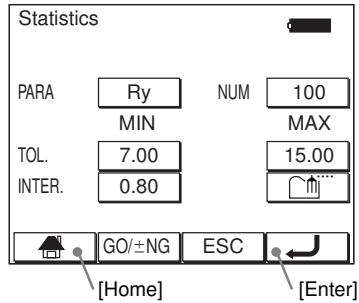


Touch the button of a file to be read, then touch the [Enter] button.

TIP If there are more than ten files, roll up/down the file name display by touching the scroll button.

⇒ The statistical data will be read and the Statistical Processing Condition Setup screen will be restored.

<Statistical Processing Condition Setup screen>



TIP

- To perform statistical processing for the data that has been read, touch the [Enter] button.
- To return to the Home screen, touch the [Home] button.

8.5 Memory Card Formatting and File Deletion

The memory card can be formatted with the SJ-301. Also, any of the files stored in the memory card can be deleted separately.

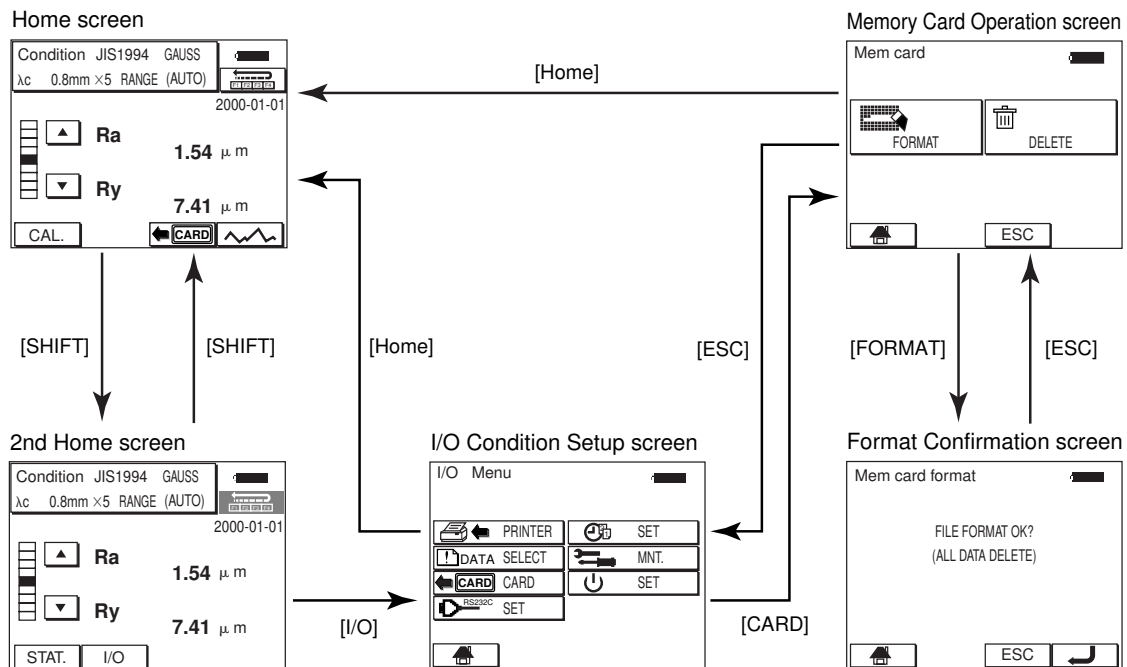
IMPORTANT Be sure to format the memory card with the SJ-301 if it is to be used for saving the data from the SJ-301. Data saving/reading is not possible with the memory card formatted on other instrument than the SJ-301. An error message “MEM ERROR 4” results in this case.

This section explains both procedures.

8.5.1 Formatting the memory card

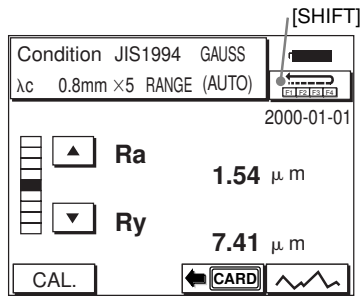
NOTE When the memory card is reformatted, all the data on the card will be completely erased.

■ Screens displayed when the memory card is formatted



■ Formatting the memory card

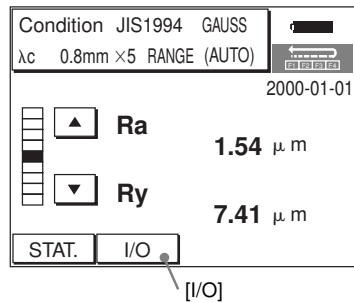
1 <Home screen>



Touch the [SHIFT] button in the Home screen.

⇒ The current screen is switched to the 2nd Home screen.

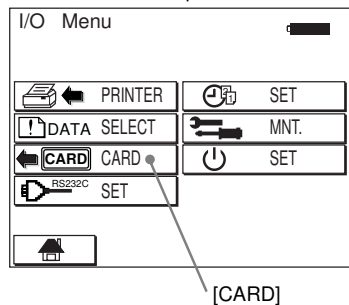
2 <2nd Home screen>



Touch the [I/O] button.

⇒ The I/O Condition Setup screen will appear.

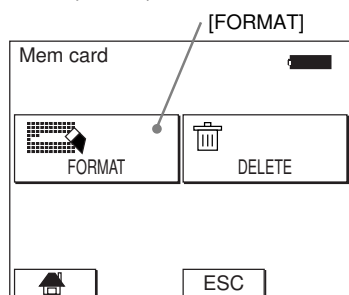
3 <I/O Condition Setup screen>



Touch the [CARD] button.

⇒ The Memory Card Operation screen will appear.

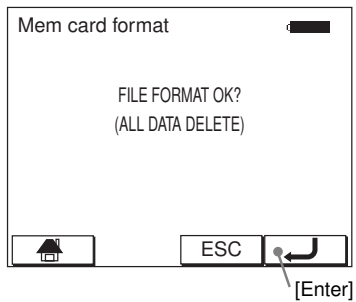
4 <Memory Card Operation screen>



Touch the [Format] button.

⇒ The Format Confirmation screen will appear.

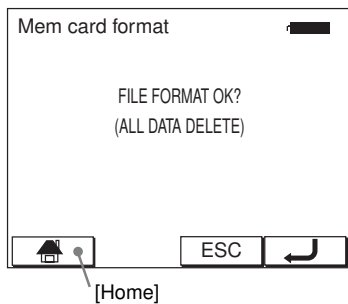
5 <Format Confirmation screen>



Touch the [Enter] button.

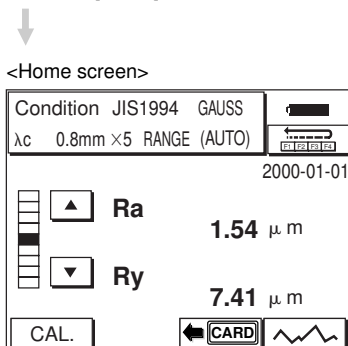
⇒ The memory card will be reformatted.

6 <Format Confirmation screen>



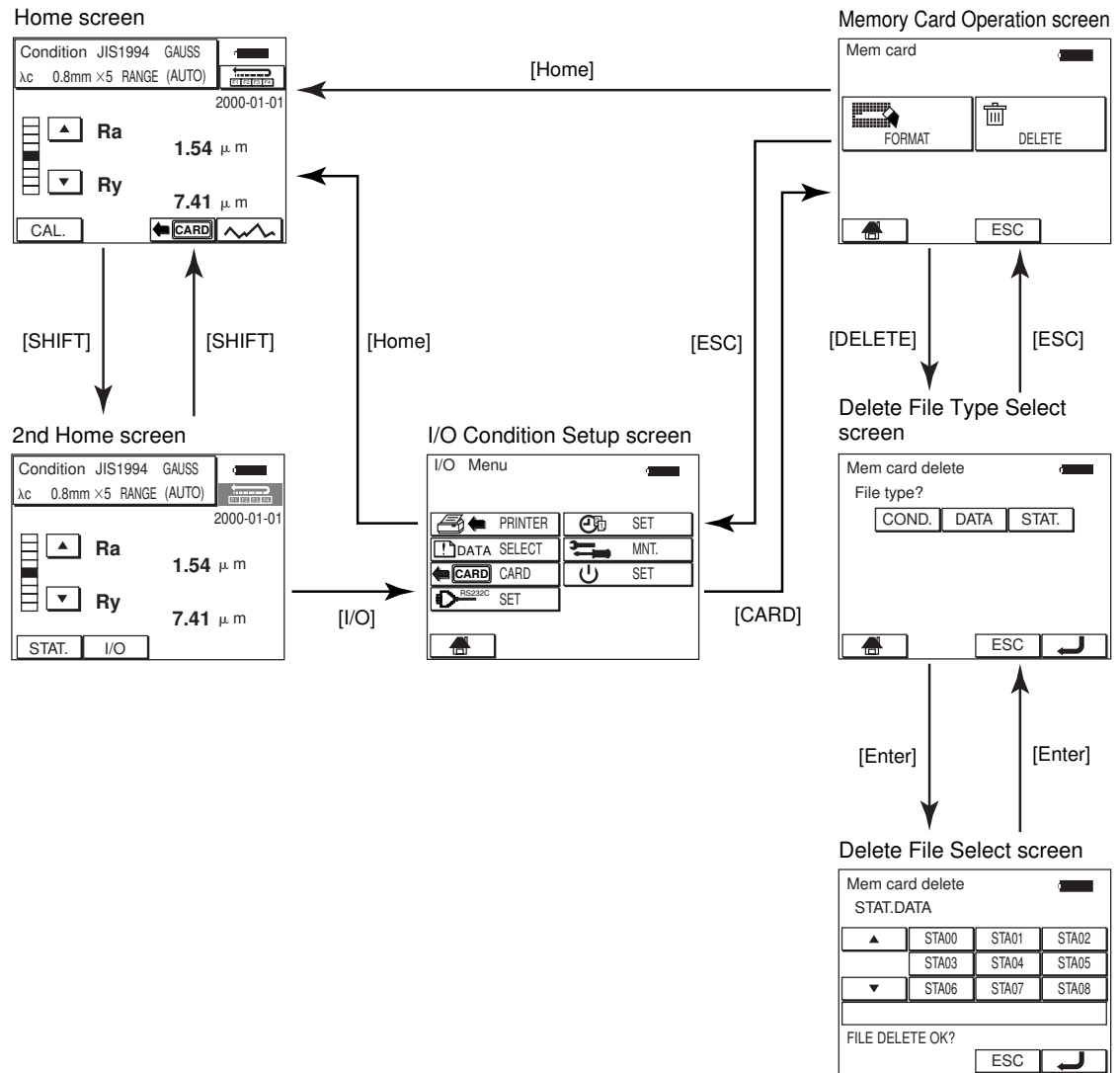
Touch the [Home] button.

⇒ The Home screen will appear.



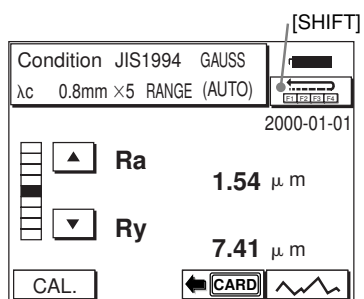
8.5.2 Deleting a file stored in the memory card

■ Screens displayed when a file is deleted



■ Deleting files in the memory card

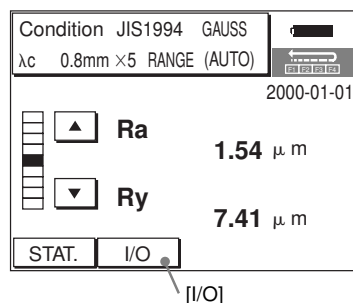
1 <Home screen>



Touch the [SHIFT] button in the Home screen.

⇒ The current screen is switched to the 2nd Home screen.

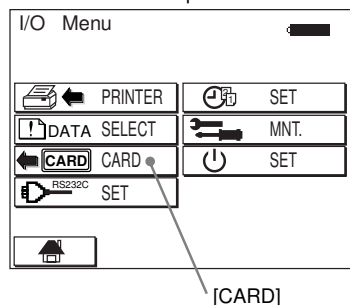
2 <2nd Home screen>



Touch the [I/O] button.

⇒ The I/O Condition Setup screen will appear.

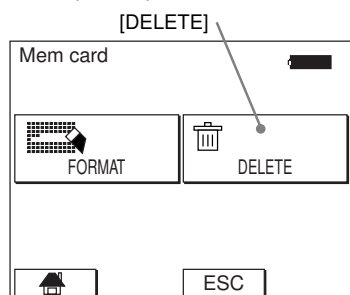
3 <I/O Condition Setup screen>



Touch the [CARD] button.

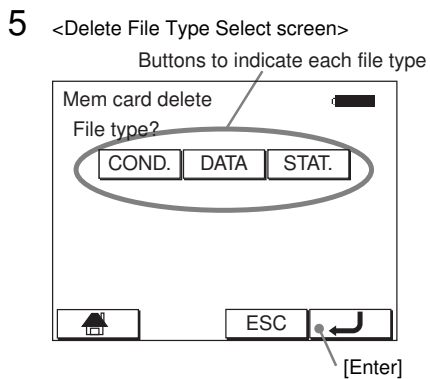
⇒ The Memory Card Operation screen will appear.

4 <Memory Card Operation screen>



Touch the [DELETE] button.

⇒ The Delete File Type Selection screen will appear.



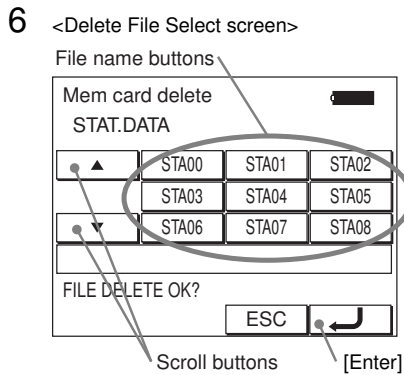
Touch the button of the file type to be deleted, then touch the [Enter] button.

COND: Measurement conditions

DATA: Measured profile data

STAT: Statistical data

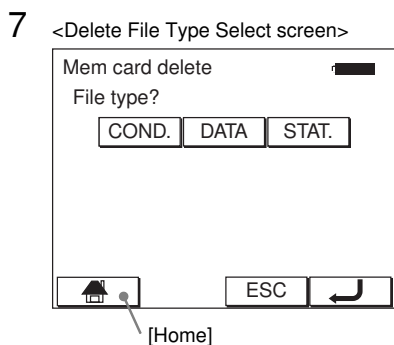
⇒ The Delete File Select screen will appear.



Touch the button of the file name to be deleted, then touch the [Enter] button.

TIP If there are more than ten files, roll up/down the file name display by touching the scroll button.

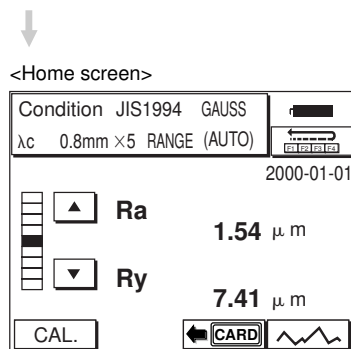
⇒ The specified file will be deleted and the Delete File Type Select screen is restored.



To delete another type of file, return to step 5.

To terminate this operation, touch the [Home] button.

⇒ Returns to the Home screen.



MEMO

9

SPC OUTPUT AND DATA COMMUNICATION

The SJ-301 has a capability of SPC data output and RS-232C-interfaced communication with external devices.

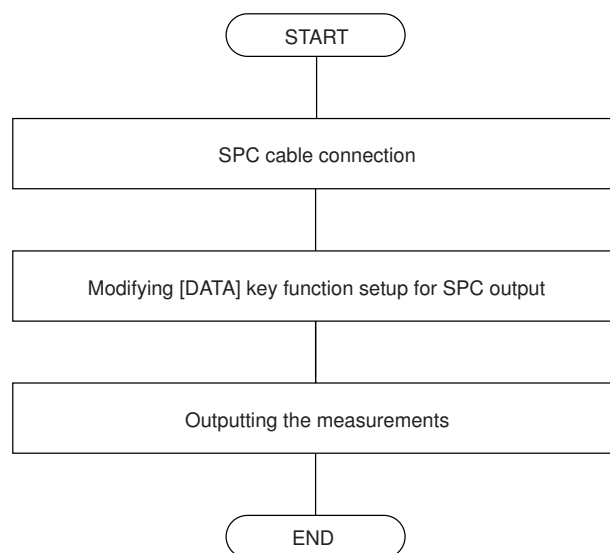
9.1 SPC Output

SPC data is available by connecting the SJ-301 to a Mitutoyo Digimatic Data Processor (such as the DP-1VR).

This chapter explains operations of the SJ-301 being connected with DP-1VR.

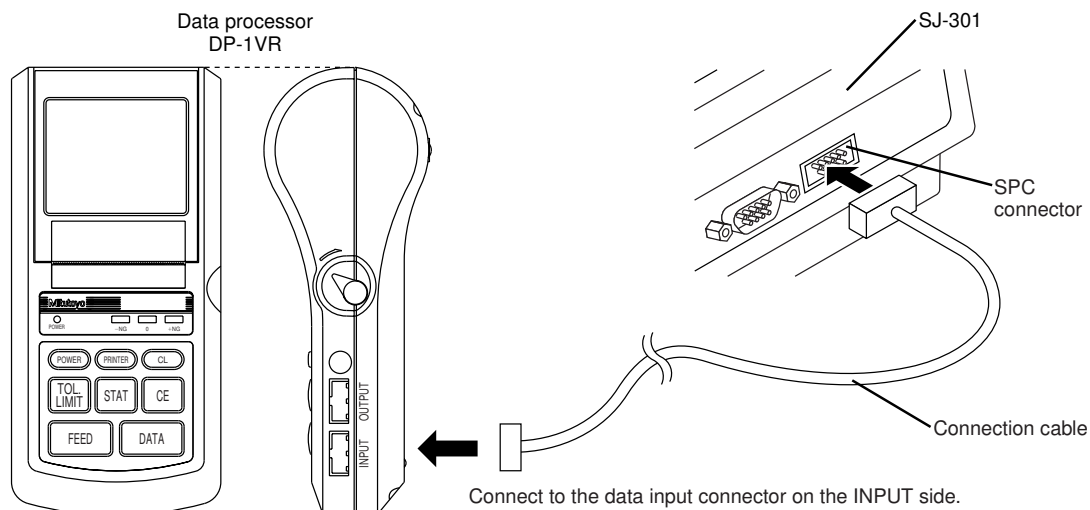
IMPORTANT The SPC data includes only the parameter value being displayed. Such as the parameter name, etc., will not be outputted. To perform data control and/or statistical processing with the multiple parameters, set up measurement routines that can avoid the data pieces from being mixed with different parameters.
Note that, the parameter data for SPC output must be consistent in terms of the decimal places, otherwise an error will occur.

■ Operation flow when performing SPC output



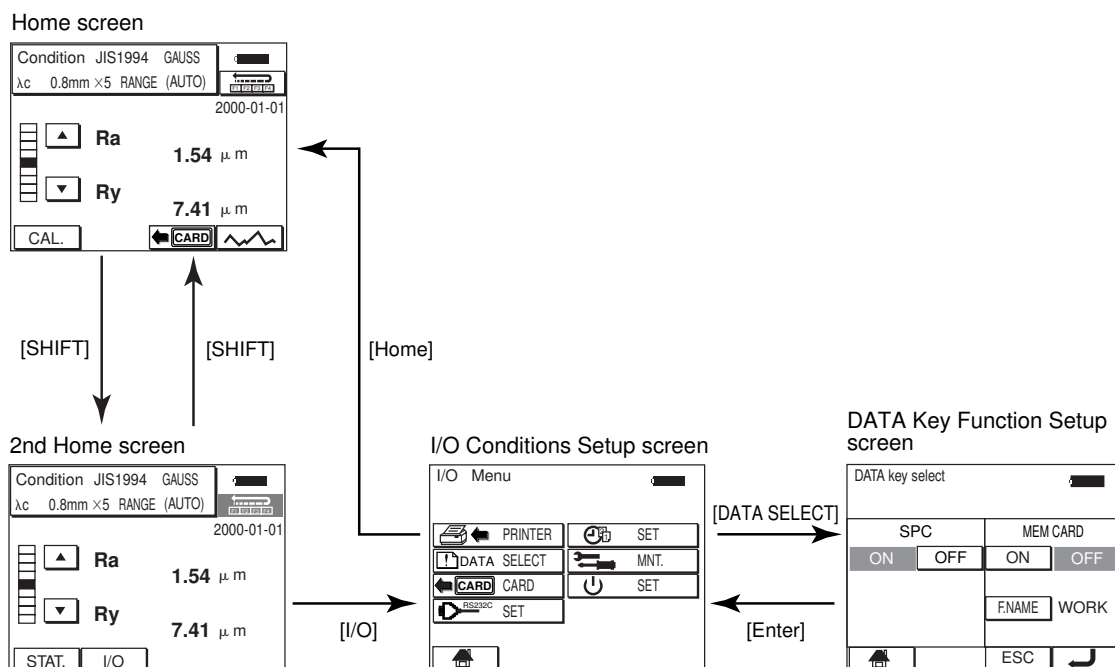
■ SPC cable connection

Connect between the SJ-301 and DP-1VR with the dedicated connection cable as illustrated below.



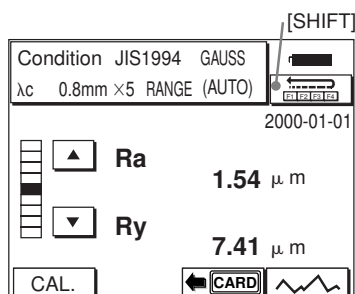
■ Modifying the [DATA] key function setup to that for SPC output

● Screens displayed for modifying the DATA key function setup



● Setting up the DATA key function for SPC output

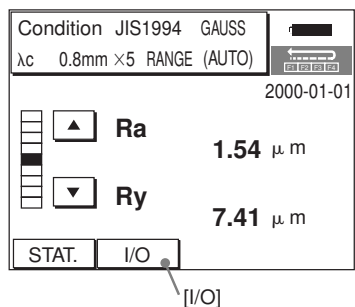
1 <Home screen>



Touch the [SHIFT] button in the Home screen.

⇒ The current screen is switched to the 2nd Home screen.

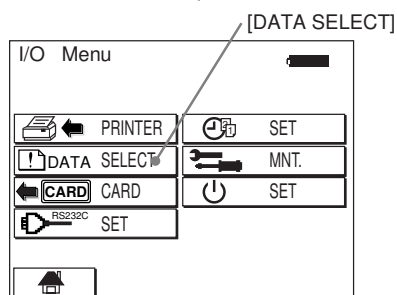
2 <2nd Home screen>



Touch the [I/O] button.

⇒ The I/O Conditions Setup screen will appear.

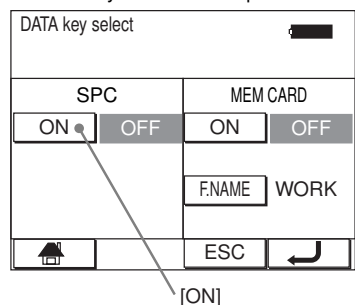
3 <I/O Conditions Setup screen>



Touch the [DATA SELECT] button.

⇒ The DATA Key Function Setup screen will appear.

4 <DATA Key Function Setup screen>



Touch the [ON] button to enable SPC data output with the [DATA] key.

5 <DATA Key Function Setup screen>

DATA key select			
SPC		MEM CARD	
ON	OFF	ON	OFF
		F.NAME	WORK
		ESC	

[Enter]

Touch the [Enter] button to accept the specified function setup.

⇒ Returns to the I/O Conditions Setup screen.

6 <I/O Condition Setup screen>

I/O Menu	
PRINTER	SET
DATA SELECT	MNT.
CARD	SET
RS232C SET	

[Home]

Touch the [Home] button.

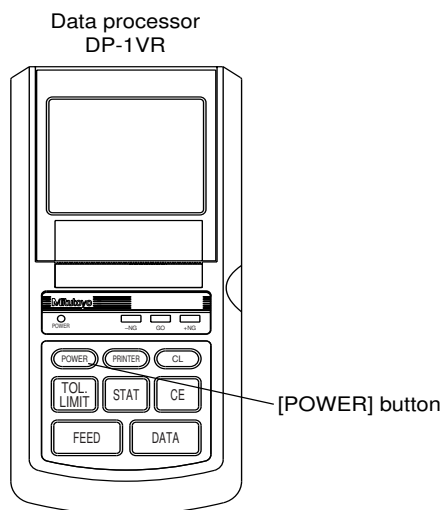
⇒ Returns to the Home screen.

<Home screen>

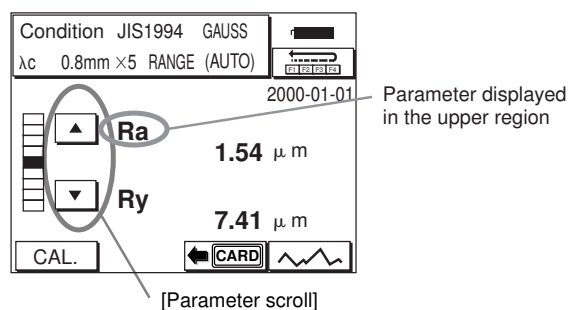
Condition JIS1994 GAUSS		
λ_c 0.8mm × 5	RANGE (AUTO)	
2000-01-01		
	Ra	1.54 μm
	Ry	7.41 μm
CAL.		

■ Outputting the measurements

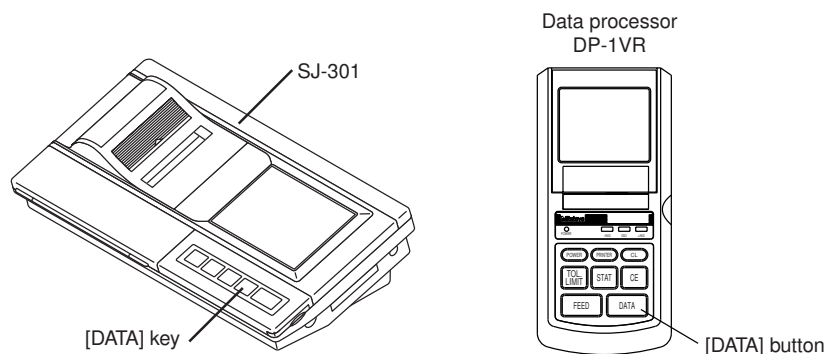
1. Press the DP-1VR/[POWER] button to turn the DP-1VR on.



2. Touch the [Parameter scroll] button in the Home screen until the desired parameter for output appears in the upper region.



3. Press the SJ-301/[DATA] key or the DP-1VR/[DATA] button.



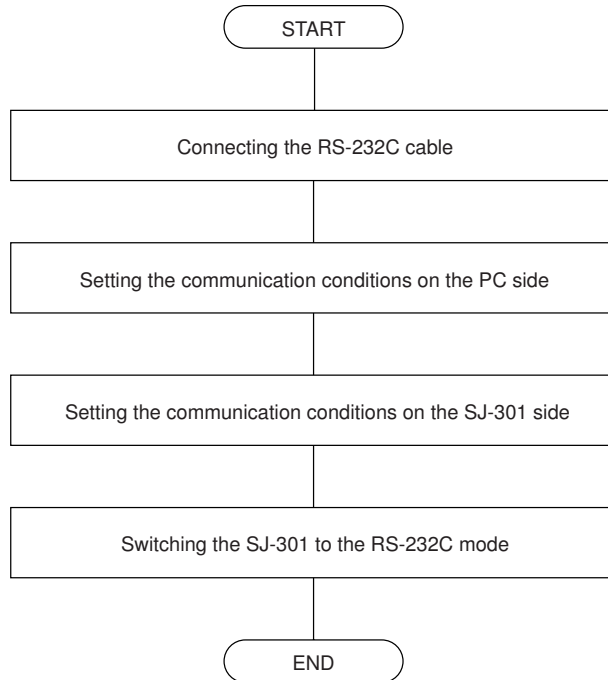
The measurement data will be outputted from the SJ-301 to the DP-1VR.

TIP For information about statistical data processing with the DP-1VR, refer to its User's Manual.

9.2 Communicating with a PC

The SJ-301 can be connected to a PC for operation with computer commands for measurement start, data acquisition including measurement conditions, etc.

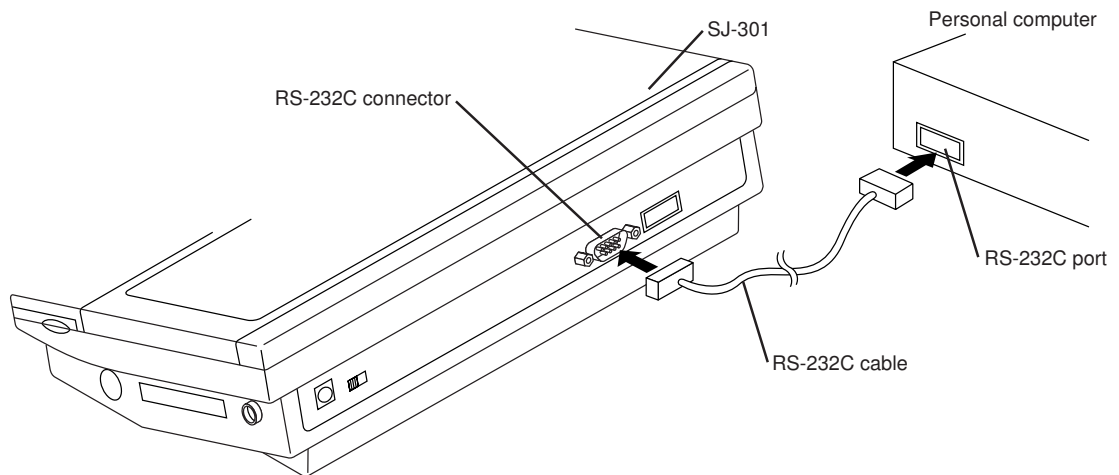
■ Operation flow for communicating with a PC



9. SPC OUTPUT AND DATA COMMUNICATION

■ Connecting the RS-232C cable

Use the optional RS-232C cable to connect the RS-232C connector on the rear of the SJ-301 Display Unit to the RS-232C port on the personal computer.

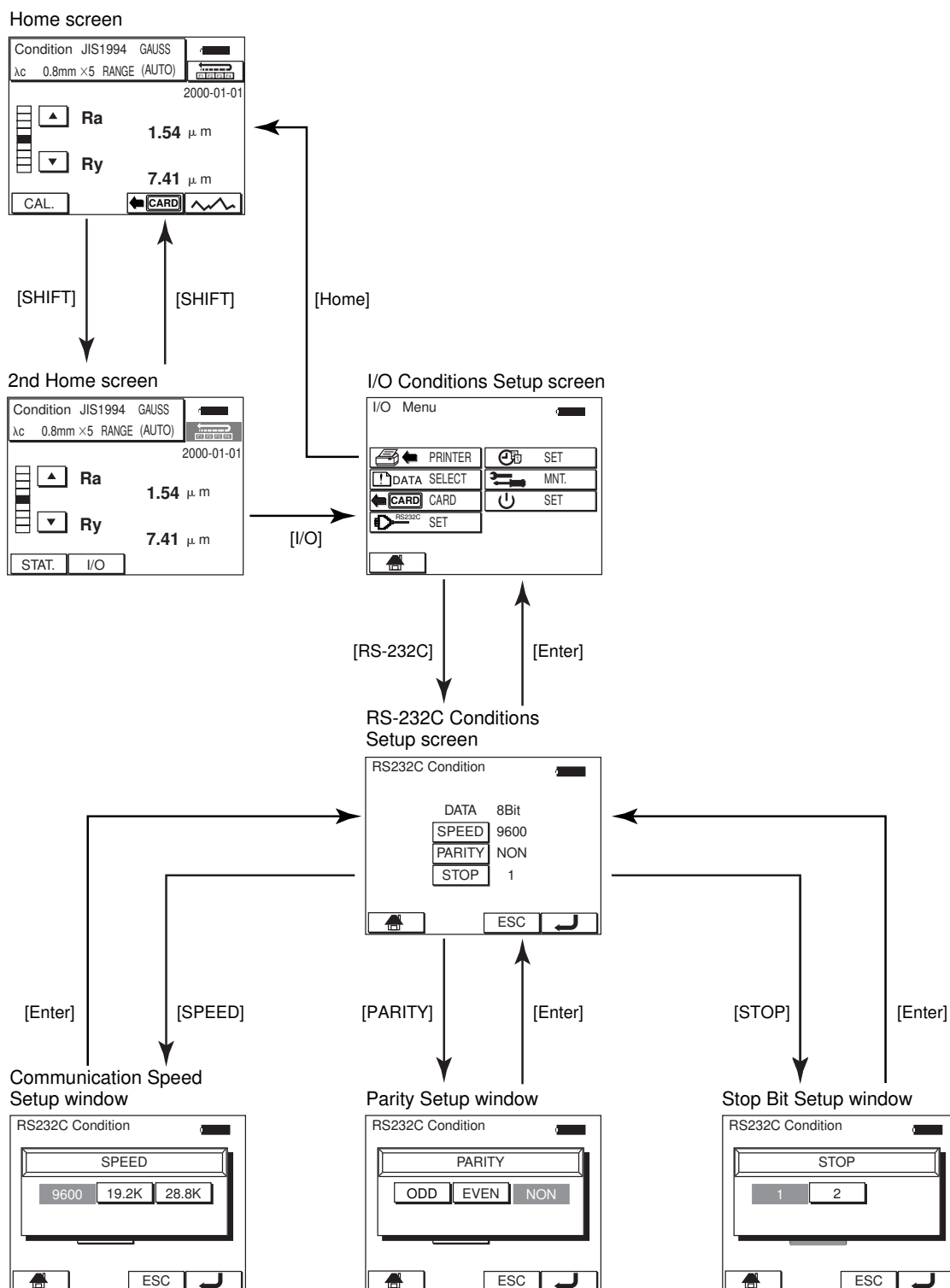


■ Setting the communication conditions on the PC side

Set up the communication conditions of the PC side. The settings to be made are shown in the following table.

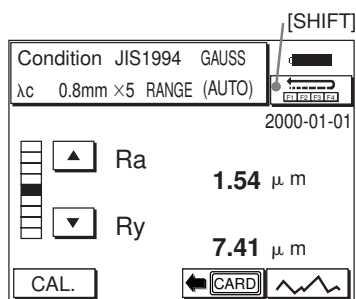
Communication method	Start/stop method
Transmission speed	9600 bps/19200 bps/28800 bps
Data bits	8 bits (fixed)
Parity	EVEN, ODD, NON
Stop bit	1 bit or 2 bits
X parameter	ON (fixed)

- Setting the communication conditions on the SJ-301 side
- Screens displayed when setting the communication conditions



● Setting up communication conditions

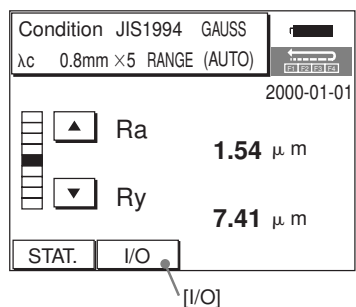
1 <Home screen>



Touch the [SHIFT] button in the Home screen.

⇒ The current screen is switched to the 2nd Home screen.

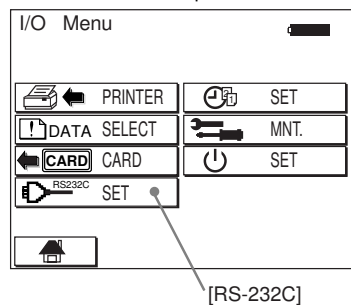
2 <2nd Home screen>



Touch the [I/O] button.

⇒ The I/O Conditions Setup screen will appear.

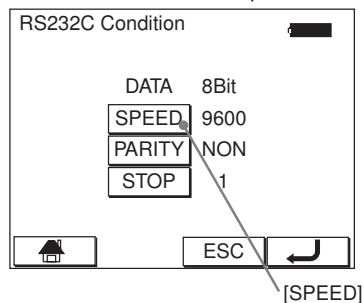
3 <I/O Conditions Setup screen>



Touch the [RS-232C] button.

⇒ The RS-232C Conditions Setup screen will appear.

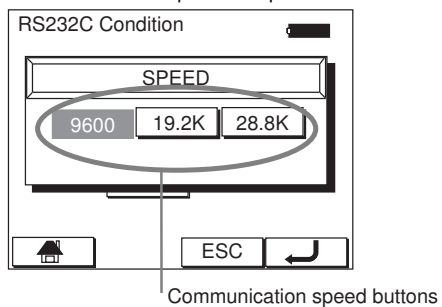
4 <RS-232C Conditions Setup screen>



Touch the [SPEED] button.

⇒ The Communication Speed Setup window will appear.

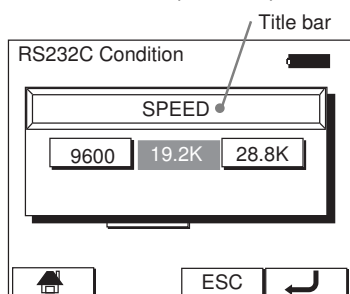
5 <Communication Speed Setup window>



Touch any communication speed button to make a setting.

⇒ The communication speed button touched will be highlighted.

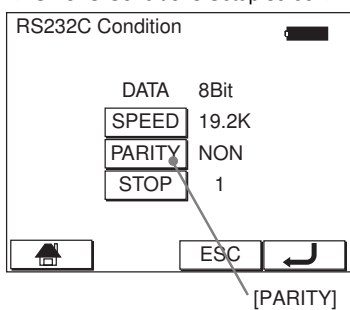
6 <Communication Speed Setup window>



Touch the title bar of the Communication Speed Setup window to accept the selected communication speed.

⇒ The Communication Speed Setup window will be closed.

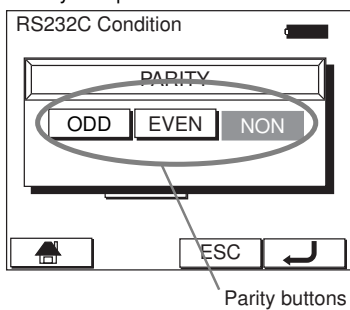
7 <RS-232C Conditions Setup screen>



Touch the [PARITY] button.

⇒ The Parity Setup window will appear.

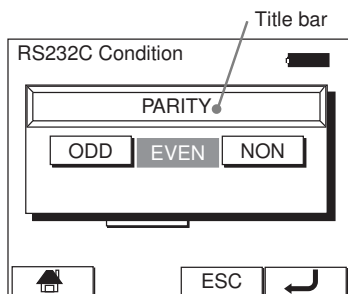
8 <Parity Setup window>



Touch the desired parity button.

⇒ The touched button will be highlighted.

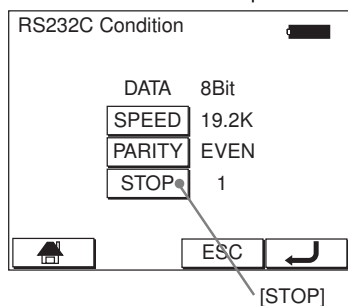
9 <Parity Setup window>



Touch the title bar of the Parity Setup window to accept the selected parity.

⇒ The Parity Setup window will be closed.

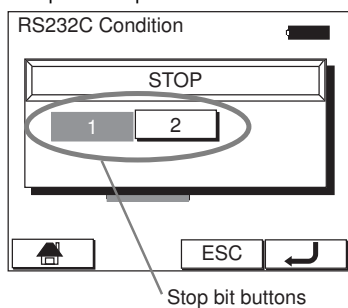
10 <RS-232C Conditions Setup screen>



Touch the [STOP] button.

⇒ The Stop Bit Setup window will appear.

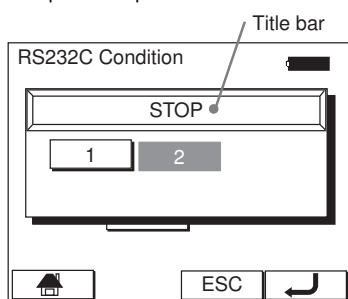
11 <Stop Bit Setup window>



Touch the desired bit button.

⇒ The touched button will be highlighted.

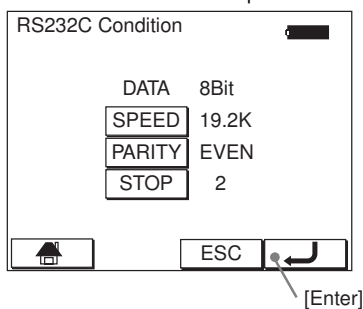
12 <Stop Bit Setup window>



Touch the title bar of the Stop Bit Setup window to accept the selected number of stop bits.

⇒ The Stop Bit Setup window will be closed.

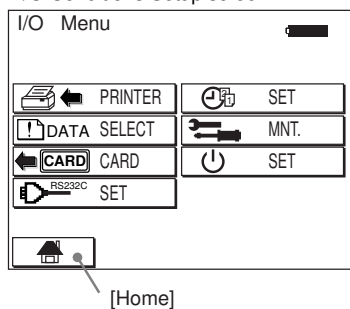
13 <RS-232C Conditions Setup screen>



Touch the [Enter] button.

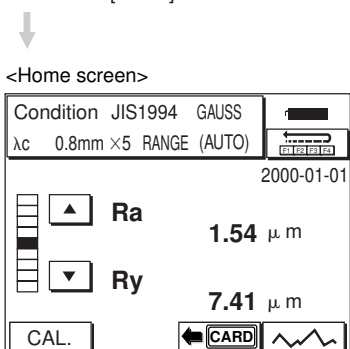
⇒ Returns to the I/O Conditions Setup screen.

14 <I/O Conditions Setup screen>



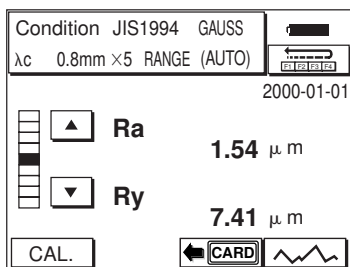
Touch the [Home] button.

⇒ Returns to the Home screen.

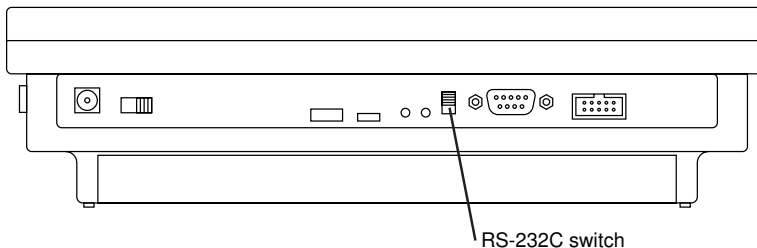


■ Switching the SJ-301 to the RS-232C mode

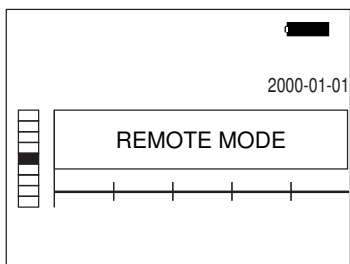
1. Restore the Home screen.



2. Turn on the RS-232C switch, which is on the rear side of the Display Unit.



⇒ This brings up the RS-232C mode indicated as “REMOTE MODE” on the screen as shown below.



NOTE If the RS-232C switch is turned on while other than the Home screen is being displayed, the RS-232C mode will not be entered at that time of the point but will be entered by pressing the [Home] button.

TIP For information about available commands refer to section 13.10, “RS-232C Communication Specifications”.

MEMO

10

INSTALLING THE SJ-301 WITH OPTIONAL ACCESSORIES

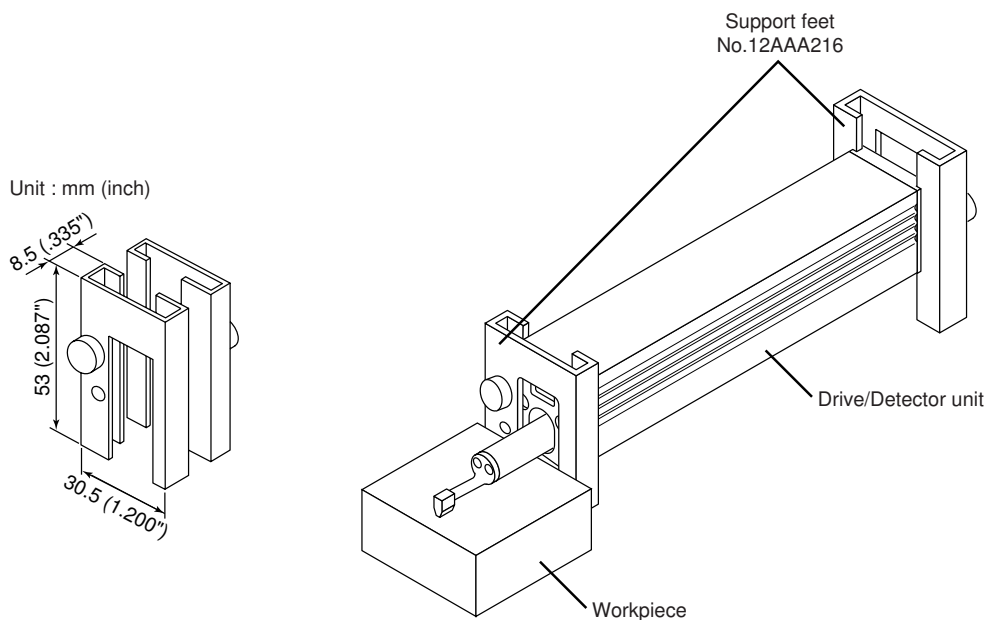
Various optional accessories are offered for the SJ-301 so it can measure a curved (cylindrical, etc.) workpiece or a workpiece with a measured surface smaller than the size of the Drive/Detector unit of the SJ-301.

■ Support feet No. 12AAA216

Used to measure a workpiece which is smaller than the Drive/Detector unit.

● Dimensions and application example

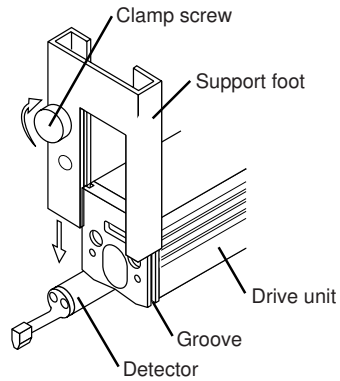
Use the Support feet on the Drive/Detector unit to adjust it to the required height as shown below.



● Attaching the Support feet

1. Fit the two Support feet in the grooves on the edges of the Drive unit.
2. Align the Drive/Detector unit so it is parallel to the measured surface.
3. After alignment fix the support feet by tightening the clamp screw clockwise.

TIP See also “4.3.1 Setting the workpiece and SJ-301”.



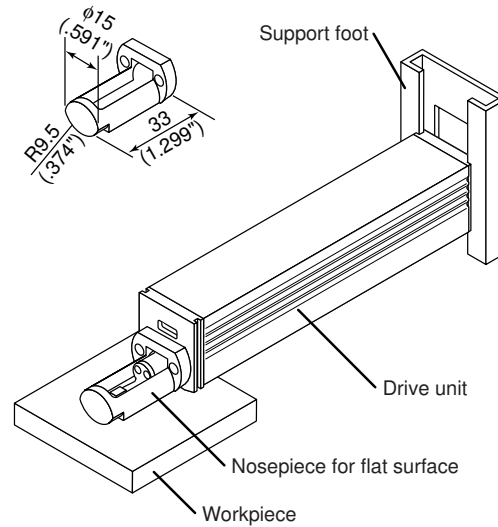
10. INSTALLING THE SJ-301 WITH OPTIONAL ACCESSORIES

■ Nosepiece for flat surface No. 12AAA217

Used to protect the Detector when measuring a flat workpiece which is smaller than the Drive/Detector unit.

● Dimensions and application example

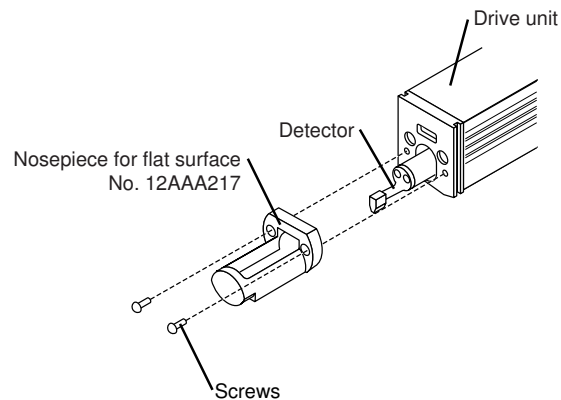
Unit : mm (inch)



● 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 Detector into the slot of the nosepiece.
2. Using the supplied Allen wrench tighten the two screws specified.

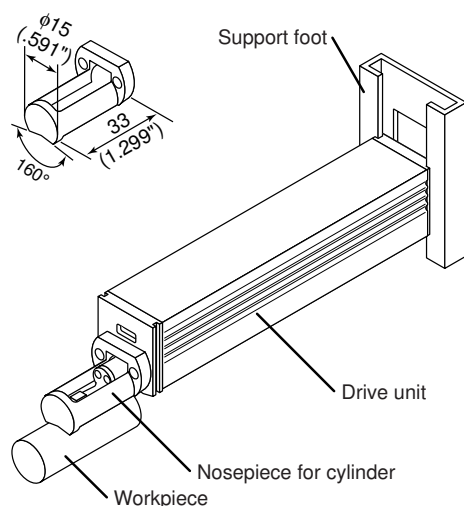


■ Nosepiece for cylinder No. 12AAA218

Used to protect and guide the Detector when measuring a cylindrical workpiece which is smaller than the Drive/Detector unit.

● Dimensions and application example

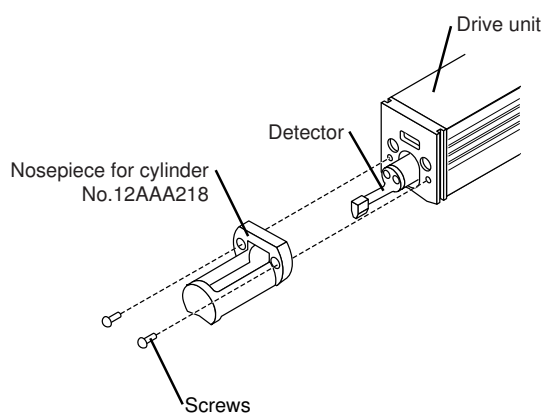
Unit : mm (inch)



● 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 Detector into the slot of the nosepiece.
2. Using the supplied Allen wrench tighten the two screws specified.

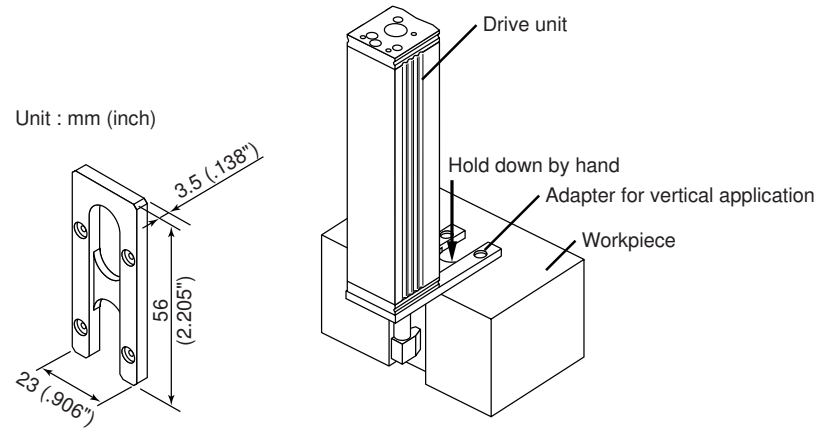


10. INSTALLING THE SJ-301 WITH OPTIONAL ACCESSORIES

■ Adapter for vertical application No. 12AAA219

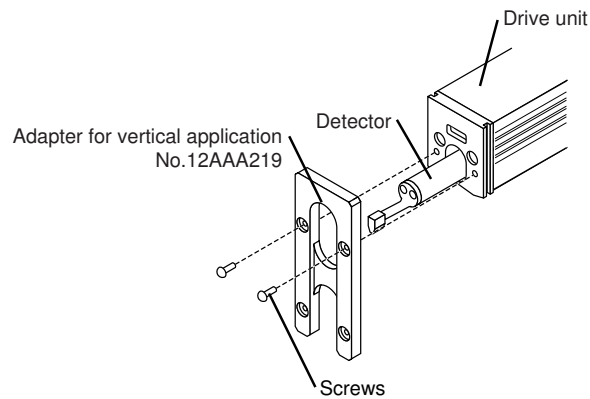
Used to support the Drive/Detector unit for measuring a vertical groove in which the Drive/Detector unit can not be placed.

● Dimensions and application example



● Attaching the Adapter for vertical application

1. Put the Detector through the hole of the adapter.
2. Using the supplied Allen wrench tighten the two screws specified.

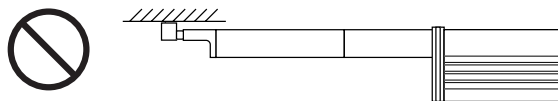


■ Extension rod No. 12AAA210

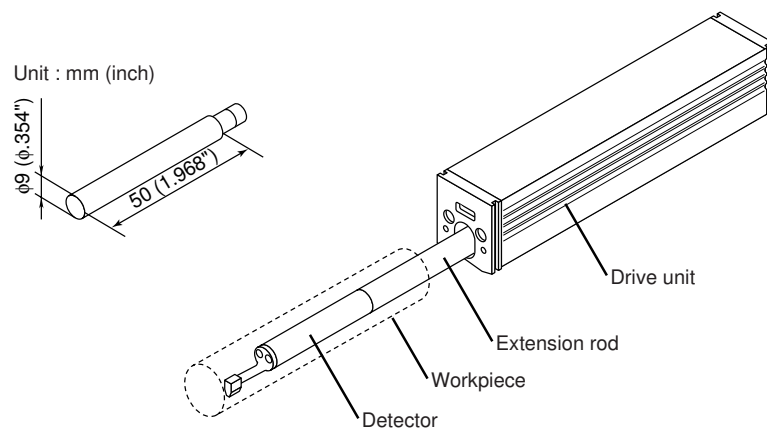
Used to measure the inside surface of a deep hole.

IMPORTANT

- Be sure to perform calibration when an Extension rod is attached or detached.
- If an Extension rod is installed, measurement is not possible to perform with the Detector positioned up side down.

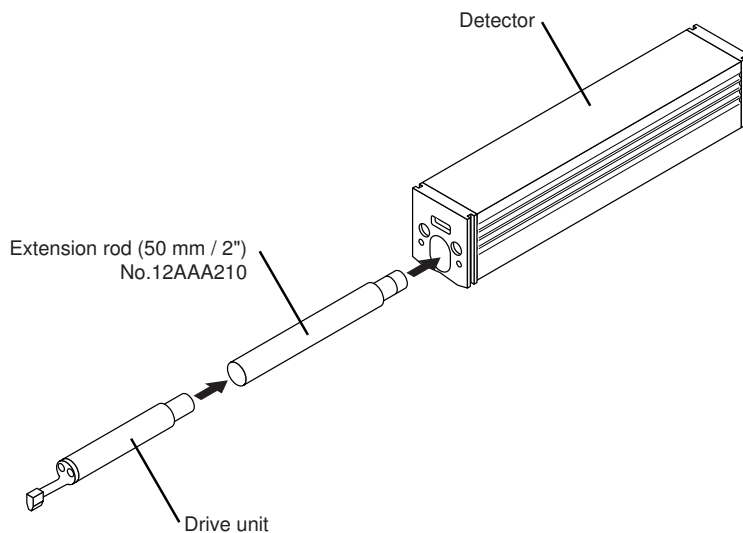


● Dimensions and application example



● Attaching the Extension rod

1. Insert the Extension rod into the Drive unit.
2. Attach the Detector to the Extension rod.



10. INSTALLING THE SJ-301 WITH OPTIONAL ACCESSORIES

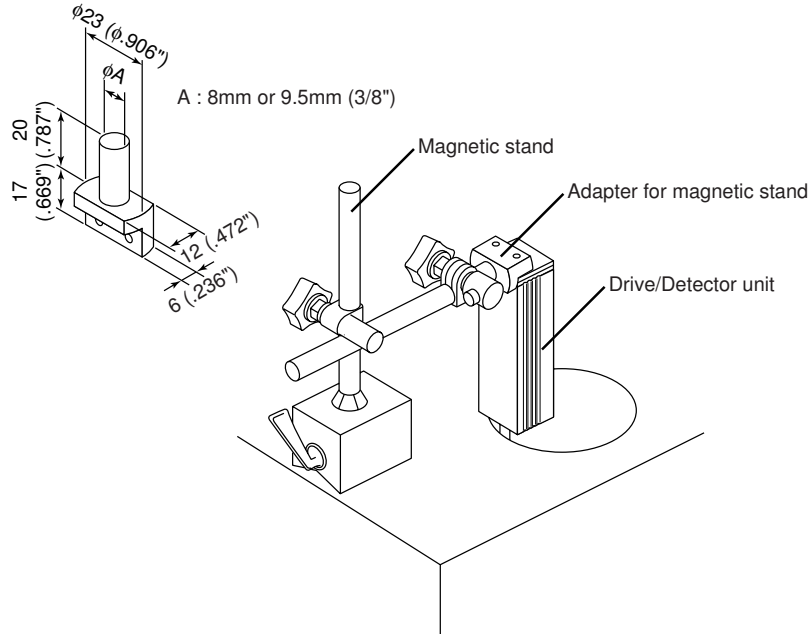
■ Adapter for magnetic stand Nos. 12AAA221, 12AAA220

Used to secure the Drive/Detector unit to the magnetic stand.

This adapter is useful if there is insufficient space for the Drive/Detector unit or if the Drive/Detector unit can not be held by hand.

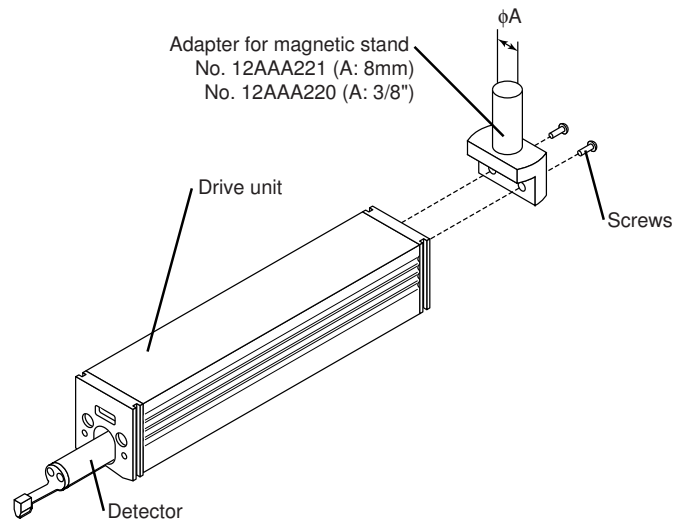
● Dimensions and application example

Unit : mm (inch)



● Attaching the Adapter for magnetic stand

1. Attach the Adapter for magnetic stand to the rear of the Drive/Detector unit.
2. Using the supplied Allen wrench tighten the two screws specified.



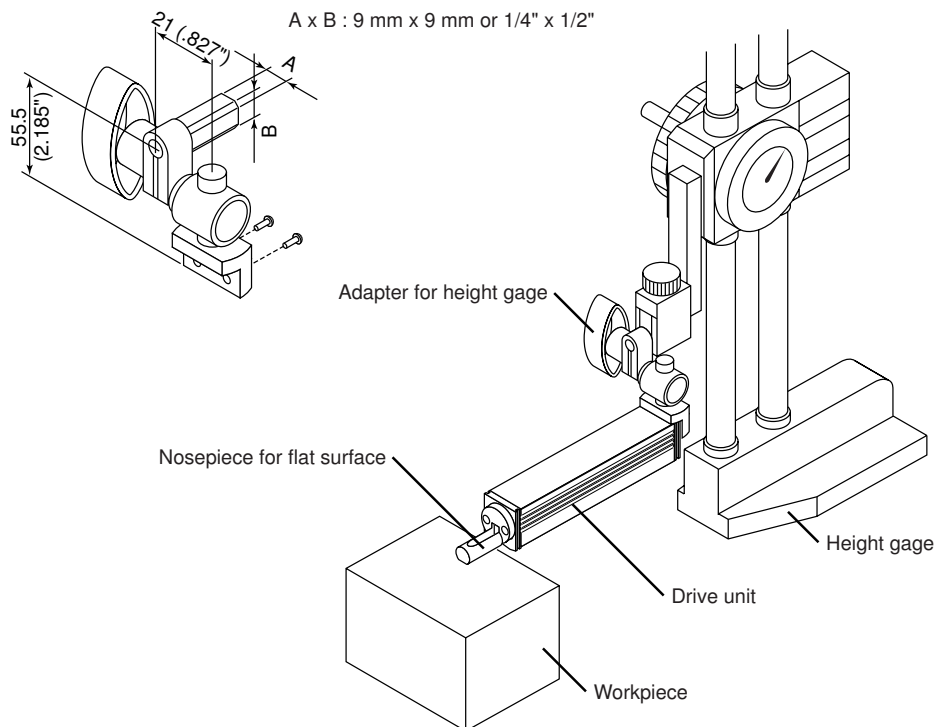
■ Adapter for height gage Nos. 12AAA222, 12AAA233

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 if the Drive/Detector unit can not be held by hand.

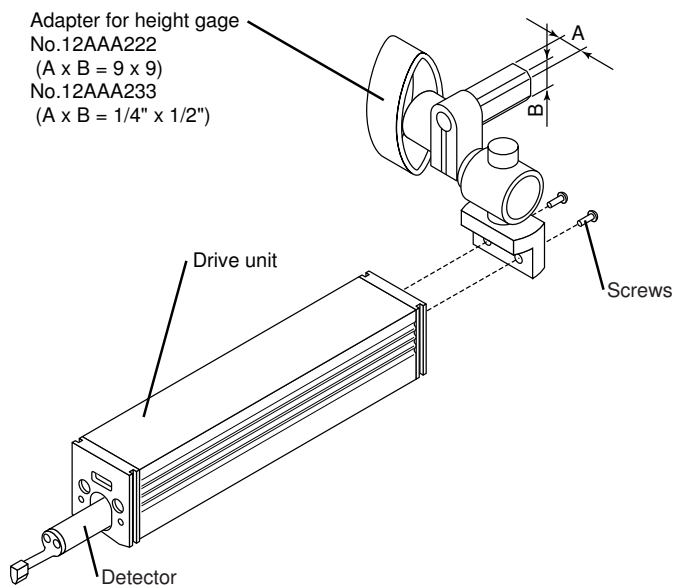
● Dimensions and application example

Unit : mm (inch)



● Attaching the Adapter for the height gage

1. Attach the Adapter to the rear of the Drive unit.
2. Using the supplied Allen wrench tighten the two screws specified.



11

MAINTENANCE AND INSPECTION OF SJ-301

11.1 Daily Care

Each time the measurement job has been completed store the Drive/Detector unit in the Display unit. Store the complete SJ-301 after checking it thoroughly so that the next measurement job can be started without incident.

■ Checking for normal operation

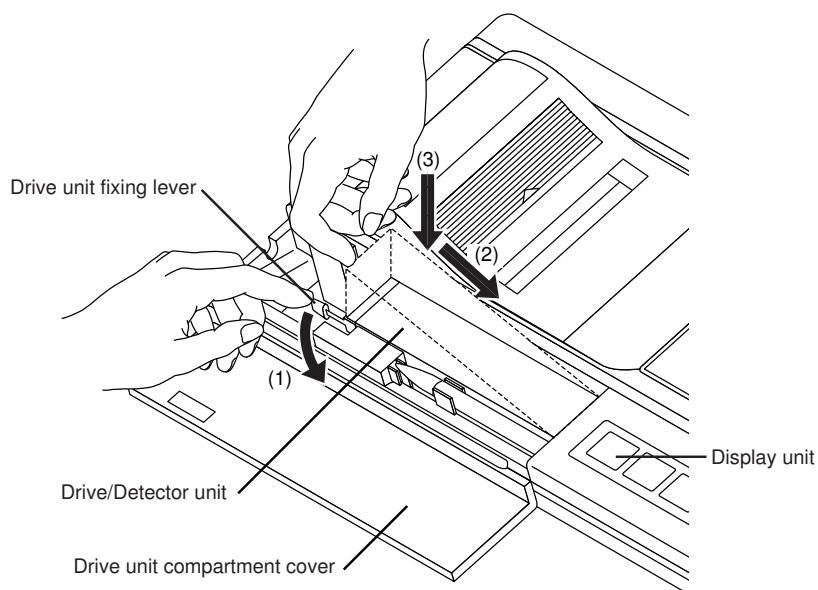
To judge whether the SJ-301 is in normal operation, after calibrating it with the supplied roughness specimen (Order No.178-601) check that the dispersion of Ra values is within $\pm 0.05 \mu\text{m}$, which are obtained from repeated measurements of the same point.

However, if the measured point on the supplied roughness specimen (Order No.178-601) is changed during repeated measurement, the dispersion of $\pm 0.09 \mu\text{m}$ ($\pm 3\%$ of the nominal value) included in the roughness specimen will be 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.

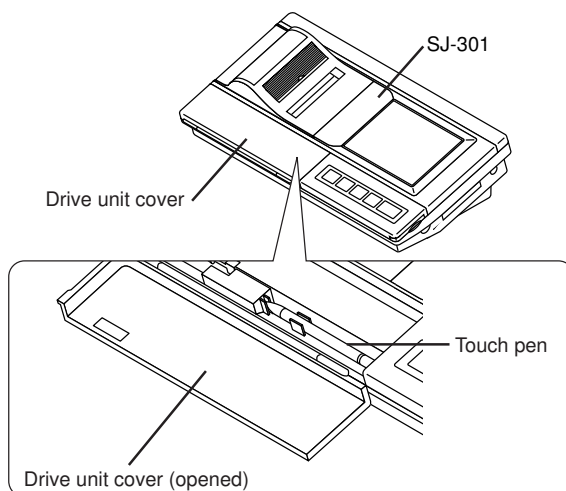
■ Storing the Drive/Detector unit in the Display unit

1. Open the drive unit compartment cover of the Display unit.
2. Move the drive unit fixing lever of the Display unit in the direction of arrow (1).
3. Exercise care so the stylus does not bump anything, and place the Drive/Detector unit in the Display unit as indicated by arrow (2).
4. While pushing the Drive/Detector unit in the direction of arrow (2), lower it as indicated by arrow (3).
5. Replace the drive unit fixing lever to the original position.



■ Storing the touch pen in the Display unit.

Store the touch pen in the drive unit storage compartment provided in the Display unit.



■ Cleaning the surface of the SJ-301

If the surface of the SJ-301 is soiled, clean it using a soft dry cloth. Do not use organic solvents such as thinner or benzine.

■ Check the condition of the touch panel protection sheet

Check if the touch panel protection sheet is soiled or warped. If it is in poor condition and might affect operation, replace it.

TIP For information about mounting the touch panel protection sheet refer to section “3.4, Applying the Touch Panel Protection Sheet”.

■ Check the condition of the printer paper

Check the amount of the printer paper remaining. If an insufficient amount of paper remains for the next work, load a new roll.

TIP For information about loading printer paper, refer to section “3.3, Loading Printer Paper”.

■ Selecting the storage location

Always store the SJ-301 and its accessories in their dedicated cases and in a location that is dust- and moisture-free.

Select a location that is between -10°C and 40°C. The life of the battery is greatly affected by temperature.

NOTE Unless the SJ-301 is not going to be used for an extended period of time (more than 2 or 3 weeks), keep the battery switch on. This allows retention of the last measurement. The measurement will be displayed the next time the power is turned on.

If the battery switch is turned off, the measured results from the last work and other data, including the measurement conditions stored in internal memory will be lost.

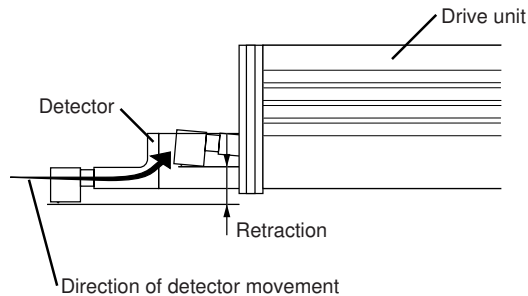
The measurement condition settings will not be lost even if the SJ-301 is turned off by the auto sleep function.

11.2 Detector Retraction Procedure and Cancellation

If the SJ-301 will be stored for an extended period of time or if it will be moved to another location, the Detector should be retract to prevent damage to the Detector or the workpiece.

-
- IMPORTANT**
- Do not retract the Detector if the optional extension rod is used. The Drive unit may be easily damaged if a force is applied to the tip of the extended Detector.
 - If the Front Escape function type drive unit is used, the Retract function is not available.
-

■ Operation of the detector retraction

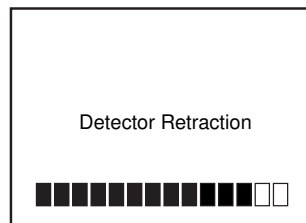


■ Detector retraction procedure

NOTE If the power is on or if the Front Escape function type drive unit is used, the Retract function is not available.

When the power is off, press the POWER switch while holding down the [START/STOP] key on the Display unit.

⇒ The Detector will start to retract. Retraction in progress is indicated by a bar on the touch panel.



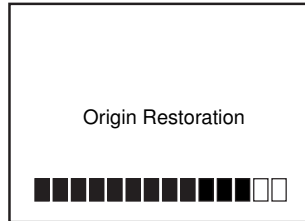
⇒ The Home screen will be restored upon completion of retraction.

NOTE If the AC adapter is used or if the auto-sleep function is set to OFF, the power is turned off.
Press the [POWER] key to turn off the power.
With auto-sleep set to ON, if key operation is not performed for more than 5 minutes after the detector retraction, the power turns off with the auto-sleep function.

■ Canceling the Detector retraction state

1. Turn on the power.
2. Press the [START/STOP] key.

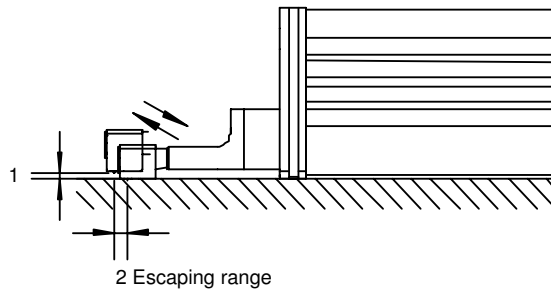
⇒ The Detector will return to its initial position. Releasing in progress is indicated by a bar on the touch panel.



⇒ The Home screen will appear after the retraction state mode is canceled.

■ Escape state of the front escape type drive unit

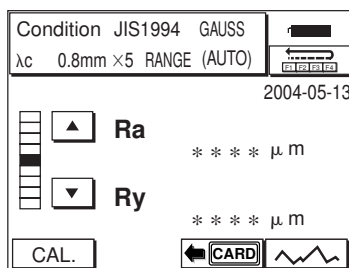
The SJ-301R detector is always escaped to the front before starting measurement. When the [START/STOP] key is pressed, the SJ-301R drives the detector from the escape position and starts measurement after passing the escape range.



NOTE The retraction function is not available with the front escape type drive unit.

■ Releasing the front escape state

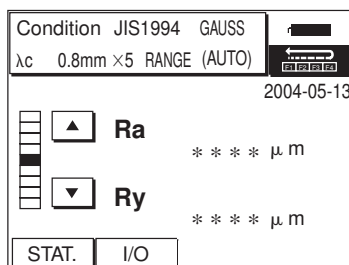
1 <Home screen>



Touch the [SHIFT] button in the Home screen.

⇒ The 2nd Home screen is displayed.

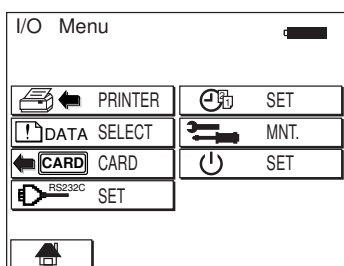
2 <2nd Home screen>



Touch the [I/O] button in the 2nd Home screen.

⇒ The I/O Condition Setup screen will appear.

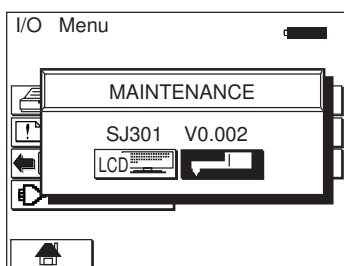
3 <I/O Condition Setup screen>



Touch the [Maintenance] button.

⇒ The Maintenance Function Select window will appear.

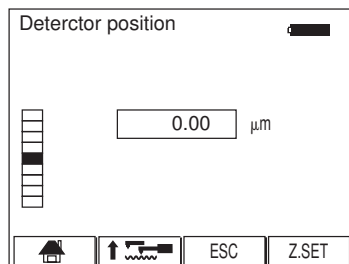
4 <Maintenance Function Select window>



Touch the [Detector] button, and then touch the title bar.

⇒ The Detector Position Display screen will appear.

5 <Detector Position Display screen>



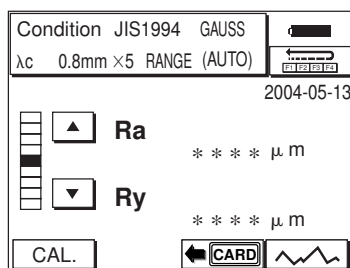
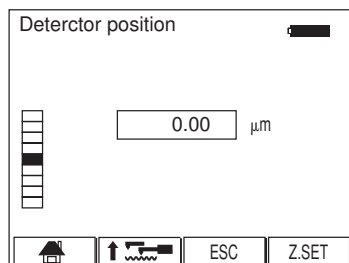
Touch the [Front escape] button.

⇒ The detector starts moving from the front escape position to the measurement start position.

If the [Front escape] button is touched with the escape state released, the SJ-301R restarts escape operation.

TIP Use the above procedure to simply check whether the stylus is in contact with a measuring surface.

6 <Detector Position Display screen>



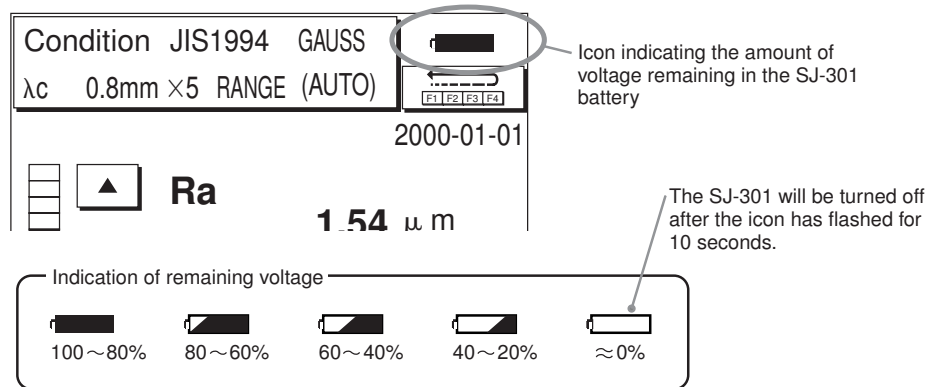
Touch the [Home] button.

⇒ The Home screen is restored.

11.3 Recharging the Battery

Recharge the battery in the following cases.

- The battery icon indicates that the remaining voltage has been reduced.
The battery icon reduces the fill area corresponding to the voltage remaining, as shown below. If the remaining voltage is found low with the icon display, recharge the battery as soon as possible.



- Although the battery icon has not yet turned out empty, a possibility is that the remaining voltage has been reduced as a result of substantial measurements conducted.

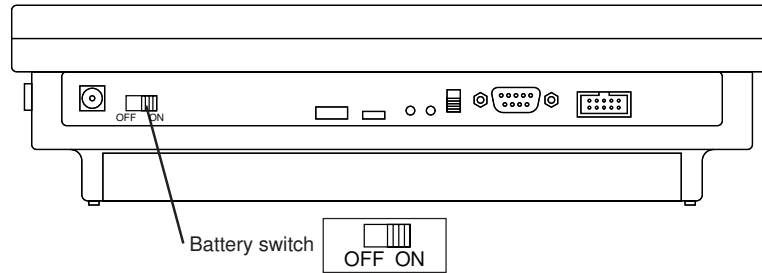
NOTE If excessive heat or abnormal voltage is detected in the battery, it may not be recharged properly.

TIP The battery that has almost no power remaining may require a maximum of 15 hours to be fully charged.

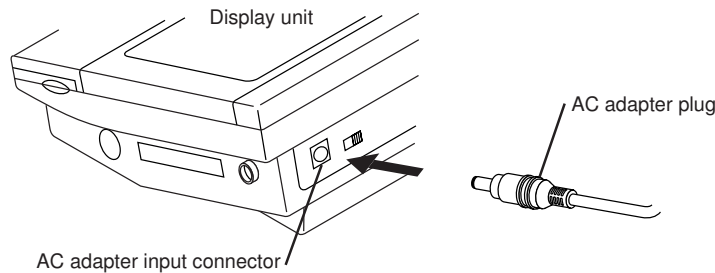
■ Recharging the battery

The battery switch must be on to recharge the battery. If it is off, turn the switch at rear of the Display unit on.

NOTE The SJ-301 determines by itself the time needed to fully charge the battery and regularly updates the data in the internal memory. This data, however, is erased if the battery switch is turned off. With the initialized time data, the SJ-301 may fail to charge the battery.
Accordingly, it is recommended that the BATTERY switch is remained ON unless otherwise necessary.



1. Plug the AC adapter into the power outlet.
2. Insert the AC adapter plug into the AC adapter input connector at the rear of the Display unit.



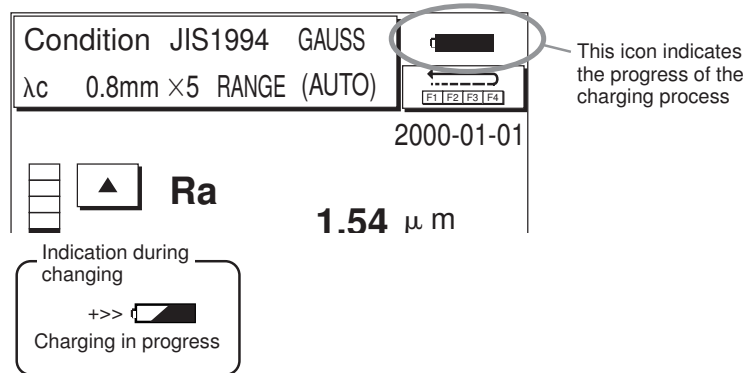
NOTE In the following conditions, the battery recharge mark may not appear and battery recharging may not be proceeded.

1. When the SJ-301 is used for the first time.
2. When the SJ-301 is used after being kept unused long time.
3. When the battery switch is set to OFF.

For the cases of 1 and 2, there is a possibility of over discharge, therefore first perform the force charging referring to section 11.3, "Recharging the battery ■ Force charging."
For the case of 3, recharge after set the battery switch to ON.

- If the power switch of the SJ-301 is on, the battery will be charged automatically if the AC adapter is connected.

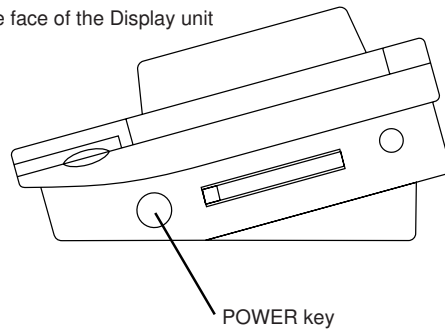
The battery icon appears on the touch panel indicating the progress of charging. After the battery has been fully charged, the battery icon will indicate the remaining voltage.



- If the power of the SJ-301 is off (in the auto-sleep mode), connect the AC adapter according to step 3.

3. Press the POWER key.

Side face of the Display unit



This starts the charging process and the battery icon indicates the progress on the touch panel. After the battery has been fully charged, the battery icon switches to indicate the remaining voltage.

NOTE Do not turn the battery switch off while the battery is being charged. The charging operation will be interrupted.

■ Purchasing a battery pack

The battery's recharging characteristics will be degraded after a long period of use. Its service hours per charge will gradually reduce. If the service hour falls insufficient to take measurement with the SJ-301, then the battery must be replaced.

Contact the sales representative from which you purchased your SJ-301 for a replacement battery pack (Part No. 12BAA688).

■ Force charging

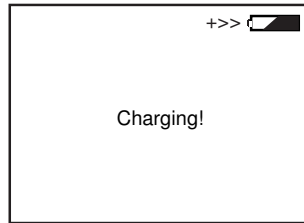
The internal battery may be excessively discharged after having the SJ-301 left unused for more than a half year.

Excessively discharge battery may not be charged in a normal way.

If this is the case, perform force charging following the procedure below:

NOTE Force charging is to raise the voltage of the excessively discharged battery to a level where charging can take place. Accordingly, force charging will not fully charge the battery. To have the battery fully charged, follow the procedures given in section 11.3 Charging the battery.

1. Turn of the battery switch on the rear of the Display unit.
2. Connect the AC adapter to the Diplay unit.
3. With the battery switch tuned off, press the [POWER] key while holding down the [CONDITION READ] key.
4. The Display unit turns on with the Force charging screen displayed on the touch panel.



5. Battery charging starts, and after completion of charging the charging sign disappears and the power turns off.

NOTE During force charging, the SJ-301 is not operative.

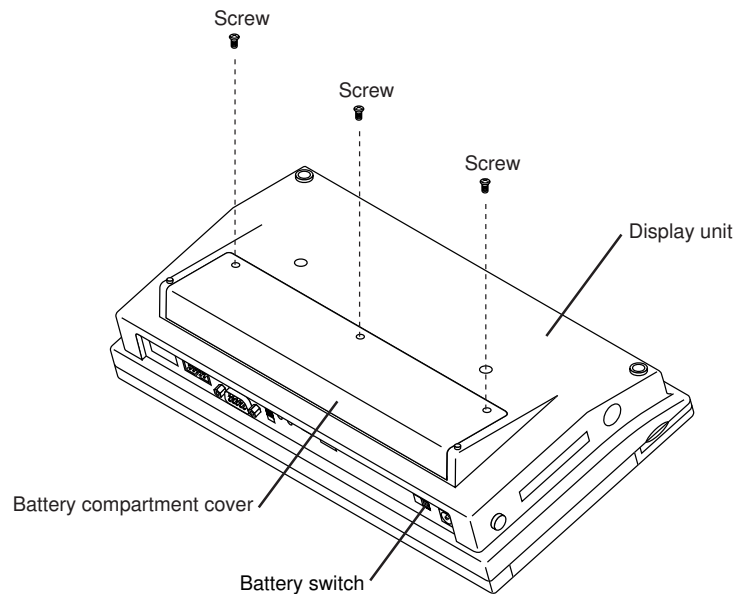
11.4 Replacing the Battery Pack

■ Battery pack replacement procedure

IMPORTANT Read the following instructions thoroughly before replacing the battery pack. Replace the battery pack carefully so as not to damage or break the Display unit or cables.

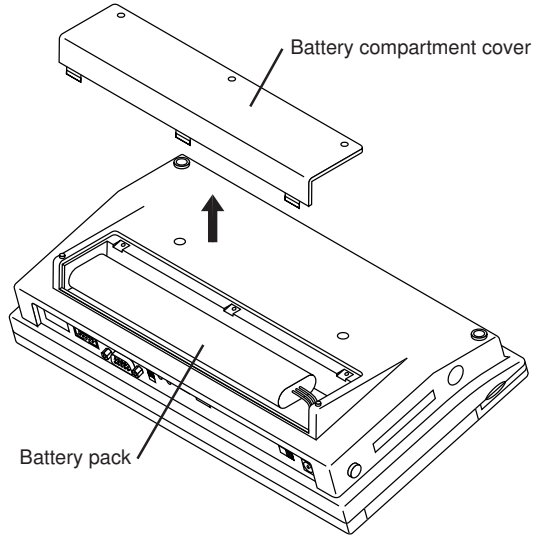
- NOTE**
- The battery replacement should be performed in a room with as little dust as possible. Exercise care so that neither dust nor oil mist make their way into the Display unit. The contamination on the inside of the Display unit may result in unit malfunction.
 - Replacing the built-in battery will erase all the measurement data and measurement conditions stored in the internal memory. Arrange a backup of the necessary data using the printer or the memory card.
-

1. Turn off the power to the Display unit.
 2. Disconnect the AC adapter if connected with the Display unit.
 3. Turn the battery switch at the rear of the Display unit to OFF.
 4. Use a Phillips-head screwdriver and remove the three screws that secure the battery compartment cover to the bottom of the Display unit.
- Be careful so as not to lose the screws and battery compartment cover.

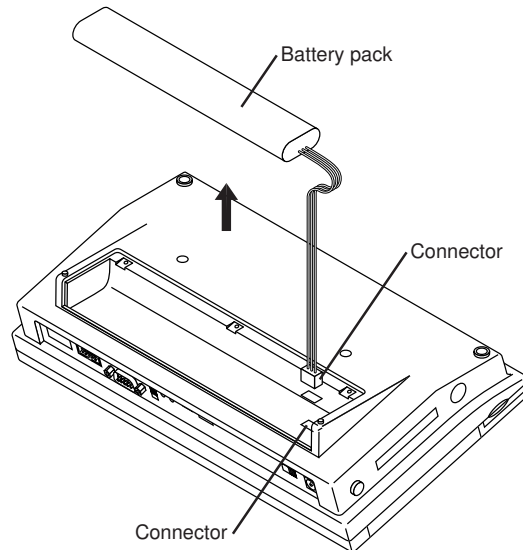


- IMPORTANT**
- Remove the battery compartment cover gently so that the inside of the Display unit is not damaged.
 - There is a factory-set DIP switch on the inside of the Display unit. Do not change the DIP switch settings, otherwise the SJ-301 may not operate properly.

5. Remove the battery compartment cover on the bottom of the Display unit.

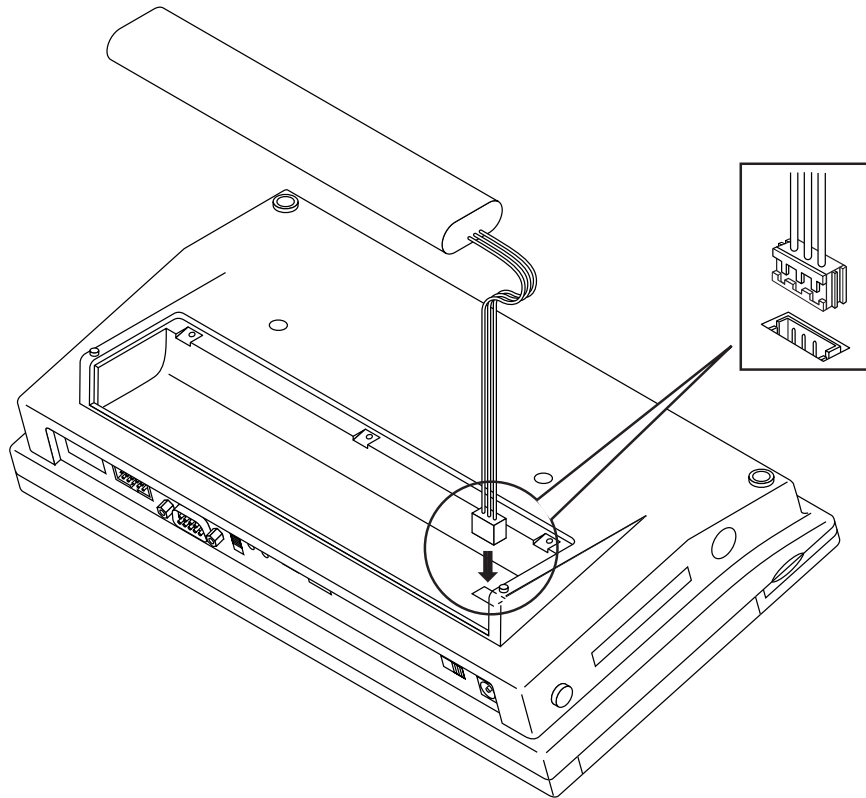


6. Unplug the connector of the battery pack from the connector in the Display unit.
7. Remove the battery pack from the Display unit.



NOTE Align the mating connectors properly when connecting them. If the connectors are not firmly connected, the SJ-301 may not operate properly.

8. Plug the connector of the new battery pack into the connector of the Display unit.



9. Place the new battery pack neatly inside the Display unit.

IMPORTANT When replacing the battery compartment cover of the Display unit, exercise care so that the cables are not pinched by the cover.

10. Replace the battery compartment cover.

NOTE The screws must not be torqued to more than 29.4 N•cm (3 kgf•cm), otherwise the Display unit may be damaged.

11. Fasten the three screws at the bottom of the Display unit.
12. Turn the battery switch at the rear of the Display unit on.

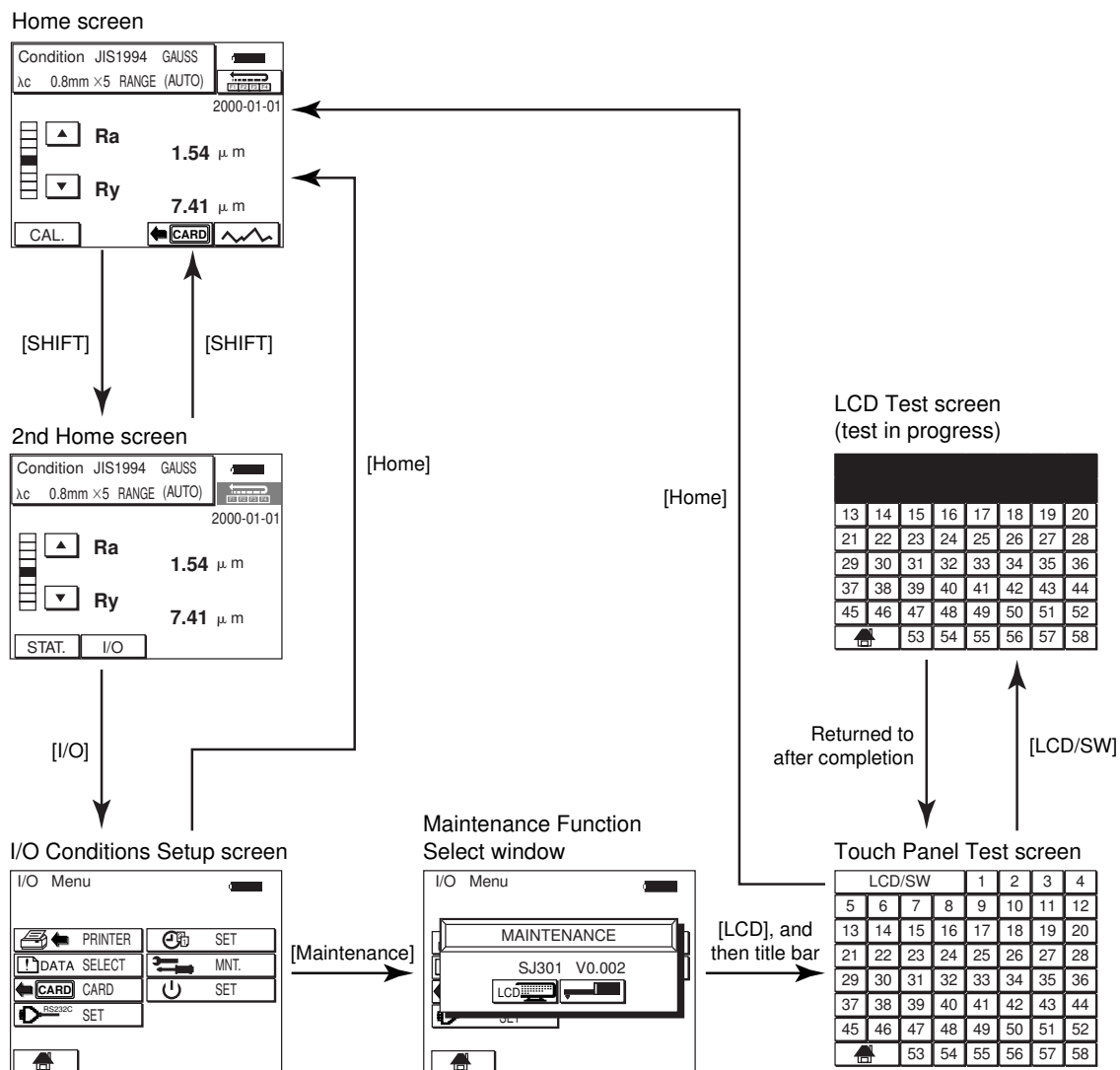
TIP In case the battery can not be charged after battery replacement, force charge the battery as it may be excessively discharged.
For details of force charging, refer to section 11.3 Recharging the battery
■ Force charging.

11.5 Testing the Touch Panel

The SJ-301 has a function for testing the touch panel. Test the touch panel if the LCD screen loses its clarity or quick response when touched.

NOTE If something is found to be abnormal, contact your SJ-301 dealer.

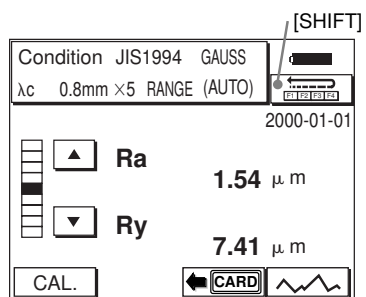
■ Screens displayed during touch panel testing



IMPORTANT Do not touch . This is for factory setting.

■ Operating procedure

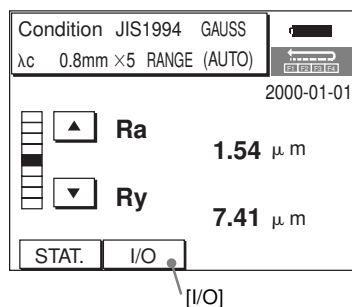
1 <Home screen>



Touch the [SHIFT] button in the Home screen.

⇒ The current screen is switched to the 2nd Home screen.

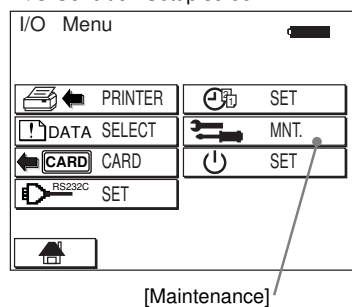
2 <2nd Home screen>



Touch the [I/O] button.

⇒ The I/O Condition Setup screen will be displayed.

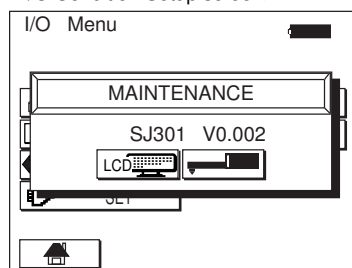
3 <I/O Condition Setup screen>



Touch the [Maintenance] button.

⇒ The Maintenance Function Setup window will be displayed.

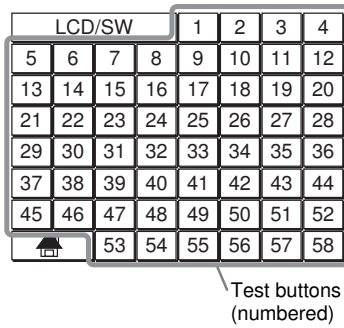
4 <I/O Condition Setup screen>



Touch the [LCD test] button, then touch the title bar.

⇒ The Touch Panel Test screen will be displayed.

5 <Touch Panel Test screen>

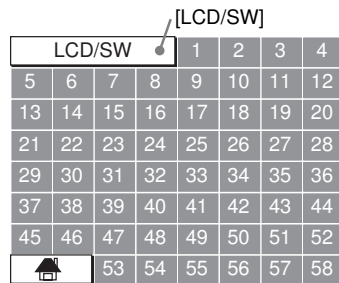


Touch the test buttons one by one, starting with the [1] button to highlight all the buttons.

⇒ If the button touched is highlighted, the LCD panel is normal for the area that corresponds to the touched button. If it is not highlighted, the LCD panel has something wrong with touch function for the area that corresponds to the touched button.

NOTE Do not touch the [LCD/SW] button during this LCD button test.
If the [LCD/SW] button is touched another test will be initiated.

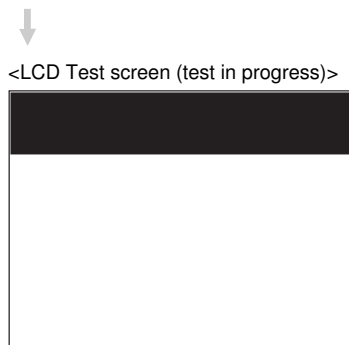
6 <Touch Panel Test screen>



Touch the [LCD/SW] button after all the test buttons have been touched.

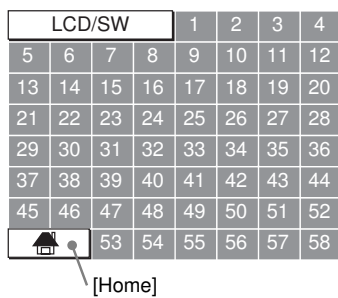
⇒ The LCD Test screen (test in progress) will be gradually filled from the top.

If the entire screen is filled in, the LCD has been found to be normal. If any sections are not filled, the display function of the LCD may not be operating normally.



⇒ After the entire screen has been filled, a blank (background color) display will rise from the bottom section. After a short period the original Touch Panel Test screen will be restored.

7 <Touch Panel Test screen>

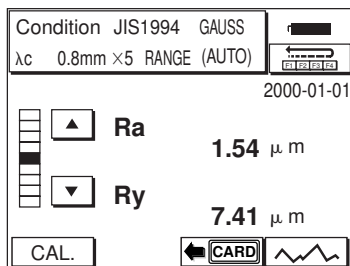


Touch the [Home] button.

⇒ Returns to the Home screen.



<Home screen>



12

TROUBLESHOOTING

If an error message window appears on the touch panel, look up the table below to identify the error for an appropriate remedy. Touch the [OK] button or other according to the message and close the window. Then take necessary measures against the error.

■ Troubleshooting (1/2)

Symptom/ Error message	Possible causes	Remedies
Battery can not be charged	- The battery switch is left off. - The internal battery has been excessively discharged. - SJ-301 has been left turned off with the AC-adaptor connected. - The internal battery has been deteriorated.	- Turn on the battery switch. - Fore charge the battery. - Turn the SJ-301 on and check the battery icon to make sure that the battery is being charged. - Replace the internal battery with the new one.
Auto-sleep will not function.	- RS-232C communication is being effected. - Statistical processing is being performed. - The AC adapter is connected. - The Auto-sleep function has been set to OFF.	No problem. Auto-sleep function is ineffective during RS-232C communication or during statistical processing. Press the [POWER] key to turn off the power.
The touch panel does not react.	The Key Mask select switch has been turned on.	Turn off the Key Mask select switch.
SPC ERROR 1	Error location: SPC output. Data communication error with the SPC device	Reconnect the SPC cable properly. Turn on the power to the Digimatic Processor.
PRINT ERROR 1	Error location: Printer Print-out request is received with no paper in the printer.	Load printer paper in the printer, then press the [PRINT] key again.
PRINT ERROR 2	Error location: Printer Head-up error	Load printer paper in the printer, then turn the head lever.
PRINT ERROR 3	Error location: Printer Printer anomaly	- Charge the battery if the remaining battery power has become less than 40% to 20% level. - Turn off the power and wait for a few seconds, then turn on the power if the remaining battery power is over 60% to 40% level. Try to print out again. If the problem persists, contact your SJ-301 dealer or the nearest Mitutoyo sales office.
MEM CARD ERROR 1	Error location: Memory card Write, formatting, or delete request is made while the card is write-protected.	Remove the memory card from the slot, cancel the write-protect, and reinsert the memory card into the slot.
MEM CARD ERROR 2	Error location: Memory card Data to be saved exceeds the available capacity.	Insert a new memory card and format it, then perform the save operation.
MEM CARD ERROR 3	Error location: Memory card Transfer error occurred during read.	Make sure that the memory card is firmly inserted in the slot. If it is not, reinsert it properly.
MEM CARD ERROR 4	Error location: Memory card Card is not formatted. This error may occur if the card is accessed for read or write.	Format the memory card.
MEM CARD ERROR 5	Error location: Memory card No card in slot during access.	Insert a memory card into the slot. If it is a new memory card, format it.
The LCD displays nothing.	- The contrast is not adjusted properly. - The power is retained off.	Turn the Contrast adjusting knob counterclockwise when viewed from the front, and then turn on the power. Next, adjust the contrast of the LCD.

■ Troubleshooting (2/2)

Symptom/ Error message	Possible causes	Remedies
MEMORY ERROR 1	Error location: Internal memory Write/read compare error of the internal memory for data processing	Contact your SJ-301 dealer or the nearest Mitutoyo sales office.
MEMORY ERROR 2	Error location: Internal memory FRAM access error	Contact your SJ-301 dealer or the nearest Mitutoyo sales office.
DRIVE ERROR 1	Error location: Drive/Detector unit Origin limit cannot be detected within a given period of time.	Properly connect the Drive/Detector unit to the Display unit. If the problem persists, contact your SJ-301 dealer or the nearest Mitutoyo sales office.
DRIVE ERROR 2	Error location: Drive/Detector unit Retraction limit cannot be detected within a given period of time.	Properly connect the Drive/Detector unit and Display unit. If the problem persists, contact your SJ-301 dealer or the nearest Mitutoyo sales office.
DETECTOR ERROR 1	Error location: Detector Detector position exceeds the detection range at the start of measurement.	Set the Detector in a correct position on the workpiece. Properly mount the Detector to the Drive unit. Check the type of the used drive unit, and then confirm that the drive unit has been set properly.
DETECTOR ERROR 2	Error location: Detector D/A value for detector offset is out of the range.	Set the Detector in a correct position on the workpiece. Properly mount the Detector to the Drive unit.
Ra ---- μm	Error location: Calculation unit Parameter calculation error occurred.	
☆25.65 μm	Error location: Calculation unit Over-range is detected during calculation. A star (☆) is appended to the measurement data.	Use a larger measuring range. Check the type of the used drive unit, and then confirm that the drive unit has been set properly.
Rz #5.68 μm	Error location: Calculation unit The number of peaks and valleys for calculating Rz is smaller than that specified. A "#" will be displayed next to the calculation result.	
Ra **** μm	Error location: Calculation unit If no calculation result is obtained	
Rz L-P	Error location: Calculation unit There is an insufficient number of peaks and valleys for calculating Rz or Sm. "L-P" will be displayed as the calculation result.	
CALIBRATION ERROR	Error location: Calibration Calibration measurement result exceeded the possible range	Check the roughness value on the reference specimen against that displayed on the touch panel. Make sure that the Detector is correctly set up on the reference specimen.
CONDITION ERROR 1	The relationship between the evaluation criteria setting and measured data is not appropriate for recalculation.	Check the evaluation criteria.
CONDITION ERROR 2	The relationship between the measurement condition setting and measured data is not appropriate for recalculation.	Check the measurement condition.

13

SPECIFICATIONS

13.1 Detector

Model No.	SJ-301	
Detector unit	178-390	178-296
Detection method	Differential inductance method	
Measuring range	350 μ m (-200 to +150 μ m), 14000 μ in (-8000 to +6000 μ in)	
Stylus material	Diamond	
Tip radius	5 μ m	2 μ m
Measuring force	4mN (0.4gf)	0.75mN (0.075gf)
Radius of skid curvature	40mm (1.57in)	

13.2 Drive Unit

Model No.	SJ-301
Detector drive range	21mm (.82in)
Traversing speed	Measurement: 0.25mm/s, 0.5mm/s (.01in/s, .02in/s) Return: 1mm/s (.04in/s)
Detector retraction function	Stylus UP
Bottom configuration	V-way

13.3 Display Unit

13.3.1 Compatible surface texture standard

JIS (B 0601-1994, B 0601-1982)

DIN

ISO

ANSI

13.3.2 Measured profiles and applicable filters

Measured profile	Filter
R-profile DIN4776	GAUSS PC75 2RC (without phase correction)
P-profile	-
MOTIF.R-profile	-
MOTIF.W-profile	-

13.3.3 Cutoff length/Sampling length, Number of sampling lengths, and Sampling interval

Cutoff length(λ_c) *1	Sampling length (ℓ)	λ_s	Sampling interval	Number of samples per length	Number of sampling lengths
0.08mm (.003")	0.08mm (.003")	2.5 μ m (98.4 μ in)	0.25 μ m (9.84 μ in)	320	1, 3, 5
0.25mm (.01")	0.25mm (.01")	2.5 μ m (98.4 μ in)	0.25 μ m (9.84 μ in)	1000	1, 3, 5
0.8mm (.03")	0.8mm (.03")	2.5 μ m (98.4 μ in)	0.5 μ m (19.69 μ in)	1600	1, 3, 5
2.5mm (.1")	2.5mm (.1")	8 μ m (315 μ in)	1.5 μ m (59.1 μ in)	1666	1, 3, 5
8mm (.3")	8mm (.3")	25 μ m (984 μ in)	5 μ m (196.9 μ in)	1600	1

*1: Cutoff length λ_c applies if R-profile is specified.

Upper limit length (A)	Upper limit length (B)	Evaluation length (L)	Cutoff length (λ_s)	Sampling interval
0.02mm (.001in)	0.1mm (.004in)	0.3mm (.012in) $\leq$ L $\leq$ 0.64mm (.025in)	2.5 μ m (98.4 μ in)	0.25 μ m (9.84 μ in)
0.1mm (.004in)	0.5mm (.02in)	0.7mm (.028in) $\leq$ L $\leq$ 3.2mm (.126in)	2.5 μ m (98.4 μ in)	0.5 μ m (19.69 μ in)
0.5mm (.02in)	2.5mm (.1in)	3.3mm (.130in) $\leq$ L $\leq$ 16mm (.63in)	8 μ m (315 μ in)	1.5 μ m (59.1 μ in)

13.3.4 Roughness parameters and display range

Parameter	Display range
Ra	0.01 to 100 μ m
Rq	(.4 μ in to 4000 μ in)
Ry	
Rz	
Rp	
Rt	
R3z	
Rv	
Rk	0.02 μ m to 350 μ m
Rpk	(.8 μ in to 14000 μ in)
Rvk	
R	
Rx	
W	
Wx	
Wte	
AR	2 μ m to 350 μ m
AW	(80 μ in to 14000 μ in)
Pc	2.5/cm to 5000/cm
HSC	(6.35/inch to 12700/inch)
Ppi	6.35/inch to 12700/inch
Sm	2 μ m to 4000 μ m
S	(79 μ in to 160000 μ in)
mr[c]	
mr	0% to 100%
Mr1	
Mr2	
δ c	-350 μ m to 350 μ m (-14000 μ in to 14000 μ in)
Lo	0.100mm to 99.999mm (.004inch to 3.999inch)
A1	0 to 15000
A2	
Δ a	
Δ q	0.01 to 100
ku	
Sk	-99.99 to 99.99
Vo	0.0000 to 999.99

13.3.5 Evaluation length

Profile	Evaluation length
R-profile	Cutoff length(λ_c) $\times$ number of sampling lengths(n) where n is either 1, 3, or 5.
P-profile	Sampling length(ℓ) $\times$ number of sampling lengths(n) where n is either 1, 3, or 5.
MOTIF.R-profile	0.64, 3.2, 16 mm
MOTIF.W-profile	0.64, 3.2, 16 mm

13.3.6 Measuring range and resolution

Measuring range	Resolution
Auto	0.01 μ m and 0.4 μ m depending on the range
350 μ m (14000 μ in)	0.4 μ m (16 μ in)
100 μ m (4000 μ in)	0.1 μ m (4 μ in)
50 μ m (2000 μ in)	0.05 μ m (2 μ in)
10 μ m (400 μ in)	0.01 μ m (.4 μ in)

13.3.7 Pre-travel/Post-travel length

Pre-travel length and post-travel length to be included in the traversing length are as shown below in the table.

Conditions set	Pre-travel	Post-travel	Remarks
P-profile, MOTIF	0	0	*
R-profile, 2RC	λ_c	0	*
R-profile, PC75	λ_c	λ_c	*
R-profile, GAUSS, DIN4476	$\lambda_c/2$	$\lambda_c/2$	*

*: In either case, the traveling length includes a start-up length (0.5mm approx.) and a length equivalent to λ_s on both ends of the traverse.

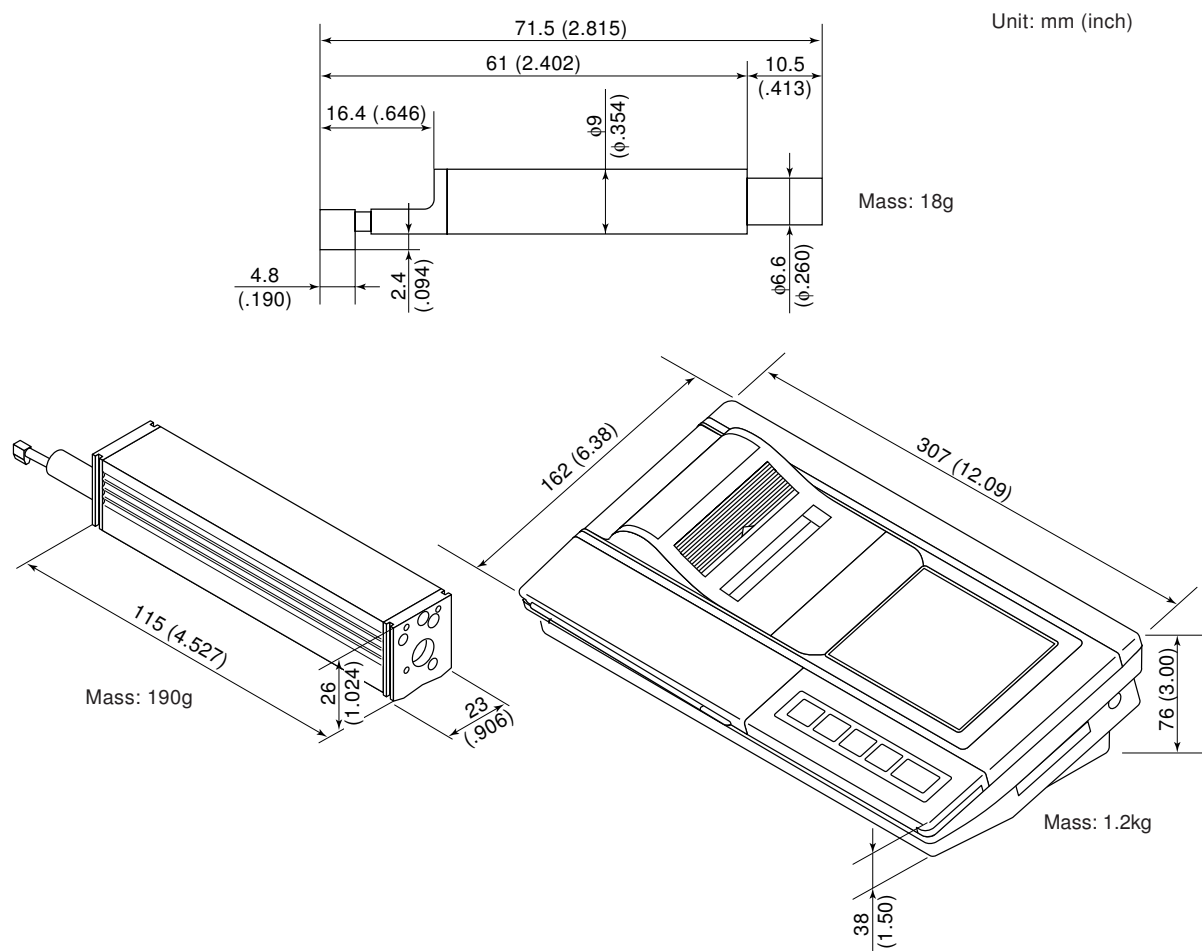
13.4 Power Supply

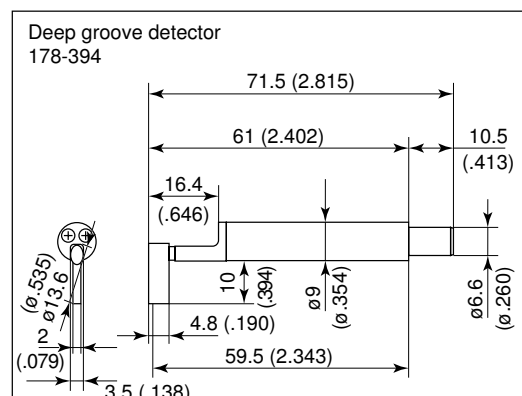
- AC adapter
 - Rating: 12 V, 3.5 A
 - Supply voltage: 100 V to 240 V
- Built-in battery (Ni-H battery)
 - Charging hours: 15 hours maximum
 - Number of measurements per charge: 800 approx. (without output to the printer)
 - Charging temperature: 5 °C to 35 °C
 - Auto-sleep function: 5 minutes

13.5 Temperature/Humidity Range

- Operation temperature: 5 °C to 40 °C
- Storage temperature: -10 °C to 40 °C
- Relative humidity: 85 % maximum (without condensation)

13.6 External Dimensions and Mass



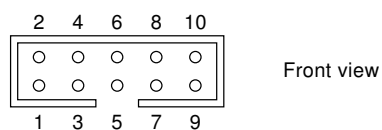


13.8 Consumables

Consumables	Part No.
Printer paper (5 rolls)	270732
Battery pack	12BAA688
Touch panel protection sheet (1 sheet)	12BAA690
Touch panel protection sheet (10 sheets)	12AAA896

13.9 SPC Output Specifications

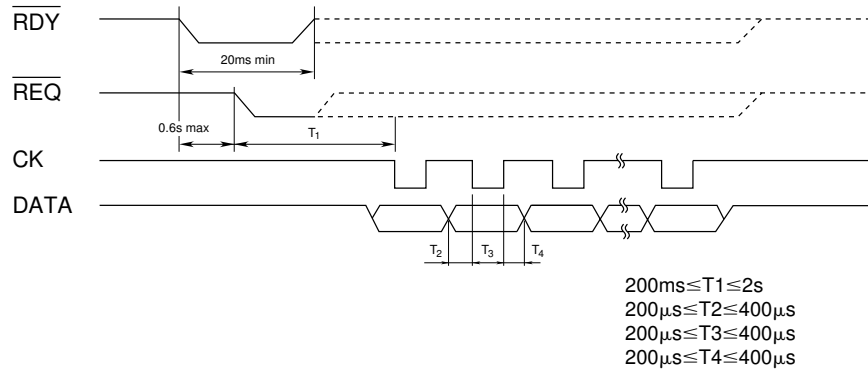
■ Connector pin assignment



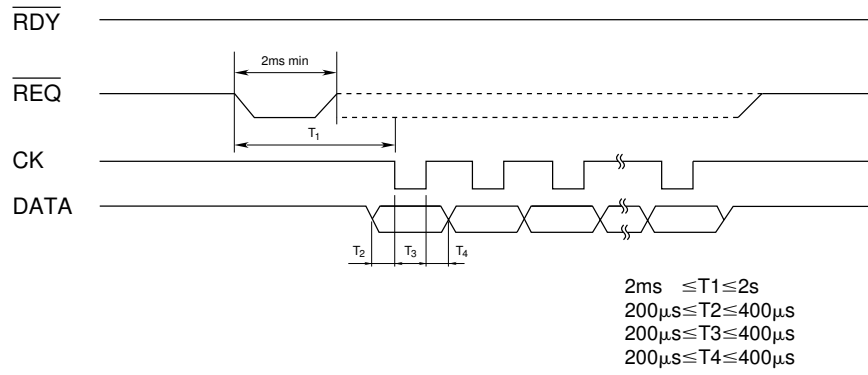
Pin No.	Name	Description
1	GND	Ground
2	DATA	Open collector output
3	CK	
4	$\overline{\text{READY}}$	
5	$\overline{\text{REQUEST}}$	Pull up to Vdd(5V)
6 to 10	N.C to N.C	-

■ Timing chart

● [DATA] key output

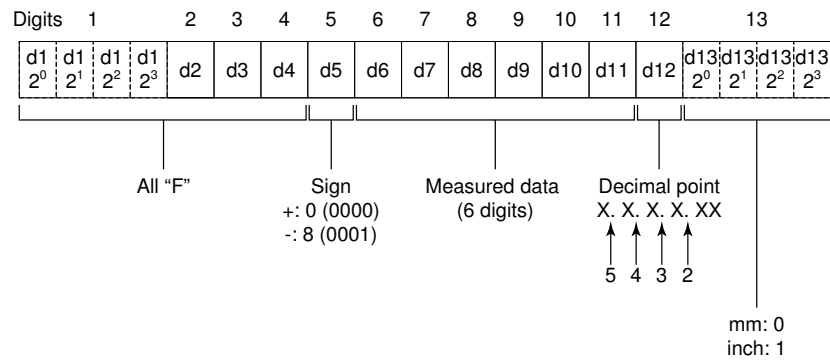


● Output request (interrupt) by external device



● Data format

Each piece of data consists of 13 hexadecimal digits, 4 bits/digit. The data is output serially, starting from the LSB (2^0) of d1 and up to the MSB (2^3) of d13.



13.10 RS-232C Communication Specifications

“EM” and “CR” in the following tables have the following meanings:

EM: End mark
CR: Carriage return

■ Overview of the interface between the SJ-301 and personal computer

If the SJ-301 is in the communication mode, the sheet keys and the touch panel cannot be operated. All SJ-301 operations are performed via communication.

Various communication commands are issued to execute operations.

● About communication I/F

Xon/Xoff control and hard wired connection, etc., are supported

● Communicating conditions

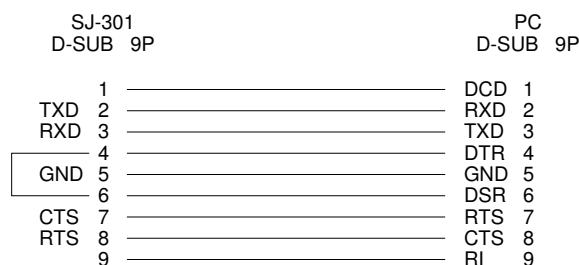
Communication method: Start/stop method
Transmission speed: 9.6 K/19.2 K/28.8 Kbps
Data bits: 8 bits
Parity: NON/EVEN/ODD
Stop bit: 1 bit/ 2 bits
X parameter: ON

● Communication timeout

If a timeout occurs in the execution of a communication protocol, the operation returns to the wait state.

● Connection to a personal computer

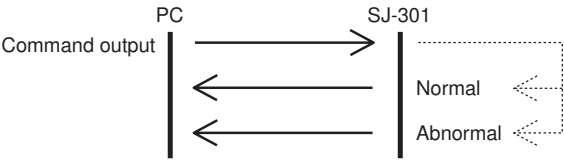
Connect to the D-SUB 9P (9-pin) port of the SJ-301.



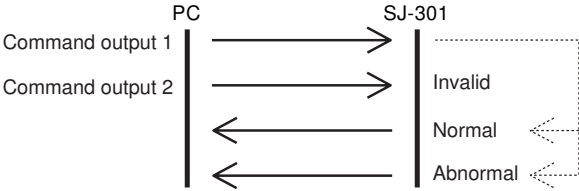
Pin No.	Signal name	JIS abbreviation	Description	I/O
1	-	-	-	-
2	TXD	(SD)	Send data	Out
3	RXD	(RD)	Receive data	In
4	-	-	-	-
5	GND	-	Frame ground	Out
6	-	-	-	-
7	CTS	(CS)	Clear to send	In
8	RTS	(RS)	Request to send	Out
9	-	-	-	-

■ Communication protocol

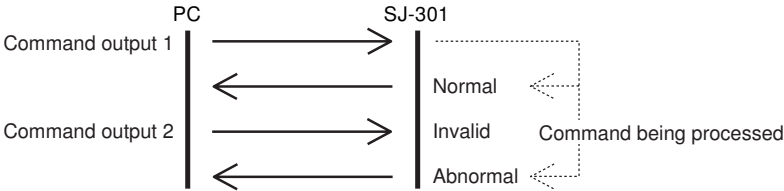
● Normal processing



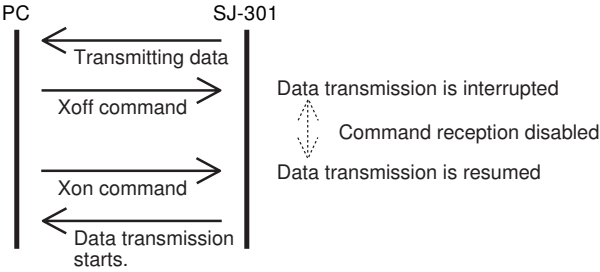
● Duplicate reception of commands



● Command reception during command processing



● Reception of Xon/Xoff control signal



■ Basic answer data

● Normal response

Header		EM
O	K	CR

Header		Data			EM
O	K	*	*	...	CR

● Abnormal response

Header		Status		EM
N	G	*	*	CR

Below are the contents of the status column shown above:

Status	Description	Status	Description
01	Command anomaly	09	Hardware problem
02	Processing in progress	10	Communication error
03	Timeout error	11	Out of the range
04	No corresponding data	12	Data is not ready
05	Over-range	16	Setup prohibition error
07	Drive unit anomaly		
08	Detector anomaly		

● Response timing to command

Responses to the write command and read command are made as a result notification after processing.

Response to the control command is made according to the command reception status.

■ Control command

● Start measurement

Header		Sub-field			EM
W	R	S	T	A	CR

● Interrupt measurement

Header		Sub-field			EM
W	R	S	T	P	CR

● Power off

Header		Sub-field			EM
W	R	O	F	F	CR

The SJ-301 will turn off 30 seconds after receiving this command.

● Detector retraction

Header		Sub-field			EM
W	R	E	S	P	CR

● Cancel detector retraction

Header		Sub-field			EM
W	R	R	T	N	CR

■ Read command

● Basic command

Header		Sub-field			Data		EM
R	D	*	*	*	*	*	CR

The contents of the sub-field column and data column shown above follow:

Sub-field	Description	Data
STU	Status information	00, 01
CON	Measurement conditions stored in RAM	00
DTA	Data (ASCII) stored in RAM	00
RES	Calculation result in memory	00
PSA	Position data (ASCII)	00
CUS	Customized information	00

If the data is set to "00" for the CON command, the measurement condition immediately after the command is issued will be returned.

If the measurement condition is modified with the data set to "00", the data that existed before the modification will be made invalid.

● Status information read command

Header		Sub-field			Data		EM
R	D	S	T	U	0	0	CR

• Return data to RDSTU00 command

Header		Data								EM
O	K	*1	*2	*3	*4	*5	*6	*7	*8	CR

Below are the contents of *1, *2, ..., above.

Data	Bytes	Description
*1 Instrument operation status	1	0: Ready 1: Measurement in progress 2: Calculation in progress 3: Print in progress 4: Detector is or has been retracted 5: Detector is being returned or is operating
*2 Existence of data	1	0: No measurement data 1: Measurement data present *Usually set when calculation has been completed.
*3 Battery status	1	0: Properly recharged 1: Poorly recharged
*4 Start key status	1	0: Start key OFF 1: Start key pressed *Cleared after read once.
*5 Stop key status	1	0: Stop key OFF 1: Stop key pressed *Cleared after read once.
*6 Electronics status	1	1: Normal 2: Dedicated for Surfpak *Usually represents AC adapter connection status.
*7 AC adapter present	1	0: Not connected 1: Connected
*8	1	Not assigned

Header		Sub-field			Data		EM
R	D	S	T	U	0	1	CR

• Return data to RDSTU01 command

Header		Data				EM
O	K	*1	*2	*3	*4	CR

The contents of the above *1 *2... is that follows:

Data	Bytes	Description
*1 Number of requested data points	5	*****
*2 Timeout period	2	**
*3 Key mask	1	* (1: Masked 2: Without mask)
*4 Calibration factor	7	*.*****

● Measurement condition read command

Header		Sub-field			Data		EM
R	D	C	O	N	0	0	CR

• Return data to RDCON** command

Header		Data					EM
O	K	*1	*2	*3	. . .	*40	CR

Below are the contents of *1, *2, ..., above.

Data	Bytes	Description
*1 Cutoff length λc mm(in)	1	1: 0.08(.003), 2: 0.25(.01), 3: 0.8(.03), 4: 2.5(.1), 5: 8(.3)
*2 Number of sampling lengths	1	1: ×1, 2: ×2, 3: ×3, 4: ×4, 5: ×5, L: L
*3 Measured profile	1	1: P, 2: R, 3: W, 4: DIN4776, 5: MOTIF.R, 6: MOTIF.W
*4 Filter	1	1: 2RC, 2: PC75, 3: PC50, 4: None
*5 Standard	1	1: JIS'82, 2: JIS'94, 3: DIN, 4: ISO, 5: ANSI, 6: JIS'01
*6 Range μm(μin)	1	1: 350(14000), 2: 100(4000), 3: 50(2000) 4: 10(400), A: AUTO
*7 Not assigned	1	*
*8 Tilt compensation	1	0: SPECIAL, 1: None, 2: Entire, 3: Arbitrary segment
*9 Arbitrary range	11	*****
*10 Traversing speed mm/s (in/s)	1	2: 0.2(.008), 3: 0.5(.02)
*11 Unit	1	1: mm, 2: in
*12 Arbitrary length	5	mm: ***.*
*13 Sampling interval	5	**.*
*14 Measuring data points	5	***** Data points transmittable
*15 Parameter subject to GO/NG judgment	14	*****
*16 UL/LL	53	U=*****, U=*****, U=*****, L=*****, L=*****, L=*****
*17 Timeout period	2	** : 1 to 60s
*18 Calibration value	6	*.****
*19 Calibration factor	7	*.*****
*20 Traversing length	1	0: Excluded, 1: Included
*21 Pc, Sm setting	8	***** (numeric value) + *** (Unit: μm, μin, %)
*22 Not assigned	10	*****
*23 mr setting value	18	*.***% (ref. line), ***** (section level) + *** (Unit: μm), ** (number of sections) rg *, 50%, 10.0μm, 12
*24 HSC setting value	10	***** (B: BASE, P: PEEK), ***** + *** (Unit: μm, μin, %)
*25 δc setting value	31	* (Number of pieces), ***% (ref. line1), ***% (slice line1), ***% (ref. line2), ***% (slice line2), ***% (ref. line3), ***% (slice line3)
*26 Not assigned	1	*
*27 Not assigned	1	*
*28 MOTIF. A	1	0: None, 2: 0.02 (.0008), 3: 0.1 (.004), 4: 0.5 (.02), 5: 2.5 (.1) mm (in)
*29 MOTIF. B	1	0: None, 2: 0.02 (.0008), 3: 0.1 (.004), 4: 0.5 (.02), 5: 2.5 (.1) mm (in)
*30 Over-range processing	1	1: ±Pause, 4: Continue
*31 Cutoff length value λs	1	1: 0.25 (10), 2: 0.8 (32), 3: 2.5 (100), 4: 8 (320), 5: 25 (1000) μm (μin)
*32 Motiof Arbitrary length	17	*****
*33 motif calculation method	1	0: Extended T method, 1: Segment method
*34 Data deletion	1	1: Without, 2: With
*35 Data deletion range	11	*****
*36 Drive unit information	1	1: Standard, 2: Front escape type
*37 Arbitrary range	1	1: P1P2, 2: P3P4, 3: P1P2P3P4
*38 Arbitrary range (P3,P4)	11	*****
*39 GO/NG judgment	1	1: Average value, 2: 16%, 3: Max
*40 Profile Element	1	1: Zp/Zv, 2: Zt
*41 mr[c] setting	11	***** (B: BASE, P: PEEK), ***** + *** (Unit: μm, μin, %)
Total	258	

Parameter value section that includes a “.” (decimal point) is right justified and padded with spaces (20H) from the left.

13. SPECIFICATIONS

● ASCII data read command

- Return data to RDDTA** command

Header		Number of valid data pieces					Measurement data										EM				
O	K	*	*	*	*	*	±	*	*	*	*	.	*	*	*	,	±	*	*	*	CR

If there is no data to be transmitted because measurement is in progress, the number of transmitted data bytes is zero.

If there is no data to be transmitted after measurement has been completed, an error code of "04" will be returned. One piece of measurement data will be right-justified after eliminating spaces that follow the sign.

Example: -0.30

If there is an over-range, "9999" will be returned.

- Calculation result read command

Header		Sub-field			Data		EM
R	D	R	E	S	0	0	CR

- Return data to RDRES** command

Header		Data													
R	D	R	a	–	±	*	*	*	.	*	*	u	m	–	,

															EM
P	P	c	±	*	*	.	*	*	*	/	c	m	,	...	CR

* All the customized parameter data will be transmitted.

* Communication format: The calculation result will be transmitted following the parameter symbol.

* Parameters will be separated by a comma (“,”).

* Only a negative sign will be added to the data, if it is negative.

* For NG data either an “L” (LL) or a “U” (UL) will be added after the sign.

* A “#” will be added to the Rz value if LES PEAK results.

* An “*” will be added to a data piece resulted from measurement in over-range

Notation of δc parameters: dc

● Position data (ASCII) read command

Header		Sub-field			Data		EM
R	D	P	S	A	0	0	CR

- Return data to RDPSA** command

Header		Measurement data														EM		
O	K	±	0	0	0	0	0	0	0	.	±	*	*	*	.	*	*	CR

X axis: 2 bytes

Z axis: 2 bytes

“00” will be output for the X-axis data section, and the same value as the signed transfer data will be outputted as the Z-axis data.

● Customized information read command

Header		Sub-field			Data		EM
R	D	C	U	S	0	0	CR

• Return data to RDCSU** command

Header		Data	EM
O	K	*1	CR

Below is the content of *1 above.

Data	Bytes	Description
*1 Customized info	Variable	Ra,Ry,Rz,Rq . . . mr separated by “;”

■ Write command

● Basic command

Header		Sub-field			Data								EM
W	R	*	*	*	*1	*2	*3	*4	*5	*6	*7	...	CR

Below are the contents of the above sub-field column and *1, *2, ..., in the data column.

Sub-field	Set data content
CNT	Setting the cutoff length/number of sections
FIL	Setting P,R,W,DIN4776, MOTIF.R,MOTIF.W and filters
STD	Standard
RAN	Range setting, pause/continue
T__	Time-out period
LCD	LED ON/OFF
NUM	Number of samples
SPD	Traversing speed
CUS	Customized info
M_A	Setting Roughness motif A
M_B	Setting waviness motif B
KEY	Key mask
LAN	Language
CAN	Specifying the leading piece of data to be transmitted by RDDTA or RDDTB, and the storage area
TRA	Specification if the traverse length includes a pre-travel length and/or post-travel length
ML_	Evaluation length setup when MOTIF is selected

● Unit write command

Header		Sub-field			Data	EM
W	R	U	N	T	*1	CR

Below is the content of *1 in the data column above.

Data	Bytes	Description
*1 Unit	1	1: mm, 2: in

● Standard write command

Header		Sub-field			Data	EM
W	R	S	T	D	*1	CR

Below is the content of *1 in the data column above.

Data	Bytes	Description
*1 Standard	1	1: JIS1982, 2: JIS1994, 3: DIN, 4: ISO, 5: ANSI, 6: JIS2001

● Measuring range and over-range processing write command

Header		Sub-field			Data		EM
W	R	R	A	N	*1	*2	CR

Below are the contents of *1 and *2 in the data column above.

Data	Bytes	Description
*1 Range $\mu\text{m}(\mu\text{in})$	1	1: 350 (14000), 2: 100 (4000), 3: 50 (2000), 4: 10 (400), A: AUTO
*2 Over-range processing	1	1: $\pm$ Pause, 4: Continue

● Timeout period write command

Header		Sub-field			Data	EM
W	R	T	–	–	*1	CR

Below is the content of *1 in the data column above.

Data	Bytes	Description
*1 Timeout period	2	1 to 60s

● LCD ON/OFF setting write command

Header		Sub-field			Data	EM
W	R	L	C	D	*1	CR

Below is the content of *1 in the data column above.

Data	Bytes	Description
*1 LCD ON	3	*** ON/OFF Right justified and padded with space codes (20H) from the left.

● Number of data pieces write command

Header		Sub-field			Data	EM
W	R	N	U	M	*1	CR

Below is the content of *1 in the data column above.

Data	Bytes	Description
*1 Number of measurement data pieces	5	*****

● Traversing speed write command

Header		Sub-field			Data	EM
W	R	S	P	D	*1	CR

Below are the contents of *1 in the data column above.

Data	Bytes	Description
*1 Speed	1	2: 0.25mm/s (.01in/s) , 3: 0.5mm/s (.02in/s)

● Customized info write command

Header		Sub-field			Data	EM
W	R	C	U	S	*1	CR

Below is the content of *1 in the data column above.

Data	Bytes	Description
*1 Customized info	Variable length	Ra, Ry, Rz, Rq***mr, separated by comma (“,”).

● Key mask write command

Header		Sub-field			Data	EM
W	R	K	E	Y	*1	CR

Below is the content of *1 in the data column above.

Data	Bytes	Description
*1 Key mask	1	1: Masked 2: Without mask

● Roughness motif A write command

Header		Sub-field			Data	EM
W	R	M	_	A	*1	CR

_:Space code (20H)

Below is the content of *1 in the data column above.

Data	Bytes	Description
*1 Roughness motif A	1	2: 0.02mm(.001") 3: 0.1mm(.004") 4: 0.5mm(.02")

● Transfer data top specification and storage area specification write command

Header		Sub-field			Data		EM
W	R	C	A	N	*1	*2	CR

Below are the contents of *1 and *2 in the data column above.

Data	Bytes	Description
*1 Start data point	5	***** Specification of the leading data to be transmitted by the RDDTA command.
*2 Specification of data storage area	2	** 00: Measurement data 01: Evaluation data

Under the following conditions, except when using WRCAN command, the start data point is “1”.

- At power ON
- At the start of measurement

● Traversing length setting write command

Header		Sub-field			Data	EM
W	R	T	R	A	*1	CR

Below is the content of *1 in the data column above.

Data	Bytes	Description
*1 Traversing length setting	1	0: Includes pre/post-travel 1: Excludes pre/post-travel

● Write command of evaluation length for MOTIF

Header		Sub-field			Data	EM
W	R	M	L	_	*1	CR

_:Space code (20H)

Below is the content of *1 in the data column above.

Data	Bytes	Description
*1 Evaluation lengths for each upper limit length	17	*****, *****, *****

■ Procedure for extracting measured data

The following describes the procedure of how the SJ-301 extracts measured data using communication commands

1. Make the communication conditions consistent between the personal computer and the SJ-301.
2. Set the SJ-301 communication mode to the RS-232C mode.
3. Issue the Write command for the number of required pieces of data from the personal computer.

Example: When requiring 9600 pieces of data

W	R	N	U	M	_	9	6	0	0	CR
---	---	---	---	---	---	---	---	---	---	----

_ : Space, CR: Carriage return

If the SJ-301 receives the command properly, it returns a normal response to the personal computer.

O	K	CR
---	---	----

If the SJ-301 does not receive the command properly, it returns an abnormal response. Check the status contents and reissue the command.

4. Issue the Write command for the beginning and storage instructions of transfer data from the personal computer.

Example: When extracting data from the beginning (1st point) of measured data

W	R	C	A	N	_	_	_	_	1	0	0	CR
---	---	---	---	---	---	---	---	---	---	---	---	----

_ : Space, CR: Carriage return

If the SJ-301 receives the command properly, it returns a normal response to the personal computer.

O	K	CR
---	---	----

If the SJ-301 does not receive the command properly, it returns an abnormal response. Check the status contents and reissue the command.

5. Issue the Read command for the ASCII data from the personal computer.

R	D	D	T	A	0	0	CR
---	---	---	---	---	---	---	----

CR: Carriage return

If the SJ-301 receives the command properly, it returns a normal response to the personal computer.

O	K	*	*	. . .	CR
---	---	---	---	-------	----

*: Measured data

If the SJ-301 does not receive the command properly, it returns an abnormal response. Check the status contents and reissue the command.

14

REFERENCE INFORMATION

14.1 Surface Texture Standard

14.1.1 Evaluation according to JIS B0601-1982

- Standard cutoff length and evaluation length for Ra (Use the 2RC filter.)

Range of Ra (μm)	Cutoff length (λ_c) (mm)	Evaluation length (ℓ_n) (mm)
$Ra \leq 12.5$	0.8	2.4 or greater
$12.5 < Ra \leq 100$	2.5	7.5 or greater

- Standard sampling length for Ry

Range of Ry (μm)	Sampling length (ℓ) (mm)
$Ry \leq 0.8$	0.25
$0.8 < Ry \leq 6.3$	0.8
$6.3 < Ry \leq 25$	2.5
$25 < Ry \leq 100$	8
$100 < Ry \leq 400$	25

- Standard sampling length for Rz

Range of Rz (μm)	Sampling length (ℓ) (mm)
$Rz \leq 0.8$	0.25
$0.8 < Rz \leq 6.3$	0.8
$6.3 < Rz \leq 25$	2.5
$25 < Rz \leq 100$	8
$100 < Rz \leq 400$	25

14.1.2 Evaluation according to JIS B0601-1994

■ Standard cutoff length, sampling length, and evaluation length for Ra

Range of Ra (μm)	Cutoff length (λ_c) (mm)	Sampling length (ℓ) (mm)	Evaluation length (ℓ_n) (mm)
(0.006) < Ra $\leq$ 0.02	0.08	0.08	0.4
0.02 < Ra $\leq$ 0.1	0.25	0.25	1.25
0.1 < Ra $\leq$ 2.0	0.8	0.8	4
2.0 < Ra $\leq$ 10.0	2.5	2.5	12.5
10.0 < Ra $\leq$ 80.0	8	8	40

■ Standard cutoff length, sampling length and evaluation length for Rz

Range of Rz (μm)	Cutoff length (λ_c) (mm)	Sampling length (ℓ) (mm)	Evaluation length (ℓ_n) (mm)
(0.025) < Rz $\leq$ 0.10	0.08	0.08	0.4
0.10 < Rz $\leq$ 0.50	0.25	0.25	1.25
0.50 < Rz $\leq$ 10.0	0.8	0.8	4
10.0 < Rz $\leq$ 50.0	2.5	2.5	12.5
50.0 < Rz $\leq$ 200.0	8	8	40

■ Standard cutoff length, sampling length and evaluation length for Ry

Range of Ry (μm)	Cutoff length (λ_c) (mm)	Sampling length (ℓ) (mm)	Evaluation length (ℓ_n) (mm)
(0.025) < Ry $\leq$ 0.10	0.08	0.08	0.4
0.10 < Ry $\leq$ 0.50	0.25	0.25	1.25
0.50 < Ry $\leq$ 10.0	0.8	0.8	4
10.0 < Ry $\leq$ 50.0	2.5	2.5	12.5
50.0 < Ry $\leq$ 200.0	8	8	40

■ Standard cutoff length, sampling length, and evaluation length for Sm

Range of Sm (mm)	Cutoff length (λ_c) (mm)	Sampling length (ℓ) (mm)	Evaluation length (ℓ_n) (mm)
0.013 < Sm $\leq$ 0.04	0.08	0.08	0.4
0.04 < Sm $\leq$ 0.13	0.25	0.25	1.25
0.13 < Sm $\leq$ 0.4	0.8	0.8	4
0.4 < Sm $\leq$ 1.3	2.5	2.5	12.5
1.3 < Sm $\leq$ 4.0	8	8	40

For information about m, refer to section 14.5.14, "Mean width of the profile elements, Sm(JIS, ISO, DIN)."

14.1.3 Evaluation according to DIN

Shown below are the standard cutoff length, sampling length, and evaluation length for evaluation according to DIN.

- Standard cutoff length, sampling length, and evaluation length for R_a , R_z , and R_y (DIN) from periodic roughness profile

Range of S_m (mm)	Cutoff length (λ_c) (mm)	Sampling length (ℓ_e) (mm)	Evaluation length (ℓ_n) (mm)
0.01 < S_m ≤ 0.04	0.08	0.08	0.4
0.04 < S_m ≤ 0.13	0.25	0.25	1.25
0.13 < S_m ≤ 0.4	0.8	0.8	4
0.4 < S_m ≤ 1.3	2.5	2.5	12.5
1.3 < S_m ≤ 4	8	8	40

- Standard cutoff length and evaluation length for R_a from non-periodic roughness profile

Range of R_a (μm)	Cutoff length (λ_c) (mm)	Evaluation length (ℓ_n) (mm)
R_a ≤ 0.02	0.08	0.4
0.02 < R_a ≤ 0.1	0.25	1.25
0.1 < R_a ≤ 2	0.8	4
2 < R_a ≤ 10	2.5	12.5
10 < R_a	8	40

- Standard cutoff length, sampling length and evaluation length for R_z (DIN) from non-periodic roughness profile

Range of R_z (μm)	Cutoff length (λ_c) (mm)	Sampling length (ℓ_e) (mm)	Evaluation length (ℓ_n) (mm)
R_z ≤ 0.1	0.08	0.08	0.4
0.1 < R_z ≤ 0.5	0.25	0.25	1.25
0.5 < R_z ≤ 10	0.8	0.8	4
10 < R_z ≤ 50	2.5	2.5	12.5
50 < R_z	8	8	40

14.1.4 Evaluation according to JIS B0601-2001 and ISO

Shown below are the standard sampling length and evaluation length for evaluation according to JIS B0601-2001 and ISO.

- Standard sampling length and evaluation length for the measurement of R-parameters of periodic profiles, and RSm of periodic or non-periodic profiles

Range of RSm (mm)	Sampling length (ℓ) (mm)	Evaluation length (ℓ_n) (mm)
0.013 < RSm $\leq$ 0.04	0.08	0.4
0.04 < RSm $\leq$ 0.13	0.25	1.25
0.13 < RSm $\leq$ 0.4	0.8	4
0.4 < RSm $\leq$ 1.3	2.5	12.5
1.3 < RSm $\leq$ 4	8	40

- Standard sampling length and evaluation length for the measurement of Ra and Rq from non-periodic roughness profiles

Range of Ra (μm)	Sampling length (ℓ) (mm)	Evaluation length (ℓ_n) (mm)
(0.006) < Ra $\leq$ 0.02	0.08	0.4
0.02 < Ra $\leq$ 0.1	0.25	1.25
0.1 < Ra $\leq$ 2	0.8	4
2 < Ra $\leq$ 10	2.5	12.5
10 < Ra $\leq$ 80	8	40

- Standard sampling length and evaluation length for measurement of Rz, Rp, and Rt from non-periodic roughness profiles

Range of Rz (μm)	Sampling length (ℓ) (mm)	Evaluation length (ℓ_n) (mm)
(0.025) < Rz $\leq$ 0.10	0.08	0.4
0.10 < Rz $\leq$ 0.5	0.25	1.25
0.5 < Rz $\leq$ 10	0.8	4
10 < Rz $\leq$ 50	2.5	12.5
50 < Rz $\leq$ 200	8	40

14.1.5 Evaluation according to ANSI

Shown below are the standard cutoff length and the evaluation length for evaluation according to ANSI.

■ Standard cutoff length and evaluation length for R-parameters from periodic profiles

Range of S_m mm (inch)	Cutoff length (λ_c) mm (inch)	Evaluation length (ℓ_n) mm (inch)
0.013 < S_m ≤ 0.04 (0.0005 < S_m ≤ 0.0016)	0.08 (0.003)	0.4 (0.016)
0.040 < S_m ≤ 0.13 (0.0016 < S_m ≤ 0.005)	0.25 (0.010)	1.25 (0.05)
0.13 < S_m ≤ 0.40 (0.005 < S_m ≤ 0.016)	0.80 (0.03)	4.0 (0.16)
0.40 < S_m ≤ 1.3 (0.016 < S_m ≤ 0.05)	2.5 (0.10)	12.5 (0.5)
1.3 < S_m ≤ 4.0 (0.05 < S_m ≤ 0.16)	8.0 (0.3)	40.0 (1.6)

For selection of profile filter cutoff among from the table, estimate the roughness parameter S_m graphically from a primarily profile.

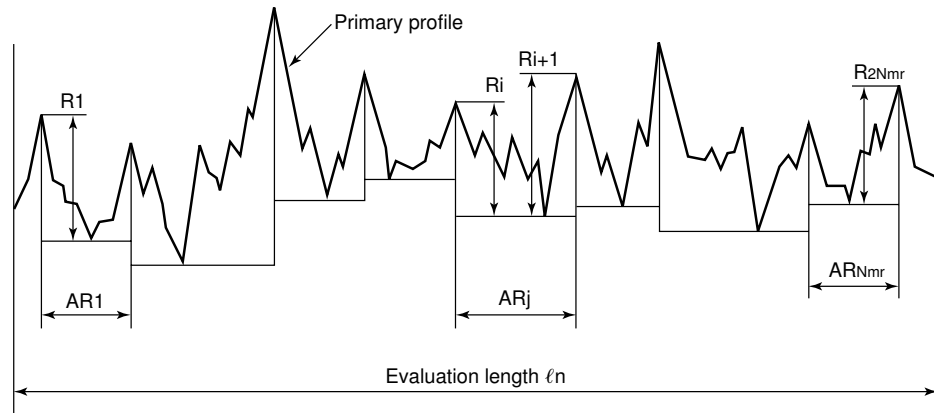
■ Standard cutoff length and evaluation length for R-parameters from non-periodic profiles

Range of R_a μm (μin)	Cutoff length (λ_c) mm (inch)	Evaluation length (ℓ_n) mm (inch)
R_a ≤ 0.02 (R_a ≤ 0.8)	0.08 (0.003)	0.40 (0.016)
0.02 < R_a ≤ 0.10 (0.8 < R_a ≤ 4)	0.25 (0.010)	1.25 (0.05)
0.10 < R_a ≤ 2.0 (4 < R_a ≤ 80)	0.80 (0.03)	4 (0.16)
2.0 < R_a ≤ 10 (80 < R_a ≤ 400)	2.5 (0.10)	12.5 (0.5)
10 < R_a (400 < R_a)	8 (0.3)	40 (1.6)

■ Motif

Generally, when waviness components are removed from a primary profile using filters, the primary profile is subjected to distortion. One method to remove waviness components from a primary profile without distorting it is by using the motif method.

With this method, a primary 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.



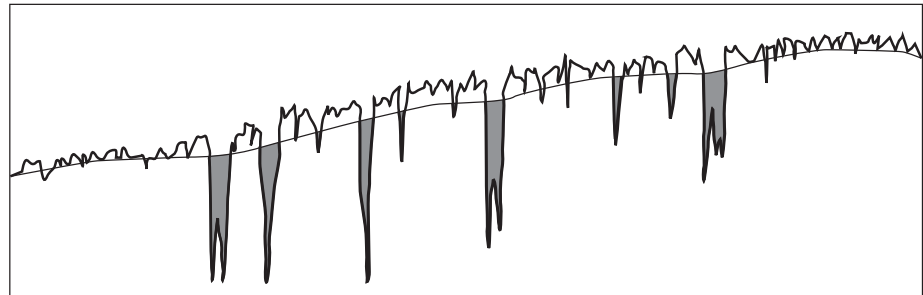
■ DIN4776 profile

For surfaces to be measured having deep valleys with respect to the irregularity on the surface, the position of the mean line may be calculated to the position shifted from the position where it is supposed to be for surface roughness evaluation.

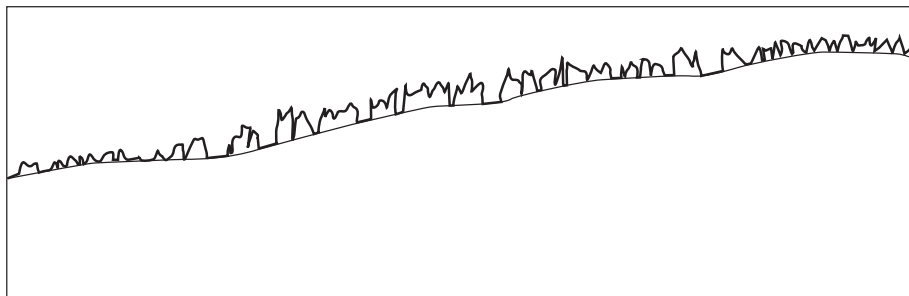
However, by this procedure, those negative effect can be avoided to a certain extent.

The actual procedure is shown below.

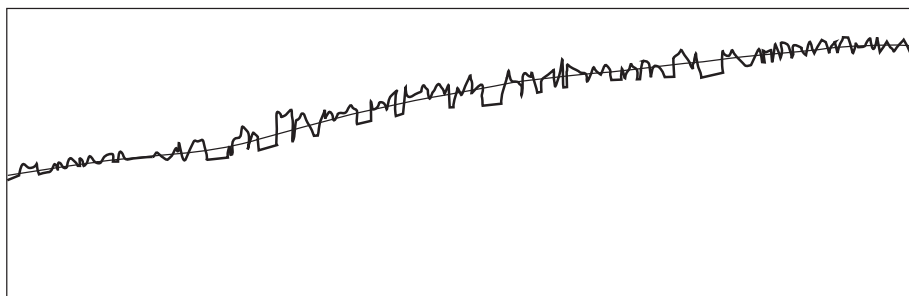
1. The first mean line is obtained with respect to the input data.



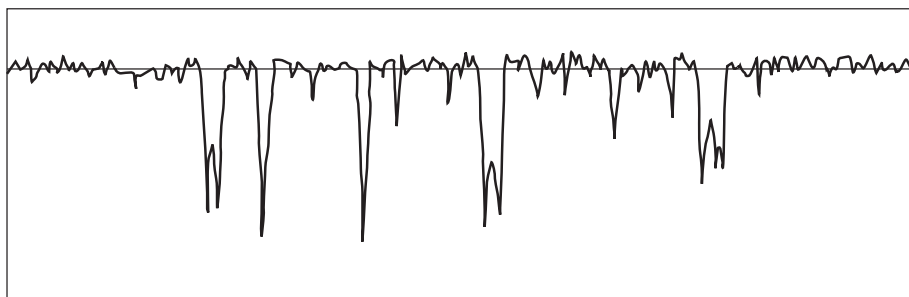
2. Valleys below the mean line are removed.



3. The second mean line is obtained with respect to the data obtained in the step 2.



4. Original input data is compensated with reference to the second mean line.



TIP The filters specified in DIN4777 are used for calculating both the first and second mean lines. For information about this, refer to section 14.1.3, "Evaluation according to DIN".

14.2.2 Filters

■ Filter types

The following 3 types of filters are available on the SJ-301.

Filter	Amplitude characteristics	Phase characteristics	Amplitude transmission at the cutoff wavelength
2RC	2RC	Without phase correction	75%
PC75	2RC	Phase correct filter	75%
GAUSS	Gaussian	Phase correct filter	50%

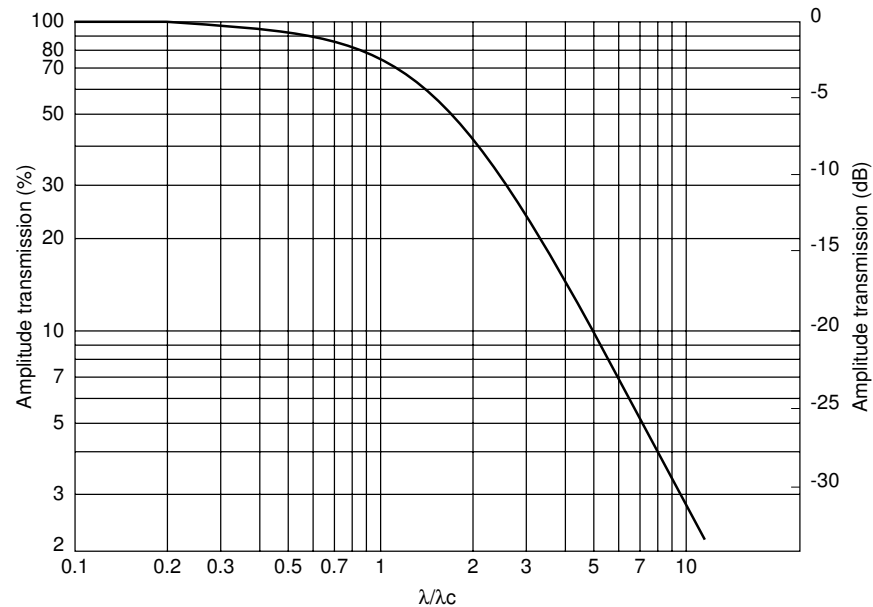
Each of the filter characteristics will be explained below.

The transmission characteristic of each filter will be represented by that of a high-pass filter.

● 2RC

This has the same transmission characteristic as that of two R-C circuits having identical time constants connected in series.

The transmission characteristic is -12dB/oct and the amplitude transmittance at the cutoff length is 75%, as shown in figure below.

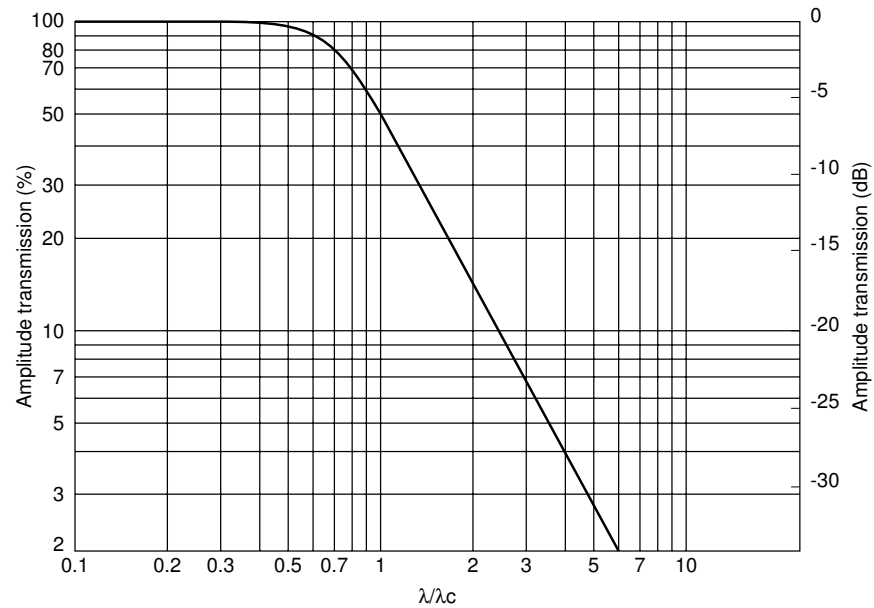


Transmission characteristic of 2RC filter

$$\text{Transmission characteristic: } H(\lambda) = \frac{1}{1 + \left(\frac{\lambda}{\sqrt{3}\lambda_c} \right)^2}$$

● GAUSS (Gaussian)

The transmission characteristic is approximately -11.6dB/oct and the amplitude transmittance at the cutoff length is 50%. The transmission characteristic is shown in figure below.



Transmission characteristic of Gaussian filter

$$\text{Transmission characteristic : } H(\lambda) = 1 - e^{-\pi \left(\frac{\alpha \cdot \lambda_c}{\lambda} \right)^2},$$

$$\text{where } \alpha = \left(\frac{\ell n 2}{\pi} \right)^{\frac{1}{2}}$$

$$\doteq 0.4697$$

The use of this filter results in a simple formula of addition:

$$\text{Primary profile} = \text{Roughness profile} + \text{Waviness profile}$$

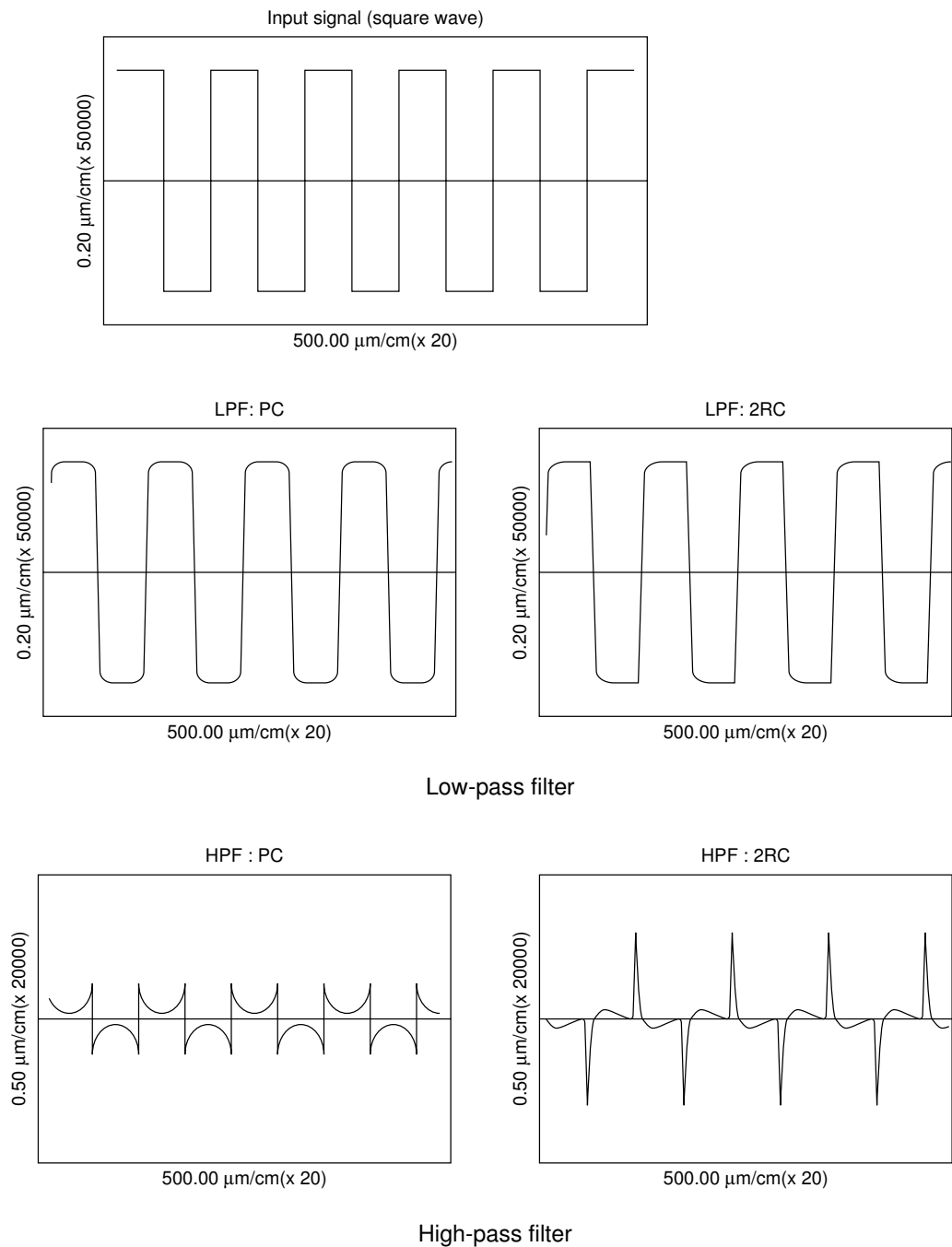
Therefore, the low-pass filter is characterized by:

$$\text{Transmission characteristic : } H(\lambda) = e^{-\pi \left(\frac{\alpha \cdot \lambda_c}{\lambda} \right)^2}$$

- Phase correct filters

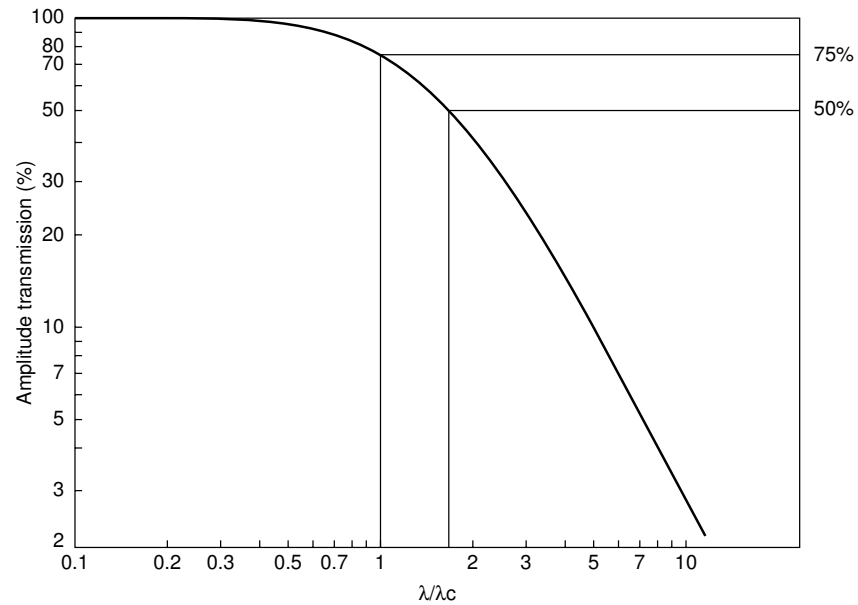
Output waveforms from the general 2RC filters may be distorted due to phase deviations that vary with each wavelength.

Shown below are the response of a low-pass filter to square wave input, and that of a high-pass filter.

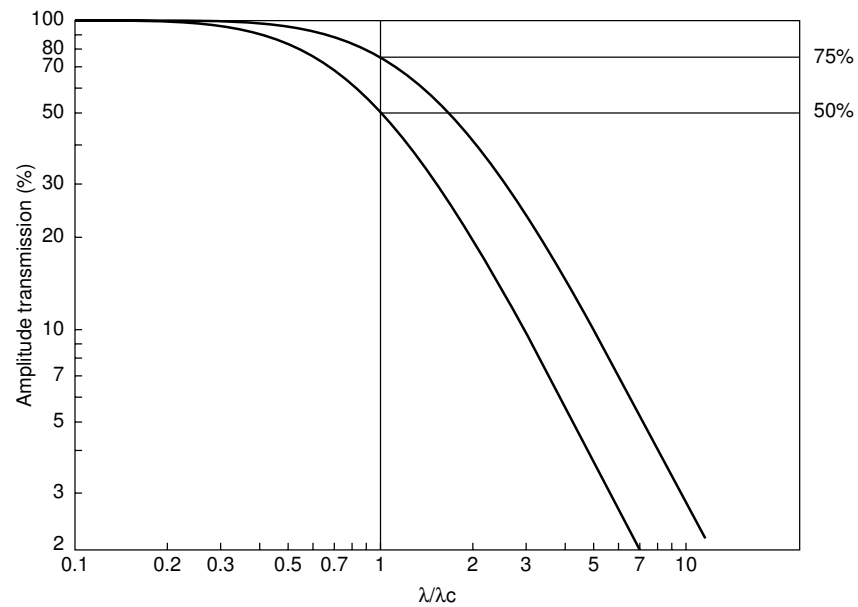


14.2.3 Difference of filter characteristics

- Difference in amplitude transmission of 2RC (and PC) type at the cutoff length
Both are the same type of filters, except with different cutoff lengths.
The difference between the two is shown in figures.



Different cutoff length with the same filter

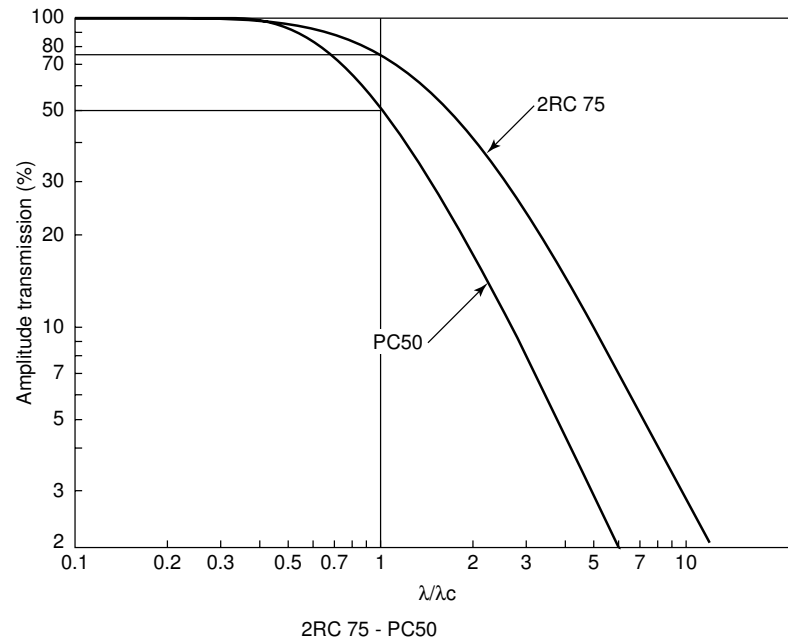


Comparison of two filters at the same cutoff length

14.2.4 Amplitude characteristic of 2RC and Gaussian filters

- About the amplitude characteristic of 2RC and Gaussian filters

The difference in amplitude characteristics between the 2RC filter and Gaussian filter is shown in figures.



■ Filters and Relevant Standards

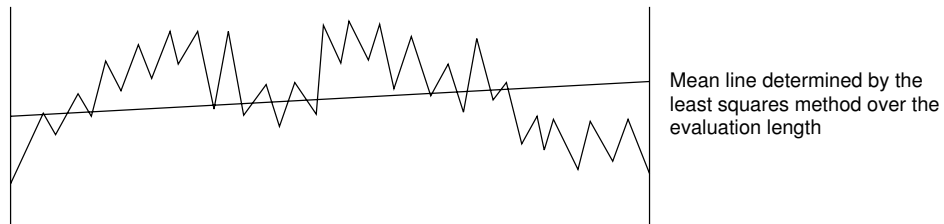
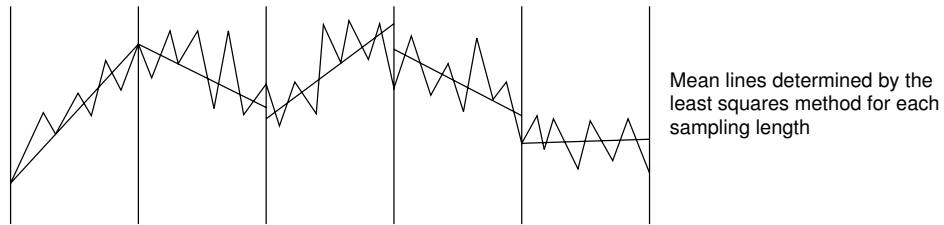
Table lists the correspondence between the filters and their standards.

	JIS	ISO	ANSI/ASME	DIN
2RC	B0601-1982 B0610-1987 B0651-1976	3274 (1975)	B46.1-1985	4762
PC 75				
GAUSS	B0601-1994 B0651-1996 B0601-2001 B0651-2001	11562 (1996)	B46.1-1995	4777

14.3 Mean line compensation

The following table shows the definition of mean line of each profile as associated with the filter.

Profile	Filter	Mean line	
P-profile	-	Arbitrary evaluation length	A line determined by the least squares method over the evaluation length
	-	Sampling length	A line determined by the least squares method for each sampling length
R-profile	2RC	A line determined by the least squares method over the evaluation length	
	PC75	A line determined by the least squares method over the evaluation length	
	GAUSS	The mean line processing is performed within the GAUSS filter processing.	



14.4 Traversing Length

A traversing length is defined as being the evaluation length plus the approach travel length, pre-travel length, and post-travel length.

NOTE The pre-travel length and the post-travel length will vary depending on the filter used. If the pre-travel and post-travel setting is set to “No”, the traversing length is reduced by as much as the pre-travel length and the post-travel length. Refer to “5.9 Setting Pre-Travel/Post-Travel to “OFF” ”.

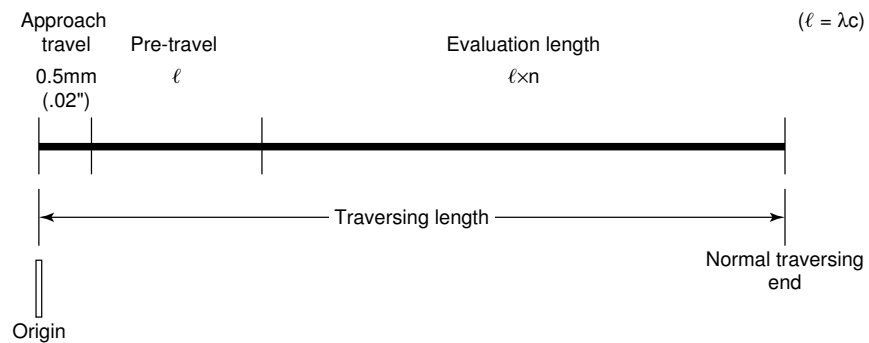
Measuring operation

1 cycle reciprocal operation	→	0.5mm/s (.02in/s)
	←	1mm/s (.04in/s)

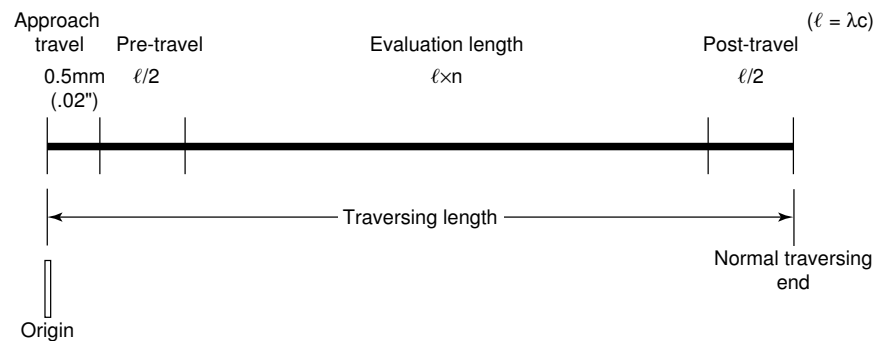
Measurement starts from the origin limit position. If measurement has been completed, the detector returns to the origin limit.

■ Traversing Length

● If the 2RC filter is selected

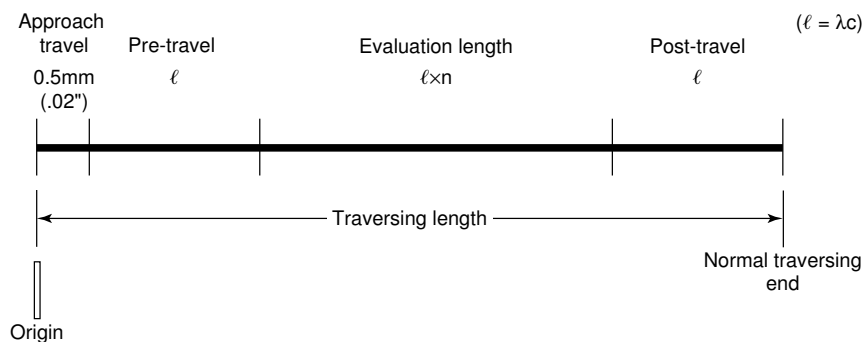


● If the GAUSS filter is selected



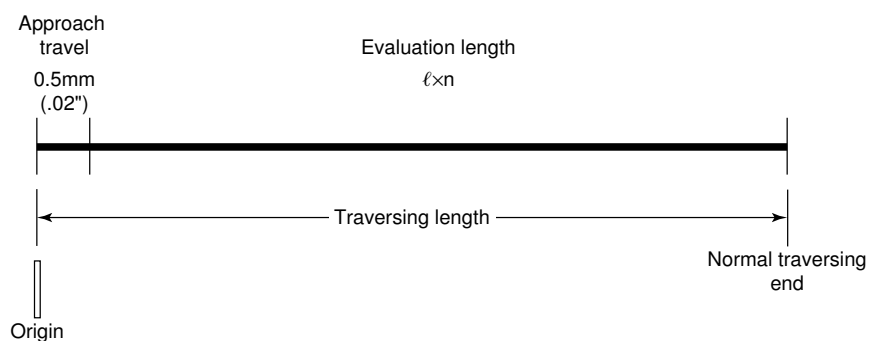
Data from the pre-travel and post-travel lengths are calculated assuming that their lengths are $\ell/2$.

- If the PC75 filter is selected



Data from the pre-travel and post-travel lengths are calculated assuming that their lengths are ℓ .

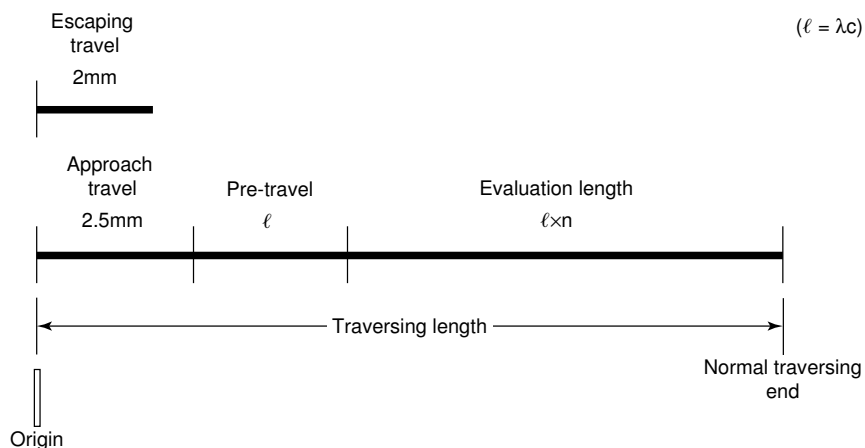
- If measuring with the primary profile (P)



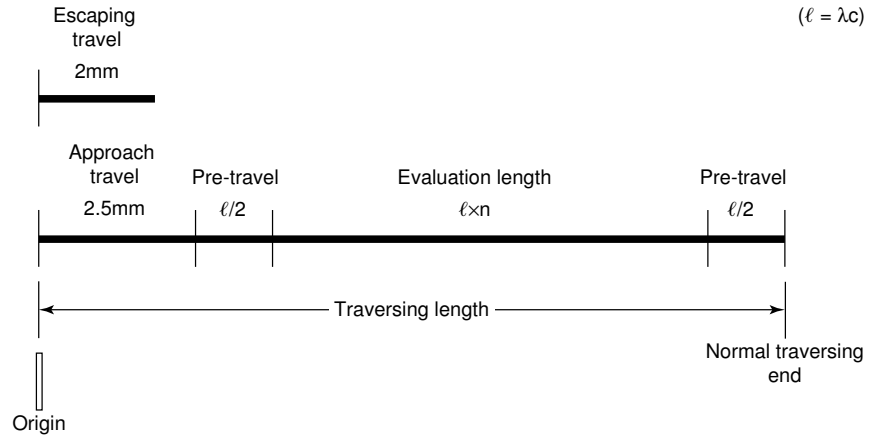
TIP If measuring the roughness profile without pre-travel and post-travel lengths is selected, calculation is performed with the pre-travel and post-travel data assumed to be folded (nulled).

■ Traverse length when using the front escape type drive unit

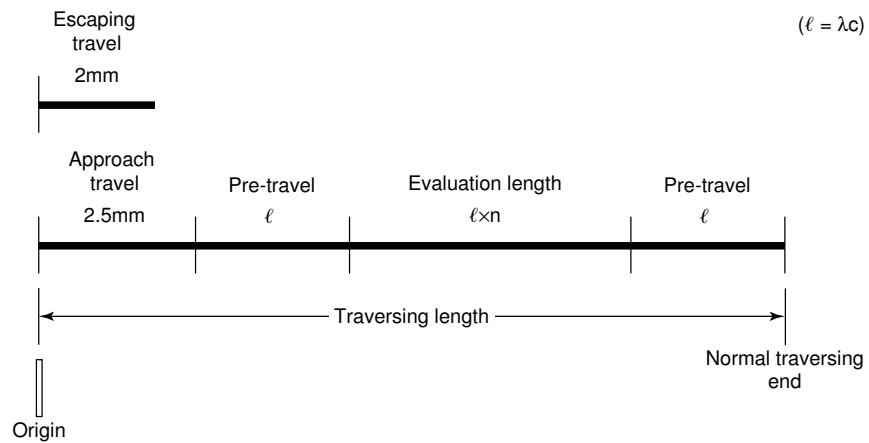
- If the 2CR75 filter is selected



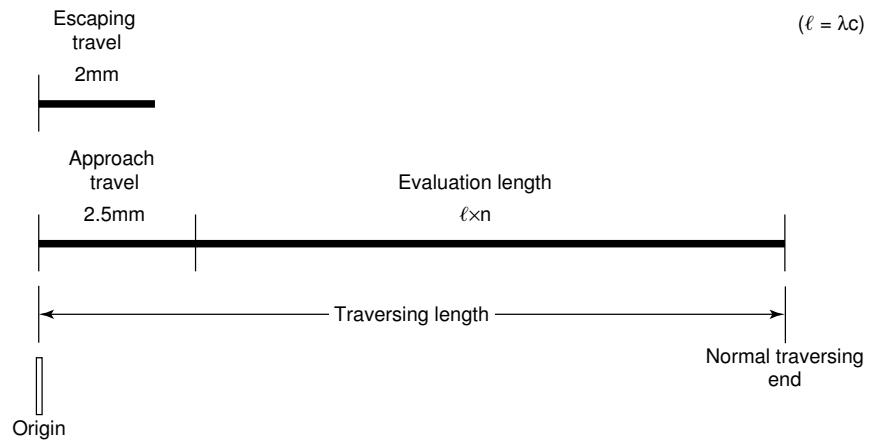
● If the PC50 filter is selected



● If the PC75 filter is selected



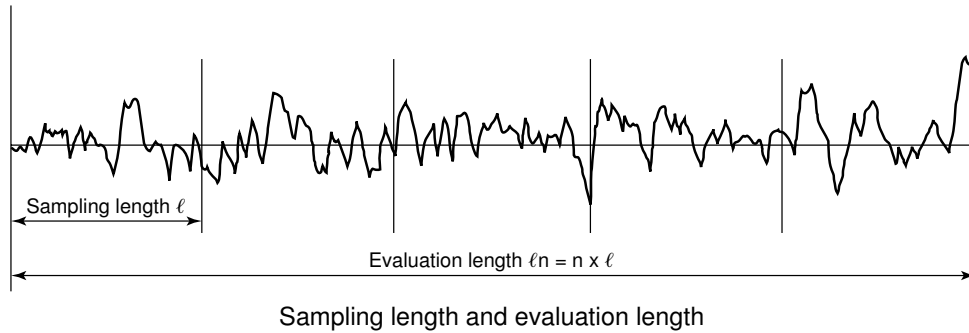
● If measuring with the primary profile (P)



TIP If measuring the roughness profile without pre-travel and post-travel lengths is selected, calculation is performed with the pre-travel and post-travel data assumed to be folded (nulled).

14.5 Definitions of the SJ-301 Roughness Parameters

This section gives the definitions (calculation methods) of the roughness parameters that can be measured with the SJ-301.



Each parameter explained below is defined as calculated within a sampling length. Specific parameters to be obtained over the evaluation length will be noted as required.

14.5.1 Arithmetic mean deviation of the profile, R_a

R_a is the arithmetic mean of the absolute values of the profile deviations (Y_i) from the mean line.

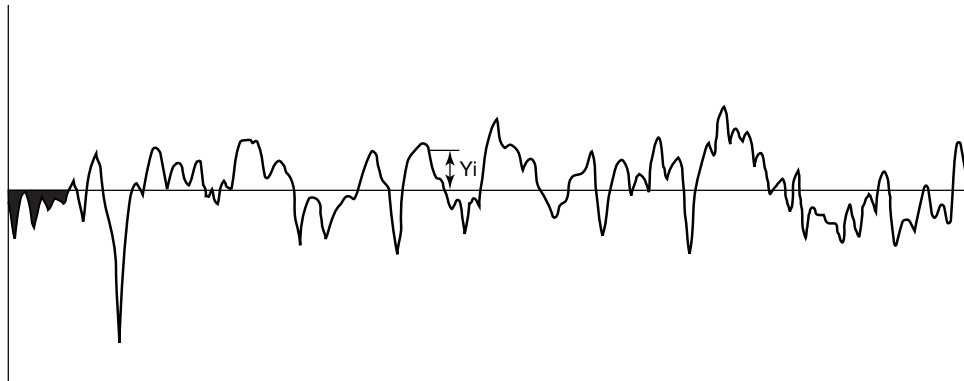
$$R_a = \frac{1}{N} \sum_{i=1}^N |Y_i|$$

● For ANSI, R_a is defined over the entire evaluation length.

14.5.2 Root-mean-square deviation of the profile, R_q

R_q is the square root of the arithmetic mean of the squares of profile deviations (Y_i) from the mean line.

$$R_q = \left(\frac{1}{N} \sum_{i=1}^N Y_i^2 \right)^{\frac{1}{2}}$$

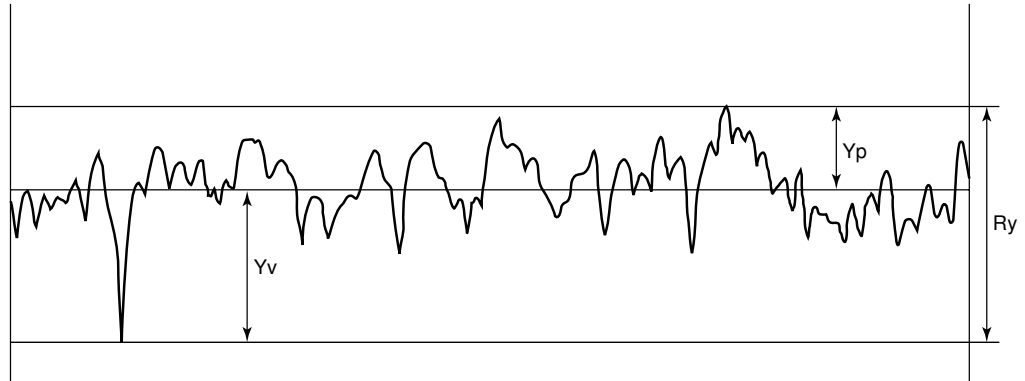


● For ANSI, R_q is defined over the entire evaluation length.

14.5.3 Maximum height of the profile, R_y (JIS'82, JIS'94)

R_y (JIS) is the sum of height Y_p of the highest peak from the mean line and depth Y_v of the deepest valley from the mean line.

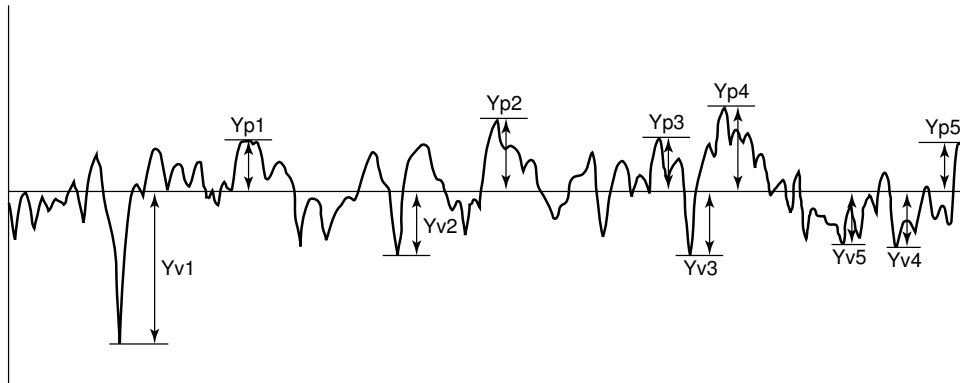
$$R_y \text{ (JIS'82, JIS'94)} = Y_p + Y_v$$



14.5.4 Ten-point height of irregularities, Rz (JIS'82, JIS'94)

Sum of the mean height of the five highest profile peaks and the mean depth of five deepest profile valleys measured from a line parallel to the mean line.

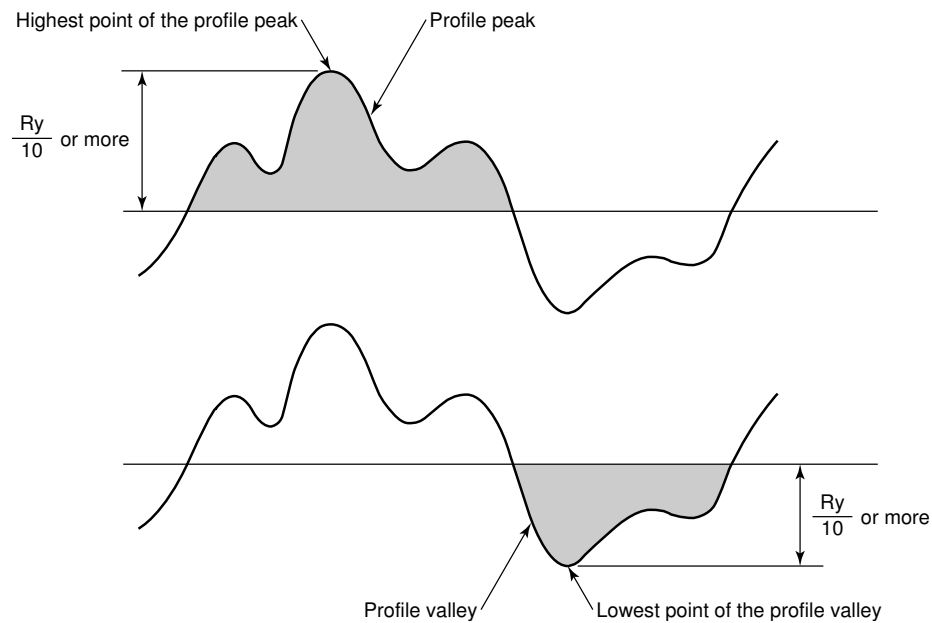
$$R_z \text{ (JIS'82, JIS'94)} = \frac{1}{5} \sum_{i=1}^5 Y_{pi} + \frac{1}{5} \sum_{i=1}^5 Y_{vi}$$



● Profile peak/profile peak height and profile valley/profile valley depth of assessed profiles

The distance between the mean line and the highest point of the profile peak is the “profile peak height”. The distance between the mean line and the lowest point of the profile valley is the “profile valley depth”.

However, if the distance (between the mean line and the highest point of the profile peak or lowest point of the profile valley) is less than 10% of the Ry value, it is not regarded as the profile peak height or profile valley depth, respectively.



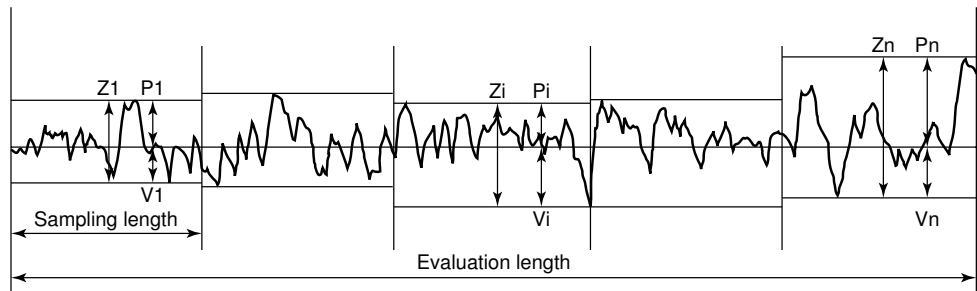
14.5.5 Maximum height of the profile, R_y (DIN, ANSI)

14.5.6 Maximum height of the profile, R_z (DIN, ISO, ANSI, JIS'01)

Obtain the sum Z_i of profile peak height P_i and profile valley depth V_i for each sampling length. The maximum value of all Z_i 's over the evaluation length is defined as R_y (DIN, ANSI), and the mean value is R_z (DIN, ISO, ANSI). In the following figure Z_n corresponds to R_y (DIN, ANSI, JIS'01).

$$R_z \text{ (DIN)} = \frac{Z_1 + Z_2 + Z_3 + Z_4 + Z_5}{5}$$

(where, the number of the sampling lengths is 5)



● Profile peak/profile peak height and profile valley/profile valley depth of assessed profiles

A portion that projects upward (convex) from the mean line of the assessed profile is called the “profile peak”, and that which projects downward (concave) is called the “profile valley”.

The distance between the mean line and the highest point of the profile peak is the “profile peak height”. The distance between the mean line and the lowest point of the profile valley is the “profile valley depth”.

14.5.7 Maximum profile height, R_p (DIN, ISO, JIS'94, JIS'01)

Obtain the profile peak height R_{pi} for each sampling length of the assessed profile. The mean of the R_{pi} 's obtained over the evaluation length is the R_p .

$$R_p = \frac{R_{p1} + R_{p2} + R_{p3} + R_{p4} + R_{p5}}{5}$$

(where, the number of the sampling lengths is 5)

● R_p (ANSI, JIS'82) is the maximum profile peak height over the evaluation length.

14.5.8 Maximum profile valley depth, Rv (DIN, ISO, JIS'94, JIS'01)

Obtain the profile valley depth Rvi for each sampling length of the assessed profile. The mean of the Rvi's obtained over the evaluation length is the Rv.

$$R_v = \frac{R_{v1} + R_{v2} + R_{v3} + R_{v4} + R_{v5}}{5}$$

(where, the number of the sampling lengths is 5)

● Rv (ANSI, JIS'82) is the maximum profile valley depth over the evaluation length.

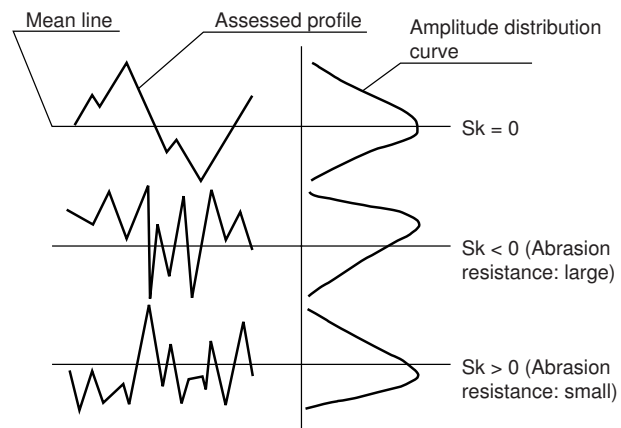
14.5.9 Total height of the profile, Rt

Rt is the sum of the maximum profile peak height and the maximum profile valley depth over the evaluation length.

14.5.10 Skewness of the profile, Sk

Sk represents the degree of bias either in the upward or downward direction of an amplitude distribution curve *1. The skewness of a profile, Sk, is given by the following formula.

$$S_k = \frac{1}{R_q^3} \cdot \frac{1}{n} \sum_{i=1}^n Y_i^3$$

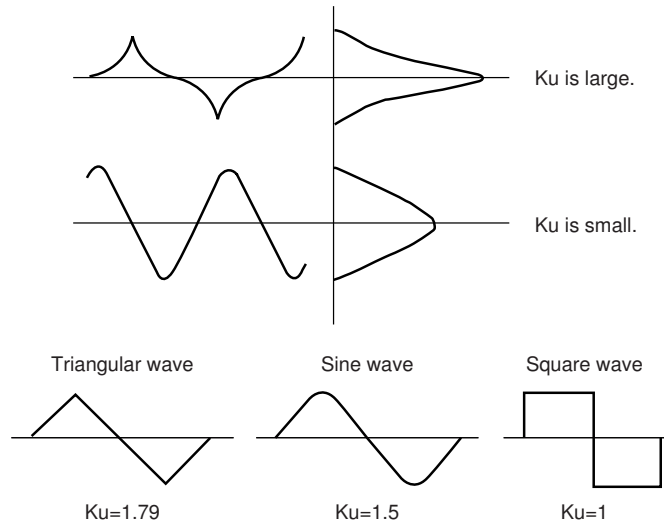


*1: Refer to section 14.5.21, "Profile height amplitude curve, ADC".

14.5.11 Kurtosis of the profile, Ku

Ku represents the degree of concentration around the mean line of an amplitude distribution curve. The kurtosis of a profile, Ku, is given by the following formula.

$$u = \frac{1}{Rq^4} \cdot \frac{1}{n} \sum_{i=1}^n Y_i^4$$



*1: Refer to section 14.5.21, "Profile height amplitude curve, ADC".

14.5.12 Arithmetic mean slope of the profile, Δa

Δa is the arithmetic mean of the absolute values of the local slope of the profile. The local slope of the profile dz/dx is given by the following formula.

$$\frac{dZ_i}{dx} = \frac{1}{60\Delta x} (Z_{i+3} - 9Z_{i+2} + 45Z_{i+1} - 45Z_{i-1} + 9Z_{i-2} - Z_{i-3})$$

(Where, the Z_i is the height of the i 'th point and the Δx is the distance to the adjacent data point.)

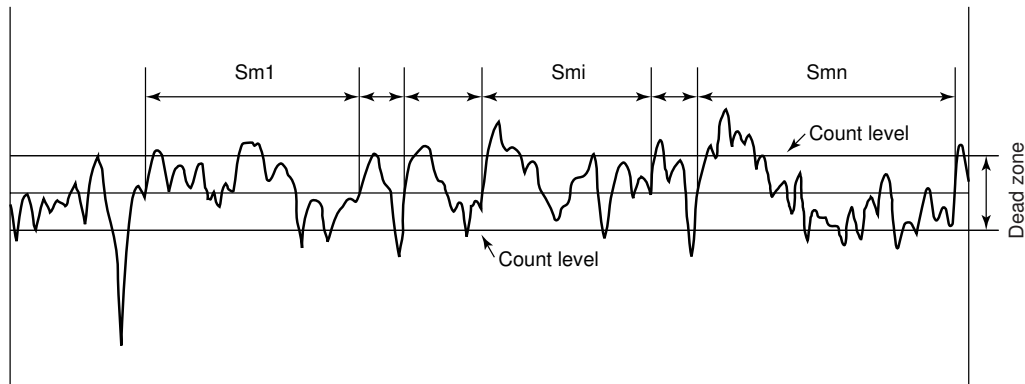
14.5.13 Root-mean-square slope of the profile, Δq

Δq is the square root of arithmetic mean of the squares of the local slope dz/dx of the profile.

14.5.14 Mean width of the profile elements, S_m (JIS, ISO, DIN)

A portion projecting upward over the given upper count level is called a profile peak, and a portion projecting downward below the given lower count level is called a profile valley. The width of the profile element is the length of the x-segment intersecting with profile peak and the adjacent profile valley. S_m is the mean of the profile element widths within a sampling length.

$$S_m = \frac{1}{n} \sum_{i=1}^n S_{mi}$$



- The following restrictions apply to determining a profile element
 - Peaks and valleys must appear alternately.
 - The intersection of the assessed profile with the mean line immediately before the profile element is the start point of itself and is the end point of the previous profile element.
 - At the start point of the sampling length, however, if either of the profile peak or profile valley is missing, the profile element width is not taken into account.
- For ANSI, S_m is defined over the evaluation length.

14.5.15 Peak count, P_c (JIS, ISO, DIN)

The reciprocal of the mean width of the profile elements, S_m , is P_c .

$$P_c = \text{Unit length} / S_m \quad (\text{Unit length} = 1 \text{ cm})$$

- For ANSI, P_c is defined over the evaluation length.

14.5.16 Peak count, P_{pi} (JIS, ISO, DIN)

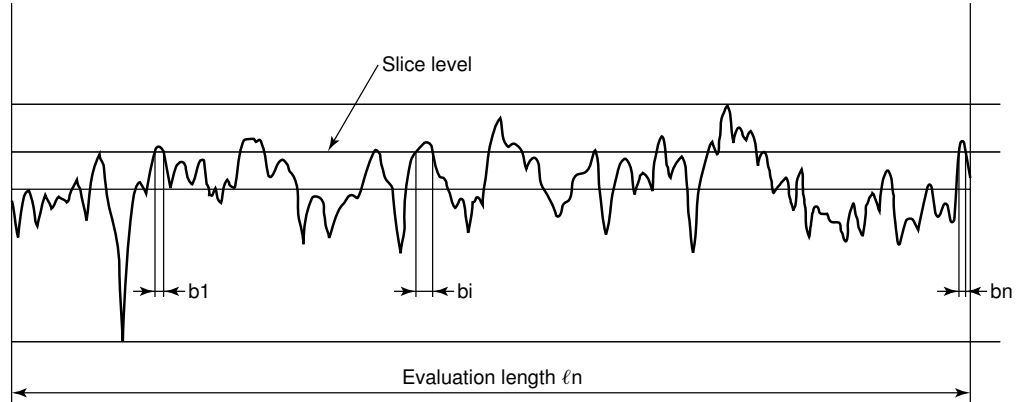
P_{pi} is a P_c value that is determined for the unit length of 1 inch.

- For ANSI, P_{pi} is defined over the evaluation length.

14.5.17 Material ratio of the profile, $mr[c]$ (tp= material ratio of the profile)

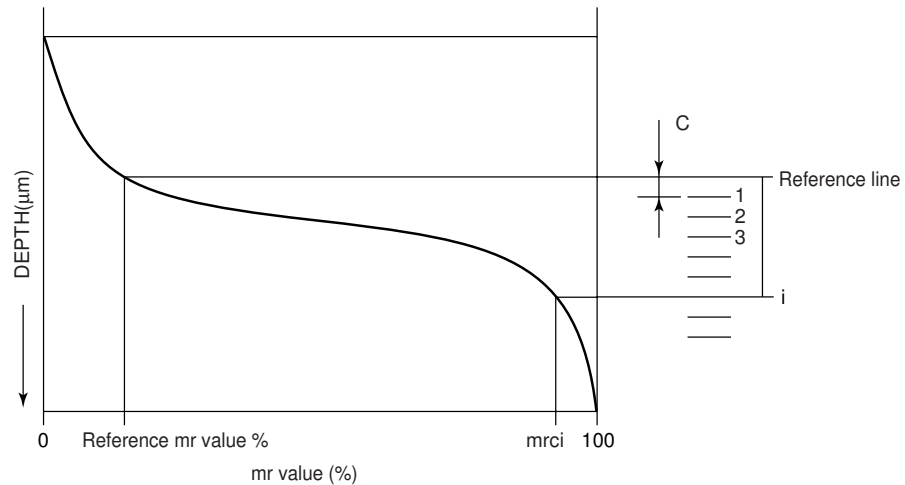
Ratio (%) of the material length (sum of the lengths of sections made by a line which is parallel to the mean line and intersects the profile element at a given level) of the profile elements at a given (slice) level to the evaluation length. Here the slice level is defined as the depth from the highest profile peak, and is called a “peak reference”. The slice level is represented by a ratio of the depth (0 to 100%) to the R_t value.

$$mr[c] = \frac{\eta p}{\ell_n} \times 100 (\%) \quad \eta p = \sum_{i=1}^n b_i$$



14.5.18 Material ratio of the profile, mr

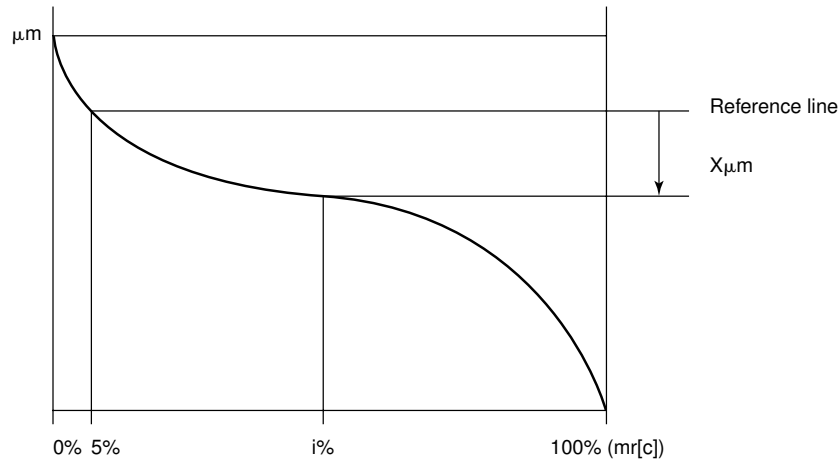
Let a slice line whose $mr[c]$ value falls between 0% and 99% (in 1% increments) be the reference line *1, and provide more slice lines in constant increments (in micrometers) below the reference line. $mr[c]$ values at each slice level are referred to as mr values.



*1: This slice line is called a reference line.

14.5.19 Profile section height difference (plateau ratio), δc

Vertical distance (in μm) between two section levels of given material ratio, where the distance is measured from one slice level *1 specified with reference to a material ratio ($\text{mr}[c]$) to another slice level representing a specified material ratio ($\text{mr}[c]$). The δc value can be negative if the slice level is set above the reference slice level.



*1: This is called a reference line.

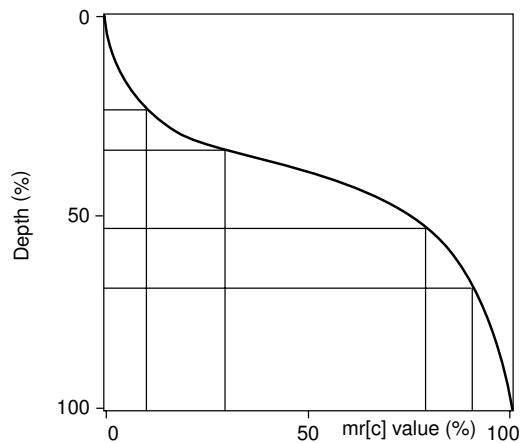
14.5.20 Material ratio curve of the profile (Abbott Firestone curve), BAC

A curve representing the material ratio of the profile as a function of (slice) level, where the mr values are plotted on the abscissa while the slice levels on the ordinate.

There are two types of BAC, depending on the method used to obtain a slice level.

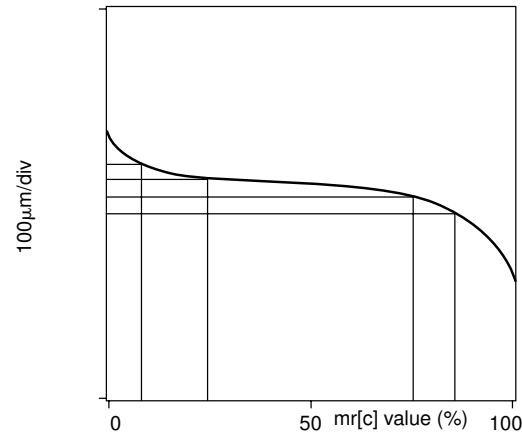
● BAC1

Peak referenced material ratio curve *1, where the abscissa represents $\text{mr}[c]$ values obtained for the slice levels set based on percentages (0% through 100%) of the R_t value *2 from the profile peak.



● BAC2

Base referenced material ratio curve *1, where the abscissa represents the $mr[c]$ values obtained for the slice levels set based on the heights (depths) from the mean line. The ordinate graduation interval corresponds to the vertical spacing of the grid lines for enlarged recording profiles.



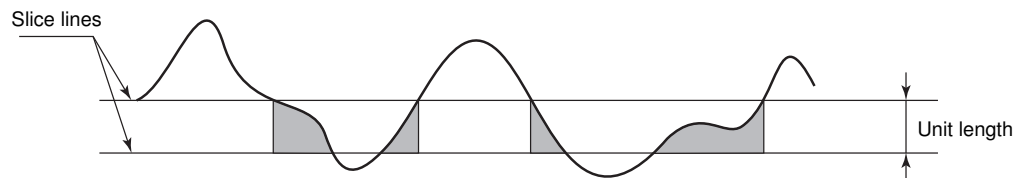
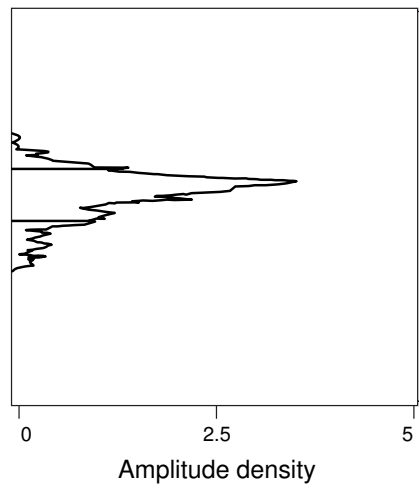
*1: For information about the peak/base reference, refer to section 14.5.17, Material ratio of the profile, $mr[c]$

*2: For information about R_t , refer to 14.5.9, Total height of the profile, R_t .

14.5.21 Profile height amplitude curve, ADC

Sample probability density function of the ordinate within the evaluation length, where the ratio in percentage (%) of the sum of the lengths of the assessed profile sectioned by and included between two slice lines set apart by unit length to the evaluation length is the amplitude density.

Profile height amplitude curve is plotted with the depth of the upper slice line on the ordinate and the amplitude density corresponding to the depth on the abscissa.

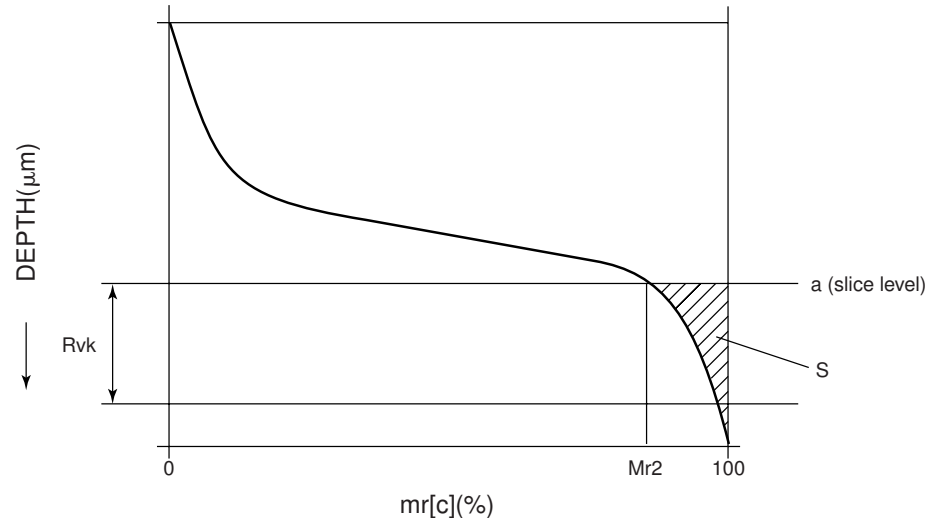


14.5.29 Measuring volume V_o

Volume V_o is a value determined from the closed area (S) lower than the slice level (a) where the $mr[c]$ value falls at $Mr2$ on the BAC (material ratio curve) and upper than the BAC.

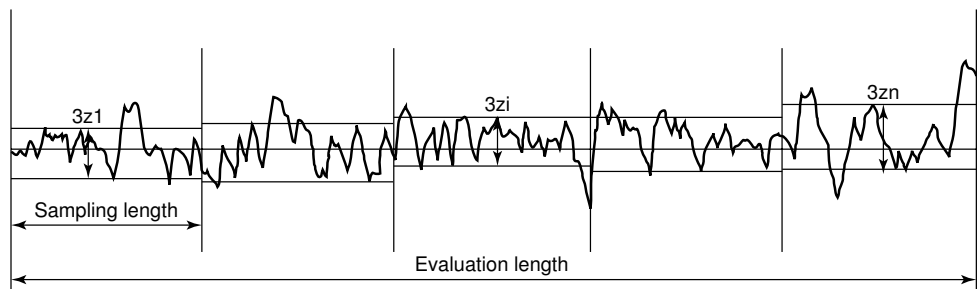
$$V_o = \frac{(100 - Mr2) \times Rvk}{2000} \quad Mr2: \%, Rvk: \mu m$$

This parameter is value that is converted from the volume (mm^3) of the concave portion lower than the slice level to a volume per area (cm^2) when viewed from the top of a workpiece, if the measured profile and slice level are assumed as a plane in a 3-dimensional space.



14.5.30 Mean peak-to-valley height points, $R3z$

Obtain, for each sampling length, the sum ($3Z_i$) of the height of the third highest profile peak above the mean line, and the depth (absolute value) of the third deepest profile valley below the mean line. The arithmetic mean of the $3Z_i$'s obtained at each sampling length is $R3z$.



● Profile peak/profile peak height and profile valley/profile valley depth of assessed profiles

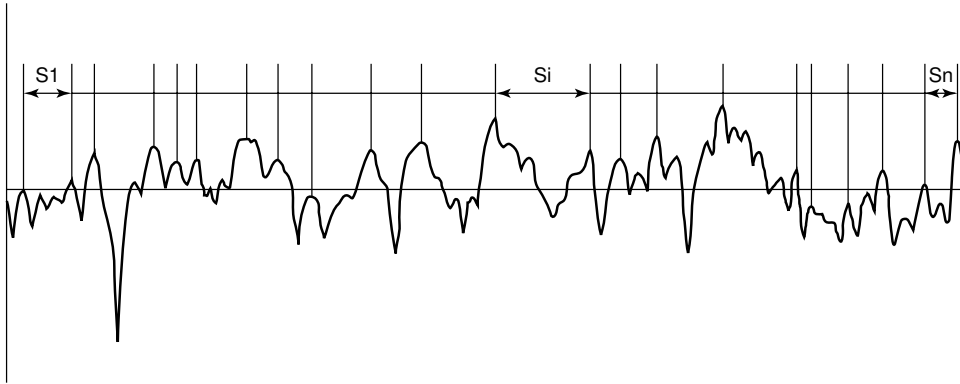
The distance between the mean line and the highest point of the profile peak is the "profile peak height". The distance between the mean line and the lowest point of the profile valley is the "profile valley depth".

However, if the distance (between the mean line and the highest point of the profile peak or lowest point of the profile valley) is less than 10% of the Ry value, it is not regarded as the profile peak height or profile valley depth, respectively.

14.5.31 Mean spacing of local peaks of profile, S

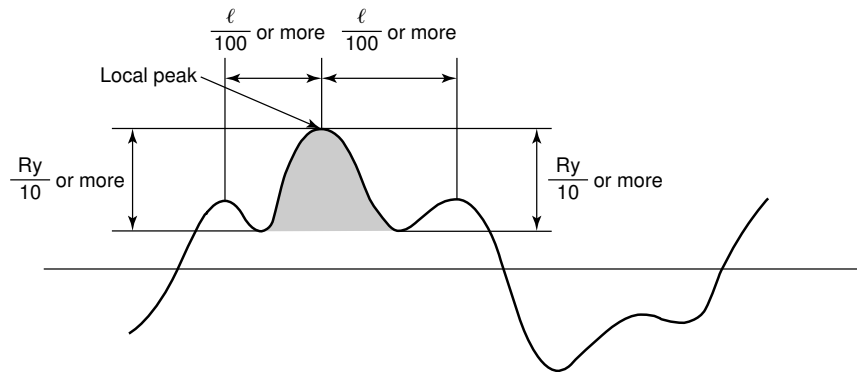
S is the arithmetic mean of peak-to-peak distances of the local peaks. For the ANSI standard, S is obtained over the evaluation length.

$$S = \frac{1}{n} \sum_{i=1}^n S_i$$



● Local peaks

If an upward convex portion of an assessed profile has concavities on both sides, the highest point of the convex portion is called a local peak. However, if the distance (in the sampling direction) between adjacent convexities is less than 1% of sampling length l , or if the depth of the concavities is less than 10% of R_y , the convex portion does not qualify as a local peak.



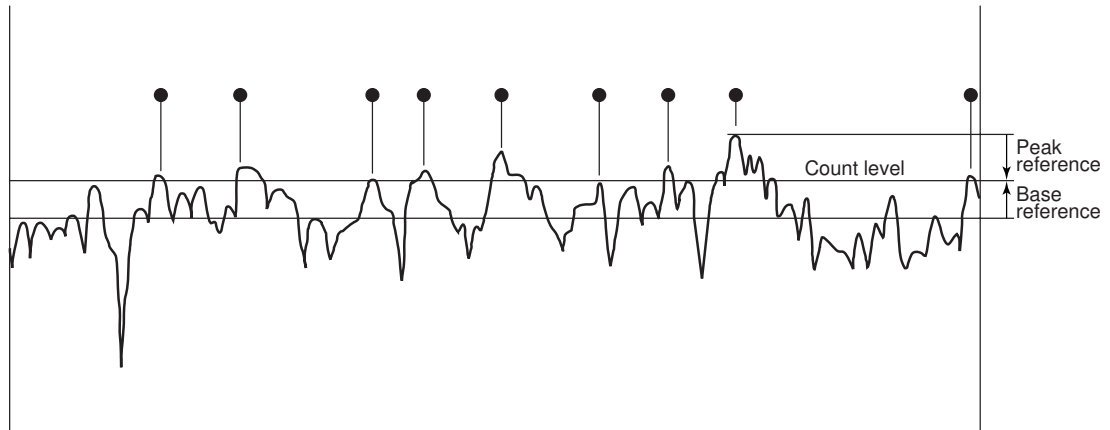
14.5.32 Developed profile length L_o

If an assessed profile has developed into a line without profile irregularities, the line length L_o is given by the following formula.

$$L_o = \sum_{i=1}^N \left(\Delta Y_i^2 + \Delta X^2 \right)^{\frac{1}{2}}$$

14.5.33 High spot count, HSC

On the assessed profile provide a line *1 which is parallel to and located above the mean line. A profile peak that projects above the line and has a local peak *2 is called a “peak for high spot count”. The number of these peaks per centimeter or inch is called the “high spot count HSC”.



There are two methods for setting the count level: the peak reference method and the base reference method.

- Peak reference

The count level is specified by the depth from the top line of the highest profile peak *3. The depth from the profile peak can be set either as a percentage of the Ry value, or as a numerical value (μm).

- Base reference

The count level is specified by the distance from the mean line. The distance from the mean line can be set either as a percentage (between 0% and 50%) of the Ry value, or as a numerical value (μm).

*1: This parallel line to the mean line is called a “count level”.

*2: For a description of the local peak, refer to section 14.5.31, “Mean spacing of local peaks of profile, S”.

*3: For a description of the highest peak of the assessed profile, refer to section 14.5.3, “Maximum height of the profile, Ry (JIS’82, JIS’94)”.

14.6 Parameters Related With Motif

The motif method is a French standard for evaluating surface roughness.

Generally, when waviness components are removed from an assessed profile using filters, the assessed profile is subjected to distortion. One method to remove waviness components from an assessed profile without distorting it is by the motif method.

With this method, an assessed 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.

The following will briefly describe the methods of obtaining the motif parameters.

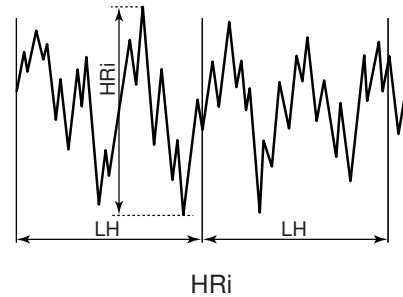
14.6.1 How to obtain roughness motifs

1) Determine the condition of the peak height

- Divide the assessed profile into sections with a set length LH (=LR/2, LR: upper limit of roughness motif length), then obtain the distance (H_{Ri}) between the highest and lowest points.
- Obtain the condition (H_{min}) of the peak height.

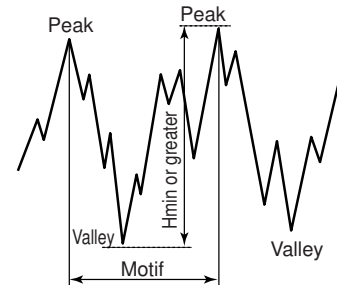
$$H_{min} = 0.05 \times \frac{1}{n} \sum_{i=1}^n H_{Ri}$$

where n is the number of sections which can secure the set length.



2) Obtain the highest point of peak and the lowest point of valley.

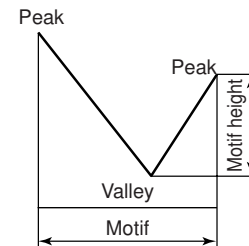
- The peak and valley should have a height difference of H_{min} or greater. The deepest point between two peaks is the valley.
- A motif consists of the section between two peaks.



Peak and valley

3) Obtain the motif height.

- The motif height is defined as the difference between the valley height and the lower peak height.



Motif height

14 - 33

If all of the following four conditions (1 through 4) are satisfied within the entire range of the evaluation length, perform composition.

- Begin with the first motif. If the i 'th motif and $i+1$ 'th motif are processed and successfully composed, then compose the $i+2$ 'th motif and $i+3$ 'th motif. If the composition is not successful, process and compose the $i+1$ 'th motif and the $i+2$ 'th motif.
- When the last two motifs are processed and at least one pair has been composed, repeat composition from the first motif. Repeat same process until all motifs that can be composed have been composed.

The height of central peak P_2 should be lower than that of either peaks P_1 or P_3 preceding and succeeding the central peak.

(Condition 2: motif height)

The motif height after composition should be higher than those of the motifs preceding and succeeding the motif.

(Condition 3: motif height)

The height of either the right or left motif should be less than T_r , which is equal to 60% of T_3 , the motif height assuming that the motif group is a motif.

(Condition 4: motif width)

After composition, motif width AR_i should be smaller than the upper limit of the motif length (AM).

$$AR_i \leq AM$$
, where AM is LR (upper limit of motif length)



5) Correct a motif.

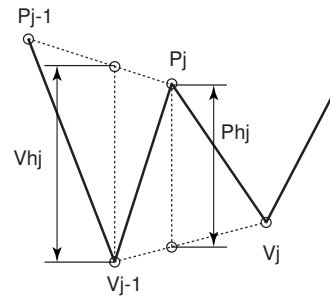
(Correction on a unique peak or valley height)

- Calculate the mean R_i , overall mean R , and standard deviation σ_R of the differences in height between the valley and the peaks on either side of it.

$$R_i = \frac{P_j + P_{j+1}}{2} + V_j$$

$$R = \left(\sum_{i=1}^{N_{mr}} R_i \right) / N$$

$$\sigma_R = \left(\frac{1}{N_{mr}} \sum_{i=1}^{N_{mr}} (R_i - R)^2 \right)^{\frac{1}{2}}$$



Correcting a motif

- Obtain reference height H_s .

$$H_s = R + 1.65\sigma_R$$

(Correcting a peak)

- Compare H_s with P_{hj} , which is the distance from P_j to an intersection of the perpendicular line from P_j and the line connecting V_{j-1} and V_j .
- If $H_s < P_{hj}$, correct the value of R_i by moving P_j so that P_{hj} is equal to H_s .

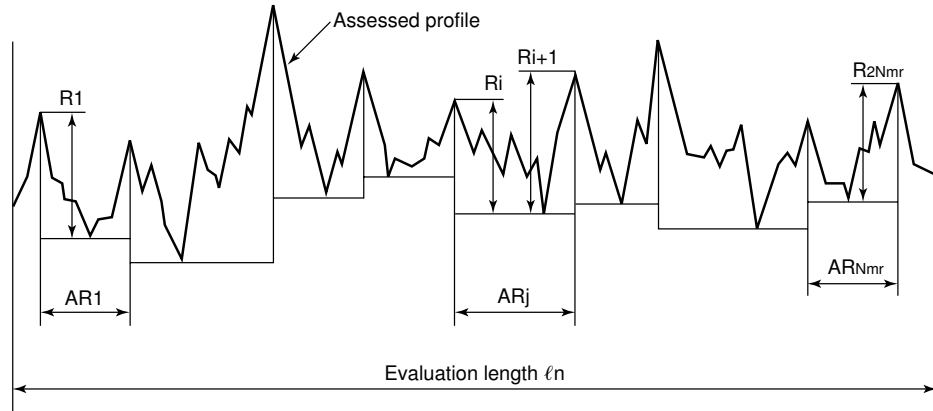
(Correcting a valley)

- Compare H_s with V_{hj} , which is the distance from V_{j-1} to the intersection of the perpendicular line from V_{j-1} and the line connecting the corrected P_{j-1} and P_j .
- If $H_s < V_{hj}$, correct the value of R_i by moving V_j so that V_{hj} is equal to H_s .

6) Calculate the roughness motif parameters.

- While selecting motifs with a width greater than LR , obtain the parameters of the roughness motif.

14.6.2 Roughness motif parameters



14.6.2.1 R

R is the mean of the R_i (height of roughness motif) values of each motif.

$$R = \frac{1}{2Nmr} \sum_{i=1}^{2Nmr} R_i$$

14.6.2.2 AR

AR is the mean of roughness motif widths.

$$AR = \frac{1}{Nmr} \sum_{j=1}^{Nmr} AR_j$$

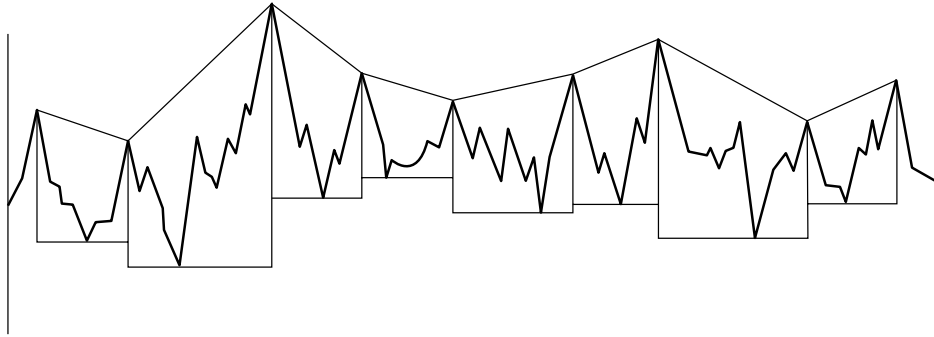
14.6.2.3 Rx

R_x is the maximum value of R_i (height of roughness motif) values of each motif.

14.6.3 How to obtain waviness motifs

1. Determine the peak and valley of a waviness motif.
Assuming the peak data in a roughness motif as a data sample (point), do the following from the first point.
Search for a point with a height that is higher than the next point, and set this point as a peak.
Search for a point with a height that is lower than the next point, and set this point as a valley.
2. Compose a waviness motif.
Perform operations similar to those described in 4) and 5) of 14.6.1 How to obtain roughness motifs.
Note that, LR should be replaced by LW (upper limit of waviness motif length).
3. Calculate the waviness motif parameters.
While selecting motifs with a width that is greater than LW, obtain the parameters of the waviness motif.

14.6.4 Waviness motif parameters



Roughness motifs used as the basis of waviness motifs

14.6.4.1 W_{te}

W_{te} is the difference between the maximum and minimum values of the envelope curve.

14.6.4.2 W_x

W_x is the maximum W_i (height of waviness motif) value of each motif.

14.6.4.3 W

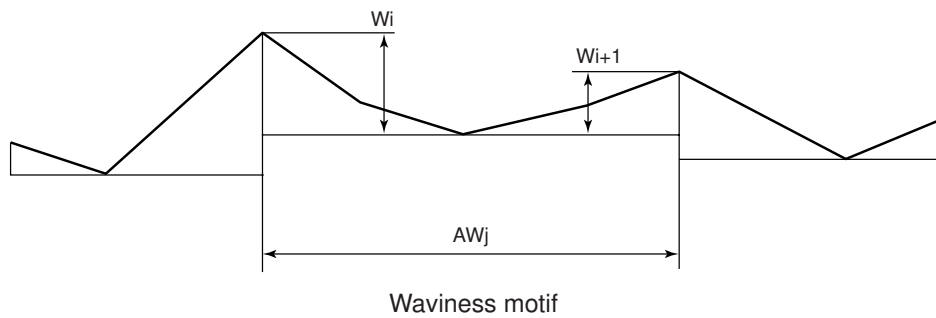
W is the mean of the W_i (height of roughness motif) values of each motif.

$$W = \frac{1}{2N_{mw}} \sum_{i=1}^{2N_{mw}} W_i$$

14.6.4.4 AW

AW is the mean of waviness motif widths.

$$AW = \frac{1}{N_{mw}} \sum_{j=1}^{N_{mw}} AW_j$$



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