

SURFACE ROUGHNESS
MEASURING INSTRUMENT

SURFCOM 130/480A
INSTRUCTION MANUAL

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Information symbols



This symbol indicates situations which may lead to incorrect measurements, faults in the measuring run, collisions or damage to the machine and workpiece.



The warning triangle indicates potential hazard sources for users or bystanders which may cause risk of injury to the user or a risk to health.

Precautions for Usage

Be sure to observe the following instructions to use this system safely.

[Warning]



1. Avoid the temperature which is out of limit of the specifications and humidity, waterdrop, dust, oily smoke, direct sunlight, strong impact, heavy vibration and corrosive gas. There is the possibility of injury due to an electric shock which is caused by trouble of the equipment or a fall of the equipment.



2. Use a table which is sufficiently able to afford the weight of the equipment as the stand, also secure fully stability of the stand. There is the possibility of injury due to fall of the equipment or the table.



3. Be sure to connect the power cable with the outlet that is the same voltage as written in the plate of the equipment, or there is the possibility of electric shock or fire due to trouble of the equipment.



4. Air source pressure indicated on the equipment name plate should be used for the air supply. Use the air source which is not contained any organic solvent or/and poisonous gas, or due to trouble of the equipment, it may cause trouble on your body. (When the optional air anti-vibration table is used.)



5. Make sure that the voltage specified on the AC adapter is supplied when the AC adapter is connected to the receptacle.



6. Ensure the ground of the earthed line. There is the possibility of electric shock or fire due to trouble of the equipment.



7. Hazardous electric current flows in the power source cable and interconnection cable. For installation and/or transferring this equipment/related equipment, always TURN OFF the MAIN POWER, and REMOVE the POWER CABLE from the outlet.



8. Pay attention not to stumble on the interconnection cables on the site floor and do not pull the cables with excessive force. Unplugging without holding the plug of the cables may cause damage. NEVER use damaged power cable or interconnection cables. Hazardous current flows inside the cable, and there is the possibility of severe injury or death by an electric shock due to electric leakage.



9. Pay attention not to stumble on the interconnection cables on the site floor. Do not pull the cables with excessive force. Pay attention not to drop the AC adapter. It may cause the failure in the AC adapter and/or the connected cables. NEVER use broken AC adapter or interconnection cables. Hazardous current flow inside the cable. Touching the portion(s) may cause severe injury or death due to electric leakage.



10. NEVER insert any kind of extraneous objects, especially avoid an electrically conductive objects such as piece of metal, into the equipment crevice. It may cause severe injury due to electric leakage, fire or problem of the equipment.



11. Pay attention when placing or replacing the workpiece or jigs onto the workpiece table. Dropping the jigs or workpiece on your toes, or pinching your finger may cause severe injury. Secure the unstable workpiece onto the table firmly with jigs.



12. Do not handle this equipment with wet hands. It may cause an electric shock leading to severe injury or death.

[Caution]



1. Connect the air tube with the air supply source OFF.

FIX the air tube for supplying air on the stand nearby the connection point, or it may cause injury when the air tube is shaken badly.

(When the optional air anti-vibration table is used.)



2. Always use the OWN power cable which is attached to the equipment. NEVER use it for other equipment.



3. Do not use cables in a bundle.



4. Always TURN OFF the power of the equipment for plugging or unplugging the power cable and the interconnection cables.



5. Use always OWN AC adapter attached to the equipment. NEVER use it for other equipment.



6. For plugging or unplugging the AC adapter cable and the interconnection cables, TURN OFF the power.



7. The tip of the stylus is very sharp, so do not look into it or touch it unnecessarily, or it may cause injury.



8. Keep off the equipment when it moves automatically, or it may cause injury.



9. Do not insert your fingers into the narrow holes on the column, or it may cause injury if your fingers being caught between the column and the block.



10. If the emergency stop button is pressed for the safety reasons, make sure that all the obstacles were removed before restarting the equipment.

Preface

This instrument has been developed by our experienced engineers with their every possible effort and technical cream in ceaseless pursuit of accuracy, and carefully manufactured by our skilled technicians with the latest production equipment.

It has passed very strict tests and verified excellent performance, ensuring its reliable operation at your sites.

However, this kind of instrument of high accuracy demands correct handling and maintenance for containing utilization of its whole functions under the best possible condition.

This manual describes the points on correct and safety handling that the persons daily using this instrument must well know. We hope that this document can be helpful for the good use of this instrument.

[Available user documents]

The user documents for the Surface Roughness Measuring Instrument SURFCOM 130A/480A are listed in the table below.

Document No.	Name	Remarks
DT04800-R001	Instruction Manual	This document. Describes the operation for handling the machine and maintenance.
DT04800-R002	Instruction Manual for Digital Data Input/Output Functions	Describes the operation of this machine from an external computer, communication specifications for transmitting data to external computer systems, and operation for handling the machine.
DT00300-R001	Parameter Description	Describes the meanings of measurement results and standards.

Configuration of this manual

This manual describes effective use of the Surface Roughness Measuring Instrument (SURFCOM 130A/480A). The configuration of this manual is outlined in the table below. Read the part of this manual according to the purpose of usage.

1. Parts Names and Configuration	Describes the parts names and functions.
2. Before powering on the system	Describes installation of measuring parts, preparation for usage including knowledge necessary for turning on the power supply and precautions.
3. Start and Shutdown	Describes operation procedures and precautions for activation of this machine, simple measurement, and shutting down the system.
4. Before Taking Measurements	Describes settings necessary before measurement, workpiece setting, and calibration procedure.
5. Setting Conditions for Measurement	Describes the conditions for measurement (system condition, measurement condition, and calculation condition), and how to set output items.
6. Taking Measurements	Describes the guidance measurement as a basic measurement example, AI measurement, operation procedure for automatic measurement, and printout of measurement results.
7. Using Measurement Results	Describes various types of graph display and how to use printout data.
8. Using Convenient Functions	This machine provides convenient functions. This chapter describes how to use functions.
9. Measuring Various Workpieces	Describes application measurement examples.
10. Using a PC Card	Describes how to store various conditions and measurement data into the PC card and how to read various conditions and measurement data from the PC card.
11. Input/Output of Digital Data	Describes condition settings for connecting this machine with serial equipment including external computer.
12. High Magnification Pickup	Describes specifications of high magnification pickup, installation, calibration and measurements.
13. Maintenance	Describes periodical maintenance.
14. In Trouble	Read this chapter when you cannot operate this machine as you expect or when you do not know what to do.
15. References	Read the reference materials, if necessary. <ul style="list-style-type: none">- Initial value list- Parameter list- Message list- Basic specifications

Cautions for operation

Daily operation and maintenance

For daily operation of the system, be sure to observe the following items.

- Working environment
- Temperature: 10 to 40 , Humidity: 40 to 80%
- Do not install or store the machine in a place where:
 - The machine is exposed to direct sunshine,
 - The temperature is very high or very low,
 - The temperature suddenly changes (prevent dew condensation)
 - The machine is strongly magnetized (near speakers),
 - The machine is covered with dust,
 - The floor vibration is large,
 - The air is impregnated with chemical gas, or
 - The machine touches chemicals.
- Wipe off foul on the equipment with dry soft cloth.
 - If foul is too sticky, soak cloth in water, squeeze it tightly and then wipe off the foul.
 - However, this manner shall not be applied to metallic parts not coated (tracing driver, column and pickup).
 - Do not use solvents including benzine and thinner.
- The touch panel fully reacts if you slightly touch it. Do not push the touch panel too strongly. Pushing the touch panel too strongly causes the touchpanel and display to be in trouble.
- Do not disassemble the machine.
 - The machine may operate abnormally.
- Do not remove screws or do not open the inside of the machine only when it is necessary.
 - Opening the inside of the machine may cause electric shock or failures.
- Do not put foreign matters in the machine.
 - Do not drop clips or staples through clearance. Do not spilt drink or other liquids on the equipment.

When carrying the machine

Be sure to observe the following items. Otherwise, malfunction or failures may occur.

- Be sure to turn off the power supply.
- Do not give strong shock (do not drop or do not hit the machine).
- Do not give sharp temperature change to the machine (do not carry the machine from the cold outdoors to the warm room).

It is convenient to retain the packing box to transport the machine to a distant place.

When the machine is abnormal or faulty

If you feel abnormal smell or find the machine to be overheated, pull out the power cord at once. If an abnormal phenomenon or failure takes place, contact Tokyo Seimitsu or service representative.

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Menu configuration

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(P.3-4)
(P.5-7)
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(P.8-32)

- Setting the following items
- Output unit
 - Polarity
 - Pickup
 - Meas. mode
 - Profile (ON/OFF)
 - Stop-Calc. (ON/OFF)
 - E. Area print (ON/OFF)
 - Division Line(ON/OFF)
 - Judgment Reference
 - Connection of Curve



(P.5-15)

- Setting the following items
- Tilt
 - Cutoff
 - s
 - Return Spd.
 - Return Set
 - Pre.drive
 - Standard



(P.5-19)

- Menu of setting items
- Param. judgment
 - Tilt Angle calc.
 - Notch Calculation
 - Partial Exclude
 - Peak Count Level

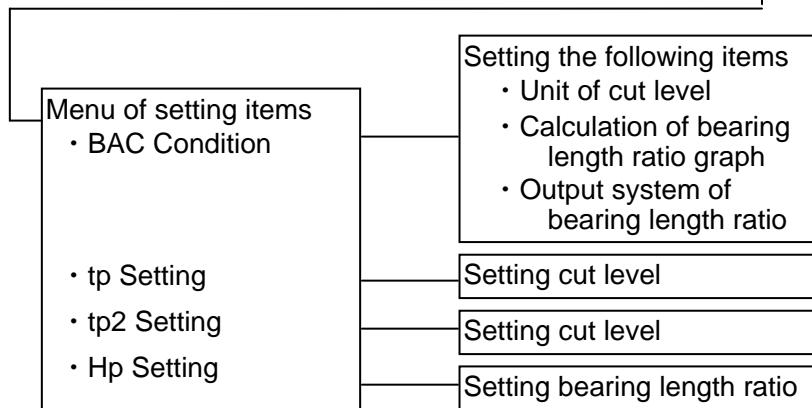
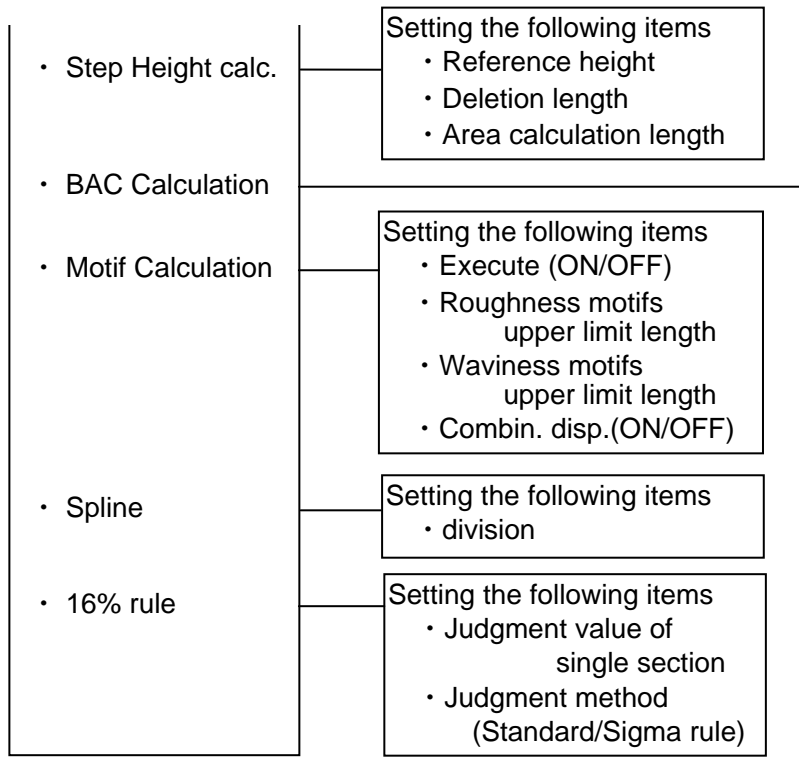
Setting of judgment values of all parameters

- Setting the following items
- Unit of tilt angle calculation
 - Polarity of tilt angle calculation

- Setting the following items
- Execute (ON/OFF)
 - Deletion length
 - Upper limit level
 - Lower limit level

- Setting the following items
- Execute (ON/OFF)
 - Deletion length at left edge
 - Deletion length at right edge

- Setting the following items
- Upper limit level
 - Lower limit level





(P.6-10)
(P.7-2)
(P.7-9)
(P.8-20)

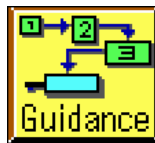
Switch of setting items
• Calc range

• Mag.

Profile curve switching
Calculation parameter display

Evaluation range setting
Tilt calculation range setting

Setting the following items
• Vertical magnification (display/printout)
• Horizontal magnification (display/printout)



(P.3-5)
(P.6-2)

Execution of guidance



(P.8-19)

Execution of re-calculation



(P.7-12)

Display of bearing length ratio graph



(P.7-12)

Display of amplitude distribution curve



(P.7-14)

Display of power graph



(P.6-4)

Automatically setting the following measurement conditions

- Cutoff value
- Evaluation length
- Measurement speed



(P.8-2)

Execution of measurement support function



(P.8-9)

Execution of interrupt measurement



(P.8-23)

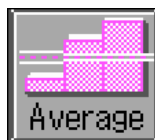
Condition saving and loading



(P.11-2)

Setting the following conditions

- Speed
 - Length
 - Stop bit
 - Parity
 - X-Flow
 - Output
- Communication test



(P.8-25)

Setting the following items

- Execute (ON/OFF)
- Frequency
- Print mode
- Delete
- Display of the effective number of data



(P.10-5)

Switching of measurement data/various condition
Save
Load
Delete
Formatting of PC card



(P.8-24)

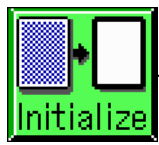
Setting sleep function (ON/OFF)
Setting of sleep timer

* It enables to use only on a color LCD type.



(P.4-5)

Selection of calibration
• Mag. calibration dev.
• Roughness standard
• Step Height Master



(P.5-6)

Execution of initialization



(P.8-11)

Display of memo pad
Output of automatic printout(ON/OFF)
Input and erasion of memo
Save, clear and load



(P.4-2)

Setting date and time



(P.8-13)

Setting user logo



(P.8-30)

Switching language (Japanese/English/German/ French/Spanish /Italian /Chinese)



(P.8-35)
(P.8-38)
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Execution item menu

- Touchpanel adjust.
- Record of Vibration
- Passwords protect function

Execution of touchpanel adjustment

Execution of vibration record

Restrict a part of operation



(P.7-16)

Setting icon display/release
Setting display position



(P.8-6)

Setting icon display/release
Setting display position

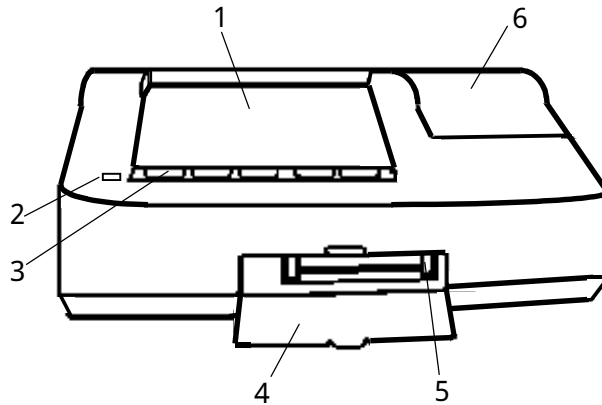
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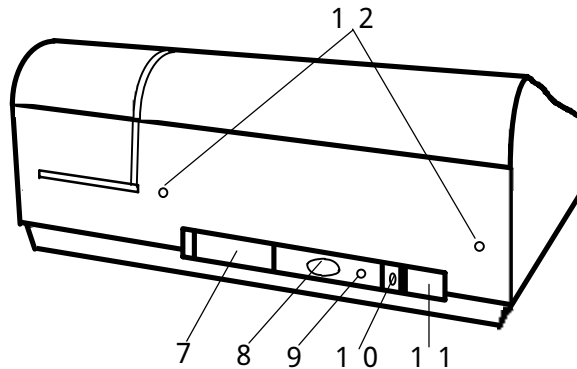
Parts Names

1. Data processor

Front face of S130A/S480A



Rear face of S130A/S480A

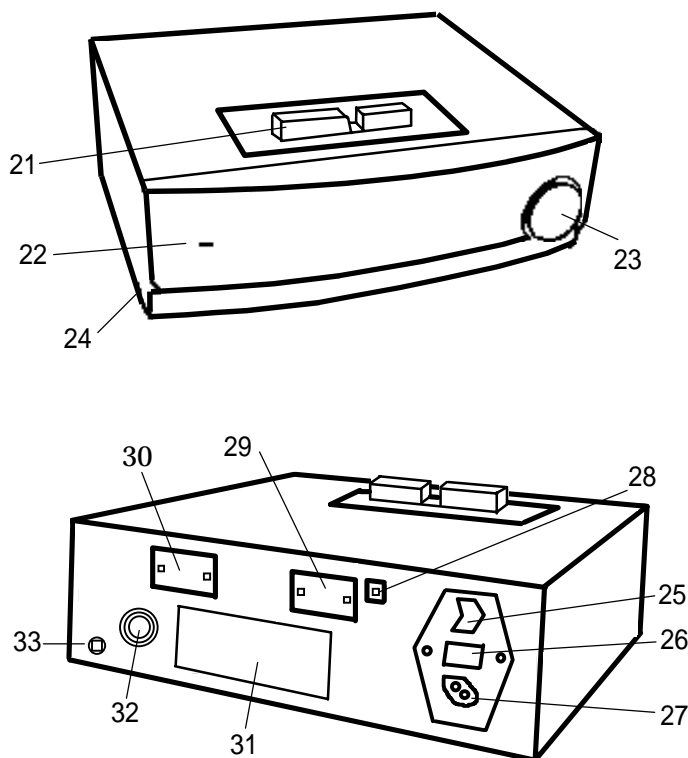


1. LCD display
Adopts a touchpanel. Soft touch of a button on the screen operates the switch.
2. Power lamp
Comes on when the system is powered on.
3. Operation switch
Dedicated switches for tracing driver, printer, etc., to be used frequently.
4. PC card storage lid
The lid is opened to insert or remove a PC card. Ordinarily, use the machine with the lid closed.

5. PC card eject button
Press the button to reject the inserted card from the PC card slot.
6. Printer cover
Open this cover to replace printing roll paper.
7. Detector/tracing driver connection connector
Connect the cable attached to the small tracing driver to this unit.
When a 100mm tracing driver is adopted, connect detector to this connector.
(Connect the cable of the tracing driver to the docking unit.)
8. RS-232C input/output connector
Available to input/output data to/from external equipment.
9. Luminance/contrast adjustment VR
Built-in volume adjustable from outside by an attached small driver.
Contrast on the white/black LCD and brightness of the back light on the color LCD can be adjusted. Contrast of the monochrome LCD is especially apt to be influenced by the surrounding temperature, so that it must be used by making timely adjustment.
10. Power jack
Power is supplied from outside. The S130A is connected to the attached AC adapter. The S480A connects this power jack of the body with the power output jack of the docking unit via the attached DC connection cable.
11. Power switch
Turns on/off the power supply to the body.
For the S480A, the switch is connected to the docking unit and the power supply to the body can be turned on/off with the power switch at the docking unit. Keep the switch turned on during operation.
12. Battery pack installation hole
Is used to install an optional battery pack.

2. Docking unit

The following component is to be used for SURFCOM 480A only.



21. Docking connector

Is available for connection with the data processor.



Do not touch or do not short-circuit this connector.

Do not turn on the power supply to the docking unit with the connector disconnected, either.

22. Power lamp

This lamp comes on when the power supply is turned on.

23. Emergency stop switch

Emergently stops operation of the tracing driver/motor column. Press the switch to for emergency stop. Rotate the switch clockwise to release the stop status.

24. Fixation bolt

It is a bolt for fixing the data processor to a docking unit. Fasten with this bolt after joining.

- 25. Power switch
Turn on/off the power supply to the body.
- 26. Fuse case
Houses fuse. This fuse prevents abnormal current from flowing to the system from outside or prevents combustion from occurrence when a failure takes place.
- 27. Power cable connection connector
Connect the AC power supply. The system operates in the range from 85 to 264V.
- 28. Power output jack
Connects the data processor via the attached DC connection cable.



This connector is a power output terminal. Do not insert a metal piece into the connector or do not connect an AC adapter by mistake. The equipment may be broken.

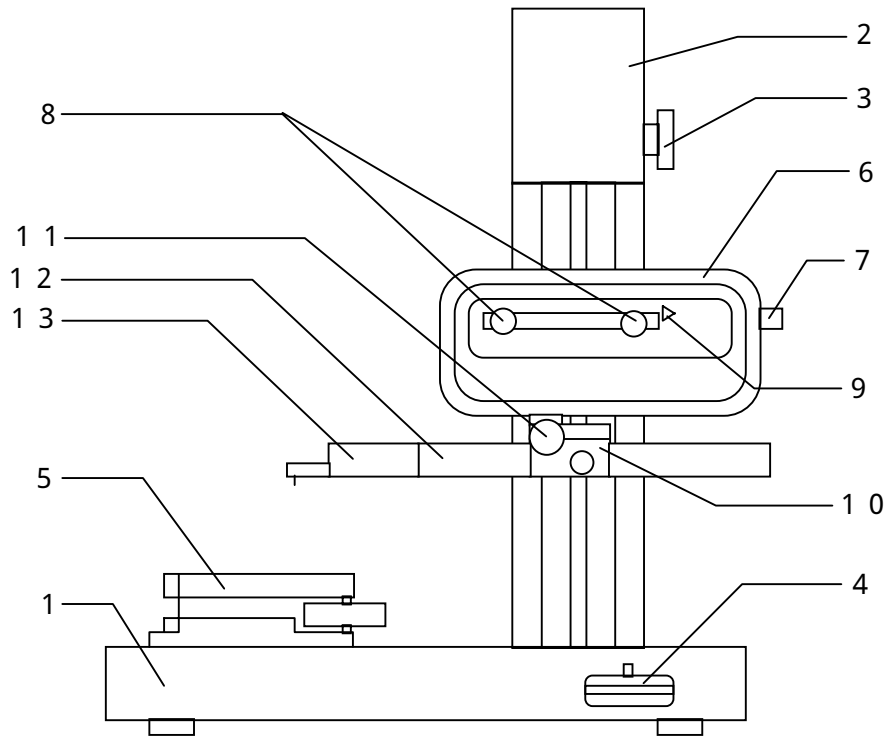
- 29. Motor column connecting connector
Is used to connect the motor column.
- 30. Driving unit connecting connector
A tracing driver except for the small tracing driver is connected to this connector.
- 31. Extension board space
Is used for insertion of an option board.
- 32. Fan



Do not close openings. Closing openings increases the internal temperature, resulting in reduction of the life.

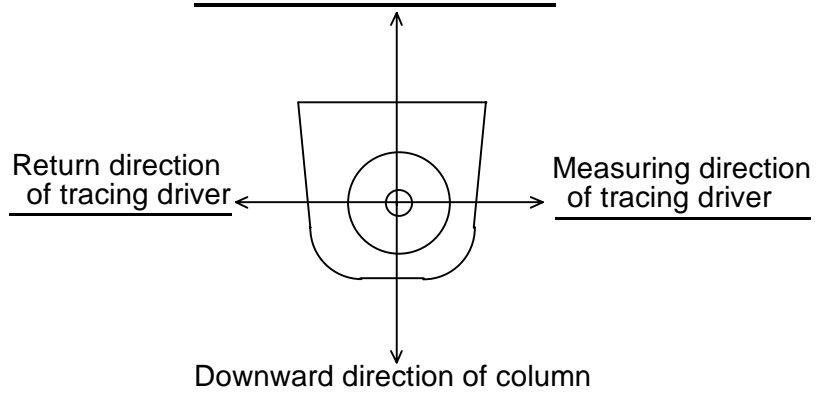
- 33. Overload prevention breaker
Operates primarily when excessive load is given to the motor column.

3. Pickup movable type measuring unit



Joy stick operating direction

Upward direction of column

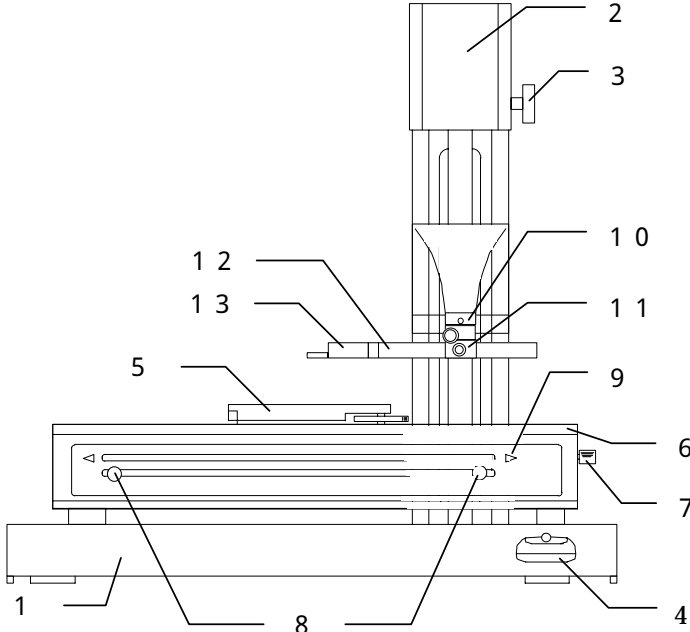


- * When the pickup movable type tracing driver is connected, turn the joy stick in the measuring direction of tracing driver to move the pickup rightward, facing it. When the workpiece movable type tracing driver is connected, turn the joy stick in the measuring direction of tracing driver measurement to move the workpiece leftward, facing it.

1. Measurement stand base
Base for supporting the measurement block.
2. Measurement block column
Moves the pickup up and down.
3. Column manual knob
Manually moves the pickup up and down.
4. Joy stick
Moves the pickup up and down and operates the motor to move the pickup in the measurement direction.
5. Leveling positioner
Adjusts the work measurement surface and the measuring direction in parallel to each other.
6. Driving unit
A carrier to drive the pickup in the measurement direction.
7. Manual knob of tracing driver
Manually moves the pickup in the measurement direction.
8. Stop position set knob
Sets the driving stop limit switch at any position.
9. Driving direction indicator lamp
Comes on at the driving direction side during driving operation.
10. Pickup holder
A holder for installing the pickup in the tracing driver.
11. Skid/skidless measurement switching knob
In the skidless measurement, tighten the knob to fix the pickup. In the skid measurement, loosen the knob while using the connect rod.
12. Connect rod
Adjusts the pickup installation position.
13. Pickup
Converts roughness profile into electric signals.

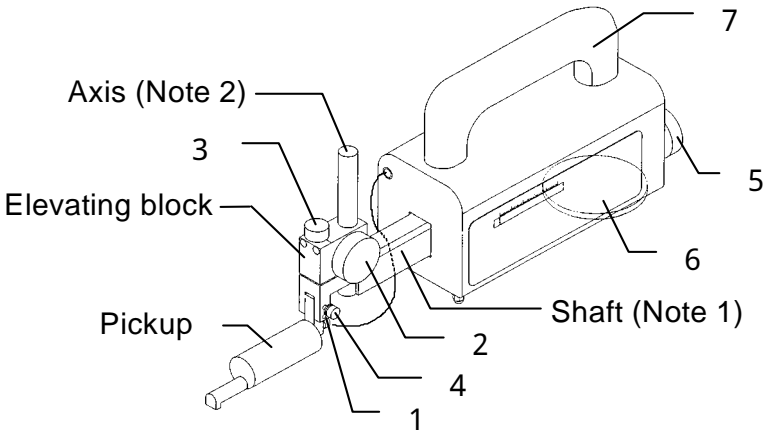
4. Workpiece movable type measuring unit

The names are the same as those of the pickup movable type.



5. Small type tracing driver

50 mm tracing driver



1. Pickup clamp knob
Installs the pickup in the driving block.
2. Elevating knob
Adjusts the height of the installed pickup from the measurement surface.
3. Fine adjustment knob
Adjusts the height of the installed pickup from the measurement surface.
4. Skid/skidless measurement switching knob
In the skidless measurement, tighten the knob to fix the pickup. In the skid measurement, loosen the knob to adjust the pickup with the measurement surface.
5. Manual feeder knob of tracing driver
Manually adjusts the measurement start position in the measurement direction.
6. Leveling knob of tracing driver
Adjusts the driving direction and the measurement surface in parallel to each other. This knob does not function when the tracing driver is installed in the column.
7. Handle
This is the handle for carrying.

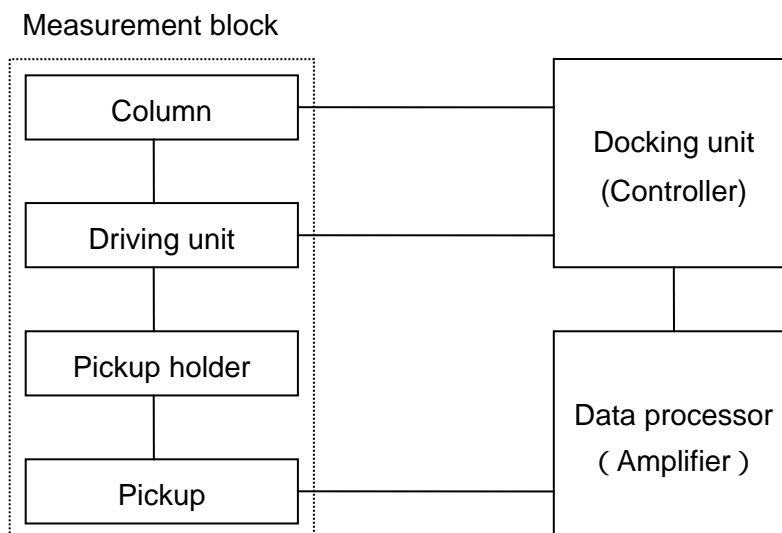
Note 1: Be careful not to touch the part of a shaft with bare hands because of easiness of being rusted. In case of being touched by any chance, wipe the part on a soft cloth earlier.

Note 2 : Take care not to come off an elevating block from the axis, because it becomes difficult to make assembling it again once it comes off.

<p>* To rotate the manual knob of the tracing driver and the leveling knob of tracing driver, hold the body of the tracing driver with hand to prevent it from moving.</p>
--

System diagram (S480A)

1. System block diagram



2. Standard configuration (S480A-12 types)

Name	Format	Quantity
Pickup	E-DT-S03A	1
Pickup holder	E-DH-S79A	1
Driving unit	E-RM-S71B	1
Measuring stand base	E-ST-S85B	1
Measurement block column	E-CL-S27C	1
Leveling positioner	E-AT-S02A	1
Precision reference specimen	E-MC-S24B	1
Data processor	E-MD-S176A ^(*1)	1
Docking unit	E-MU-S131A ^(*1)	1
Connection cable	(Power supply, tracing driver, pickup, and power supply jumper)	4 cables in total

(*1) This is the format when the software version is "Ver.4xx".

In the case of "Ver.3xxx", becomes the following format.

Data processor	E-MD-S138B
Docking unit	E-MU-S48A

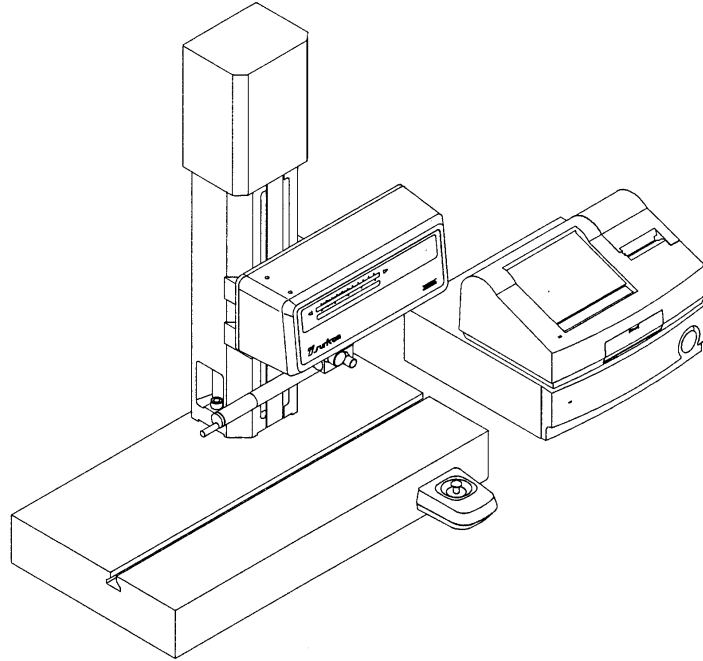
The configuration of the system differs depending on combination unit which are tracing driver, base and measuring stand column.

The following table shows system code and combination unit.

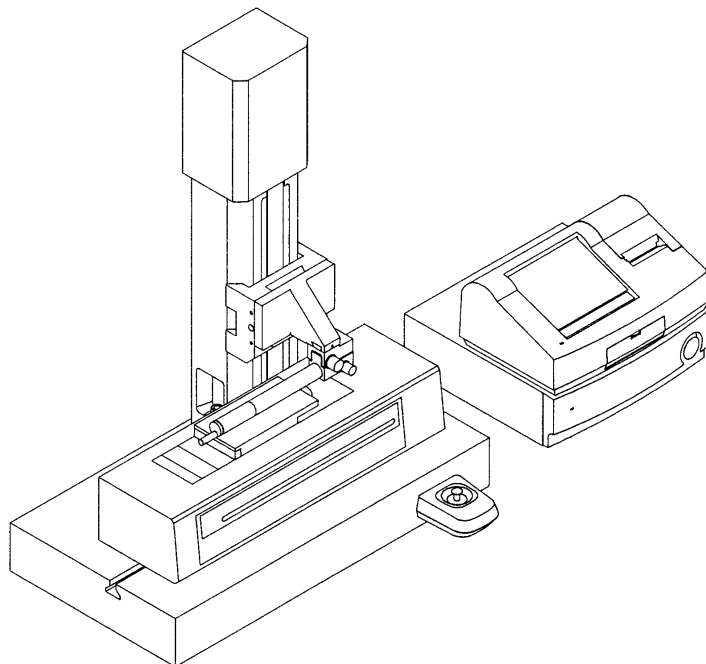
S480A-XY

		Driving unit	Positioner / column attachment
X:	1: 100 mm tracing driver	E-RM-S71B	E-AT-S02A
	2: 200 mm tracing driver	E-RM-S73A	E-AT-S02A
	3: 100 mm low speed type tracing driver	E-RM-S78A	E-AT-S02A
	4: Workpiece movable tracing driver (50 mm)	E-RM-S75A	E-CA-S25A
	5: Workpiece movable tracing driver (150 mm)	E-RM-S76A	E-CA-S25A
	6: Workpiece movable tracing driver (300 mm)	E-RM-S77A	E-CA-S25A
	7. Circumferential roughness tracing driver	E-RM-S85A	-
	8: R surface tracing driver	E-RM-S84A	E-AT-S01C
Y:	0: No measuring stand base/column	Base	Column
	1: Stone level block, manual column	E-ST-S85B	E-CL-S26A
	2: Stone level block, motor column	E-ST-S85B	E-CL-S27C
	3: Stone level block, large motor column	E-ST-S85B	E-CL-S36C
	4: Large stone level block, large motor column	E-ST-S86B	E-CL-S36C

3. Overall drawing of pickup movable 480A - 11 to 34

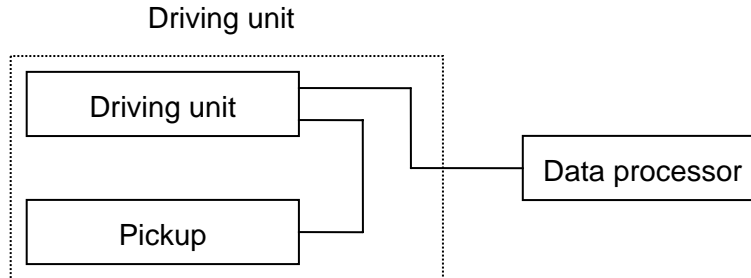


4. Overall drawing of workpiece movable 480A-41 to 64



System diagram (S130A)

1. System block diagram



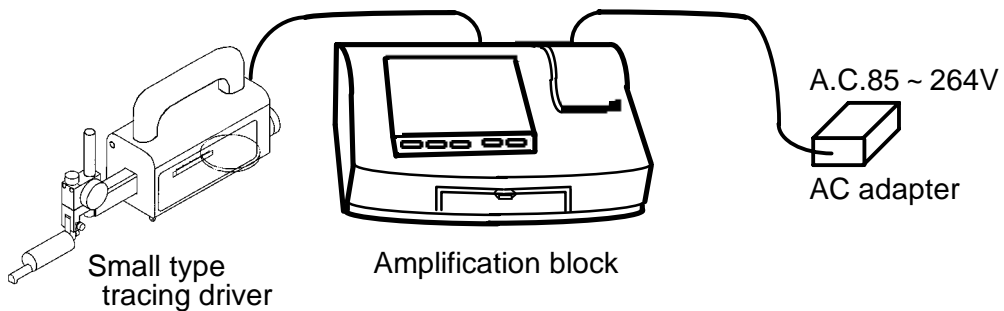
2. Standard configuration

Name	Format	Quantity
Pickup	E-DT-SE19A	1
Small type tracing driver	E-RM-S100B	1
Precision reference specimen	E-MC-S24B	1
Data processor	E-MD-S175A(mono) ^(*2) E-MD-S176A(color) ^(*2)	1

(*2) This is the format when the software version is "Ver.4xx".
In the case of "Ver.3.xxx", becomes the following format.

Data processor	E-MD-S137A(mono) E-MD-S138B(color)
----------------	---------------------------------------

3. Overall diagram

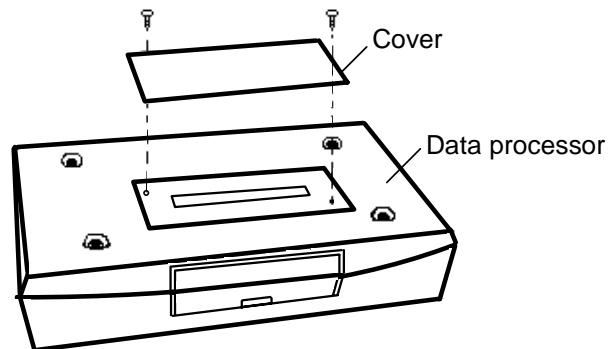


2 Before powering on the system

Connection of docking unit and data processor (S480A only)	2-2
Connection	2-4
Loading printing paper	2-5
Installation of pickup (S480A)	2-7
1. Skidless measurement	2-7
2. Skid measurement	2-8
Installation of pickup (S130A)	2-10
1. Procedure for holding pickup cable	2-10
2. Skidless measurement	2-11
3. Skid measurement	2-13

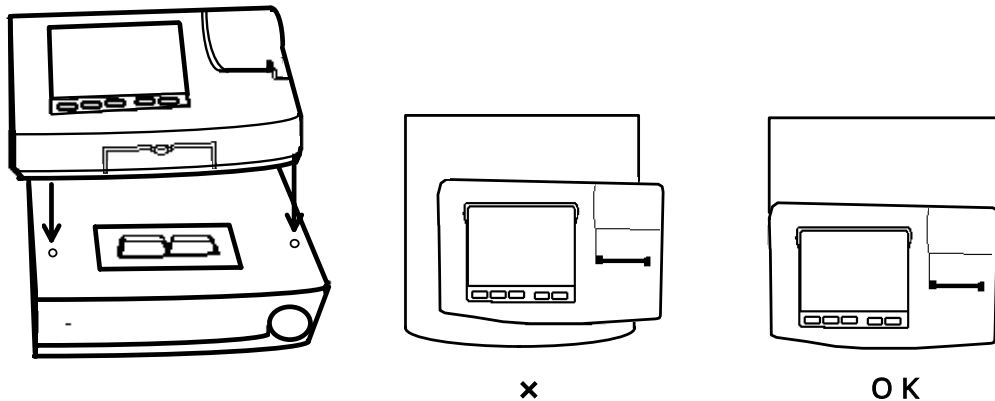
Connection of docking unit and data processor (S480A only)

- (1) Turn off the power supply to the docking unit and data processor.
- (2) Remove all cables including power cable.
- (3) Loosen the screws installing the cover on the rear side of the data processor and then remove the cover.



Retain the cover because it is to be used individually.

- (4) Connect the docking unit and data processor.
When this is the case, make exact connection by meeting the front ends, right and left ends of units.



When positions are correctly aligned to each other, the units are connected by light force. Excessive force may cause the equipment to be damaged.

(5) Fasten the data processor by a fixation bolt of a docking unit.

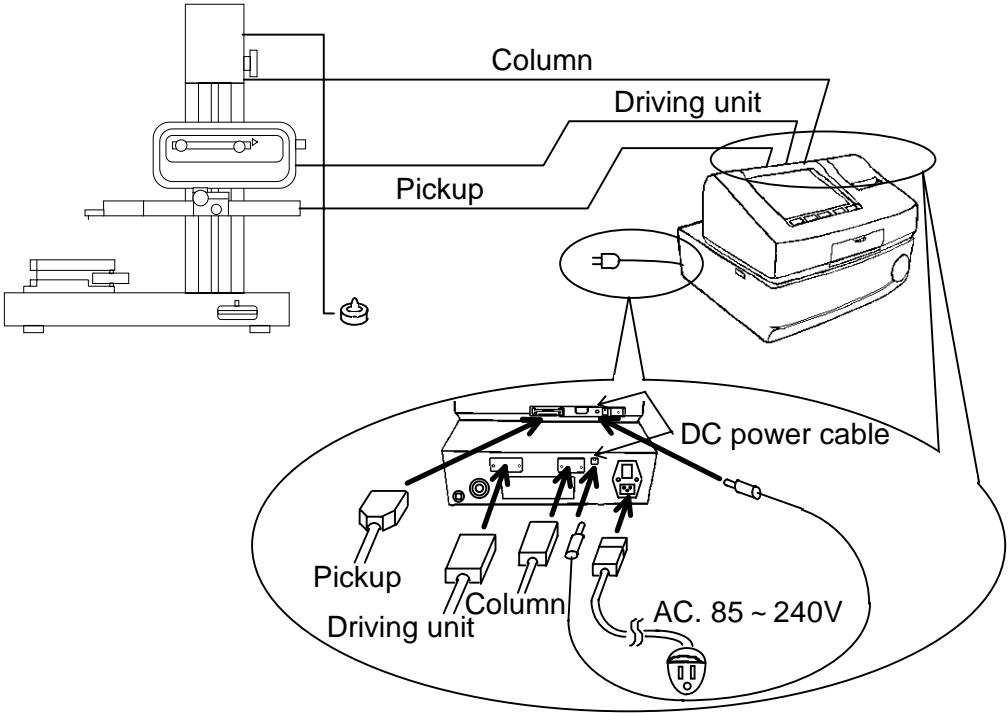


Fasten with a special bolt.
(The same knob is installed
on the other side.)

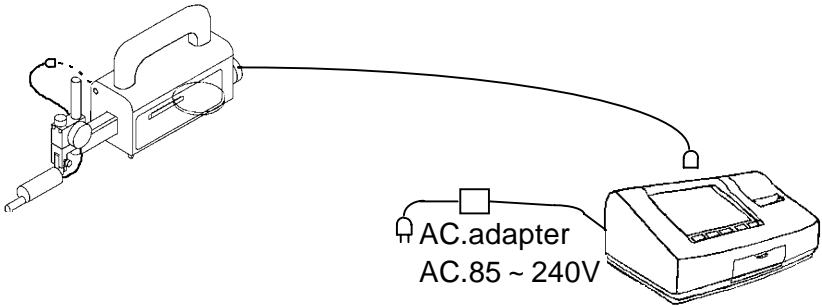
Connection

Connect as shown in the drawing below.

1. S480A



2. S130A



Loading printing paper

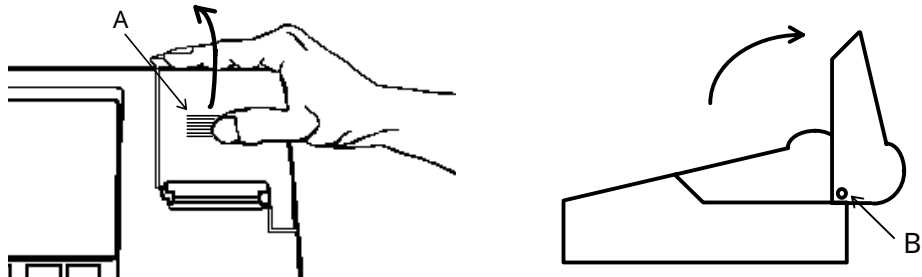
(1) Prepare print form



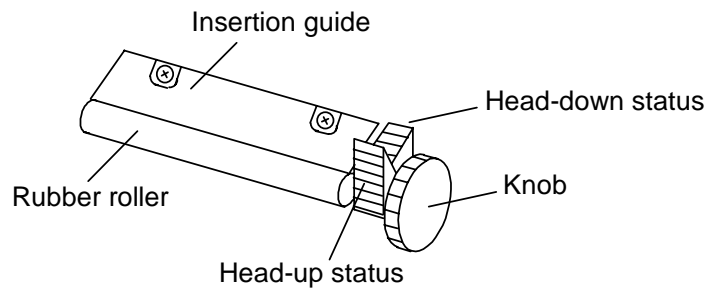
Be sure to use specified printing paper. Unless specified paper is not used, trouble may occur in print quality, durability, etc.

(2) Open the printer cover.

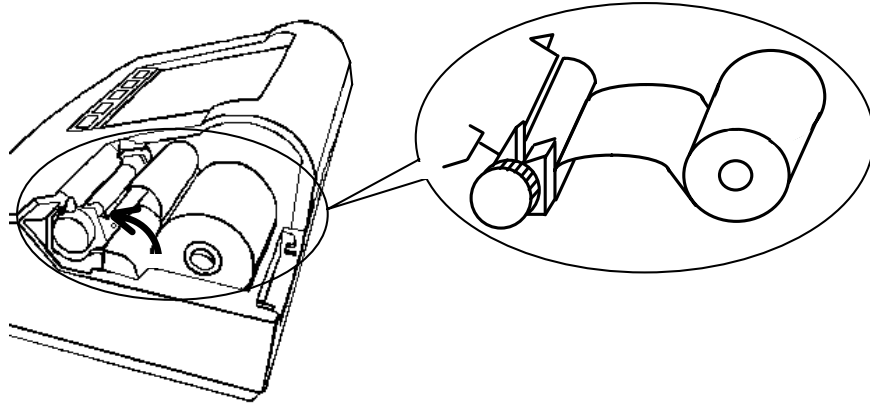
As shown in the drawing below, hold the printer cover with the thumb, lightly press slip stopper A, and then rotate round hinged B to open the cover.



(3) Place the printer in a head-up status.

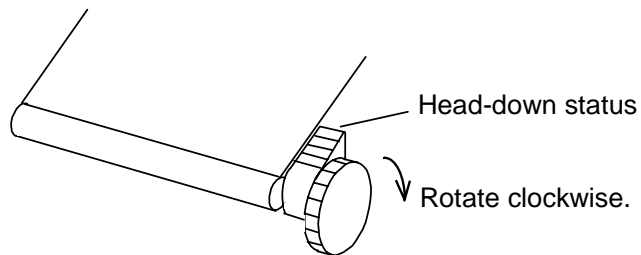


- (4) Insert the paper as shown in the drawing below.
Push the paper to the inside of the roller.



- * If the paper is set with the rear side up, printout is not allowed.
If printout is not done, turn over the roll paper.

- (5) Place the printer in the head-down status.



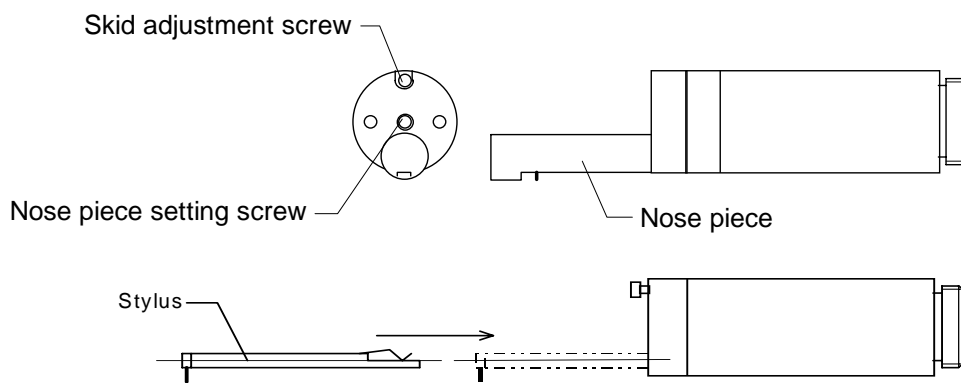
- (6) Rotate the knob clockwise to feed paper.
When paper is not fed, push paper into the roller. (See Item (4).)
- (7) Feed paper about 5 cm and then close the printer cover in such a way
that the paper can come out of the cover.

Installation of pickup (S480A)

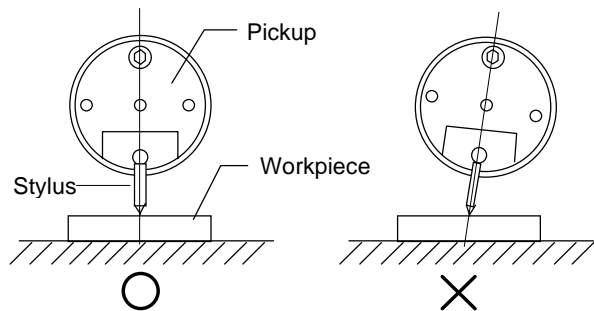
1. Skidless measurement

- (1) Remove the nosepiece from the pickup and then install the standard stylus in the pickup.

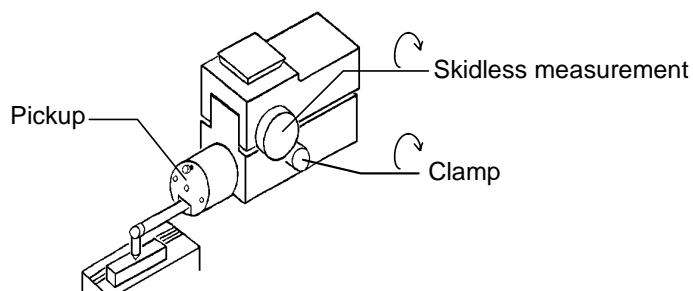
Remove the nosepiece or use the skidless nose piece (0102702). Especially when the stylus is protected, skidless measurements can be taken even if the skid adjustment screws of the pickup is loosened with the standard nosepiece installed. When this is the case, be careful not for the skid to contact the measurement surface.



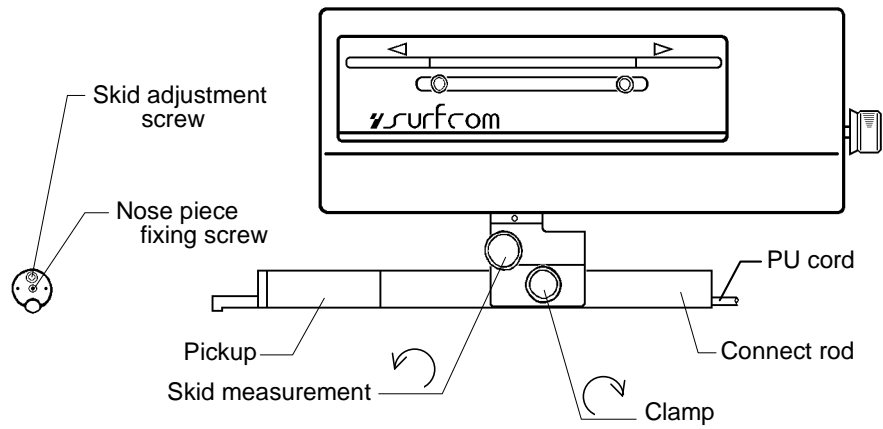
- (2) Put the pickup in a pickup holder and place the stylus perpendicular to the workpiece. Then rotate the clamp knob clockwise to fix the pickup.



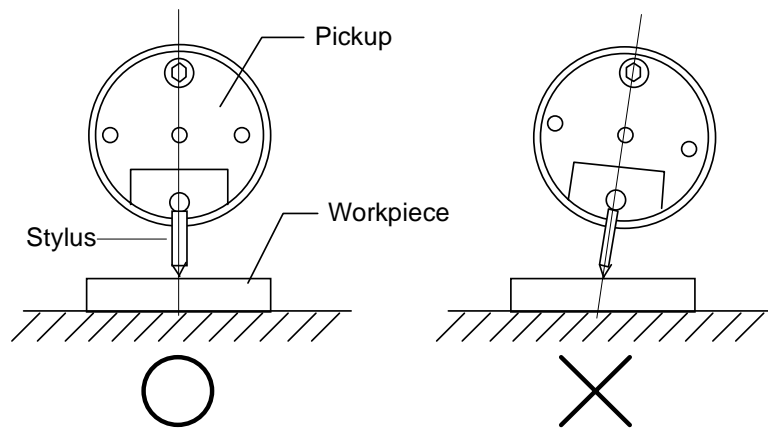
- (3) Fully rotate the skid-skidless switching knob of the pickup holder clockwise.



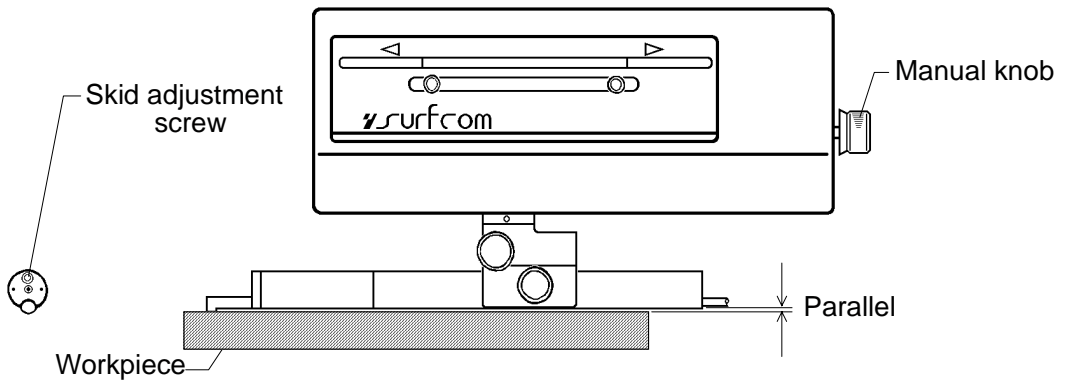
2. Skid measurement



(Figure 1)

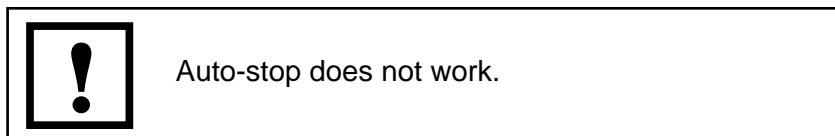


(Figure 2)



(Figure 3)

- (1) Install the standard stylus (DT43801) in the pickup and then install the nosepiece by using the attached hexagon wrench.
- (2) Pass a pickup cord through the connector rod and then connect the cord with the pickup.
- (3) Screw the connect rod behind the pickup.
- (4) Insert the connector rod into the pickup holder to make a workpiece perpendicular to the stylus (see Figure 2), and then rotate the clamp knob clockwise for fixture.
- (5) Rotate the skid-skidless switching knob of the pickup holder counterclockwise and then place the system in the skid measurement status (move the pickup up and down).
- (6) Move the column for the pickup to go down. At a place where the bottom surface of the pickup (connect rod) is almost perpendicular to the workpiece, stop the pickup (see figure 3).



- (7) Press the Meas.Range in the main menu.
- (8) Use the attached hexagon wrench to move the skid adjustment screw of the pickup and make adjustments in such a way that the index can come to the center of the level meter on the measurement range screen.
- (9) When the index of the level meter is put within the meter range in the whole measurement area by rotating the manual knob of the tracing driver, the preparation for measurement is completed.
- (10) If the meter index is out of the meter range, adjust the inclination of workpiece to be measured in such a way that the driving direction and the measurement surface can be parallel to each other.
 - * Though the skid measurement has the advantage that workpieces can be easily set, cross section profile cannot be measured because the skid is used.
 - * When a workpiece is not flat or when the cross section profile is desired to be measured, the skid measurement is not applicable. When this is the case, use optional driving unit inclination equipment to incline the tracing driver and then measure the profile.



Since the auto stop is not effective in the skid measurement, do not use the "Column Up/Down" of the "Auto set." icon. If the "Column Up/Down" used, it does not stop until the Stop switch is pressed.

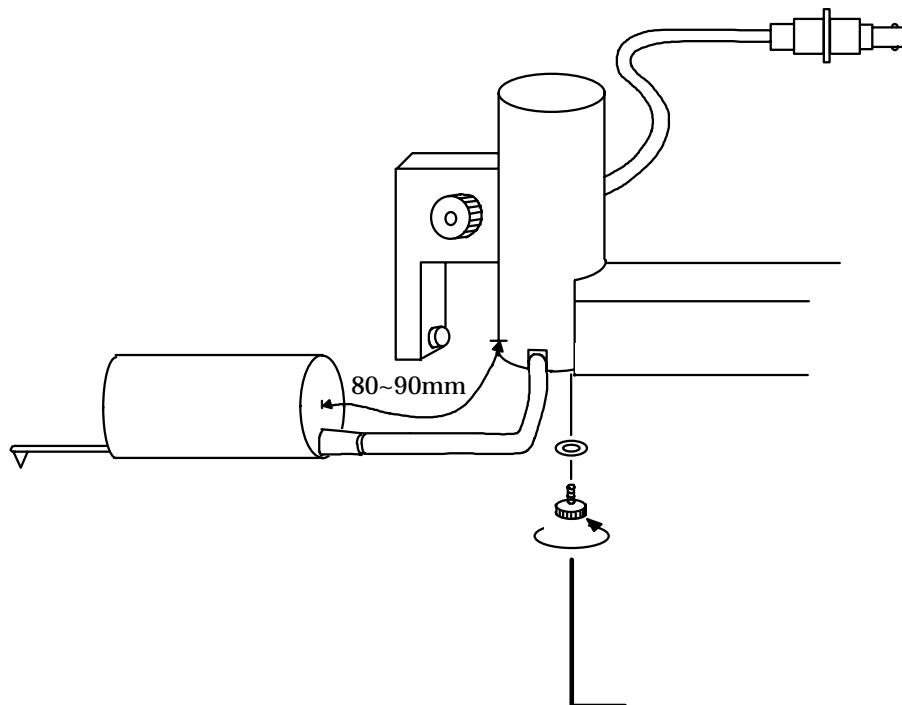
Installation of pickup (S130A)

1. Procedure for holding pickup cable

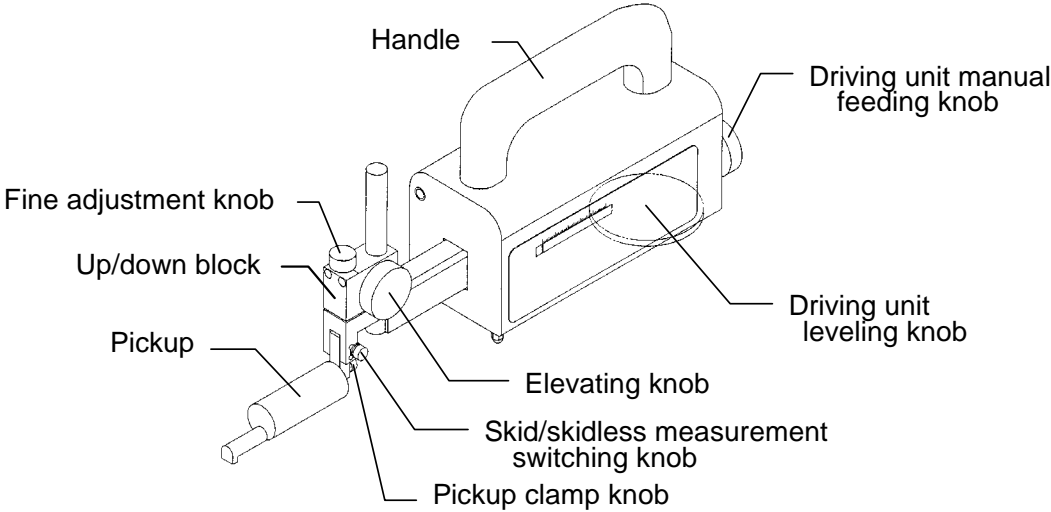
When it is connected with standard pickup, hold the cable at 80~90mm to the end face of pickup with using screw shown as the following figure.

When it is connected with other type of pickup, set the suitable length which the pickup can move up/down easily.

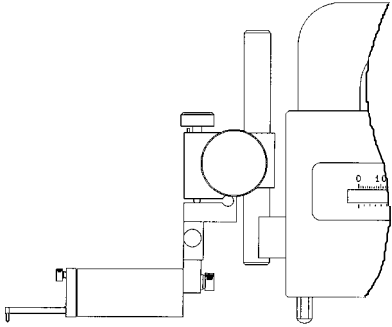
* This process is need to be guarantee accuracy.



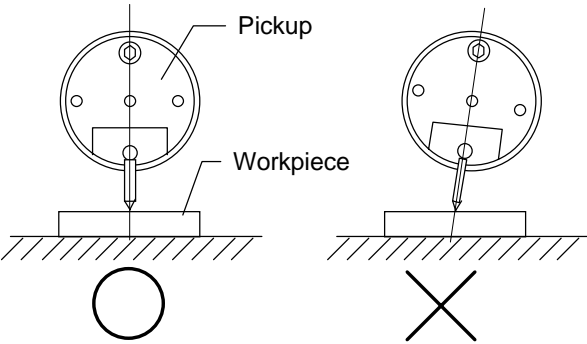
2. Skidless measurement



(Figure 1)



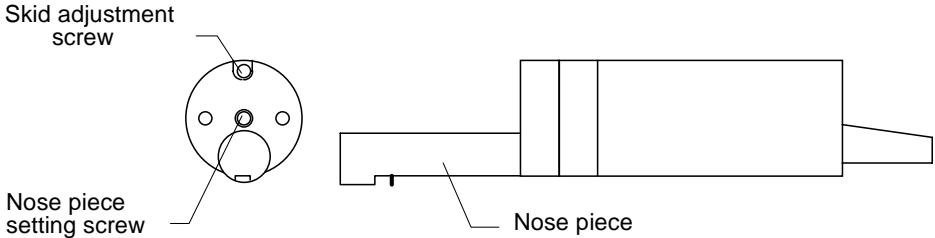
(Figure 2)



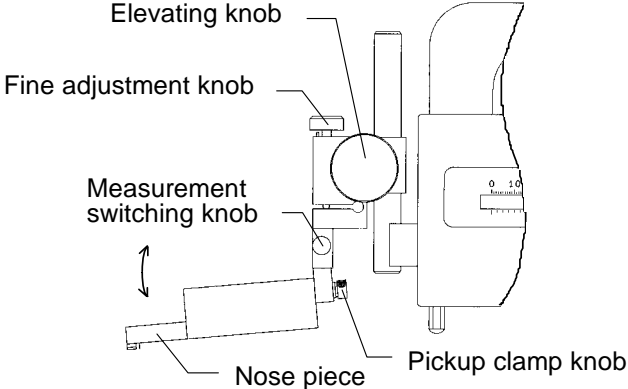
(Figure 3)

- (1) Make the pickup escape upward by using the up/down knob of the tracing driver. (See Figure 1.)
 - (2) Clamp the skid-skidless measurement switching knob to take skidless measurement. When this is the case, check the pickup body for fixture in the up/down block of the tracing driver. (See Figure 2)
 - (3) Remove the nosepiece or use the skidless nose piece (0102702). Especially when the stylus is protected, skidless measurements can be taken even if the skid adjustment screws of the pickup is loosened with the standard nosepiece installed. When this is the case, be careful not for the skid to contact the measurement surface.
 - (4) Tighten the pickup clamp knob in such a way the stylus can be perpendicular to the measurement surface. (See Figures 1 and 3.)
 - (5) Lower the pickup with the up/down knob of the tracing driver and make the stylus contact the measurement surface.
 - (6) Adjust the positions of the measurement surface and measurement direction and the inclination in such a way that they can be parallel to each other.
- * up/down knob Elevating knob and Fine adjustment knob.

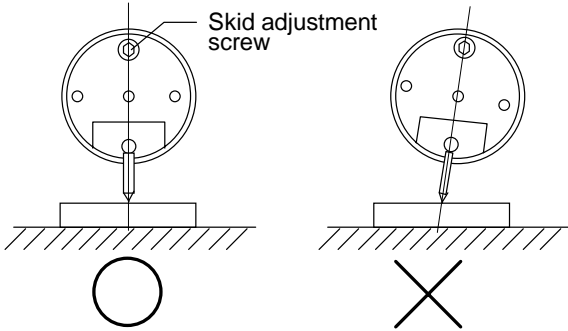
3. Skid measurement



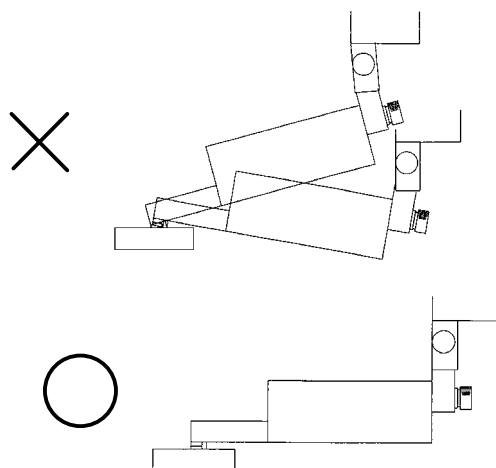
(Figure 1)



(Figure 2)



(Figure 3)



(Figure 4)

- (1) Let the pickup escape upward by using the up/down knob of the tracing driver. (See Figure 2)
- (2) Loosen the skid-skidless measurement switching knob to select skid type. When this is the case, be sure the pickup can freely oscillate. (See Figure 2.)
- (3) Install the skid type nosepiece at the pickup. (See Figure 1.)
- (4) Press the **RETURN** switch of the data processor to return the pickup to the return limit position.
- (5) Clamp the pickup clamp knob to make the skid of the pickup perpendicular to the measurement surface. (See Figure 3)
- (6) Make adjustments by slowly lowering the pickup with the up/down knob of the tracing driver in such a way that the skid and stylus can contact the measurement surface and the pickup can be placed in parallel to the measurement surface. (See Figure 4)
- (7) Press the **Meas. Range** switch in the main menu to display the Meas. Range screen.
- (8) Make adjustment by rotating the skid adjustment screw of the pickup with the hexagon wrench in such a way that the level meter can come to the center of the measurement range screen.

- MEMO -

3 Start and Shut Down

This chapter describes the procedures and cautions for activation of this machine, simple measurements, and shutdown.

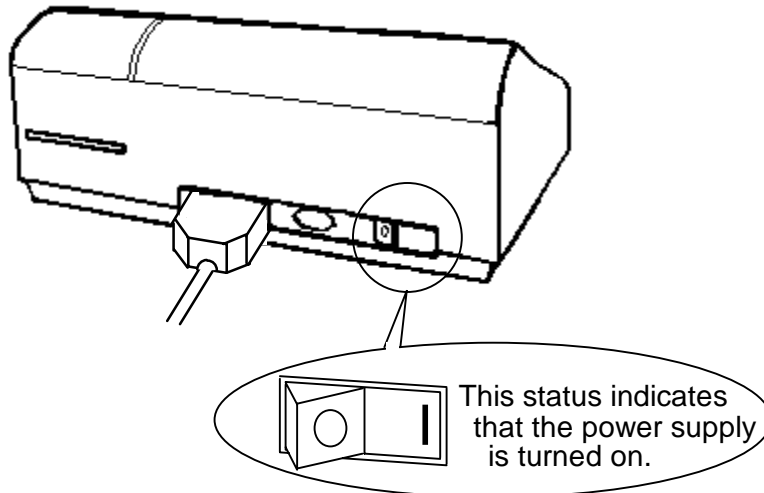
Turning on the power supply	3-2
Try to take measurements - Measure the precision reference specimen with guidance function	3-4
Turning off the power supply	3-12

Turning on the power supply

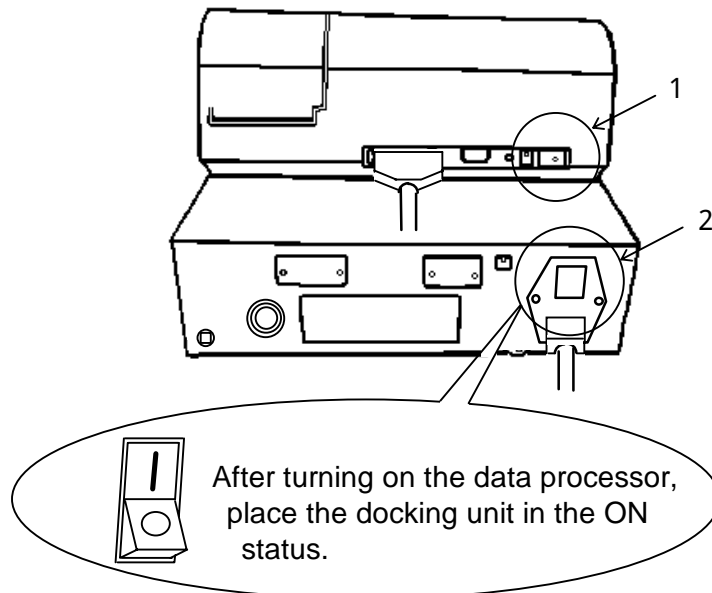
After having made the preparation described in Chapter 2, turn on the power supply according to the following procedure.

(1) Press the "I" side of the power switch on the rear side of the body.

1) S130A



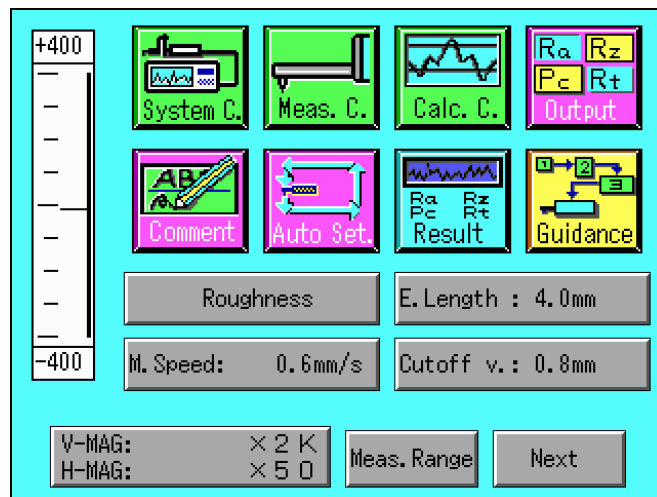
2) S480A



- (2) After a beep is heard, the following screen appears, and then the main menu is brought up.



Start screen (For S480A)



Main menu

- * When the power source is turned ON with switch being pressed, the equipment is designed to turn back to be in the condition of ex-factory. In this case, keep pressing the switch until the start screen appears.

Try to take measurements - Measure the precision reference specimen with guidance function

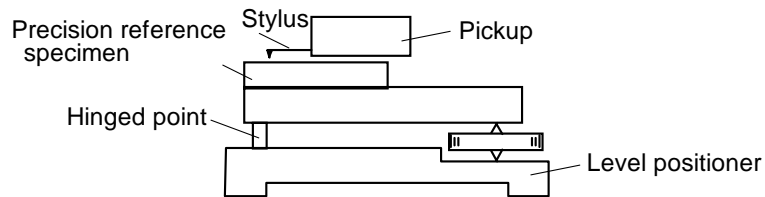
This chapter uses a roughness precision reference specimen as a measurement workpiece and describes a basic operation flow.

- (1) In this case, fix the pickup to the tracing driver and select skidless measurement.
- (2) Press the **RETURN** switch under the screen to return to the driving start (return limit) position.
- (3) Set the precision reference specimen on the positioner or measurement block.

When this is the case, set the stylus at the hinged point of the positioner.

Align the measurement start position of the precision reference specimen to that point.

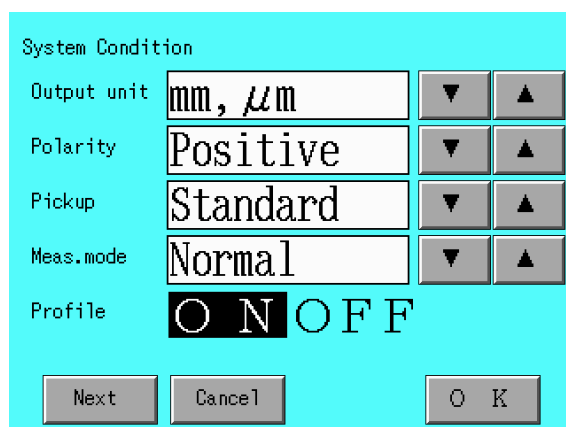
The drawing below indicates when a precision reference specimen is set on the level positioner.



- (4) Visually adjustment the tracing driver or positioner in such a way that the tracing driver and the top surface of a precision reference specimen can be placed parallel to each other.
- (5) Press the icon for "System C." on the menu screen.



The system condition setting screen appears.

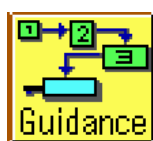


Except for the output unit, be sure the system conditions are set as shown in the above drawing.

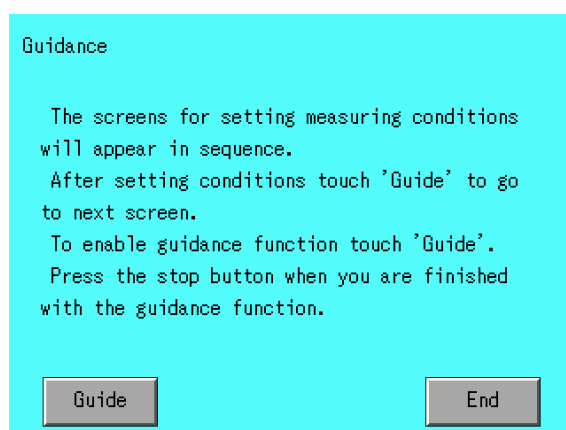
If a setting item is different, adjust the item to the above setting by using the and switches.

After end of the setting operation, return to the menu screen.

(6) Press the icon for "Guidance" on the menu screen.



The guidance description screen appears.

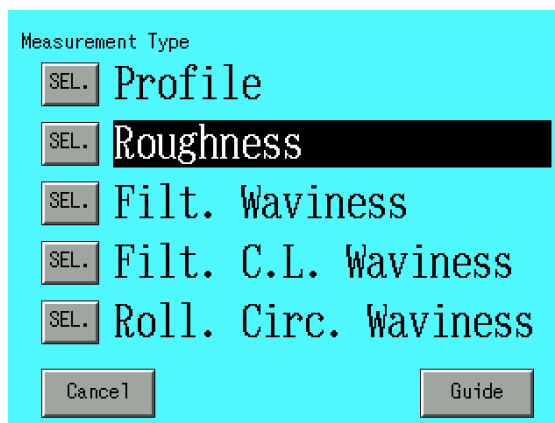


(7) Press the **Guide** switch.

Return to the guidance description screen. However, the conditions set below are effective.

* To stop the measurement with guidance function in the course, press the **Stop** switch.

The measurement type screen appears.

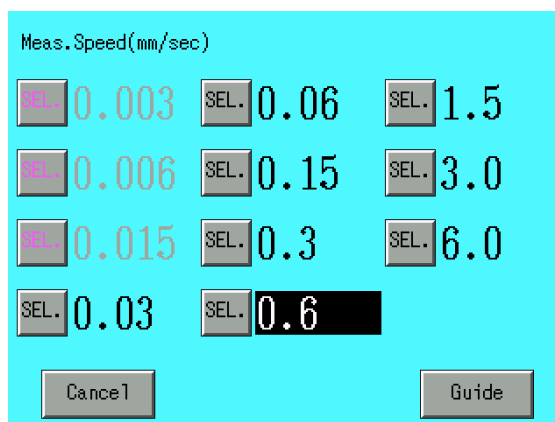


(8) Press the **SEL.** switch for "Roughness".

* Press the **Cancel** switch to cancel the settings, related to this screen, made after the appearance of this screen. (This also applies to the other guidance screen.)

(9) Press the **Guide** switch.

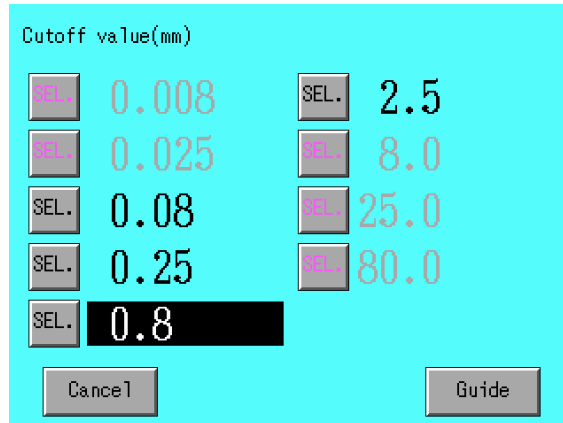
The measurement speed selection screen appears.



(10) Press the **SEL.** switch for "0.6".

(11) Press the **Guide** switch.

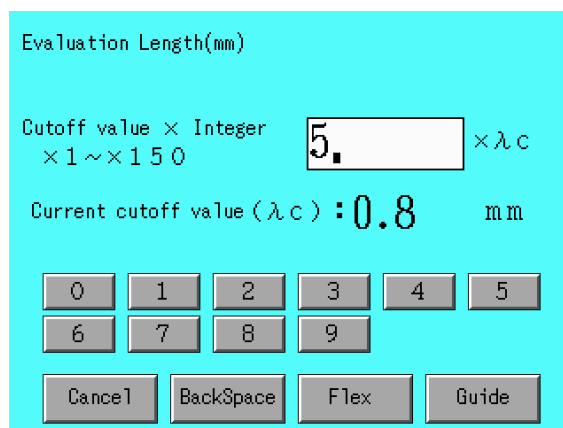
The cutoff value set screen appears.



(12) Press the **SEL.** switch for "0.8".

(13) Press the **Guide** switch.

The evaluation length selection screen appears.



(14) Set the cutoff value to multiples of " × c".

If the following screen appears, press the switch.

The screen on the previous page then appears.

Evaluation Length(mm)

mm

0 1 2 3 4 5
6 7 8 9 .

Cancel BackSpace Fix Guide

(15) Press the switch.

The measurement condition set screen appears.

Measurement Condition

Tilt ▼ ▲

Cutoff ▼ ▲

λs ▼ ▲

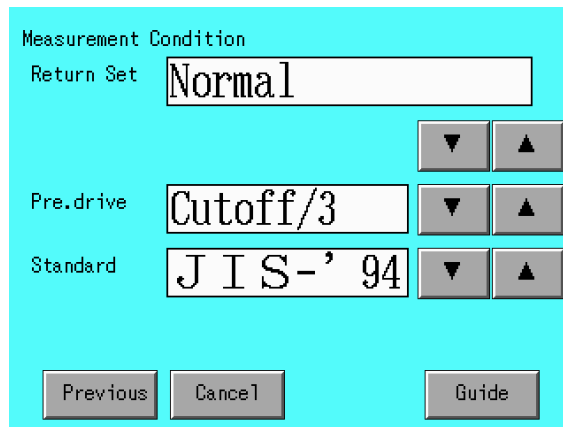
Return Spd. mm/s ▼ ▲

Next Cancel Guide

- * The return speed is fixed to the half indication, depending on the driving block in connection. When this is the case, use the displayed return speed.

If the measurement condition is different, adjust the condition to the above setting by using the and switches.

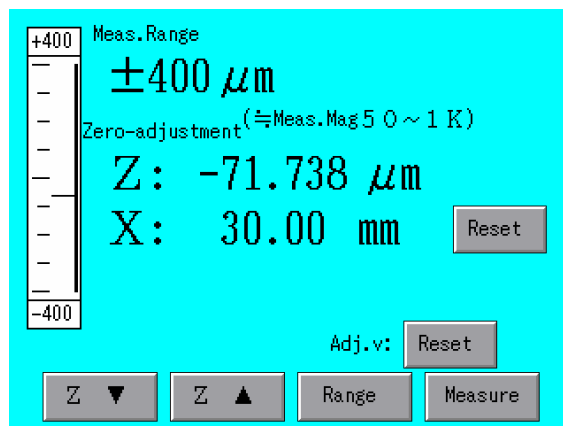
(16) Press the **Next** switch.



Except for the standard, check for the above settings.
For the standard, select the applicable standard.

(17) Press the **Guide** switch.

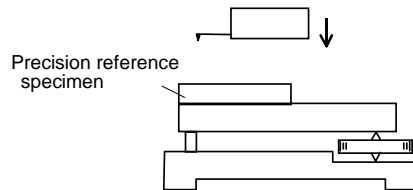
The following screen then appears.



Use the **Range** switch to switch the measurement range to $\pm 40 \mu\text{m}$.

(18) Press the Adj.v: **Reset** switch to clear the zero calibration.

(19) Lower the pickup to set the Z value within $\pm 10 \mu\text{m}$.

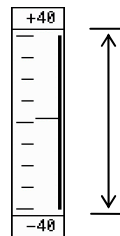
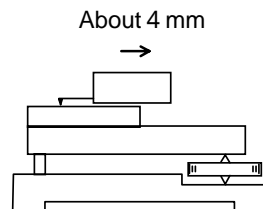


When the motor column is used, the pickup goes down with the joy stick and automatically stops near $Z = 0$.
When the manual column is used, manually lower the pickup.

(20) When the pickup is driven manually (moved to about 4 mm rightward), check for scale-over.

If scale-over takes place, adjust the level.

(For details, see Chapter 4 "Zero-adjustment and level adjustment".)



If the pickup moves about 4 mm (the knob in the tracing driver is rotated), the indication value must be put in the scale.
If the value is out of the scale, adjust the level.

(21) Return the pickup to the initial position. (before the pickup was moved 4 mm)

(22) Press the **Measure** switch.

The measurement starts. After the measurement, the measurement results are displayed. During measurements, the measured profile is displayed in real time. The full scale in the vertical direction indicates a measurement range currently being set. Whether or not scale-over takes place can be checked during measurement. In the horizontal direction, at what position (displayed in %) the evaluation length is being measured can be checked.

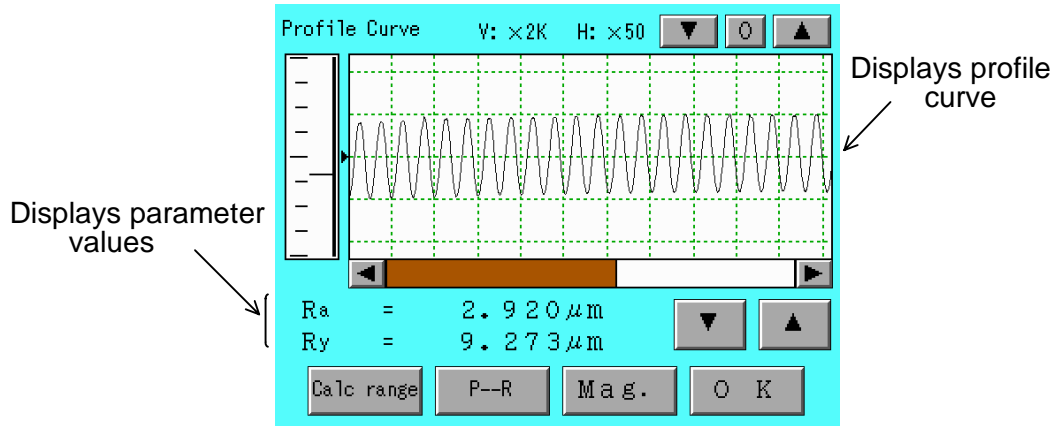
To change the analysis contents, see Chapter 5 "Setting output items".

- * Notice that the **Measure** switch on the operation panel is not available during the guidance measurement.
- * The full scale width may be narrowed more or less depending on the calibration result. When this is the case, horizontal lines appear upper and lower portions in the real time profile display frame. The inside of the two lines are specified as a measurement allowable range.

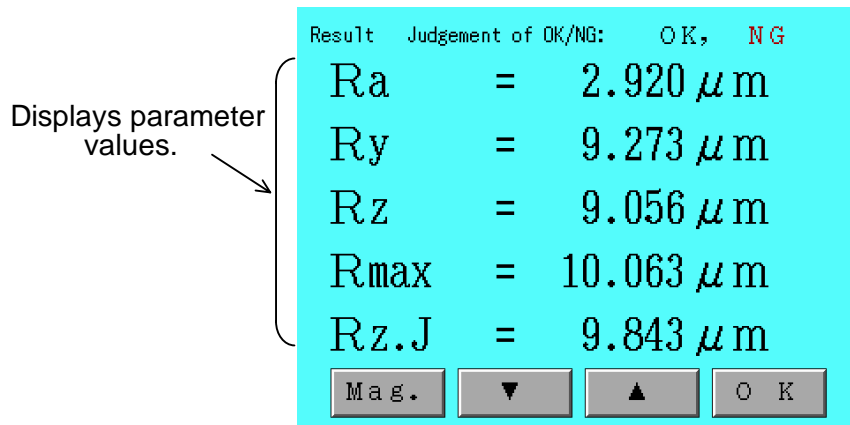
(23) Measurement result screen

In the "System Condition" screen

When the profile display is set to "ON"



When the profile display is set to "OFF"



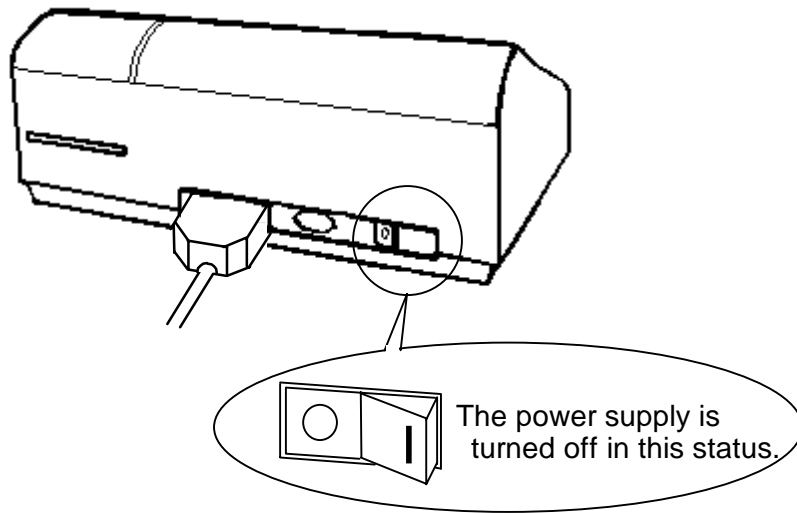
- * Parameters selected on the "Parameter selection" screen in the output item icon are displayed on this screen. For details on the measurement results, see Chapter 7.

Turning off the power supply

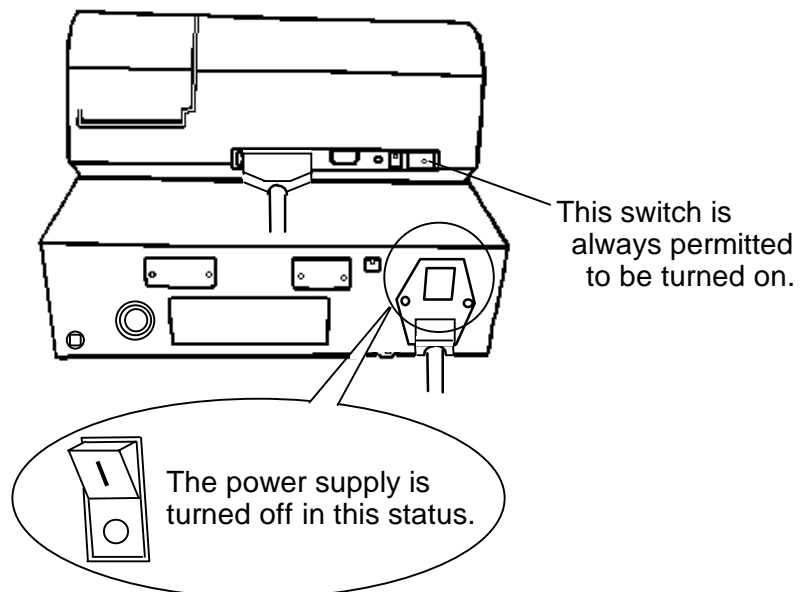
Turn off the power supply according to the following procedure.

- (1) Press the "O" side of the power switch on the rear side.
The power supply is turned off.

1) S130A



2) S480A



- MEMO -

4 Before Taking Measurements

Setup which is required before taking measurement and Calibration procedure are described in this chapter.

Setting date/time	4-2
Switching the measurement range	4-3
Calibration	4-4
Zero-adjustment and level adjustment	4-14

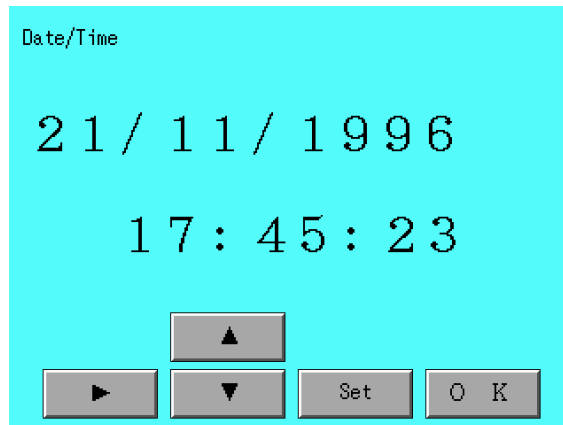
Setting date/time






This chapter describes the procedure for setting date and time. The date and time set here are used to the "date and time of measurement" to be recorded when measurements are taken.


- (1) Press the "Clock" icon on the menu screen.



The following screen appears.



- (2) Press the  to move the portion to be changed by displaying it in reverse video.
- (3) Change the set contents with the  or  switch.
- (4) Press the  switch.
The date and time are then set.
- (5) Press the  switch.
Return to the menu screen.
While settings are being changed, press this switch to cancel the changes that have been made, and the menu screen will reappear.

- * Seconds cannot be set arbitrarily.
When the  switch is pressed, the seconds are set to 00.

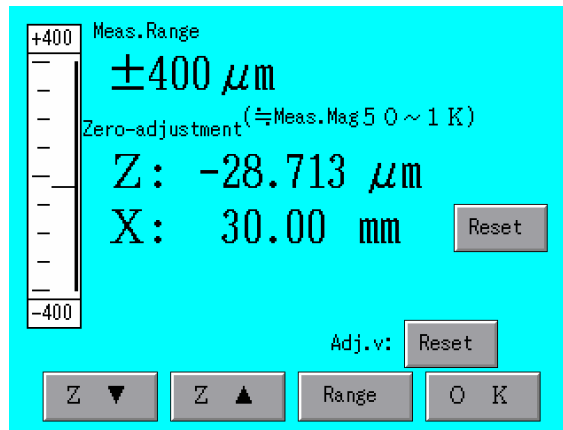
Switching the measurement range

This section describes how to switch the measurement range. The measurement range displays a range that can be set and the upper and lower boundaries of the level meter are set. Normally, take measurements in such a way that the whole measurement range can be put within this range.

- (1) Press the **Meas.Range** switch on the main menu screen.

Meas. Range

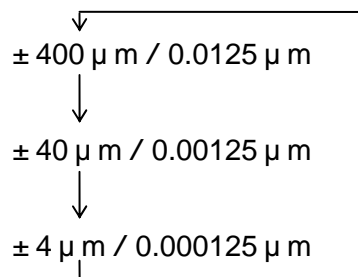
The following screen then appears.



- (2) Press the **Range** switch.

The measurement range is then switched as shown below. (When the standard pickup is connected)

Measurement range/resolution



- * The resolution is not displayed. The resolution here indicate calculation resolution when data is processed.

- * Select the meas. Range according to the purpose.
- * The measurement magnification displayed under the measurement range means approximate magnifications in the vertical direction.
- * For the measurement range with the high magnification pickup connected, see Chapter 12 "High Magnification Pickup".

Calibration

This section displays the procedure for calibration.

Calibration means magnification adjustment to reduce errors in the measurement equipment. Perform calibration once a month. When the pickup is replaced, when the sensitivity is changed, or when the stylus is replaced, be sure to perform calibration.

Calibration is divided into the following three types:

- Calibration in a magnification calibrator
 - Calibration with a precision reference specimen
 - Calibration with a step height master
-
- * When the waviness stylus (0102505) is used, perform "Mag. Calibration dev."

 - * To use the Step height master (E-MC-S57A), perform the "Calibration with a step height master."

 - * If the precision reference specimen and step height master have been flawed, perform calibration except for the portion.

1. Preparation for calibration

(1) Check when the power supply is turned off.

(2) Install the pickup with applied stylus in the tracing driver.

(3) Turn on the power supply.

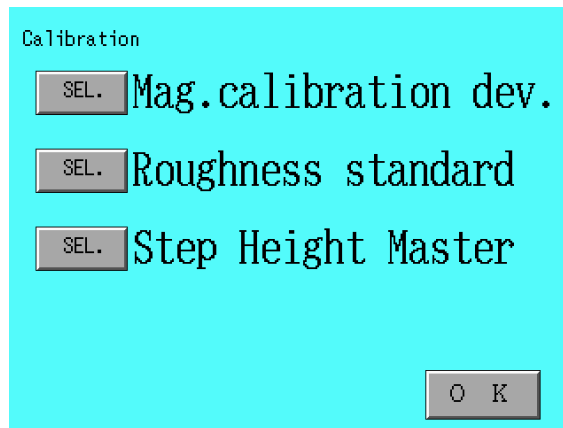
Since drift takes place just after the power supply is turned on, calibrate 15 minutes or longer after the power switch of the data processor is turned on.

2. Selection of calibration

(1) Press the "Calib." icon on the menu screen.



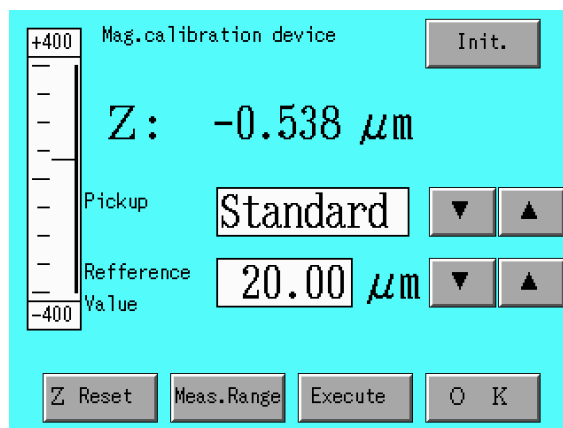
The calibration process selection screen then appears.



(2) Press the **SEL.** switch for the calibration process to be selected.

3. Calibration by the magnification calibration device.

The following screen then appears.



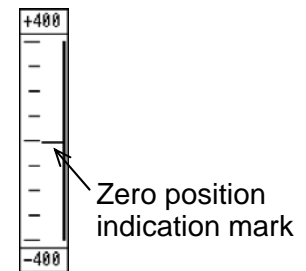
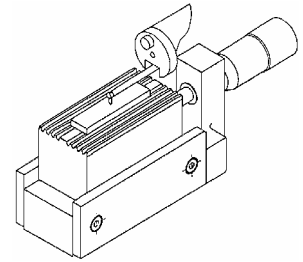
(1) Prepare the magnification calibration device (option: E-MC-50B) and a block gauge of about 2 mm in thickness (option).

(2) Tightly place the block gauge on the top of the magnification calibration device.

(3) Place the pickup in the skidless measurement status.

(4) Set the position of the magnification calibration device on the top of the block gauge placed tightly in such a way that the stylus of the pickup can contact. Lower the pickup.

Set the lowering pickup in such a way that the zero position indication mark of the level meter can come to the approximate center position.



(5) Press the switch.

Z coordinate value is reset.

(6) Press the and switches to select the pickup.

(7) Press the and switches to set the calibration reference value to "20 μ m".

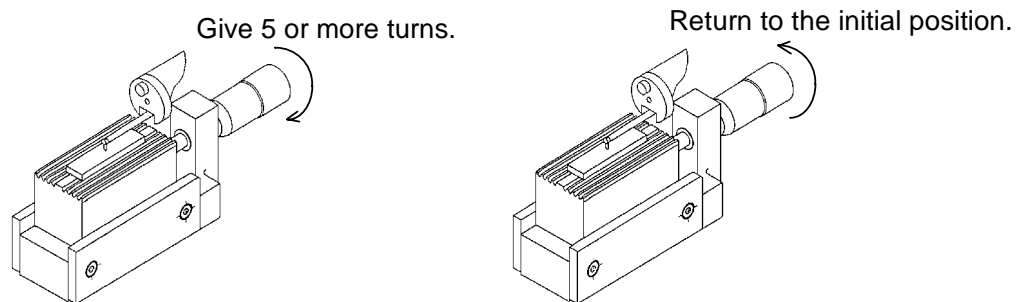
(8) Give two clockwise turns to the micrometer knob of the magnification calibration device to displace the pickup by 20 μ m.

(9) Press the switch.

(10) When the message "**Calibration is completed.**" appears, the magnification calibration ends.

4. Checking

Rotate the micrometer knob counterclockwise by 5 or more turns and then returns the knob to the initial point.

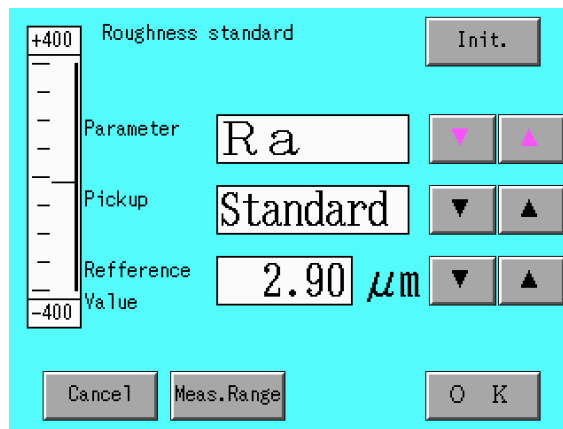


When the indication is returned to the range of $\pm 0.5 \mu\text{m}$ to '0.000', the calibration is complete.

If the message "**Calibration error. ...**" appears, check the settings for correctness, then press the **Init.** switch. Afterwards, perform the magnification calibration again.

5. Calibration with a precision reference specimen

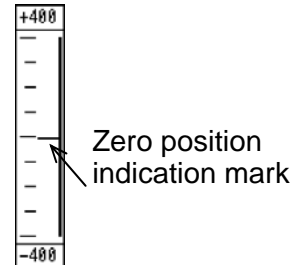
The following screen appears. This calibration requires to take measurements.



- (1) Press the **□** or **□** switch to set the calibration parameter, pickup selection, and calibration reference value setting.
Set the calibration parameter and calibration reference value to the values carved on the precision reference specimen.
 - (2) Press the **RETURN** switch to make the stylus go back to the return limit position (most advanced position).
- * When the stylus stops at the previous start point of measurement, press the **RETURN** switch again.

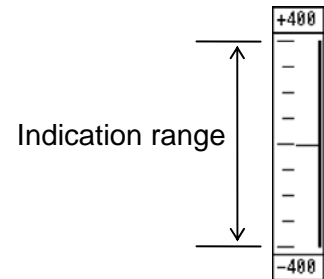
- (3) Set the portion to be used for the calibration of a precision reference specimen under the stylus.
(Of the two sides, use the calibration side when an attached precision reference specimen is used.)

- (4) Lower the pickup to make the stylus contact the precision reference specimen.
Adjust the pickup in such a way that the zero position indicator mark of the level meter can come to the center.



- (5) With the manual feed knob of the tracing driver, slowly move the pickup in the range of measurement for calibration.

- (6) If the zero position indicator mark is within the range during movement of the pickup, the level adjustment is complete.
The system is ready for measurement for calibration.
(For details on the level adjustment, see the next page.)



- (7) Press the **RETURN** switch to return the pickup to the return limit position (most advanced position of the pickup).

- (8) Press the **MEASURE** switch.

Measurements are taken for calibration. When this is the case, the measurement conditions are as follows.

	Calibration with precision reference specimen
Type of measurement	Roughness
Measurement Speed	0.3 mm/sec (0.6 mm/sec when 0.3 cannot be selected due to the tracing driver in connection)
Cutoff value	0.8mm
Tilt calibration	Straight line
Type of filter	Gaussian
s filter	C.F.R.300
Preliminary driving length	Cutoff/3
Notch calculation	OFF
Deletion of wave portion	OFF
AI function	OFF

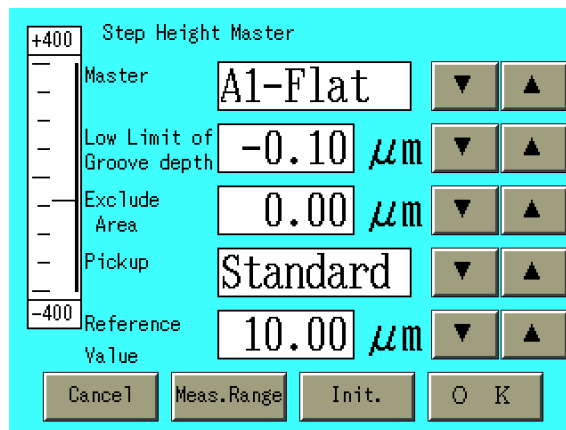
* For other condition settings, current set values are used to take measurements.

(9) When the message "**Calibration is completed.**" appears, the magnification calibration ends.

- * When the message "**Calibration error. ...**" appears, check the settings for correctness, press the **Init.** switch to initialize the calibration coefficient, and then calibrate the magnification again.

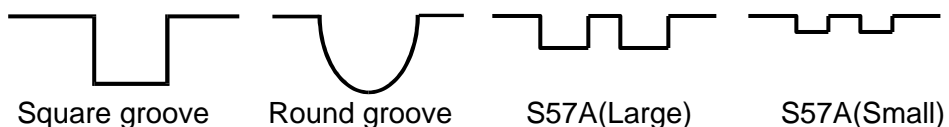
6. Calibration in a step height master

The following screen appears. This calibration requires to take measurements.



(1) Press the or itches to select Master, Low Limit of Groove Depth, Exclude Area, Pickup and Reference Value.

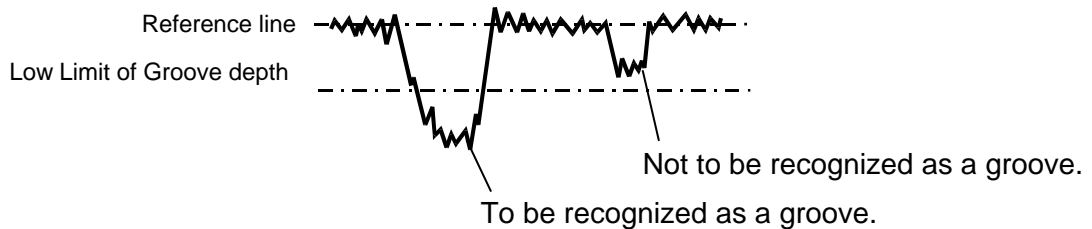
Master : Select the type of a step height master to be used.



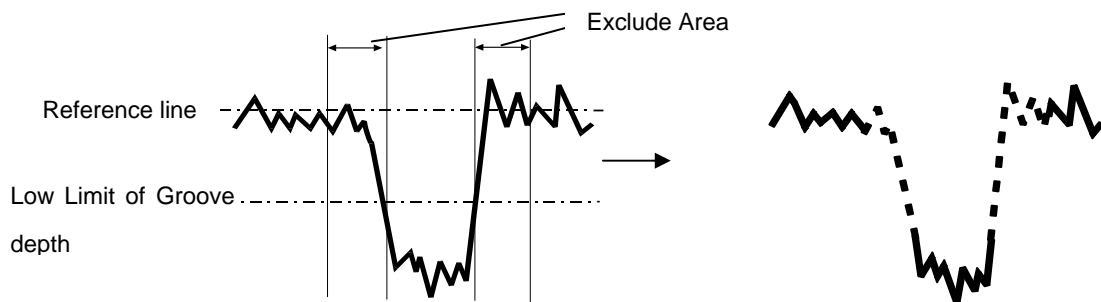
- * To use our Step height master (E-MC-S57A), select either S57A (Large) or S57A (Small). Large means the large gauge (3 grooves) while the small means the small gauge (5 grooves). Note that when selected either large or small, groove search depth and notch range items shall be fixed and the Selection button turns to half brighten. Also the measurement range turns to $\pm 40\mu\text{m}$ as the default value.

	S57A(L)	S57A(S)
Groove search depth	- 10.00 μm	- 1.00 μm
Notch range	0.0 μm	0.0 μm
Measurement range	$\pm 40 \mu\text{m}$	$\pm 40 \mu\text{m}$

Low Limit of Groove depth : The groove which is deeper than the setting value is recognized as a groove.



Exclude Area : This is set for making delete the data in both sides of the groove as shown in the figure of below.



(2) Press the **RETURN** switch to make the stylus go back to the return limit position (most advanced position).

* When the stylus stops at the previous start point of measurement, press the **RETURN** switch again.

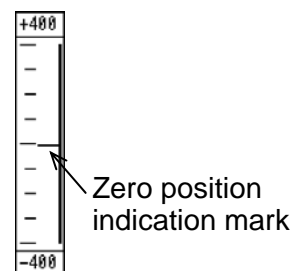
(3) Set the portion to be used for the calibration of a precision reference specimen under the stylus.

(Of the two sides, use the calibration side when an attached precision reference specimen is used.)

(4) Lower the pickup to make the stylus contact

the precision reference specimen.

Adjust the pickup in such a way that the zero position indicator mark of the level meter can come to the center.

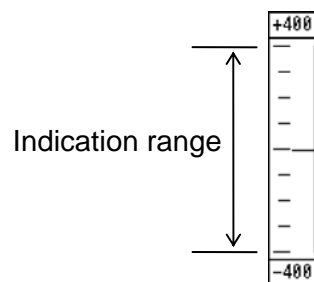


(5) With the manual feed knob of the tracing driver, slowly move the

pickup in the range of measurement for calibration.

- (6) If the zero position indicator mark is within the range during movement of the pickup, the level adjustment is complete.

The system is ready for measurement for calibration.
(For details on the level adjustment, see the next page.)



- (7) Press the **RETURN** switch to return the pickup to the return limit position (most advanced position of the pickup).

- (8) Press the **MEASURE** switch.

Measurements are taken for calibration. When this is the case, the measurement conditions are as follows.

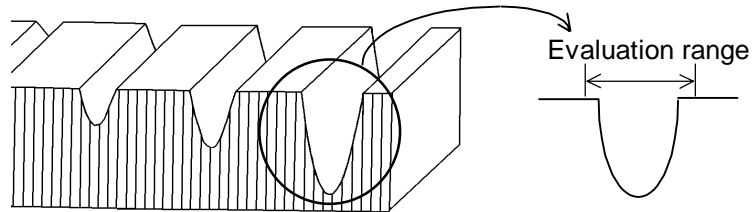
	Calibration in a step height master			
	A1-Flat	A2-Round	S57A(L)	S57A(S)
Type of measurement	Profile			
Measurement Speed	0.06 mm/sec (The lowest speed for the tracing driver which has no speed of 0.06mm/sec.)		Normal: 0.15 mm/sec High magnification pickup : 0.06 mm/sec (The lowest speed for the tracing driver which has no speed of 0.15mm/sec.)	
Cutoff value	-			
Measurement length	-		8.0mm	5.5mm
Tilt calibration	(Refer to the calculation formula on next page.)			
Type of filter	-			
s filter	None			
Preliminary driving length	Cutoff/3			
Notch calculation	OFF			
Deletion of wave portion	OFF			
AI function	OFF			

- (9) When the message "**Calibration is completed.**" appears, the magnification calibration ends.

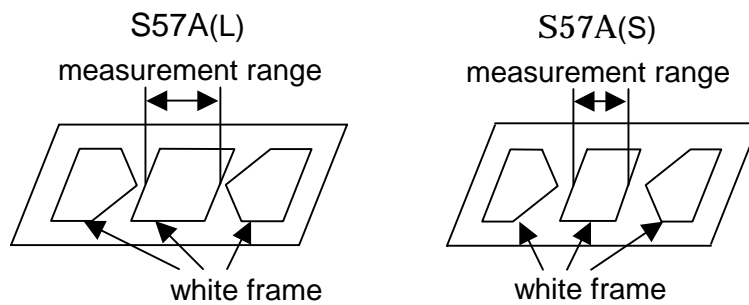
* When the message "**Calibration error.** ..." appears, check the settings for correctness, press the **Init.** switch to initialize the calibration coefficient, and

then calibrate the magnification again.

- * If the message “**Step height master type or measuring position is wrong....**” appeared, check and ensure that the Step height master type or measuring position is correct and press the **Initialize** switch to initialize the calibration coefficient so as to perform the step height master again.



A step height master in conformity to ISO should be used.

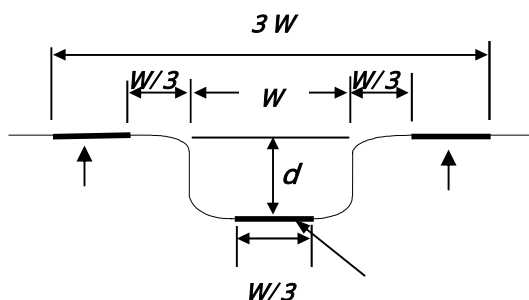


To perform calibration with our Step height master, put down the pickup in the white column left to the measurement range to start calibration.

[Calculation method]

It defines the length that is three times of a groove width(W) and it is in symmetry against to the reference point of the groove center position as shown in the figure of below.

Then draw the mean line with reference to the data of $W/3$ and d in both ends. The groove depth (d) shows vertical length between the above mean line and the center position of a mean line of the part of $W/3$. In case of the round groove, it is calculated by the length to the deepest point.



In case of being not sufficient of the range for calculating the reference line, it executes the calculation by its obtained data only.

In case of being existing plural grooves in the measuring range, it is calculated by using the deepest groove.

7. Other switches

Init. : Initializes calibration coefficients of selected pickup.

Cancel : With respect to the set value on the screen, cancels changes in setting that have been made since this screen was displayed. However, the calibration coefficient cannot be canceled.

Range : Switches the measurement range.

Perform calibration with a measurement range whose resolution is as high as possible.

However, when an attached precision reference specimen is used, use the measurement range of $\pm 40 \mu\text{m}$.

OK : Returns to the selection screen for calibration process.

8. Store of calibration coefficients

Calibration coefficients, which are calculated by magnification calibration, are stored for each pickup type (Normal, 1/2, 1/5, High magnification).
(Calibration coefficients are unable to be stored in a PC card.)

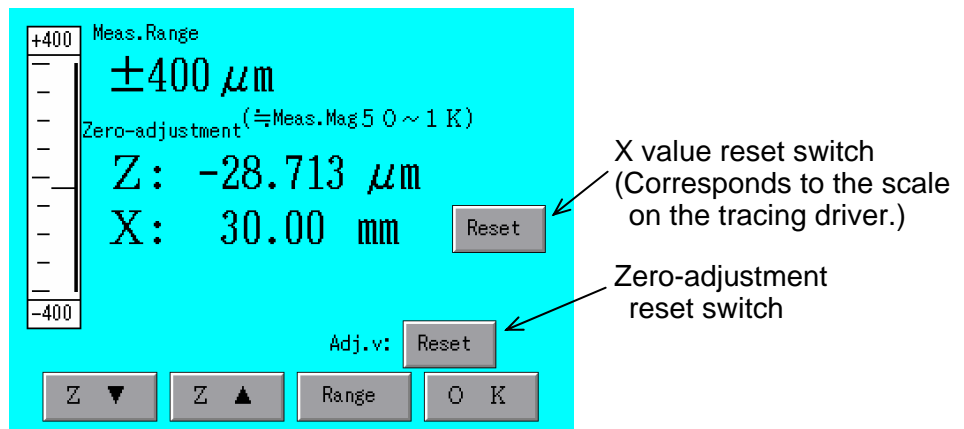
Zero-adjustment and level adjustment

This section describes the zero-adjustment and level adjustment.

- (1) Press the "Meas. Range" switch on the main menu screen.

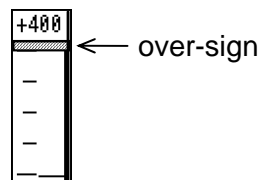
Meas. Range

The following screen then appears.



- (2) Make the stylus softly contact a measurement place of the workpiece.
- (3) Press the **Range** switch to select the measurement range to be used.
- (4) Press the **Reset** switch for zero-adjustment.
- (5) Adjust the up/down movement of the pickup to set the pickup detection level to $\pm 50 \mu\text{m}$.

- * When the detection level is out of the measurement range, an over-sign appears at the end of the direction, as shown in the drawing below, where the level is out of the range.



- * If the measurement range is not placed within the range, select a measurement range, once, whose resolution is low, and make the zero position indicator mark come to the center in the range. Then return the measurement range and perform the adjustment again.

(6) Press the Z switch and the Z switch to take zero-adjustment.

(The zero-adjustment can be taken by touch on the level meter, too.)

Pressing the Z switch moves the detection level in the - direction, while

pressing Z switch moves the detection level to the + direction. Adjust the detection level to near zero.

Since the adjustment range is $\pm 50 \mu\text{m}$, adjustments beyond this cannot be taken.

(7) With the manual feed knob of the tracing driver, move the pickup in such a way that the stylus can move from the measurement start point to the measurement end point.

Only when an over-sign appears during the pickup movement, the level adjustment is required.

(8) If an over-sign appears during movement of the pickup, adjust the level to the following description.

- When an over-sign appears at the upper end (lower end);

Return the pickup to the initial place (measurement start point) with the manual feed knob of the tracing driver.

With the leveling knob of the tracing driver or the leveling knob of the level positioner (option), perform adjustments in such a way that the zero position indicator mark of the level meter can come to the lower (upper) end where an over-sign does not appear. Separate the pickup from a workpiece once, and then make the pickup contact again and readjust the height of the pickup in such a way that the zero position indicator mark can be put within the range.

- * Repeat steps (7) and (8) until over-sign does not appear during the movement of the pickup.

(9) After completion of level adjustment, set the zero offset in the automatic set items to ON (display in reverse video).

When the level is placed within $\pm 50 \mu\text{m}$, the zero-adjustment is completed.

- * Relations with zero offset

The zero offset function automatically makes zero-adjustment during measurement. When the "Zero-offset" is set as an automatic adjustment item, the adjustment is therefore changed if the zero-adjustment function is executed for adjustment. To take measurements without changing the current detection level, release the Zero-offset setting (OFF) and then take measurements.

- MEMO -

5 Setting Conditions for Measurement

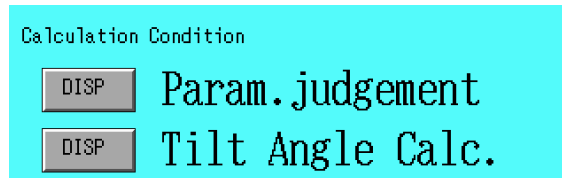
This chapter describes how to set the conditions for measurements and output items.

Setting conditions	5-2
Initializing condition setting	5-6
Setting system conditions	5-7
Setting measurement conditions	5-11
Setting calculation conditions	5-19
Setting output items	5-41
Setting comments	5-43

Setting conditions

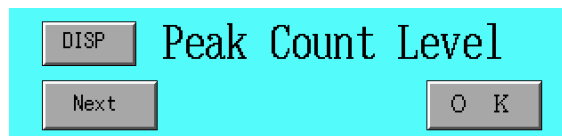
The following switches are primarily used for setting conditions in this chapter. This section describes the switches.

- (1) **DISP** switch : Displays the setting screen.



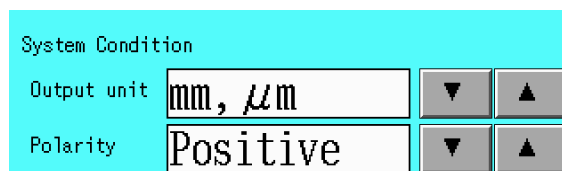
Press the **DISP** switch for the item to be set.

- (2) **Next** switch : Displays the next item.



Press the **Next** switch to display the next item.

- (3) , switch : Changes set values.



Press the , switch for an item to be changed.

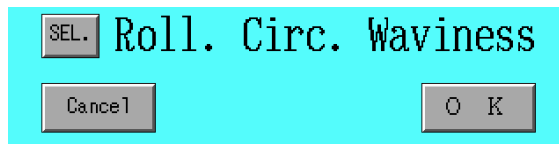
- (4) **SEL.** Switch : Changes the contents of setting.



An item currently being set is displayed in reverse video.

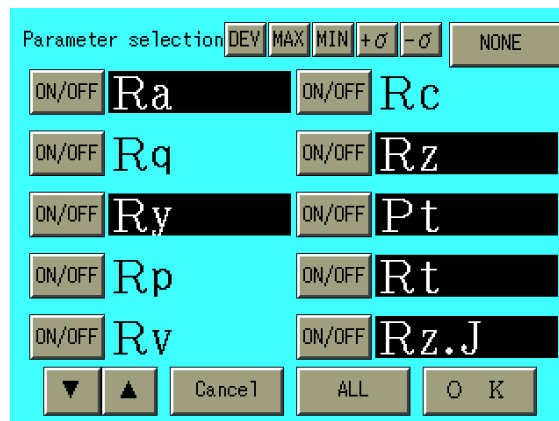
Press the **SEL.** switch for an item to be set.

- (5) **OK** switch : Returns to the menu screen.



The menu screen reappears.

- (6) **Cancel** switch : With respect to the set item and set value on the screen, cancels changes in setting that have been made since this screen was displayed.
- (7) **ON/OFF** switch : Sets and releases selected items.

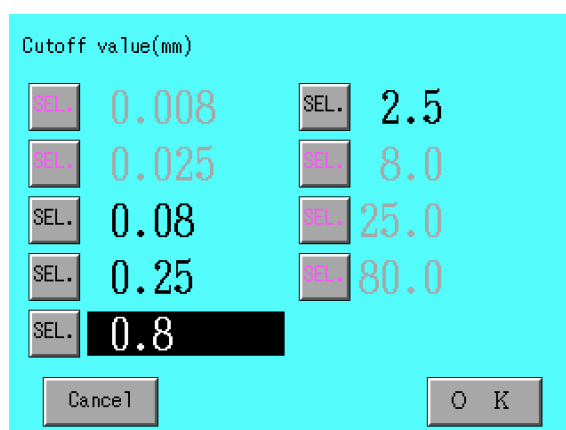


An item currently being set is displayed in reverse video.
Press the **ON/OFF** switch for an item to be changed.

- (8) **ALL** switch : Sets all items.
- (9) **NONE** switch : Releases settings of all items.

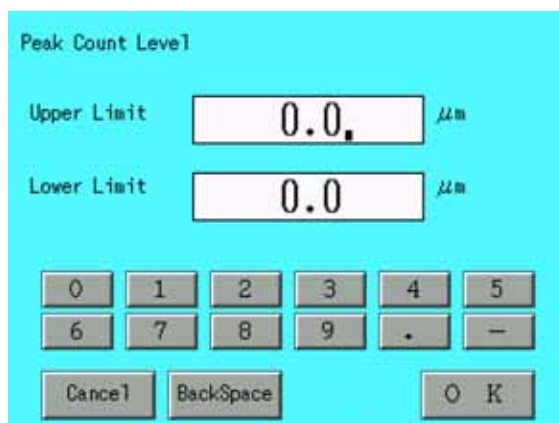
(10) Half luminance : Items that cannot be set currently are indicated in half luminance.

For example, cutoff values that can be set are changed according to measurement speeds currently being selected. When this is the case, values that cannot be set are indicated in half luminance.



(11) Ten-key pads : Enters set values.

Pressing a ten-key pad without pressing the **Back Space** switch clears a currently displayed value and enables a value to be entered from the head. For partial change, use the **Back Space** switch.



* Entry within the allowable range of setting is only allowed.

(12) Mark : Input position.

Press a column desired to be entered and display the mark.

(13) **Back Space** switch : Erases a digit number at the left side of the mark.

(14) ON/OFF : Changes the set contents.



The contents currently being set are displayed in reverse video.
Of "ON" and "OFF", directly press the one to select.

Initializing condition setting

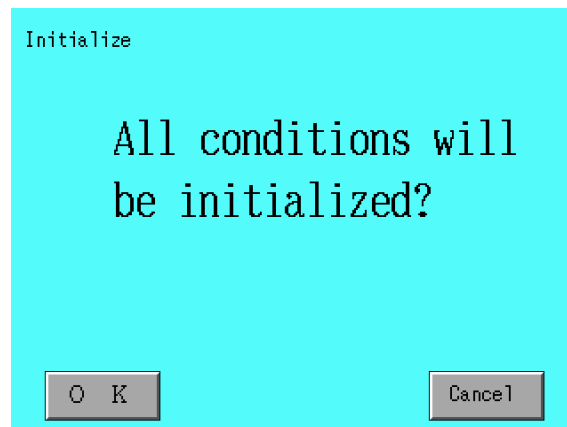
Various types of conditions are to be initialized.

Operation procedure

(1) Press the "Initialize" icon on the menu screen.



The initialization screen then appears.



(2) Press the switch.

(3) After the initialization, the message appears indicating the end of initialization. Then press the switch.

The initialization screen reappears.

(4) Press the switch.

The menu screen then reappears.

* For details on initial values, see "Initial value list" in Chapter 15.

Setting system conditions

The procedure of system condition setup is shown below.

(1) Press the "System C." icon on the main menu screen.



The system condition setting screen appears.

System Condition			
Output unit	mm, μ m	▼	▲
Polarity	Positive	▼	▲
Pickup	Standard	▼	▲
Meas. mode	Normal	▼	▲
Profile	<input type="radio"/> ON <input type="radio"/> OFF		
Next		Cancel	OK

System Condition			
Stop-Calc.	<input type="radio"/> NO <input type="radio"/> FF		
E.Area print	<input type="radio"/> NO <input type="radio"/> FF		
Division Line	<input type="radio"/> NO <input type="radio"/> FF		
Judgment Reference	Average	▼	▲
Connection of Curve	None	▼	▲
Previous		Cancel	OK

(2) Set conditions for items.

Switching setting contents.

The setting contents of items are switched as follows.

Output unit :

mm, μ m
inch, μ inch

Pickup :

Standard
1/2
1/5

When high magnification pickup is mounted:

High

Polarity :

Positive
Negative

Meas. Mode :

Normal
Print Out

* Setting the concurrent printout prints out profile curve at the same time measurements are taken. However, concurrent printout is not carried out when calibration is done or when measurement is supported.

Display of profile

- ON : Displays the profile curve and parameter values on the measurement result display screen. A range can also be set for re-calculation.
- OFF : The parameter values are only displayed on the measurement result display screen.

Calculation in the course

- ON : Press the STOP switch in the course of measurement to calculate various types of parameters with measurement data collected at that point and before.
- OFF : Press the STOP switch in the course of measurement to cancel the process after that. When this is the case, measurement data collected at that point and before is to be lost.

Evaluation area print

- ON : Only evaluation area is printed out at printout of profile curve (P-curve, R-curve, DIN4776 curve).
- OFF : All area of profile curve is printed out.

Division Line

- ON : This is a profile curve (R – Curve) on measuring result screen and printout, and a division line (a dot line) is displayed and printed.
(In case of being calculated based on “JIS-’82”, it is not displayed nor printed.)
- OFF : A division line (a dot line) is not displayed nor printed in each cutoff length.

Judgment Reference

Standard
Average
Maximum
Minimum
16% rule

This executes selection of a result of judgment to any parameters by which it is processed to divide in each reference length.

A parameter is judged by judgment method which based on selected gauge, in case of selecting Standard. (Refer to a below diagram)

	ISO'97	ASME'95	DIN'90	ISO'84	JIS'01	JIS'94	JIS'82
Profile Curve	16% rule	Average (*)	16% rule (*)	16% rule	16% rule	Average	Average
Roughness Curve							
Filtered Waviness							
Filt.C.L. Waviness							
Roll.Circ. C.L.Wav.	----	----	----	----	Average		

* A mountain height parameter (Rz, Rmax, Rp, Rv, Rc etc) on section parameter is decided whether to pass or fail by a maximum value of all sections.

There are also "Standard" and "Sigma rule" for judgment method of 16% rule. Refer to a "16% rule" on this chapter "Setting calculation condition" for a detail of 16% rule.

A parameter calculated from the evaluation length whole is decided whether to pass or fail by checking whether a calculation value is within a judgment upper boundary and judgment lower boundary.

Connection of Curve

None
Normal
Mean Line

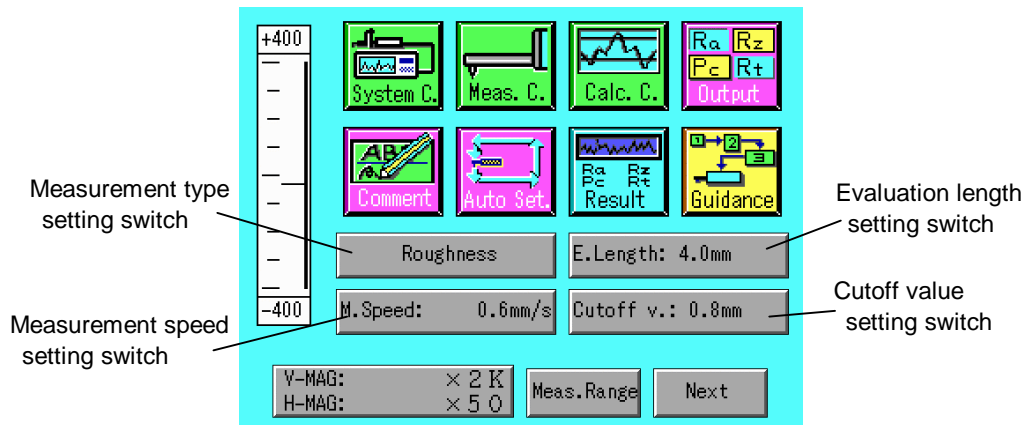
This is a process for connecting plural numbers of evaluation ranges into one range. Existence of connection and connecting method is specified. (Refer to 7-8 for the details.)

Setting measurement conditions

This chapter describes the procedure for setting measurement conditions. Measurement conditions are set on the menu screen or on the measurement condition set screen. Items to be set differ depending on the screens.

1. Setting conditions on the main menu

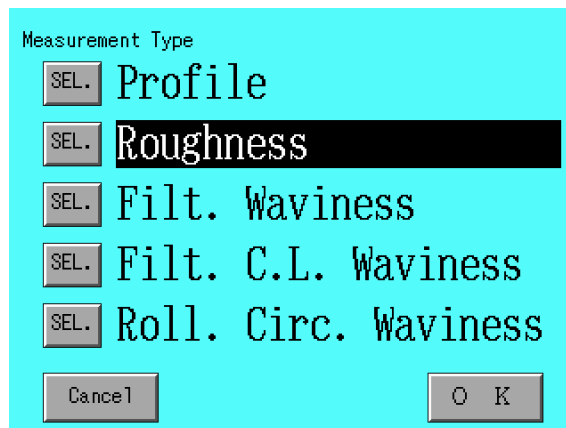
On the main menu, set measurement conditions including the type of measurement, measurement speed, cutoff value, and evaluation length.



- (1) Press the switch for the measurement condition to be set on the main screen.
A setting screen appears.

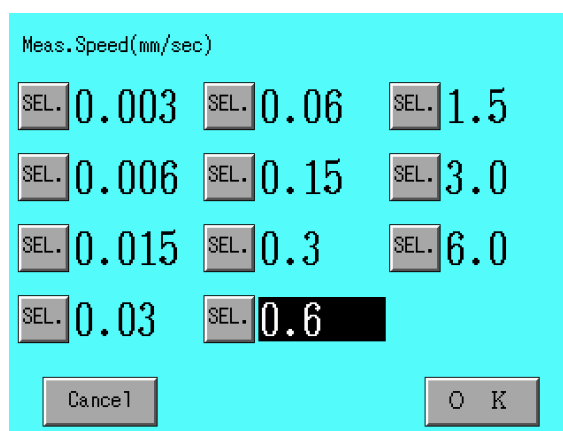
<Measurement Type>

Make selections according to the type of measurement.



<Measurement Speed>

Select a measurement speed.



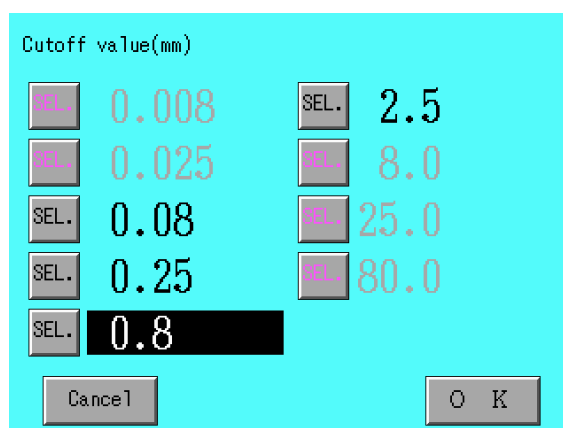
* Selectable measurement speed is different depend on drive unit. (See following table.)

Data processor	Driving unit	Selectable measurement speed (mm/s)
S130A	Small type tracing driver	0.3 / 0.6 / 1.5 / 3.0
S480A	100 mm tracing driver (Standard)	0.03 / 0.06 / 0.15 / 0.3 / 0.6 / 1.5 / 3.0 / 6.0
	100 mm low speed type tracing driver	0.003 / 0.006 / 0.015 / 0.03 / 0.06 / 0.15 / 0.3 / 0.6 / 1.5 / 3.0 / 6.0
	Circumferential roughness tracing driver	0.3 / 3.0
	R surface tracing driver	0.03 / 0.3
	Other drive units	Same as 100 mm tracing driver (Standard)

As to Data processor and format of drive unit, see "System diagram (S480A)" in Chapter 1 "Parts Names and Configuration" and "System diagram (S130A)".

<Cutoff value>

Select a cutoff value.



Cutoff values in measurement types depend on measurement speeds and the range of selection is determined according to the table given below.

(Unit: mm | inch)

<Cross section measurement>: None

<Roughness measurement>, <Measurement of filtered waviness>

Measurement speed (mm/s)	Cutoff value (mm)	Measurement speed (inch/s)	Cutoff value (inch)
0.003 ~ 0.015	0.008 , 0.025 , 0.08 , 0.25 , 0.8	0.00012 ~ 0.0006	0.0003 , 0.001 , 0.003 , 0.01 , 0.03
0.03 ~ 0.06	0.025 , 0.08 , 0.25 , 0.8 , 2.5	0.0012 ~ 0.0024	0.001 , 0.003 , 0.01 , 0.03 , 0.1
0.15 ~ 0.6	0.08 , 0.25 , 0.8 , 2.5 , 8.0	0.006 ~ 0.024	0.003 , 0.01 , 0.03 , 0.1 , 0.3
1.5	0.25 , 0.8 , 2.5 , 8.0 , 25.0	0.06	0.01 , 0.03 , 0.1 , 0.3 , 1.0
3.0 ~ 6.0	0.8 , 2.5 , 8.0 , 25.0	0.12 ~ 0.24	0.03 , 0.1 , 0.3 , 1.0

<Measurement of filtered center line waviness>

Measurement speed (mm/s)	Cutoff value (mm)	Measurement speed (inch/s)	Cutoff value (inch)
0.003 ~ 0.06	0.025 ~ 0.25 , 0.025 ~ 0.8 , 0.08 ~ 0.8 , 0.08 ~ 2.5 , 0.25 ~ 2.5 , 0.25 ~ 8.0	0.00012 ~ 0.0024	0.001 ~ 0.01 , 0.001 ~ 0.03 , 0.003 ~ 0.03 , 0.003 ~ 0.1 , 0.01 ~ 0.1 , 0.01 ~ 0.3
0.15 ~ 0.6	0.08 ~ 0.8 , 0.08 ~ 2.5 , 0.25 ~ 2.5 , 0.25 ~ 8.0 , 0.8 ~ 8.0 , 0.8 ~ 25.0	0.006 ~ 0.024	0.003 ~ 0.03 , 0.003 ~ 0.1 , 0.01 ~ 0.1 , 0.01 ~ 0.3 , 0.03 ~ 0.3 , 0.03 ~ 1.0
1.5 ~ 6.0	0.25 ~ 2.5 , 0.25 ~ 8.0 , 0.8 ~ 8.0 , 0.8 ~ 25.0 , 2.5 ~ 25.0 , 2.5 ~ 80.0	0.06 ~ 0.24	0.01 ~ 0.1 , 0.01 ~ 0.3 , 0.03 ~ 0.3 , 0.03 ~ 1.0 , 0.1 ~ 1.0 , 0.1 ~ 3.0

<Measurement of rolling circle waviness>

Measurement speed (mm/s)	Cutoff value (mm)	Measurement speed (inch/s)	Cutoff value (inch)
0.003 ~ 0.06	0.25 , 0.8 , 2.5 , 8.0	0.00012 ~ 0.0024	0.01 , 0.03 , 0.1 , 0.3
0.15 ~ 0.6	0.8 , 2.5 , 8.0 , 25.0	0.006 ~ 0.024	0.03 , 0.1 , 0.3 , 1.0
1.5 ~ 6.0	2.5 , 8.0 , 25.0 , 80.0	0.06 ~ 0.24	0.1 , 0.3 , 1.0 , 3.0

- * Cutoff values are effective up to 25 mm, when a 50 mm tracing driver is connected. Any can be selected, when a tracing driver other than the aforesaid is connected.

<Evaluation Length>

For evaluation length, the following modes are available: fix mode for setting according to cutoff values and flex mode for setting any measurement length.

The modes can be switched by pressing the **Fix** and **Flex** switches.

In the measurement of cross section, however, only the **Flex** mode is available.

Evaluation Length(mm)

mm

0 1 2 3 4 5
6 7 8 9 .

Cancel BackSpace Fix O K

Evaluation Length(mm)

Cutoff value × Integer
× 1 ~ × 300 × λ c

Current cutoff value (λ c) : 0.8 mm

0 1 2 3 4 5
6 7 8 9

Cancel BackSpace Flex O K

The minimum value of evaluation length is determined as shown in the table below according to the measurement speed. However, it must be longer than the cutoff value except for profile measurement.

Measurement speed (mm/s)	Min. Evaluation Length (mm)	Measurement speed (inch/s)	Min. Evaluation Length (inch)
6.00	3	0.24	0.12
3.00	1.5	0.12	0.06
1.50	0.75	0.06	0.03
0.60	0.3	0.024	0.012
0.3	0.1	0.012	0.004
0.15	0.1	0.006	0.004
0.06	0.1	0.0024	0.004
0.03	0.1	0.0012	0.004
0.015	0.1	0.0006	0.004
0.006	0.1	0.00024	0.004
0.003	0.1	0.00012	0.004

Input range

The input range is as follows:

Fix mode : 1 c to 300 c

Flex mode : Ranging from 0.1 to 1200.0 mm

2. Setting on the condition setting screen

Measurement conditions except for those set on the main menu are to be set on the condition setting screen.

(1) Press the "Meas. C." icon on the menu screen.



The measurement condition setting screen appears.

The image shows two side-by-side screenshots of the "Measurement Condition" setting screen. The left screenshot shows the "Tilt" setting set to "Straight", "Cutoff" set to "Gaussian", "λs" set to "C.F.R.300", and "Return Spd." set to "3.0 mm/s". The right screenshot shows the "Return Set" set to "Normal", "Pre.drive" set to "Cutoff/3", and "Standard" set to "J I S-' 94". Both screens have "Next" and "Cancel" buttons at the bottom left and an "O K" button at the bottom right.

(2) Set the conditions of items.

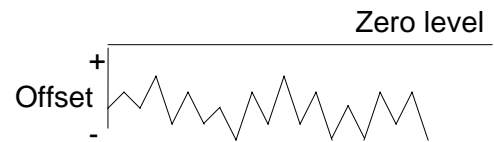
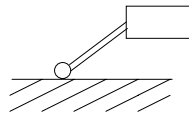
<Tilt>

Select the type of tilt correction to be performed according to the data obtained after measurement.

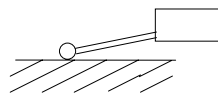
None
Straight
R-Curve
Begin. Half
End. Half
Begin-End
Spline

- * When the condition for no tilt correction is set, the offset that differs depending on the status of pickup contact is not corrected. With the condition set for no tilt correction, profile curve sliding in the Z axis direction is obtained if a workpiece is placed at the same position. Similarly, the offset is not corrected in the parameter calculation and, therefore, different calculation results are to be output.

Make the stylus contact shallowly.



Make the stylus contact deeply.



<Cutoff>

Set the type of filter to be used for roughness and waviness measurements.

2RC	: JIS B 0651-'76, ANSI B46.1-'85, ISO3274-'75
2RC (P.C.)	
Gaussian	: JIS B 0632-'01, ISO11562-'96, JIS B 0651-'96, DIN4777-'90

< S >

Sets the S filter process. S filter is available for all measurement types.

In Roughness
None
C.F.R.30
C.F.R.100
C.F.R.300
C.F.R.1000

In the case of others (Unit: μ m)
None
0.25
0.8
2.5
8.0
25.0
80.0

- * C.F.R.100 means $c/s = 100$.
With $c = 0.8$ mm, for example, $s = 8.0$ μ m is specified.

<Return speed>

Sets the return speed. (Unit: mm/s)

0.03	0.6
0.06	1.5
0.15	3.0
0.3	6.0

- * A return speed that cannot be set in the tracing driver is indicated in half luminance.

Excessive return speed may cause an object to be flawed.

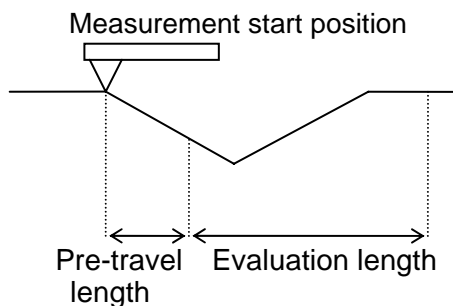
<Return setting>

Selects motion of the tracing driver just after the **MEASURE** switch is pressed.

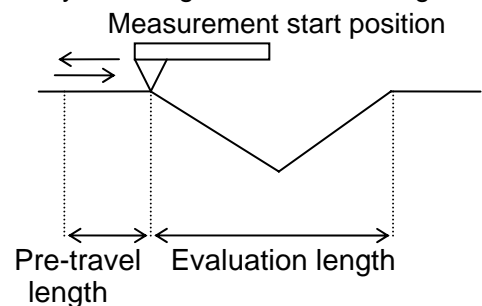
Normal measurement	Starts measurement from the position where the measurement switch is pressed.
Measurement of preliminary length return	For the length of preliminary drive, returns from the position where the measurement switch is pressed, and then starts measurement.

In the roughness measurement, the system waits for the transition response of the filter at start of measurement to converge. However, the measurement start position slides for this Pre-travel length and makes the measurement of very small portions inconvenient. To solve this inconvenience, pressing the measurement switch returns the pickup for the Pre-travel drive length and starts measurement. The measurement can be thus set for sampling data from the true position of measurement start.

Normal measurement



Measurement by returning for Pre-travel length



<Pre / Post travel length>

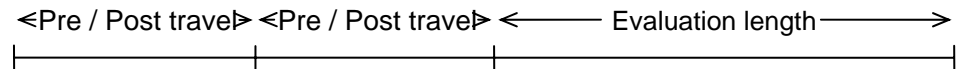
Sets the distance of Pre / Post travel from pressing the **MEASURE** switch until beginning of data sampling. When "Profile" is selected for the type of measurement, Pre / Post travel is not provided and, therefore, this length does not have to be set.

Cutoff
Cutoff/2
Cutoff/3

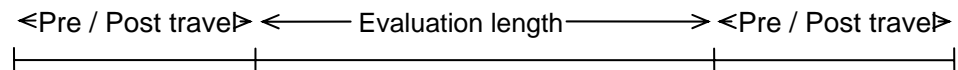
- * The preliminary drive length at a side is set.

- * Relationships between Traversed length, evaluation length and Pre / Post travel length
Pre / Post travel is to be taken as shown below, depending on the type of filter.
When a filter changes from 2RC to another filter (or viceversa) during re-calculation, the position of evaluation data changes as shown in the drawing below.

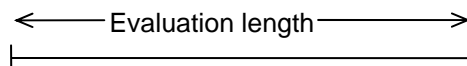
- 2RC filter



- 2RC (P.C.) and phase compensation filter (Gaussian filter)



- Profile curve (no filter)



<Calculation standards>

Sets the parameter calculation standards.

JIS-'01
JIS-'94
JIS-'82
ISO-'97
ISO-'84
DIN-'90
ASME-'95

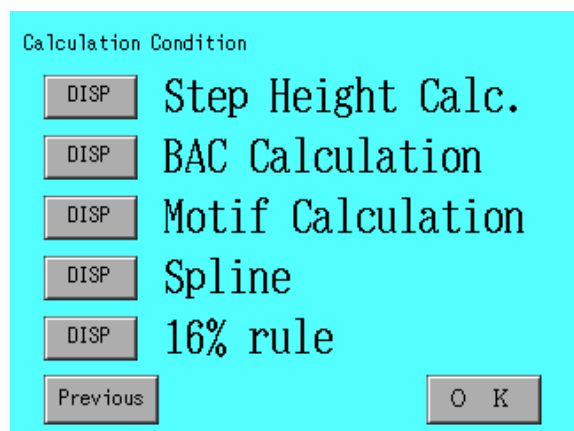
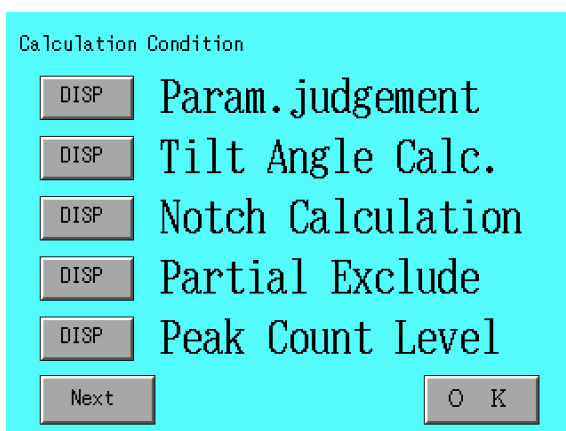
Setting calculation conditions

This section describes setting calculation conditions.

(1) Press the "Calc. C." icon on the menu screen.



The calculation condition menu appears.



(2) Set the conditions of items.

<Parameter judgment>

This system provides a function for comparison of entered design values of various parameters with the results of measurements.

This section sets upper boundaries and lower boundaries for the parameter judgment values.

Set values with judgment upper boundary \geq judgment lower boundary. When both upper boundary and lower boundary are set to '0', judgment on acceptance/nonacceptance is not made.

Parameters differ depending on the type of measurement or calculation standards.

A parameter selected in the parameter selection on the output item setting screen is to be displayed.

In case of that the parameter value is higher than judgment lower boundary and lower than judgment upper boundary, it will be judged as acceptance (OK).

<Profile measurement>, <Roughness measurement>

Calculation parameter	JIS'82	JIS'94	ISO'84	JIS'01/ISO'97	ASME'95	DIN'90	Judgment upper limit value/lower limit value	
Arithmetical mean deviation of the profile	Ra	Ra	Ra	Pa, Ra	Ra	Ra	0.000 μm ~ 4000.000 μm (0000.0 μ" ~ 157480 μ")	
Root mean square deviation of the profile	Rq	Rq	Rq	Pq, Rq	Rq	Rq		
Total height of roughness profile	-	Ry	Ry	Rz	Rz	Rz		
Maximum profile peak height	Rp	Rp	Rp	Pp, Rp	Rpm	Rp		
Maximum profile valley depth	Rv	Rv	Rv	Pv, Rv	Rv	Rv		
Mean height of elements	Rc	Rc	Rc	Pc.l, Rc	Rc	Rc		
Ten point height of irregularities (ISO)	-	Rz	Rz	Rz94	Rz.l	Rz.l		
Maximum height (JIS82)	Rmax	Rmax	Pt	Pt	Pt	Pt		
Total height of roughness profile (ISO)	Rt	Rt	Rt	Rt	Rt	Rt		
Ten point height of irregularities (JIS82)	Rz	Rz.J	Rz.J	Rz.J	Rz.J	Rz.J		
Base roughness depth	R3z	R3z	R3z	R3z	R3z	R3z		
Mean spacing of profile irregularities	Sm	Sm	RSm	PSm, RSm	RSm	RSm		0.000mm ~ 400.000mm (0.0000" ~ 15.7480")
Mean spacing of local peaks of the profile	S	S	RS	-	RS	RS		
Arithmetical mean slope of the profile	a	R a	R a	R a	R a	R a		0.000 ~ 999.999
Root mean square slope of the profile	q	R q	R q	P q, R q	R q	R q		
Average wavelength of the profile	a	R a	R a	R a	R a	R a	0.000mm ~ 400.000mm (0.0000" ~ 15.7480")	
Root mean square wavelength of the profile	q	R q	R q	R q	R q	R q		
Average slope angle	TiltA						-89.000° ~ +89.000°	
Profile length ratio	lr						100% ~ 200%	
Peak count	Pc						0 ~ 4000	
Skewness of the profile	Rsk (Psk --- JIS'01, ISO'97)						-20.000 ~ +20.000	
Kurtosis of the profile	Rku (Pku --- JIS'01, ISO'97)						0.000 ~ 99.999	
Core roughness depth	Rk (Pk --- JIS'01, ISO'97)						0.000 μm ~ 4000.000 μm (0000.0 μ" ~ 157480 μ")	
The reduced peak height	Rpk (Ppk --- JIS'01, ISO'97)							
The reduced valley depth	Rvk (Pvk --- JIS'01, ISO'97)							
Oil retention volume	V0						0.0000 ~ 400.0000	
Material ratio 1	Mr1						0.0% ~ 99.9%	
Material ratio 2	Mr2							
Reduced valley depth ratio	K						(K without unit)	
Number of valleys	Except for JIS'82	NCRX					0 ~ 10000	
Mean depth of roughness motifs		R					0 ~ 4000.000 μm (0 ~ 157480 μ")	
Maximum depth of profile irregularity		Rx					0 ~ 4000.000 μm (0 ~ 157480 μ")	
Mean spacing of roughness motifs		AR					0 ~ 4000.000 μm (0 ~ 157480 μ")	
Number of roughness motifs		NR					0 ~ 10000	
Mean number of valleys		CPM					0 ~ 9999.999	
Standard deviation of roughness motifs depth		SR					0 ~ 2000.000 μm (0 ~ 78740 μ")	
Standard deviation of roughness motifs space		SAR					0 ~ 4000.000 μm (0 ~ 157480 μ")	
Mean depth of waviness motifs		W					0 ~ 4000.000 μm (0 ~ 157480 μ")	
Maximum depth of waviness		Wx					0 ~ 4000.000 μm (0 ~ 157480 μ")	
Mean spacing of waviness motifs		AW					0 ~ 20000.00 μm (0 ~ 787400 μ")	
Total depth of waviness		Wte					0 ~ 4000.000 μm (0 ~ 157480 μ")	
Number of waviness motifs		NW					0 ~ 10000	
Standard deviation of waviness motifs depth		SW					0 ~ 2000.000 μm (0 ~ 78740 μ")	
Standard deviation of waviness motifs space		SAW					0 ~ 20000.00 μm (0 ~ 787400 μ")	

Calculation parameter	JIS'82	JIS'94	ISO'84	JIS'01/ISO'97	ASME'95	DIN'90	Judgment upper limit value/lower limit value
Profile bearing length	tp	-	-	-	-	-	0.0% ~ 99.9%
Profile bearing length 2	tp2	-	-	-	-	-	
Profile bearing length ratio (standard law)	-	tp	tp	-	-	-	
Profile bearing length ratio (evaluation law)	-	Rmr	Rmr	Pmr, Rmr	Rmr	Rmr	
Profile bearing length ratio 2 (standard law)	-	tp2	tp2	-	-	-	
Profile bearing length ratio 2 (evaluation law)	-	Rmr2	Rmr2	Pmr2, Rmr2	Rmr2	Rmr2	
Profile section level separation	Hp	R c	R c	P c, R c	R c	R c	0.000 μ m ~ 4000.000 μ m (0000.0 μ " ~ 157480 μ ")
Step difference value average height	AVH	AVH	AVH	AVH	AVH	AVH	
Step difference value maximum value	Hmax	Hmax	Hmax	Hmax	Hmax	Hmax	
Step difference value min. value	Hmin	Hmin	Hmin	Hmin	Hmin	Hmin	0 μ m ² ~ 99999999 μ m ² (0000 μ " ² ~ 99999999 μ " ²)
Step difference section area	AREA	AREA	AREA	AREA	AREA	AREA	

Note) The part mentioned as “of roughness curve” in the calculation parameter is changed to “of profile curve” depending on standards and types of measurement. For the details, refer to Chapter 15 information “Parameter list”.

<Measurement of filtered waviness>, <Measurement of filtered center line waviness>

Calculation parameter	Filtered waviness parameter	Filtered center line waviness parameter	Judgment upper limit value/lower limit value
Centerline mean value	WC-a,Wa	-	0.000 μ m ~ 4000.000 μ m (0000.0 μ " ~ 157480 μ ")
Filtered centerline waviness	-	WCA,Wa	
Root mean square value	WC-q,Wq	WCC-q,WC-q,Wq	
Filtered maximum waviness	WCM,Wt	-	
Maximum height	-	WCC-m,WC-t,Wt	
Maximum peak height	WC-p,Wp	WCC-p,WC-p,Wp	
Maximum valley depth	WC-v,Wv	WCC-v,WC-v,Wv	
Mean spacing of profile irregularities	WC-Sm,WSm	WCC-Sm, WC-Sm,WSm	0.000mm ~ 400.000mm (0.0000" ~ 15.7480")
Maximum height	-	Wz	
Mean height of elements	-	Wc	
Skewness of the profile	-	Wsk	
Kurtosis of the profile	-	Wku	
Root mean square slope of the profile	-	WΔq	
Profile bearing length	-	Wmr	
Profile bearing length 2	-	Wmr2	
Profile section level separation	-	Wδc	
	-		

Note 1) The JIS'82, JIS'94, JIS'01, ISO'97, ISO'84, ASME'95 and DIN'90 standards provide different parameter symbols but have the same set range of judgment upper boundaries and lower boundaries.

Note 2) The above calculation parameter name is for measurement of filtered center line waviness.
For the calculation parameter name of filtered waviness, refer to Chapter 15 information “Parameter list”.

Note 3) Wsk, Wku, W q, Wmr, Wmr2 and W c are available only when JIS'01 and ISO'97 are used.

<Measurement of rolling circle waviness>

Calculation parameter	Rolling circle waviness parameter	Center line waviness parameter of rolling circle	Judgment upper limit value/lower limit value
Center line mean value	WE-a	-	0.000 μ m ~ 4000.000 μ m (0000.0 μ " ~ 157480 μ ")
Rolling circle filtered waviness	-	WEA	
Root mean square value	WE-q	WEC-q	
Rolling circle maximum waviness	WEM	-	
Maximum height	-	WEC-m,t	
Maximum peak height	WE-p	WEC-p	
Maximum valley depth	WE-v	WEC-v	
Mean spacing of profile irregularities	WE-Sm	WEC-Sm	0.000mm ~ 400.000mm (0.0000" ~ 15.7480")

Note) The JIS'82, JIS'94 and JIS'01 standards provide different parameter symbols but have the same set range of judgment upper boundaries and lower boundaries.

<Tilt Angle calculation>

Sets the conditions of tilt angle parameters (Tilt A).

1. Calculation unit of tilt angle

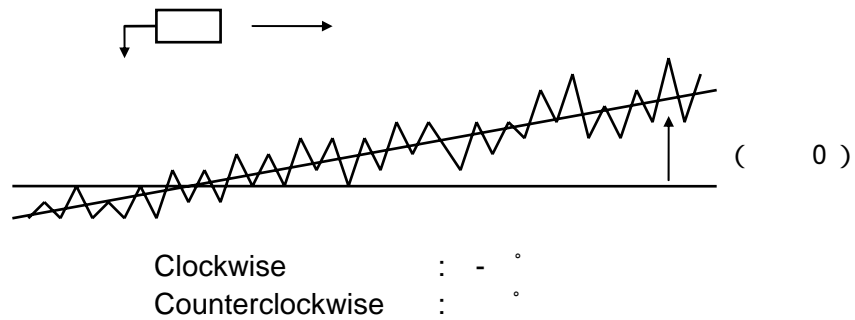
Degree
D.M.S

2. Polarity of tilt angle calculation

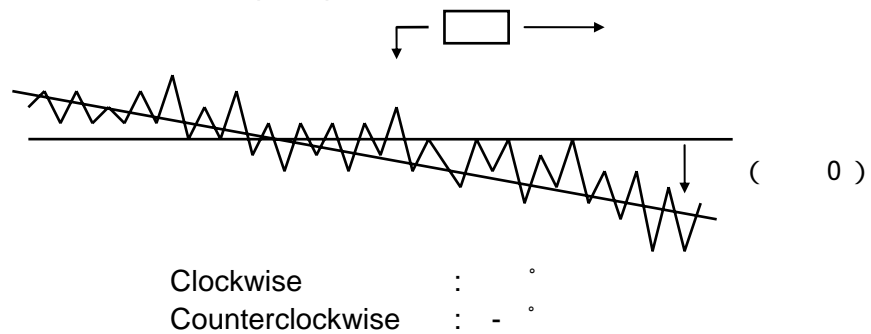
C.W.
C.C.W.

* According to the setting of polarity of tilt angle calculation, the Tilt A value is displayed ranging from -90° to $+90^{\circ}$.

- i) When the detection value of measurement surface is increasing against the trace direction of the pickup;



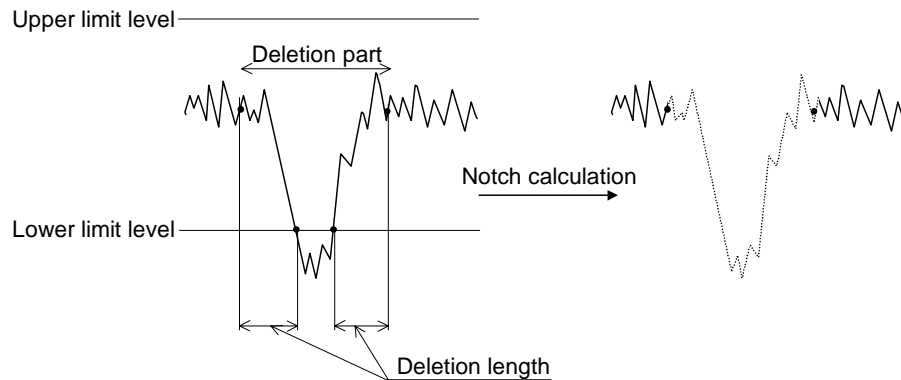
- ii) When the detection value of measurement surface is decreasing against the trace direction of the pickup;



<Notch Calculation>

When a flawed workpiece is to be measured, 'Notch Calculation' can be carried out by setting the upper and lower limit levels for the discrimination of its roughness, waviness, flaws and dust from each other and by removing values exceeding the levels to calculate various types of parameters.

In the execution item, select "ON" to perform the notch calculation or select "OFF" not to perform the calculation.



Input Range

The input range is as shown below.

<Deletion length>

Millimeter unit	Integer in units of 1 μm ranging from 0 to 9999 (μm)
Inch unit	Real number in units of 0.00001" ranging from 0 to 3.93670 (")

<Upper limit level and lower limit level>

Millimeter unit	Real number in units of 0.001 μm ranging from -2000 to 2000 (μm)
Inch unit	Real number in units of 0.1 $\mu\text{"}$ ranging from -78740.0 to 78740.0 ($\mu\text{"}$)

<Partial Exclude>

In some case, a certain length is required to be removed from the start point and end point to evaluate measured data. "Partial Exclude" function is convenient in such a case.

Set the conditions for Partial Exclude process.

In the execution item, select "ON" to delete wave part or select "OFF" not to delete.

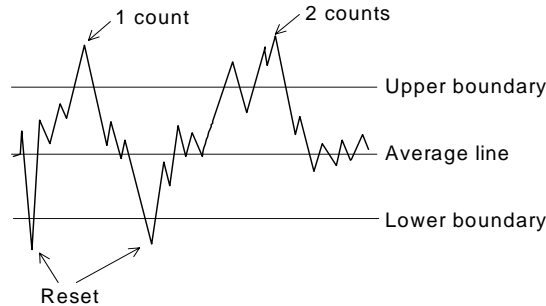
Input range

The allowable input range is 1200 mm (47.244") at each of the right and left ends.

In the actual measurement or re-calculation, however, an error will occur and measurement and re-calculation cannot be done if the sum of values at the right and left ends exceeds the evaluation length.

<Peak Count Level>

Peak count is one of the parameters for evaluation of surface roughness. An upper boundary/lower boundary is set to measure the total count (number of peaks) by counting as one (1 peak) each time the profile curve goes over the upper boundary after the lower boundary.



Set the upper and lower judgment values of peak count level. The judgment value is given in deviation from the average line (line of 0 height in the record on roughness curve).

Input range

The input range is as shown below.

<Upper boundary>

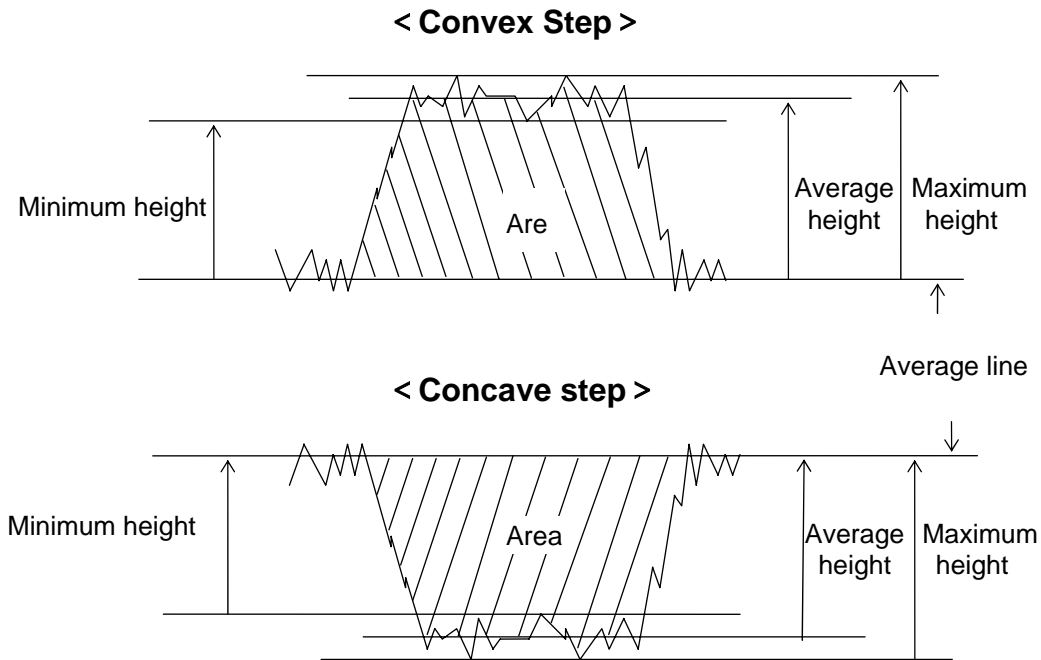
Millimeter unit	Real number with the 3rd decimal place, ranging from -2000.000 to $2000.000 \mu\text{m}$ (*.*** μm)
Inch unit	Real number with 1st decimal place, ranging from -78740.0 to $78740.0 \mu''$

<Lower boundary>

Millimeter unit	Real number with the 3rd decimal place, ranging from -200.0000 to $2000.000 \mu\text{m}$ (*.*** μm)
Inch unit	Real number with 1st decimal place, ranging from -78740.0 to $78740.0 \mu''$

<Step Height Calculation>

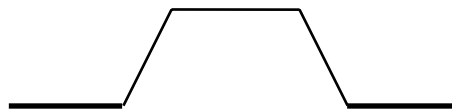
The calculation of step height can calculate average height, maximum height, minimum height and area of a workpiece having a step as shown in the drawing below.



- * Before performing the step height calculation, set begin-end compensation, begin half compensation or end half compensation for tilt compensation on the measurement condition setting screen.
- * This section describes the step height of convex part. The step height calculation of concave part is made in the same way.

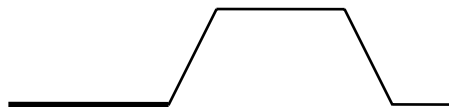
Example)

Begin-end compensation



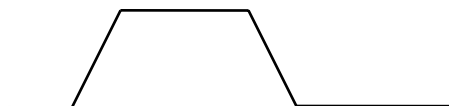
Set flat parts at both ends.

Begin half compensation



Is used to specify the 1st half as a reference surface.

End half compensation



Is used to specify the 2nd half as a reference surface.

Input Range

The input range is as shown below.

<Reference height>

Millimeter unit	- 4000.000 to 4000.000 (μ m)
Inch unit	- 0.15748 to 0.15748 (")

<Deletion length>

Millimeter unit	0.00 to 9999 (μ m)
Inch unit	0.0 to 0.39367 (")

<Area calculation length>

Millimeter unit	0.00 to 9999 (μ m)
Inch unit	0.0 to 0.39367 (")

- * When values bigger than 0 are set to the reference height, convex type step difference is evaluated. When minus values are set to the one, concave type step difference is evaluated.

According to the above setting values, the step height parameters are calculated as follow.

- A. Compensates the tilt according to the indication of the tilt compensation of the measurement condition. (See Figure 1.)
- B. Retrieves parts higher than the reference height (lower part in case of a concave step) and removes the deletion length. The range thus obtained is specified as a calculation range for average height, maximum height and minimum height. (See Figure 2,3.)
- C. Specifies the range extended from the reference height position forward and backward for the length of area calculation length as a step area calculation range. (See Figure 4.)
- D. In the above calculation range, parameters are calculated with the following specifications.

$$A V H = \frac{1}{k} \times \sum_{i=1}^k Z_i$$

Z_i : All data in the range of average height calculation
 k : Number of data pieces in the average height calculation
 H_{max} = Maximum value in the average height calculation range of step height
 H_{min} = Minimum value in the average height calculation range of step height

$$A R E A = P \times \sum_{i=1}^k Z_i$$

Z_i : All data in the area calculation range
 P : Sampling pitch
 k : Number of data pieces in the area calculation range

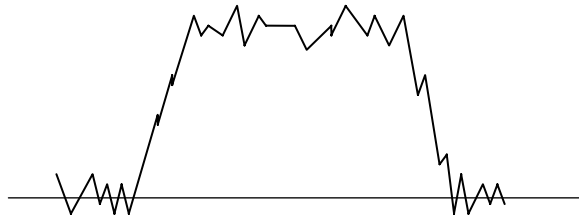


Figure 1 Measurement data after tilt compensation

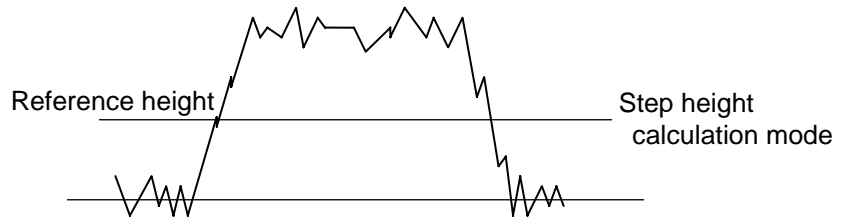


Figure 2 Retrieval of step part

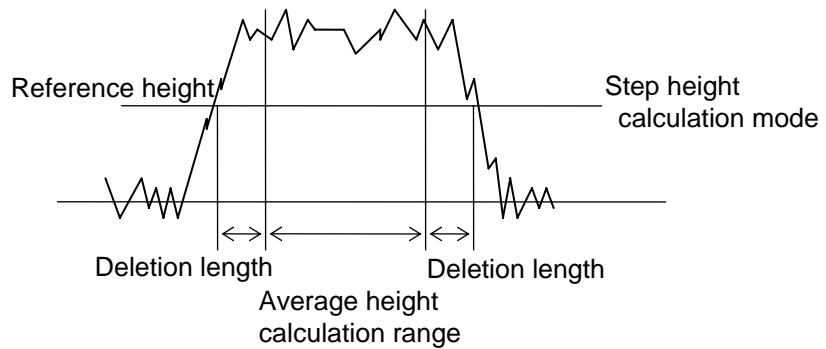


Figure 3 Average height calculation range

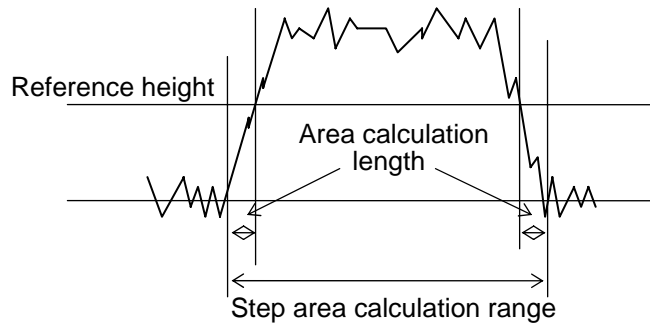


Figure 4 Area calculation

<Bearing length ratio graph calculation>

This equipment is available for calculation of load curve, parameter “load length factor: Rmr”, “Relative load length factor: Rmr2” and “Cut-off level difference: R_c”.

* For the details of calculating method, refer to the parameter description.

Conditions of calculating load length factor

- Set the unit of cut level. The set items are mentioned below.

Relative
Absolute
Mean Line

- Designate the calculation method of load curve. The set items are mentioned below.

E. Length
DIN4776
Absolute
Relative
C. U. envelop

(Note 1) For the details of each calculation method, refer to “SURFCOM SERIES PARAMETER DESCRIPTION”.

(Note 2) The calculation methods which can be designated depending on calculation standards and measurement types are limited as follows.

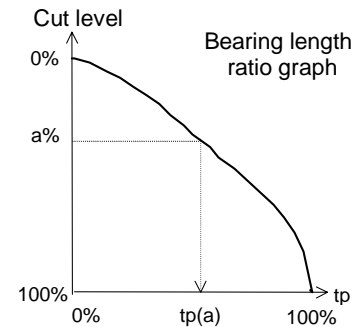
1. Any method other than envelope wave curve method is available:
Roughness measurement of JIS'94 & ISO'84 standards
2. Evaluation length method and DIN 4776 method only are available:
Profile and roughness measurement of JIS'82 standard
Roughness measurement of DIN'90 and ASEME'95 standards
Measurement of profile, roughness and filtered center line waviness of JIS'01 and ISO'97 standards
3. Envelope wave curve method only is available:
Profile measurement with motif calculation ON, when ISO'01 and ISO'97 are used

- Designate the output system of load length factor. The items to be selected are mentioned below.

Indivi.
Diff.

Bearing length ratio: tp (*) or Rmr (*)

Indicates the bearing length ratio "tp(a)" when arbitrary cut level "a" is specified with the reference parameter of the bearing length ratio graph. The cut level can be specified with one of the three methods: relative specification, absolute specification, and absolute specification of the mean line reference.



The method of evaluation length adopts Rmr.

- * One of the under-said is printed as a symbol, representing its specification method in the printout of cut level.

For relative specification : (No printing)
 For absolute specification : P
 For absolute specification of mean line reference : B

Input range

The input range is as follows.

<Specifying absolute cut level>

Millimeter unit	Real number with the 3rd decimal place, ranging from 0 to 4000.000 (μ m)
Inch unit	Real number with the 2nd decimal place, ranging from 0 to 157480.00 (μ ")

<Specifying relative cut level>

Real number with the 2nd decimal place, ranging from 0.00 to 99.99%

<Cut level for Mean Line Reference • Absolute Specification>

Millimeter unit	Real number with the 3rd decimal place, range from -4000.000 to 4000.000 (μ m)
Inch unit	Real number with the 2nd decimal place, range from -157480.00 to 157480.00 (μ ")

<Judgment upper/lower limit value>

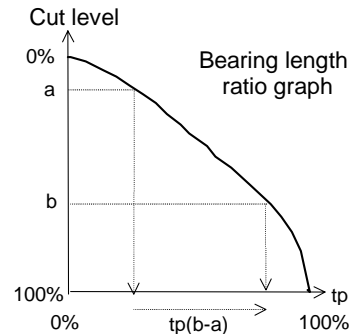
Real number with the 2nd decimal place, ranging from 0.00 to 99.99%

Difference in bearing length: tp (*-*) or Rmr (*-*)

The basic calculation is the same as that of "bearing length ratio: tp". As a "difference of reference values", the output method is used to display the difference between two bearing length ratios. When the bearing length ratios of cut levels "a" and "b" are specified to be "tp (a)" and "tp (b)", the following formula can be obtained.

$$tp(b-a)=tp(b)-tp(a)$$

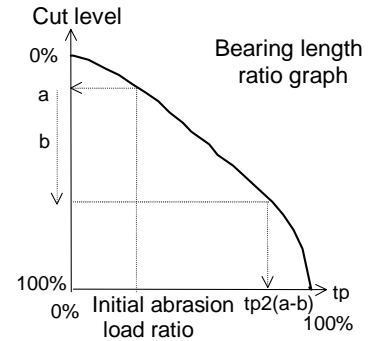
The cut level can be specified with either of the following three methods: relative specification, absolute specification, and absolute specification of the mean line reference.



- * Entry of "0" into both upper and lower boundaries does not judge acceptance/nonacceptance.
- * Selection of "absolute specification" for bearing length unit changes the cut level unit on the screen to (μ m/ μ inch).
- * Selection of JIS'01/JIS'94/ISO'97/ISO'84/ASME'95/DIN'90 for the calculation standard with "evaluation length" selected for the bearing length ratio graph calculation system changes the name of bearing length ratio to 'Rmr'. (Refer to Chapter 15 information "Parameter list".)
- * For the standards JIS'01 and ISO'97, the curves are called as follows by the sampled curve.
Profile curve: Pmr, Roughness curve: Rmr, Waviness curve: Wmr

Relative load length factor : tp 2 (*-*) or Rmr 2 (*-*)

Any bearing length ratio is set at first as an initial abrasion bearing ratio. Cut level "a" corresponding to the initial abrasion bearing ratio is used as the reference to express the bearing length ratio corresponding to cut level "b" specified from the point as bearing length ratio 2 "tp2(a-b)". The cut level can be specified with one of the following methods: relative specification and absolute specification.



Input range

The input range is as follows.

<Initial abrasion bearing ratio>, <Cut level - relative specification>,
 <Judgment upper/lower boundary of initial abrasion bearing ratio - relative specification>,
 <Judgment upper/lower boundary of relative load length factor>

Real number with 2nd decimal position, ranging from 0.00 to 99.99%

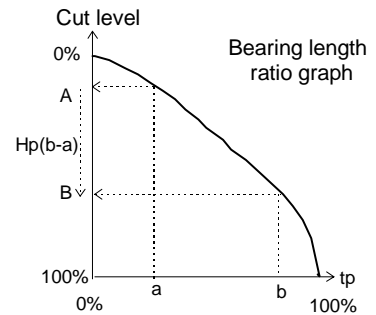
<Cut level - absolute specification>
 <Judgment upper/lower boundary of initial abrasion bearing ratio - relative specification>,

Millimeter unit	Real number with the 3rd decimal place, ranging from 0 to 4000.000 (μ m)
Inch unit	Real number with the 2nd decimal place, ranging from 0 to 157480.00 (μ ")

- * Entry of "0" into both upper and lower boundaries does not judge acceptance/nonacceptance.
- * Selection of "absolute specification" for bearing length unit changes the cut level unit on the screen and the unit of initial abrasion bearing ratio to (μ m / μ inch).
- * Selection of JIS'01/JIS'94/ISO'97/ISO'84/ASME'95/DIN'90 for the calculation standard with "evaluation length" selected for the bearing length ratio graph calculation system changes the name of bearing length ratio to 'Rmr2'. (Refer to Chapter 15 information "Parameter list".)
- * For the standards JIS'01 and ISO'97, the curves are called as follows by the sampled curve.
 Profile curve: Pmr2, Roughness curve: Rmr2, Waviness curve: Wmr2

Cut level difference : Hp (*-*)

Arbitrary bearing length ratio "a" is specified at first. The cut level at that time is specified to be "A". When the cut level with bearing length ratio "b" is specified to be "B", the cut level difference is expressed with **Hp (b.a) = B.A**, a difference between the two cut levels. The cut level difference is always expressed with the absolute indication ($\mu\text{m}/\mu\text{inch}$).



Input range

The input range is as follows.

<Bearing length ratio>

Real number with 2nd decimal position, ranging from 0.00 to 99.99%

<Judgment upper boundary, judgment lower boundary>,

Millimeter unit	Real number with the 3 rd decimal place, ranging from 0 to 4000.000 (μm)
Inch unit	Real number with the 2nd decimal place, ranging from 0 to 157480.00 (μinch)

- * Entry of "0" into both upper and lower boundaries does not judge acceptance/nonacceptance.
- * Selection of JIS'01/JIS'94/ISO'97/ISO'84/ASME'95/DIN'90 for the calculation standard changes the name of plateau ratio to 'R_c'.
- * For the standards JIS'01 and ISO'97, the curves are called as follows by the sampled curve.
Profile curve: P_c, Roughness curve: R_c, Waviness curve: W_c

<Motif Calculation>

The motif calculation is an evaluation method which has been used in the French automobile industry. It becomes effective only when the “Profile measurement” is selected. For further information, please refer to the 「Application guide manual for surface roughness & waviness parameters」.

In the ‘Execute’ items, select “ON” or “OFF” of the motif calculation.

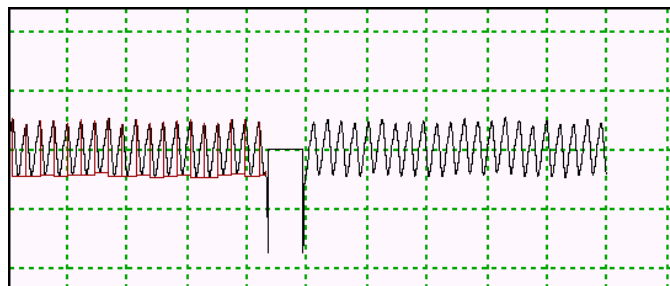
Roughness motif, waviness motif upper limit length

The choice of the length changes as follows.

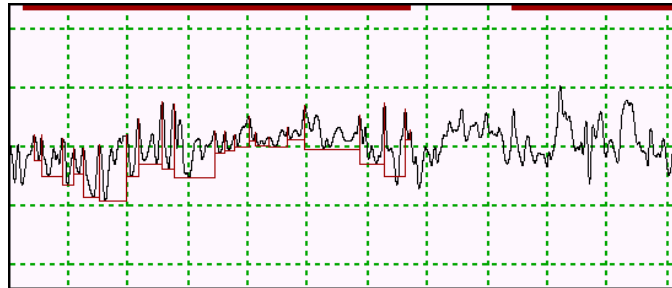
Roughness motifs Upper limit length	Unit / mm	0.02	0.1	0.5	2.5
	Unit / inch	0.0008	0.004	0.02	0.1
Waviness motifs Upper limit length	Unit / mm	0.1	0.5	2.5	12.5
	Unit / inch	0.004	0.02	0.1	0.5

* Set them to become as Roughness motifs upper limit length < Waviness motifs upper limit length.

Note) • When the notch processing was executed, the motif calculation is performed on the profile just before the first notch part only. But in case of executing “Connection of Curve”, the motif calculation is performed on the whole profile after the connection.



- When the plural evaluation range are set, the motif calculation is performed on the first evaluation range only. But in case of executing “Connection of Curve”, the motif calculation is performed on the whole profile after the connection.



Combined display

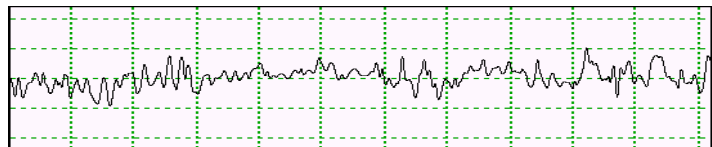
When this item is set “ON”, it becomes possible to display combined the Roughness motifs with the Profile curve or the Envelope line.

Each time the P--R button of the measurement result display is pressed, the profile curve is changed as follows.

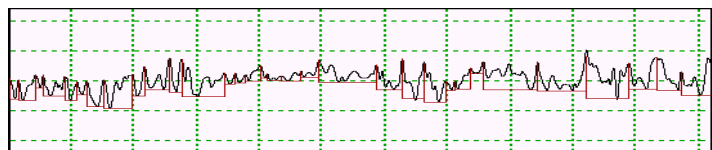
* The Calc. Range switch becomes effective only when the “Profile Curve ” is displayed.

When “ON” is selected:

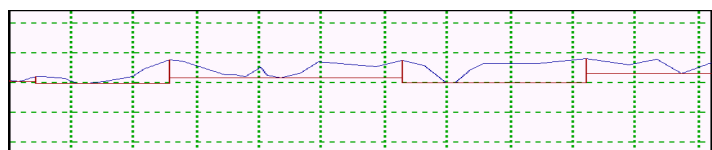
→ Profile curve



↓
Roughness motifs with profile curve

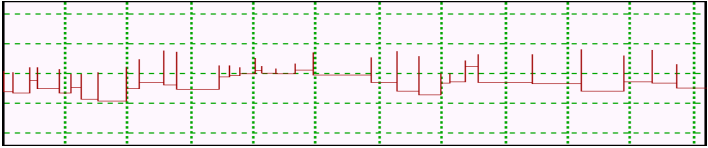
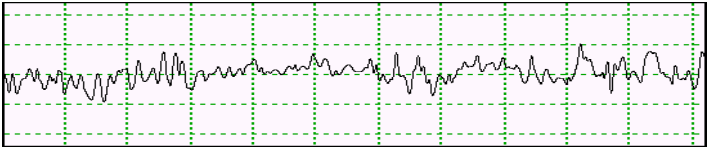


↓
Waviness motifs with upper envelope line



When "OFF" is selected:

→ Profile curve



Roughness motifs



Waviness motifs

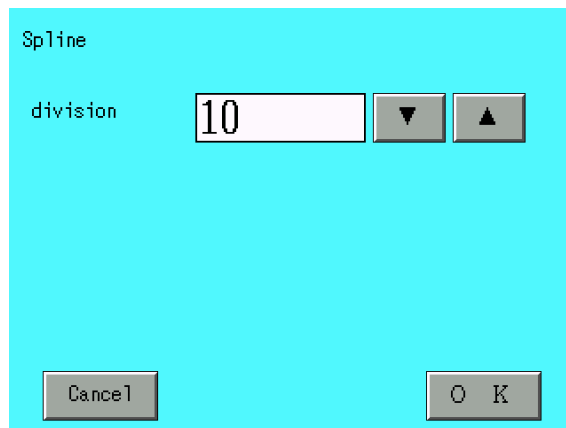


<Spline correction>

This equipment can set the number of division for correcting spline.

The number of division for spline correction to be set here is applied in correcting the spline. The whole evaluated length is equally divided by the set number of division so as to correct the spline.

For the details about calculation for spline correction, refer to the "Surfcom Series Parameter Description".



10, 20, 30, 40, 50, 60, 70, 80, 90, 100 can be set as the number of division.

As the number of division gets larger, small curve compositions remain in the curve data after correction of spline. Therefore, when more precise analysis is needed, application of larger number of division is recommended. (However, note that there is a possibility to delete some necessary curves.)

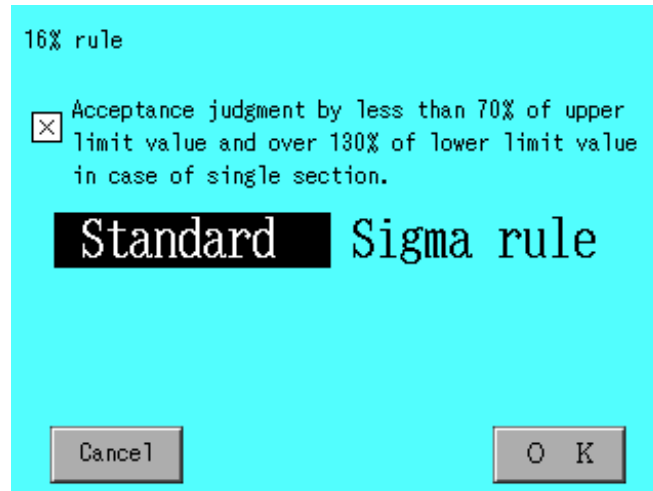
Since the effectiveness varies according to the curves in case of this process, it is necessary to previously confirm acquisition of proper effectiveness. The effectiveness is indicated below for reference, but it is important to calculate with a few numbers of division to find out the optimum value.

<Reference of effectiveness>

- Calculate the length of one divided section based on the number of division.
(Length of a section divided) = (Evaluated length) / (Number of division)
- Divide the profile curve when tilt correction is regarded as "no tilt correction", in order from the head by length of a section divided.
- II Suppose that the effectiveness is almost the same as the 3rd curve correction is performed in each section.

<16% rule >

This is a screen for executing detail setting in case of using 16% rule for a parameter judgment method.



There are two parameter judgment methods to decide whether to pass or fail by 16% rule which are “standard” and “Sigma rule”. Execute a judgment to decide whether to pass or fail with following method.

- 16% rule of Standard
Execute a judgment to decide whether to pass or fail by checking an each parameter is within a judgment lower boundary and judgment upper boundary. If a ratio of section parameter which is disqualification within all sections is under 16%, it is acceptable.
- 16% rule by Sigma rule
It is acceptable if a Ave.+Dev. is under a judgment upper boundary and a Ave.-Dev. is over a judgment lower boundary.

It is possible to judge a calculated single parameter (parameter without an existence of plural section and a parameter calculated from the evaluation length whole) as following below method.

- If “Acceptance judgment by less than 70% of upper limit value and over 130% of lower limit value in case of single section” is ON,
It is acceptable when a single calculated parameter is within a range under 70% of a judgment upper boundary and over 130% of a judgment lower boundary.

It can be described by formula as follows:

$$X = A - |A| \times 30\%$$

$$Y = B + |B| \times 30\%$$

A: judgment upper boundary (setting value)

B: judgment lower boundary (setting value)

X: Actual using of a judgment upper boundary, in case of making this formula effective.

Y: Actual using of a judgment lower boundary, in case of making this formula effective.

This formula can be on/off by pressing a check box.

x : ON - press a check box and switch to : OFF

: OFF - press a check box and switch to x : ON

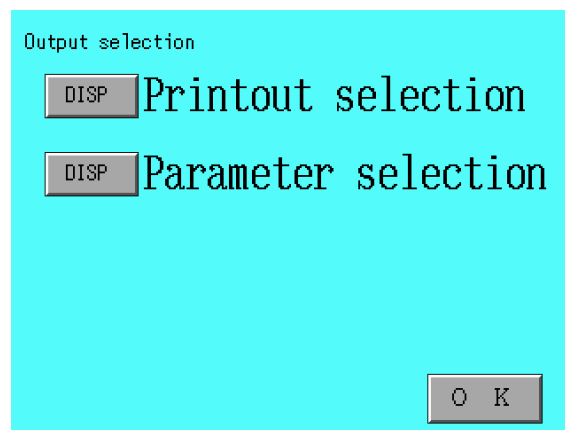
Setting output items

This section describes the setting of output items.

(1) Press the "Out put" icon on the menu screen.



The menu for setting of output items then appears.



(2) Select the item to be set.

<Printout selection>

Sets the items to be output to the printer (and data items to be output to an external personal computer etc., via RS-232C).

After measurement, the output contents can be changed effectively.

Setting items are as follows.

1. Comment 1	6. Operator	11. ADF (P,R,W)	16. Roughness Motifs
2. Serial No.	7. Meas. Condition	12. Power Graph (P,R,W)	17. Waviness Motifs
3. Work name	8. Calc. Condition	13. P-Curve	
4. Comment 2	9. Parameter(Section)	14. R-Curve	
5. Date/Time	10. BAC (P,R,W)	15. DIN4776-Curve	

* Items are printed out in order of numbers.

Both the "P-curve" and "R-curve" mean different curves depending on the measurement type. Refer to the following table.

Measurement type	P-curve	R-curve
Profile Measurement	Profile Curve	-
Roughness Measurement	Profile Curve	Roughness Curve
Filtered Waviness Measurement	Profile Curve	Filtered Waviness Curve
Filtered Center Line Waviness Measurement	Profile Curve	Filtered Waviness
Rolling Circle Waviness Measurement	Rolling Circle Waviness Profile Curve	Rolling Circle Waviness Curve

'DIN47776-Curve' can be selected only when the bearing length ratio graph calculation is specified to be 'DIN4776'.

"Roughness motifs" and "Waviness motifs" are selectable only when the motif calculation is set "ON".

In case of JIS'01 and ISO'97 standards, 'Section' switch appears on the left of 'Parameter' switch. If the 'Section' switch is selected, the section parameter appears after each parameter.

'Load curve' (P,R,W) and 'Amplitude distribution curve' (P,R,W) are displayed only for JIS'01 and ISO'97, and can be selected.

<Parameter selection>

Sets parameters to be calculated (output).

If this selection is changed after measurement, the parameter output to the measurement result screen and printer cannot be changed.

Data is to be output according to this setting with measurement taken. To change parameter outputs with data on previous measurement, select the parameter and then perform re-calculation.

Setting comments

This section describes comment setting.

(1) Press the "Comment" icon on the menu screen.



The comment setting menu then appears.

Press the **Shift** switch to switch uppercase/lowercase alphanumeric characters.

Press the **Next** switch to switch the setting item.

(2) Set the comment.

Set item and maximum number of characters

Comment 1	14 characters	Can be printed out.
Comment 2	10 characters	"
Serial NO	4 characters	"
Work Name	10 characters	"
Operator	10 characters	"
Data Name	4 characters	Is used for the file name to be stored.
Condition	4 characters	"

Serial No.

The serial No. is incremented (by +1) each time a measurement is taken.

The current set value is the serial No. of the data on next measurement.

A serial number consisting of up to 4 digits can be set. As shown below, numbers are given looped in set digits.

When 1-digit numbers (0 to 9) are set;

→ 0 1 2 3.....8 9

When 2-digit numbers (00 to 99) are set;

→ 00 01 02 03.....98 99

When 3-digit numbers (000 to 999) are set;

→ 000 001 002 003.....998 999

When 4-digit numbers (0000 to 9999) are set;

→ 0000 0001 0002 0003.....9998 9999

Measurement data and various conditions

The following characters are available.

- Alphanumeric characters in the 'alphanumeric' mode (uppercase characters and lowercase characters cannot be discriminated)
- Symbols

_	under line	^	Symbol for omitted word	\$	Dollar symbol
~	Waveform symbol	!	Explanation mark	#	Number symbol
%	Percent symbol	&	Ampersand	-	Hyphen
{ }	Braces	@	AT mark	'	Quotation marks
'	Apostrophe	()	Parentheses		

- * In items including measurement data and various types of conditions, only the allowable characters can be entered.
- * Measurement or Re-calculation is necessary to print out after changing comment. Please use Re-calculation, if you want to change comment only.

6 Taking Measurements

This chapter describes the procedure for measurements and printout.

Taking guidance measurements	6-2
Taking AI measurements	6-4
Taking automatic measurements	6-7
Displaying profile/setting printout magnification	6-10
Printing out measurement results	6-12

Taking guidance measurements

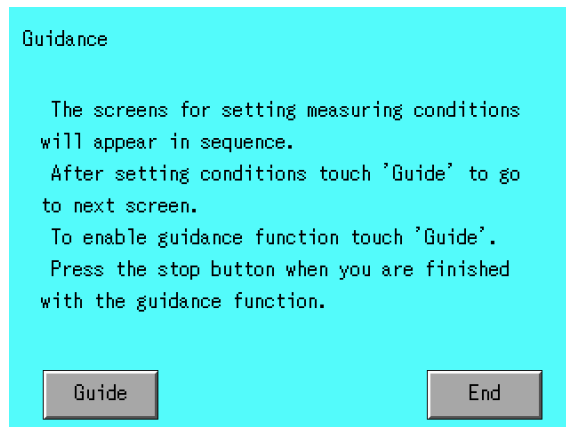
The guidance measurement is a function to guide a flow from setup of various types of conditions to measurement.

Setting conditions displayed in sequence on the screen can set minimum conditions necessary for measurement and can take measurements.

(1) Press the "Guidance" icon on the menu screen.



The guidance measurement screen appears.



(2) After having read the description on guidance measurement, press the **Guide** switch. Press **End** to return to the menu screen.

(3) Condition setting screens are displayed in the following order.

Measurement Type
Measurement Speed
Cutoff value
Evaluation length
Measurement Condition

- To stop the guidance measurement in the course, press the **STOP** switch to be used for stopping the operation of the tracing driver.

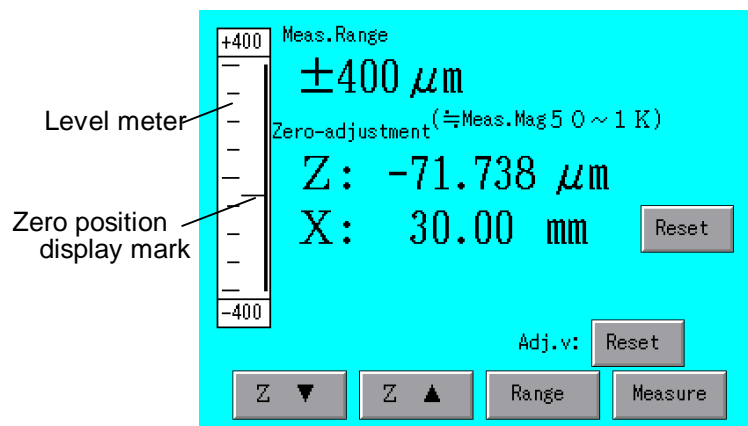
(4) Set conditions on each setting screen.

The setting procedure is the same as that for setting ordinary conditions. The switch functions are as given below.

Guide switch : Goes to the next screen.

Cancel switch : With respect to the set values on the screen, cancels changes in setting that have been made since this screen appeared.

(5) The measurement screen appears.



(6) With the **Range** switch, switch the measurement range, if necessary.

(7) Be sure the 'Zero position display mark' exists in the display range.

Unless the 'zero position display mark' exists in the display range, perform zero-adjustment and level adjustment.

(8) Press the **Measure** switch.

Measurement then starts. After the end of measurement, the results of measurement appear.

Other switches

OK : Returns to the menu screen.

STOP : Stops guidance measurement and then returns to the guidance screen.

Taking AI measurements

The AI measurement is a function of automatically setting the following measurement conditions to take measurements, using various types of standards (JIS, ISO, ASME, and DIN) as database*1, by entering the parameters specified on the workpiece drawing and the specified values.

1. Cutoff value
2. Evaluation length
3. Measurement speed
4. Filter type

The preliminary measurement is also taken to set the optimum value of measurement range.

*1 Database

The contents of Chapter 9, "SELECTION & EVALUATION METHOD OF CUOFF VALUE· SAMPLING LENGTH," in Parameter Description are used as the database.

- (1) Press the "AI func." icon on the menu screen.



The condition setting screen then appears.

A screenshot of the 'AI-Function' condition setting screen. The screen has a light blue background. At the top, it says 'AI-Function'. Below that, there is a switch for 'ON/OFF'. The 'ON' option is currently selected and is in white, while 'OFF' is in black. Underneath, there is a field for 'Parameter of target' with 'Ra' selected and two arrow buttons. Below that is a field for 'Indicated value of parameter' with '1.0.' entered and a unit of 'μm'. At the bottom, there are two rows of numeric buttons (0-9 and a decimal point), and three larger buttons: 'Cancel', 'BackSpace', and 'OK'.

- (2) To take AI measurements, press the "ON" switch to display the conditions in reverse video.

(3) Set the parameter for primary purpose.

The parameters are specified on the drawing. The following parameters can be selected.

Calculation standard	Measurement type	Parameter for primary purpose
JIS'82	Cross section measurement	Rmax, Rz
	Roughness measurement	Ra, Rmax, Rz
JIS'94	Cross section measurement	Rmax, Rz-J
	Roughness measurement	Ra, Ry, Rz, Sm, S, Rmax, Rz-J
JIS'01 / ISO'97	Cross section measurement	Pt, Rz-J
	Roughness measurement	Ra, Rz, RSm, Pt, Rz-J
ISO'84	Cross section measurement	Pt, Rz-J
	Roughness measurement	Pt, Rz-J, Ra, Ry, Rz, RSm, RS
ASME'95 DIN'90	Cross section measurement	Pt, Rz-J
	Roughness measurement	Pt, Rz-J, Ra, Rz, Rz-l, RSm, RS

(4) Set the value specified with parameter.

Set the value specified with the parameter for primary purpose, set in Item (3). RSm, Sm and S are given in "mm". Other parameters are given in "µm".

(5) Press the **MEASURE** switch.

Preliminary measurement is taken and measurement conditions are set in the AI calculation. Then this measurement is carried out.

- * The AI function is invalid in the guidance measurement, calibration and measurement support. This function is not available when the R tracing driver and circumference roughness tracing driver are connected.

Measurement conditions to be calculated

Measurement conditions to be calculated in the AI measurement differ depending on type of measurement conditions.

See the table below.

Measurement condition	Calculatable measurement type
Cutoff value and filter type	R
Evaluation length	P, R
Measurement speed	P, R
Measurement range	P, R, W

- P : Cross section measurement
- R : Roughness measurement
- W : Measurement of filtered waviness measurement, measurement of filtered center line waviness, and measurement of rolling circle waviness

Determining set values

- Cutoff value : Set the standard value listed in standards.
(Refer to Chapter 9 in Parameter Description.)
- Evaluation length : Set the standard value listed in standards.
(Refer to Chapter 9 in Parameter Description.)
- Measurement speed : Of the set cutoff values, set a center value in the range that can be selected.
- Measurement range : Set the measurement range in which the whole measurement profile is contained and whose resolution is the highest.

- * Measurement range is calculated in the range of preparatory measurement, so that the detection level may exceed the measuring range in the process of measurement when the measurement has a wider range and the workpiece has a large tilting. The workpiece should be set less tilted beforehand, using the measurement support function, etc.
- * Measurement speed and evaluation length have their limits depending on the tracing driver connected therewith. Thus, the setting value may not serve for the reference value of each standard.
- * AI mark is displayed on the right below of the screen, when AI function is working.



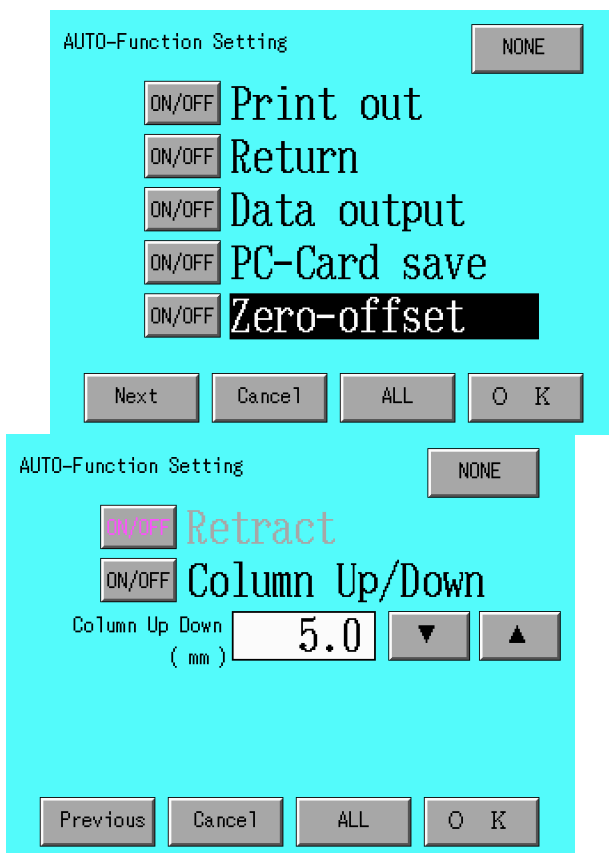
Taking automatic measurements

Set an item to be automatically operated with measurement taken.

- (1) Press the "Auto Set." icon on the menu screen.



The setting screen then appears.



- (2) Press the **ON/OFF** switch of the item to be automatically set to display it in reverse video.

Press the and switches to set the amount of column up/down.

- (3) Press the **OK** switch.

The menu screen reappears.

Automatic set items

<Print out>

Prints out the results of measurement after the end of measurement and calculation.

<Return>

After the end of measurement, the tracing driver operates to automatically return the pickup to the measurement start point.

Column Up/Down, if automatically set, is carried out after column UP.

<Data output>

After the end of measurement and calculation, the results of the measurement are output to an external personal computer via RS-232C.

<PC-Card save>

After the end of measurement and calculation, data on the measurement is stored in a PC card.

<Zero-offset>

At the measurement start point, zero-adjustment in software is to be carried out for the detection level to be set to zero.

<Retract>

Carries out the retract operation of the pickup before and after the measurement. (When the high magnification pickup is used)

<Column Up/Down>

Before the measurement starts, the column goes down to the zero level. After the end of measurement, the column goes up to the position specified for the amount of column u/down. The set range of column up/down is as follows.

Millimeter unit	0.1 ~ 999.9(mm)
Inch unit	0.004 ~ 39.366(")

* The automatic measurements are executed in the following order. However, only the set items are carried out.

MEASURE	Retract off	Column Down	Zero offset
(Measurement)	Retract ON	Column up	Return
(Calculation)	Printout	PC card save	Data output

If the **STOP** switch is pressed during automatic measurement or an error occurs, the processing after that is canceled.

Other switches

- : Displays the next item.
- : Selects all items.
- : Releases settings of all items.
- : With respect to the set value on the screen, cancels changes in setting that have been made since this screen was displayed.

- * At the time of calibration and measurement support, only “Return”, “Zero-offset” and “Column UP/Down” are valid.
- * At the time of recording of vibration, only “Zero-offset” and “Column Up/Down” are valid.

Displaying profile/setting printout magnification

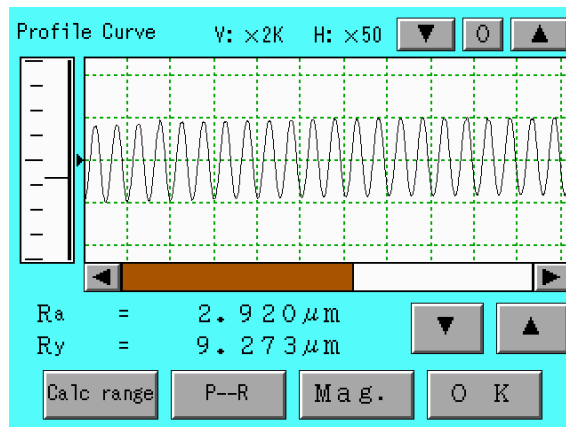
This machine can change the display magnification and display position after measurement. In addition, conditions can be set for re-calculation to change the evaluation range and tilt compensation range.

(1) Press the "Result" icon on the menu screen.



The measurement result display screen then appears.

(When the profile display is set to "ON" on the system condition setting screen)



<Setting range>

Is used for re-calculation.

For details on re-calculation, see Chapter 8.

<Switching profile>

Press the switch.

Profile curve is switched.

<Changing magnification>

Press the Mag. switch to switch the screen.

The profile curve is displayed and the printout magnification is set.

Vertical magnification		Horizontal magnification	
× 50	× 10K	× 1	× 200
× 100	× 20K	× 2	× 500
× 200	× 50K	× 5	× 1K
× 500	× 100K	× 10	× 2K
× 1K	× 200K	× 20	× 5K
× 2K	× 500K	× 50	AUTO
× 5K	AUTO	× 100	-

- * AUTO in vertical magnification
From the above magnifications, select the maximum magnification that allows the whole profile to be contained with the height of profile display frame.
- AUTO in horizontal magnification
From the above magnifications, select the maximum magnification that allows the whole length of profile record to be contained in 180 mm.
- * Vertical magnifications 200K and 500K are available only when the high magnification pickup is connected.

Other switches

, (Upper-right corner of the screen) : Inches a displayed profile upward and downward.

, (Lower-right corner of the screen) : Switches the calculated parameter.

, : Inches a displayed profile rightward and leftward.

Printing out measurement results

The measurement result of previous measurement is printed out as following.

Printout

Press the switch.

Items set in the 'Printout selection' is printed out.

Stopping operation in the course

Press the switch.

Printout operation stops.

- * When the following screen appears, pressing the switch makes the printer perform different operation.
"Memo paper screen" appears --- 'MEMO' is printed out.
- * Print-output is made by the contents set at the time of measurement or recalculation, such as comment, measurement condition, calculation condition, or parameter selection, etc. Thus, the change of setting after measurement or recalculation effects difference between the screen display and print-out.

- MEMO -

7 Using Measurement Results

This chapter describes how to use measurement results.

Profile curve and parameter value	7-2
Bearing length ratio graph and amplitude distribution curve	7-12
Power graph	7-14
Section parameter	7-16
Results of printout	7-18

Profile curve and parameter value

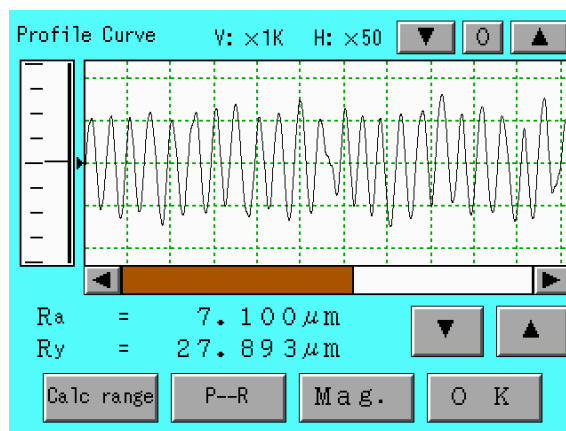
Following is the explanation of Profile curve and Parameter value.

(1) Press the "Result" icon on the menu screen.

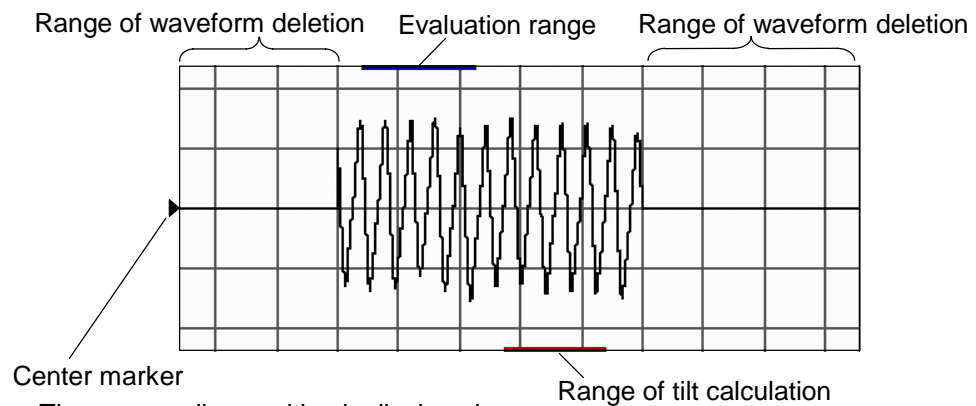


The measurement results then appear.

(When the profile display is set to "ON" on the system condition setting screen)



Screen for measurement results



The average line position is displayed.

This line, together with the profile, is moved with and .

The range of movement is +/- 2 scales.

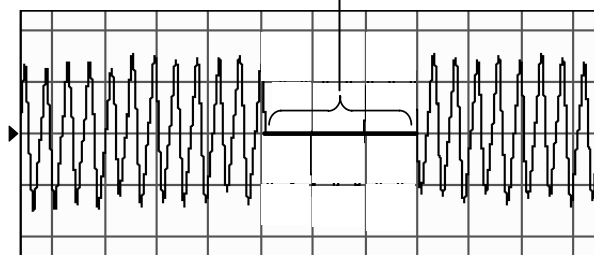
Press to move the profile downward.

Press to return the profile to the center.

Press to move the profile upward.

And the profile can be moved direct movement of center marker, too.

The notch range is set to 0.



Range of tilt calculation

Range for calculating the tilt compensation. This range can be set only for re-calculation.

The set range is automatically cleared when the next measurement is taken.

Evaluation range

Range for calculating parameter values. This range is calculated only for re-calculation.

The set range is automatically cleared when the next measurement is taken.

Range of waveform deletion (set with the "Calc. C." icon)

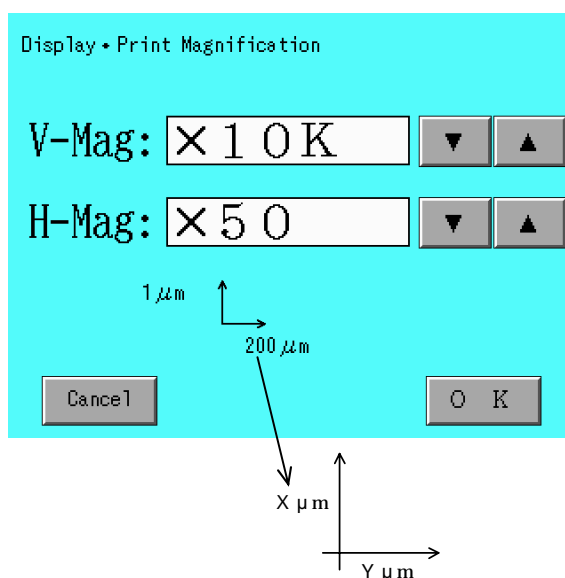
Range deleted with the wave part deletion specified. This range is not to be evaluated (range not to be used for the calculation of tilt compensation or for the calculation of parameter values).

Notch range (set with the "Calc. C." icon)

Range deleted with the notch compensation. This range is not to be evaluated.

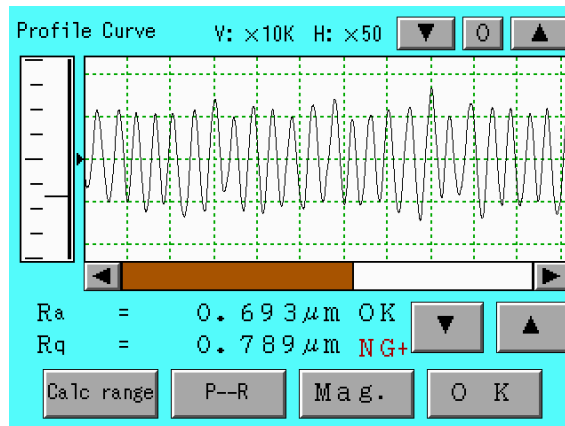
- * The value of a vertical/horizontal scale is displayed on the magnification setting screen.

Press the switch to display this screen.



Parameter value

When the profile display is set to 'ON'

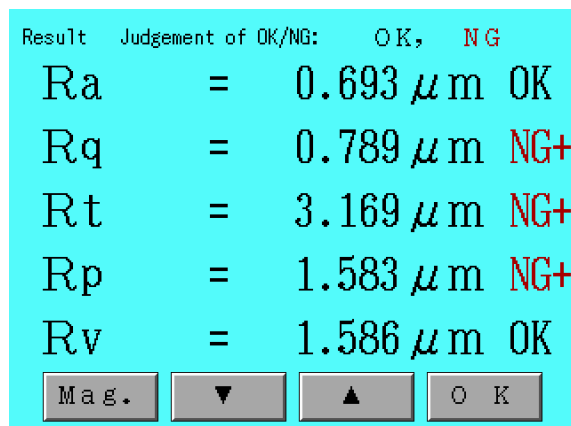


Rq = 0.789 μm NG+

└─ Displays the results of acceptance/nonacceptance.

When the profile display is set to 'OFF'

Larger characters are used to display parameter values only.



* Display of a judgment result

Display as below by following a judgment reference.

In case of judgment reference = Average

Display a judgment of OK/NG at side of a average parameter.

(Example) Ra = 2.345 μm NG+

Upper	Parameter	Lower	OK
Upper	<	Parameter	NG+
Lower	>	Parameter	NG-

Upper : Judgment upper boundary

Lower : Judgment lower boundary

Parameter : Parameter value

In case of judgment reference = Maximum
 Display a judgment of OK/NG at side of a maximum parameter.

(Example) $R_{max} = 2.456 \mu m$ OK
 Upper Maximum Lower OK
 Upper < Maximum NG+
 Lower > Maximum NG-

Maximum : Maximum value of all sections

In case of judgment reference = Minimum
 Display a judgment of OK/NG at side of a minimum parameter.

(Example) $R_{min} = 2.123 \mu m$ NG-
 Upper Minimum Lower OK
 Upper < Minimum NG+
 Lower > Minimum NG-

Minimum : Minimum value of all sections

In case of judgment reference = 16% rule
 (Detail setting of 16% rule = Standard)
 Display a judgment of OK/NG at side of each section parameter or average parameter.

(Example) $R_a = 2.345 \mu m$ NG End judgment result
 $R_a(1) 2.234 \mu m$
 $R_a(2) 2.456 \mu m$
 $R_a(3) 2.356 \mu m$
 $R_a(4) 2.354 \mu m$
 $R_a(5) 2.223 \mu m$ A judgment result of each section parameter

- Display of a side average parameter
 Number of NG / Number of all sections 16% OK
 Number of NG / Number of all sections > 16% NG
- Display of a side section parameter
 Upper Section parameter Lower
 Upper < Section parameter
 Lower > Section parameter

Section parameter : Section parameter value

In case of judgment reference = 16% rule
 (Detail setting of 16% rule = Sigma rule)
 Display a judgment of OK/NG at side of Ave.±Dev. parameter or average parameter. However if there is a setting of a judgment upper boundary, display it at side of Ave.+Dev. If there is a setting of judgment lower boundary, display it at side of Ave.-Dev.

(Example) Ra = 2.345 μ m NG+ End judgment result
 Ra+std = 2.456 μ m NG+
 Ra-std = 2.312 μ m OK

- Display of a side Ave.+Dev. parameter

Only if there is a setting of judgment upper boundary, execute a checking by a judgment upper boundary.

Upper	Ave.+Dev. parameter	OK
Upper <	Ave.+Dev. parameter	NG+

- Display of a side Ave.-Dev parameter

Only if there is a setting of judgment lower boundary, execute a checking by a judgment lower boundary.

Lower	Ave.-Dev. parameter	OK
Lower >	Ave.-Dev. parameter	NG-

- Display of a side average parameter

Execute an end judgment from upper and lower check result as above.

Upper boundary is OK	And also	Lower boundary is OK	OK
Upper boundary is NG+	And also	Lower boundary is OK	NG+
Upper boundary is OK	And also	Lower boundary is NG-	NG-
Upper boundary is NG+	And also	Lower boundary is NG-	NG±

Ave.±Dev. parameter : Average±Deviation parameter value

In case of judgment reference = Standard

Execute a judgment to decide whether to pass or fail by following a judgment reference (16% rule, average or maximum) which is fixed by the standard.

Refer to the "setting system condition" in Chapter 5 "setting conditions for Measurement" for a judgment reference by "calculation standards", "type of measurement", "calculate parameter".

Note 1: A judgment result (OK/NG etc.) is not displayed if a judgment is not executed (set "0" for both judgment upper boundary / judgment lower boundary).

Note 2: Use a standard deviation which is converted to 5 intervals as following the standard, if a number of interval is $1 < n < 5$.

Note 3: If an "Acceptance judgment by less than 70% of upper limit value and over 130% of lower limit value in case of single section" is ticked, it is acceptable if a calculated parameter of single section is within ranges which are under 70% of judgment upper boundary and over 130% of judgment lower boundary

(2) Press the switch.

The menu screen reappears.

- * When parameter values including tp (Rmr), tp2 (Rmr2) and HP (R_c) are displayed, 'Cut level' or 'bearing length ratio' is displayed following the symbol in the printout. On the measurement result screen, however, array numbers are displayed.

Example. Screen display : tp (0) = ---
 Printout : tp (0.100 μ m) = ---

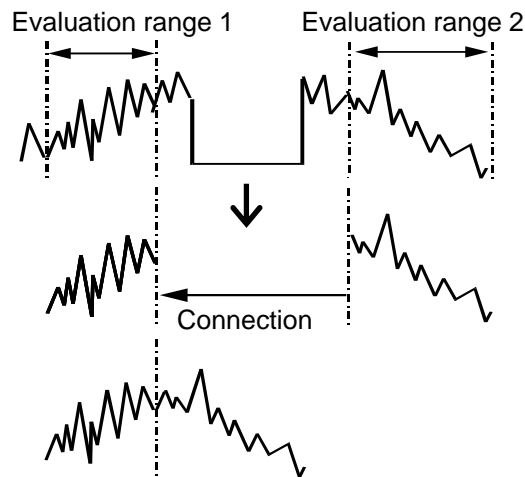
Connection of Curve

Plural numbers of data in the discontinuous evaluation range are made to be connected and data of unnecessary part are removed. This function becomes effective when the evaluation range becomes discontinuous and when it is recalculated after setting the evaluation range.

There are following two types of connection of the curve. "General connection" is effective for including a workpiece profile in a subject of evaluation and "An average line connection" is effective for the purpose of evaluating a workpiece surface.

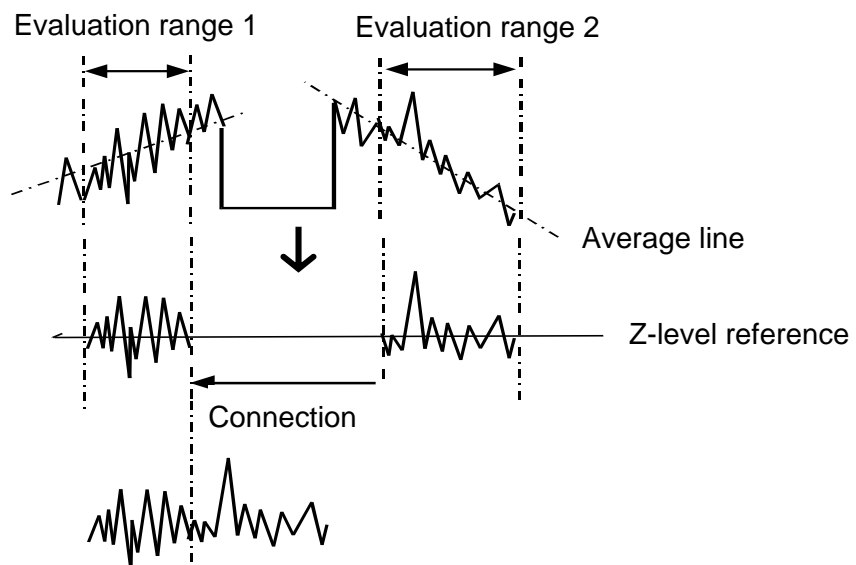
1. General connection

This is the way of connecting data by making move of the date in the specified range to X-direction.



2. An average line connection

This is the way of connecting data as Z-level reference by calculating the mean line in each specified range. Note further that the average line connection becomes effective when the evaluation range was set on two places or more.



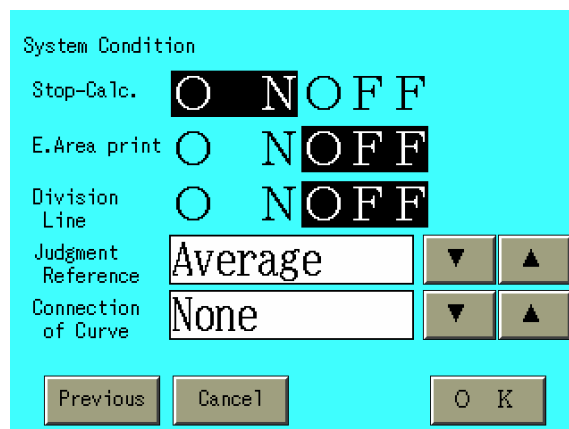
- * Neither average line calculation nor curve cut out shall be performed when no evaluation range was set. If the evaluation range was set only on one place, a curve in the set evaluation range shall be cut out and indicated but the average line calculation shall not be performed.

The procedure of 'connection of curve' is shown below.

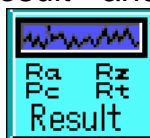
- (1) Press the "System C." icon on the main menu screen.



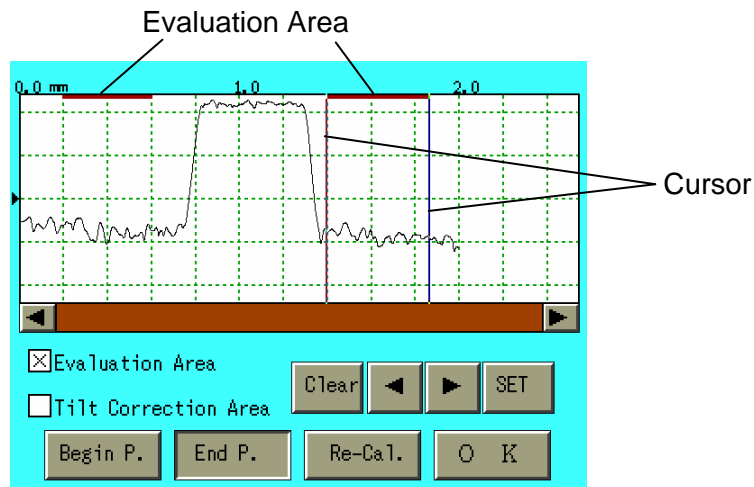
- (2) By pressing switch, set the connection of curve to "Normal" or "Mean Line" with switch, and press switch. Then it will be returned to the menu screen.



- (3) Press an icon of "Result" and display the curve profile.



(4) Press the **Calc range** switch.



(5) Press of an item of "Evaluation Area", and change it to become the mark of , then make setting of the range of curve portion which is necessary to be used next.

(6) Press the **Begin P.** switch, move cursor 1 with the and switches or by using the touch-pen, and then place the cursor at Begin P.

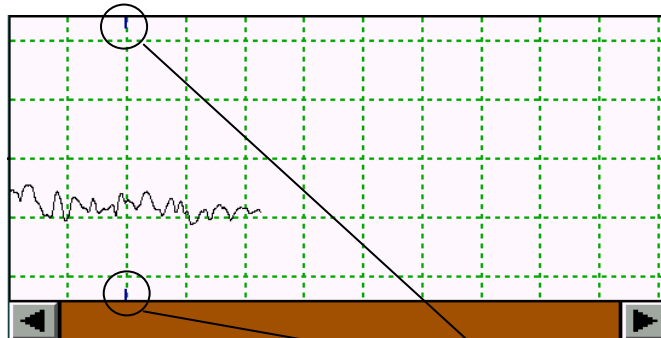
(7) Similarly, press the **End P.** switch, move cursor 2 with the and switches or by using the touch-pen, and then place the cursor at End P.

(8) Press the **SET** switch. The specified range is then set.

(9) Repeat from (6) to (8), and specify all the ranges.

(10) Press the **Re-Cal.** switch. Curves of the specified portions are connected.

the curve posterior to the connection



This markers indicate the boundary of the connection.

- * The part which exceeded a measuring range is removed and connected after that.

(11) Press the **OK** switch. The menu screen reappears.

- * By changing the type of filter (Gaussian/2RC[compensation] 2RC) at the same time, the evaluation range having been set is shifted to the reserved length in one side.

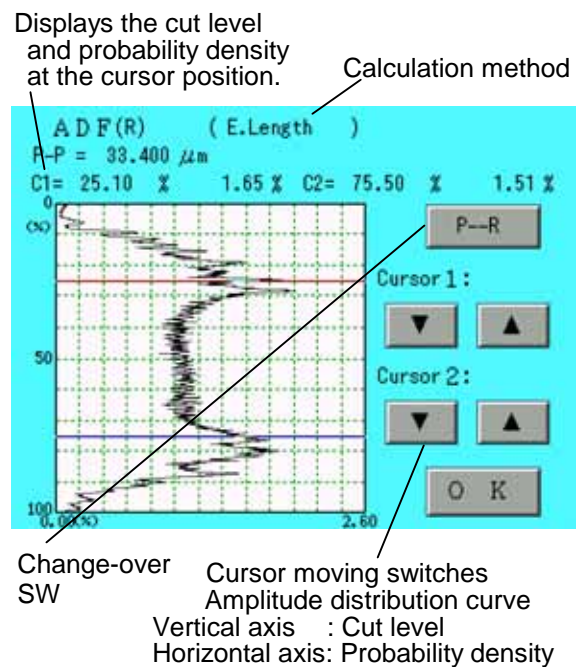
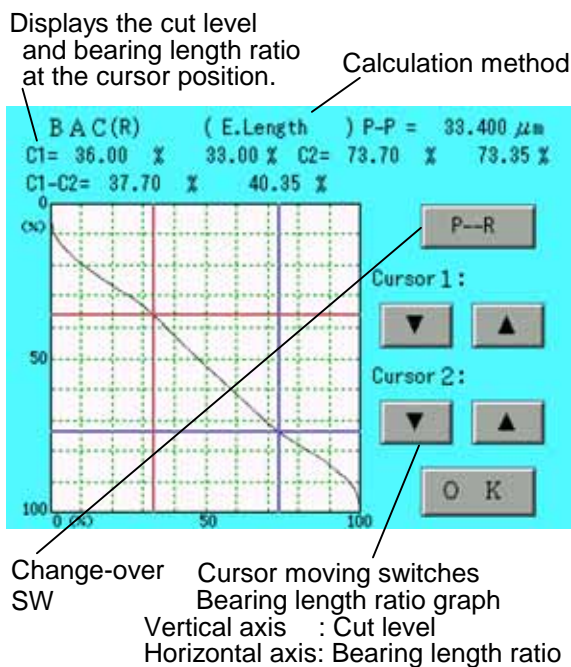
Bearing length ratio graph and amplitude distribution curve

This section describes the display of bearing length ratio curve and amplitude distribution curve.

(1) Press the following icons on the menu screen.



The screen for curve then appear.



Coordinate of point of intersection of cursor and curve

Displays the cut level, bearing length ratio or probability density at the intersection point of the cursor, bearing length ratio curve and amplitude distribution curve.

Moving the cursor

The cursor movement is divided into the following two types:

- 1) Movement with the switch (inching)
Press the cursor movement switches on the screen.
The cursor moves to a specified direction.
- 2) Movement with the touch-pen (coarse movement)
Press the inside of the graph with the touch-pen. A cursor then moves to the point.
The cursor nearest to the point is to move.

Difference between cursors 1 and 2

The bearing length ratio curve indicates the difference between cursors 1 and 2.

$$C1-C2 = * . * * * \% \quad \# . \# \# \# \%$$

The difference between cut levels is indicated with * . * * * and the difference between bearing length ratios is indicated with # . # # # . Absolute values are used for both of them.

Change-over switch

It is the switch with which it is displayed only at the time of JIS01 and ISO97.

It is used when changing the sampled curve of BAC and ADF.

When you check the present sampled curve, please refer to the title (P/R/W) at the upper left of a screen.

(2) Press the switch.

The menu screen then reappears.

Power graph

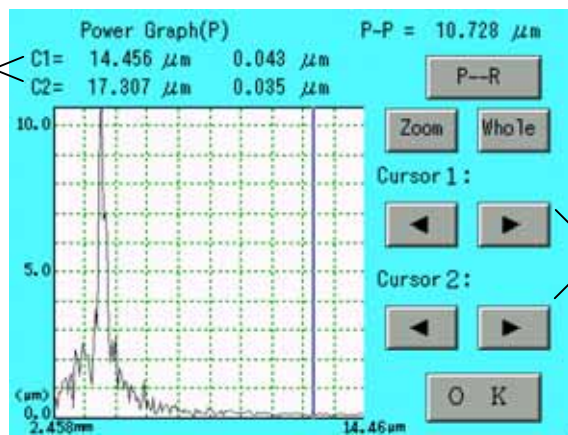
This section describes the display of power graph.

(1) Press the "Power G." icon on the menu screen.



A power graph then appears.

Wavelength and power (amplitude) at the cursor position



Cursor movement switches

Power graph
Vertical axis : Amplitude
Horizontal axis : Wavelength

Coordinate of point of intersection of the cursor and power graph

Displays the wavelength and power at the point of intersection of the cursor and the power graph.

Enlarged view of profile

Displayed an enlarged view of a portion between the two cursors.

1) Move the cursors to put a portion to be enlarged between cursors 1 and 2.

2) Press the **Zoom** switch.

An enlarged view of the specified portion then appears.

Moving the cursor

The cursor movement is divided into the following two types:

1) Movement with the switch (inching)

Press the cursor movement switches on the screen.

The cursor moves to a specified direction.

2) Movement with the touch-pen (coarse movement)

Press the inside of the graph with the touch-pen. A cursor then moves to the point.

The cursor nearest to the point is to move.

Change-over switch

This switch is used for changing the sampled curve in calculating a power graph.

For confirming the present sampled curve, refer to the power graph (P, R, W) in the left upper corner on the screen.

Other switches

Whole : Displays the whole graph.

(2) Press the OK switch.

The menu screen reappears.

Section parameter

Display of section parameter is described here.

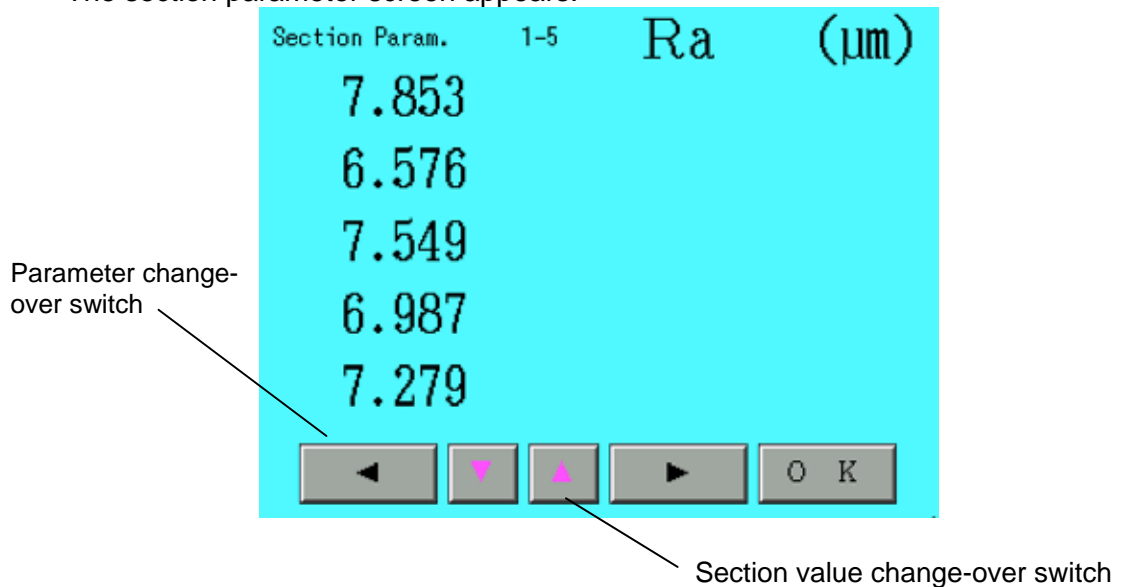
In this screen, the results of judgment under 16% rule can be confirmed.

(A judgment of each section parameter is not executed if a judgment is done by a sigma rule.)

(1) Press “Power graph” icon on the menu screen.



The section parameter screen appears.

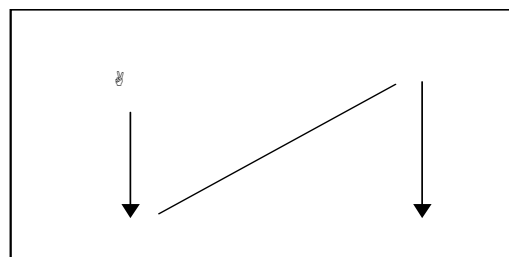


Order of display of section value parameter

This icon is available only when JIS'01 and ISO'97 standards are used.

On the section parameter screen, 10 section values are displayed in 2 files 5 ranks.

The values are displayed from the top as the following fig. shows.



Section value change-over switch

Ten section values before and after can be displayed by the section value change-over switch.

Parameter change-over switch

The parameter change-over switch can change the display to one of other parameter section value.

Symbol of OK/NG judgment

One of the following judgment results is displayed for every section value.

- OK : Acceptance
- NG+ : NG, due to excess over the upper limit
- NG- : NG, due to excess over the low limit

(2) Press the switch.

The menu screen reappears.

Result of printout

This section adopts an example to describe how to use results printed of measurements.

Items set on the print output item screen are printed out.

TOKYO SEIMITSU	Ver. 3.03	Header	When a user's logo is set, a simplified header is printed.
Surfcom 480A		Version No.	
Let's Measure		Comment 1	
No. = 16		Serial No.	
Work = TEST WORK		Workpiece name	
Comment = Sample		Comment 2	
Date = 26. Dec. 01		Date and time	Date and time of measurement has made.
Time = 09:53:36			
Operator = ACCRETECH		Name of measurement operator	
Roughness (ISO' 97)		Measurement condition	The measurement length is displayed even in the fix mode.
Eval.Length = 4.000mm		Parameter of measurement results (1)	Items set on the parameter selection screen are printed out.
M. Speed = 0.6mm/s		Results of acceptance/nonacceptance	
Cutoff value = 0.8mm		: Acceptance ,	
Cutoff = Gaussian		: NG because the value is larger than the judgment upper boundary.	
Meas. Range = ±400.0μm		: NG because the value is less than the judgment lower boundary.	
Tilt = Straight		: NG, under 16% rule	
C.F.R. = 300			
Ra = 1.208μm○			
Rz = 21.397μm▲			
*RSm = 79.255μm▼			

Calculation cannot be made in a reference length sector at least.
Or, convexity and concavity required for calculation are insufficient.

1 (Measurement conditions and calculation conditions)

The following items are printed out depending on the conditions.

Polarity : Printed out only in "Negative".

Pickup : Printed out when the high magnification detector is in use.

Notch deletion length

Notch upper limit

Notch lower limit

} Printed out only when the notch mode is selected.

Deletion length at left end

Deletion length at right end

} Printed out only when the waveform deletion mode is selected

Step reference height

Step deletion length

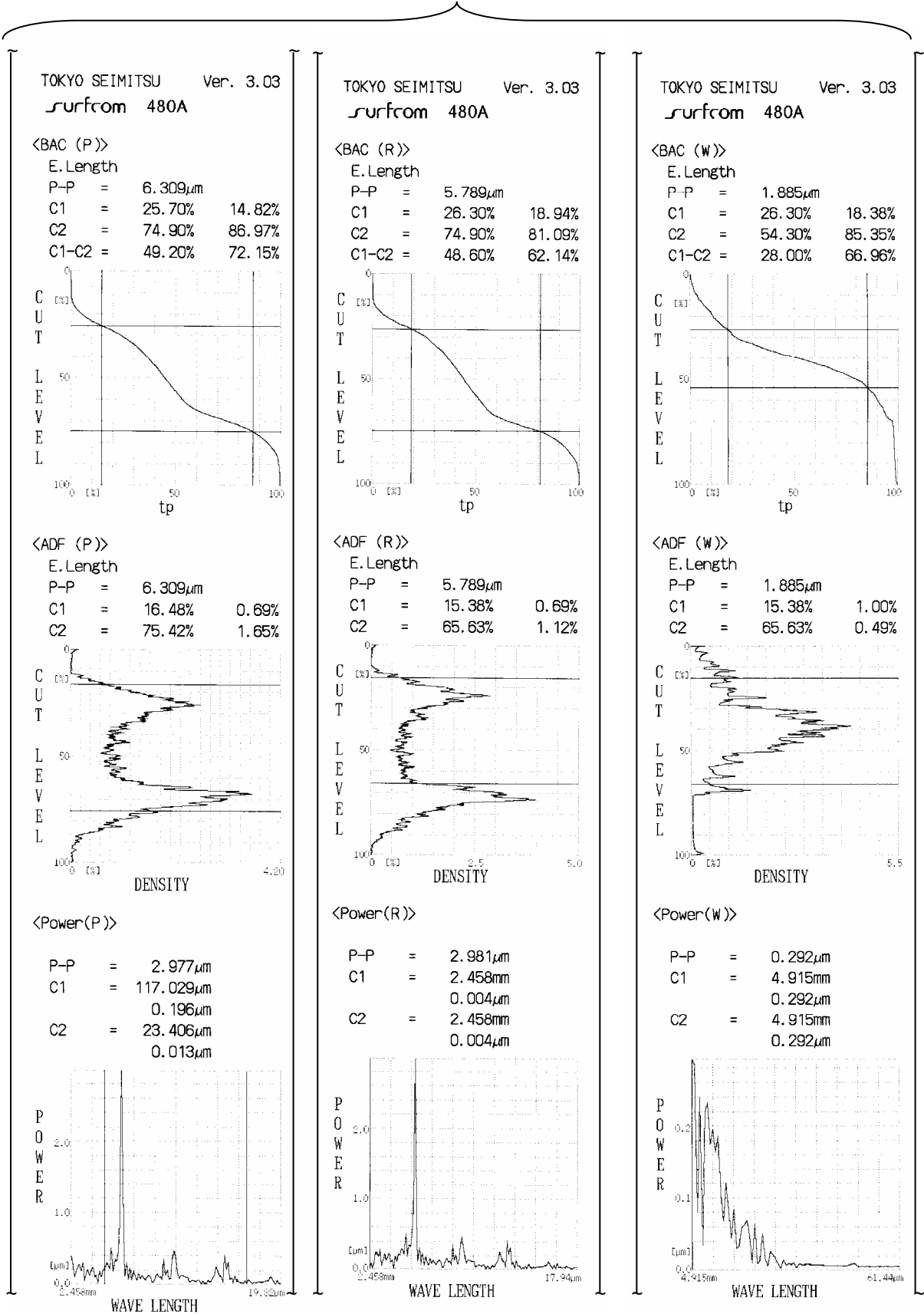
Step area length

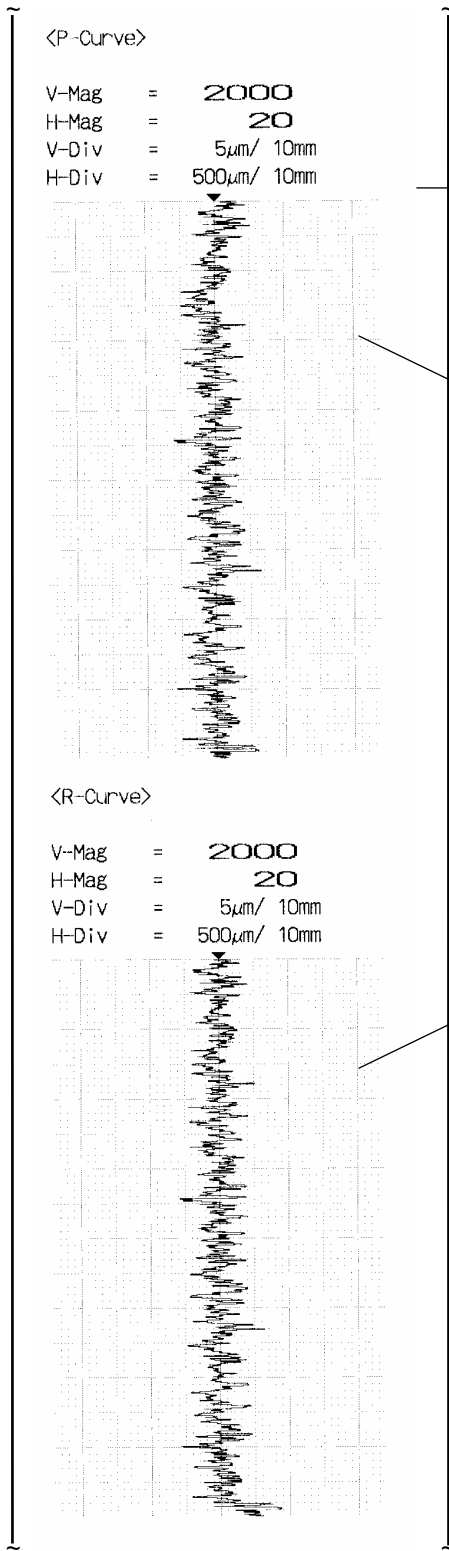
} Printed out only when the step height calculation mode is selected.

Roughness motifs upper limit length

Waviness motifs upper limit length

} These are printed only when the motif calculation is executed.



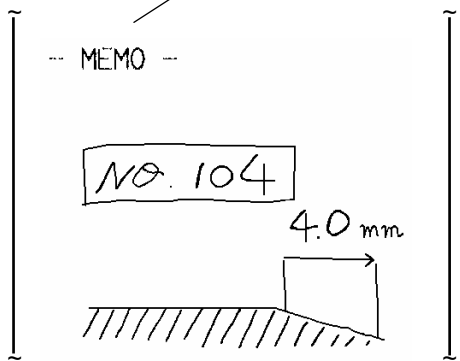


Zero position

Profile curve (P curve)
 Peak at the right side.

Roughness curve (R curve)

Memo pad



Printing average values
<Printing all data>

TOKYO SEIMITSU Ver. 3.03
Surfcom 480A

Date =26. Dec. 01
Time =10:55:22
Operator=ACCRETECH

No. =1

Ra = 1.232 μ m
Rz = 4.907 μ m
RSm = 79.243 μ m

Avg. (1)

Ra = 1.232 μ m
Rz = 4.907 μ m
RSm = 79.243 μ m

TOKYO SEIMITSU Ver. 3.03
Surfcom 480A

Date =26. Dec. 01
Time =10:55:53
Operator=ACCRETECH

No. =1

Ra = 1.232 μ m
Rz = 4.907 μ m
RSm = 79.243 μ m

No. =2

Ra = 1.237 μ m
Rz = 4.841 μ m
RSm = 79.095 μ m

Avg. (2)

Ra = 1.235 μ m
Rz = 4.874 μ m
RSm = 79.169 μ m

TOKYO SEIMITSU Ver. 3.03
Surfcom 480A

Date =26. Dec. 01
Time =10:56:29
Operator=ACCRETECH

No. =1

Ra = 1.232 μ m
Rz = 4.907 μ m
RSm = 79.243 μ m

No. =2

Ra = 1.237 μ m
Rz = 4.841 μ m
RSm = 79.095 μ m

No. =3

Ra = 1.240 μ m
Rz = 4.846 μ m
RSm = 79.267 μ m

Avg. (3)

Ra = 1.236 μ m
Rz = 4.865 μ m
RSm = 79.201 μ m

<Select print>

TOKYO SEIMITSU Ver. 3.03

Surfcom 480A

Date =26. Dec. 01

Time =11:10:06

Operator=ACCRETECH

No. =1

Ra = 1.273 μ m

Rz = 4.958 μ m

RSm = 79.109 μ m

No. =2

Ra = 1.276 μ m

Rz = 4.958 μ m

RSm = 79.149 μ m

No. =3

Ra = 1.277 μ m

Rz = 4.959 μ m

RSm = 79.136 μ m

Avg. (3)

Ra = 1.275 μ m

Rz = 4.958 μ m

RSm = 79.132 μ m

TOKYO SEIMITSU Ver. 3.03	
surfcom 480A	
Ra	= 0.048 μm ○
Ra-1	= 0.055 μm ○
Ra-2	= 0.080 μm ○
Ra-3	= 0.036 μm ○
Ra-4	= 0.036 μm ○
Ra-5	= 0.033 μm ○
Rz	= 0.462 μm ●
Rz-1	= 0.628 μm ▲
Rz-2	= 0.595 μm ▲
Rz-3	= 0.415 μm ▲
Rz-4	= 0.254 μm ▲
Rz-5	= 0.416 μm ▲
Rz.J	= 0.510 μm ▼
RSm	= 75.941 μm ●
RSm-1	= 115.500 μm ○
RSm-2	= 85.800 μm ▼
RSm-3	= 63.000 μm ▼
RSm-4	= 60.250 μm ▼
RSm-5	= 55.154 μm ▼

Parameter judgment results
The displayed is the results of parameter judgment under 16% rule.

Printing of section parameter

Section parameter

8 Using Convenient Functions

This chapter describes how to use convenient functions of this system.

Setting workpieces with measurement support function	8-2
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Restrict a part of operation	8-35

Setting workpieces with measurement support function

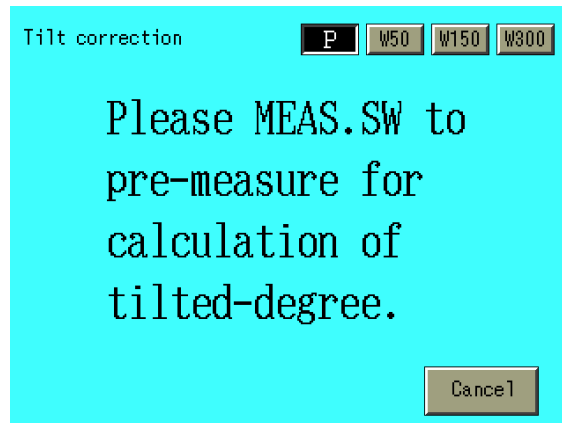
This function is used to set workpieces during preparation for measurement.
This function is available in the following cases.

1. When the 30 mm tracing driver or 50 mm tracing driver is connected.
 2. When the positioner is adopted in the system for using the column.
 3. When the workpiece moving type tracing driver (50mm, 150mm, 300mm) is connected.
- * This function is not available when the R surface tracing driver or circumference roughness tracing driver is not connected.
 - * Make a rough level adjustment prior to use of this function, so that detection level does not exceed the measurement range in the measurement stroke from the start to the end.

(1) Press the "Tilt. corr" icon on the menu screen.



The following screen then appears.



(2) Select the switch located in upper right side on the screen by the type of tracing driver to be used. (These switches are not displayed on the screen when the tracing driver for 30mm or 50mm is used.)

P : Usually select this switch when the tracing drivers except for the workpiece moving type tracing driver of 50mm, 150mm and 300mm are connected.

W50 : Select this switch when the workpiece moving type tracing driver of 50mm is connected.

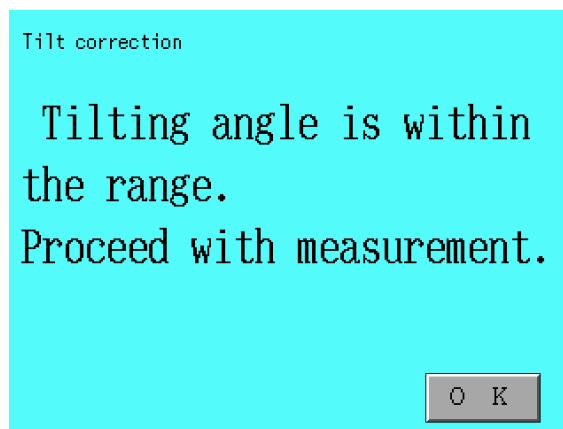
W150 : Select this switch when the workpiece moving type tracing driver of 150mm is connected.

W300 : Select this switch when the workpiece moving type tracing driver of 300mm is connected.

(3) Set a workpiece to be used for measurement, make preparations for measurement, and then press the MEASURE switch. Preliminary measurement is taken to calculate the tilt.

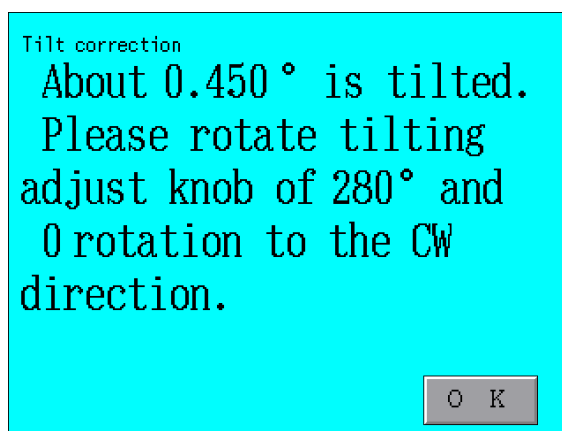
(4) Screens are displayed according to the calculated tilt.

A. When the tilt is less than 10° of the turn of the tilt adjustment knob in the tracing driver or positioner.



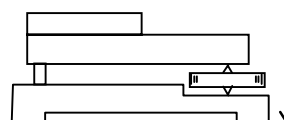
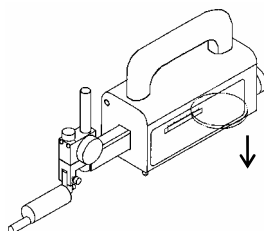
Adjustment is unnecessary when the above screen appears. When this is the case, continue with the measuring operation.

B. When the tilt is put within the adjustable range



When the above screen appears, take the following procedure for adjustment.

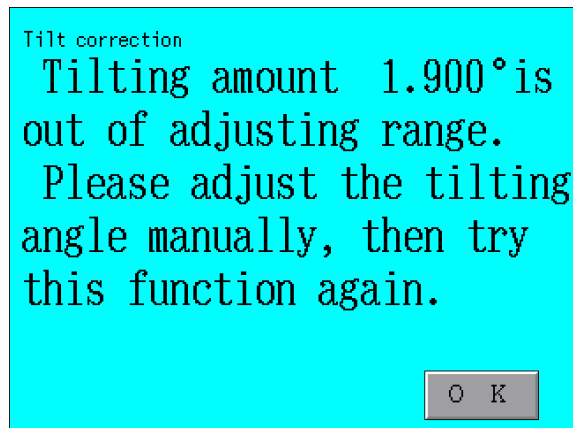
- 1) According to the message, rotate the tilt adjustment knob.
The 'tilt adjustment knob' means the following parts.
 - When the 30 mm tracing driver or 50 mm tracing driver is used.
: Tracing driver leveling knob installed in the tracing driver
 - Other cases : Leveling knob on the positionerWhen the knob is rotated clockwise;



The result is as given above.

- 2) Align the zero-point.
Rotating the tilt adjustment knob may cause the zero point to move, resulting in exceeding the measurement range. When this happens, align the zero-point to almost zero-position with the level meter in the main menu or on the measurement range screen, or with the upper or lower knob or with the zero-adjustment button.
- 3) Take measurements.

C. When the tilt is out of the adjustable range



When the above screen appears, make adjustments according to the following steps.

- 1) The tilt of the measured workpiece is too large. Prepare a jig etc., to put the tilt within the adjustable range and then adjust the tilt to $\pm 1.5^\circ$ ($\pm 1.0^\circ$ when the 30 mm tracing driver or 50 mm tracing driver is used, and $\pm 0.8^\circ$ when the 50mm, 150mm and 300mm workpiece moving type tracing drivers are used) against the reference surface of the tracing driver.
- 2) Execute this function again.

Repeat steps (1) and (2) until screen A or B appears. Afterwards, read the descriptive message displayed on the screen.

(5) Press the switch.

The menu screen reappears.

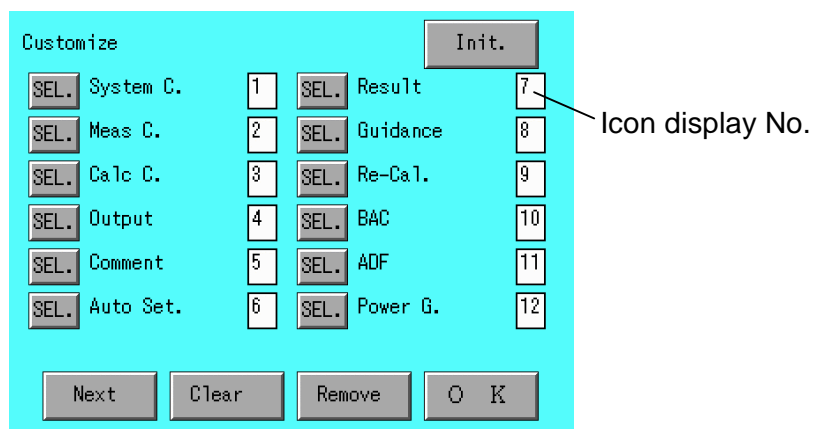
Customizing menu configuration

This function is available to select an icon to be displayed on the menu screen and to set display positions.

Press the "Custom." icon on the menu screen.

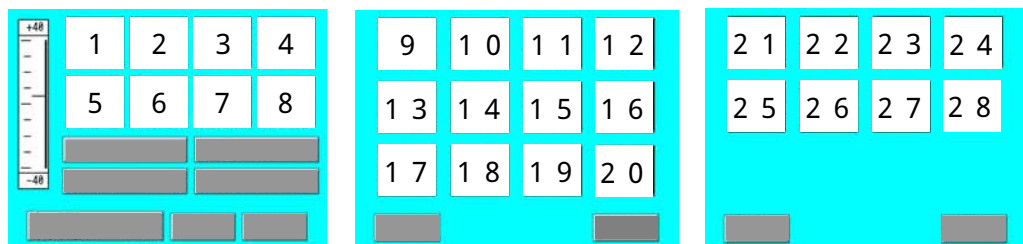


The following screen then appears.



Layout of icons

Layout of icons on the menu screen is set on the above screen. Icons are displayed in ascending order from icon display No.1 as follows.



- * When the number of icon display numbers is up to '19', two menu screens are provided. When the number of icon display numbers is up to '7', a screen is provided.

Changing the layout

The layout of icons can be changed.

- 1) Press the **Clear** switch.
- 2) When a check message appears, press the **OK** switch.

- 3) Press switches with icon names in the order of icons to be displayed.
Icon display Nos. are set in the selected order.
- 4) Press the switch to return to the menu screen.
Layout of icons has been changed.

* The "Custom." icon cannot be selected or removed. The "Custom." icon is always displayed last.

Adding icons

Icons can be added to the menu screen.

An icon is to be added to the last position of the icon currently being selected.

- 1) Be sure the switches before the icon names are switches.
If the switches are switches, press a switch. The switches are then switched to Switches.
- 2) Press the switch of the icon name to be displayed.
- 3) Press the switch to return to the menu screen.
The icon has been added.

Removing icons

An icon displayed on the menu screen is to be removed.

- 1) Be sure the switches before icon names are switches.
If the switches are switches, press a switch. The switches are then switched to switches.
- 2) Press the switch of the icon name to be removed.
- 3) Press the switch to return to the menu screen.
The icon has been removed.

* For the icon display number canceled, "-" is displayed. Cancellation of an icon carries up icon display numbers, in sequence, following the canceled number.

Other switches

: Displays the next item.

: Initializes the setting of icon display numbers to the setting at shipment.
(All available icons are displayed.)

Analyzing data on measurement in the course

When a measurement stops in the course, this function calculate the results of measurement from the data collected before that. In concrete, this function is available when the **STOP** switch is pressed in measurement or when the limit switch on the tracing drive is turned on in measurement.

(1) Press the "System C." icon on the menu screen.



The system condition setting screen then appears

System Condition			
Output unit	mm, μ m	▼	▲
Polarity	Positive	▼	▲
Pickup	Standard	▼	▲
Meas.mode	Normal	▼	▲
Profile	<input type="radio"/> ON <input type="radio"/> OFF		
Next		Cancel	<input type="radio"/> OK

System Condition			
Stop-Calc.	<input type="radio"/> ON <input checked="" type="radio"/> OFF		
E.Area print	<input type="radio"/> ON <input checked="" type="radio"/> OFF		
Division Line	<input type="radio"/> ON <input checked="" type="radio"/> OFF		
Judgment Reference	Average	▼	▲
Connection of Curve	None	▼	▲
Previous		Cancel	<input type="radio"/> OK

(2) Press the **Next** switch to switch the screen.

(3) Press "ON" for Stop-Calc. .

(4) Press the **OK** switch.

(5) Press the **MEASURE** switch to start measurement.

(6) Press the **STOP** switch to stop measurement.

The system carries out calculation from the measurement data collected before that point and then displays the results of measurement.

- * If the measured length is less than the minimum evaluation length except for the pre-travel length or if it is less than the cutoff length except for the profile measurement, the system does not perform calculation in the course.

Taking an interrupt measurement

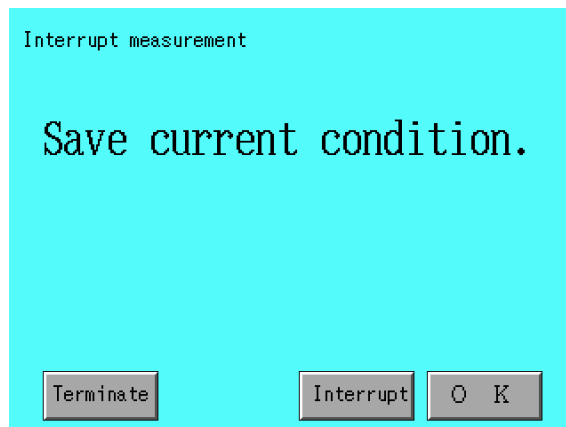
When workpieces are continuously measured under a condition, this function is available to measure other workpieces in a different setting condition. The current set condition is saved with an interrupt measurement taken. The saved condition is set again when the interrupt measurement ends.

Starting an interrupt measurement

(1) Press the "Interrupt" icon on the menu screen.



The following screen then appears.



(2) Press the switch.

The current set condition is stored and then the message "**During interrupt measurement**" appears.

(3) Press the switch.

The menu screen reappears. Measurements can be taken by changing various conditions.

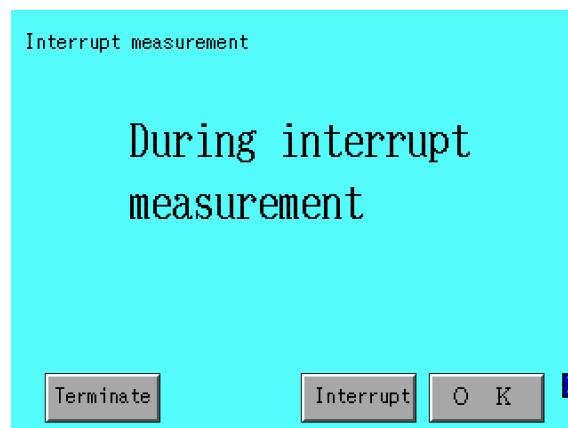
* During interrupt measurement, mark appears in the lower-right corner of the screen.



Average value processing cannot be performed during interrupt measurement. Execution of the interrupt measurement during average value processing stops the average value processing and the average value processing automatically restarts after the end of interrupt measurement.

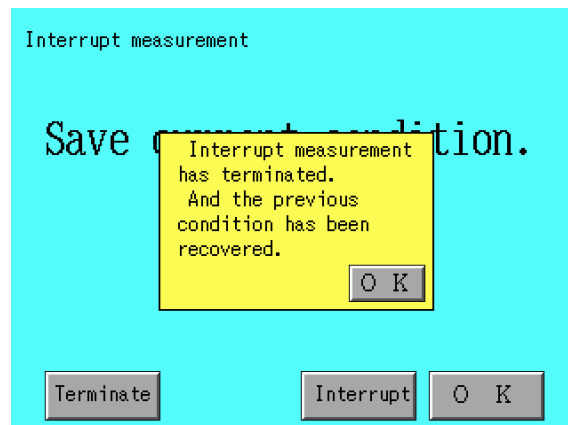
Terminating interrupt measurement

- (1) Press the "Interrupt" icon on the menu screen.
The following screen then appears.



- (2) Press the **Terminate** switch.

A check message for termination of interrupt measurement then appears.



- (3) Press the **OK** switch in message box.

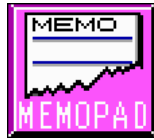
- (4) Press the **OK** switch.

The saved condition is recovered and the menu screen reappears.

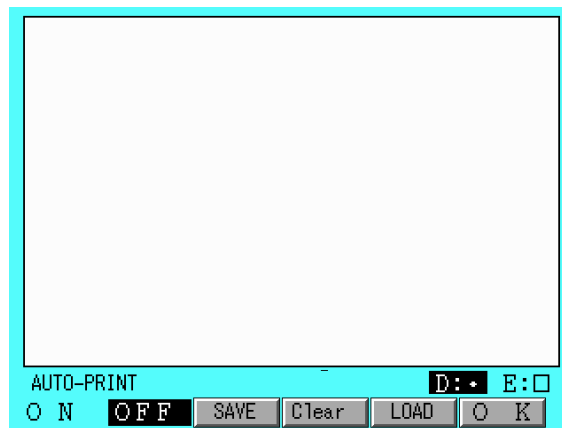
Using memo pad

This function is available to write characters etc. with the touch-pen and to print out them.

- (1) Press the "MEMOPAD" icon on the menu screen.



The memo pad then appears.



- (2) Write memo with the touch-pen.
Select "D: •" to use as a pen. Select "E: □" to use as an eraser.
Press the switch to clear all characters on the memo pad.

Printing out memo pad

While the memo pad is displayed, press the switch to print out the memo pad.

Automatic printout

When the results of measurement are printed out, a memo pad can be added to the end of the printout (when a screen except for memo pad appears).

Press the switch to perform automatic printout.

Press the switch not to perform automatic printout.

Saving memo pad

Memo pad can be saved.

Press the switch.

Loading memo pad

Memo pad can be loaded.

Press the switch.

Each time the switch is pressed, stored memo pads are displayed in sequence.

(3) Press the switch.

The menu screen reappears.

- * Up to 10 files of memo pads can be saved in a PC card.
Saving the 11th file automatically erases the oldest file.
- * When the memo screen appears, neither the switch nor the switch is available.

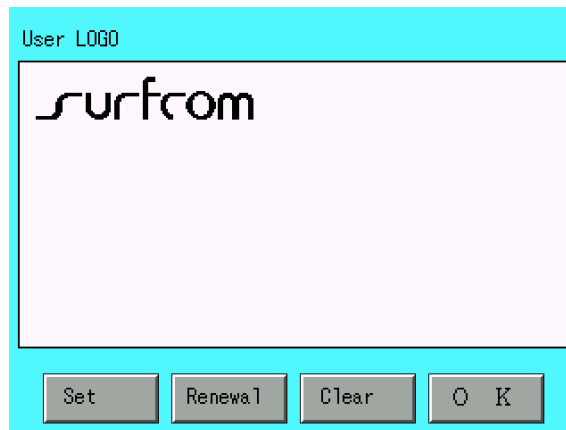
Setting user logo

This function is available to register and print out a created bitmap as a user log.

- (1) Insert the PC card storing a logo file into the card socket.
- (2) Press the "User LOGO" icon on the menu screen.



The user log currently registered is displayed on the logo setting screen.



- (3) Press the **Renewal** switch.

The log file on the PC card is read and displayed.

- (4) Press the **Set** switch.

The bitmap being displayed is registered as a user logo and then output to the printer.

- (5) Press the **OK** switch.

The menu screen reappears.

When the user logo is not printed out.

(1) Press the "User LOGO" icon on the menu screen.

(2) Press the switch.

The displayed user log is then cleared.
After that, no logo file is output to the printer.

(3) Press the switch.

The menu screen reappears.

Specifications of log file

Logo files can be created arbitrarily.
However, the following requirements are applied.

- 1) File format : Monochrome bitmap file format of Windows (* .BMP)
- 2) Maximum size of logo : 300 (horizontal) x 150 (vertical) dots
- 3) File Name : USERLOGO.BMP

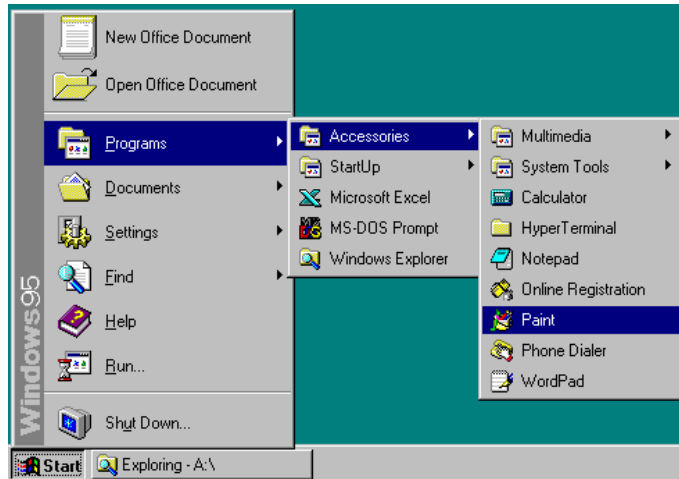
Creation of user logo

User logo can be created in BMP file of Windows with "Paint"^{*1} attached to Windows 95^{*2}. Since logo files are read from and written into a PC card, a personal computer ^{*3} equipped with PCMCIA socket must be used.

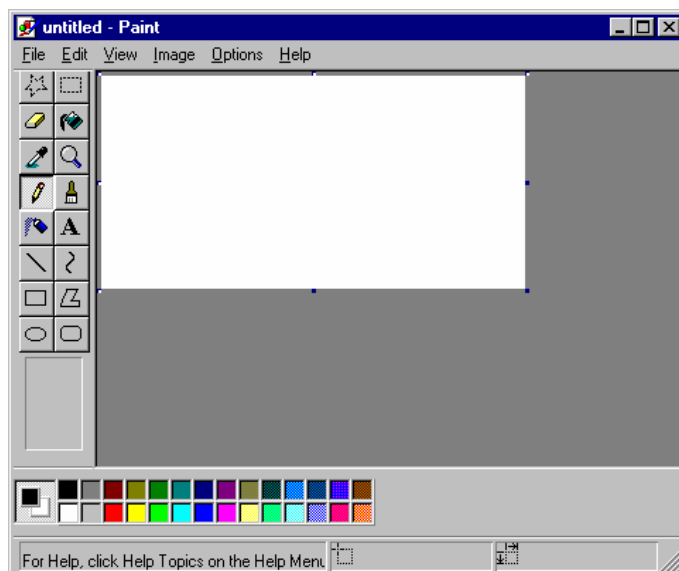
- *1 : Almost all painting programs sold on market are available for creation.
- *2 : Also in Windows 98/2000/NT/XP, it can create by the same operation.
- *3 : Almost all notebook personal computers are equipped with PCMCIA socket.

The following is the way to make a user logo using the “Paint” which is an appendage of MS Windows 95.

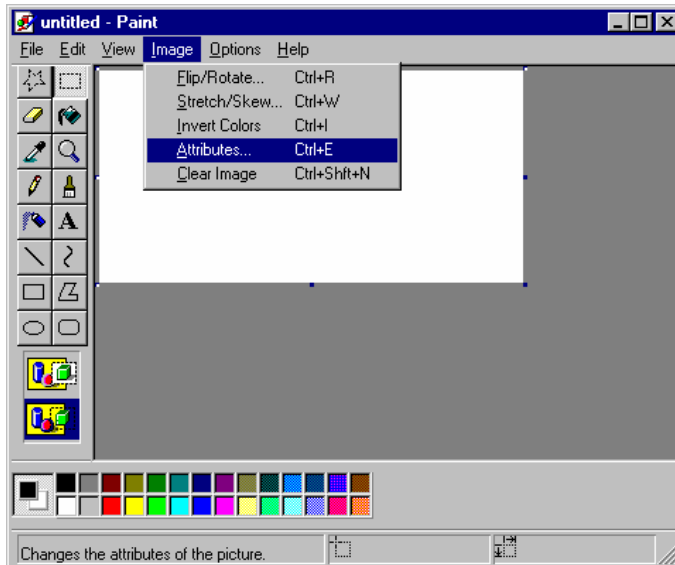
- (1) Activate Windows95 and select [Start]-[Programs]-[Accessories]-[Paint] in this order.



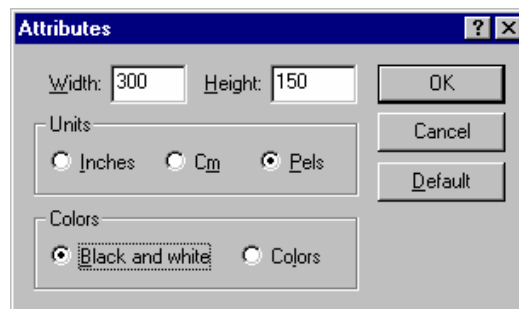
“Paint” display will appear on the screen.



(2) Left-click the “Image” of the menu bar and left-click the “Attributes” with a mouse.



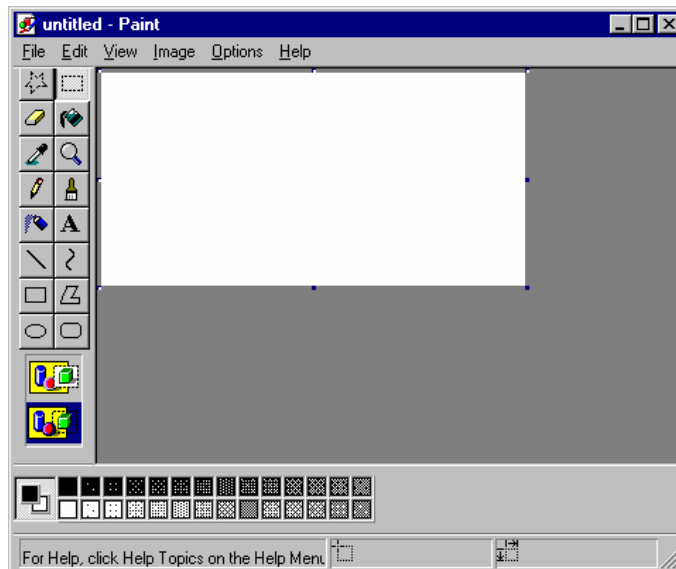
The following display will appear on the screen.



(3) Set as the below and press the **OK** .

Width: under 300
Height: under 150
Units: Pels
Colors: Black and white

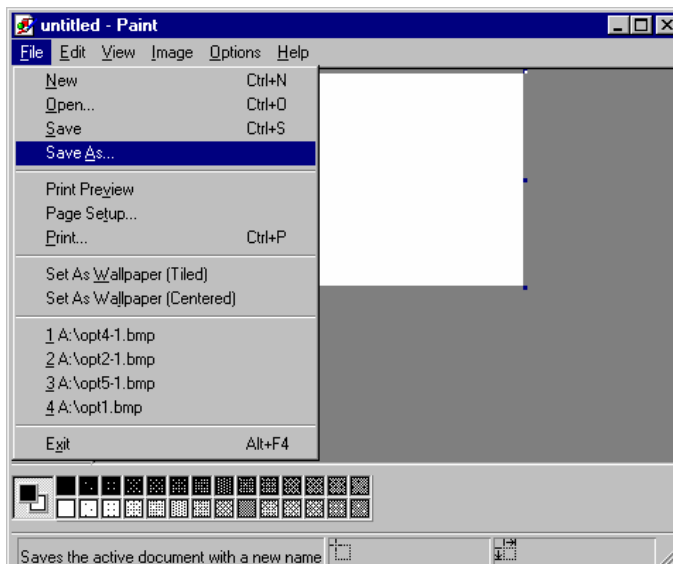
The extent of drawing is set.



(4) Draw up a logo.

* For more detailed information on “Paint”, please refer to the Windows 95 manual.

(5) After drawing, left-click the “File” in the menu bar, and left-click the “Save As” in the pull-down menu with a mouse.



The following screen appears.



- (6) Designate the drive in which a PC card is in, and enter "userlogo.bmp" for the file name, then press the Save.

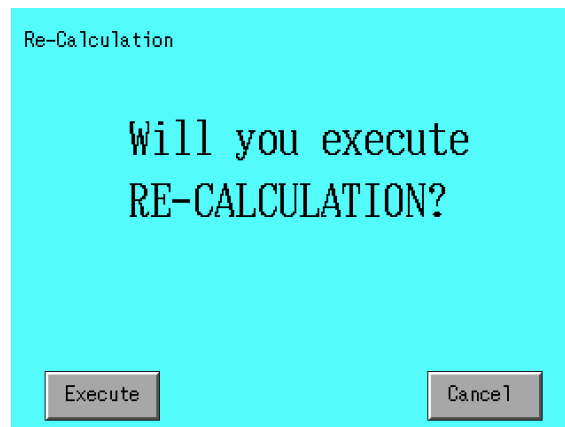
Re-calculation

To make effective use of data on measurements, this System can read data on measurements or data stored in a PC card, set a calculation range and change calculation conditions for re-calculation.

(1) Press the "Re-Cal." icon on the menu screen.



The re-calculation execution screen appears.



(2) Press the switch.

The System makes a re-calculation and displays the results of calculation.

- * Pressing switch in the Range-setting screen also carries out the same re-calculation.

Various changeable conditions

- All setting of system conditions
- Of the measurement conditions, measurement type, cutoff value, tilt correction, filter type and calculation standards
- All calculation conditions
- Parameters to calculate (Select on the parameter select screen.)
- Each type of graph to calculate (A calculation is to be made when an icon for each type of graph is displayed.)

Setting calculation range

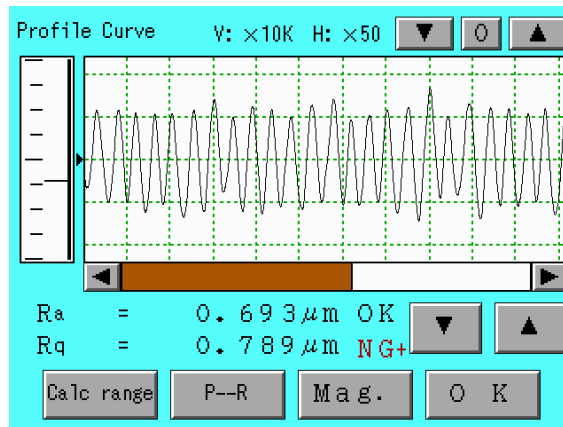
Take the following steps to set an evaluation range and tilt calculation range for re-calculation.

- (1) Press the "Result" icon on the menu screen.



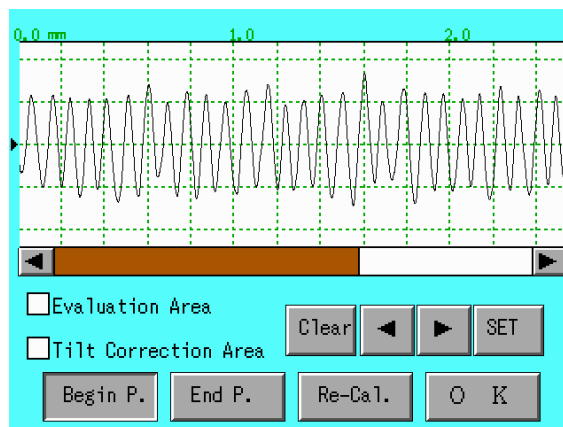
The measurement result screen then appears.

(When the profile display is set to "ON" on the system condition setting screen)



- (2) Press the **Calc range** switch.

The range setting screen then appears.



(3) Press of the item to set.

is changed to the mark indicating that the item has been set.

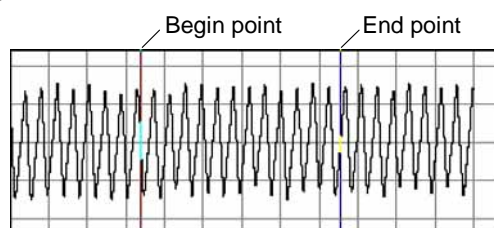
This setting allows the evaluation range and the tilt calculation range to be specified individually and allows the same ranges (up to 10 ranges) to be specified.

Evaluation Area

Tilt Correction Area

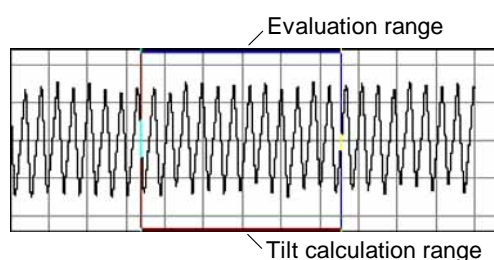
(4) Press the **Begin P.** switch, move cursor 1 with the and switches or by using the touch-pen, and then place the cursor at Begin P.

(5) Similarly, press the **End P.** switch, move cursor 2 with the and switches or by using the touch-pen, and then place the cursor at End P.



(6) Press the **SET** switch.

The specified range is then set.



* To set multiple ranges, repeat steps (4) to (6).

This allows the above range to be used for parameter calculation in the next re-calculation. This range is cleared when a measurement is made next time.

Clearing the calculation range

Press the switch on the range setting screen.

The setting of calculation range is then cleared.

This allows the whole range (entire evaluation length) to be used for parameter calculation in the next re-calculation.

Storing condition settings

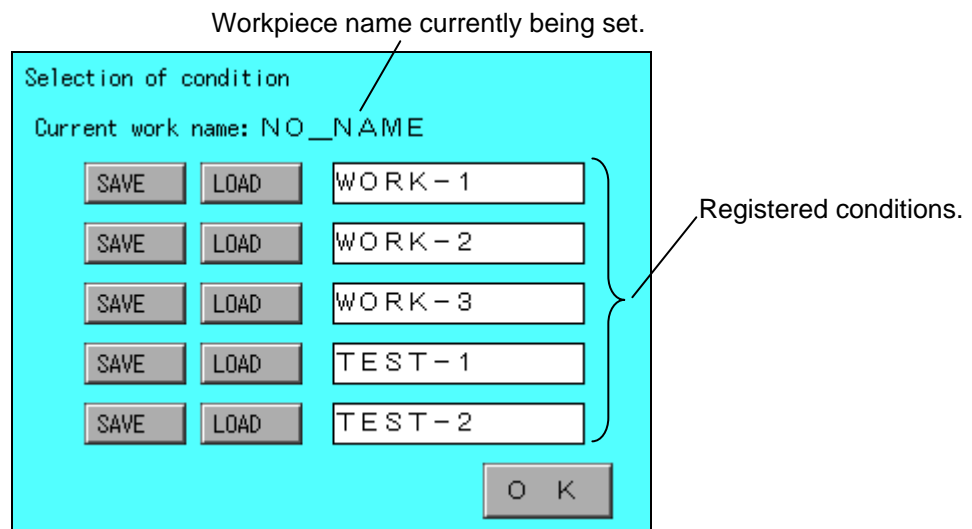
This function can store and read up to 5 conditions not by using a PC card but by using the built-in RAM drive.

To specify storing or reading operation, a workpiece name set in Comment is used.

- (1) Press the "Cond. Sel." icon on the menu screen.



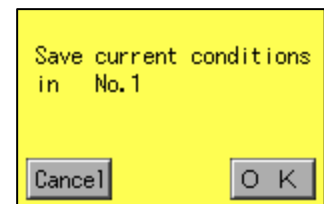
The condition selection screen then appears. Condition selection items shall be No. 1, 2, 3, 4, 5 in order from the top.



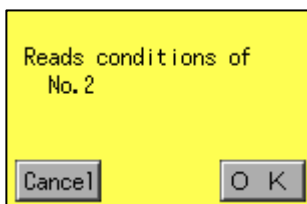
Saving conditions

- 1) Press the **SAVE** switch at the column to save.
- 2) Check message is indicated. When **OK** button is clicked, saves data in the current work name.

The file, already saved, is overwritten.



Loading conditions



- 1) Press the **LOAD** switch at the column of the workpiece name to load.
- 2) Check message is indicated. When **OK** button is clicked, reads specified conditions and its work name shall be displayed in "Current work name" field.

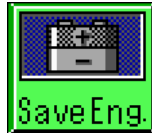
- (2) Press the **OK** switch.

The menu screen reappears.

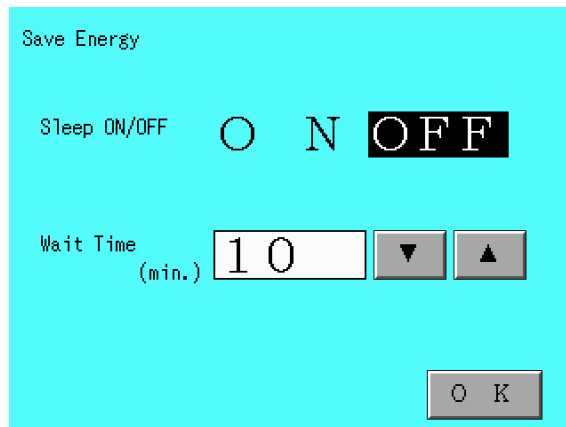
Using sleep function

The sleep function saves power consumption when the operator forgets to turn off the power supply or when the machine does not operate. In the sleep status, about 30% of the power consumption in the normal operation can be saved. (This function is available only for the equipment with color LCD.)

- (1) Press the "Save Eng." icon on the menu screen.



The save energy setting screen then appears.



Sleep function ON

- 1) Press "ON".
- 2) Set the time until sleep by using the and switches.

Time that can be set (Unit: minute)

3	5	10	15	20	30
---	---	----	----	----	----

- 3) Afterwards, if the touchpanel or the switch is not touched for the set time, LCD goes off and the system is placed in the sleep status.

Sleep function OFF

- 1) Press "OFF".

Recovery from the sleep status

- 1) Press the touchpanel or any switch. The system is then recovered.

- (2) Press the switch.

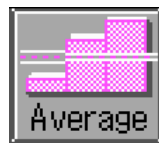
The menu screen reappears.

Average value processing

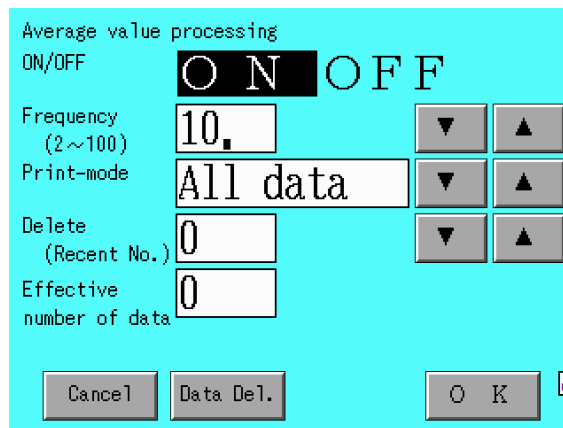
The surface roughness of a general workpieces differs depending on particular points and usually indicate large dispersion. To obtain the roughness on surface to be measured, the measurement positions and the number of positions must be determined to effectively estimate the population mean.

The average value processing is carried out by taking measures at several places when the surface is desired to be evaluated with the mean value.

(1) Press the "Average" icon on the menu screen.



The average value process setting screen then appears.



Starting average value processing

- 1) Press "ON".
- 2) Set the average number of measurements.

The average processing is carried out by using the measurement data for the average number of measurements from the latest data. The allowable set range is 2 to 100.

Set the value by using the and switches.

- Number of measurements < Average number of measurements
Data for the number of measurements is used for average value processing.
- Number of measurements \geq Average number of measurements
The latest data for the average number of measurements is used for average value processing each time measurement and re-calculation are carried out.

3) Set the print mode.

The print mode is divided into the two types and the printout contents differ depending on the average number of measurements, and the number of measurements.

<All data>

- a. Number of measurements < Average number of measurements
Outputs all measured data and the average value at the measurement and before.
- b. Number of measurements = Average number of measurements
Outputs all measured data and the average value.
- c. Number of measurements > Average number of measurements
Outputs the latest data for the average number of measurements and the average value.

<Select>

- a. Number of measurements < Average number of measurements
Outputs only the data at time of measurement.
- b. Number of measurements = Average number of measurements
Outputs data at time of measurement and the average value.
- c. Number of measurements > Average number of measurements
Outputs data at time of measurement and an average value of latest data for the average number of measurements.

Deleting data

Deletes data to be processed for average value processing.

- 1) Set the number of data to be deleted.
Data is deleted from the latest data for the number of set data pieces.
The number of data items to be set ranges from 0 to 100.
Press the and switches for setting.
- 2) Press the switch.

Terminating the average value processing

- 1) Press "OFF".
- * Even after data is deleted once by pressing 'OFF', pressing the switch can restore the data.

Others

The effective number of data pieces to be used for average value processing is displayed in "Effective number of data". The effective number of data pieces is incremented by +1 each time a measurement or a re-calculation is made.

: With respect to the set values on the screen, changes in setting that have been made since this screen was displayed are canceled.

(2) Press the switch.

The menu screen reappears.

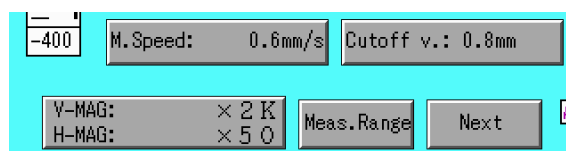
- * Parameters to be used for average value processing have been set in the parameter in the parameter selection in "Output Item".
When the average value processing is carried out, the results of the average value processing are displayed on the measurement result screen.

(Display example)

```

R a = * * * * * * * μ m
R q = * * * * * * * μ m
R a = * * * * * * * μ m
R q = * * * * * * * μ m
  
```

- * When the execution of average value processing is turned "ON", mark appears at the lower-right corner of the screen.



During the average value processing, the following functions cannot be executed and their settings cannot be changed.

AI function	All functions
Calibration processing	All functions
Initialization	All functions
Measurement conditions	Tilt correction, filter type, s filter, calculation standard, measurement type, measurement speed, evaluation length, and cutoff value
Calculation conditions	All functions except for parameter judgment value and BAC calculation, and BAC condition in BAC calculation
System condition	Polarity, pickup, measurement mode
Output item	parameter selection
Condition selection	Read function
PC card	Read function
Guidance	All functions

Concurrent printout at measurement

This function is available to concurrently print out a profile curve when the measurement is taken.

- (1) Press the "System C." icon on the menu screen.



The setting screen then appears.

System Condition		
Output unit	mm, μ m	<input type="button" value="▼"/> <input type="button" value="▲"/>
Polarity	Positive	<input type="button" value="▼"/> <input type="button" value="▲"/>
Pickup	Standard	<input type="button" value="▼"/> <input type="button" value="▲"/>
Meas. mode	Print Out	<input type="button" value="▼"/> <input type="button" value="▲"/>
Profile	<input type="radio"/> N <input type="radio"/> F	
<input type="button" value="Next"/> <input type="button" value="Cancel"/>		<input type="button" value="OK"/>

- (2) Set the measurement mode. (Meas. mode)
Press the and switches to set "Print Out".
- (3) Press the switch.
The menu screen reappears.

- (4) As soon as a measurement is taken^{*1}, profile curves can be printed out at the magnification specified in the "Print Magnification Setting", afterwards.

However, the following restrictions are applied to the horizontal magnification due to measurement speeds. If a magnification is larger than the magnification listed below, the magnification is selected as the maximum magnification that is available.

Measurement speed	Maximum horizontal magnification that can be set
0.003 ~ 0.15 (mm/s)	x 5K (No restriction)
0.3 ~ 1.5	x 500
3.0 , 6.0	x 50

When AUTO is set, the magnifications are as follows.

Vertical magnification : x1K

Horizontal magnification : The length of recorded profile with maximum magnification is within 180 mm. However, the above restrictions are applied.

- *1 : Be noted that the output of the print is not completely synchronized with the measurement. So that it continues to output the print until being completed the print of whole measured profile even after the end of measurement. In order to interrupt the output of print on the way , press the "FEED" switch while being indicated the screen of "Printing ...". Then it stops the output of concurrent print.

Using other languages

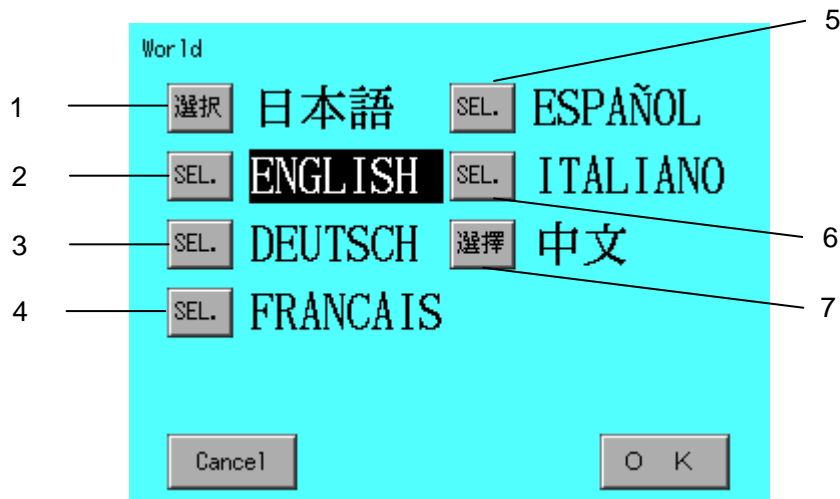
This machine can display in 7 languages, Japanese, English, German, French, Spanish, Italian and Chinese.

This function is available to select and switch the languages to be used on screens and for printout.

(1) Press the "WORLD" icon on the menu screen.



The setting screen then appears.



(2) Set the language to be used.

To select Japanese, press the 1. switch.

To select English, press the 2. switch.

To select German, press the 3. switch.

To select French, press the 4. switch.

To select Spanish, press the 5. switch.

To select Italian, press the 6. switch.

To select Chinese, press the 7. switch.

The language is switched to the selected one.

(3) Press the **OK** switch.

The menu screen reappears.

Press the **Cancel** switch to cancel changes in setting that have been made since this screen was displayed, with respect to the set values on the screen.

Making hard copies of screens

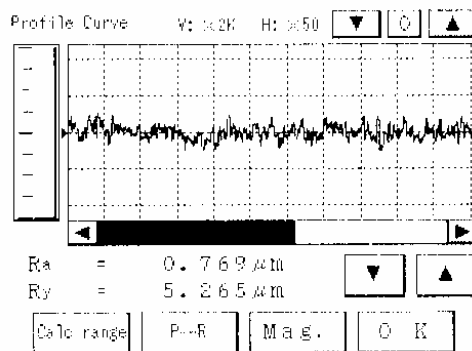
This function is available to print out hard copies

(1) Press the **PRINT** switch while pressing the **STOP** switch.

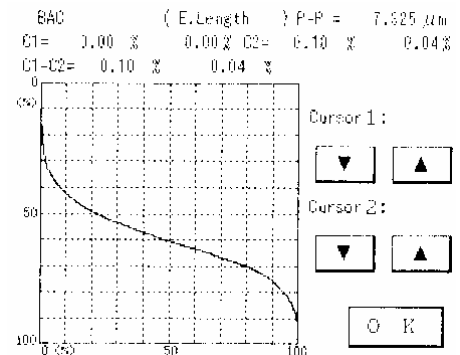
A hard copy of screen is printed out.

* This function is helpful to arrange the results of measurement and to create an operation manual.

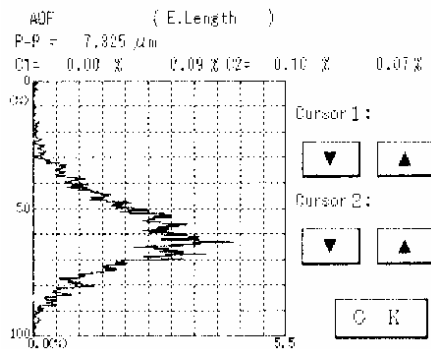
(Example) Result of measurement



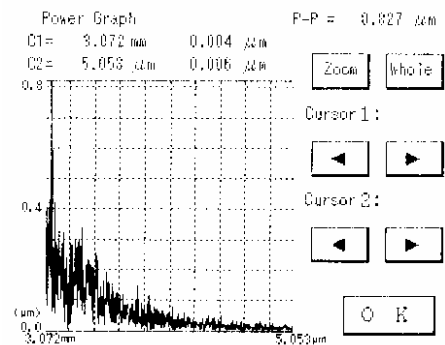
Profile Curve



Bearing length ratio graph



Amplitude display curve



Power graph

Result Judgement of OK/NG: OK, NG

Ra = 0.769 μm

Ry = 5.265 μm

Rz = 3.984 μm

Rmax = 6.163 μm

Rz.J = 5.330 μm

Mag. [Down] [Up] OK

Parameter value

Setting password

This is the function that enables a limited person to be recognized as an operator by means of setting a password.

Be careful not to forget the setting password.

1. Setting password

- (1) Press the "System C." icon on the menu screen.



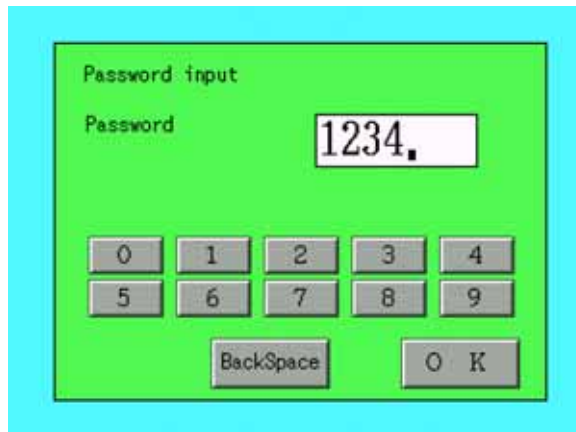
The system condition setting screen appears. Press the switch.

- (2) Input a password in numerical numbers of 4 digits to the new password section in the password registration screen. Press the switch in case of the necessity for making stop of the password registration on the way.



- (3) Switch over the reverse display from OFF to ON, and press the switch. Then it becomes effective for setting password.

- (4) When the power supply to the computer is set to ON again after being set to OFF, the password setting screen will be appeared. Then input the previously registered password and press the **OK** switch. Then the menu screen will be appeared and the system can be started.



2. Change or making void of a password

- (1) Press the **Password** switch in the setting screen of System Condition, and display the password registration screen.



- (2) Input the password which has been previously registered in the password section.
- (3) Press the **OK** switch. Then the password registration screen will be appeared again.

(4) For change of a password: Input a new password and press the switch. Then the new password becomes effective from the next time.

For cancel of a password: Switch over the reverse display from ON to OFF, and press the switch. Then the system can be used without making input of a password when it will be started again.

Restrict a part of operation

This is a function that makes unable to change a measurement condition easily by restricting a part of operation for a general operator. This function is called "passwords protect function".

It divides 2 different kind of a user as "administrator" and "operator". A system always presumes that a user is an "operator" when a machine is switched on. This condition is called "operator mode". It enables to operate as "administrator" after entering a password. This condition is called "administration mode"

It enables to convert "on" and "off" on restricted operation of "operator mode" in "administration mode". When a restricted operation is "on", some part of operation is restricted in "operator mode". When a restricted operation is "off", there is no restriction. An operation is always not restricted on "administration mode".

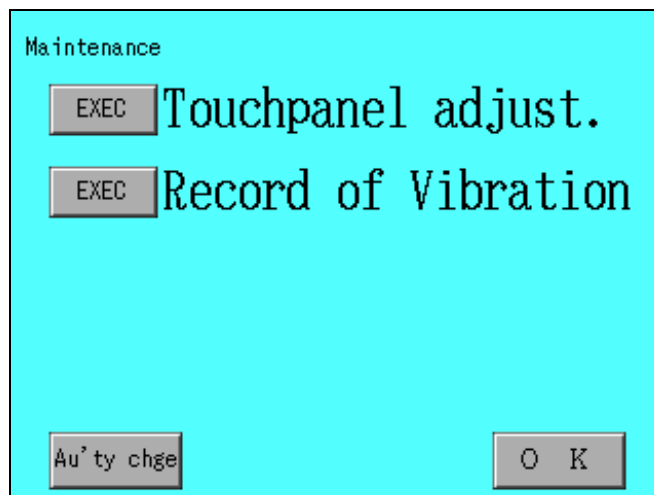
A password change can be done at "administration mode" which enables to convert from "operator mode" to "administration mode".

Convert to "administration mode"

- (1) Press "Mainte." icon on the menu screen.

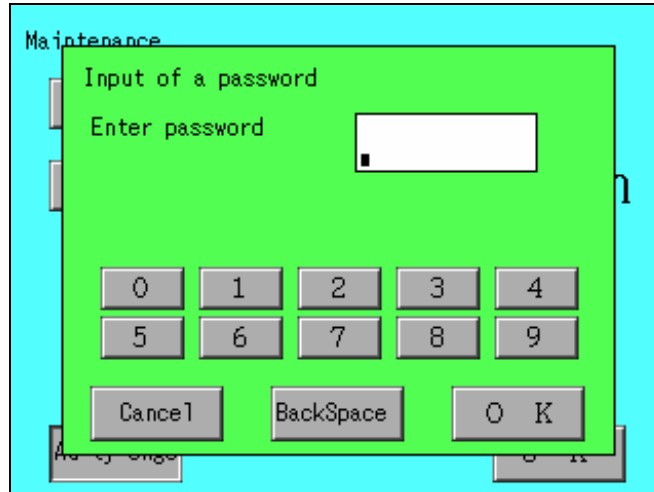


The maintenance select screen then appears.



(2) Press "Au'ty chge" switch.

A password entering screen will be displayed.

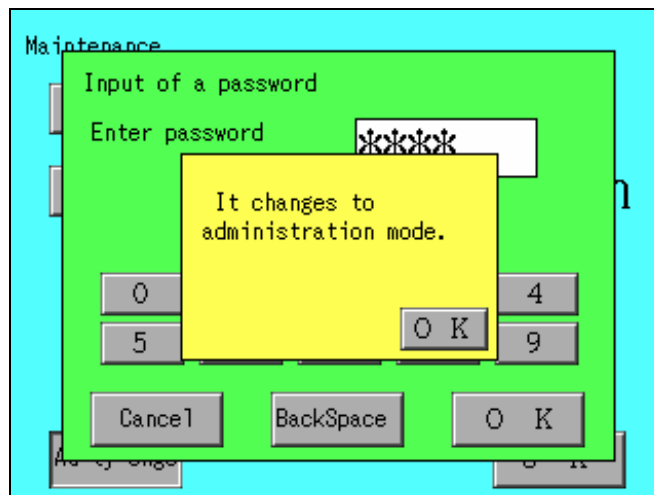


(3) Enter a password.

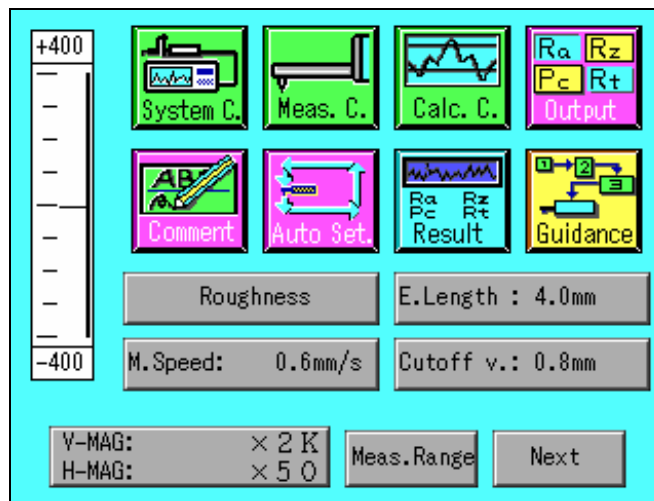
Enter a password by using "0"- "9" switches and then press "OK" switch. When there is a mistake, press a "BackSpace" switch and it enables to clear entered character one by one.

It convert to "administration mode" after a correct password is entered.

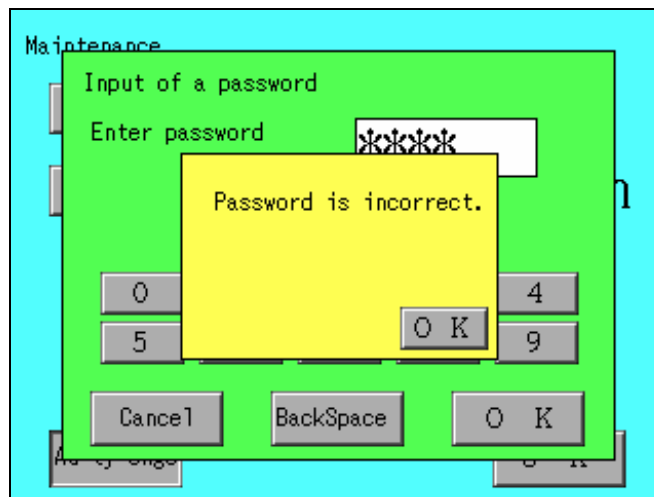
- * A password is "0000" at an ex-factory condition. To change this password, please refer to "Change password" on this section.



Press "OK" switch. It goes back to a main menu.



Following message is displayed when an incorrect password is entered.



Press "OK" switch then go back to a main menu.

When a "Cancel" switch is pressed while entering a password, password entering is cancelled and goes back to a main menu.

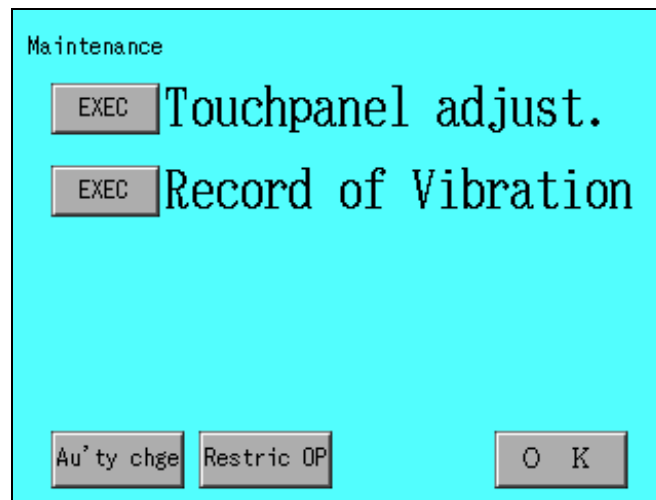
Convert On/Off of restricted operation

* This operation is done by "administration mode"

(1) Press "Mainte." icon on the menu screen.

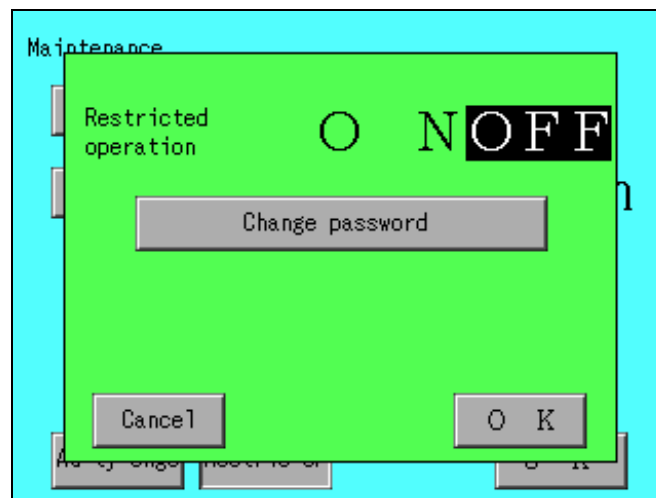


The maintenance select screen then appears.



(2) Press "Restric OP" switch.

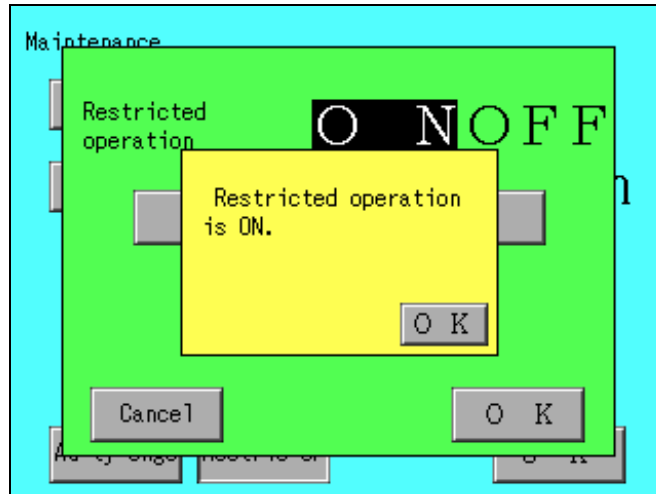
A restricted operation screen is displayed.



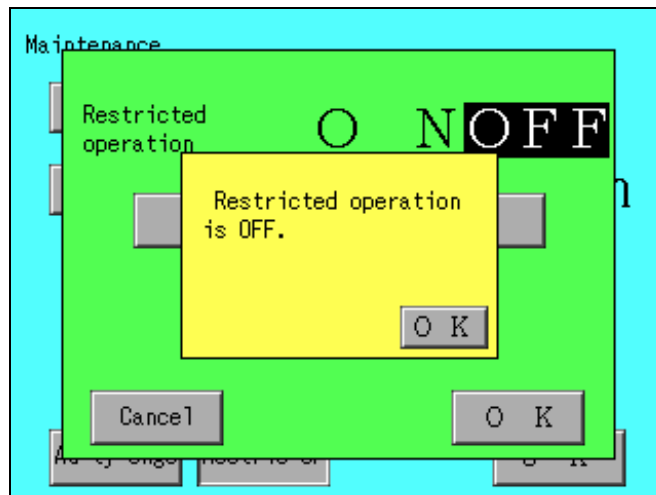
(3) Convert On/Off of restricted operation

Press "ON" or "OFF" switch and press "OK" switch after selecting on/off of a restricted operation.

A following message will be displayed when selecting "ON" for restricted operation.



A following message is displayed when selecting "OFF" for restricted operation.



When "OK" switch is pressed then it goes back to a maintenance select screen.

When cancel is clicked then it goes back to a condition which is a before conversion to "on/off" for restricted operation.

Convert to "operator mode"

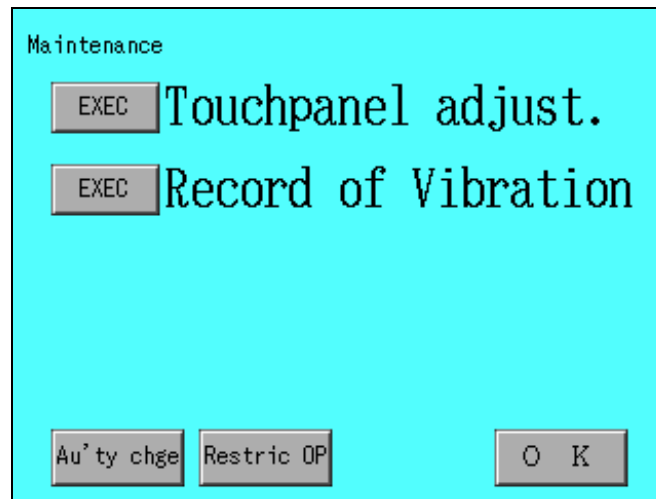
It converts to "operator mode" by turning on the switch again or execute following operation.

* This operation is done by "administration mode"

(1) Press "Mainte." icon on the menu screen.

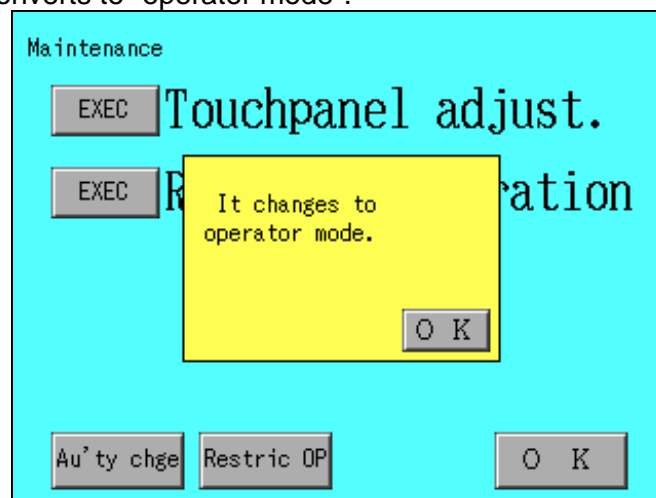


The maintenance select screen then appears.



(2) Press "Au'ty chge" switch.

It converts to "operator mode".



Press "OK" switch. It goes back to a main menu.

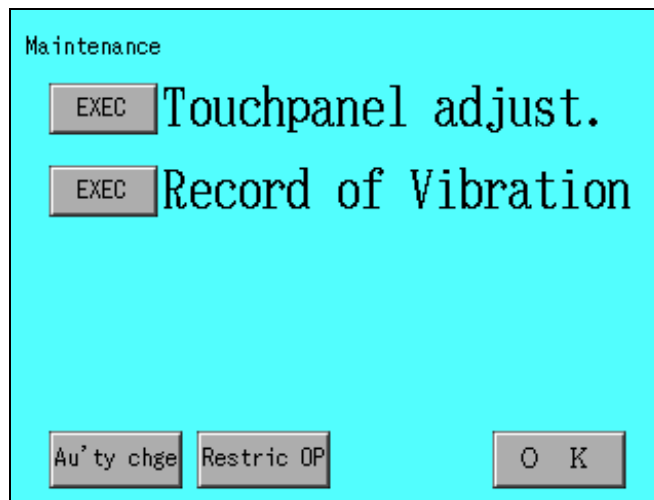
Change password

* This operation is done by "administration mode"

(1) Press "Mainte." icon on the menu screen.

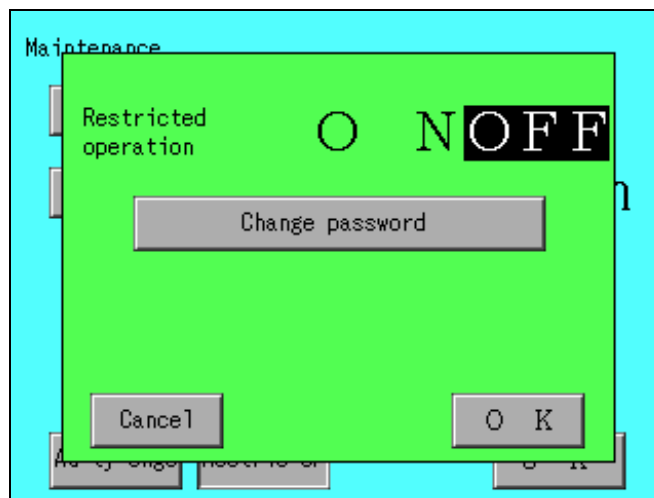


The maintenance select screen then appears.

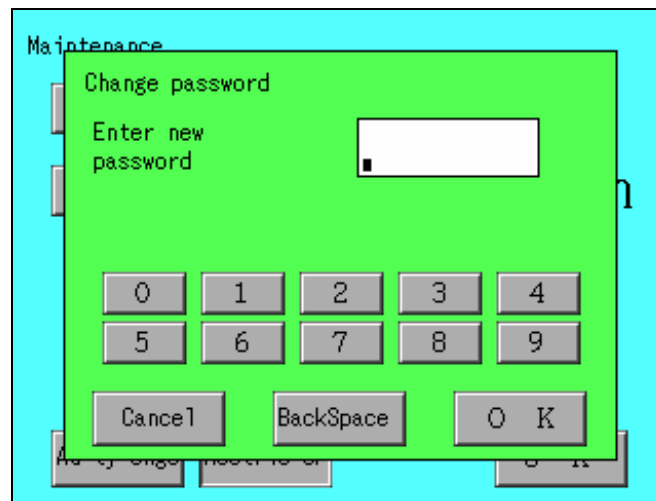


(2) Press "Restric OP" switch.

A restricted operation screen is displayed.

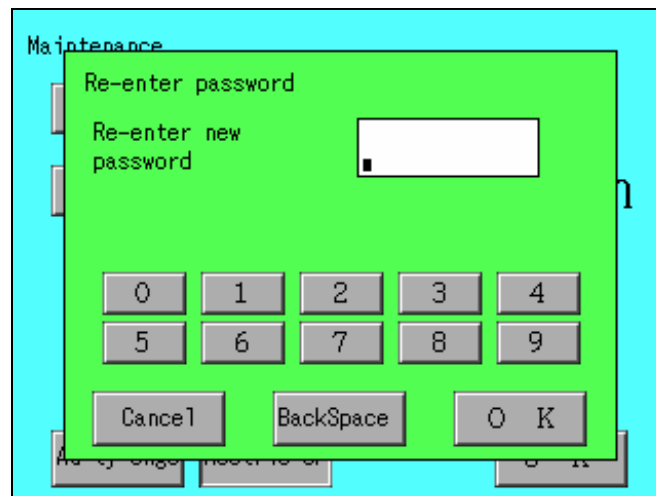


(3) Press "Change password" switch.

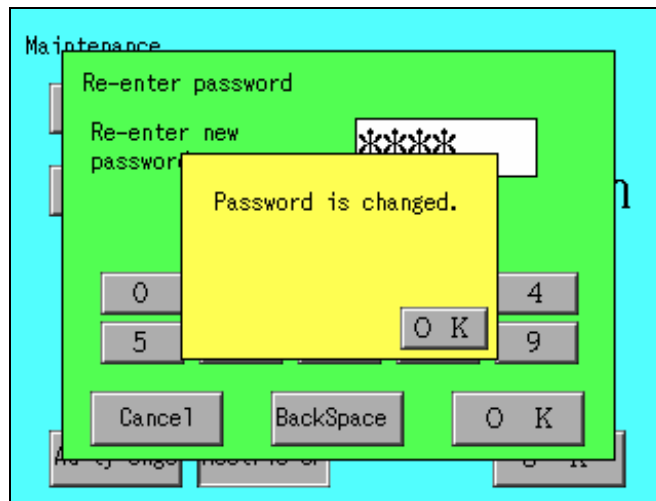


Enter a new password by "0"- "9" switches then press "OK" switch. A password should be 4 digits number.

(4) Re-enter a new password again.



Enter a new password twice to confirm. A password is changed after same password is entered twice.

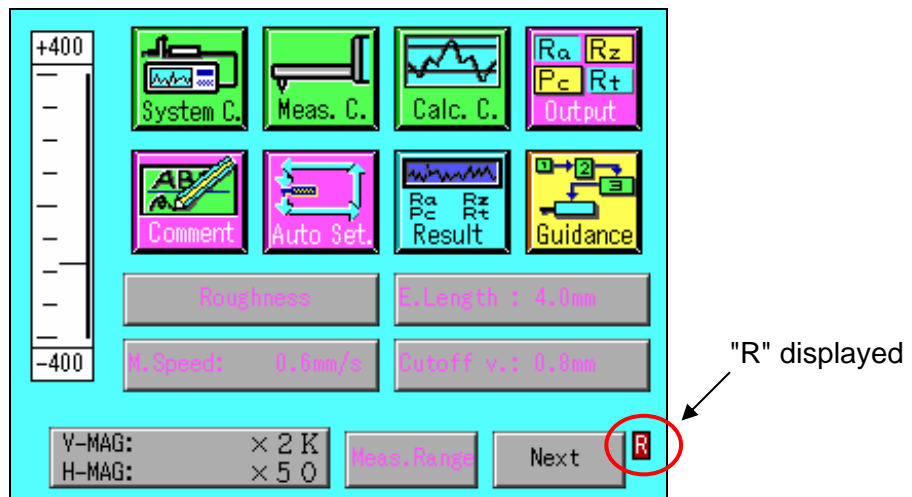


When "OK" switch is pressed, it goes back to restricted operation screen.

When a "Cancel" switch is pressed while changing a password, password changing is cancelled and goes back to restricted operation screen.

Restricted operation

When "restricted operation" is ON at "operator mode", it shows an operation is restricted by displaying "R" at lower right hand of a screen.



A following operation can not be done with this condition.

(1) Unusable Icon



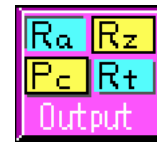
System conditions



Measurement conditions



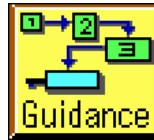
Calculation conditions



Output items



Automatic measurements



Guidance



AI measurements



RS-232-C



Calibration



Initialization



Date and time



User logo



Switching language

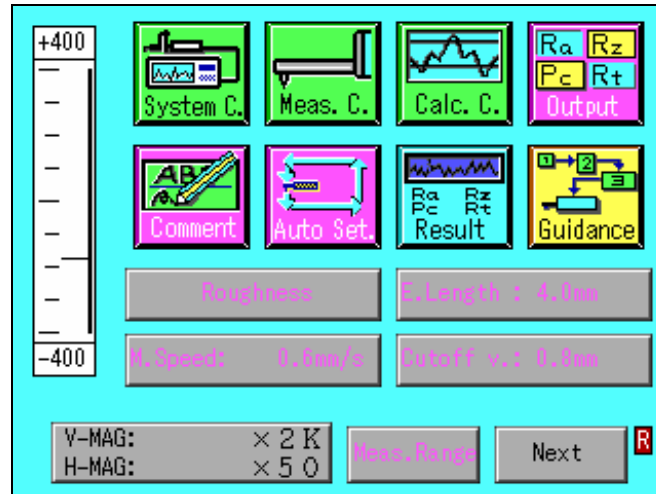
A following message is displayed when these icons is pressed.



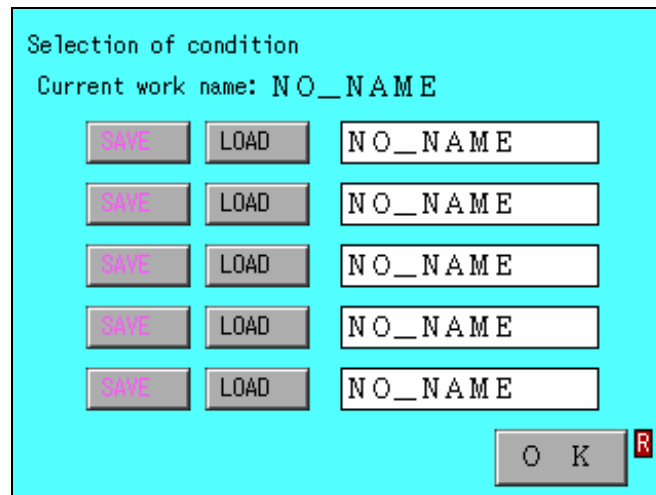
(2) Unusable switches

Unusable switches are displayed with half brightness of an icon. It does not work even these switches are pressed. A following switches will be unusable.

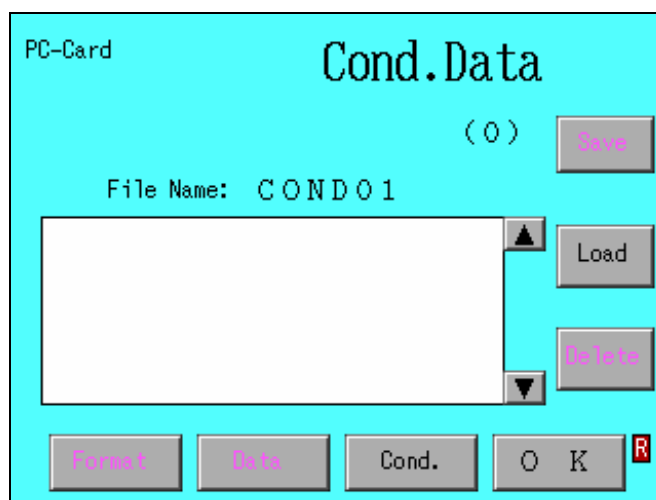
- "Measurement type", "M.Speed", "E.Length", "Cutoff v." and "Meas.Range" switches on a main menu.



- "Save" switch on a selection of condition screen.



- "Save", "Delete", "Format" and "Data" switches on a PC-Card screen.



- * Cond.Data is always selected on PC-Card screen.

Reset

In case a password is forgotten, please refer to "reset" of "Chapter-13 maintenance". It is reset to an ex-factory condition. However in this situation, all of other information is also reset to an initial condition.

Ex-factory condition

- Password "0000"
- Restricted operation "OFF"
- Machine condition "operator mode"

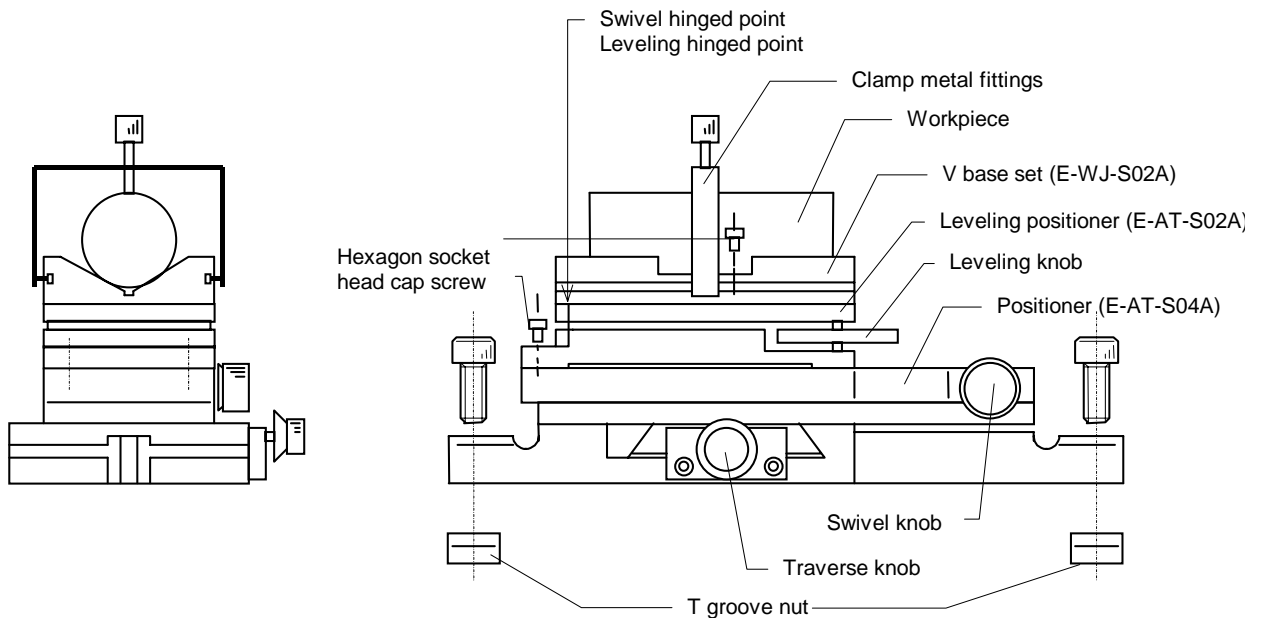
9 Measuring Various Workpieces

This chapter describes application measurement examples.

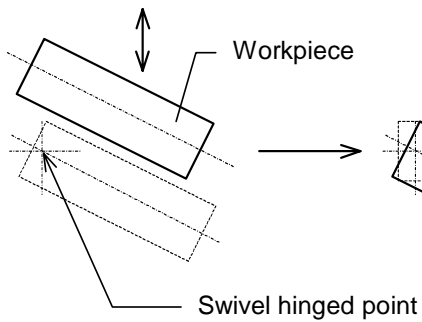
Measuring cylindrical workpiece (Tracing driver that drivers pickup)	9-2
Measuring cylindrical workpiece (Tracing driver that drivers workpiece)	9-5
Measuring the inside of hole	9-9
Measuring R surface	9-11
Measuring step height	9-16
Measurement for deletion at both ends or at single end	9-17
Measuring notched workpieces	9-18
Measuring workpieces whose base surface and evaluation surface are defined independently	9-22
Measuring edges	9-24

Measuring cylindrical workpiece (Tracing driver that drivers pickup)

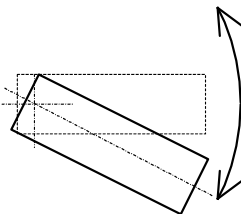
Measurement of a cylindrical workpiece in the axial direction requires optional V base set (E-WJ-S02A) and positioner (E-AT-S04A).



Traverse adjustment

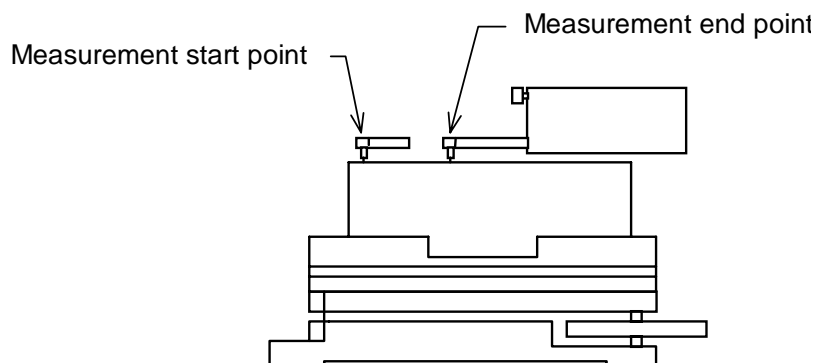


Swivel adjustment



Meanings of words

- Swivel = Horizontal rotation
- Traverse = Horizontal movement
- Leveling = Paralleling
- Tilt adjustment



- (1) Place the leveling positioner (E-AT-S02A) on the positioner (E-AT-S04A) and then fix them with two hexagon socket head cap bolts.
- (2) Place the V base set (E-W-J-S02A) on the leveling positioner (E-AT-S02A).
According to the work diameter, make either larger V groove or smaller V groove facing up and then fix them with two hexagon socket head cap bolts.
- (3) Put a workpiece on the V base and then fix it with attached fatclay or stopper metal fitting in such a way that the measurement start point can be placed on the leveling hinged point.
- (4) Determine the position of the positioner in such a way that the pickup stylus can be placed on the leveling hinged point. Then fix the positioner to the measuring stand base with the attached T groove nut.
- (5) Display the main menu screen.
Place the measurement start point at the center of the swivel on the measuring stand.
- (6) Lower the pickup for the stylus to be placed on the leveling hinged point.
When a motor column is used, the pickup goes down and then automatically stops at the zero-position of the level meter on the main menu screen. Turn the joy stick toward you until the pickup stops.
- (7) Rotate the traverse knob on the positioner and move the workpiece forward and backward.
When the level meter arrives at the top, i.e., when the stylus comes to the highest point on the arc, stop moving the workpiece forward and backward.
- (8) Move the column upward or downward from this position or place the mark at the center of the level meter by using the zero-adjustment function of the level meter.
- (9) Rotate the manual knob of the tracing driver and move the pickup in such a way that the stylus can come to the measurement end point.
If the level meter indicates the uppermost end or lowermost end during adjustment, make adjustments in the course by rotating the leveling knob.

- (10) Move the workpiece by rotating the swivel of the positioner and then stop it at the highest position to which the level meter comes.
 - (11) Rotate the leveling knob to place the level meter mark at the center. However, do not move the level meter zero-adjustment function column.
 - (12) If steps (7) to (11) are repeated again, and the whole area of measurement range of workpiece axial line can be moved within the range of level meter, the preparation for measurement is completed.
- * To measure the straightness of an axis with small diameter, make this swivel adjustment precisely. If this swivel adjustment is incomplete, a workpiece is measured as a convex profile.

Measuring cylindrical workpiece (Tracing driver that drivers workpiece)

An adjust block and a V-block are needed for measurement of a cylindrical workpiece in the direction of its axial line. The adjust block and V-block used for each drive unit are as follows.

Drive unit type	Adjust block	V-block
E-RM-S75A	E-AT-S03A	E-WJ-S05A
E-RM-S76A	E-AT-S05A	E-WJ-S02A
E-RM-S77A	E-AT-S01C	E-WJ-S02A

Mounting of adjust block (E-AT-S03A/E-AT-S05A)

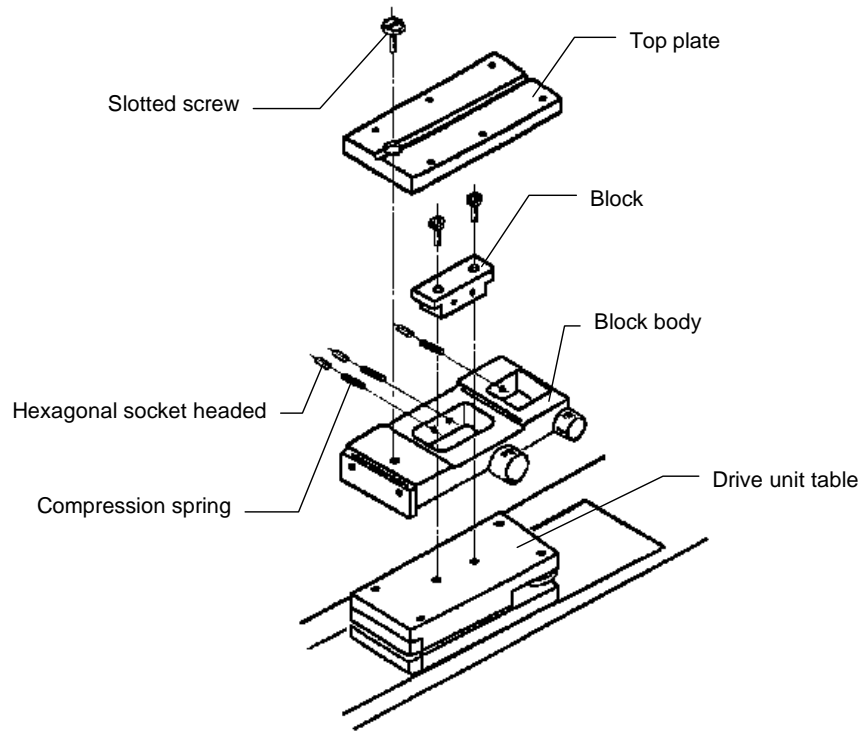
- (1) Remove hexagonal socket headed set screws at three places on the rear face of the adjust block, and take out the compression spring from the inside.
- (2) Loosen the slotted screw on the top face of the adjust block, and remove the top plate.
- (3) Place the adjust block body on the drive unit table with the drive unit table pinched by guides on both sides.
- (4) Fix the block, which is located in the adjust block body, then insert hexagonal socket headed bolts into the taps at two places on the rear face of the drive unit table.
- (5) Place the table on the adjust block body, and fix it by slotted screws. Place compression springs in the taps on the rear face of the adjust block and screw in the hexagonal socket headed set screws as before.
- (6) Place the V-block on the top plate and fix it by two hexagonal socket headed bolts.

Mounting of adjust block (E-AT-S01C)

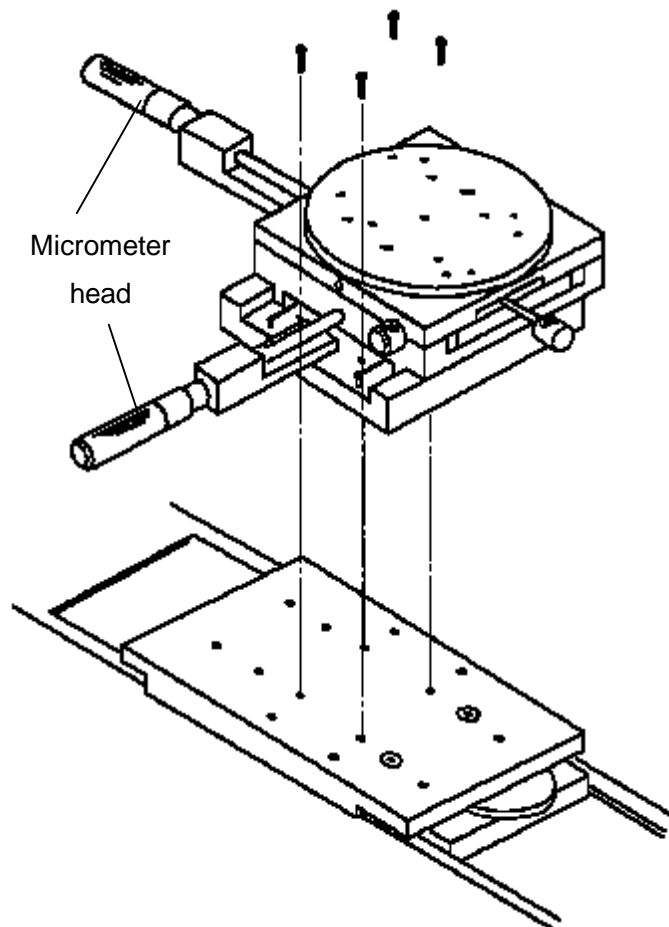
- (1) Remove the clamp piece by turning the T-groove mounting lever of the adjust block.
- (2) Turn the micrometer head of the Y direction so that the slide surface freely moves by hand. When the slide face is moved back and forth, two mounting holes can be observed respectively.
Carry out fixing to the drive unit table by four hexagonal socket headed bolts.
- (3) Place the V-block on the adjust block, and fix it by two hexagonal

socket headed bolts.

Case of E-AT-S03A/S05A

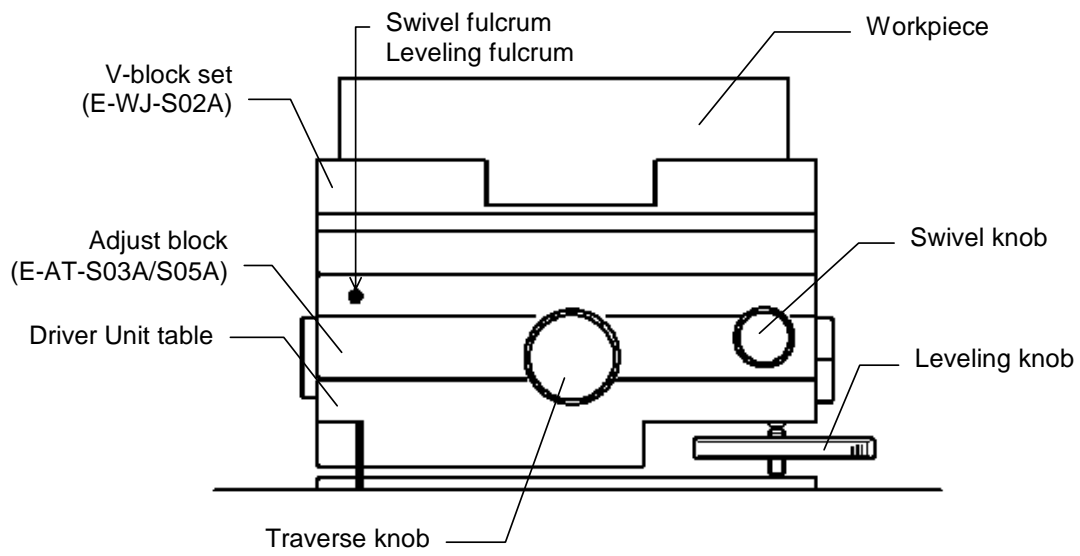


Case of E-AT-S01C



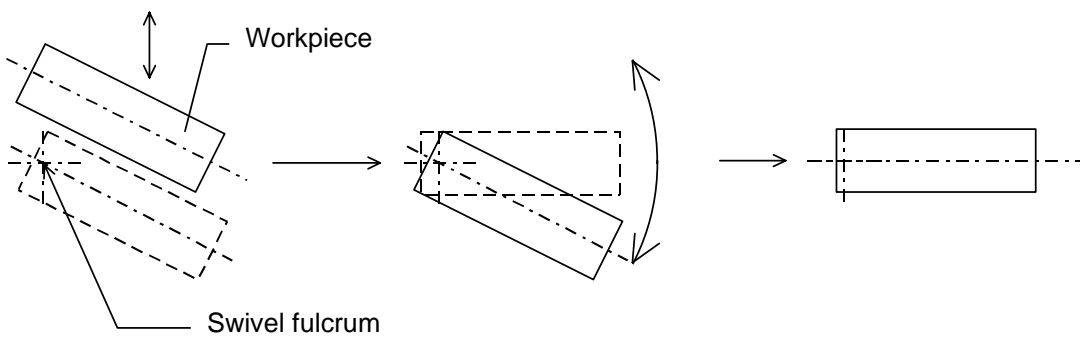
Preparation for measurement

- (1) Have the "Main menu" screen displayed.
- (2) Lower the pickup, by shifting the joystick , so that the stylus comes to a point above the leveling fulcrum. Lowering of the pickup will be stopped automatically at the point where the mark is lit at the center of the level meter on the "Main menu" screen. Therefore, keep the joystick in the position until the the mark is lit at the center of the level meter.
- (3) Move the workpiece back and forth by turning the traverse knob of the adjust block or by turning the micrometer knob in the Y direction. Stop the workpiece at the point where the level meter is lit at the highest point, that is, when the stylus comes to the highest point of the circular arc.
- (4) Cause the mark to light up at the center of the level meter by moving the column up/down again in this position or by making use of the zero adjust function of the level meter.
- (5) Move the pickup so that the stylus comes to the measurement end point by turning the manual knob of the drive unit.
- (6) Cause the workpiece to move by turning the swivel knob of the adjust block, and stop the workpiece at the point where the mark of the level meter lights at the highest point.
- (7) Make setting so that the mark of the level meter comes to the central position by turning the leveling knob. If the mark is lit at both ends of the level meter during adjustment of step (6) above, it is permitted that adjustment is made by turning the leveling knob on the way. It is provided, however, that the zero adjust function of the level meter and the column should not be used.
- (8) Check the adjustment of (3) ~ (7) once again. The preparation for measurement has been completed if the display of the level meter is in the measurement range in the entire area of the measurement portion.



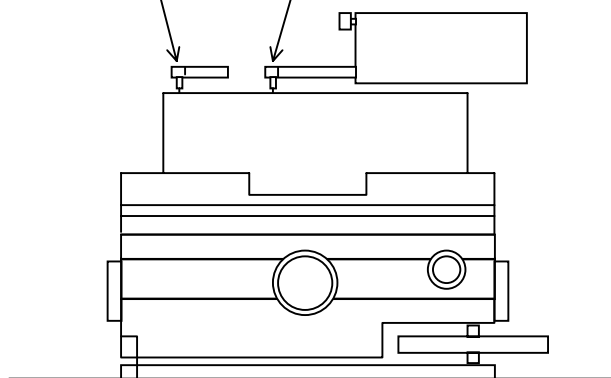
Traverse adj.

Swivel adj.



Measurement start point

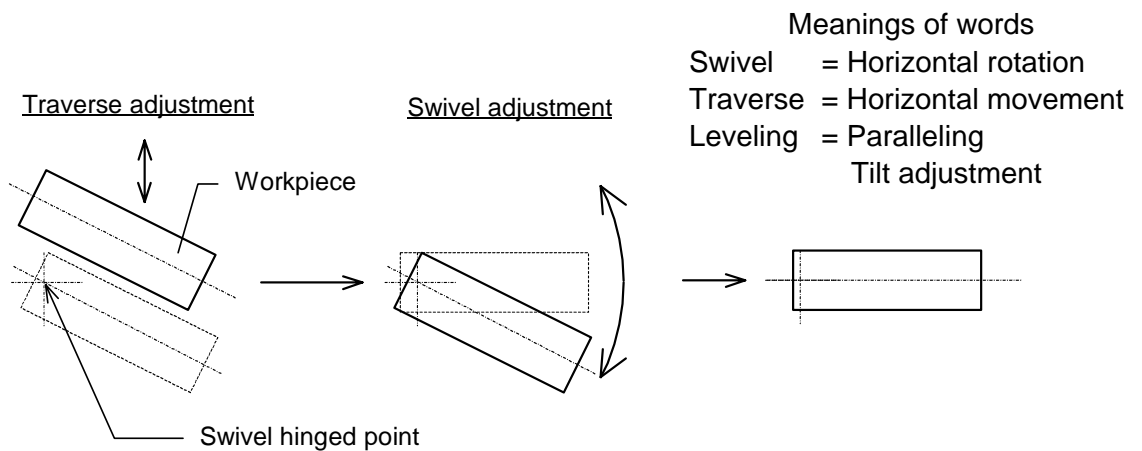
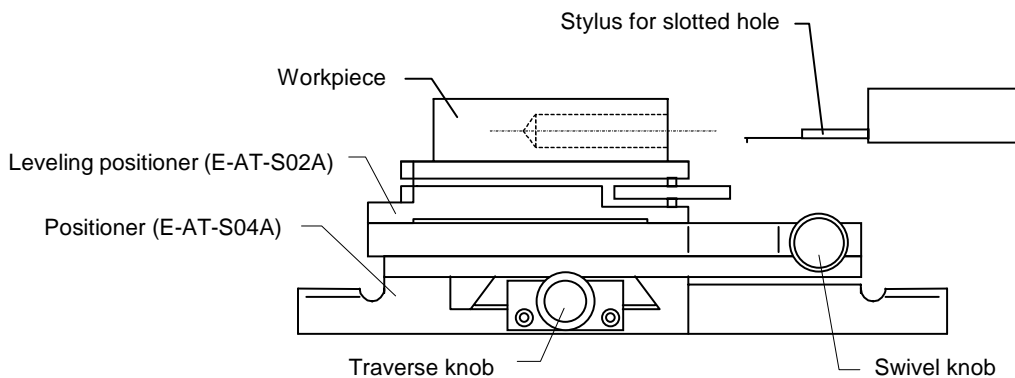
Measurement end point



Measuring the inside of hole

If a hole to be measured is too deep for the standard stylus (pickup) to reach the target point, use an optional stylus (pickup). (For details on the stylus (pickup), refer to the catalog.)

The optional positioner (E-AT-S04A, -S03A, or -S05A) is also required. The swivel adjustment and leveling adjustment are almost same as those for cylindrical workpieces, but the measurement position cannot be visually checked. Be careful not to damage the stylus.



- (1) Remove the standard stylus from the pickup and then install the stylus to be used.
- (2) Call the calibration screen from the main menu screen, and then make a calibration according to the pickup in use.

- (3) Put the leveling positioner on the positioner and then fix them with two hexagon socket head cap bolts.
- (4) Put a workpiece on the leveling positioner.
- (5) Move the column and lower the pickup.
When lowering the column to the height of the hole, rotate the manual knob of the tracing driver to put the stylus into the hole and then move it to a measurement start point.
Make every effort to set the measurement start point at the swivel center on the positioner.
- (6) Lower the pickup.
When a motor column is used, the pickup goes down and then automatically stops at the position where the mark comes to the center of the level meter on the main menu screen. Turn the joy stick toward you until the pickup stops.
- (7) Rotate the traverse knob to move the workpiece forward and backward. Then stop the workpiece at the position where the mark comes to the lowermost position of the level meter.
- (8) Rotate the manual knob of the tracing driver to move the pickup to the measurement end point.
- (9) Rotate the swivel knob to move the workpiece and then stop it at the position where the mark comes to the lowermost position of the level meter. Rotate the leveling knob to place the mark at the center of the level meter.
(Leveling adjustment is allowed in the course of swivel adjustment. However, do not move the zero-adjustment function of the level meter and the column.)
- (10) If steps (7) to (9) are repeated again, and the whole area of measurement range of workpiece axial line can be moved within the range of level meter, the preparation for measurement is completed.



To use automatic column UP/DOWN during measurement, be careful for the setting of the distance of column upward movement (when the S480A system is used).

If the distance of column upward movement is set to a value larger than the hole diameter, workpieces may be flawed or the stylus and the pickup may be damaged.

To measure the straightness of a hole, make this swivel adjustment precisely. If this swivel adjustment is incomplete, a workpiece is measured as a concave profile.

Measuring R surface

Measurement of surface roughness of curvature by the SURFCOM 130A/480A is divided into the following four types. These types have their merits and demerits. Select appropriate one according to the purpose of measurement.

- 1) R-correction
- 2) R groove nosepiece
- 3) Circumference tracing driver
- 4) R surface tracing driver

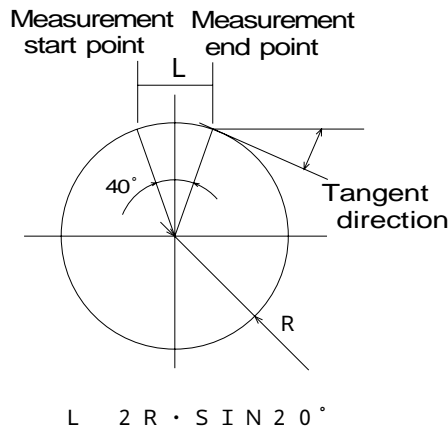
1. R-correction

No option is required. Parameters can be calculated from profile curve and roughness curve only by the leveling adjustment. However, since curvatures are measured in straight line, the measurement length is limited as follows.

In addition, a large measurement length causes to be large in the drawing below and, therefore, takes the measurement with an angle in the direction of primary measurement (tangent direction), resulting in generating waveform distortion.

Meas. Length : $L \leq 2R \cdot \sin 20^\circ$ (R = Curvature radius of workpiece) --- Condition 1
That is, $L \leq 0.684 \times R$

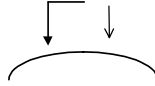
Set a workpiece within a range in which condition 1 can be satisfied.



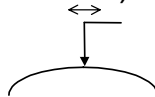
- (1) Press the "Meas. C." icon on the menu screen.
- (2) Set the "Tilt" Correction to "R-Curve" on the measurement condition setting screen.
- (3) Press the Meas. Range switch to display the measurement range screen and then specify the measurement range, considered to be appropriate, for the workpiece.
Notice that higher magnification makes the measurement length shorter.

(4) Lower the pickup.

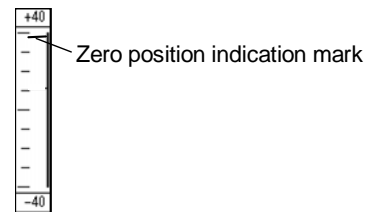
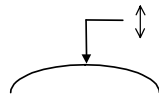
Lower the pickup and then stop it at the position where the mark comes to the center of the level meter on the measurement range screen.



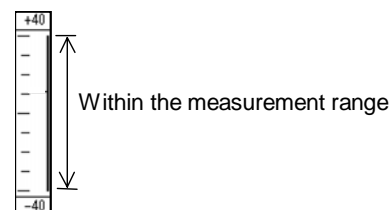
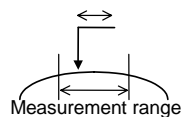
(5) Adjust the manual knob of the tracing driver in such a way that the pickup position comes to the top of arc (bottom when a concave type workpiece is to be measured).



(6) At the top of arc, move the pickup upward or downward or perform zero-adjustment operation in such a way that the mark can come to a point slightly lower than the top of the level meter range (a point slightly higher than the bottom of a concave profile).



(7) Rotate the manual knob of the tracing driver and move the pickup rightward or leftward in units of 1/2 of the measurement length. In the entire area, then check that the mark is put within the level meter display range (red indicator at end means that the mark is out of the range) on the measurement range screen. If the mark is out of the range, shorten the measurement length or lower the measurement range.



(8) Rotate the manual knob of the tracing driver to align the stylus to the measurement start point.

(9) Press the "Auto Set." icon on the menu screen.

Cancel "Zero-offset" on the auto-function setting screen.

If the measurement conditions of the data processor have been set, the preparation for measurement is completed.

- * When roughness measurement is used for the R-correction, use of a Gaussian filter as a cutoff type makes errors smaller.

2. R groove nosepiece

- (1) Press the "Meas. C." icon on the menu screen.
- (2) Set "Tilt" Correction to "R-Curve" on the measurement condition setting screen.
- (3) Install the optional R groove nosepiece (0102712) and the stylus (DT43815) in the pickup.
- (4) Pass a pickup cord through the connector rod and then connect the cord with the pickup.
- (5) Screw the connect rod behind the pickup.
- (6) Insert the connector rod into the pickup holder to make the skid of nosepiece parallel to the workpiece and then rotate the clamp knob clockwise for fixture.
- (7) Rotate the skid-skidless switching knob of the pickup holder counterclockwise and then set the knob to skid.
- (8) Loosen the skid position adjustment screw of the nosepiece skid, align the stylus and ball skid positions to each other, and clamp the screw again for fixing them.
- (9) Move the column and lower the pickup. At the position where the pickup and the measuring stand base are parallel to each other, stop the pickup.
- (10) Display the measurement range screen.
- (11) Rotate the skid adjustment screw and make adjustment in such a way that the mark can come to the center of the level meter on the main screen.

- (12) Rotate the manual knob of the tracing driver and move the pickup to check that the whole area from the measurement start point to the end point is put within the range of the level meter.
- (13) If the mark is placed at the upper end of the level meter when the pickup is at the measurement end point, and a concave profile appears, slightly slid the skid to the right from the stylus.
Perform the opposite operation when a convex profile appears.
- (14) When the mark is placed at the lower end of the level meter when the pickup is at the measurement end point, make adjustment in a manner opposite to that in Item (13).

If the whole portion of measurement of the level meter indication is put within the measurement range, the preparation for measurement is completed.

3. Circumference roughness tracing driver

A cylindrical workpiece can be rotated to measure the roughness of the whole circumference.

However, this measurement requires the optional circumference roughness tracing driver (E-RM-S37A) and general area trace nosepiece (0102703).

Measurement outer diameter	12 to 20 mm	Length: 30 to 150 mm
	20 to 150 mm	Length: 30 to 250 mm *

Note) To use the circumference roughness tracing driver, select the Rotary in the measuring speed setting screen.

4. R surface tracing driver

A rotary tracing driver for measuring the roughness of arc and the profile.

This measurement requires the optional R surface tracing driver (E-RM-S38A).

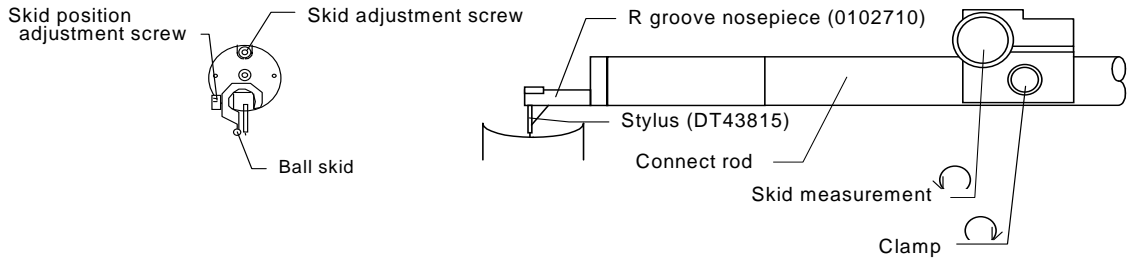
Measurement radius	0.25 to 40 mm *
Rotation angle	340 ° (Any angle of 5 ° or more can be set.)

* For details on the specifications, refer to the catalog.

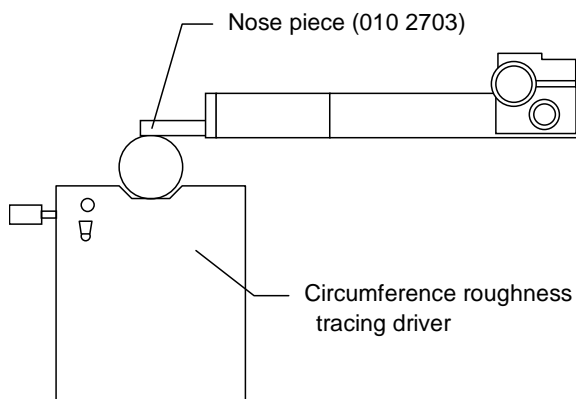
Note) To use the R surface tracing driver, select the Rsurf in the measuring speed setting screen.

To use the zero-stop function on the joystick operation, make the "Column up/down" "ON" in the auto-setting screen. When this setting is "OFF", zero-stop does not work. Generally, when the pick-up is set horizontally make it "OFF", when it is set downward, make it "ON".

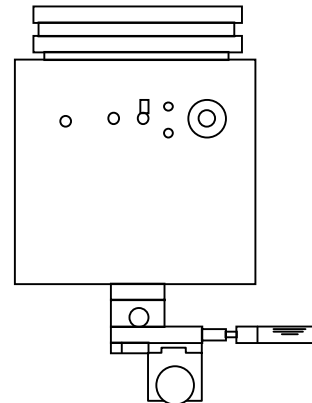
R groove nose piece



Circumference roughness tracing driver



R surface tracing driver



	Measurement	Measurable item	Workpiece	Workpiece diameter (R mm) and Measurement length (L mm)
R surface correction	Skidless	Profile curve Roughness curve Profile and Roughness parameters	Cylinder Ellipse Sphere, etc.	$L = 2R \cdot \sin 20^\circ$
R groove nosepiece	Skid	Roughness curve	Cylinder Ellipse Sphere, etc.	Cutoff = 0.08mm ~ 0.25mm $R > M/140$ $L = 40R / M$ M : Vertical magnification
Circumference roughness tracing driver	Skid	Roughness curve Roughness parameter	Cylinder only	$6 R 75$ Whole circumference measurable
R surface tracing driver	Skid	Roughness curve Roughness parameter	Cylinder Sphere etc.	$1 R 40$ $0^\circ \sim 340^\circ$

Because of skid R = 0.8mm for R groove nosepiece, the available cutoff value is 0.25 mm or less.

Measuring step height

If the message "Over range data exists." is displayed when a workpiece with comparatively large difference in height is measured, take measurements according to the following procedures.

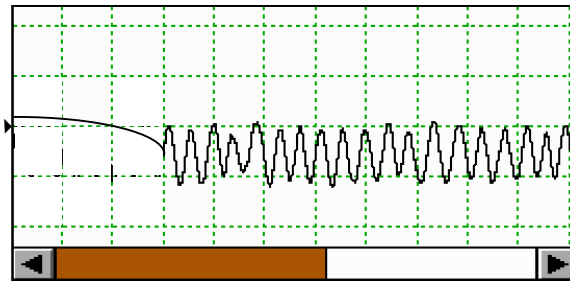
- (1) Turn the joy stick in the opposite direction to you to let the pickup escape upward once.
- (2) Rotate the manual knob of the tracing driver from the highest portion of the workpiece surface to be placed just under the stylus.
- (3) Turn the joy stick toward you to lower the pickup.
When the pickup goes down, it automatically stops at a place where the mark comes to the center of the zero-position indication mark on the main menu screen. Turn the joy stick toward you until the pickup stops.
- (4) Operate the joy stick in such a way that the mark of the level meter can come to a place slightly below the highest point of the level meter range on the main menu.
- (5) Rotate the manual knob of the tracing driver to align the stylus to the measurement start position.
- (6) Press the MEASURE switch to measure the workpiece surface.
 - * If the difference in height is 800 μ m or more, replace the stylus with another. If a stylus of 1/2 in sensitivity or 1/5 pickup is used, the measurable difference in height is up to 4000 μ m. However, if a workpiece has a large difference in height, error in the X axis direction becomes larger due to arc movement of the arm.
 - * For the S130A system without joy stick, move the pickup upward or downward with the up/down knob.

Measurement for deletion at both ends or at single end

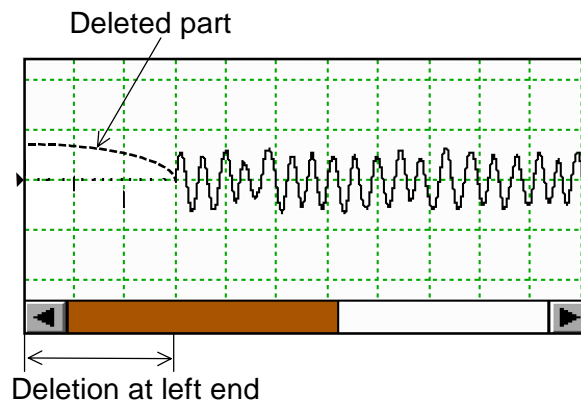
Except for the data for the length specified from the right and left ends, the measurement data is to be evaluated.

- (1) Press the "Calc. C." icon on the menu screen.
- (2) Press the **DISP** switch for the deletion of Partial Exclude.
- (3) Press the "ON" switch for "ON/OFF" and set the deletion length.
- (4) Press the **OK** switch.
- (5) Take measurements.
The results of measurement are displayed.

When the waveform deletion is not executed;



When the waveform deletion is executed;

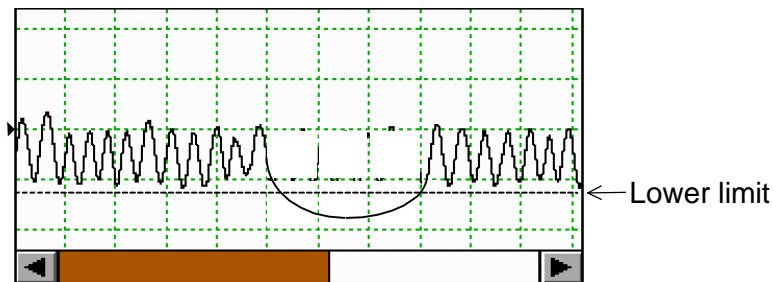


Measuring notched workpieces

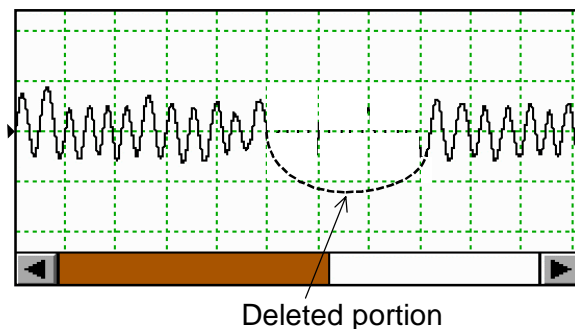
When a flawed workpiece is to be measured or to discriminate the roughness, waviness, flaw and dust from each other, various types of parameters are calculated by setting the upper limit and lower limit levels and by removing values exceeding the levels.

- (1) Press the "Calc. C." icon on the menu screen.
- (2) Press the **DISP** switch for Notch Calculation.
- (3) Press the "ON" switch for "ON/OFF" to set conditions.
- (4) Press the **OK** switch.
- (5) Take measurements.
The results of measurement are displayed.

When notch calculation is not executed;



When waveform deletion is executed;

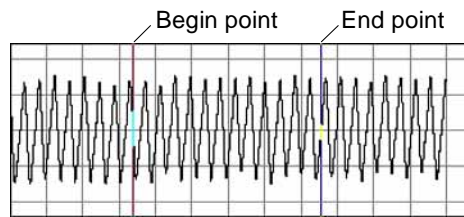


By using the function of “Connection of Curve”, each parameter can be calculated after removing the data of deleted portion and making connection of the remained evaluated portion. In addition to that, by using this function each parameter can be calculated after removing the portion which has not been selected as an evaluation range and making connection of the remained portion of the evaluation range.

That is to say, when the notch processing function is used, the portion to be deleted is designated by the upper and lower limits and when the evaluation range is selected, it is specified with a cursor by looking at the curve profile.

(The operation procedure in case of making selection of an evaluation range becomes as follows.)

- (1) Press the “System C.” icon on the menu screen.
- (2) Press the switch.
- (3) By pressing >, > switch of “Connection of Curve”, set it to “Normal” or “Mean Line”.
- (4) Press the switch.
- (5) After executing the measurement, press an icon of “Result” in the menu screen.
- (6) Press the switch.
- (7) Press > for the items of "Evaluation Area" . The mark is then switched to , indicating that these items have been set.
- (8) Then specify the bounds where is required to be reserved.
Press the switch, move cursor 1 with the > and > switches or by using the touch-pen, and then place the cursor at Begin P.
- (9) Similarly, press the switch, move cursor 2 with the > and > switches or by using the touch-pen, and then place the cursor at End P.



(10) Press the **Set** switch.

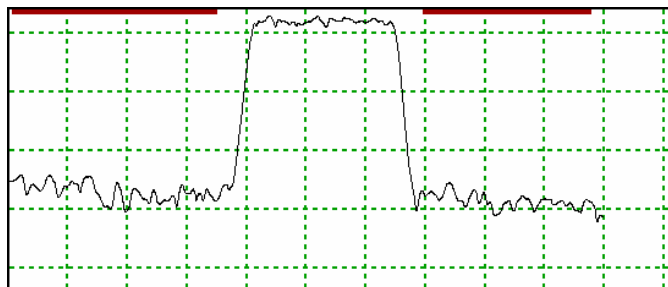
The specified range is then set.

(11) Repeat the above (8) to (10) and set the all ranges. (This setting can be made up to 10 ranges at the maximum.)

(12) Press the **Re-Cal.** switch.

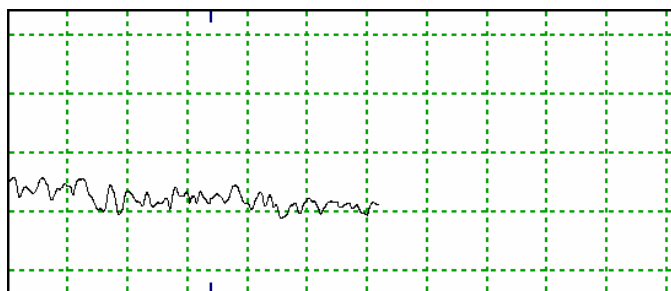
The range that has not been set is deleted and the curve will be connected.

Example) Before connection: The upper thick lines show the range which is necessary to be remained.



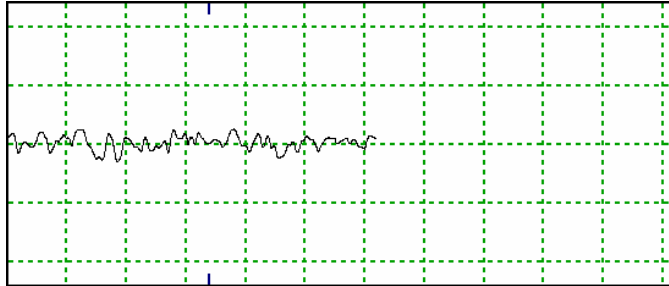
After connection (Normal connection):

The upper and lower short vertical lines show the connecting position.



After connection (Mean line connection):

The upper and lower short vertical lines show the connecting position.



(13) After making connection of a curve, a profile in case of non-connection

can be checked. Press the switch, then the area setting

screen will be appeared but the curve on this screen is a profile for non-connection. In order to change the area which is necessary to be

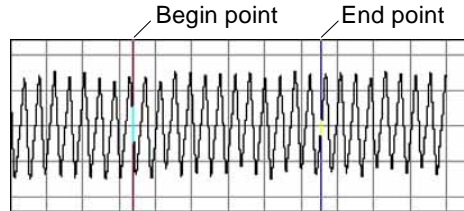
remained, press the switch and release the area setting, then make the area setting again and press the switch.

When it is necessary to return to the curve prior to the connection, it does not make the area setting and press the switch.

Measuring workpieces whose base surface and evaluation surface are defined independently

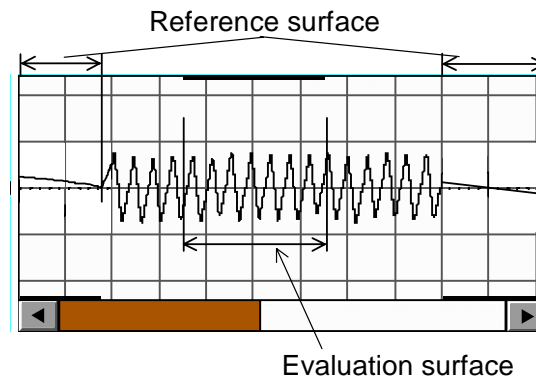
With respect to results of measurement, the evaluation range and tilt calculation range are set for re-calculation.

- (1) Press the "Result" icon on the menu screen after measurement.
- (2) Press the **Calc range** switch.
- (3) Press for the items of "Evaluation Area" and "Tilt Correction Area".
The mark is then switched to , indicating that these items have been set.
- (4) Press the **Begin P.** switch, move cursor 1 with the and switches or by using the touch-pen, and then place the cursor at Begin P.
- (5) Similarly, press the **End P.** switch, move cursor 2 with the and switches or by using the touch-pen, and then place the cursor at End P.



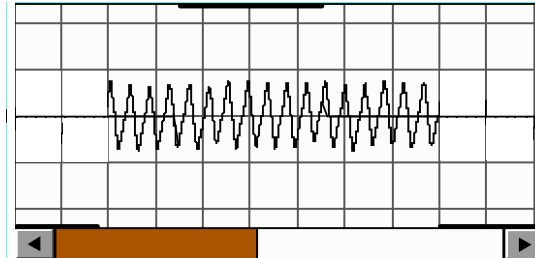
- (6) Press the **Set** switch.
The specified range is then set.

* Set the reference surface and the evaluation surface as a tilt calculation range and an evaluation range, respectively.



(7) Press the switch.

The reference surface is set in the tilt amount calculation range and the evaluation surface is set in the evaluation range, then recalculation will be made.



- * The setting of the tilt amount calculation range is only effective when the “Tilt” in the measuring condition setting screen is set to ‘Straight’, ‘R-Curve’ and ‘Begin-End’.
- * When recalculation is executed after making set of the evaluation range by using the function of “Curve connection”, a curve of unnecessary portion can be removed.

Measuring edges

The optional skidless measurement nosepiece (0102702) is available to simply measure the profile of an edge and the straightness of upper surface in pointed Gothic arc trunk.

(1) The setting of conditions and the leveling adjustments are the same as those for ordinary measurements.

(2) Remove the standard nosepiece and stylus from the pickup.

(3) Install the skidless measurement nosepiece in the pickup. After that, insert the stylus into the pickup.

(4) Rotate the skid adjustment screw to adjust the front travel.

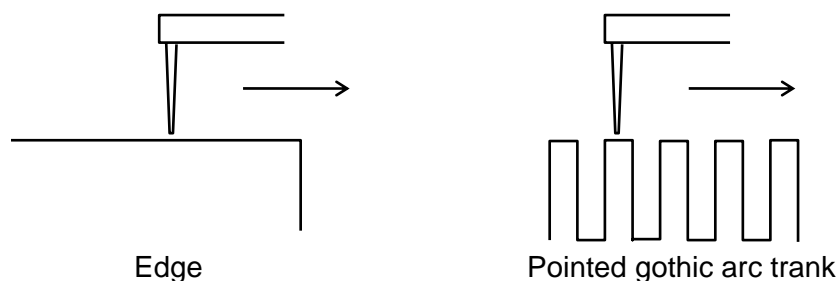
* Front travel means the amount of collapse of a stylus when the stylus is not made to contact a workpiece.

(5) Align the stylus of the pickup to the edge or the pointed Gothic arc trunk to be measured, rotate the manual knob of the tracing driver, and then trace the measurement portions.

(6) When this is the case, adjust the front travel in such a way that the tip of the stylus cannot be caught at the edge.

(7) Align the stylus of the pickup to the measurement start position. The preparation for measurement has been thus completed.

* The parameter value shows the height of front travel, which is meaningless, in this measuring procedure. Please evaluate the data from recording profile. In this case, use “ Notch calculation ” or “ Evaluation length area set ” function of “ Profile Curve ” screen to do parameter calculation without edge portion.



- MEMO -

10 Using a PC Card

This chapter describes how to save and read various types of conditions and measurement data by using a PC card.

- Precautions on use10-2
- Installation and removal10-3
- Using a PC card10-5

Precautions on use

Pay attention to the following to use the PC card.

Use the following dedicated PC card supplied by us for this machine. Please note that we shall not ensure normal operation for the use of PC card otherwise purchased.

Name	Type	Capacity
PC card (option)	E-MU-S50B	64MB

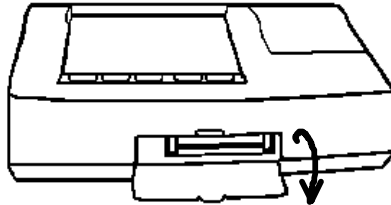
Note further that the PC card formatted through any other PC might not applicable to this machine. Format it through this machine when necessary. Normally formatting is not necessitated.

- * Please refer to Chapter 14 "In Trouble" when not available to implement normal operation of the PC card.

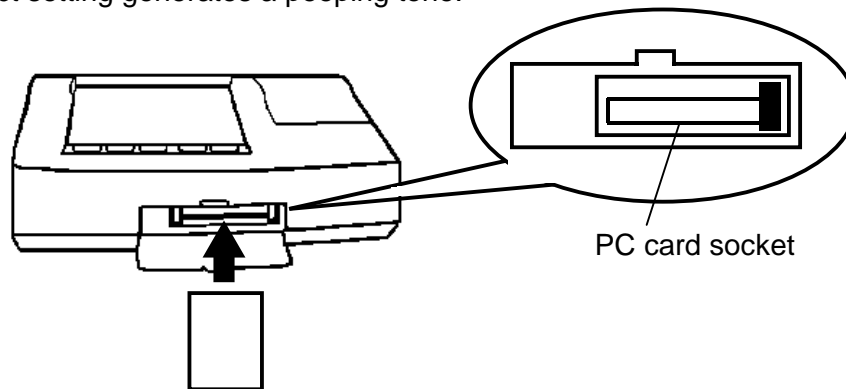
Installation and removal

Installation

- (1) Open the PC card storage lid on the front face of the main unit.



- (2) Insert a PC card in parallel to the PC card socket with the rear side up. Correct setting generates a peeping tone.

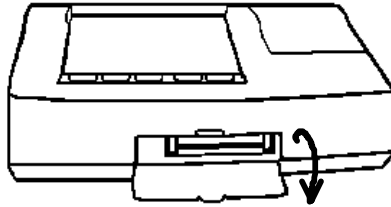


- * The PC card has the surface and the rear face, and the card can not be inserted to the slot unless setting the correct face to up face. As to which face should be up face, follow the table below.

Model of PC card	Soft version of SURF-COM130A/480A	Direction which inserts to SURFCOM130A/480A	In the case of being used in such as a notebook PC
E-MU-S50A	Before Ver.3.xx	Follow the instruction of the seal attached on the card.	Insert to the reverse direction with SURFCOM.
	After Ver.4.xx	Insert to the reverse of the seal instruction attached on the card.	Insert to the same direction as SURFCOM.
E-MU-S50B	Before Ver.3.xx	Follow the instruction of the seal attached on the card.	Insert to the reverse direction with SURFCOM.
	After Ver.4.xx		Insert to the same direction as SURFCOM.

Removal

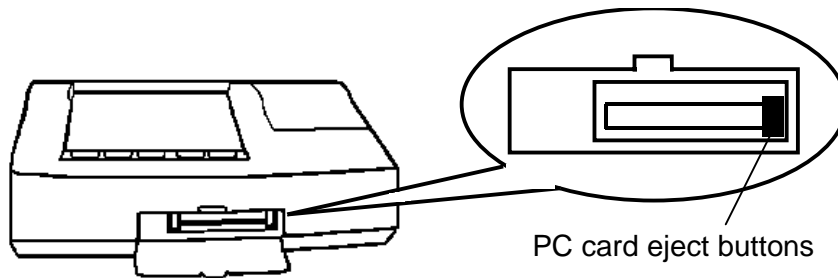
- (1) Open the PC card storage lid on the front face of the main unit.



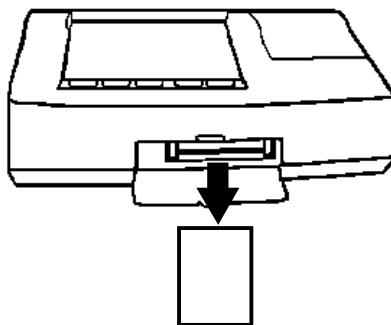
- (2) Press the PC card eject button.

Press the eject button at the right side.

- * When the software version of SURFCOM 130A/480A is before "Ver.3xx", the position of the PC card ejection button is located at the left.



- (3) Remove the PC card.



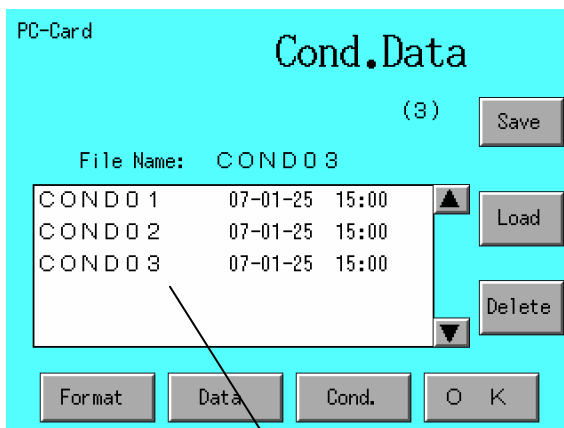
Using a PC card

This section describes how to save and read various types of conditions and measurement data by using a PC card.

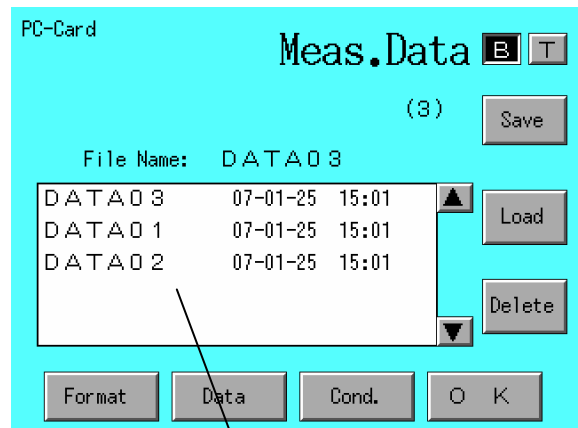
(1) Press the "PC-Card" icon on the menu screen.



The following screen then appears.



Various types of conditions saved
in the PC card



Measurement data saved
in the PC card

Switching screens

Switches the screen from the measurement data file to the various condition file, and viceversa.


switch : Switches to the measurement data file screen.

switch : Switches to the condition file screen.

Selection of file format

For making store of measuring data, it can be set by selecting from either binary format or text format. Press the switch for selection.

 Switch: This is switched over to binary format.

 Switch: This is switched over to text format.

The each file format is used for the purpose of below. It can be selected upon each purpose.

Binary format

This is the exclusive file format that can be used only for Surfcom. This is the most suitable format for storing measuring data due to the availability of reading and its small file size.

Text format

This is the versatile file format that can be used for a personal computer. This can be read from an application for spreadsheet program of a personal computer. By making use of its plotting function, it can be plotted Profile curve and Roughness Curve. This is the most suitable format to make the exclusive inspection certificate. (TXT for the extension)

The output item is shown in the figure of below, which individual output selection is available. The output selection is linked together with the setting of print output item screen and parameter selection screen.

The output is indicated in English in spite of the setting in any languages.

For further information, please refer to the measuring data (Txt file) format at the end of this chapter.

1. Comment 1	5. Date/Time	9. Parameter
2. Serial NO	6. Operator	10. P-Curve
3. Work name	7. Meas. Condition	11. R-Curve
4. Comment 2	8. Calc. Condition	

File name

A file name to be given to save various types of conditions and measurement data currently existing on memory in a PC card is displayed.

The file name is automatically given as the following procedure.

- Measurement data file

Name set with "Data Name" on the "Comment" setting screen + "Serial NO".

(Example) File name : DATA18
Meas. data Name Serial NO

- Various types of condition files
Name set with the "Conditions" on the "Comment" setting screen + "Serial NO".

(Example) File name : COND18
 Condition Name Serial NO

- * Measurement data Name, Condition Name and Serial NO can be set on the Comment setting screen. The Serial NO is incremented by +1 each time a measurement is taken.
- * To make the Serial NO of the print output result correspond to the Serial NO of the measurement data file, perform the automatic PC card save.

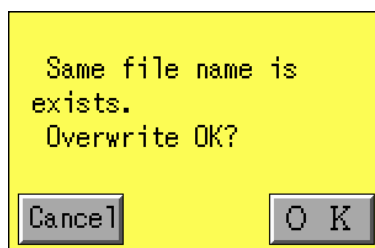
Save

Saves various types of conditions or measurement data in a PC card.

- 1) Press the switch.

Various types of conditions or measurement data is then saved.

If the same file name has been existent in the card, the following screen appears.



Press the switch to overwrite.

Press the switch to stop saving.

- * The file number which can be saved is approximately 500 if it is only measuring data (Binary format) and various conditions in the optional PC card (64MB). Also, in the case of the measuring data (Text format), since the data size changes depending on the selection of the output item and the evaluation length, the file number which can be saved changes depending on the setting. For your reference, the file number which can be saved in the maximum data size is approximately 100.

Load

Loads various types of conditions or measurement data in binary file format from a PC card.

- 1) Press the file name to load and display it in reverse video.
- 2) Press the switch.

The file is then loaded.

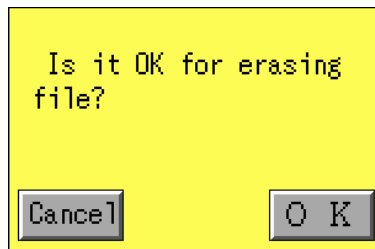
- * For measurement data in binary file format, a re-calculation is made.

Delete

Deletes a saved file from a PC card.

- 1) Press a file name to delete and display it in reverse video.
- 2) Press the switch.

The following screen then appears.



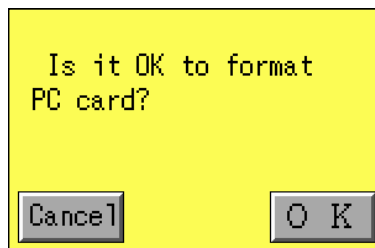
- 3) Press the switch.
The specified file is deleted.
Press the switch to stop deleting.

Format

Formats a PC card.

- 1) Press the switch.

The following screen then appears.



- 2) Press the switch.
The formatting operation then starts.
Press the switch to stop formatting.

- (2) Press the switch.
The menu screen reappears.

[A format of measuring data in text file]

A format of measuring data in text file is as shown below. The output order is the same as the order of printout.

- * Each calculation condition is output in the same way as the printout as the need arises.
- * The similar curve data which is displayed in the screen of measuring result is output.
- * The data pitch can be calculated by "Evaluation length / (data number – 1)".

< Output Example >	< Explanation of Contents >
COMMENT1	: Comment1
No. =05	: Serial NO.
Work =WORK NAME	: Workpiece name
Comment =COMMENT2	: Comment2
Date =98/10/02	: Measuring date (Date)
Time =11:40:02	: Measuring date (Time)
Operator=OPERATOR	: Name of measurement operator
Roughness (JIS'94)	: Measurement type <Measurement conditions> : Calculation standards
Eval.Length = 4.000mm	: Evaluation length
M.Speed =0.6mm/s	: Measurement speed
Cutoff value=0.8mm	: Cutoff value
Cutoff =Gaussian	: Type of filter
Meas.Range =+-400.0um	: Measurement range
Tilt =Straight	: Type of tilt correction
C.F.R. =300	: s filter
Polarity =Negative	: Polarity (only in "Negative")
Pc Upp-L = 0.100um	: Peak count upper limit <Calculation conditions>
Pc Low-L =-0.100um	: Peak count lower limit
Not.Del-L = 1um	: Notch deletion length
Not.Upp-L = 400.000um	: Notch upper limit
Not.Low-L =-400.000um	: Notch lower limit
Exclude(L) =0.000mm	: Deletion length at left end
Exclude(R) =1.000mm	: Deletion length at right end
Stp Ref-H =1.000um	: Step reference height
Stp Del-L = 2um	: Step deletion length
Stp Area-L = 2um	: Step area length

R. lmt. val. A=0.5mm	: Roughness motifs upper limit length
W. lmt. val. B=2.5mm	: Waviness motifs upper limit length
	: < Parameter of measurement results >
MM	: Output unit (MM-Metric/INCH-Inch)
Ra, 6.741	: Parameter symbol , Parameter value (μ m)
Ry, 28.308	Only for the TILT A, output format shall be
Rz, 24.689	as shown below;
Rmax, 30.575	-when selected the degree, minute and
Sm, 86.436	second;
S, 86.489	-0.00.25 (-0 ° 00 25 ")
Pc, 35	-when selected the degree;
AVH, 7.759	-0.007 (-0.007 °)
TILT A, -0.00.25	
	: < Curve Data >
MM	: Output unit (MM-Metric/INCH-Inch)
P	: Curve type (P/R)
4.000	: Evaluation length (mm)
6667	: Data point numbers
9.7500	: Measuring data (μ m), Including data point numbers
9.6125	In case of creating a profile curve by using the
9.4625	plotting function in spreadsheet application ,
9.3125	select the measuring data only.
9.1875	
9.0500	
8.9250	
8.7500	
8.5125	

11 Input/Output of Digital Data

This chapter describes the setting of conditions for connecting serial equipment including external computer.

Connection with external serial equipment11-2
Input/output of data into/from personal computer11-4

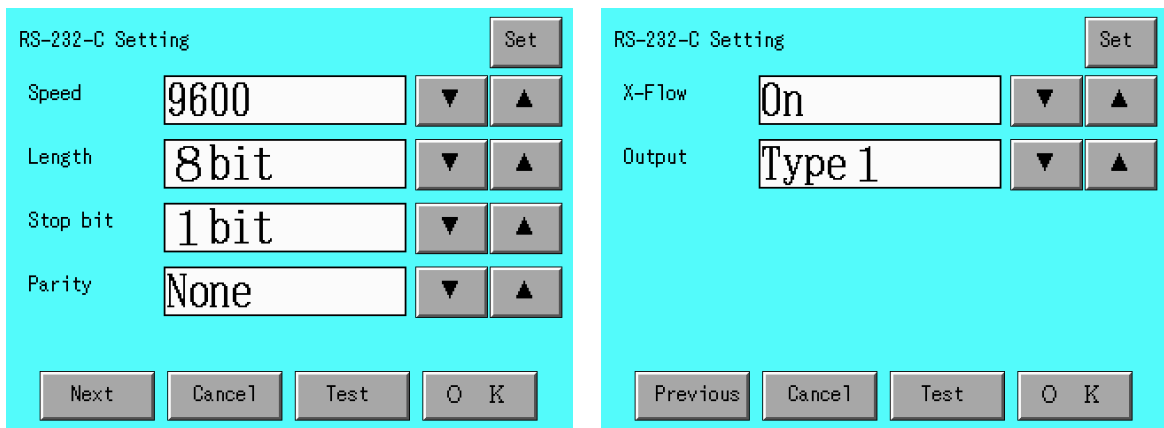
Connection with external serial equipment

This chapter describes the setting of conditions for connecting serial equipment including external computer.

- (1) Press the "RS-232-C" icon on the menu screen.



The condition setting screen then appears.

Two screenshots of the "RS-232-C Setting" screen. The left screenshot shows the following settings: Speed: 9600, Length: 8bit, Stop bit: 1 bit, Parity: None. The right screenshot shows the following settings: X-Flow: On, Output: Type 1. Both screens have a "Set" button at the top right and a row of buttons (Next, Cancel, Test, O K) at the bottom.

- (2) Set conditions according to the computer in connection.
- (3) Press the **Set** switch.
The set conditions are registered.
- (4) Press the **Test** switch.
Communication test is performed.
- (5) The following 'text' is sent to the computer in connection.
If the contents are correct, the system is ready for communication.
- (6) Press the **OK** switch.
The menu screen reappears.

Example)

Welcome to Surfcom

Speed : 9600bps

length : 8bit

stop bit : 1bit

parity : None

x-flow : On

} Actual set values are to be output.

COMMUNICATION - OK

Switching the contents of settings

Each time the or switch is pressed, the contents of settings in items are switched as given below.

Speed :	300
	600
	1200
	2400
	4800
	9600
	19200
	38400
	57600
	115200

Parity :	None
	Even
	Odd

X-Flow :	On
	Off

Length :	7bit
	8bit

Output :	Type 1
	Type 2

Stop bit :	1 bit
	2 bit

* The output type is a format of data output.
For details, refer to the instruction manual "Digital Data I/O Function".

* When the communication speed was set higher, there might be a risk of reception data loss depending on the receiving instrument. In such a case, set the speed lower and try the communication again.

Input/Output of data into/from personal computer

This function is available to output conditions, measurement data, and results of measurement to external serial equipment (e.g., personal computer) in connection via a serial cable.

(1) While pressing the **STOP** switch, press the **FEED** switch.

Conditions, measurement data and results of measurement are output to external serial equipment.

For details on digital data output, refer to the instruction manual "Digital Data I/O Function".

- MEMO -

12 High Magnification Pickup

This chapter describes the high magnification pickup.

- Specifications12-2
- Installation and connection12-3
- Retract function12-4
- Calibration12-6

Specifications

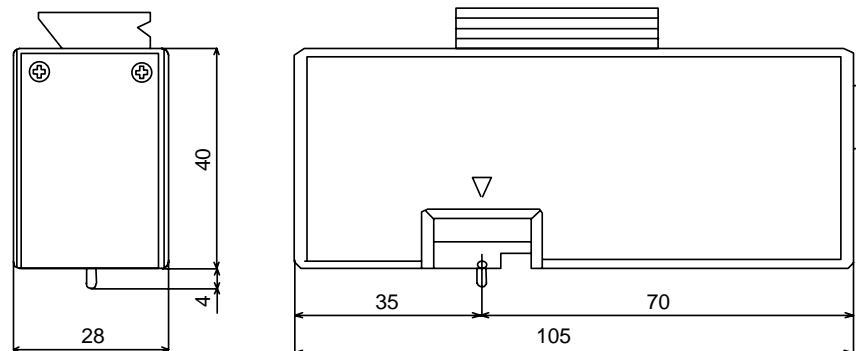
SURFCOM 480A can be equipped with the standard pickup (E-DT-S01A) to take measurements at a vertical magnification of 100,000. However, to measure minute profile at a higher magnification, use of the optional high magnification pickup (E-DT-SH01A) enables taking measurements at a vertical magnification of 500,000. However, a combination with this option is not available for SURFCOM 130A.

- Name and type : High magnification pickup (E-DT-SH01A)
- Measurement range : Up to +/-40 μ m
- Display vertical magnification : 500 1,000 2,000 5,000 10,000 20,000 50,000
100,000 200,000 500,000
- Measurement speed : 0.06 mm/s or less
 - * **The system can take measurements at a speed other than the above. However, since the stylus force of the high magnification pickup is small, i.e., 0.2mN, the stylus cannot follow a workpiece, depending on the profile.**
- Stylus : Type (0162854), tip diamond 1 μ mR 90° cone
- Stylus force : Approx. 0.2mN
 - * **The high magnification pickup can take measurements at high magnifications with low stylus force. Since this pickup is easily affected by vibration, use an air type vibration proofing board during operation.**

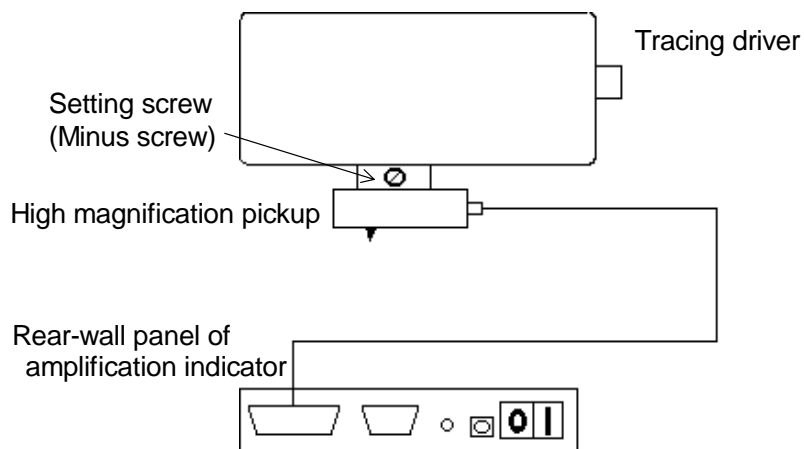
Installation and connection

This section describes how to install and connect the high magnification pickup.

- (1) Loosen a small dovetail groove screw under the tracing driver to remove the pickup holder.
 - (2) Insert small dovetails on the high magnification pickup into the small dovetail groove under the tracing driver and then rotate a minus driver to fix the screw.
 - (3) Connect the high magnification pickup cord (dedicated cable of SURFCOM480A) to the pickup, pass the cord through the cord hook on the rear side of the column, and then connect it to the pickup connector.
- * If the high magnification pickup is not used, retain the pickup by putting it back in the box where the pickup was housed. If the pickup is left fallen sidelong, the functions may be degraded.

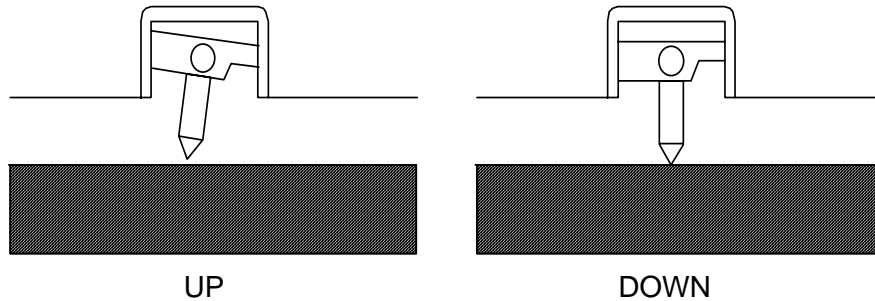


Installation and connection



Retract function

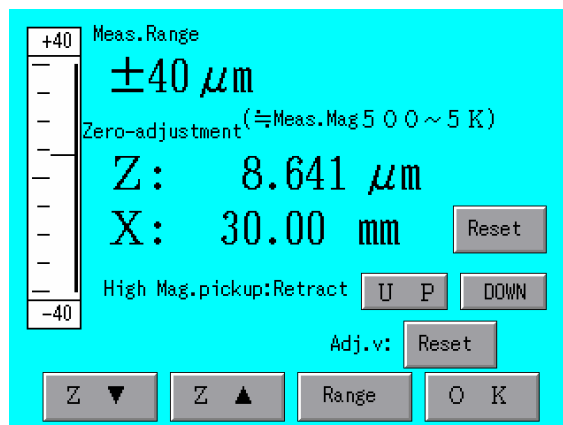
The retracting operation of this machine can be divided into the following two types.



1. Manual retract

- (1) Press the **Meas. Range** switch on the menu screen.

The following screen then appears.



- (2) Press the retract **UP** switch.

The machine performs retracting.

(Press the **DOWN** switch to release retracting.)

- (3) Press the **OK** switch.

The menu screen reappears.

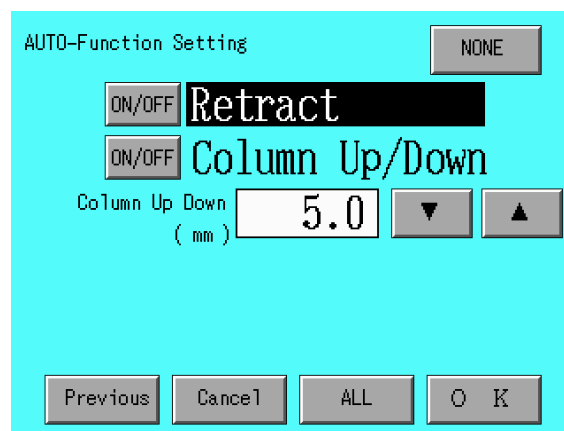
2. Automatic retract

Before measurement starts, the stylus is put in the down status. After measurement, the stylus is put in the up status.

- (1) Press the "Auto Set." icon on the menu screen.



The following screen then appears.



- (2) Press the retract ON/OFF switch to set the automatic retract (display in reverse video). After that, the retracting operation is performed during measurement.
- (3) Press the OK switch.
The menu screen reappears.

Calibration

When the standard pickup is replaced with a high magnification pickup, be sure to make calibration. The calibration is the same as that for the standard pickup. (Where the measuring speed for calibration is 0.06mm/s.)

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13 Maintenance

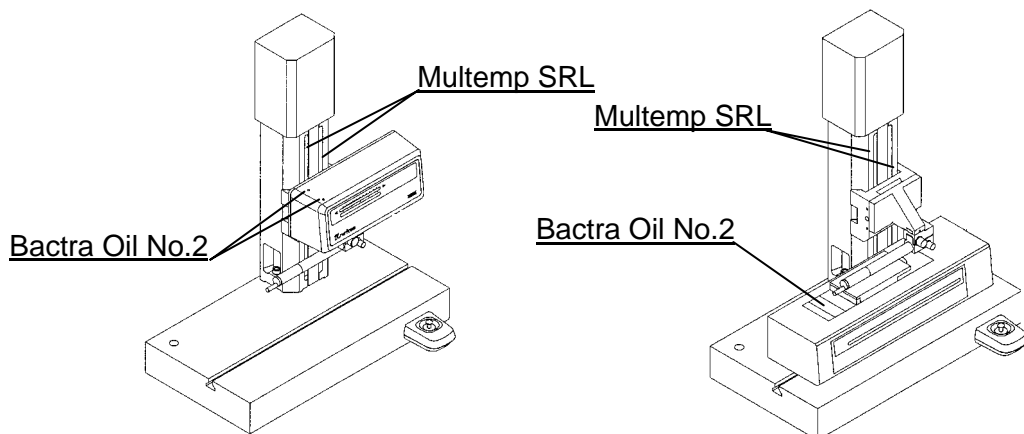
This chapter describes the maintenance.

General maintenance	13-2
Checking stylus	13-3
Adjusting the touchpanel	13-4
Recording displacement/checking vibration	13-6
Re-set	13-8

General maintenance

Normal operation of SURFCOM 130A/480A requires regular maintenance. Life of the measuring instrument may be shortened or correct results of measurements may not be obtained by neglecting this maintenance.

- (1) Though the number of calibrations to take differs depending on the frequency in use, the machine, in a standard case, should be calibrated once a month at least. (See Chapter 4, "Before Taking Measurement".)
- (2) Supply a drop of the special lubrication oil (Mobile Bactra Oil No.2) to each of upper and lower sliding surfaces of the main shaft and column in the tracing driver. (See the drawing below. For -S480A system)
- (3) Oil the vertical sliding surfaces of column once a month by one to two drops of the above-mentioned oil (Multemp SRL) contained in the accessory oiler, and then move the carriage from the bottom end to the top end once or twice.
- (4) Do not expose the measuring instrument to moisture, water, dust, dirt, soot, direct sunshine, strong shock and vibration.
- (5) Coat the surface of the measurement board (option) at times with a small quantity of spindle oil etc. to prevent rust.
- (6) When cleaning the surface of touchpanel and cover, softly wipe off foul with a cloth containing a neutral detergent or alcohol. Do not use an organic solvent.



Checking stylus

The tip of standard stylus (DT43801) is made of diamond. However, since the tip is very small, i.e., 2 μ m, it is gradually worn away as the tip is used. A shock may chip the tip of stylus. Use of a chipped stylus causes an error in the results of measurement.

Regular maintenance (once or more in a week) is therefore required.

(1) Prepare the attached precision reference specimen (E-MC-S24B)




(2) Set the data processor as follows.

Measurement type	: Roughness
Measurement range	: $\pm 40\mu\text{m}$
Vertical magnification	: $\times 10\text{K}$
Horizontal magnification	: $\times 200$
Cutoff value	: 0.8mm
Measurement length	: 4.0mm
Measurement speed	: 0.3mm/s
Filter type	: Gaussian filter
s filter	: Cutoff ratio 300

(3) Place side B of the precision reference specimen (Ra surface of approx. 0.4 μ m) under the stylus of the pickup.

(4) After the level adjustment, measure side B.

(5) Make judgment from the record waveform and Ra value of roughness curve by seeing the table below.

Judgment of results of measurement	Normal	Wear	Chip
Record		Head is rounding. 	Head is chipped flat. 
Ra value	$\pm 0.03 \mu\text{m}$ against the indication value	$\pm 0.03 \mu\text{m}$ to $-0.1 \mu\text{m}$ against the indication value	$-0.1 \mu\text{m}$ or less against the indication value

When the stylus is worn away or chipped, replace it with a new stylus.

- * The indication value of the precision reference specimen is a result of measurement taken with the stylus whose tip is 2 μ mR.
If the tip of stylus produces a result other than the above, compare the result with that at purchase.
- * The precision reference specimen disperses values more or less, depending on the place.
Repeated measurements of the same place cause the piece to be worn away, resulting in reducing the value. Take measurements at several places and then make judgment with the mean value.

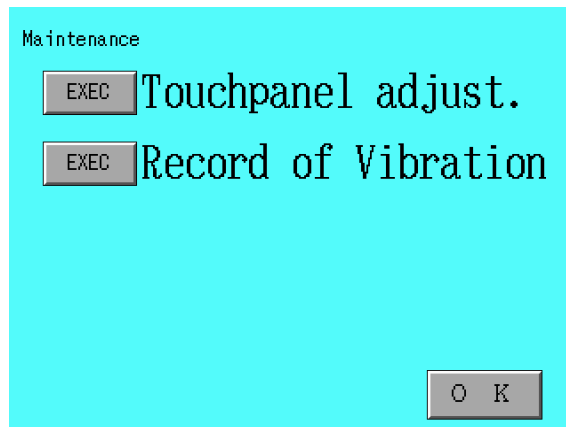
Adjusting the touchpanel

This section describes the procedure for adjusting the touchpanel. This adjustment is not ordinarily required because the touchpanel was already adjusted at shipment. However, when no reaction is made even if an internal portion of the outer frame of a switch has been pressed, perform this adjustment.

- (1) Press the "Mainte." icon on the menu screen.

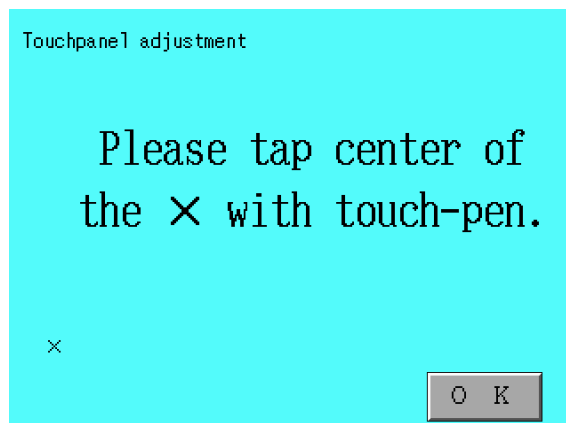


The maintenance select screen then appears.



- (2) Press the **EXEC** switch on the "Touchpanel adjust."

The following screen appears.



- (3) Press the center of the × mark on the screen with the touch-pen.
The × mark moves. Perform the same operation.
- (4) When the message for the end of touchpanel adjustment has appeared, press the switch.
- (5) Press the switch.
The maintenance select screen reappears.

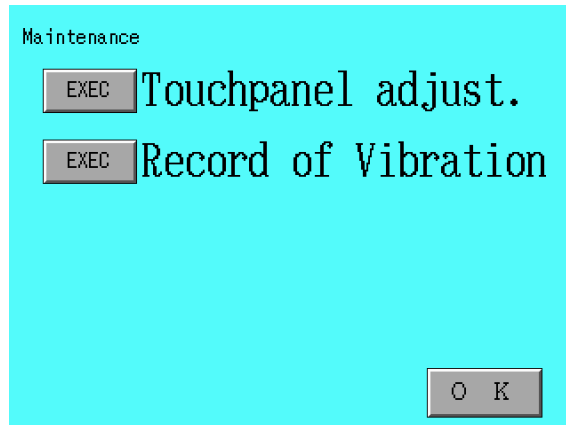
Recording displacement/checking vibration

When the pickup is in stop, the system records displacements in time feed.
The system is available as a simple displacement recorder or errors due to floor vibration can be checked.

- (1) Press the "Mainte." icon on the menu screen.

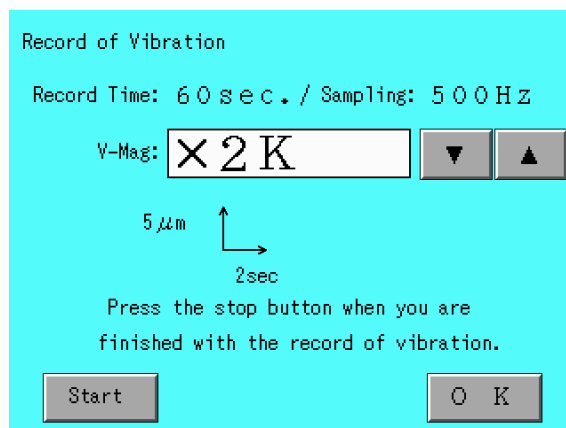


The maintenance select screen then appears.



- (2) Press the **EXEC** switch for the "Record of Vibration".

The following screen appears.



- (3) Set the vertical magnification with the and switches.

(4) Make the stylus contact the object to make zero-point alignment.

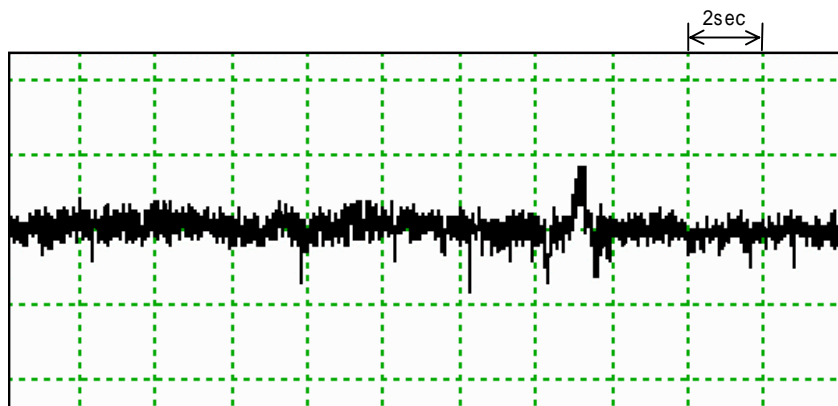
(5) Press the **Start** switch.

The displacement of the stylus is printed out in real-time waveform in the printer. A record time takes up to 60 sec. When this record time has passed, the operation automatically ends.

(6) Press the **STOP** switch.

Printout of waveform record stops.

* How to use the record



The printer feeds paper at a fixed speed of 5.0mm/sec. The record length is 300mm max.

* This data is not available for various types of analysis processing. This data cannot be saved in a PC card, either.

Re-set

How to return the equipment to be in the ex-factory condition is described here.

(1) Turn OFF the power source.

(2) Turn ON the power source with switch being pressed, in turning it ON again.

* Be sure to keep pressing the switch till the start screen appears.

(3) The state of equipment turns back to the ex-factory condition.

- MEMO -

14 In Trouble

Read this chapter when you cannot operate the machine as you expect or you do not know what to do.

Troubles on operation14-2
Troubles and actions14-5

Troubles on operation

Trouble	Cause and measure
The number of icons and layout on the menu screen are not as specified.	They are assumed to have been changed because of "Customize". Since saving the conditions with "Selection of condition" also saves the customized information, up to five layouts can be saved. Users can conveniently make proper use of them.
Profile curve is not displayed on the measurement result screen.	"Profile : OFF" is assumed to have been selected in the "System". Make proper use of it according to the application.
When the <input type="checkbox"/> STOP switch was pressed in measurement to stop the measurement, the calculation starts.	"Stop-Calc. : ON" is assumed to have been selected in the "System".
The displayed parameter value is different from the ordinary parameter.	The condition setting of cutoff value etc., may have been change. Up to five types of condition saving is allowed. Users can conveniently make proper use of them.
Though a detection level at the measurement start position is set in the step height measurement without tilt compensation, zero offset is done.	"Zero-offset" is assumed to have been set in the "Auto Set.". Though this function is convenient in the normal measurement, the function should be released in the step height measurement etc.
The calculation time is too long.	Set in such a way that unnecessary parameters are not to be calculated. Set required parameters only in the parameter selection in "Output". In addition, if bearing length ratio graph, amplitude distribution curve, and power graph are unnecessary, use the customization function not to display the icon. This prevents graphs from being calculated.
Interrupt measurement is taken during average processing.	Use the interrupt measurement function. Average processing subsequent to the release of interruption can be done.
Though the condition setting is appropriate, RS communication cannot be provided.	The serial port on the personal computer side may be set incorrectly or power may not be supplied to the serial port due to the power saving function. Refer to the manual for your personal computer.

Trouble	Cause and measure																		
PC card cannot be inserted.	Refer to "Installation/removal" of Chapter 10 "Use the PC card", and insert it to the correct direction.																		
PC card cannot be used.	FLASH ATA card in conformity with the PCMCIA code (Ver 2.1) as well the Compact Flash card mounted in the PC card adapter is applicable. Be sure to use the PC card supplied by us as there are some commercially offered cards are not applicable.																		
	PC card formatted through other PCs such like Windows machine might not be applicable to this machine. Format again such a card through this machine to make it applicable.																		
The screen disappears when the system is not operated for a while.	The sleep function is assumed to be set to 'ON' for "Save Energy". This function is effective when the battery is in use.																		
Calibration cannot be made.	Press the <input type="button" value="Init."/> switch and make calibration again.																		
"MEMO PAD" file cannot be deleted from the PC card.	<p>This machine does not provide a function for deleting "MEMO PAD" files from a PC card. A "MEMO PAD" file uses an area of up to 300 KB.</p> <p>* If you strongly desire to delete the file; PC card to be used in this machine is DOS formatted. It is accessible via a card socket of a PC compatible machine. The file can be deleted with the DOS "del" command etc.</p>																		
Numeric values cannot be entered.	An item requiring a numeric value to be entered has a setting range. A value beyond the range cannot be entered. Check the set range of the item.																		
<p>Real-time profile display during measurement takes a time from when the measurement switch is pressed until the system begins to plot the profile. In addition, after the end of plotting, the system takes a measurement for a while.</p> <p>Waiting time for stable operation (sec) :</p> <p>30mm tracing driver : 1.2</p> <p>50mm tracing driver : 0.7 ~ 2.4</p>	<p>The system performs sampling of measurement data with respect to the evaluation range (length set in the evaluation length) as well as preliminary driving length for filtering process before and after the evaluation range. In the display of real-time profile, it indicates the profile only in the evaluation range so that it takes the extra time for preliminary drive length. In addition to that, a waiting time for stable operation is added at the beginning of measurement.</p> <p>(See the table below - standard 100mm tracing driver.)</p> <table border="1"> <tbody> <tr> <td>Measurement speed (mm/sec)</td> <td>0.003</td> <td>0.006</td> <td>0.015</td> <td>0.03</td> <td>0.06</td> <td>0.15</td> <td>0.3</td> <td>0.6</td> </tr> <tr> <td>Waiting time for stable operation(sec)</td> <td>34.3</td> <td>17.7</td> <td>7.7</td> <td>4.3</td> <td>2.7</td> <td>1.7</td> <td>1.3</td> <td>1.2</td> </tr> </tbody> </table>	Measurement speed (mm/sec)	0.003	0.006	0.015	0.03	0.06	0.15	0.3	0.6	Waiting time for stable operation(sec)	34.3	17.7	7.7	4.3	2.7	1.7	1.3	1.2
Measurement speed (mm/sec)	0.003	0.006	0.015	0.03	0.06	0.15	0.3	0.6											
Waiting time for stable operation(sec)	34.3	17.7	7.7	4.3	2.7	1.7	1.3	1.2											

Trouble	Cause and measure
When a note is made on the memo pad screen, useless segment is generated.	A useless segment may be rarely generated when a note is made on the memo pad. Make a note slowly at a certain speed.
Profile is not displayed on the measurement result screen.	A set value of the vertical magnification may be too large for a profile to be displayed within the display frame. Set the vertical magnification to AUTO or reduce to a smaller value.
Erroneous characters may be displayed on the screen and the PC card cannot be used. (In the S480A system)	The data process and the docking unit are assumed to be connected defectively. Connect them without looseness.
Changing the contents of comment never works outputting print.	Change of comment makes its output of print valid after next measurement or recalculation.
The change of parameter selection never displayed their parameter values.	The change of parameter selection is valid after next measurement or recalculation. Carry out recalculation, when the calculation of additional parameter values is required with the acquired measurement data.
Password forgotten	It can be released by re-set. In this case, however, it will turn back to the ex-factory condition. When the condition set and others need to be remained, please contact the service factory. The master password will be issued.
Hard to watch a monochrome LCD due to excessively dark or bright screen.	Make adjustment of brightness by using a volume for making adjustment of the contrast at rear side of an amplification indicator.

Troubles and actions

If the following phenomena occur during operation of SURFCOM 130A/480A, take the actions at first. If the phenomena still appear or if the phenomena are not found in the table, contact Tokyo Seimitsu Co., Ltd., or authorized service representative. Engineering.

Failure status	Cause	Action
- The display of the data processor shows nothing.	- No power is supplied.	- Check the voltage at the plug socket. - Replace the power cord. (480A) - Replace the AC adapter. (130A) - Charge the battery. (when battery is attached)
	- Fuse is blown.	(130A) - Since fuse is installed inside, contact the service factory. (480A) - Replace the extension unit fuse with the specified one. If the fuse is still blown, contact the service factory.
	- The built-in battery of the data processor has run down.	- Contact the service factory.
- The zero-position indicator mark on the data processor does not deflect at all or deflects only to a side.	- The pickup cord is disconnected.	- Replace the pickup cord. - Replace the pickup.
	- The pickup cord is slipped off.	- Appropriately insert the pickup as far as it goes.
- The zero-position indicator mark on the data processor is unstable.	- The pickup cord defectively contacts.	- Replace the pickup cord. - Replace the pickup.
	- The leaf-spring of the stylus replacement unit is not inserted deeply.	- Appropriately insert the leaf-spring of the stylus replacement unit as far as it goes.
- The tracing driver is not driven even though the measurement switch and the return switch are pressed.	- Ringing on the sliding surface of the tracing driver	- Supply oil and operate the driver manually.
	- The cable of tracing driver is slipped off.	- Appropriately connect the cable of tracing driver.
- The measured roughness does not meet the result of measurement. - When displacement is given to the machine with the magnification calibrator, and the machine is then returned to the original point, the measured value is largely different from the initial value.	- The stylus and the nosepiece are worn out.	- Install the nosepiece and make adjustments.
	- Bearing at the hinged point of the pickup is flawed or rusted.	- Contact the service factory.

Failure status	Cause	Action
- Printing paper is not fed.	- Roll paper was jammed.	- Load the roll paper appropriately.
	- Printer error.	- Contact the service factory.
- Though printing paper is fed, the printer does not print out.	- Roll paper is set reversely.	- Reverse the direction of roll paper.
	- Printer error.	- Contact the service factory.
- Thin print density.	- Check that the printing paper is as specified.	- When the print density is still thin if specified printing paper is used, contact the service factory.
- Workpiece is flawed when measurement is taken.	- Stylus force is large.	- Use a pickup of low stylus force (E-DT-SE02A).
	- Workpiece is soft.	- Use the stylus with larger R.
	- Stylus tip R is small.	
- Fluctuation of measurement value becomes large suddenly. - When the stylus is placed on a workpiece, displacement changes largely. (Drift)	- The ambient temperature changes largely.	- Change the installation place.
	- The air conditioner directly blows air to the workpiece.	- Improve the temperature control.
	- Dust enters the sliding block.	- Put on a windbreak cover.
	- Contact the service factory.	
	- Looseness of skid-skidless switching knob	- Clamp the knob tightly.
	- The column is abnormal.	- Contact the service factory.
- Data of fine amplitude is recorded (amplitude is large).	- The clamp knob of pickup is loosened.	- Clamp portions tightly.
	- When the measuring stand is used, clamping screws of the tracing driver are loosened and/or column fixing screws are loosened.	
- When the 3.2 μ m Ra surface of standard is measured, the waveform is abnormal.	- The joint portion of the stylus is loosened.	- Replace the stylus.
	- The leaf-spring of the stylus replacement block is broken.	
	- The tip of the stylus is chipped.	- Replace the stylus.
	- Flawed precision reference specimen	- Take measurements at different places.
	- Dust on precision reference specimen	- Perform clearing.

Failure status	Cause	Action
- Wrong date and time are displayed and printed out. Or, saved measurement conditions are defective.	- The built-in battery of the data processor has run down.	- Contact the service factory.
	- Defective contact with the docking unit	- Insert and remove the connector to and from the docking unit and then turn on the power supply again.
- Measurement conditions are not stored.	- The built-in battery of the data processor has run down.	- Contact the service factory.
- The LCD back light becomes dark.	- Expiration of service life. If the back light becomes bright with the luminance increased, it must be replaced.	- Contact the service factory.
- The touchpanel does not operate.	- A portion with large flaw will not operate. If the touchpanel is inconvenient, it must be replaced. - The cover, which has slided, extends to the sensor area of the touchpanel.	- Contact the service factory.
- The screen is foul and is unclear to see.		- Wipe off foul with a cloth soaked in a neutral detergent.
- Wrong data and time	- The built-in battery of the data processor has run down.	
- No icon on display screen	- Since the measurement data file or the measurement condition file, which are stored in the old version, are read into, the condition set has got wrong.	- Turn ON the power source while pressing the STOP switch. - The condition set returns to the ex-factory condition. (Keep pressing the STOP switch till the start screen appears.)

15 References

Initial value list	15-2
Parameter list	15-6
Message list	15-13
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Initial value list

Initialization sets conditions as follows.

Values put in parentheses '()' are applicable when the high magnification pickup is in connection.

System Condition	Output unit	_____
	Polarity	Positive
	Pickup	Standard (high magnification)
	Meas. mode	Normal
	Profile	ON
	Stop-Calc.	ON
	E.Area print	OFF
	Division Line	OFF
	Judgment Reference	Average
	Connection of Curve	None
	Measurement Condition	Measurement Type
Meas. Speed		0.6mm/s
Evaluation Length		Fix mode (5 × c)
Cutoff value		0.8mm
Tilt		Straight
Cutoff		Gaussian
s		C.F.R.300
Return speed		3.0mm/s
Return setting		Normal
Pre. drive		Cutoff/3
Standard		JIS-'94 (in Japanese mode)
Meas. Range		± 400 μ m (± 40 μ m)
Calculation Condition	Param. Judgment	0.0 for all (no judgment of acceptance/nonacceptance)
	Tilt Angle Calc. Unit	Degree
	Tilt Angle Calc. Polarity	C.C.W.
	Notch Calculation	OFF
	Notch Calculation Delete Length	0.0 μ m
	Notch Calculation Upper Limit	400 μ m
	Notch Calculation Lower Limit	-400 μ m

	Partial Profile Exclude	OFF
	Partial Profile Exclude Left	0.0mm
	Partial Profile Exclude Right	0.0mm
	Peak Count Level Upper Limit	0.0 μ m
	Peak Count Level Lower Limit	0.0 μ m
	Step Height Calculation Ref. Height	0.0 μ m
	Step Height Calculation Delete Length	0.0 μ m
	Step Height Calculation Area Calc.	0.0 μ m
	BAC Calculation Cut-level unit	Relative
	BAC Calculation Method	E.Length
	BAC Output Method	Indivi.
	tp Setting	10.0 ~ 80.0%
	tp2 Setting	10.0,10.0 ~ 70.0%
	HP Setting	10.0 ~ 80.0%
	Motif Calculation	OFF
	Roughness Motifs Upper Limit Length (A)	0.5mm
	Waviness Motifs Upper Limit Length (B)	2.5mm
	Combined Display	ON
	Spline correction (Number of division)	10
	16% rule (Judgment method)	Standard
	16% rule (Judgment value of single section)	OFF
Printout selection	Comment 1	OFF
	Serial NO	ON
	Work name	ON
	Comment 2	ON
	Date / Time	ON
	Operator	ON
	Meas. Condition	ON
	Calc. Condition	OFF
	Parameter	ON
	BAC	OFF
	ADF	OFF
	Power Graph	OFF

	P-Curve	ON
	R-Curve	ON
	DIN4776-Curve	OFF
	Roughness motifs	OFF
	Waviness motifs	OFF
Parameter selection	Profile parameter	Set only for Rmax, Rz• J
	Roughness parameter	Set only for Ra, Ry, Rz, Sm, S, Rmax, Rz• J.
	Filt. Waviness parameter	Set only for Wa, WCM
	Filt. C.L. Waviness parameter	Set only for WCA, WC-t
	Roll. Circ. Waviness parameter	Set only for WE-a, WEM.
	Roll. C.L. Waviness parameter	Set only for WEA, WEC-t
Comment	Comment 1	Blank
	Comment 2	Blank
	Serial NO	01
	Work Name	Blank
	Operator	Blank
	Data Name	DATA
	Condition	COND
AUTO-Function Setting	Print out	OFF
	Return	OFF
	Data output	OFF
	PC-Card save	OFF
	Zero offset	ON
	Retract	OFF
	Column Up/Down	OFF
	Column Up Down	5mm
Result	Display/printout vertical magnification	× 2K
	Display/printout horizontal magnification	× 50
	Select curve	P curve
	Amount of shift in vertical direction of profile curve	0.0 μ m
	Cursor position Cursor 1	Data position of the 1st point
	Cursor position Cursor 2	Data position of the last point
BAC	Cursor position Cursor 1	Data position of the 1st point

	Cursor position Cursor 2	Data position of the 2nd point
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ADF	Cursor position Cursor 1	Data position of the 1st point
	Cursor position Cursor 2	Data position of the 2nd point
Power Graph	Cursor position Cursor 1	Data position of the 1st point
	Cursor position Cursor 2	Data position of the 2nd point
AI-Function	AI-Function	OFF
	Parameter of target	Ra
	Indicated value of parameter	1.0 μ m
RS-232-C	Speed	9600
	Length	8bit
	Stop bit	1bit
	Parity	None
	X-Flow	On
	Output	Type 1
Average Value processing	Average Value processing	OFF
	Frequency	10
	Print-mode	All data
	Delete	1
PC-Card	Display item	Cond. Data
Save Energy	Sleep ON/OFF	OFF
	Wait Time	5 minutes
Calibration	Mag. calibration device Pickup	Standard
	Mag. calibration device Reference Value	20 μ m
	Roughness standard Parameter	Ra
	Roughness standard Pickup	Standard
	Roughness standard Reference Value	2.9 μ m
	Step Height Master Master	A1-Flat
	Step Height Master Low Limit of Groove depth	-0.1 μ m
	Step Height Master Exclude Area	0.0 μ m
	Step Height Master Pickup	Standard
	Step Height Master Reference Value	10 μ m
MEMO PAD	AUTO-PRINT	OFF

Parameter list

P : Profile curve
 R : Roughness curve
 D : DIN4776 Special roughness curve
 RM : Roughness Motifs
 WM : Waviness Motifs
 UE : Upper envelope line
 W : Filtered Waviness
 WC : Filtered Center Line Waviness
 WE : Rolling Circle Waviness
 WEC : Rolling Circle Center Line Waviness

Parameter list (Profile parameter)

Average value processing : Available : Not available : x

Name	JIS'82 Display	JIS'94 Display	JIS'01 Display	ISO'84 Display	ISO'97 Display	DIN'90 Display	ASME'95 Display	Average
Arithmetical mean deviation of the profile	-----	-----	Pa :P	-----	Pa :P	-----	-----	
Root mean Square deviation of the profile	-----	-----	Pq :P	-----	Pq :P	-----	-----	
Maximum profile peak height	-----	-----	Pp :P	-----	Pp :P	-----	-----	
Maximum profile valley depth	-----	-----	Pv :P	-----	Pv :P	-----	-----	
Mean height of elements	-----	-----	Pc.l :P	-----	Pc.l :P	-----	-----	
Maximum height(JIS82)	Rmax :P	Rmax :P	Pt :P	Pt :P	Pt :P	Pt :P	Pt :P	
Ten point height of irregularities(JIS82)	Rz :P	Rz.J :P	Rz.J :P	Rz.J :P	Rz.J :P	Rz.J :P	Rz.J :P	
Mean spacing of profile irregularities	Sm :P	-----	PSm :P	-----	PSm :P	-----	-----	
Arithmetical mean slope of the profile	a :P	-----	-----	-----	-----	-----	-----	
Root mean square slope of the profile	q :P	-----	P q :P	-----	P q :P	-----	-----	
Average wavelength of the profile	a :P	-----	-----	-----	-----	-----	-----	
Root mean square wavelength of profile	q :P	-----	-----	-----	-----	-----	-----	
Average slope angle	TILTA :P	TILTA :P	TILTA :P	TILTA :P	TILTA :P	TILTA :P	TILTA :P	
Profile length ratio	l r :P	-----	-----	-----	-----	-----	-----	
Skewness of the profile	Rsk :P	-----	Psk :P	-----	Psk :P	-----	-----	
Kurtosis of the profile	Rku :P	-----	Pku :P	-----	Pku :P	-----	-----	
Core roughness depth	Rk :P	-----	-----	-----	-----	-----	-----	
The reduced peak height	Rpk :P	-----	-----	-----	-----	-----	-----	
The reduced valley depth	Rvk :P	-----	-----	-----	-----	-----	-----	
Material ratio 1	Mr1 :P	-----	-----	-----	-----	-----	-----	
Material ratio 2	Mr2 :P	-----	-----	-----	-----	-----	-----	
Oil retention volume	VO :P	-----	-----	-----	-----	-----	-----	
Reduced valley depth ratio	K :P	-----	-----	-----	-----	-----	-----	
Step difference value average height	AVH :P	AVH :P	AVH :P	AVH :P	AVH :P	AVH :P	AVH :P	
Step difference value maximum value	Hmax :P	Hmax :P	Hmax :P	Hmax :P	Hmax :P	Hmax :P	Hmax :P	
Step difference value minimum value	Hmin :P	Hmin :P	Hmin :P	Hmin :P	Hmin :P	Hmin :P	Hmin :P	
Step difference section area	AREA :P	AREA :P	AREA :P	AREA :P	AREA :P	AREA :P	AREA :P	
Profile bearing length	Tp :P	-----	Pmr :P	-----	Pmr :P	-----	-----	x
Profile bearing length 2	Tp2 :P	-----	Pmr2 :P	-----	Pmr2 :P	-----	-----	x
Profile section level separation	Hp :P	-----	P c :P	-----	P c :P	-----	-----	x

Parameter list (Motifs parameter)

	JIS'82	JIS'94	JIS'01	ISO'84	ISO'97	DIN'90	ASME'95	Ave- rage
Name	Display	Display	Display	Display	Display	Display	Display	
Number of valleys	-----	NCRX :P	NCRX :P	NCRX :P	NCRX :P	NCRX :P	NCRX :P	
Mean depth of roughness motifs	-----	R :RM	R :RM	R :RM	R :RM	R :RM	R :RM	
Maximum depth of profile irregularity	-----	Rx :RM	Rx :RM	Rx :RM	Rx :RM	Rx :RM	Rx :RM	
Mean spacing of roughness motifs	-----	AR :RM	AR :RM	AR :RM	AR :RM	AR :RM	AR :RM	
Number of roughness motifs	-----	NR :RM	NR :RM	NR :RM	NR :RM	NR :RM	NR :RM	
Mean number of valleys	-----	CPM :RM	CPM :RM	CPM :RM	CPM :RM	CPM :RM	CPM :RM	
Standard deviation of roughness motifs depth	-----	SR :RM	SR :RM	SR :RM	SR :RM	SR :RM	SR :RM	
Standard deviation of roughness motifs space	-----	SAR :RM	SAR :RM	SAR :RM	SAR :RM	SAR :RM	SAR :RM	
Mean depth of waviness motifs	-----	W :WM	W :WM	W :WM	W :WM	W :WM	W :WM	
Maximum depth of waviness	-----	Wx :WM	Wx :WM	Wx :WM	Wx :WM	Wx :WM	Wx :WM	
Mean spacing of waviness motifs	-----	AW :WM	AW :WM	AW :WM	AW :WM	AW :WM	AW :WM	
Total depth of waviness	-----	Wte :WM	Wte :WM	Wte :WM	Wte :WM	Wte :WM	Wte :WM	
Number of waviness motifs	-----	NW :WM	NW :WM	NW :WM	NW :WM	NW :WM	NW :WM	
Standard deviation of waviness motifs depth	-----	SW :WM	SW :WM	SW :WM	SW :WM	SW :WM	SW :WM	
Standard deviation of waviness motifs space	-----	SAW :WM	SAW :WM	SAW :WM	SAW :WM	SAW :WM	SAW :WM	
Core roughness depth	-----	-----	Rke :UE	-----	Rke :UE	-----	-----	
The reduced peak height	-----	-----	Rpke :UE	-----	Rpke :UE	-----	-----	
The reduced valley depth	-----	-----	Rvke :UE	-----	Rvke :UE	-----	-----	
Material ratio 1	-----	-----	Mr1 :UE	-----	Mr1 :UE	-----	-----	
Material ratio 2	-----	-----	Mr2 :UE	-----	Mr2 :UE	-----	-----	
Oil retention volume	-----	-----	Vo :UE	-----	Vo :UE	-----	-----	
Reduced valley depth ratio	-----	-----	K :UE	-----	K :UE	-----	-----	

Parameter list (Roughness parameter)

Name	JIS'82 Display	JIS'94 Display	JIS'01 Display	ISO'84 Display	ISO'97 Display	DIN'90 Display	ASME'95 Display	Ave- rage
Arithmetical mean deviation of the profile	Ra :R	Ra :R	Ra :R	Ra :R	Ra :R	Ra :R	Ra :R	
ditto standard deviation	-----	Rasd :R	Rasd :R	Rasd :R	Rasd :R	Rasd :R	Rasd :R	x
ditto Maximum in division	-----	Ramax :R	Ramax :R	Ramax :R	Ramax :R	Ramax :R	Ramax :R	x
ditto Minimum in division	-----	Ramin :R	Ramin :R	Ramin :R	Ramin :R	Ramin :R	Ramin :R	x
ditto Average+standard deviation	-----	Ra+sd :R	Ra+sd :R	Ra+sd :R	Ra+sd :R	Ra+sd :R	Ra+sd :R	x
ditto Average-standard deviation	-----	Ra-sd :R	Ra-sd :R	Ra-sd :R	Ra-sd :R	Ra-sd :R	Ra-sd :R	x
Root mean Square deviation of the profile	Rq :R	Rq :R	Rq :R	Rq :R	Rq :R	Rq :R	Rq :R	
ditto standard deviation	-----	Rqsd :R	Rqsd :R	Rqsd :R	Rqsd :R	Rqsd :R	Rqsd :R	x
ditto Maximum in division	-----	Rqmax :R	Rqmax :R	Rqmax :R	Rqmax :R	Rqmax :R	Rqmax :R	x
ditto Minimum in division	-----	Rqmin :R	Rqmin :R	Rqmin :R	Rqmin :R	Rqmin :R	Rqmin :R	x
ditto Average+standard deviation	-----	Rq+sd :R	Rq+sd :R	Rq+sd :R	Rq+sd :R	Rq+sd :R	Rq+sd :R	x
ditto Average-standard deviation	-----	Rq-sd :R	Rq-sd :R	Rq-sd :R	Rq-sd :R	Rq-sd :R	Rq-sd :R	x
Maximum height of the profile	-----	Ry :R	Rz :R	Ry :R	Rz :R	Rz :R	Rz :R	
ditto standard deviation	-----	Rysd :R	Rysd :R	Rysd :R	Rzsd :R	Rzsd :R	Rzsd :R	x
ditto Maximum in division	-----	Rymax :R	Rymax :R	Rymax :R	Rzmax :R	Rmax :R	Rmax :R	x
ditto Minimum in division	-----	Rymin :R	Rymin :R	Rymin :R	Rzmin :R	Rmin :R	Rmin :R	x
ditto Average+standard deviation	-----	Ry+sd :R	Ry+sd :R	Ry+sd :R	Rz+sd :R	Rz+sd :R	Rz+sd :R	x
ditto Average-standard deviation	-----	Ry-sd :R	Ry-sd :R	Ry-sd :R	Rz-sd :R	Rz-sd :R	Rz-sd :R	x
Maximum profile peak height	Rp :R	Rp :R	Rp :R	Rp :R	Rp :R	Rp :R	Rpm :R	
ditto standard deviation	-----	Rpsd :R	Rpsd :R	Rpsd :R	Rpsd :R	Rpsd :R	Rpsd :R	x
ditto Maximum in division	-----	Rpmax :R	Rpmax :R	Rpmax :R	Rpmax :R	Rpmax :R	Rp :R	x
ditto Minimum in division	-----	Rpmin :R	Rpmin :R	Rpmin :R	Rpmin :R	Rpmin :R	Rpmin :R	x
ditto Average+standard deviation	-----	Rp+sd :R	Rp+sd :R	Rp+sd :R	Rp+sd :R	Rp+sd :R	Rp+sd :R	x
ditto Average-standard deviation	-----	Rp-sd :R	Rp-sd :R	Rp-sd :R	Rp-sd :R	Rp-sd :R	Rpm-sd :R	x
Maximum profile valley depth	Rv :R	Rv :R	Rv :R	Rv :R	Rv :R	Rv :R	Rv :R	
ditto standard deviation	-----	Rvsd :R	Rvsd :R	Rvsd :R	Rvsd :R	Rvsd :R	-----	x
ditto Maximum in division	-----	Rvmax :R	Rvmax :R	Rvmax :R	Rvmax :R	Rvmax :R	-----	x
ditto Minimum in division	-----	Rvmin :R	Rvmin :R	Rvmin :R	Rvmin :R	Rvmin :R	-----	x
ditto Average+standard deviation	-----	Rv+sd :R	Rv+sd :R	Rv+sd :R	Rv+sd :R	Rv+sd :R	-----	x
ditto Average-standard deviation	-----	Rv-sd :R	Rv-sd :R	Rv-sd :R	Rv-sd :R	Rv-sd :R	-----	x
Mean height of elements	Rc :R	Rc :R	Rc :R	Rc :R	Rc :R	Rc :R	Rc :R	
ditto standard deviation	-----	Rcsd :R	Rcsd :R	Rcsd :R	Rcsd :R	Rcsd :R	Rcsd :R	x
ditto Maximum in division	-----	Rcmax :R	Rcmax :R	Rcmax :R	Rcmax :R	Rcmax :R	Rcmax :R	x
ditto Minimum in division	-----	Rcmin :R	Rcmin :R	Rcmin :R	Rcmin :R	Rcmin :R	Rcmin :R	x
ditto Average+standard deviation	-----	Rc+sd :R	Rc+sd :R	Rc+sd :R	Rc+sd :R	Rc+sd :R	Rc+sd :R	x
ditto Average-standard deviation	-----	Rc-sd :R	Rc-sd :R	Rc-sd :R	Rc-sd :R	Rc-sd :R	Rc-sd :R	x
Ten point height of irregularities(ISO)	-----	Rz :R	Rz94 :R	Rz :R	Rz94 :R	Rz.l :R	Rz.l :R	
ditto standard deviation	-----	Rzsd :R	Rz94sd :R	Rzsd :R	Rz94sd :R	Rz.lsd :R	Rz.lsd :R	x
ditto Maximum in division	-----	Rzmax :R	Rz94max :R	Rzmax :R	Rz94max :R	Rz.lmax :R	Rz.lmax :R	x
ditto Minimum in division	-----	Rzmin :R	Rz94min :R	Rzmin :R	Rz94min :R	Rz.lmin :R	Rz.lmin :R	x
ditto Average+standard deviation	-----	Rz+sd :R	Rz94+sd :R	Rz+sd :R	Rz94+sd :R	Rz.l+sd :R	Rz.l+sd :R	x
ditto Average-standard deviation	-----	Rz-sd :R	Rz94-sd :R	Rz-sd :R	Rz94-sd :R	Rz.l-sd :R	Rz.l-sd :R	x
Maximum height(ISO)	Rt :R	Rt :R	Rt :R	Rt :R	Rt :R	Rt :R	Rt :R	

Parameter list (Roughness parameter)

Name	JIS'82 Display	JIS'94 Display	JIS'01 Display	ISO'84 Display	ISO'97 Display	DIN'90 Display	ASME'95 Display	Ave- rage
Base roughness height	R3z :R	R3z :R	R3z :R	R3z :R	R3z :R	R3z :R	R3z :R	
Mean spacing of profile irregularities	-----	Sm :R	RSm :R	RSm :R	RSm :R	RSm :R	RSm :R	
ditto standard deviation	-----	Smsd :R	RSmsd :R	RSmsd :R	RSmsd :R	RSmsd :R	RSmsd :R	x
ditto Maximum in division	-----	Smax :R	RSmax :R	RSmax :R	RSmax :R	RSmax :R	RSmax :R	x
ditto Minimum in division	-----	Smin :R	RSmin :R	RSmin :R	RSmin :R	RSmin :R	RSmin :R	x
ditto Average+standard deviation	-----	Sm+sd :R	RSm+sd :R	RSm+sd :R	RSm+sd :R	RSm+sd :R	RSm+sd :R	x
ditto Average-standard deviation	-----	Sm-sd :R	RSm-sd :R	RSm-sd :R	RSm-sd :R	RSm-sd :R	RSm-sd :R	x
Mean spacing of local peaks of the profile	S :R	S :R	-----	RS :R	-----	RS :R	RS :R	
ditto standard deviation	-----	Ssd :R	-----	RSsd :R	-----	RSsd :R	RSsd :R	x
ditto Maximum in division	-----	Smax :R	-----	RSmax :R	-----	RSmax :R	RSmax :R	x
ditto Minimum in division	-----	Smin :R	-----	RSmin :R	-----	RSmin :R	RSmin :R	x
ditto Average+standard deviation	-----	S+sd :R	-----	RS+sd :R	-----	RS+sd :R	RS+sd :R	x
ditto Average-standard deviation	-----	S-sd :R	-----	RS-sd :R	-----	RS-sd :R	RS-sd :R	x
Arithmetical mean slope of the profile	-----	R a :R	R a :R	R a :R	R a :R	R a :R	R a :R	
ditto standard deviation	-----	R asd :R	R asd :R	R asd :R	R asd :R	R asd :R	R asd :R	x
ditto Maximum in division	-----	R amax :R	R amax :R	R amax :R	R amax :R	R amax :R	R amax :R	x
ditto Minimum in division	-----	R amin :R	R amin :R	R amin :R	R amin :R	R amin :R	R amin :R	x
ditto Average+standard deviation	-----	R a+sd :R	R a+sd :R	R a+sd :R	R a+sd :R	R a+sd :R	R a+sd :R	x
ditto Average-standard deviation	-----	R a-sd :R	R a-sd :R	R a-sd :R	R a-sd :R	R a-sd :R	R a-sd :R	x
Root mean square slope of the profile	-----	R q :R	R q :R	R q :R	R q :R	R q :R	R q :R	
ditto standard deviation	-----	R qsd :R	R qsd :R	R qsd :R	R qsd :R	R qsd :R	R qsd :R	x
ditto Maximum in division	-----	R qmax :R	R qmax :R	R qmax :R	R qmax :R	R qmax :R	R qmax :R	x
ditto Minimum in division	-----	R qmin :R	R qmin :R	R qmin :R	R qmin :R	R qmin :R	R qmin :R	x
ditto Average+standard deviation	-----	R q+sd :R	R q+sd :R	R q+sd :R	R q+sd :R	R q+sd :R	R q+sd :R	x
ditto Average-standard deviation	-----	R q-sd :R	R q-sd :R	R q-sd :R	R q-sd :R	R q-sd :R	R q-sd :R	x
Average wavelength of the profile	-----	R a :R	R a :R	R a :R	R a :R	R a :R	R a :R	
ditto standard deviation	-----	R asd :R	R asd :R	R asd :R	R asd :R	R asd :R	R asd :R	x
ditto Maximum in division	-----	R amax :R	R amax :R	R amax :R	R amax :R	R amax :R	R amax :R	x
ditto Minimum in division	-----	R amin :R	R amin :R	R amin :R	R amin :R	R amin :R	R amin :R	x
ditto Average+standard deviation	-----	R a+sd :R	R a+sd :R	R a+sd :R	R a+sd :R	R a+sd :R	R a+sd :R	x
ditto Average-standard deviation	-----	R a-sd :R	R a-sd :R	R a-sd :R	R a-sd :R	R a-sd :R	R a-sd :R	x
Root mean square wavelength of profile	-----	R q :R	R q :R	R q :R	R q :R	R q :R	R q :R	
ditto standard deviation	-----	R qsd :R	R qsd :R	R qsd :R	R qsd :R	R qsd :R	R qsd :R	x
ditto Maximum in division	-----	R qmax :R	R qmax :R	R qmax :R	R qmax :R	R qmax :R	R qmax :R	x
ditto Minimum in division	-----	R qmin :R	R qmin :R	R qmin :R	R qmin :R	R qmin :R	R qmin :R	x
ditto Average+standard deviation	-----	R q+sd :R	R q+sd :R	R q+sd :R	R q+sd :R	R q+sd :R	R q+sd :R	x
ditto Average-standard deviation	-----	R q-sd :R	R q-sd :R	R q-sd :R	R q-sd :R	R q-sd :R	R q-sd :R	x
Profile length ratio	-----	lr :R	lr :R	lr :R	lr :R	lr :R	lr :R	
Peak count	Pc :R	Pc :R	Pc :R	Pc :R	Pc :R	Pc :R	Pc :R	

Parameter list (Roughness parameter)

Name	JIS'82 Display	JIS'94 Display	JIS'01 Display	ISO'84 Display	ISO'97 Display	DIN'90 Display	ASME'95 Display	Average
Skewness of the profile	-----	Rsk :R,D	Rsk :R,D	Rsk :R,D	Rsk :R,D	Rsk :R,D	Rsk :R,D	
ditto standard deviation	-----	-----	Rsksd :R,D	-----	Rsksd :R,D	-----	-----	x
ditto Maximum in division	-----	-----	Rskmax:R,D	-----	Rskmax:R,D	-----	-----	x
ditto Minimum in division	-----	-----	Rskmin:R,D	-----	Rskmin:R,D	-----	-----	x
ditto Average+standard deviation	-----	-----	Rsk+sd:R,D	-----	Rsk+sd:R,D	-----	-----	x
ditto Average-standard deviation	-----	-----	Rsk-sd:R,D	-----	Rsk-sd:R,D	-----	-----	x
Kurtosis of the profile	-----	Rku :R,D	Rku :R,D	Rku :R,D	Rku :R,D	Rku :R,D	Rku :R,D	
ditto standard deviation	-----	-----	Rkusd :R,D	-----	Rkusd :R,D	-----	-----	x
ditto Maximum in division	-----	-----	Rkumax:R,D	-----	Rkumax:R,D	-----	-----	x
ditto Minimum in division	-----	-----	Rkumin:R,D	-----	Rkumin:R,D	-----	-----	x
ditto Average+standard deviation	-----	-----	Rku+sd:R,D	-----	Rku+sd:R,D	-----	-----	x
ditto Average-standard deviation	-----	-----	Rku-sd:R,D	-----	Rku-sd:R,D	-----	-----	x
Core roughness depth	-----	Rk :R,D	Rk :R,D	Rk :R,D	Rk :R,D	Rk :R,D	Rk :R,D	
The reduced peak height	-----	Rpk :R,D	Rpk :R,D	Rpk :R,D	Rpk :R,D	Rpk :R,D	Rpk :R,D	
The reduced valley depth	-----	Rvk :R,D	Rvk :R,D	Rvk :R,D	Rvk :R,D	Rvk :R,D	Rvk :R,D	
Material ratio 1	-----	Mr1 :R,D	Mr1 :R,D	Mr1 :R,D	Mr1 :R,D	Mr1 :R,D	Mr1 :R,D	
Material ratio 2	-----	Mr2 :R,D	Mr2 :R,D	Mr2 :R,D	Mr2 :R,D	Mr2 :R,D	Mr2 :R,D	
Oil retention volume	-----	VO :R,D	VO :R,D	VO :R,D	VO :R,D	VO :R,D	VO :R,D	
Reduced valley depth ratio	-----	K :R,D	K :R,D	K :R,D	K :R,D	K :R,D	K :R,D	
Profile bearing length (Reference length)	-----	-----	-----	-----	-----	-----	-----	x
Profile bearing length (Evaluation length)	-----	Rmr :R,D	Rmr :R,D	Rmr :R,D	Rmr :R,D	Rmr :R,D	Rmr :R,D	x
Profile bearing length2(Reference length)	-----	-----	-----	-----	-----	-----	-----	x
Profile bearing length2(Evaluation length)	-----	Rmr2 :R,D	Rmr2 :R,D	Rmr2 :R,D	Rmr2 :R,D	Rmr2 :R,D	Rmr2 :R,D	x
Profile section level separation	-----	R c :R,D	R c :R,D	R c :R,D	R c :R,D	R c :R,D	R c :R,D	x

Parameter list (Waviness parameter)

Name	JIS'82 Display	JIS'94 Display	JIS'01 Display	ISO'84 Display	ISO'97 Display	DIN'90 Display	ASME'95 Display	Average
Center line mean value	WC-a :W	Wa :W	Wa :W	Wa :W	Wa :W	Wa :W	Wa :W	
Root mean square value	WC-q :W	Wq :W	Wq :W	Wq :W	Wq :W	Wq :W	Wq :W	
Filtered maximum waviness	WCM :W	WCM :W	Wt :W	Wt :W	Wt :W	Wt :W	Wt :W	
Maximum peak height	WC-p :W	Wp :W	Wp :W	Wp :W	Wp :W	Wp :W	Wp :W	
Maximum valley depth	WC-v :W	Wv :W	Wv :W	Wv :W	Wv :W	Wv :W	Wv :W	
Mean spacing of profile irregularities	WC-Sm :W	WSm :W	WSm :W	WSm :W	WSm :W	WSm :W	WSm :W	

Parameter list (Waviness parameter)

Name	JIS'82 Display	JIS'94 Display	JIS'01 Display	ISO'84 Display	ISO'97 Display	DIN'90 Display	ASME'95 Display	Average
Filtered center line waviness	WCA : WC	WCA : WC	Wa : WC	Wa : WC	Wa : WC	Wa : WC	Wa : WC	
ditto standard deviation	-----	-----	Wasd : WC	-----	Wasd : WC	-----	-----	x
ditto Maximum in division	-----	-----	Wamax : WC	-----	Wamax : WC	-----	-----	x
ditto Minimum in division	-----	-----	Wamin : WC	-----	Wamin : WC	-----	-----	x
ditto Average+standard deviation	-----	-----	Wa+sd : WC	-----	Wa+sd : WC	-----	-----	x
ditto Average-standard deviation	-----	-----	Wa-sd : WC	-----	Wa-sd : WC	-----	-----	x
Root mean square value	WCC-q : WC	WC-q : WC	Wq : WC	Wq : WC	Wq : WC	Wq : WC	Wq : WC	
ditto standard deviation	-----	-----	Wqsd : WC	-----	Wqsd : WC	-----	-----	x
ditto Maximum in division	-----	-----	Wqmax : WC	-----	Wqmax : WC	-----	-----	x
ditto Minimum in division	-----	-----	Wqmin : WC	-----	Wqmin : WC	-----	-----	x
ditto Average+standard deviation	-----	-----	Wq+sd : WC	-----	Wq+sd : WC	-----	-----	x
ditto Average-standard deviation	-----	-----	Wq-sd : WC	-----	Wq-sd : WC	-----	-----	x
Maximum height	WCC-m : WC	WC-t : WC	Wt : WC	Wt : WC	Wt : WC	Wt : WC	Wt : WC	
Maximum peak height	WCC-p : WC	WC-p : WC	Wp : WC	Wp : WC	Wp : WC	Wp : WC	Wp : WC	
ditto standard deviation	-----	-----	Wpsd : WC	-----	Wpsd : WC	-----	-----	x
ditto Maximum in division	-----	-----	Wpmax : WC	-----	Wpmax : WC	-----	-----	x
ditto Minimum in division	-----	-----	Wpmin : WC	-----	Wpmin : WC	-----	-----	x
ditto Average+standard deviation	-----	-----	Wp+sd : WC	-----	Wp+sd : WC	-----	-----	x
ditto Average-standard deviation	-----	-----	Wp-sd : WC	-----	Wp-sd : WC	-----	-----	x
Maximum valley depth	WCC-v : WC	WC-v : WC	Wv : WC	Wv : WC	Wv : WC	Wv : WC	Wv : WC	
ditto standard deviation	-----	-----	Wvsd : WC	-----	Wvsd : WC	-----	-----	x
ditto Maximum in division	-----	-----	Wvmax : WC	-----	Wvmax : WC	-----	-----	x
ditto Minimum in division	-----	-----	Wvmin : WC	-----	Wvmin : WC	-----	-----	x
ditto Average+standard deviation	-----	-----	Wv+sd : WC	-----	Wv+sd : WC	-----	-----	x
ditto Average-standard deviation	-----	-----	Wv-sd : WC	-----	Wv-sd : WC	-----	-----	x
Mean spacing of profile irregularities	WCC-Sm : WC	WC-Sm : WC	WSm : WC	WSm : WC	WSm : WC	WSm : WC	WSm : WC	
ditto standard deviation	-----	-----	WSmsd : WC	-----	WSmsd : WC	-----	-----	x
ditto Maximum in division	-----	-----	WSmmax : WC	-----	WSmmax : WC	-----	-----	x
ditto Minimum in division	-----	-----	WSmmin : WC	-----	WSmmin : WC	-----	-----	x
ditto Average+standard deviation	-----	-----	WSm+sd : WC	-----	WSm+sd : WC	-----	-----	x
ditto Average-standard deviation	-----	-----	WSm-sd : WC	-----	WSm-sd : WC	-----	-----	x
Maximum height	-----	-----	Wz : WC	-----	Wz : WC	-----	-----	
ditto standard deviation	-----	-----	Wzsd : WC	-----	Wzsd : WC	-----	-----	x
ditto Maximum in division	-----	-----	Wzmax : WC	-----	Wzmax : WC	-----	-----	x
ditto Minimum in division	-----	-----	Wzmin : WC	-----	Wzmin : WC	-----	-----	x
ditto Average+standard deviation	-----	-----	Wz+sd : WC	-----	Wz+sd : WC	-----	-----	x
ditto Average-standard deviation	-----	-----	Wz-sd : WC	-----	Wz-sd : WC	-----	-----	x
Mean height of elements	-----	-----	Wc : WC	-----	Wc : WC	-----	-----	
ditto standard deviation	-----	-----	Wcsd : WC	-----	Wcsd : WC	-----	-----	x
ditto Maximum in division	-----	-----	Wcmax : WC	-----	Wcmax : WC	-----	-----	x
ditto Minimum in division	-----	-----	Wcmin : WC	-----	Wcmin : WC	-----	-----	x
ditto Average+standard deviation	-----	-----	Wc+sd : WC	-----	Wc+sd : WC	-----	-----	x
ditto Average-standard deviation	-----	-----	Wc-sd : WC	-----	Wc-sd : WC	-----	-----	x

Parameter list (Waviness parameter)

	JIS'82	JIS'94	JIS'01	ISO'84	ISO'97	DIN'90	ASME'95	Ave- rage
Name	Display	Display	Display	Display	Display	Display	Display	
Skewness of the profile	-----	-----	Wsk : WC	-----	Wsk : WC	-----	-----	
ditto standard deviation	-----	-----	Wksd : WC	-----	Wksd : WC	-----	-----	x
ditto Maximum in division	-----	-----	Wskmax : WC	-----	Wskmax : WC	-----	-----	x
ditto Minimum in division	-----	-----	Wskmin : WC	-----	Wskmin : WC	-----	-----	x
ditto Average+standard deviation	-----	-----	Wsk+sd : WC	-----	Wsk+sd : WC	-----	-----	x
ditto Average-standard deviation	-----	-----	Wsk-sd : WC	-----	Wsk-sd : WC	-----	-----	x
Kurtosis of the profile	-----	-----	Wku : WC	-----	Wku : WC	-----	-----	
ditto standard deviation	-----	-----	Wkud : WC	-----	Wkud : WC	-----	-----	x
ditto Maximum in division	-----	-----	Wkumax : WC	-----	Wkumax : WC	-----	-----	x
ditto Minimum in division	-----	-----	Wkumin : WC	-----	Wkumin : WC	-----	-----	x
ditto Average+standard deviation	-----	-----	Wku+sd : WC	-----	Wku+sd : WC	-----	-----	x
ditto Average-standard deviation	-----	-----	Wku-sd : WC	-----	Wku-sd : WC	-----	-----	x
Root mean square slope of the profile	-----	-----	W q : WC	-----	W q : WC	-----	-----	
ditto standard deviation	-----	-----	W qsd : WC	-----	W qsd : WC	-----	-----	x
ditto Maximum in division	-----	-----	W qmax : WC	-----	W qmax : WC	-----	-----	x
ditto Minimum in division	-----	-----	W qmin : WC	-----	W qmin : WC	-----	-----	x
ditto Average+standard deviation	-----	-----	W q+sd : WC	-----	W q+sd : WC	-----	-----	x
ditto Average-standard deviation	-----	-----	W q-sd : WC	-----	W q-sd : WC	-----	-----	x
Profile bearing length	-----	-----	Wmr : WC	-----	Wmr : WC	-----	-----	x
Profile bearing length 2	-----	-----	Wmr2 : WC	-----	Wmr2 : WC	-----	-----	x
Profile section level separation	-----	-----	W c : WC	-----	W c : WC	-----	-----	x

Parameter list (Rolling Circle Waviness parameter)

	JIS'82	JIS'94	JIS'01	ISO'84	ISO'97	DIN'90	ASME'95	Ave- rage
Name	Display	Display	Display	Display	Display	Display	Display	
Center line mean value	WE-a : WE	WE-a : WE	WE-a : WE	-----	-----	-----	-----	
Root mean square value	WE-q : WE	WE-q : WE	WE-q : WE	-----	-----	-----	-----	
Rolling circle waviness	WEM : WE	WEM : WE	WEM : WE	-----	-----	-----	-----	
Maximum peak height	WE-p : WE	WE-p : WE	WE-p : WE	-----	-----	-----	-----	
Maximum valley depth	WE-v : WE	WE-v : WE	WE-v : WE	-----	-----	-----	-----	
Mean spacing of profile irregularities	WE-Sm : WE	WE-Sm : WE	WE-Sm : WE	-----	-----	-----	-----	

Parameter list (Rolling Circle Waviness parameter)

	JIS'82	JIS'94	JIS'01	ISO'84	ISO'97	DIN'90	ASME'95	Ave- rage
Name	Display	Display	Display	Display	Display	Display	Display	
Rolling circle filtered waviness	WEA : WEC	WEA : WEC	WEA : WEC	-----	-----	-----	-----	
Root mean square value	WEC-q : WEC	WEC-q : WEC	WEC-q : WEC	-----	-----	-----	-----	
Maximum height	WEC-m : WEC	WEC-t : WEC	WEC-t : WEC	-----	-----	-----	-----	
Maximum peak height	WEC-p : WEC	WEC-p : WEC	WEC-p : WEC	-----	-----	-----	-----	
Maximum valley depth	WEC-v : WEC	WEC-v : WEC	WEC-v : WEC	-----	-----	-----	-----	
Mean spacing of profile irregularities	WEC-Sm : WEC	WEC-Sm : WEC	WEC-Sm : WEC	-----	-----	-----	-----	

Message list

This section describes messages to be displayed on the LCD display and actions to be taken.

Calibration

- **"Calibration is completed."**
This message appears when correct calibration has been made.
- **"Calibration error. Confirm calibration setting, and try again."**
This message appears when the magnification calibration is not made correctly. Perform initialization, check the setting for correctness, and then make a magnification calibration again.
- **"Step height master type or measuring position is wrong. Check and ensure that the setting is correct to perform the magnification calibration again. "**
S57A (L) shall perform measurement and calibration of three grooves while the S57A (S) does five grooves. Above message shall appear if measured with a different type or failed to measure all grooves. Initialize the system and check and ensure that the setting is correct so as to perform measurement and calibration again.
- **"The coefficient of calibration is initialized."**
This message appears when the switch is pressed.
- **"Cannot reset Z-value. Zero-adjustment value is out of range."**
This message appears when the switch is pressed in the calibration with the magnification calibrator, but the Z replacement value to adjust exceeds the zero-adjustment range.

Setting conditions

- **"Is it OK for canceling setted up conditions"**
This message appears when not the switch but the switch is pressed after the judgment value is changed on the parameter judgment value setting screen.
- **"A lower limit value is greater than the upper limit value."**
This message appears when the switch is pressed on the notch calculation screen or on the parameter judgment value screen with "Upper limit level <= Lower limit level".

- **"The setting value (Partial Exclude) is greater than evaluation length."**
This message appears when measurement or re-calculation is taken since the total of right and left deletion lengths is greater than the evaluation length on the partial profile exclude screen.
- **"Set values with roughness motif limit < waviness motif limit."**
This message appears on the screen when or is pressed at the situation of "Roughness motifs upper limit length Waviness motifs upper limit length" in the motif calculation display.

Measurements

- **"Tracing driver is not connected."**
This message appears when the switch is pressed with the tracing driver and the data processor not connected to each other or with the tracing driver cable disconnected.
- **"Column unit is not connected."**
This message appears when the switch is pressed with the column unit not connected to the data processor.
- **"Pickup is not connected."**
This message appears when the switch is pressed with the pickup not connected to the data processor.
- **"Cannot start measurement. Limit switch is turned ON."**
This message appears when the switch is pressed with the limit switch turned on.
- **"Measurement has stopped. Limit switch is turned ON."**
This message appears when the limit switch is turned on during measurement. In the part-way calculation mode, however, this message does not appear when the measurement length is larger than the length necessary for parameter calculation.
- **"Measurement has stopped."**
This message appears when the switch is pressed during measurement.
- **"Emergency switch has been pressed."**
This message appears when the switch or the switch is pressed with the emergency stop switch pressed already.

- **"Evaluation length is smaller than minimum value."**
This message appears with the switch pressed when the set evaluation length is less than the measurable minimum value.
- **"Evaluation length is greater than maximum value."**
This message appears when the switch was pressed in case where the set evaluation length was larger than the measurable maximum value.
- **"Cutoff value is set as a value larger than the evaluation value. Make it smaller and execute again. "**
This is displayed when the switch is pressed in case of that the setting cutoff value is longer than the setting evaluation length, and this is also displayed when the actual evaluation length becomes smaller than the cutoff value in case of using the function of stop calculation, notch processing or profile portion cancellation. The actual evaluation length means the length from the measurement start point to the point of being pressed the switch and the length of the notch portion is excluded.
- **"Error occurred during Auto stop operation."**
This is displayed in case where the Auto stop operation was not completed within 10 second, then the Auto stop operation stops and operations thereafter are terminated. This is displayed also displayed in case the pickup moved 5mm or more toward the +Z-axis direction during the Auto stop operation, then the Auto stop operation stops and operations thereafter are terminated as well.
When this message is displayed, there is a risk that the probe gets trapped in the pickup. In such a case, pull out the probe in a safe area and put it in again. If the message still appears, please contact us or TOSEI Engineering Co., Ltd.

Calculation processing

- **"Over range data exists. Recalculate with notch calculation?"**
This message appears when the scale over data is detected in the calculation processing with the notch calculation set to OFF.
Pressing switch in the message effects a notch calculation converting the upper and lower limits of measuring range into its correspondents. Further, pressing switch never effects calculation. In the process of recalculation, the previous condition effects recalculation.

- **"Cannot calculate parameter. The amount of notch count is out of range."**
This message appears when the notch count exceeds the upper limit of 100 in the calculation processing.
- **"Cannot calculate parameter. Lack of sampling data."**
This message appears when the number of sampling data pieces is less than the minimum number of sampling data pieces necessary for calculation.
To be concrete, it is displayed when the effective evaluation length is smaller than the least evaluation length. The least evaluation length differs depend on the measuring speed. For the further information, please refer to the Chapter 5 "Setting conditions for measurement" in this manual.
The effective evaluation length are the length that to remove the notch part length, partially eliminated length of the wave, etc. from the actual measurement length. And when the evaluation range setting is set, the effective evaluation length becomes the total length of the setting range.

Results of calculation

- **"There are no results."**
This is displayed by print-outputting and pressing either icon, "Result", "BAC", "ADF" or "Power G", "Section" when no measuring results were obtained.
- **"Area for defining exceeded the 10 area limit."**
This message appears when an attempt is made to set the range exceeding 10 in setting evaluation range or in setting tilt calculation range.
- **"Motifs could not be calculated."**
This message is displayed when the motifs are not calculated as the result of the motif calculation. The roughness motifs and the waviness motifs are not displayed in this case.
- **"Waviness motifs could not be calculated."**
This message is displayed when the waviness motifs are not calculated as the result of the motif calculation. The waviness motifs are not displayed in this case, however, if the combined display is ON, only the upper envelope line is displayed.

Print

- **"Printer paper is out."**
This message appears when printer paper is out during printing operation or when the switch pressed without printer paper.
- **"Printer error."**
This message appears when no response is received from the printer with the switch or the switch pressed. A failure may occur in the printer.

- **"Print process has stopped."**

This message appears when the switch is pressed in printing.

Average processing

- **"Is it OK for erasing data?"**

This message appears when the switch is pressed on the average processing screen. Pressing the switch erases data.

- **"It can not be used while it is in the average processing."**

In the average processing, part of measurement condition and calculation condition cannot be set or changed.

This message appears when an attempt is made to change an item that cannot be changed.

Interrupt measurement

- **"Average value processing cannot be used while it is in the interrupt measurement."**

This message appears when the "Average" icon is pressed in the interrupt measurement.

- **"Interrupt measurement has terminated. And the previous condition has been recovered."**

This message appears when the interrupt measurement is canceled.

Re-calculation

- **"Samp. data which has been taken from roll. circ. wav. cannot change measurement type for re-calculation."**

This message appears because data on rolling circle waviness measurement and other measurement data are not compatible with each other.

- **"Measurement type cannot be changed if the samp. data was taken by except roll. circ. wav."**

This message appears because data on rolling circle waviness measurement and other measurement data are not compatible with each other.

- **"There is no data."**

This message appears when the "Re-Cal" icon is pressed without measurement data.

Initialization

- **"The condition has initialized."**
This message appears when the condition is initialized on the initialization screen for setting various types of conditions.

PC card processing

- **"Is it OK to format PC card?"**
This message appears when the **Format** switch is pressed on the PC card screen.
- **"Formatting PC card has completed."**
This message appears when formatting PC card has been completed.
- **"There is no PC card."**
This message appears when an attempt is made to gain access with the PC card not inserted or when no response is received from the PC card.
- **"Cannot save data. Storage capacity is too low."**
This message appears when an attempt is made to save data of more than idle storage capacity in the PC card.
- **"PC card is write-protected."**
This message appears when an attempt is made to erase or save data with the PC card write-protected.
- **"PC card is not formatted. Or cannot use."**
This message appears when an attempt is made to access an unformatted PC card. This message may also appear when the PC card in use is not a specified PC card. If this message appears when a specified card is used, the most possible cause is a defective connection of the connector. Remove the card once, insert it correctly, and then format the card. If this message still appears, a failure may have occurred in the hardware of this machine or in the PC card. Contact Tokyo Seimitsu Co., Ltd. or authorized service representative.
- **"Same file name is exists. Overwrite OK?"**
This message appears with data saved in a PC card when the same file name exists.
- **"Cannot read data file."**
This message appears when a measurement data file is not read.
- **"Cannot read condition file."**
This message appears when a condition file is not read.

- **"Is it OK for erasing file?"**
This message appears when the switch is pressed.
- **"There is no data."**
This message appears when an attempt is made to save measurement data in a PC card, and the data does not exist.
- **"There is no Memo file in PC card."**
This message appears when an attempt is made to read a memo file, and the memo file does not exist on the PC card.
- **"There is no Logo file in PC card."**
This message appears when an attempt is made to load a logo file, and the logo file does not exist in the PC card.
- **"Output is not selected."**
This is displayed when the output items are not selected in the printout item screen at the time of making store of the measuring data in text mode.

RS-232-C output

- **"RS-232-C communication error. Confirm setting and connection."**
This message appears when an error occurs in data output.
- **"Data output has stopped."**
This message appears when the switch is pressed during transmission of data.
- **"There is no data."**
This message appears when an attempt is made to output data by pressing both the switch and the switch at a time, and measurement data does not exist.

Setting user logo

- **"The logo is customized."**
This message appears when the switch is pressed and then the user logo is set on the user logo setting screen.
- **"The logo has cleared."**
This message appears when the switch is pressed and then the user logo is cleared on the user logo setting screen.

- **"Cannot read Logo file."**

This message appears in logo setting when an attempt is made to display a logo except for monochrome logo or when an attempt is made to display a logo that is larger than the specified size.

Battery in use

- **"Battery Capacity is too low. It may not be used for 5 minutes."**

This message appears when the residual battery capacity is low.

Switch to the AC power supply or turn off the power supply once for charging the battery, and then operate the system again.

Maintenance

- **"Touchpanel-adjustment is completed."**

This message appears when the touchpanel is completely adjusted.

- **"Touchpanel-adjustment is failed. Please tap center of x."**

This message appears when touchpanel-adjustment is failed.

Customizing

- **"The information of customizing will be erased. Are you sure?"**

This message appears when information on customization will be erased.

Abnormal value of parameter

- **" * " appears before a parameter symbol.**

This symbol appears when the number of peaks or the number of valleys is insufficient in the Rz calculation or when parameter cannot be obtained in a sector, at least, through the calculation where parameters are to be found with average of divided reference lengths.

- **"No P's & V's" is displayed at the place for the parameter value.**

This message appears when no peaks and no valleys exist in Rz, R3z, Sm and Rc.

- **"No partial P" is displayed at the place for the parameter value.**

This message appears when no partial peak exists in S.

- **"Not Enough Amp" is displayed at the place for the parameter value.**

This message appears when the amplitude of profile curve is too small to create a bearing length ratio graph.

- **"Invalid Data" is displayed at the place for the parameter value.**

This message appears when a profile is not appropriate to calculate a bearing length ratio graph in Rk, Rpk, Rvk, Mr1, Mr2, V0 and K or when the values of a and q are 0.0 in a and q .

- **"tpn <= tp0" is displayed at the place for the parameter value.**
This message appears when the relationship of setting in Hp between tp(0) and tp (n) is as follows:
tp (n) <= tp (0)
- **"Large Z value" is displayed at the place for the parameter value.**
This message appears when the Z value set in tp2 is too large.
- **"No Str-L Corr." is displayed at the place for the parameter value.**
This message appears in Tilt A, when R-curve or spline collection is used for or tilt correction.
- **"Invalid Cond." is displayed at the place for the parameter value.**
This message appears when the condition setting value is too large in the step height calculation (parameters AVH, Hmax, Hmin and AREA).
- **"No local peaks" is displayed at the place for the parameter value.**
This message appears when the peaks do not exist in the motifs parameter (NCRX, R, Rx, AR, NR, CPM, SR, SAR, W, Wx, AW, Wte, NW SW, SAW).
- **"No motifs" is displayed at the place for the parameter value.**
This message appears when the motifs do not exist in the motifs parameter (NCRX, R, Rx, AR, NR, CPM, SR, SAR, W, Wx, AW, Wte, NW SW, SAW). The parameters below are calculated when the motifs are existed 3 or more, so this message is displayed even if 1 or 2 motifs exist.
The parameters that are calculated when 3 or more parameters are existed:
R, AR, W, AW

Password protect function

- **"This icon is restricted to use."**
This message is displayed by "password protects function" when press a restricted icon.
- **"It changes to administration mode."**
- **"It changes to operator mode."**
This message is displayed when converting "administration mode" and "operator mode".
- **"Restricted operation is ON."**
- **"Restricted operation is OFF."**
This message is displayed when converting to on/off of restricted operation at "administration mode".

- **"Password is changed."**
This message is displayed when a password is changed for converting to "administration mode".
- **"Password is incorrect."**
This message is displayed when an incorrect password is entered.

Others

- **"Emergency switch has pressed."**
This message appears when the emergency switch on the docking unit is pressed.
- **"Cannot use this function under current driver."**
Some of functions are restricted due to the tracing driver in connection.

Basic specifications

(Data processor)

Major category	Medium category	Specifications	
Function	Device	SURFCOM 480A	SURFCOM 130A
Display function	Display device	Cold-cathode tube side light system TFT color liquid crystal display (6.5")	Cold-cathode tube side light system STN monochrome liquid crystal display (5.7") (MONOCHROME TYPE) Cold-cathode tube side light system TFT color liquid crystal display (6.5") (COLOR TYPE)
Input device	Touchpanel	Analog system	
	Sheet switch	Equipped with 5 switches	
Output device	Printout	Thermo-sensitive recording type. 58 mm in width (record width of 48 mm)	
Interface (data processor)	RS-232C interface	Equipped with a channel. Supports up to 119200 bps in asynchronous mode	
	Special interface	Equipped with 2 interfaces for controlling the measuring unit	Not provided
	PC card interface	Equipped with 1 interfaces. Conforming to PCMCIA Ver2.1 types I and II	
Docking unit		Provided	Not provided
Power supply		85 to 264 VAC single phase (50 Hz or 60 Hz)	
Power consumption		With motor-column Approx. 90W Without motor-column Approx. 60W	Approx. 35W
Rough dimensions		300(w) × 293(D) × 211(H) mm	300(w) × 188(D) × 115(H) mm
Weight		Approx. 9.2 kg	Approx. 3.6kg
Working environment al condition		Temperature: 10 to 40 , Humidity: 40% to 80%	

(Measuring Unit)

- Small type tracing driver (E-RM-S100A) <S130A>
 - Driving speed : 0.0.3 , 0.6 , 1.5 , 3.0 mm/sec
 - Drive length : 50 mm max.
 - Measurement height : 50 mm max.
 - Level adjustment range : $\pm 1^\circ$
 - Straightness accuracy : 0.3 μ m / 50mm
 - Power supply : Supplied from the data processor
 - Cable length : 2.5m
 - Rough dimensions : 240(W) \times 78(D) \times 145(H)mm
 - Weight : Approx. 3.5kg

- Tracing driver pickup movable type 100 mm (E-RM-S71B) <S480A>
 - Driving speed : 0.03 , 0.06 , 0.15 , 0.6 , 1.5 , 3.0 , 6.0 mm/sec
 - Drive length : 100mm max.
 - Straightness accuracy : (0.05+1.5L/1000) μ m L = Evaluation length (mm)
 - Power supply : Supplied from the data processor
 - Rough dimensions : 324(W) \times 123(D) \times 134(H)mm
 - Weight : Approx. 9kg

- Measuring stand (E-ST-S85B/E-CL-S27C)
 - Measurement height : 0 ~ 250mm
 - Material of measuring stand base : Gabbro
 - Permissible dead-weight : 50kg
 - Rough dimensions : 600(W) \times 410(D) \times 717(H)mm
 - Weight : Approx. 65kg
 - Up/down speed : Approx. 3.0mm/sec max.
 - Power supply : Supplied from the data processor

- Magnification calibrator (E-MC-50B)
 - Application : For vertical magnification calibration in the data processor
 - Maximum displacement : 400 μ m
 - Minimum read scale : 0.2 μ m(10 μ m/rev)
 - Rough dimensions : 180(W) \times 40(D) \times 50(H)mm
 - Weight : Approx. 1 kg

- Precision reference specimen (E-MC-S24B)
 - Application Side A : For vertical magnification calibration in data processor
 - Application Side B : For checking the stylus of pickup
 - Surface roughness Side A : Approx. 3.2 μ m Ra
 - Surface roughness Side B : Approx. 0.4 μ m Ra
 - Rough dimensions : 82(W) \times 39(D) \times 8(H)mm

- Positioner (E-AT-S02A)
 - Application : Parallel adjustment of a measured surface and the driving reference surface of the tracing driver
 - Adjustment range : $\pm 1.5^\circ$
 - Permissible dead-weight : 15kg
 - Rough dimensions : 153(W) × 80(D) × 40(H)mm
 - Weight : Approx. 3kg

- Standard pickup
 - Main unit
 - Transducer : Differential transformer
 - Stylus force : 0.7mN(0.07gf)
 - Stylus (DT43801: Standard stylus)
 - Material of stylus tip : Diamond
 - Shape of stylus tip : Cone of 2 μ m R 60 °
 - Nosepiece (0102701: Standard nosepiece)
 - Type of skid : Tip skid
 - Material of skid : Sapphire
 - Shape of skid : 32 mm R (tracing direction)

(Analysis function) Common to SURFCOM480A and 130A

Item		Specifications
Measurement range		800 , 80 , 8 < 4 > μ m
Display vertical magnification		50 , 100 , 200 , 500 , 1K , 2K , 5K , 10K , 20K , 50K , 100K , AUTO < 200K , 500K >
Display horizontal magnification		1 , 2 , 5 , 10 , 20 , 50 , 100 , 200 , 500 , 1K , 2K , 5K , AUTO
Number of sampling data pieces		32767 max.
Evaluation length		0.1 mm step from 0.1 mm to maximum drive distance However, the maximum evaluation length differs depending on measurement speed.
Arithmetic resolution		Measurement range/64000
Calculation curve		Profile curve, roughness curve, filtered waviness curve, filtered center line waviness curve, rolling circle waviness curve, rolling circle center line waviness curve, DIN4776 special roughness curve, Roughness motifs, and Waviness motifs
Filter		2RC, 2RC (phase compensation), Gaussian
Cutoff value	c	0.008 , 0.025 , 0.08 , 0.25 , 0.8 , 2.5 , 8 , [25]mm
	f	0.008 , 0.025 , 0.08 , 0.25 , 0.8 , 2.5 , 8 , [25,80]mm
Tilt correction		Straight line, rounded surface, Begin-End, begin half, end half, spline, no correction
Calculation standards		JIS-'82, JIS-'94, JIS-'01, ISO-'84, ISO-'97, DIN-'90, ASME-'95
Graphs		Bearing length ratio graph, amplitude distribution curve, and power graph
Average number of processing times		100 times max.

The value put in '< >' is applicable when the system is equipped with the high magnification pickup.

However, SURFCOM 130A cannot be equipped with the high magnification pickup.

The value put in '[']' can be set in SURFCOM 480A only.