

User's Manual
No. 99MAH040B4
SERIES No. 543

ID-C112GXB

ABS Digimatic Indicator For Bore gage

User's Manual

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

Mitutoyo

CONVENTIONS USED IN THIS MANUAL

Safety Precautions

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

The following signs indicate **general** warnings:



WARNING

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



CAUTION

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

Types of Notes

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

IMPORTANT

An important note provides information essential to use the product. You cannot disregard this note.

An important note is a type of precaution, which if neglected could result in degraded performance or accuracy, or instrument malfunction/failure.

NOTE

A note provides information to be especially noted or supplemented to use the product. A note also supplies information to be noted for specific operations.

TIP

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

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

The specifications and information in this manual are subject to change without notice.

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Battery-related Warnings



WARNING

- Always keep the battery out of the reach of infants and toddler to prevent it from being swallowed. If it is swallowed, consult a physician immediately.
 - The battery should never be short-circuit, disassembled or deformed, heated or exposed to flames.
 - If alkaline liquid contained in the battery does come in contact with your eyes, flush them immediately with plenty of clean water and consult a physician. If the liquid adheres to the skin or clothes, immediately flush it with plenty of clean water.
-



CAUTION

- Never charge the battery since it is a primary battery. Never reverse the positive and negative terminals when mounting. Improper handling of the battery could lead to leakage or explosion, causing bodily injury or malfunction.
-

NOTE

- Always use the recommended battery.
 - If the instrument will not be used for more than three months, remove the battery and store it separately.
 - When discarding or storing the battery, cover the positive (+) and negative (–) terminals with insulating tape to prevent contact with other metals. When disposing of it, follow the ordinances or regulations of the local government.
-

Disposal Warnings



WARNING

- A liquid crystal display and a lithium metal battery are used in this product. When disposing of the instrument, follow the ordinances or regulations of the local government.
 - The liquid crystal display contains an irritating substance. Should the liquid content contact an eye or skin, flush with clean, flowing water. If the substance enters the mouth, immediately rinse the mouth, drink plenty of water, induce vomiting, and then consult a physician.
-

Cautions on use

Observe the following precautions to avoid instrument failure or malfunction.

IMPORTANT

- Do not strike the instrument or allow it to be struck.
- Do not drop it or apply excessive force to it.
- Do not disassemble or modify the instrument.
- Do not press the keys with a pointed object (such as screwdriver or ballpoint pen).
- Do not use or store the instrument under direct sunlight, or in an excessively hot or cold environment.
- Be alert for malfunction due to material deterioration if it is used in an environment with low or high atmospheric pressure.
- Do not store the instrument in a high-humidity environment. Do not use the instrument where it could be splashed with coolant.
- Do not use high-voltage equipment, such as an electric marking pen, near the instrument. Electronic parts may be damaged by such equipment. Be alert for malfunction if it is used in the vicinity of electric noise.
- Secure the instrument with a fixture such as a dial gage stand in a vibration-free environment.
- Do not subject the spindle to a vertical load or torsion.
- Wipe stains from the instrument panel by using a soft cloth or a cotton swab that is dry or moistened with diluted neutral detergent. Do not use an organic solvent such as thinner and benzene, which may cause the instrument panel to deform or malfunction.
- The contaminated spindle may cause malfunction. Wipe them off with a cloth damped with alcohol.

NOTE

- Be alert for measurement errors caused by thermal expansion of the component parts and the fixtures, resulting from a significant temperature fluctuation. Use the instrument in a temperature-controlled room that has minimum temperature fluctuation. Allow sufficient time for the instrument to thermally stabilize if it is moved to an environment with a different temperature.

Warranty

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

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

- (a) Failure or damage owing to fair wear and tear.
- (b) Failure or damage owing to inappropriate handling, maintenance or repair, or to unauthorized modification.
- (c) Failure or damage owing to transport, dropping, or relocation of the instrument after purchase.
- (d) Failure or damage owing to fire, salt, gas, abnormal voltage, lightning surge, or natural disaster.
- (e) Failure or damage owing to use in combination with hardware or software other than those designated or permitted by Mitutoyo.
- (f) Failure or damage owing to use in ultra-hazardous activities.

This warranty is effective only where the instrument is properly installed and operated in conformance with the instructions in this manual within the original country of the installation.

EXCEPT AS SPECIFIED IN THIS WARRANTY, ALL EXPRESS OR IMPLIED CONDITIONS, REPRESENTATIONS, AND WARRANTIES OF ANY NATURE WHATSOEVER INCLUDING, WITHOUT LIMITATION, ANY IMPLIED WARRANTY OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE, NONINFRINGEMENT OR WARRANTY ARISING FROM A COURSE OF DEALING, USAGE, OR TRADE PRACTICE, ARE HEREBY EXCLUDED TO THE MAXIMUM EXTENT ALLOWED BY APPLICABLE LAW.

You assume all responsibility for all results arising out of its selection of this product to achieve its intended results.

Export Control Compliance

This Product falls into the Catch-All-Controlled Goods and/or Catch-All-Controlled Technologies (including Programs) under Category 16 of Appended Table 1 of Export Trade Control Order or under Category 16 of Appended Table of Foreign Exchange Control Order, based on Foreign Exchange and Foreign Trade Law of Japan.

If you intend re-exporting the product from a country other than Japan, re-selling the product in a country other than Japan, or re-providing the technology (including program), you shall observe the regulations of your country.

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Service Network

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OVERVIEW

This chapter describes overview of this instrument including names and functions of each part, external dimensions, and details of the display unit.

1.1 Overview

This instrument is the dedicated inside diameter measuring instrument mounted to the bore gage (511, 526 series). To obtain the highest performance from this instrument and to use it safely, read this User's Manual and User's Manual of the bore gage prior to use.

Measurement and Setup mode are available with this instrument.

- Measurement mode
 - Normal mode : Dynamically displays measurement data
 - Minimum value detection mode: Detects minimum value of the measurement data
- Setup mode: Enables each setting

The measuring system of this instrument is the only ABS system (Absolute value measurement which measures distance (displacement) from a preset position).

NOTE

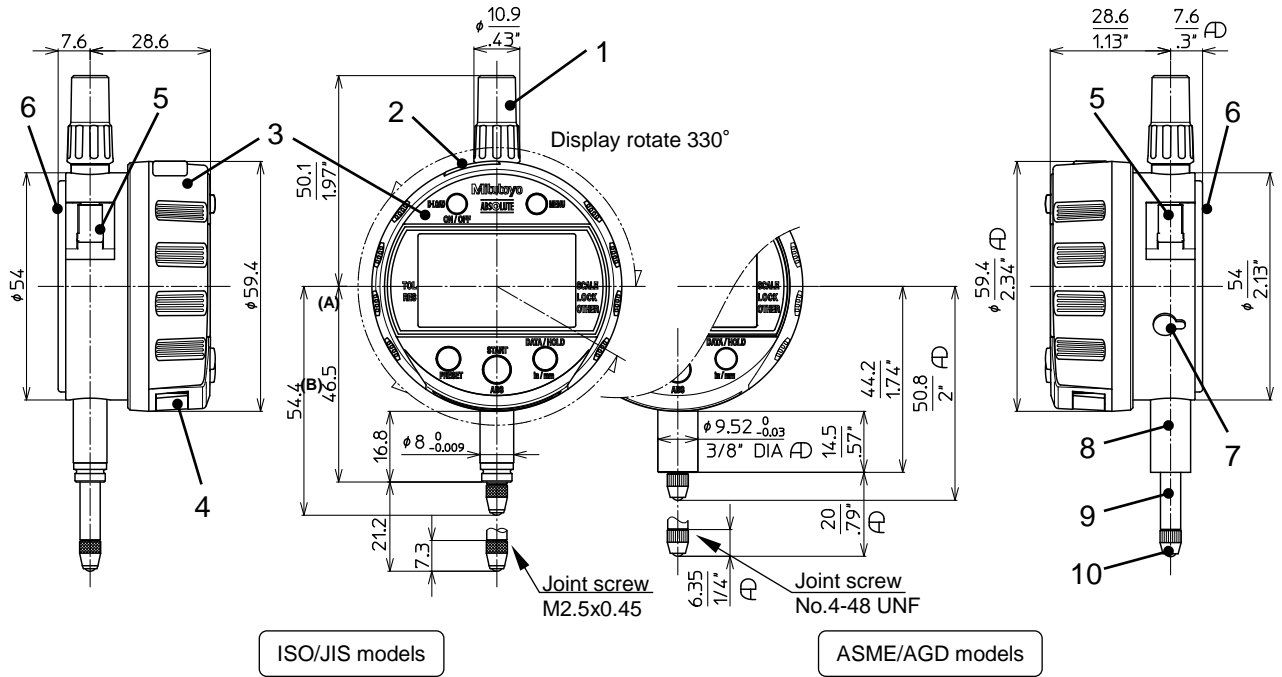
- In this instrument, there are no run-out value detection mode and maximum value detection mode.
 - There is not INC system.
 - This instrument is specially designed for bore gage. Therefore, the count direction when spindle is pressed is limited to minus, and the plus direction is not available.
-

1.2 Features (what you can do)

The following can be achieved with this instrument:

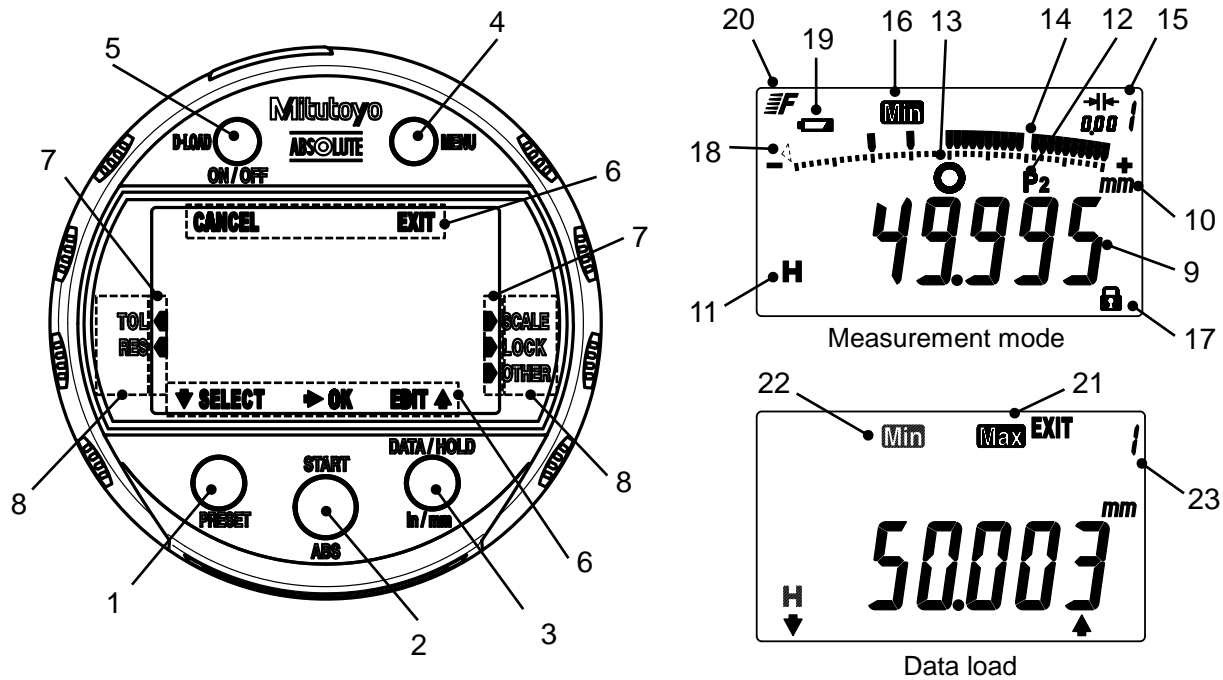
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1.3 Part Names and Dimensions



1	Cap
2	Output connector (with rubber cap)
3	Display unit
4	Battery holder
5	Lever mounting position (left and right)
6	Flat back
7	Release mounting hole (with cap)
8	Stem
9	Spindle
10	Contact point
	ISO/JIS models : Part No.901312
	ASME/AGD models : Part No.21BZB005

1.4 Details of the Display unit



1	Lower left key	13	Tolerance judgment
2	Center key	14	Analog bar
3	Lower right key	15	Analog bar graduation
4	Upper right key	16	Minimum value detection measurement
5	Upper left key	17	Lock
6	Key assist	18	Lower over-range
7	Cursor	19	Low battery alarm
8	Parameter	20	FAST
9	Display value	21	Maximum value
10	Unit	22	Minimum value
11	Data hold	23	Data No.
12	Preset No.		

1.5 Specifications

Model name *1	ID-C112GXB	ID-C112GMXB	ID-C112GEXB
Code No. *1	543-310B	543-311B	543-312B
Resolution *2	0.001 /0.01 mm	0.00005/0.0001/0.0005 in // 0.001/0.01 mm	
Measuring range	12.7 mm	0.5 in / 12.7 mm	
Error of indication for the total measuring range MPE _E *3	0.003 mm	±0.0001 in / 0.003 mm	
Hysteresis MPE _H *3	0.002 mm	0.0001 in / 0.002 mm	
Repeatability MPE _R *3	0.002 mm	0.0001 in / 0.002 mm	
Stem diameter	φ8 mm	3/8 in DIA	
Contact point	Carbide (M2.5x0.45)	Carbide (No.4-48UNF)	
Measuring force MPL	≤1.5 N		
Measuring direction	Useful in all directions		
Protection level *4	IP42 (in factory shipment state)		
Power supply	Lithium battery CR2032 × 1pc.		
Battery life *5	Normal use :Approx. 1 year		
Scale	Electrostatic capacitance absolute encoder		
Response speed	Infinite		
Measurement frequency *6	Normal mode: 10 times/s Minimum value detection mode: 50 times/s		
CE marking	EMC Directive: EN 61326-1 Immunity test requirements: Clause 6.2 Table 2 Emission limit: Class B RoHS Directive: EN IEC 63000		
Operating temperature	0 °C~40 °C		
Storage temperature	-10 °C~60 °C		
Net weight	170 g		

*1 : All instruments in this series are of the flat-back type.

*2 : Changeable by way of setting. Refer to “3.3.2 RES : Resolution”.

*3 : 20°C, normal measurement.

The values are calculated with the resolution set to 0.001mm.

*4 : The protection level (IP: International Protection) is indicated according to IEC 60529 and JIS C 0920 standards.

*5 : Battery life depends on use of the indicator. Use the above value as a guide.

*6 : If the spindle speed exceeds following, the correct peak value may not be displayed.

Normal mode: 10μm/s

Minimum value detection mode: 50μm/s

1.6 Standard accessories

- Lithium battery CR2032(for monitor)
- No.99MAH040B User's Manual
- No.99MAH041B Quick Reference Manual
- No.99MAH042M Product regulation guide
- No.421RAC717 Precautions for Use
- Certificate of inspection
- No.WA100 Warranty

1.7 Optional accessories

- No.905338 Connecting cable (1m)
- No.905409 Connecting cable (2m)
- No.21EZA313 Parameter Setup Kit

2

SETUP

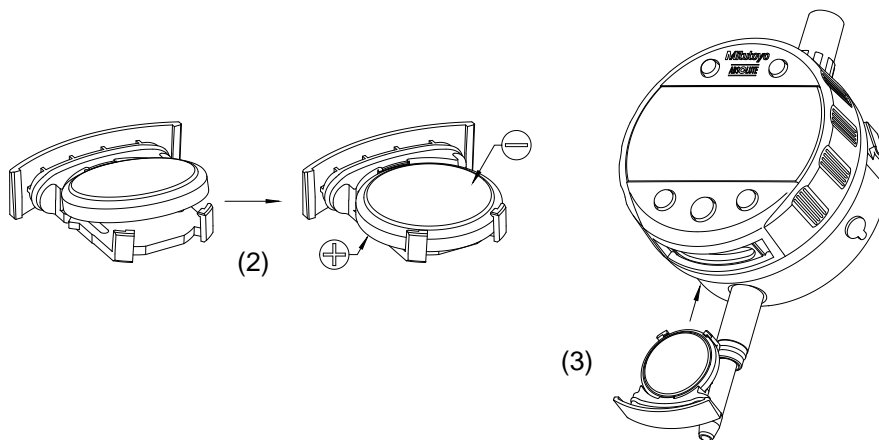
This chapter describes installation of a battery, adjusting display angle and mounting on the bore gage

2.1 Installation (replacement) of Battery and Initial Setting

A lithium battery (CR2032) is used with this instrument.

This instrument is not delivered with the battery set into position, so set the battery before use.

1. Remove the battery holder by using a flat-blade screwdriver or the like.
(When replacing the battery, remove the spent battery.)
2. Set the battery into the battery holder as described in the figure below.
3. Set the battery holder into the original position. ([-----] is displayed.)
4. To enter into the preset setting, press the center key.
5. Set up the preset values referring to "3.2.1 Preset setting".
6. Set up measurement mode and function which you want. (See section 3. Functions and Operating Procedure.)



IMPORTANT

- Do not use a sharp-pointed tool to remove the battery holder and not pry out the battery holder, to prevent damage to the battery holder.
 - Note not to damage your nail when the battery holder is removed by hand.
 - If the battery and battery holder is not set properly, a damage and malfunction may result.
 - If the Measurement mode is not entered after executing the above procedure, set the battery again.
 - If the instrument will not be used for more than three months, remove the battery and store it separately to prevent damage by battery leakage.
-

NOTES

- The supplied battery is used only to check the functions and performance of the instrument, so it may not meet the battery life specification.
-

2.2 Adjusting Display Angle

The display can be rotated 90° (to position A) clockwise or 240° (to position B) counterclockwise from the initial position. (For the rotating range, see 1. Part Names and Dimensions.)

IMPORTANT

- Stoppers are set at both positions A and B. Stop rotating the display at the stoppers, or the instrument may malfunction.
 - Do not push in the display or pull it out. Doing so may cause the instrument to malfunction.
-

2.3 Mounting on the bore gage

This instrument is used by mounting on a bore gage (optional) correctly. For details, refer to the User's Manual of the bore gage.

3

FUNCTIONS AND OPERATIONS

This chapter describes functions and their operations of this instrument.

Each key function will change as follows depending on the operation mode.

- Measurement mode

* "Press and hold" means pressing and holding the key for 2 seconds or more.

Keys	Press	Press and hold
Lower left	—	PRESET (3.2.1)
Center	START (3.2.5)	—
Lower right	DATA (3.2.7) HOLD (3.2.6)	in/mm (3.2.10)
Upper left	D-LOAD(3.2.9)	ON/OFF (3.1)
Upper right	MENU (3.3)	—

- Setup mode/Numerical values setting

Keys	Press	Press and hold
Lower left	SELECT / ▼	—
Center	OK / ►	—
Lower right	EDIT / ▲	—
Upper left	CANCEL	—
Upper right	EXIT	—

3.1 Power ON/OFF

Power ON: Press the upper left key.

Power OFF: Press and hold the upper left key

NOTE

- If the power is turned off right after the battery is installed before completing preset setting, "-----" will be displayed when the power is turned on again.
 - When the power is turned off while the instrument is holding the display value, and then the power is turned on again, the held display value will be released.
 - When the power is turned off, all the measurement values saved with the data save function will be deleted.
-

Auto-off function (energy saving function): The power automatically will be turned off after approximately 20 minutes of idle time.

NOTE

- When enabling FAST mode, auto-off function will be disabled. (Refer to "3.3.6.3 FAST(3): FAST mode".)
-

3.2 Measurement mode

The following describes each setting and operation of the measurement mode of this instrument. Refer to "1.1 Overview" for details of the measurement mode.

3.2.1 Preset setting

Set up the preset when performing master setting.

Three settings; P1, P2, P3 are available as preset values.

1. Starting the preset setting
Press and hold the lower left key in the measurement mode. "P□" (□ indicates Preset No.) starts blinking and the previously set value will be displayed. If the value does not need to be changed, skip to step 4.
2. Selecting preset No.
Press the lower left key and select the preset No. to be set. Pressing the lower left key, the display changes in the following order: P1→P2→P3.
3. Editing the preset value.
Press the lower right key to move the numerical value editing. Refer to "3.2.3 Numerical value editing" for details of the setting.
4. Completing the preset setting
Lift up the spindle and position the contact point in the desired preset position. Next, press the center key.
In the peak detection mode, the spindle position of minimum value will be set as the preset position.

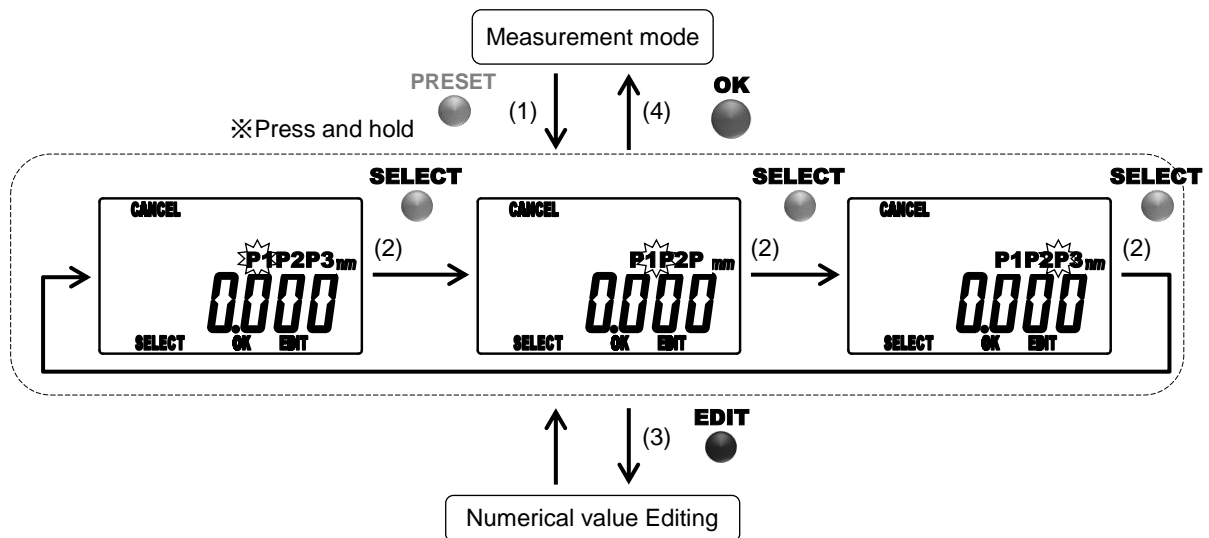
IMPORTANT

- Repeatability in the range of 0.2 mm (.0079") from the bottom of the stroke is not guaranteed for this indicator. When setting the origin, be sure to lift the spindle at least 0.2 mm (.0079") from the bottom of the stroke.
- The preset value will be calculated automatically according to the resolution. Check the preset value when the resolution is changed since the conversion error may occur.

NOTE

- Press the upper left key to cancel the setting,
- The preset setting cannot be completed while the spindle is moving. So complete it after the spindle stops.
- The power supply cannot be turned off with the upper left key in the preset setting.
- When auto-off is activated during preset setting, the setting will be canceled.
- The setup preset values and position will be held after the power is turned off. However, when the battery is replaced, the preset position will be cleared. Set up the position again.
- The preset setting cannot be completed if Overflow error of preset value (Err95) is occurring for the selected preset number. Reset the preset value.
- When preset setting is changed, all the measurement values saved with the data save function will be deleted.
- A rubber damper has been attached to the spindle in this indicator as a shock absorber. The elasticity of the damper may cause the indicated value to not stabilize at the bottom of the stroke, but this will not cause any operational problems. Also, the spindle may feel heavy at the bottom of the stroke when this indicator is first used, but this can be resolved by pushing the spindle up once.

Preset setting (Master setting)



3.2.2 Numerical value Editing

Numerical value for "Preset", "Tolerance judgment" can be edit by same key operation.

Items that requires numerical value editing

Functions	Editing items
Preset	P1, P2, P3
Tolerance judgment	Upper limit, Lower limit

- Moving signs (+/-) and digits
Press the center key to move the sign or digit.
- Changing signs (+/-) and numerical values
Press the lower left key or lower right key to change the sign (+/-) or numerical value.

For signs (+/-)

Press the lower left or lower right key to switch the signs "+" ⇔ "-".

For numerical values

Pressing the lower left key, the display changes in the following order:

0→9→8→... →1→0.

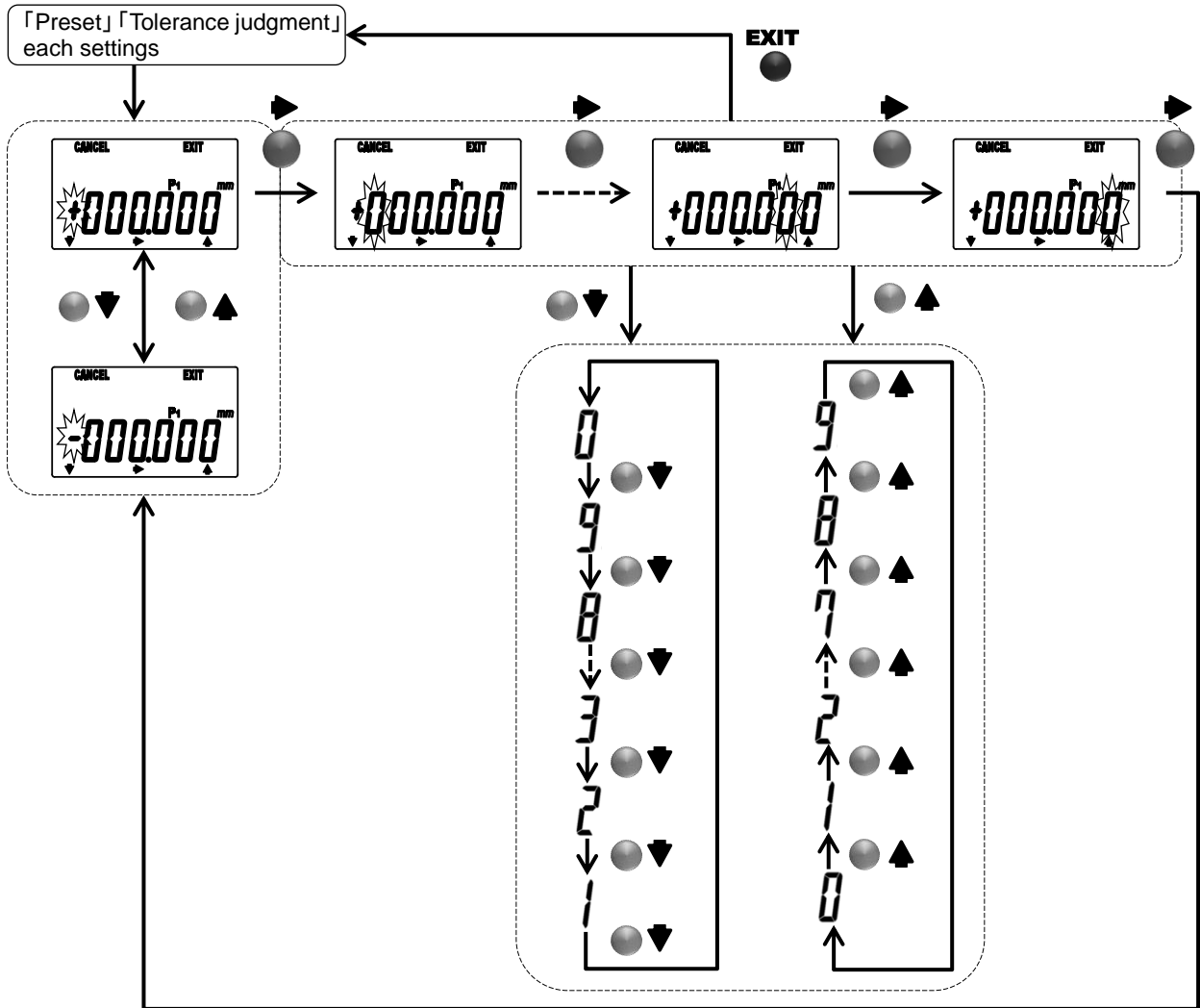
Pressing the lower right key, the display changes in the following order:

0→1→2→... →9→0.

- Completing the numerical value editing
Press the upper right key to complete the numerical value editing.
After editing the numerical values, the previous setup widow will be restored.

-
- NOTE**
- If the last digit of resolution is "5", that of the numerical value changes in the order of "0 →5→0".
 - Press the upper left key to cancel the setting.
 - The value is temporarily saved until completing each setting before moving the numerical value editing. If canceled, it will be deleted.
-

Numerical value Editing

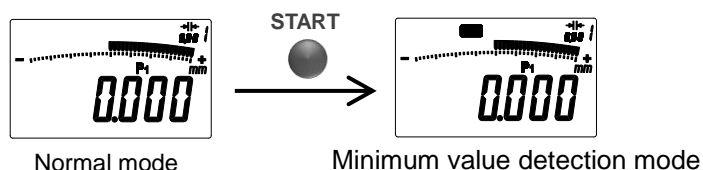


3.2.3 Changing to minimum value detection mode

Press the center key to change the minimum value detection mode. It can to hold the minimum values of the measured values fluctuate.

When the measurement value is below the minimum value is retained a new minimum value, and then held until the center key is pressed. Press the center key to restart minimum value measurement.

When Power OFF, Setup mode transition, preset setting, and data load is performed, the minimum value detection mode is canceled, and change to normal mode.



NOTE

- Please start measuring while the contact point is contacting the measuring target.
 - Note that the displacement caused by vibration, impact, etc. is detected.
 - Holding and saving the display value is possible in the minimum value detection mode. (Refer to "3.2.4 Holding display value", "3.2.6 Data save/Data load")
 - The minimum point can be edited into a desired value. So this instrument can measure based on this point. Refer to "3.2.1 Preset setting" to set the preset.
 - When a minimum value pointer of the analog bar is out of displayable range, the pointer automatically moves to the center by selecting the "Auto".
-

3.2.4 Holding display value (when a data processor is not connected)

Press the lower right key in the measurement mode. "H" is displayed and the display value will be held. Press the lower right key again to release the hold.

NOTE

- If a data processor is connecting to this instrument during "H" is displayed, the held value will be output to it and then be released.
 - The spindle position is being detected while "H" is displayed.
-

3.2.5 Display value output (when a data processor is connected)

The display value can be output to the data processor.

Press the lower right key in the measurement mode to output the display value to the data processor.

Refer to "4 Data Output" for cable connections, pin assignment, output format, and timing chart.

NOTE

- To use the data output function properly, refer to the operation manual of the data processor to be connected.
 - When inputting a data output request (REQ) from a data processor, the spindle must be stopped. Otherwise, this instrument may output wrong data or may not output.
 - If this instrument receives data output request (REQ) signals repeatedly at short intervals, it may not output a data.
-

3.2.6 Data save/Data load

Up to 9 data can be stored in the internal memory of this instrument.

The saved measurement values can be displayed by loading operation. The following data can be also checked by loading the data.

- For the maximum value among the saved measurement values, "Max" will be displayed.
- For the minimum value among the saved measurement values, "Min" will be displayed.
- The result of tolerance judgment for the saved values will be displayed while the tolerance judgment is enabled. (Refer to "3.3.1 TOL: Tolerance judgment".)

- **Data save**

Press the lower right key in the measurement mode.

When a data processor is not connected, data will be saved at the time when the displayed value is held. Data save will not be performed when the hold status is released.

When a data processor is connected, data will be saved at the time when the displayed value is output.

- **Data load**

1. Press the upper left key in the measurement mode, to enter into the data load mode. "H" will blink, and the last saved value will be displayed.
2. Press the lower left or the lower right key, to change display value. The data number displayed in the upper right of the display unit indicates the order of saving. The larger the number is, the more recent the measurement value is.

- **Stopping the data load**

Press the upper right key to restore the normal mode after deleting all the saved measurement values.

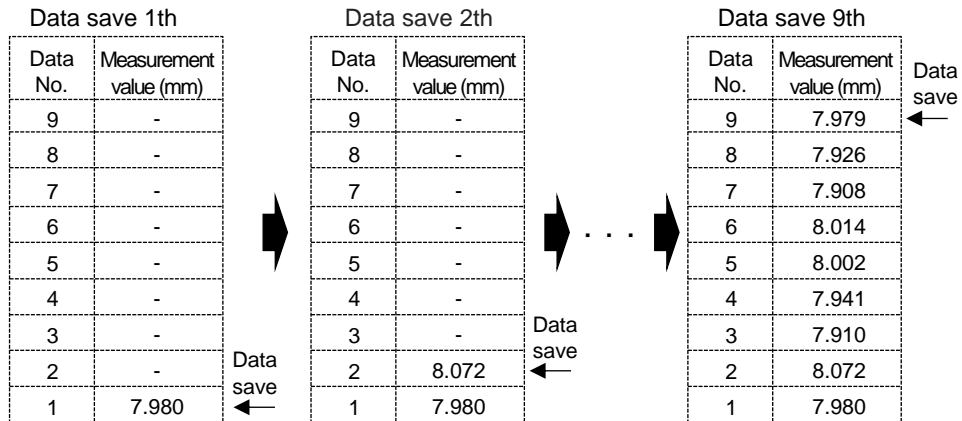
NOTE

- When data save is executed while 9 data are already saved, the data number "1", which is the oldest data, will be deleted. When a data is deleted, the data numbers descend and the measured value to be saved this time will be numbered "9".
 - When data load is stop, the saved measurement values will be deleted. Therefore, make a note of data if necessary.
 - Set the followings before performing data save or data load, because all the saved measurement values will be deleted, if any of the following operation is performed besides data load stopping:
 - Selecting the preset values
 - Selecting the tolerance judgment setting
-

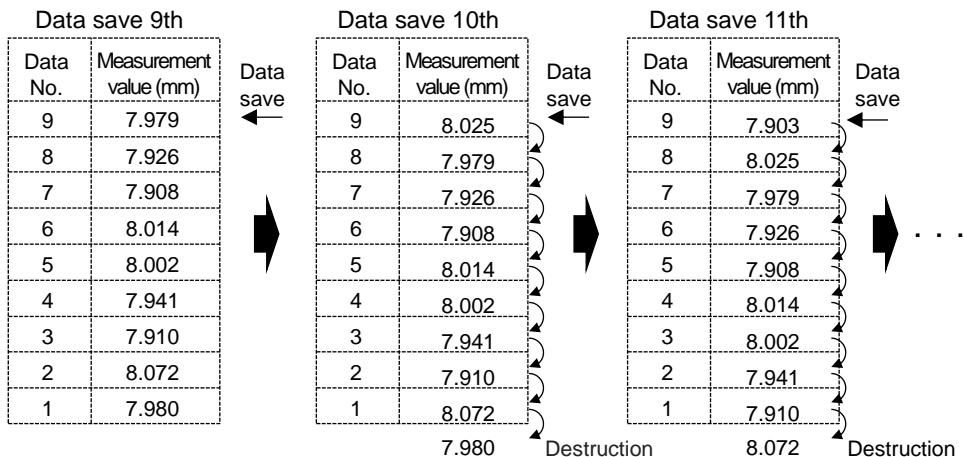
- Changing the resolution
 - Shifting into PC communication status
 - Power off (auto-off)
 - Switching units
- Even when shifting from the minimum value detection mode to the data load, the normal mode will be restored when data load is stop.
 - When the maximum and the minimum values are the same, both "Max" and "Min" will be displayed.
 - If there are multiple maximum or minimum values, "Max" or "Min" will be displayed respectively with each value.
 - If data load is executed when no data is saved, "0" as data number and "-----" as measurement value will be displayed.

TIP

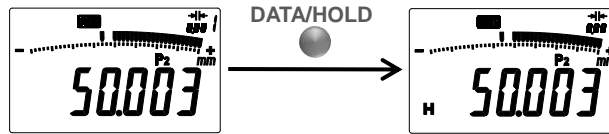
- The following describes some examples of the data number
 - When the number of saved measurement data are less than 9



- When the number of saved measurement data are 9 (maximum number) or more

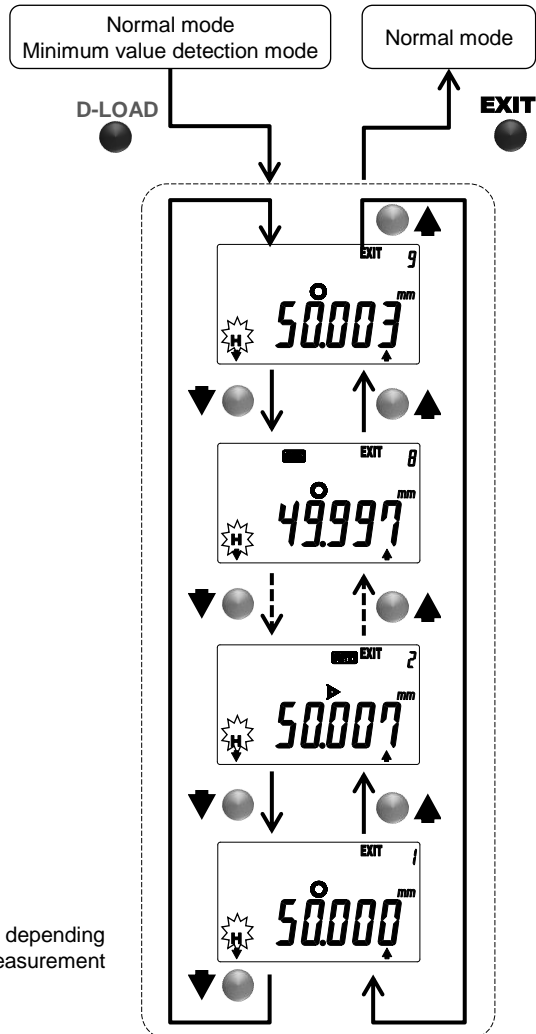


Data save



(Note) Hold the display value is performed at the same time when the data processor is not connected.

Data load



(Note) The number of data will vary depending on the number of the saved measurement values.

3.2.7 Switching units (in/mm)

Press and hold the lower right key to switch the display unit between inch and metric.

NOTE

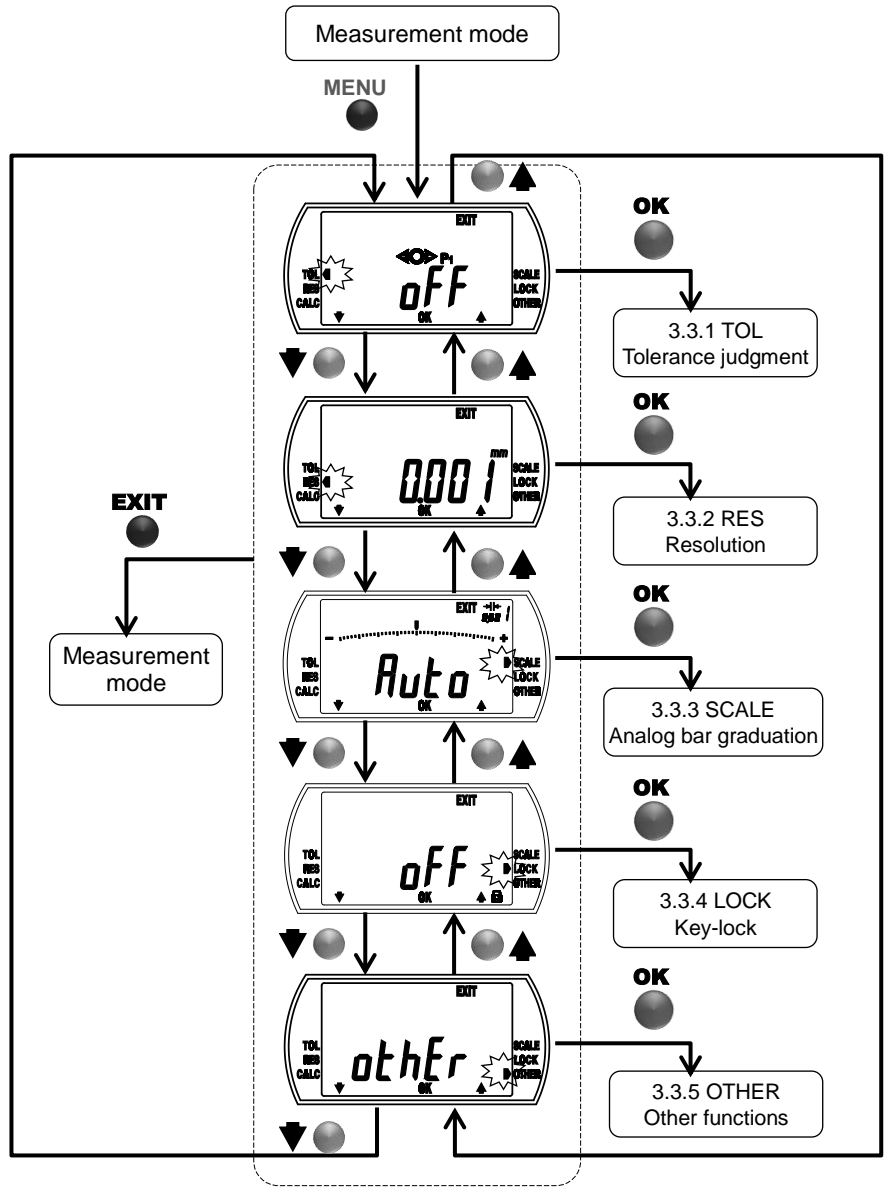
- When the unit is switched, the following will be converted accordingly: display value, preset values, tolerance value, resolution, and analog bar graduation. If it causes the overflow error of display value (Err 30), set the proper resolution. Also, it causes overflow error of each setting values or conversion error, it is recommended to check the values of each setting after switching unit.
 - The display unit can be switched only in the normal mode. So if switching is required in the peak detection mode, press the lower left key a few times to change the mode to the normal, and then switch.
-

3.3 Setup Mode

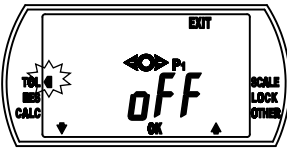
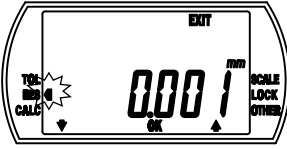
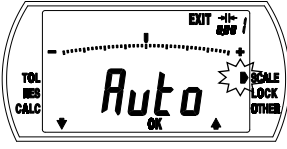

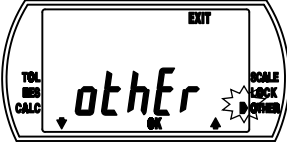
The following parameters can be checked or set in the setup mode.

- Starting up the setup mode
Press the upper right key in the measurement mode to move into the setup mode.
- Selecting parameters
 1. The blinking cursor indicates the currently selected parameter.
 2. Press the lower left or lower right key to display the current set parameter.
 - Pressing the lower left key, the cursor moves in the following order: TOL→RES→ ... →OTHER→TOL.
 - Pressing the lower right key, the cursor moves in the following order: TOL→OTHER→ ... →RES→TOL.
 3. Press the center key to move the parameter setting
- Completing the setup mode
Press the upper right key to complete setup mode and return to the measurement mode,

-
- NOTE**
- During the setup mode, key assists which correspond to each key will be displayed. (Refer to "1.4 Details of Display Unit".)
 - The setup parameters will be registered even after the battery is replaced or power is turned off. However, if the battery is replaced while the key-lock function is enabled, the key-lock function will be set off.
 - The power supply cannot be turned off with the upper left key in the setup mode.
-



Parameters

Parameter	Example of display	Settings
<p>TOL (Tolerance judgment)</p>	 <p>“ON” or “OFF”</p>	<p>Selecting ON/OFF of tolerance judgment and tolerance value setting</p>
<p>RES (Resolution)</p>	 <p>Current resolution</p>	<p>Selecting resolution of the display</p>
<p>SCALE (Analog bar graduation)</p>	 <p>Current analog bar graduation</p>	<p>Selecting analog bar graduation</p>
<p>LOCK (Key-lock)</p>	 <p>“ON” or “OFF”</p>	<p>Selecting ON/OFF of key-lock function</p>
<p>OTHER (Other functions)</p>	 <p>“other”</p>	<p>Setting other functions (Refer to "3.3.5 OTHER: Other functions".)</p>

3.3.1 TOL: Tolerance judgment

The tolerance judgment function compares measurement data (display value) with tolerance values (upper/lower limit) for OK/NG judgment. The tolerance values can be set in preset No. (P1, P2, P3) respectively.

- Enabling tolerance judgment. Changing tolerance values
 1. Press the upper right key in the measurement mode to move the setup mode.
 2. Press the lower left or lower right key to move the blinking cursor to "TOL".
 3. Press the center key to move the ON/OFF selection of the tolerance judgment function.
 4. Press the lower left key to select "ON".
 5. Press the center key to move the tolerance value setting (upper/lower limit). The upper limit sign is blinking, and currently set value will be displayed.
 6. When press the lower left key, the display switches to the lower limit. (Pressing the lower left key, the upper limit and the lower limit switch.) The lower limit sign (or the upper limit sign) is blinking, and the currently set lower limit (or the upper limit) will be displayed.
 7. To edit the tolerance value, select the target value and press the lower right key. The numerical value editing will be enabled. (Refer to "3.2.2 Numerical value editing".)
 8. Press the center key after checking or editing the tolerance values. The tolerance judgment is set "ON", and the mode returns to the parameter setting. (Refer to "3.3 Setup Mode".)
- Disabling tolerance judgment
 1. Press the upper right key in the measurement mode to move the setup mode.
 2. Press the lower left or lower right key to move the blinking cursor to "TOL".
 3. Press the center key to move the ON/OFF selection of the tolerance judgment function.
 4. Press the lower left key to select "OFF".
 5. Press the center key to set the tolerance judgment "OFF" and return to the parameter setting. (Refer to "3.3 Setup Mode".)

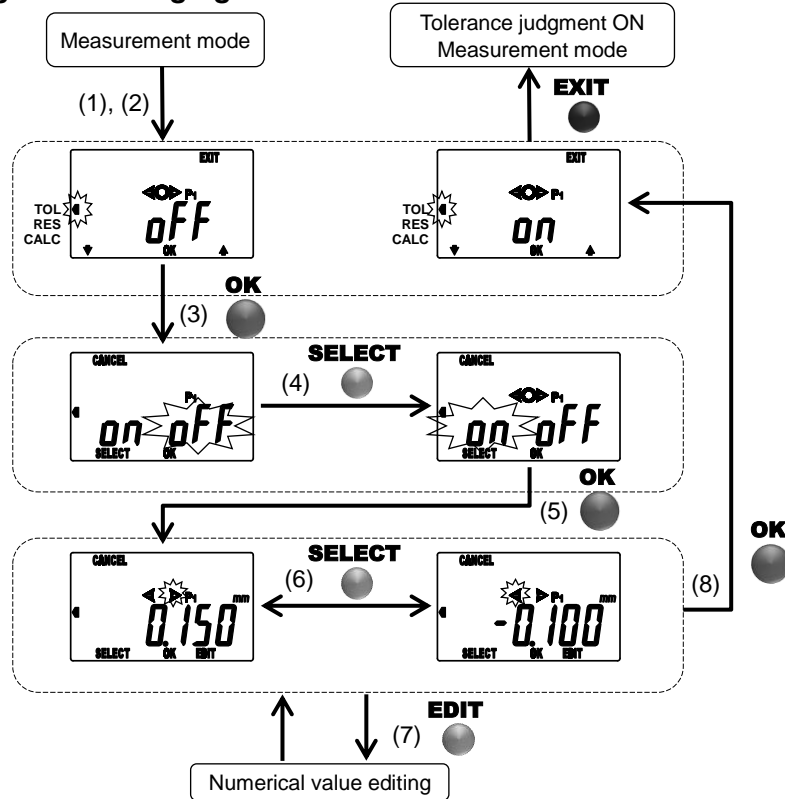
IMPORTANT

- The tolerance values will be set in the currently active preset No. (P1, P2, P3) . Check the desired measuring system is selected before setting the tolerance judgment function.
- The tolerance values will be calculated automatically according to the unit or the resolution. Check the tolerance values after the resolution is changed since the conversion error may occur.

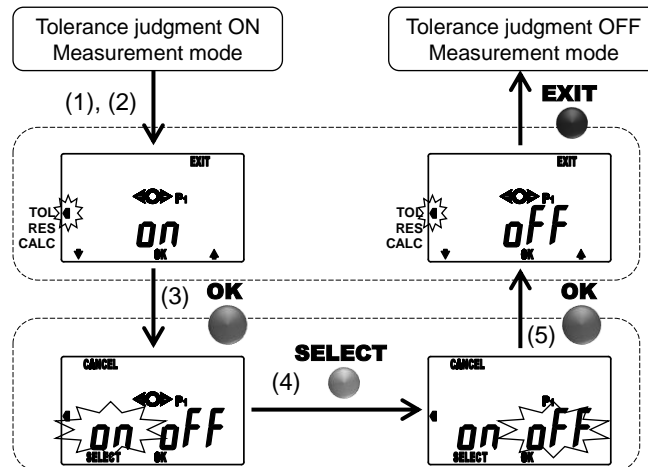
NOTE

- Press the upper left key to cancel the operation.
 - If the upper limit is set lower than the lower limit, the tolerance upper/lower limit setting error (Err 90) will occur. Reset the values to be the upper limit is greater than the lower limit.
 - The tolerance judgment setting cannot be completed if Overflow error of upper / lower limit value (Err95) is occurring. Reset the upper or lower limit value.
 - When the tolerance judgment setting is changed, all the measurement values saved with the data save function will be deleted.
-

Enabling tolerance judgment. Changing tolerance values



Disabling tolerance judgment



3.3.2 RES: Resolution

The resolution of the display can be changed.

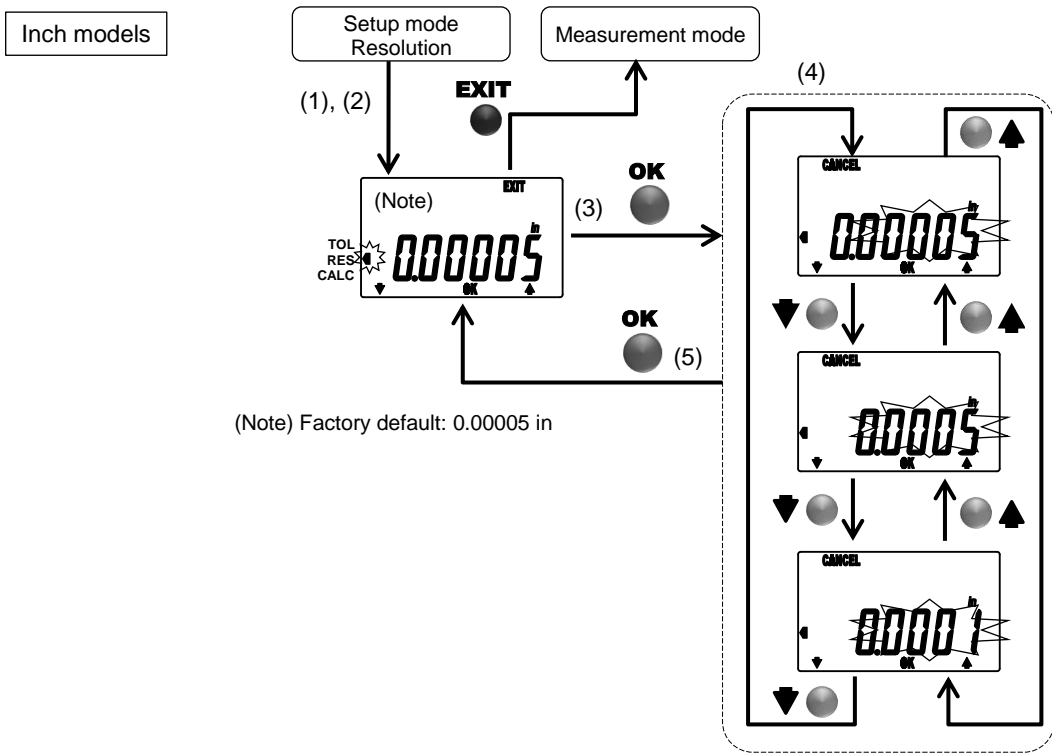
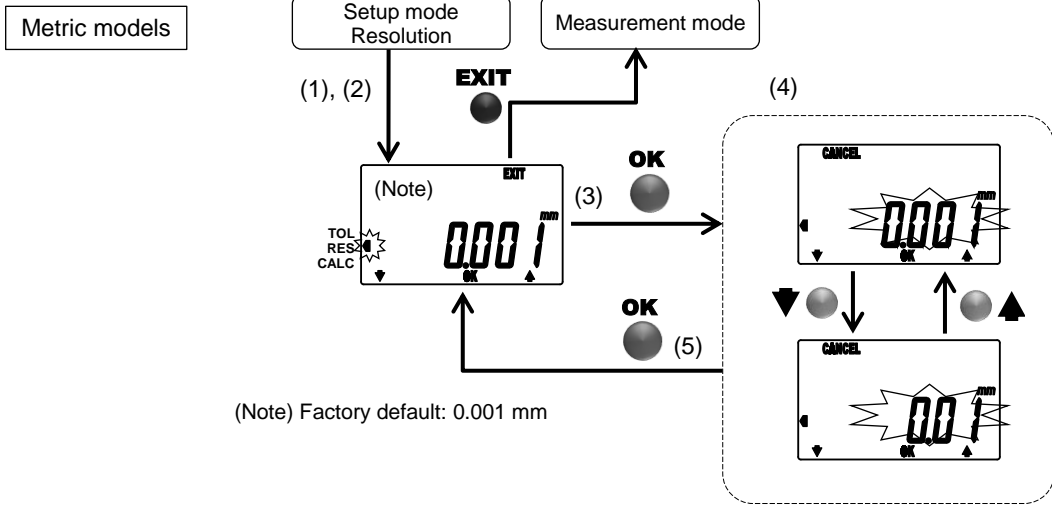
- Selecting the resolution

3. Press the upper right key in the measurement mode to move the setup mode.
4. Press the lower left or lower right key to move the blinking cursor to "RES".
5. Press the center key to set the resolution.
6. Press the lower left or lower right key to switch the resolution.
7. Press the center key to set the resolution and the mode returns to the parameter setting. (Refer to "3.3 Setup Mode".)

IMPORTANT ▪ The preset values (P1, P2, P3) and the tolerance values (upper and lower limits) will be calculated automatically according to the resolution. Check the values after changing the resolution, since the conversion error or overflow error (Err95) may occur.

NOTE ▪ Press the upper left key to cancel the operation.
▪ When the unit is switched, the resolution will be automatically changed accordingly. Check the resolution after switching the unit.

Selecting the resolution



3.3.3 SCALE: Analog bar graduation

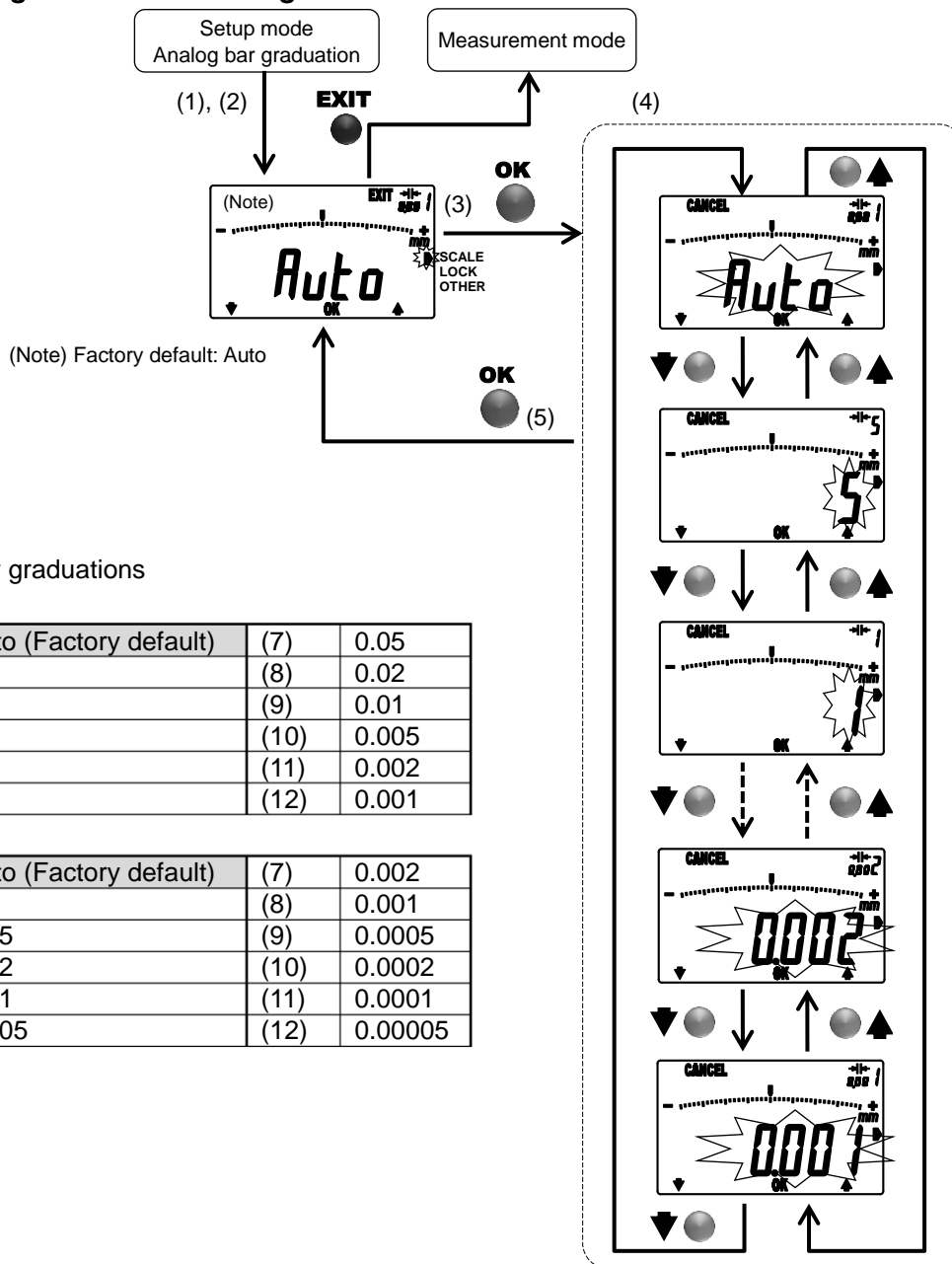
The analog bar graduation (Display range: ± 20) can be changed.

- Selecting a graduation of analog bar
 1. Press the upper right key in the measurement mode to move the setup mode.
 2. Press the lower left or lower right key to move the blinking cursor to "SCALE".
 3. Press the center key to set the analog bar graduation.
 4. Press the lower left or lower right key to switch the analog bar graduation.
 5. Press the center key to set the analog bar graduation and return to the parameter setting. (Refer to "3.3 Setup Mode".)

-
- NOTE**
- Press the upper left key to cancel the operation.
 - The factory default of the analog bar graduation is "Auto". Change it as required.
 - If the analog bar graduation is set to "0.0005mm" or "0.0002mm", the resolution will be "0.001mm". Because the resolution of the spindle displacement "x" is "0.001mm".
 - The analog bar will be displayed based on the display value. If the analog bar graduation is selected lower than the resolution of display value, the analog bar will vary discontinuously.
 - When the unit is switched, the graduation of the analog bar will be automatically changed accordingly. After switching the unit, check the graduation of the analog bar.

-
- TIP**
- The graduation of the analog bar will change automatically in the following conditions:
 1. Tolerance judgment ON: Graduation will change tolerance values to be within the display range.
 2. Changing resolution: Graduation will change same as resolution.
-

Selecting a graduation of analog bar



3.3.4 LOCK: Key-lock

Key operation can be partially disabled in order to avoid incorrect key operation.

- Enabling key-lock (disabling key operation)
 1. Press the upper right key in the measurement mode to move the setup mode.
 2. Press the lower left or lower right key to move the blinking cursor to "LOCK".
 3. Press the center key to move the ON/OFF selection of the key-lock function.
 4. Press the lower left key to select "ON".
 5. Press the center key to set the key-lock function "ON" and return to the parameter setting. (Refer to "3.3 Setup Mode".)
- Disabling key-lock (enabling key operation)
 1. Press the upper right key in the measurement mode to move the setup mode.
 2. Press the lower left or lower right key to move the blinking cursor to "LOCK".
 3. Press the center key to move the ON/OFF selection of the key-lock function.
 4. Press the lower left key to select "OFF".
 5. Press the center key to set the key-lock function "OFF" and return to the parameter setting. (Refer to "3.3 Setup Mode".)

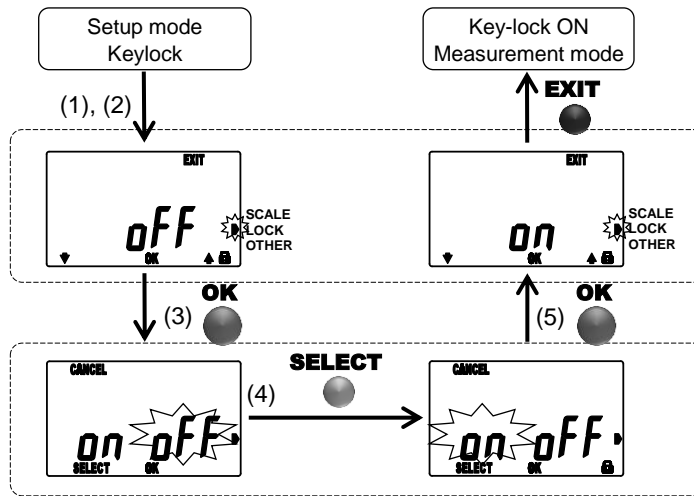
- NOTE**
- Press the upper left key to cancel the operation.
 - The key-lock function will not be disabled by turning off the power. However, it will be set off when the battery is replaced.
 - When the key-lock is set on, other than key-lock cannot be selected in the setup mode.
 - The key-lock items can be customized via PC communication. (Refer to "3.3.5.1 PC(1): PC communication".)

Functions to be disabled while key-lock is on

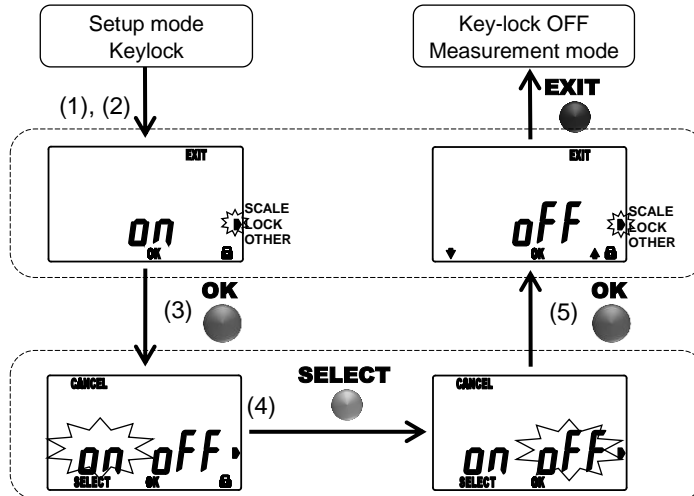
- Measurement mode

Keys	Operation	Key names		Disabled functions		Remarks
		Metric model	Inch models	Metric model	Inch models	
Lower left key	Press	—		—		
	Press and Hold	PRESET		○		3.2.1
Center key	Press	START		—		3.2.3
	Press and Hold	—		—		
Lower right key	Press	DATA/HOLD		—		3.2.4
	Press and Hold	—	in/mm	—	○	3.2.7
Upper left key	Press	D-LOAD		—		3.2.6
	Press and Hold	ON/OFF		—		3.1
Upper right key	Press	MENU		—		3.3
	Press and Hold	—		—		

Enabling key-lock (disabling key operation)



Disabling key-lock (enabling key operation)

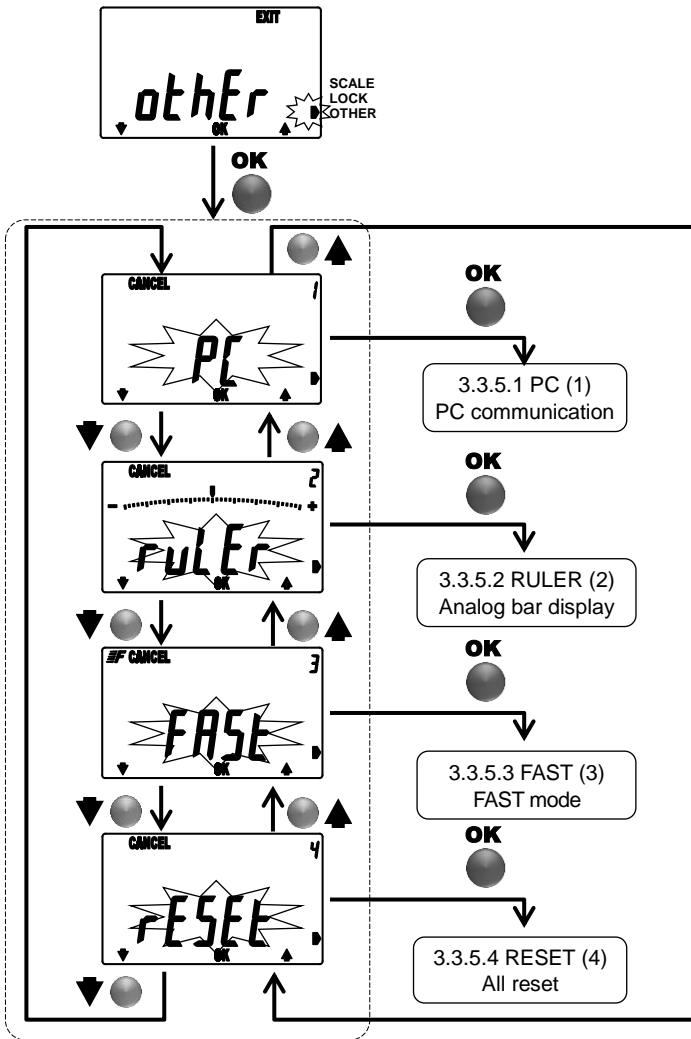


3.3.5 OTHER: Other functions

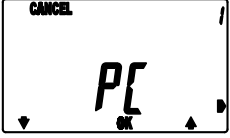
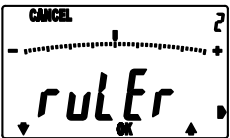

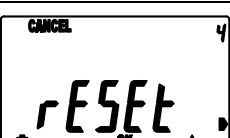
Check or set up the PC communication or the unit display.

- Selecting items available in OTHER functions
 1. Press the upper right key in the measurement mode to move the setup mode.
 2. Press the lower left or lower right key to move the blinking cursor to "OTHER".
 3. Press the center key to move the ON/OFF selection of OTHER functions.
 4. Press the lower left or lower right key to change the item in the other functions.
 - Pressing the lower left key, the display changes in the following order:
PC communication → Analog bar display →...→ All reset → PC communication
 - Pressing the lower right key, the display changes in the following order:
PC communication → All reset→...→ Analog bar display → PC communication
 5. Press the center key to return to the parameter setting.

NOTE · Press the upper left key to cancel the operation.



Items available in OTHERs

Other functions (Item No.)	Example of LCD display	Settings
<p>PC(1) PC communication</p>	 <p>1, PC</p>	<p>Selecting ON/OFF of PC communication for each setting</p>
<p>RULER(2) Analog bar display</p>	 <p>2, RULER</p>	<p>Selecting ON/OFF of analog bar display</p>
<p>FAST(3) FAST mode</p>	 <p>3, FAST</p>	<p>Selecting ON/OFF of FAST mode</p>
<p>RESET(4) All reset</p>	 <p>4, RESET</p>	<p>Executing all reset</p>

3.3.5.1 PC(1): PC communication

This instrument can set up or change various items with special software, if it connects to Personal computer with a Parameter setup kit (optional accessory).

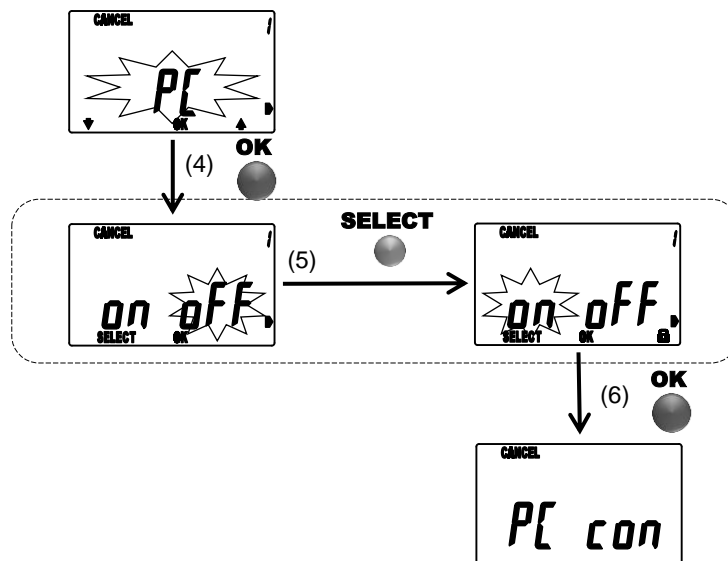
- Enabling PC communication

1. Connect a Parameter setup kit.
2. Press the upper right key in the measurement mode to move the setup mode, and select OTHER functions. (Refer to "3.3.5 OTHER: Other functions".)
3. Press the lower left or lower right key until "PC" is blinking.
4. Press the center key to move the PC communication setting.
5. Press the lower left key to select "ON".
6. Press the center key to start communication with the PC.
When the communication is started, "PC con" will be displayed.

NOTE

- Press the upper left key to cancel the communication with the PC.
 - Remove the cap of the output connector, and securely connect the cable.
 - Do not disconnect the Parameter setup kit while communicating with the PC.
 - When communication with PC is finished, the measurement mode will be restored.
 - For details of communication with the PC, refer to the operation manual supplied with the Parameter setup kit.
 - When the mode is shifted into PC communication, all the measurement values saved with the data save function will be deleted.
-

Enabling PC communication



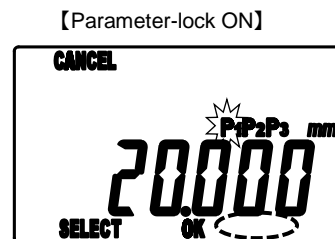
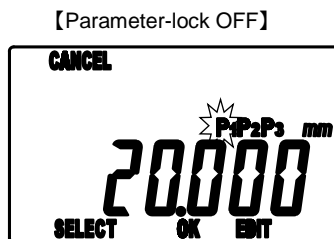
Configurable items by external input

Configurable items		Settings
Preset		Preset No.: P1 / P2 / P3 Preset value: P1 / P2 / P3
Unit		mm / in (only inch models)
Tolerance judgment		ON / OFF Upper and lower limit of each preset No.(P1, P2, P3)
Resolution	Metric	0.001 / 0.01
	Inch	0.00005 / 0.0001 / 0.0005
Analog bar graduation	Metric	AUTO / 0.001 / 0.002 / 0.005 / 0.01 / 0.02 / 0.05 / 0.1 / 0.2 / 0.5 / 1 / 5
	Inch	AUTO / 0.00005 / 0.0001 / 0.0002 / 0.0005 / 0.001 / 0.002 / 0.005 / 0.01 / 0.02 / 0.05 / 0.2
Key-lock		ON / OFF Key-lock setting (multiple selection possible) <ul style="list-style-type: none"> • PRESET(Preset setting) • DATA/HOLD (Holding the display value/Display value output) • in/mm (Switching the unit (inch↔mm))
Analog bar display		ON / OFF
FAST mode		ON / OFF
Parameter-lock		ON / OFF Parameter-lock setting (multiple selection possible) <ul style="list-style-type: none"> • Preset value setting: P1/ P2/ P3 • Tolerance setting: P1: upper limit/lower limit P2: upper limit/lower limit P3: upper limit/ lower limit • MENU key

TIP

- The parameter-lock function is to disable each setting and all reset operation, and it is available only while communicating with PC.
 - When the parameter lock is enabled, the locked parameter cannot be edited with the instrument.
 - While the parameter lock is enabled, the "EDIT" sign with the lower right key will not be displayed.
 - When the MENU Key is set to "Lock", the parameters other than PC communication cannot be confirmed and set by operating the key of this instrument. Release the Lock of MENU Key by conducting the PC communication if you want to confirm or set each parameter.
-

Display example during parameter-lock (Preset setting)



※The "EDIT" sign will not be displayed

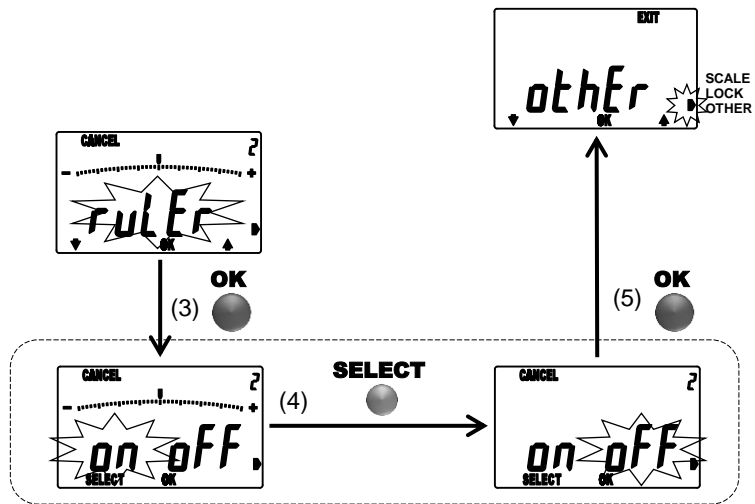
3.3.5.2 RULER(2): Analog bar display

Analog bar can be set up displayed or hidden.

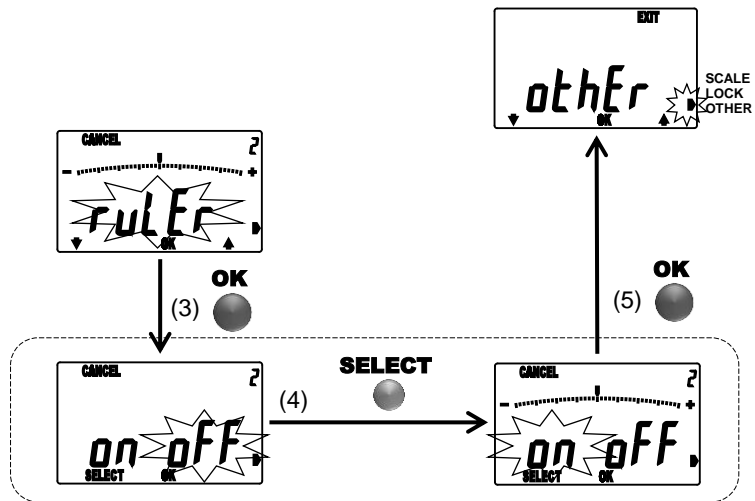
- Hiding the analog bar
 1. Press the upper right key in the measurement mode to move the setup mode, and select OTHER functions. (Refer to "3.3.5 OTHER: Other functions".)
 2. Press the lower left or lower right key until "RULER" is blinking.
 3. Press the center key to move the ON/OFF selection of the analog bar display.
 4. Press the lower left key to select "OFF".
 5. Press the center key to hide the analog bar and return to the parameter setting. (Refer to "3.3 Setup Mode".)
- Displaying the analog bar
 1. Press the upper right key in the measurement mode to move the setup mode, and select OTHER functions. (Refer to "3.3.5 OTHER: Other functions".)
 2. Press the lower left or lower right key until "RULER" is blinking.
 3. Press the center key to move the ON/OFF selection of the analog bar display.
 4. Press the lower left key to select "ON".
 5. Press the center key to hide the analog bar and return to the parameter setting. (Refer to "3.3 Setup Mode".)

NOTE ▪ The analog bar will not be displayed if the graduation is changed while it is hidden. (Refer to "3.3.3 SCALE: Selecting analog bar graduation".)

Hiding the analog bar



Displaying the analog bar



3.3.5.3 FAST(3): FAST mode

When enabling the FAST mode, the minimum value detection mode, it enables to detect minimum value more correctly.

Auto-off function is disabled in FAST mode.

- Enabling the FAST mode

1. Press the upper right key in the measurement mode to move the setup mode, and select OTHER functions. (Refer to "3.3.5 OTHER: Other functions".)
2. Press the lower left or lower right key until "FAST" is blinking.
3. Press the center key to move the ON/OFF selection of the FAST mode.
4. Press the lower left key to select "ON".
5. Press the center key to enable this function and return to the parameter setting. (Refer to "3.3 Setup Mode".)

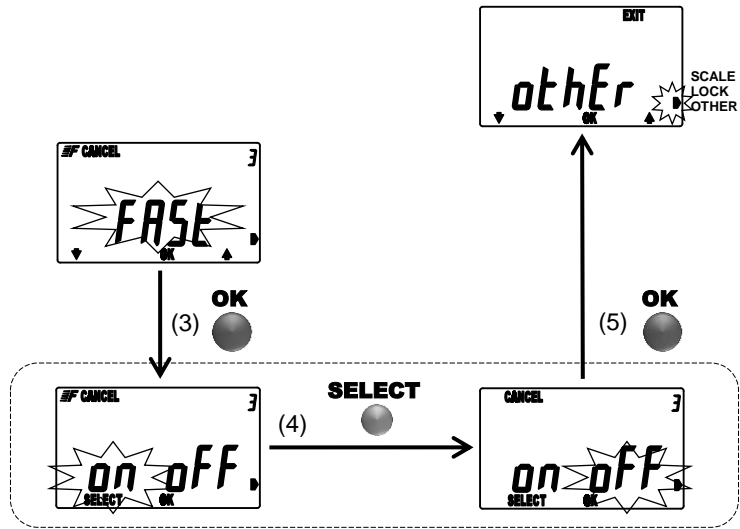
- Disabling the FAST mode

1. Press the upper right key in the measurement mode to move the setup mode, and select OTHER functions. (Refer to "3.3.5 OTHER: Other functions".)
2. Press the lower left or lower right key until "FAST" is blinking.
3. Press the center key to move the ON/OFF selection of the FAST mode.
4. Press the lower left key to select "ON".
5. Press the center key to disable this function and return to the parameter setting. (Refer to "3.3 Setup Mode".)

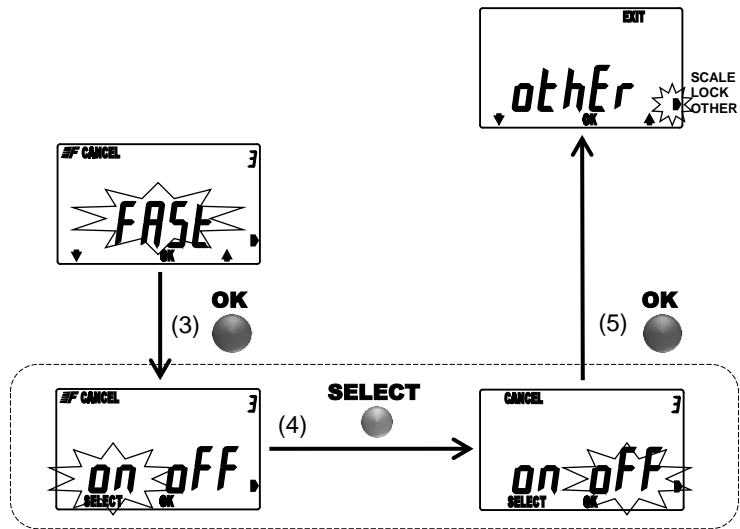
IMPORTANT · The accuracy will not be affected by this function.

NOTE · Operating in this function will shorten the battery life.
It is recommended to operate with disabling this function if not necessary.

Enabling the FAST mode



Disabling the FAST mode



3.3.5.4 RESET(4): All reset

It restores the factory default.

- Executing all reset

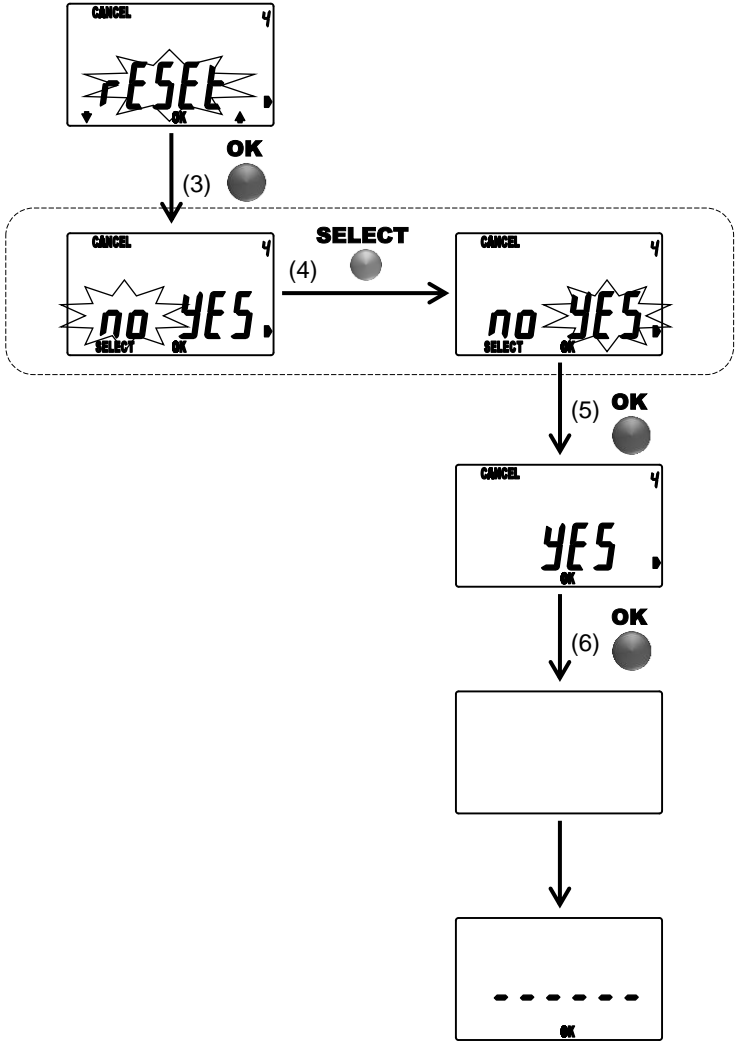
1. Press the upper right key in the measurement mode to move the setup mode, and select OTHER functions. (Refer to "3.3.5 OTHER: Other functions".)
2. Press the lower left or lower right key until "RESET" is blinking.
3. Press the center key to move the all reset setting.
4. Press the lower left key to select "YES".
5. Press the center key, then "YES" will be displayed again.
6. Press the center key to execute all reset.
The display turns off shortly, and restores the display of the time when the battery is installed.

IMPORTANT • The setting before executing all reset cannot be restored.

Factory default

Setting items	Settings
Preset	Preset No. (P1/P2/P3): P1 Preset values (P1/P2/P3): Zero for all
Unit	mm (for inch models: in)
Center position of the analog bar	Centered at zero
Tolerance judgment	OFF Tolerance judgment (upper limit/lower limit): Zero for all
Resolution	0.001mm (0.00005in)
Analog bar graduation	Auto
Key-lock	OFF All key function: Enabled
Analog bar display	ON
FAST mode	OFF
Data save	Discard all saved measurements
Parameter-lock	OFF

Excuting all reset



3.4 Calibration mode

In this mode the instrument can measure with an appropriate setting of accuracy inspection and calibration while retaining the current settings in memory. The INC system is employed with this mode, in which comparative measurement will be performed by measuring the distance and the displacement from the zero-set position. And also in this mode when the instrument receives an output request (REQ) from the data processor, it outputs a display value. (Refer to 3.2.5 Display value output)

The settings of calibration mode
(The settings change automatically when starting the calibration mode)

Setting items	Settings
Measurement mode	Normal mode
Measuring system	INC
Unit	mm / in(for inch models)
Resolution	0.001mm / 0.00005in(for inch models)
Other	Tolerance judgment :OFF Key-lock :OFF Analog bar display :OFF

Key function for the calibration mode

Keys	Press	Press and hold
Lower left	-	-
Center	Set to zero	-
Lower right	-	Switching the unit
Upper left	-	
Upper right	-	

● Starting the calibration mode

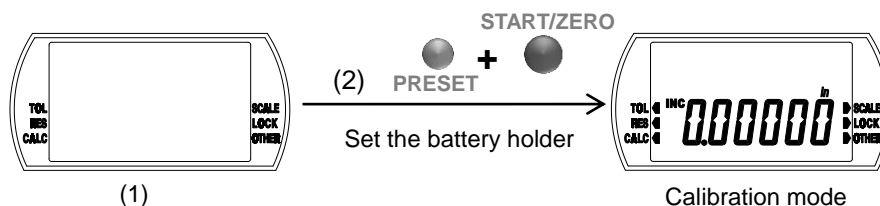
1. Remove the battery holder by using a flat-blade screwdriver or the like.
2. While pressing the lower left key and center key, set to the battery holder. This instrument will be started up in the calibration mode.

● Stopping the calibration mode

1. Remove the battery holder, so it means stopping the calibration mode. The measurement mode (the normal mode) will be restarted when the battery holder is set into the original position again (Refer to 2. SETUP).

IMPORTANT

- The preset setting is required in the measurement mode after using this mode (Refer to 3.2.1 Preset setting). However other settings and parameters are held with the former setting which moves to this mode.



4

DATA OUTPUT

This chapter describes how to output data.

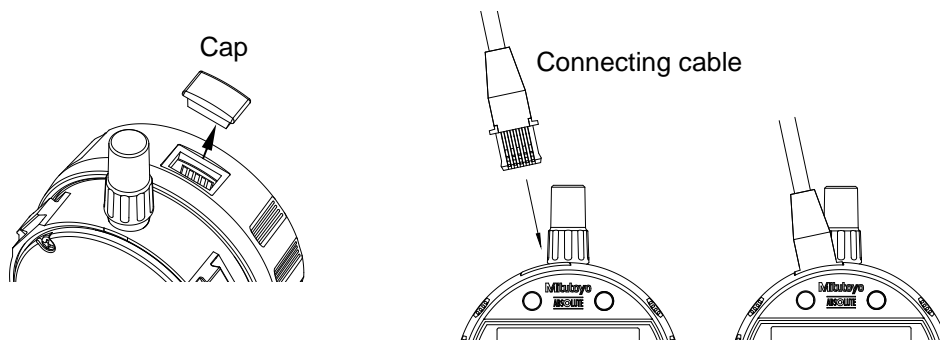
The measurement data can be outputted to the data processor such as Digimatic Mini-processor DP-1VR with an optional connecting cable (Parts No. 905338 (1m) or No. 905409 (2m)). And the data can be summed up or recorded

NOTE

- Use only the output cable of Mitutoyo specific accessories. The use of an improper cable or deteriorated cable may disable data output.
- Prior to data output carefully read the user's manual of the data processor to use it correctly.

4.1 Cable Connection

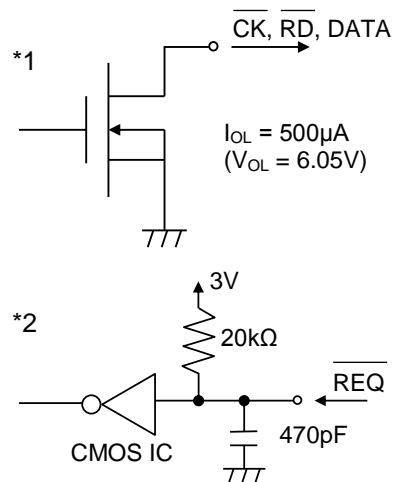
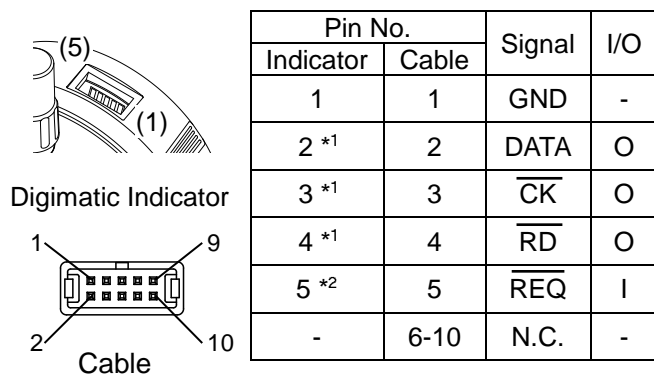
Remove the output connector cap, and then connect the instrument to the data processor by using a connecting cable. Insert the cable securely to the end, in the direction as shown.



NOTE

- Store the removed cap, taking care to prevent loss.
- Install the direction of output pin correctly.
- Be sure to attach a cap to the connecting cable when not in use.

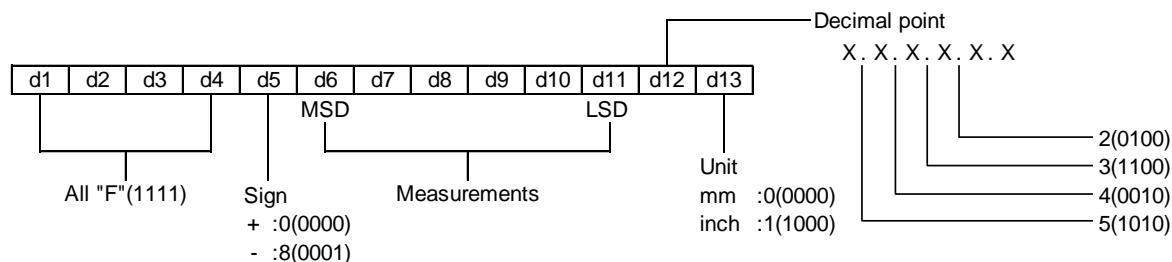
4.2 Output Connector



IMPORTANT

- Since the power voltage differs between this instrument and the data processor, absolutely design an output system either open-collector or open-drain. Do not use CMOS output.

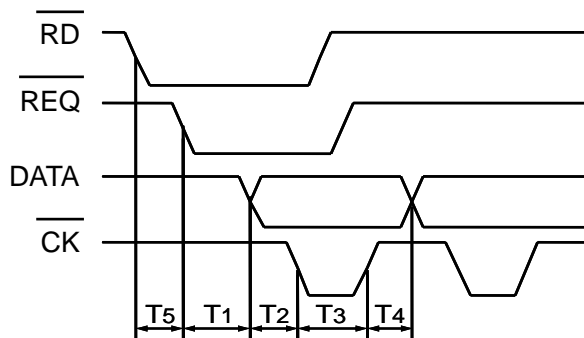
4.3 Output Data Format



※This instrument outputs 13 digits from d1 to d13 by making 4 bits into 1 digit.

※Each digit is outputted in the order from least significant bit (LSB) to most significant bit (MSB).

4.4 Timing Chart



$0.7 \text{ ms} \leq \overline{T1} \leq 1.2 \text{ ms}$
 $100 \text{ } \mu\text{s} \leq \overline{T2} \leq 200 \text{ } \mu\text{s}$
 $200 \text{ } \mu\text{s} \leq \overline{T3} \leq 300 \text{ } \mu\text{s}$
 $100 \text{ } \mu\text{s} \leq \overline{T4} \leq 200 \text{ } \mu\text{s}$
T5 : Determined by the performance
of the data processor

IMPORTANT

- If the output request (REQ) signal is received during the spindle displacement or if the inverter receives output request (REQ) signals repeatedly at short intervals, the instrument may not output data.

NOTE

- Retain the REQ signal at Low level until the CK signal is outputted. Also, return the REQ signal to High level before the last CK signal (at the 52nd bit) is outputted.
-

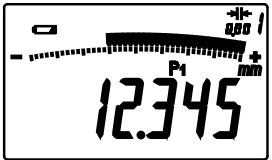
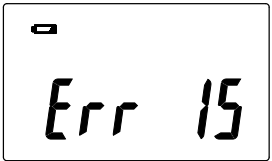
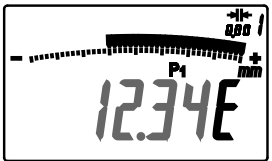
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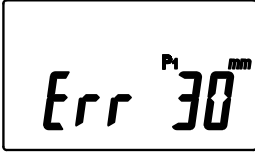
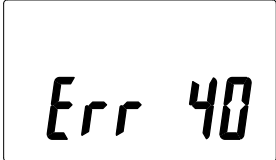

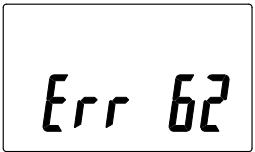
5


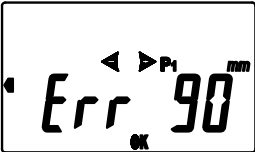
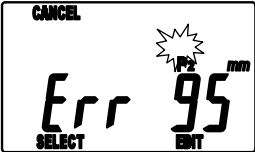
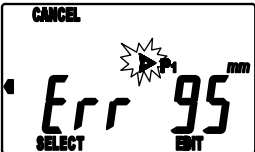
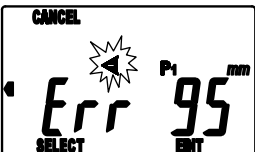
ERROR MESSAGE AND ACTION

This chapter describes the error messages and their corrective actions.

If any error occurs in this Digimatic indicator, a corresponding error message is displayed. If the instrument does not recover the normal conditions after corrective actions, contact your dealer or Mitutoyo sales office.

Display	definition	Actions
	Low battery alarm <ul style="list-style-type: none"> Battery voltage is getting low 	<ul style="list-style-type: none"> Replace the battery with the new one.
	Low battery error <ul style="list-style-type: none"> Measurement cannot be performed due to consumption of the battery. 	<ul style="list-style-type: none"> Replace the battery with the new one.
	Sensor signal synthesizing error <ul style="list-style-type: none"> Synthesizing of sensor signal is failed. 	<ul style="list-style-type: none"> A sensor signal synthesizing error occurred while the spindle was moving at high speed. Keep on using the indicator since this error does not affect measured values. * If this error occurs while the spindle is stopped, it could be due to sensor failure. In this case, contact the nearest Mitutoyo sales office.

Display	definition	Actions
	<p>Overflow error of display value</p> <ul style="list-style-type: none"> The display value has exceeded the maximum number of digits that can be displayed. 	<ul style="list-style-type: none"> Return the display value to the permissible number of digits to automatically reset the error. Press the center key, or press and hold Move the Setup mode to change the resolution. (Refer to "3.3.2 RES: Resolution".)
	<p>Internal connection error</p>	<ul style="list-style-type: none"> This could be due to instrument failure. In this case, contact your dealer or Mitutoyo sales office.
	<p>Setting value rewrite error</p> <ul style="list-style-type: none"> A setting value has been rewritten from any cause after the previous use. 	<ul style="list-style-type: none"> Press the center key will return to the initial state after setting the battery. Perform re-setting after confirming the setting value, referring to "2.1 Installation (replacement) of Battery and Initial Setting".
	<p>Setting value storage error</p> <ul style="list-style-type: none"> A setting value could not be stored. A setting value could not be loaded. 	<ul style="list-style-type: none"> Remove the battery once and perform re-setting, referring to "2.1 Installation (replacement) of Battery and Initial Setting". If this error occurs even after re-setting the battery, replace it. If this error occurs even after replacing the battery, it could be due to instrument failure. In this case, contact your dealer or Mitutoyo sales office.

Display	definition	Actions
	<p>Internal program error</p> <ul style="list-style-type: none"> Measurement cannot be performed due to occurrence of an anomaly in the internal program. 	<ul style="list-style-type: none"> This could be due to instrument failure. In this case, contact your dealer or Mitutoyo sales office.
	<p>Tolerance upper/lower limit setting error</p> <ul style="list-style-type: none"> The tolerance limit value is set with the upper limit value being smaller than the lower limit value. 	<ul style="list-style-type: none"> Press the center key to reset to be the upper limit value is greater than the lower limit value. (Refer to "3.3.1 TOL: Tolerance judgment".)
	<p>Overflow error of preset value</p> <ul style="list-style-type: none"> The preset value has exceeded the maximum number of digits that can be displayed. 	<ul style="list-style-type: none"> Press the lower right key to reset the preset value. Lower the resolution. (Refer to "3.3.2 RES: Resolution".)
	<p>Overflow error of upper limit value</p> <ul style="list-style-type: none"> The upper limit value has exceeded the maximum number of digits that can be displayed. 	<ul style="list-style-type: none"> Press the lower right key to reset the upper limit value. (Refer to "3.3.1 TOL: Tolerance judgment".) Lower the resolution. (Refer to "3.3.2 RES: Resolution".)
	<p>Overflow error of lower limit value</p> <ul style="list-style-type: none"> The lower limit value has exceeded the maximum number of digits that can be displayed. 	<ul style="list-style-type: none"> Press the lower right key to reset the lower limit value. (Refer to "3.3.1 TOL: Tolerance judgment".) Lower the resolution. (Refer to "3.3.2 RES: Resolution".)

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