

ID-C112JX2

Signal ABS Digimatic Indicator

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:



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

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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Power supply and external device connecting-related Warnings



WARNING

Take sufficient care for the connection with the external device. Connecting improperly may damage this product and the external device.

- Do not supply reverse voltage.
 - Use the stabilized power supply, avoid it from coming into contact with another terminal.
 - Make sure to ground.
 - Be careful to avoid electric shocks.
-

Disposal Warnings



WARNING

• A liquid crystal display is 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.
- Display unit of this product cannot be rotated. Applying excessive force to the display unit may cause product failure.
- 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.

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.

Electromagnetic Compatibility (EMC)

This product complies with the EMC Directive. Note that in environments where electromagnetic interference exceeds EMC requirements defined in this directive, appropriate countermeasures are required to assure the product performance.

This product is an industrial product, and is not intended to be used in residential environment. If this product is used in residential environment, this product may cause electromagnetic interference with other instruments. In such a case, it is required to take appropriate measures for preventing such electromagnetic interference.

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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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 product as well indicating the determination result on the liquid crystal display and two-color LED by setting the tolerance value, and can be output to external equipment.

Measurement and Setup mode are available with this instrument.

- Measurement mode
 - Normal mode : Dynamically displays measurement data
 - Peak detection mode :
 - Run-out detection mode: Detects run-out of the measurement data
 - Maximum value detection mode: Detects maximum value of the measurement data
 - Minimum value detection mode: Detects minimum value of the measurement data
- Setup mode: Enables each setting

There are two measuring systems, ABS (Preset) system and INC (Comparison) system in measurement mode.

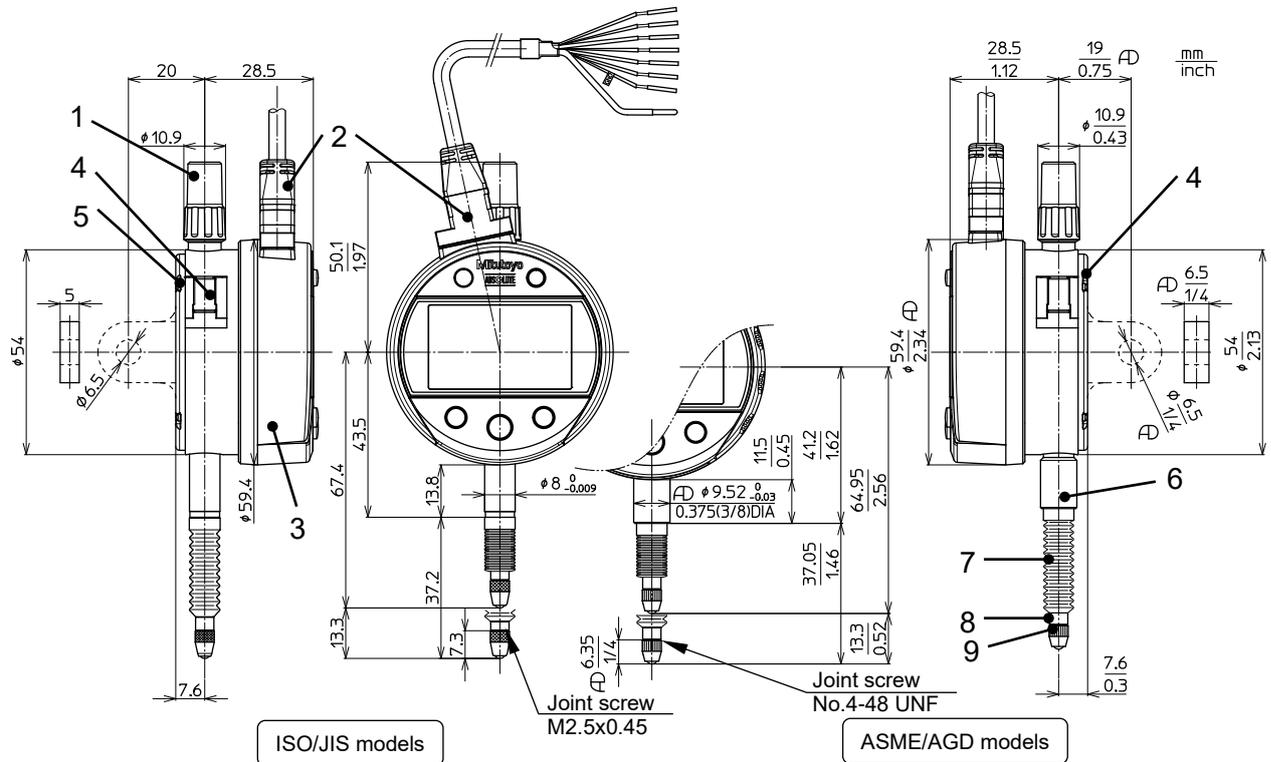
- Measuring system
 - ABS system: Absolute value measurement which measures distance (displacement) from a preset position .
 - INC system: Comparative measurement which measures distance (displacement) from the zero-set position .

1.2 Features (what you can do)

The following can be achieved with this product:

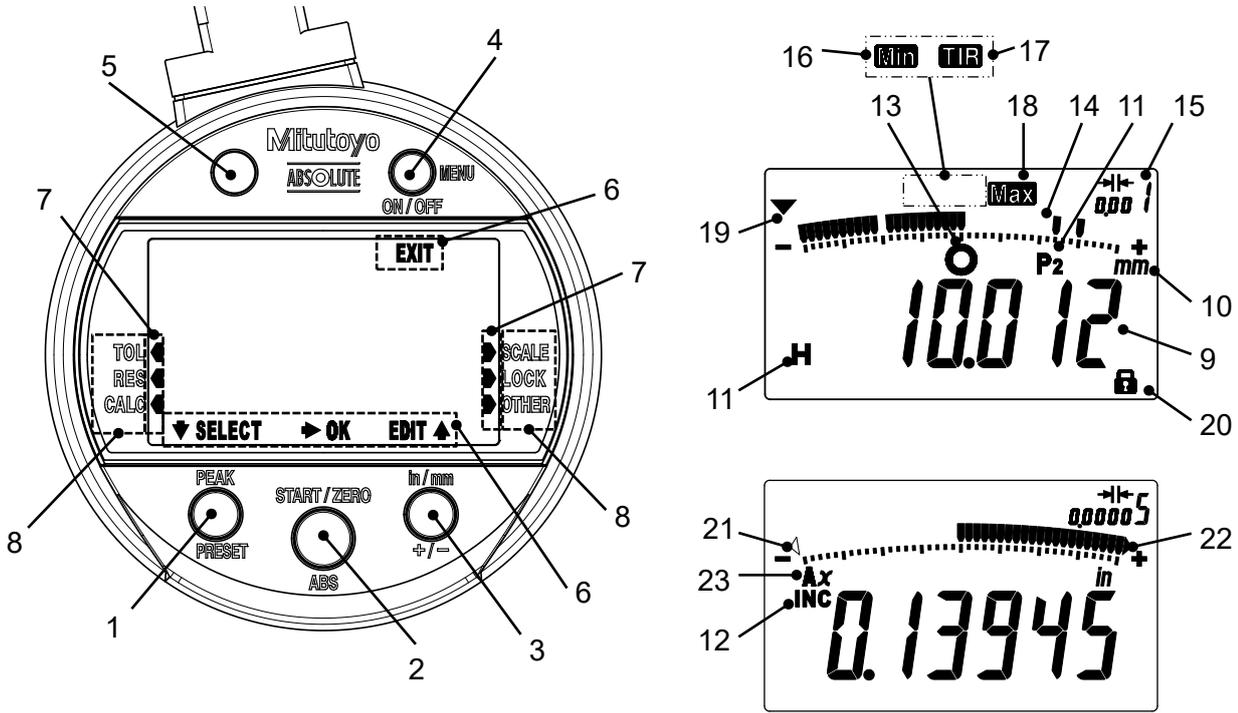
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1.3 Part Names and Dimensions



1	Cap
2	Output cable (4m)
3	Display unit
4	Lever mounting position (left and right)
5	Back
6	Stem
7	Rubber boot
8	Spindle
9	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	11	Preset No.	21	Lower over-range
2	Center key	12	Comparative measurement	22	Upper over-range
3	Lower right key	13	Tolerance judgment	23	Calculation formula
4	Upper right key	14	Analog bar		
5	LED	15	Analog bar graduation		
6	Key assist	16	Minimum value detection measurement		
7	Cursor	17	Run-out detection measurement		
8	Parameter	18	Maximum value detection measurement		
9	Display value	19	Reverse direction measurement		
10	Unit	20	Lock		

1.5 Specifications

Model name *1		ID-C112JX2	ID-C112JXB2	ID-C112JMX2	ID-C112JMXB2	ID-C112JEX2	ID-C112JEXB2
Code No. *1		543-350-10	543-350B-10	543-351-10	543-351B-10	543-352-10	543-352B-10
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			
ISO/JIS	Error of indication (MPE)	Partial measuring range P_{MPE} *3	0.003 mm		0.003 mm		
		Total measuring range E_{MPE} *3	0.003 mm		0.003 mm		
	Hysteresis H_{MPE} *3	0.003 mm					
	Repeatability R_{MPE} *3	0.002 mm					
ASME	Overall *3*4	-		±0.0001 in			
	Hysteresis *3	-		0.0001 in			
	Repeatability*3	-		0.0001 in			
Stem diameter		φ8 mm				0.375 in DIA	
Contact point		Carbide (M2.5x0.45)				Carbide (No.4-48UNF)	
Measuring force MPL		≤2.5 N					
Measuring direction		Useful in all directions					
Protection level *5		IP54 (in factory shipment state)					
Power supply		DC 5V~24V					
Control output		N-ch open drain					
Response time of the output		≤ 20 ms					
Control input		No-voltage input (PRESET_RECALL/ZERO, PEAK_START)					
Output cable		4 m One end is fixed the main unit. No connector is supplied for the other end. (AWG-24: 7 wires, Shielded line: 1 wire)					
Scale		Electrostatic capacitance absolute encoder					
Response speed		Infinite					
Measurement frequency *6		100 times/s (Min.)					
CE marking/ UKCA marking		EMC Directive/Electromagnetic Compatibility Regulations: EN IEC 61326-1 Immunity test requirement: Clause 6.2 Table 2 Emission limit: Class B RoHS Directive/The Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment Regulations: EN IEC 63000					
Operating temperature		0 °C~40 °C					
Storage temperature		-10 °C~60 °C					
Back type		With lug	Flat	With lug	Flat	With lug	Flat
Net weight		295 g	285 g	295 g	285 g	295 g	285 g

*1 : The flat back models have a suffix 'B' to the Order Numbers. Or with-center-lug back model have not one.

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

*3 : 20°C, normal measurement.

The values are calculated with coefficients; A=1 and the resolution set to 0.001mm. They are subject to change depending on the coefficient settings.

*4 : Overall magnification and linearity.

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

*6 : If the spindle speed exceeds 0.1mm/s, the correct peak value may not be displayed.

1.6 Protection from dust and water

This product has a rubber boot to protect itself from dust, water, oil, etc. Since this product is not water-proof, do not dip it into liquid or use it where it will be exposed to splash of water or oil. This product meets class IP-54 (DIN) standards for resistance to dust and water.

- IMPOTANT**
- The external device side of the connecting cable (core wire part) is not protective structured. Install the product at a place where it is not splashed directly with water or oil.
 - If the cable covering is broken, liquid will penetrate into the product inside due to capillary phenomenon. This will cause damage to the product. Immediately repair the cable.
 - Be greatly careful not to damage the rubber boot due to chips, etc. If the rubber boot is damaged, dust-proof and water-proof function will be deteriorated. Immediately replace the rubber boot (Refer to the “2.7 Replace the rubber boot”) or repair.
 - The materials of rubber which are used for the rubber boot and other sealing parts are not universal against coolants and chemicals.
-

1.7 Standard accessories

- No. 99MAH064B User's Manual
- No. 99MAH047B Quick Reference Manual
- No. 99MAH043M Product regulation manual
- — Certificate of inspection
- No. WA100 Warranty

1.8 Optional accessories

- No. 21EAA194 Connecting cable(1m) *1
 - No. 21EAA190 Connecting cable (2m) *1
 - No. 21EZA345※ Digimatic power supply unit *1 *2
 - No. 21EZA198 Lifting lever *3
 - No. 21EZA105 Lifting knob *3
 - Interchangeable contact points and extension rods for Mitutoyo dial indicators
 - Color caps for Mitutoyo dial indicators (waterproof type)
- *1. It is used when sending measurement data to i-Checker, for example, in the calibration mode.
- *2. To denote your AC power cable add the following suffixes to the order No.: A for UL/CSA, D for CEE, DC for CCC, E for BS, K for KC, No suffix is required for JIS/100V
- *3. When lifting options are used, please note that the dust-proof and waterproof performance is compromised.

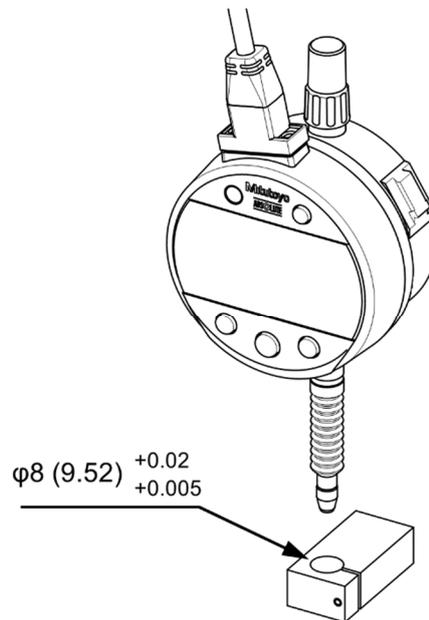
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SETUP

This chapter describes installation of a battery, how to mount the stand or jigs, and the accessory replacement procedure.

2.1 Securing Instrument

Secure the instrument to a stand, or fix it with a fixture or jig, when using it.



IMPORTANT

- Avoid using a lock screw to fix the stem directly. If fixed under a clamping torque of 150 N·cm or greater, the spindle may not move smoothly.

NOTES

- Set up the instrument with the spindle perpendicular to the reference plane or the surface to be measured. If the spindle axis is not perpendicular to the reference plane (measured surface), measurement errors will result.
 - If the spindle axis is inclined ϕ from the perpendicular line to the reference plane, measurement error δ will be as follows for the measured length of 12 mm:
 - $\phi = 1^\circ$: $\delta = 0.002\text{mm}$
 - $\phi = 2^\circ$: $\delta = 0.007\text{mm}$
 - $\phi = 3^\circ$: $\delta = 0.016\text{mm}$
- If the instrument is to be secured with a fixture, fix it by the stem in a slotted hole of about $\phi 8G7 (+0.005 \text{ to } +0.02)$ or $\phi 9.52 (+0.005 \text{ to } +0.02)$.

2.2 Connecting the external devices

Connect the product properly to an external device, referring to following table. If using connectors or terminals for connection, select the parts applicable to AWG-24 wires.

Wire color	Signal name	I/O	Description
Black	-V(GND)	—	Connect to the minus (-) terminal
Red	+V(plus power voltage)	—	Supply a power voltage between 5VDC and 24VDC
Orange	$\overline{\text{NG}}$	O	Tolerance judgment result output terminals (N-ch open drain output); Only the terminal corresponding to a judgment result is set to the low level. (See the output circuit diagram.)
Green	$\overline{\text{OK}}$	O	
Brown	$\overline{\text{+NG}}$	O	
Yellow	$\overline{\text{PRESET_RECALL/ZERO}}$	I	External input terminals (no-voltage input): If the relevant terminal is set to the low level, its signal becomes true. (See the input circuit diagram)
Blue	$\overline{\text{PEAK_START}}$	I	
Shield	F.G. (Frame ground)	—	Connect to the ground

When the power is supplied, this product starts up in the measurement mode, and outputs the judgment result. The various settings will be the one previously set before the power is turned off.

* This product starts up in the normal mode of the ABS system when it starts up for the first time.

IMPORTANT

- Clap the output cable properly so that an excessive force may not be applied to the cable.
- If the external input terminal is not used, avoid it from coming into contact with another terminal.

To prevent a malfunction, observe the following precautions.

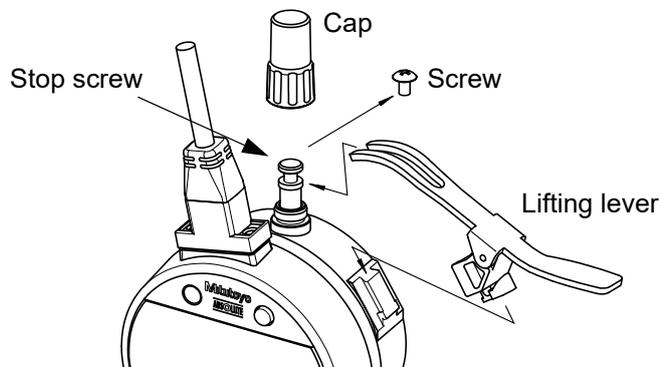
NOTES

- Use an external device for which noise prevention measures have been taken.
 - Be sure to ground the FG (shield frame).
 - Isolate this product from other power cables
 - Use the stabilized power supply, and do not share the power with other devices.
-

2.3 Mounting Lifting Lever

A lifting lever (optional/ Parts No. 21EZA198) is available for this instrument.

1. Rotate the cap counterclockwise to remove it from the instrument.
2. Hold the spindle with pliers protecting it with a rag to prevent it from rotating, remove the screw at the top of the spindle.
3. Attach the spindle stop provided with the lifting lever. Next, fix the lifting lever to the lever mounting part (dovetail) while applying its top to the spindle stop.



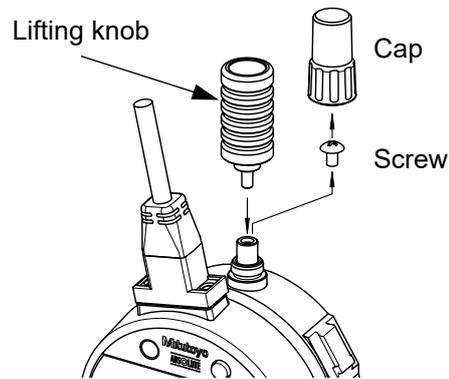
IMPORTANT

- When lifting lever is used, please note that the dust-proof and waterproof performance is compromised.
 - Store the removed screw and cap, taking care to prevent loss.
 - Using this instrument with the spindle stop loose may damage the internal parts or workpiece.
 - When the spindle stop is not mounted, be sure to attach the removed screw to the top of the spindle. Failure to do so may damage the internal parts or workpiece.
-

2.4 Mounting Lifting Knob

A lifting knob (optional/ Parts No. 21EZA105) is available.

1. Rotate the cap counterclockwise to remove it from the instrument.
2. Hold the spindle with pliers while protecting it with a rag to prevent rotation, remove the screw at the top of the spindle.
3. Fix the lifting knob to the top of the spindle.



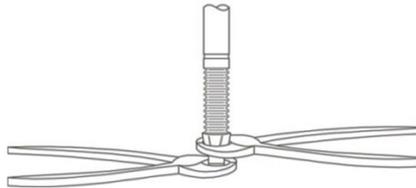
IMPORTANT

- When lifting knob is used, please note that the dust-proof and waterproof performance is compromised.
 - Store the removed screw and cap, taking care to prevent loss.
 - Using this instrument with the lifting knob loose may damage the internal parts or workpiece.
 - When the lifting knob is not mounted, be sure to attach the removed screw to the top of the spindle. Failure to do so may damage the internal parts or workpiece.
-

2.5 Replacing Contact Point

Interchangeable contact points and extension rods for Mitutoyo dial indicators are available.

1. Use two pliers (One is for holding the spindle under the rubber boot and the other is for holding the contact point.) and a rag in the figure below. Rotate the plier which is holding the contact point clockwise to remove the contact point.
2. In a similar way, rotate the plier which is holding a contact point or an extension rod counterclockwise to mount.



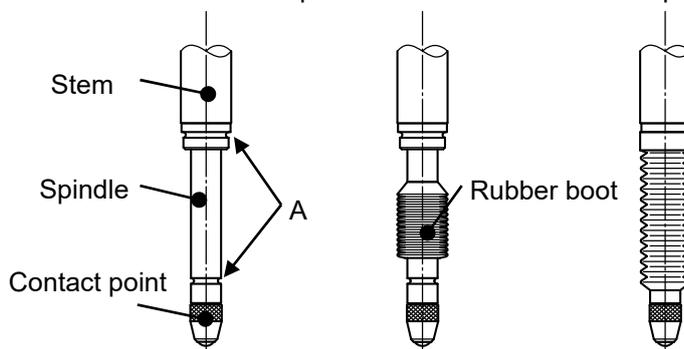
IMPORTANT

- When replacing the contact point hold the spindle under the rubber boot and turn the contact point. Otherwise, the indicator may be damaged.
 - Changing the contact point also may change the external dimensions, measuring force, and limitation of the measuring direction. Contact point errors such as the non-perpendicularity of a flat contact point and run-out of the roller point add to the measurement error.
-

2.6 Replace the rubber boot

Follow the steps below to replace the rubber boot for deterioration or damage (Part No.21EAA423).

1. After remove the old rubber boot, use alcohol or other cleaning agent to wipe dust and oil from the groove (A) on the stem, groove (B) on the spindle, and the spindle.
2. Insert a new rubber boot between the stem and the contact point. The end of the boot with the larger diameter should be on the stem side.
3. Apply a small amount of a silicone-based adhesive (cold-setting type) to the grooves (A) and (B). Apply the adhesive carefully so that no adhesive gets on the sliding part of the spindle.
4. Use a pair of tweezers to fit the upper end of the boot into the groove on the stem (A). Stretch the boot with your fingers so as to fit the other end into the groove on the spindle (B).
5. Use a clean cloth to wipe off the adhesive that was squeezed out of the grooves.



IMPORTANT

- When the silicone adhesive is adhered to the spindle, it may cause spindle moving malfunction. Wipe clean if adhered to the spindle.
-

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	PEAK (3.2.6)	PRESET (3.2.1)
Center	START (3.2.6) ZERO (3.2.4)	ABS (3.2.3)
Lower right	in/mm (3.2.9)	+/- (3.2.8)
Upper right	MENU (3.3)	ON/OFF(3.1)

●Setup mode/Numerical values setting

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

This product is equipped with a LED to display the tolerance judgment result and various abnormal (error condition). The LED lights as shown in the table below in accordance with each state.

Lighting pattern	Description
Green	Tolerance judgment result is OK
Red	Tolerance judgment result is NG
Red blinking	Abnormality has occurred (Error is displayed)
Extinction	Other than the above <ul style="list-style-type: none">• Preset setting• Setup mode• Calibration mode

3.1 Power ON/OFF

Power ON: Press the upper right key.

Power OFF: Press and hold the upper right key

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 "3.2.2 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. The preset setting is completed and the measurement in the ABS system will be ready.
In the peak detection mode, the spindle position of maximum or 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 unit or the resolution. Check the preset value when the resolution is changed since the conversion error may occur.

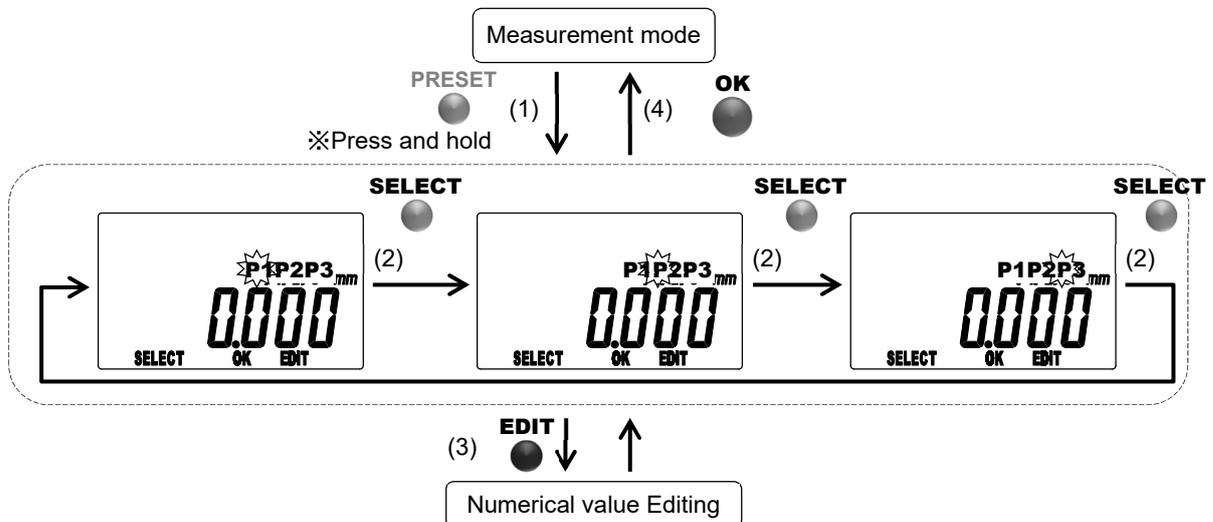
NOTE

- The preset setting cannot be completed while the spindle is moving. So complete it after the spindle stops.
- The setup preset values and position will be held after the power is turned off. However, when the power supply is disconnected, the preset position will be cleared. Set up the position again.
- The power supply cannot be turned off with the upper right key in the preset setting.
- The preset setting cannot be completed if Overflow error of preset value (Err95) is occurring for the selected preset number. Reset the preset value.
- 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.

TIP

- The current spindle position can be preset by the signal input of PRESET_RECALL/ZERO from the external device. (Refer to the "3.2.5 External Preset recall/Zero-set(External switch)" and "4.3 External input signal".)

Preset setting (Master setting)



3.2.2 Numerical value Editing

This product is in the "Preset", "tolerance judgment function" and "calculation function", can be set to any value (numerical value editing).

Items that can be numerical value editing

Functions	Editing items
Preset	P1, P2, P3
Tolerance judgment	Upper limit, Lower limit
Calculation function	Calculation coefficient: A

- 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 "+" \leftrightarrow "-".

For numerical values

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

0→9→8→... →1→0.

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

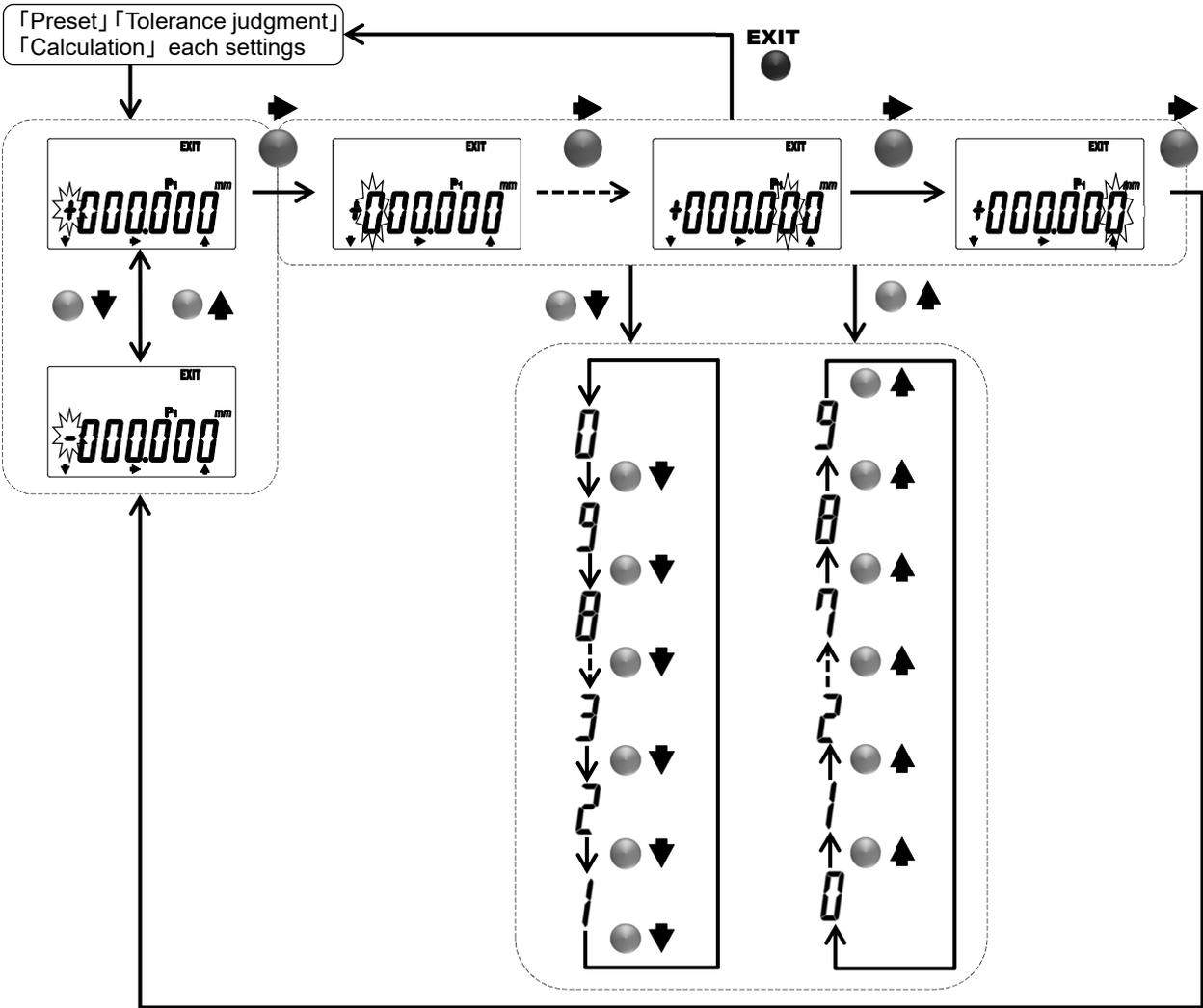
0→1→2→... →9→0.

- Completing the numerical value editing
Press the upper right key to complete the numerical value editing.
After editing the numerical values, the previous setup window 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".
- The value is temporarily saved until completing each setting before moving the numerical value editing. If canceled, it will be deleted.

Numerical value Editing

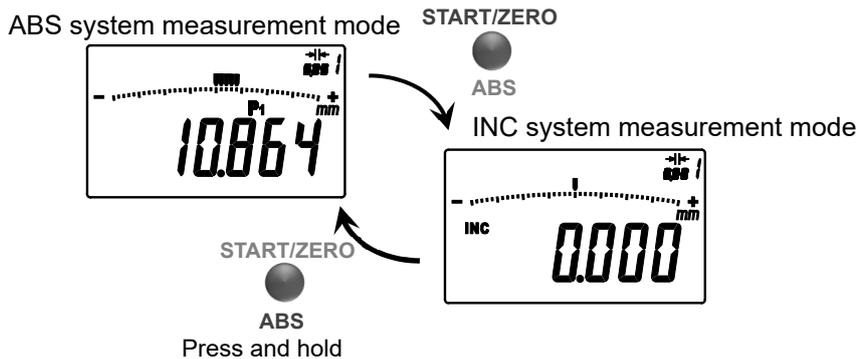


3.2.3 Switching measuring system (ABS/INC)

This can be operated only in the normal mode, not in the peak detection mode.
Press the center key to switch from ABS to INC.
Press and hold the center key to switch from INC to ABS.

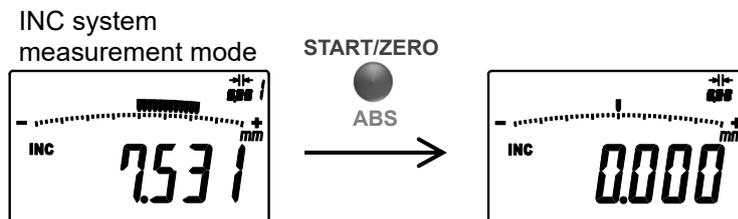
NOTE

- When the system is switched from ABS to INC, also display value will be set to the zero.
- It cannot switch from ABS to INC while the spindle is moving. So switch from ABS to INC after stopping the spindle.
- 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 the system.



3.2.4 Zero-setting display value

Press the center key in the normal mode, the display value is set to zero.



NOTE

- It cannot set to zero while the spindle is moving. So set to zero after stopping the spindle.

TIP

- By the input of PRESET_RECALL/ZERO signal from an external device, this product can be zero set. (Refer to the “3.2.5 External Preset recall/Zero-set(External switch)” and “4.3 External input signal”.)

3.2.5 External Preset Recall/Zero-set(External switch)

By the signal input of PRESET_RECALL/ZERO from the external device, this product can be preset or zero-set.

ABS system, Normal mode, Maximum/Minimum detection mode

: Preset the current spindle position.

INC system, Normal mode

: Zero-set the current spindle position.

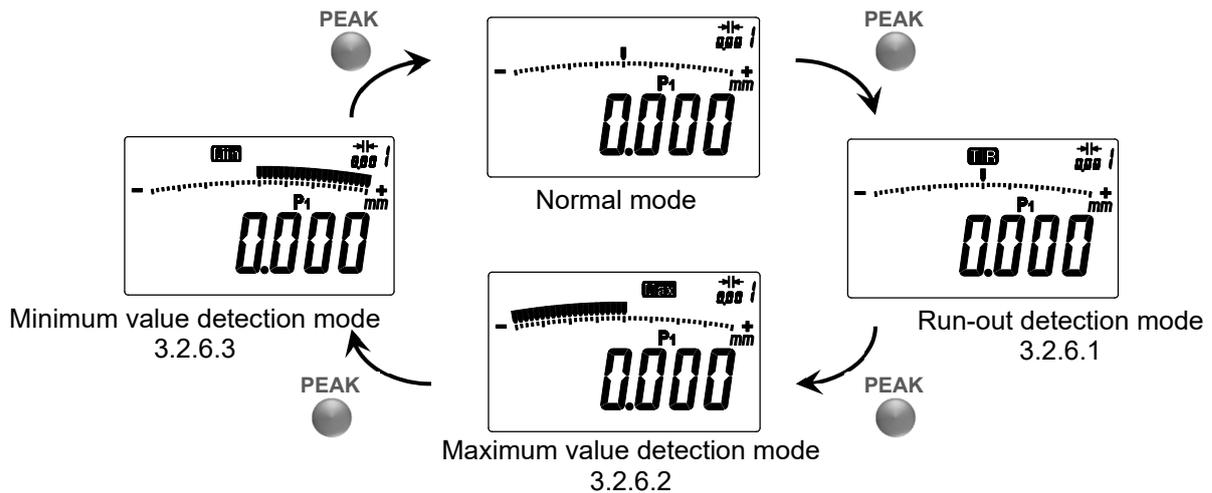
注記

- Specification of the input signal, refer to the 『4.4 External input signal』 .
- Note that the operation in the maximum/minimum value detection mode differs from the preset/zero-set operation through keys of the main unit.
- After this function is used in the maximum/minimum value detection mode, the unit will be back to the peak detection wait status in each mode. Therefore, to start a peak detection measurement, press the center key once again or input PEAK_START signal.

3.2.6 Changing to peak detection mode

Press the lower left key to switch the mode between the normal mode and peak detection mode.

Pressing the lower left key to check each peak value by changing the display "TIR", "Max", and "Min" while the run-out, maximum and minimum value are held.



NOTE

- In the peak detection mode, start measuring while the contact point is contacting the measuring target.
- Note that the displacement caused by vibration, impact, etc. is detected.
- Detecting the peak will be being continued until changing to the normal mode.

3.2.6.1 Run-out detection mode "TIR"

Hold the run-out of fluctuating measurement data (maximum value - minimum value). When the tolerance judgment condition has been set, the instrument displays the result of tolerance judgment for the run-out.

1. Press the lower left key a few times until "TIR" is displayed.
2. Press the center key. Run-out detection measurement is started.
3. When the measurement data exceeds either the maximum or minimum value, the display value will be updated.
During update, "Max" or "Min" will blink.
4. The detected run-out will be held until the center key is pressed next time. Press the center key to restart run-out measurement.

NOTE ▪ The tolerance judgment in the run-out detection mode is made by comparing the actual run-out value with the tolerance value (upper limit - lower limit).

3.2.6.2 Maximum value detection mode "Max"

Hold the maximum value of fluctuating measurement data. When the tolerance judgment condition has been set, the instrument displays the result of tolerance judgment for the maximum value.

1. Press the lower left key a few times until "Max" is displayed.
2. Press the center key. Maximum value detection measurement is started.
3. When the measurement data exceeds the maximum value, "Max" starts blinking and the value is updated.
4. The detected maximum value will be held until the center key is pressed next time. Press the center key to restart maximum value measurement.

NOTE ▪ The maximum 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.

3.2.6.3 Minimum value detection mode "Min"

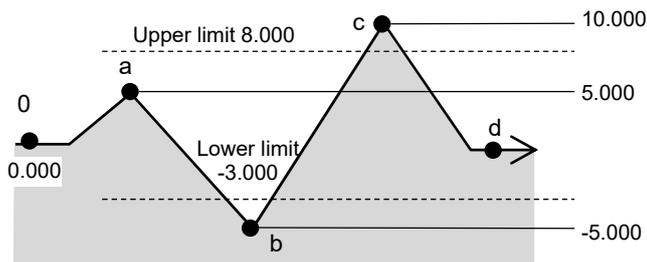
Hold the minimum value of fluctuating measurement data. When the tolerance judgment condition has been set, the instrument displays the result of tolerance judgment for the minimum value.

1. Press the lower left key a few times until "Min" is displayed.
2. Press the center key. Minimum value detection measurement is started.
3. When the measurement data falls below the minimum value, "Min" starts blinking and the value is updated.
4. The detected minimum value will be held until the center key is pressed next time. Press the center key to restart minimum value measurement.

NOTE ▪ 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.

TIP

The following describes examples of display value and tolerance judgment in each measurement mode.



Example of display value in each measurement mode

	0	→	a	→	b	→	c	→	d
Normal	0.000	↗	5.000	↘	-5.000	↗	10.000	↘	0.000
TIR	0.000	↗	5.000	↗	10.000	↗	15.000		
Max	0.000	↗	5.000			↗	10.000		
Min	0.000			↘	-5.000				

Example of tolerance judgment (upper limit 8.000, Lower limit-3.000)

	0	a	b	c	d
Normal	○		◀	▶	○
TIR		○		◀ ▶	
Max		○		▶	
Min	○			◀	

3.2.7 Peak start (External switch)

The peak detection can be restarted after clearing retained runout, maximum value, and minimum value by setting the output signal cable PEAK_START (blue) to the low level.

NOTE • Specification of the input signal, refer to the 『4.4 External input signal』 .

3.2.8 Switching the counting direction

Set the counting direction against the spindle moving direction. Press and hold the upper right key in normal mode. When the direction is switched to reverse(-), this indicator counts down by pushing up the spindle, and “▼” is displayed.

NOTE • The preset position will not be changed by the counting direction switching.

3.2.9 Switching units (in/mm)

This function is available for inch models only. Press and hold the lower right key to switch the display unit between inch and metric.

NOTE

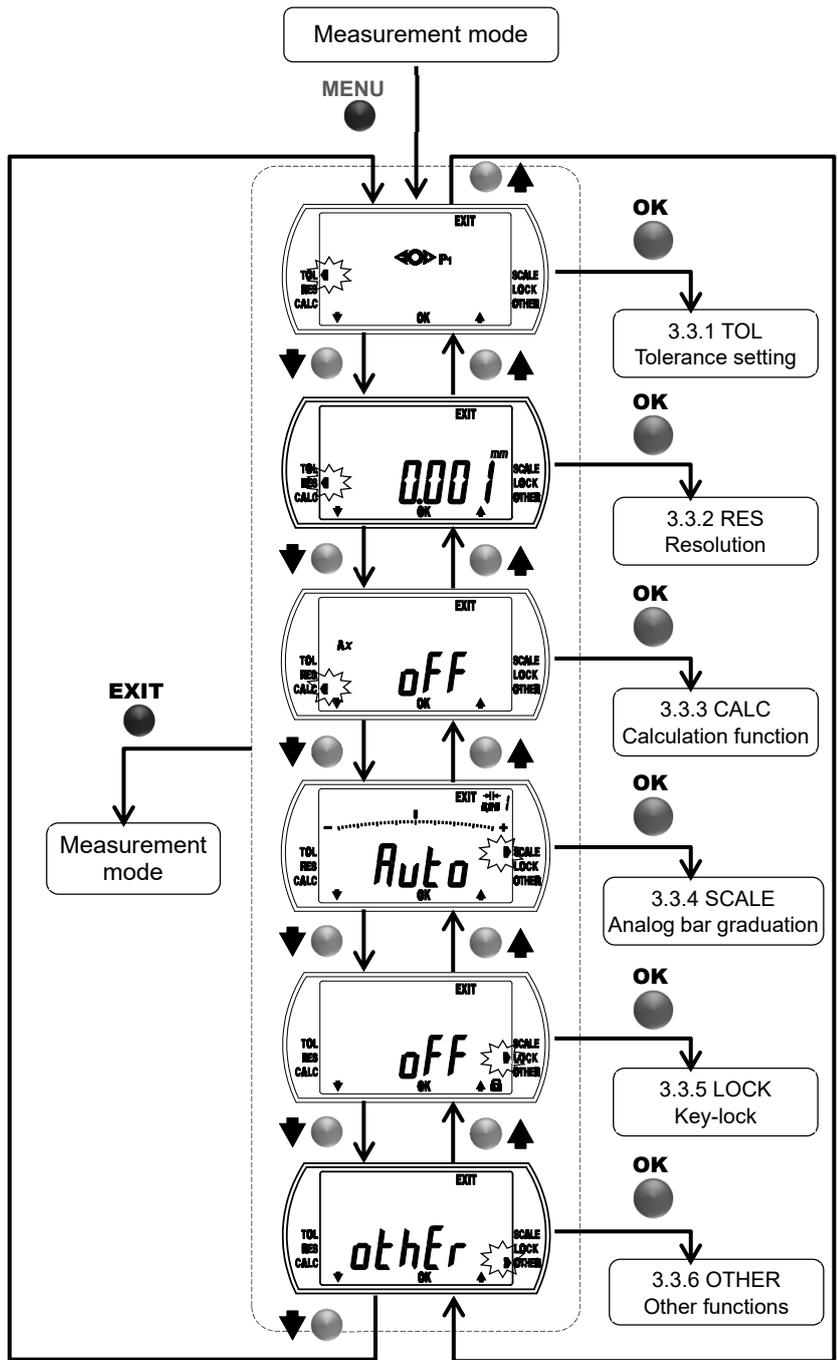
-
- When the unit is switched, the following will be converted accordingly: display value, preset values, tolerance value, resolution, and analog bar graduation. If it causes the overflow error of display value (Err 30), set the proper resolution. Also, it causes overflow error of each setting values 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

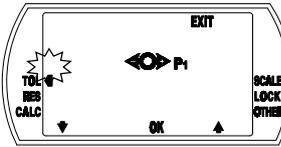
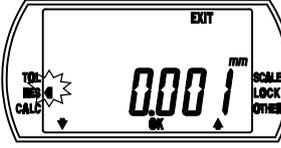
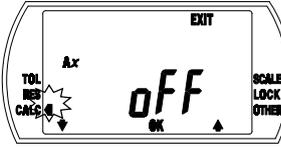
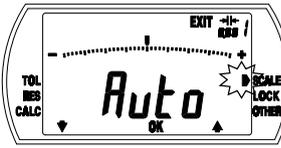
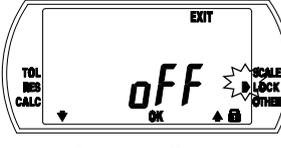
The following parameters can be checked or set in the setup mode.

- 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 the Display Unit".)
 - The setup parameters will be registered even after the power supply is disconnected or power is turned off. However, if the power supply is disconnected 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 right key in the setup mode.
-



Parameters

Parameter	Example of display	Settings
<p>TOL (Tolerance setting)</p>		<p>Tolerance value setting</p>
<p>RES (Resolution)</p>	 <p>Current resolution</p>	<p>Selecting resolution of the display</p>
<p>CALC (Calculation function)</p>	 <p>"ON" or "OFF"</p>	<p>Selecting ON/OFF of calculation function and coefficients setting</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 "3.3.6 OTHER: Other functions".)</p>

3.3.1 TOL: Tolerance setting

This product will be enabled at all times 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 ABS system (P1, P2 and P3) and INC system respectively.

- 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 tolerance value setting (upper/lower limit).
The upper limit sign is blinking, and currently set value will be displayed.
4. 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.
5. 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".)
6. 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".)

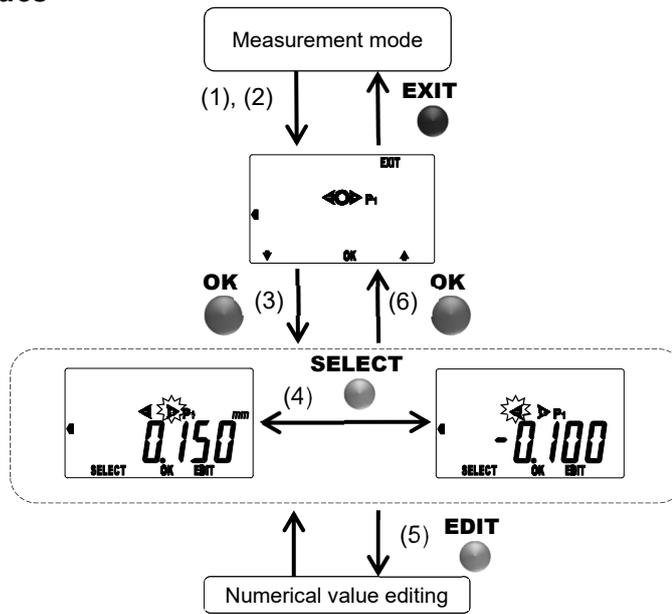
IMPORTANT

- The tolerance values will be set in the currently active system (ABS (P1, P2, P3) or INC). 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

- The tolerance judgment in the run-out detection mode is made by comparing the actual run-out value with the tolerance value (upper limit - lower limit).
 - 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 power is shut down during setup, the content being set up will be deleted.
-

Changing tolerance values



3.3.2 RES: Resolution

The resolution of the display can be changed.

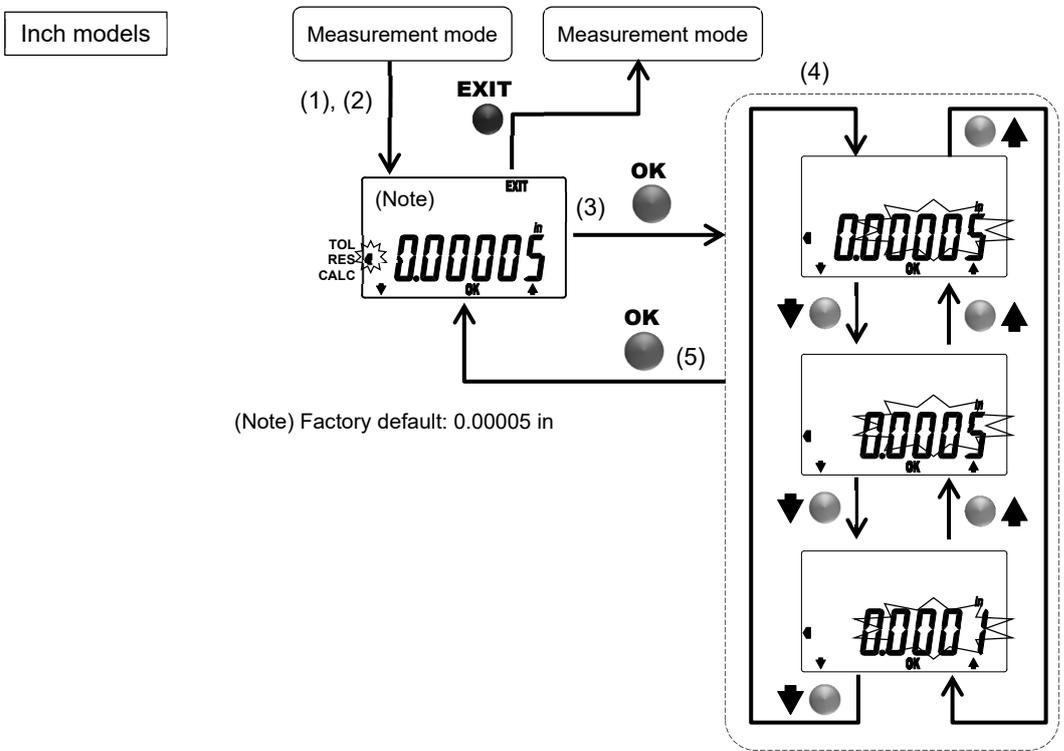
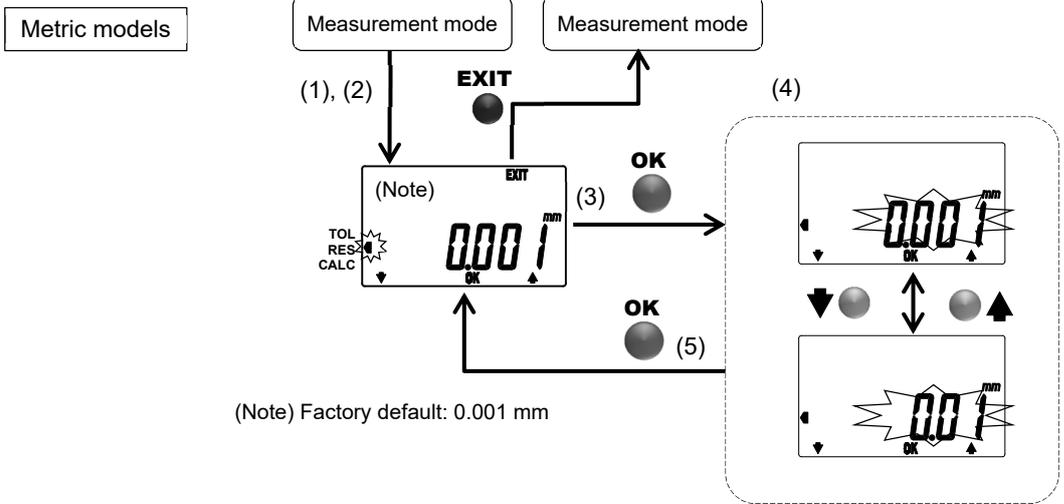
- Selecting the resolution

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 "RES".
3. Press the center key to set the resolution.
4. Press the lower left or lower right key to switch the resolution.
5. 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 · When the unit is switched, the resolution will be automatically changed accordingly. Check the resolution after switching the unit.
· When the power is shut down during setup, the content being set up will be deleted.

Selecting the resolution



3.3.3 CALC: Calculation function

This special instrument supports measurements by internal calculations using the formula $f(x)=Ax$ ("x" is a spindle displacement). The calculation coefficient A can be set.

- Enabling the calculation function. Checking or changing the calculation coefficient.
 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 "CALC".
 3. Press the center key to move the ON/OFF selection of the calculation function.
 4. Press the lower left key to select "ON".
 5. Press the center key to move the calculation coefficient setting
 6. Press the lower right key, to move the numerical value editing. (Refer to "3.2.2 Numerical value editing".)
 7. Press the center key after checking or changing the calculation coefficient. The calculation function is set "ON", and the mode returns to the parameter setting. (Refer to "3.3 Setup Mode".)
- Disabling the calculation function
 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 "CALC".
 3. Press the center key to move the ON/OFF selection of the calculation function.
 4. Press the lower left key to select "OFF".
 5. Press the center key to set the calculation function "OFF" and return to the parameter setting. (Refer to "3.3 Setup Mode".)

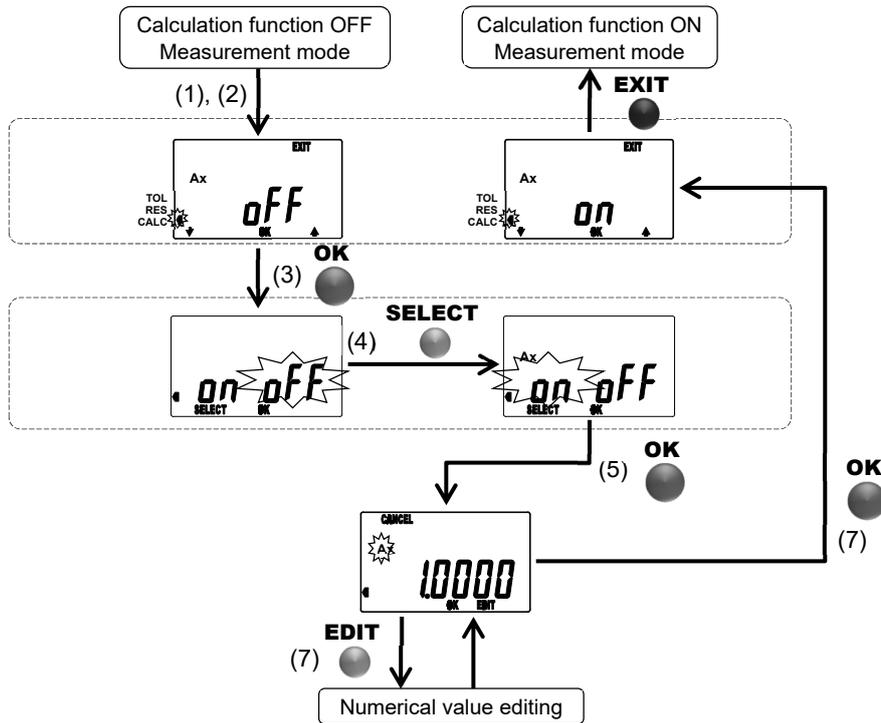
IMPORTANT

- When enabling the calculation function or changing the calculation coefficient in the ABS system, the preset position will be cleared. However the preset value can be called, as it is being registered.
-

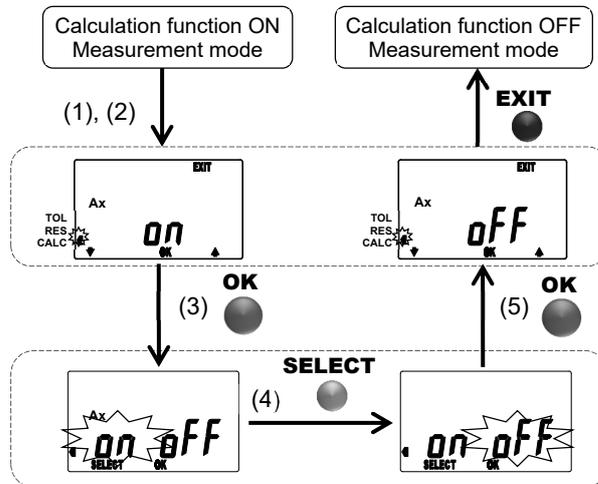
NOTE

- Overflow error of display value (Err30) may occur as a result of calculation. (Refer to "5 ERROR MESSAGES AND ACTION".)
 - The factory default of the calculation coefficients are $A=1$.
 - The calculation function setting cannot be completed if the calculation coefficient A is set to zero. Reset the calculation coefficient A.
 - The calculation coefficient A will not be converted by the resolution changing.
 - The number of digits available for the calculation coefficient A is 2 digits before the decimal point, 4 digits after the decimal point.
 - When the power is shut down during setup, the content being set up will be deleted.
-

Enabling the calculation function. Checking or changing the calculation coefficients.



Disabling the calculation function



3.3.4 SCALE: Analog bar graduation

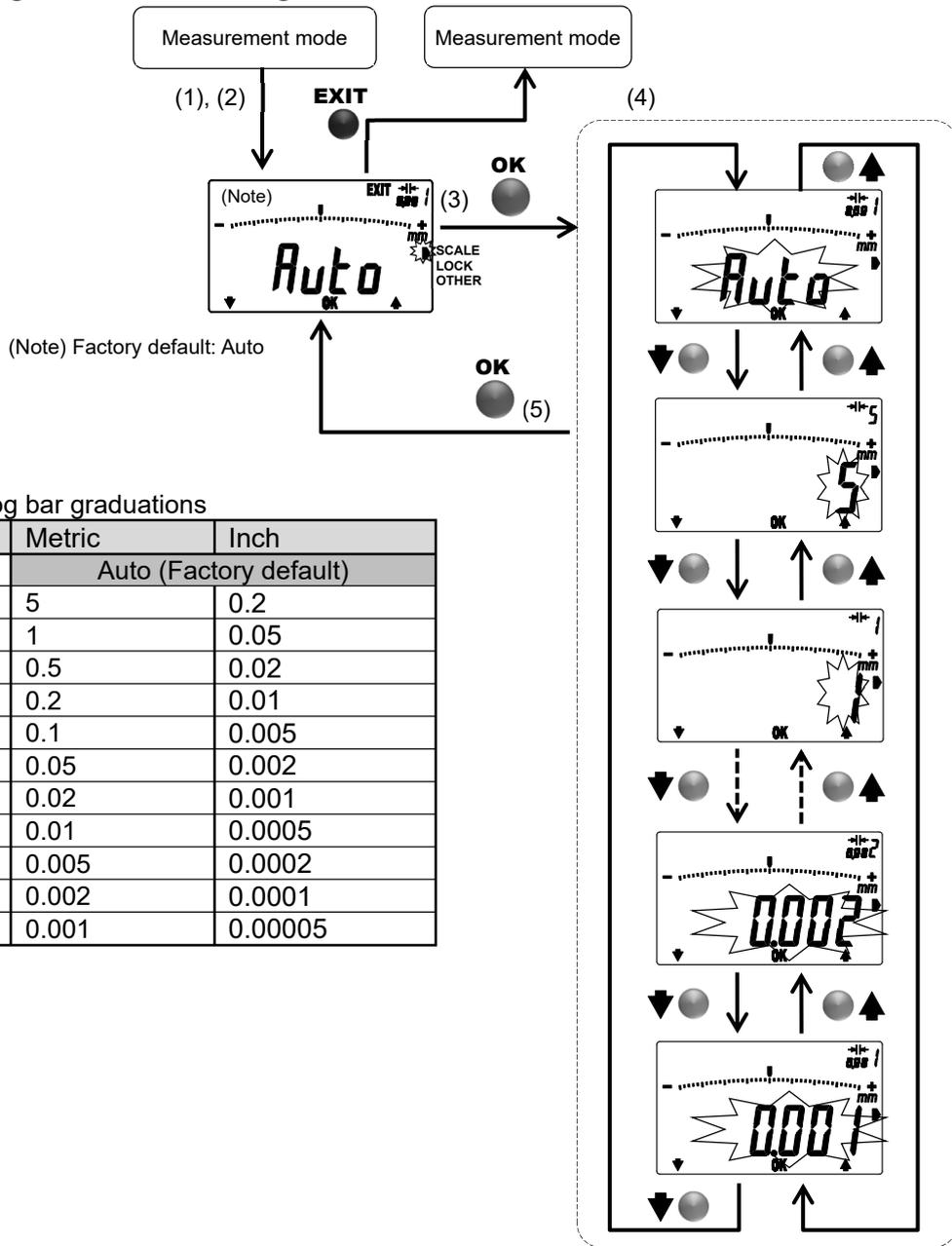
The analog bar graduation (Display range: ± 20) can be changed.

- 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**
- The factory default of the analog bar graduation is "Auto". Change it as required.
 - 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.
 - When the power is shut down during setup, the content being set up will be deleted.
-

- TIP**
- The graduation of the analog bar will change automatically in the following conditions:
 1. Graduation will change tolerance values to be within the display range.
 2. Changing resolution: If analog bar graduation which is automatically set in the previous section is smaller than the resolution, the analog bar graduation will change same as the resolution.
-

Selecting a graduation of analog bar



Analog bar graduations

	Metric	Inch
(1)	Auto (Factory default)	
(2)	5	0.2
(3)	1	0.05
(4)	0.5	0.02
(5)	0.2	0.01
(6)	0.1	0.005
(7)	0.05	0.002
(8)	0.02	0.001
(9)	0.01	0.0005
(10)	0.005	0.0002
(11)	0.002	0.0001
(12)	0.001	0.00005

3.3.5 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".)

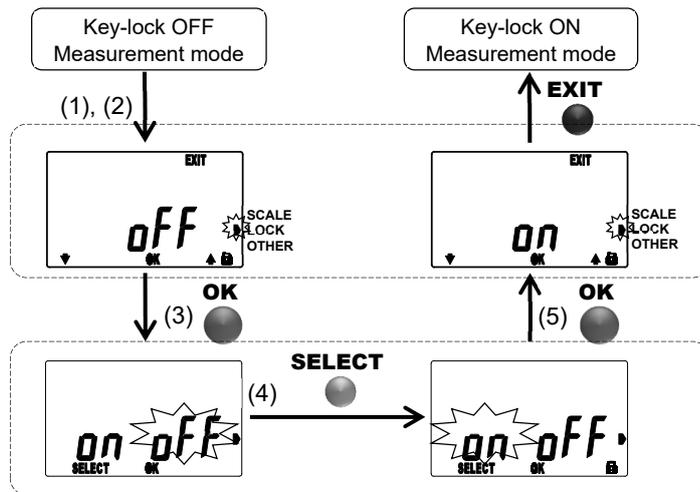
- NOTE**
- The key-lock function will not be disabled by turning off the power. However, it will be set off when the power supply is disconnected.
 - When the key-lock is set on, other than key-lock cannot be selected in the setup mode.
 - When the power is shut down during setup, the content being set up will be deleted.

Functions to be disabled while key-lock is on

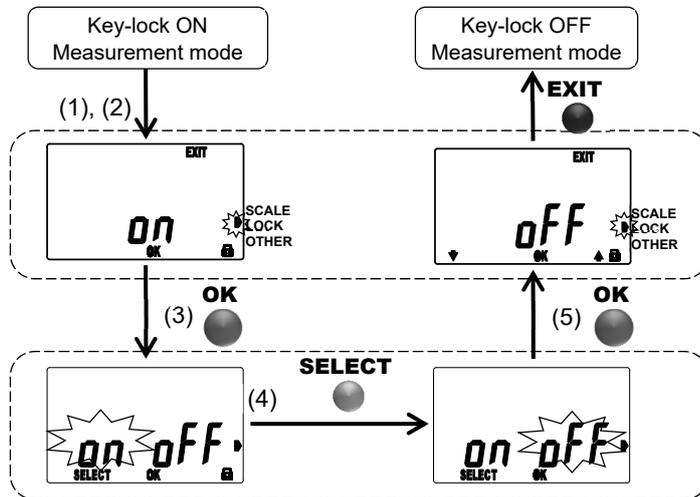
- Measurement mode

Keys	Operation	Key names		Disabled functions		Remarks
		Metric model	Inch model	Metric model	Inch model	
Lower left key	Press	PEAK		✓		3.2.6
	Press and Hold	PRESET		✓		3.2.1
Center key	Press	ZERO		✓		3.2.4
	Press and Hold	ABS		✓		3.2.3
Lower right key	Press	—	in/mm	—	✓	3.2.9
	Press and Hold	+/-		✓		3.2.8
Upper right key	Press	MENU		—		3.3
	Press and Hold	ON/OFF		—		3.1

Enabling key-lock (disabling key operation)



Disabling key-lock (enabling key operation)

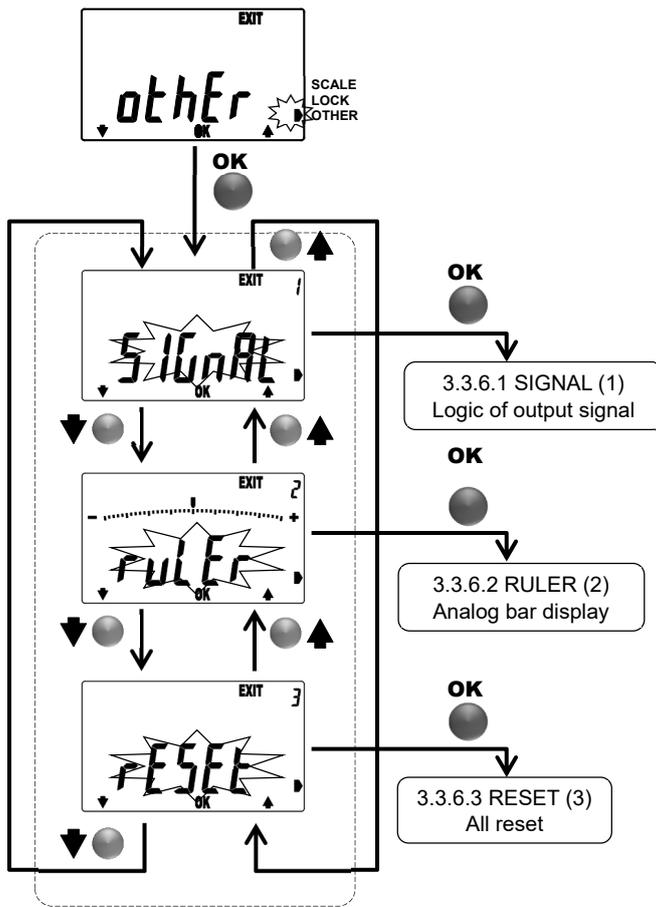


3.3.6 OTHER: Other functions

Check or set up the logic of output signal, analog bar display and all reset.

- 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:
Logic of output signal → Analog bar display →...→ All reset → Logic of output signal
 - Pressing the lower right key, the display changes in the following order:
Logic of output signal → All reset →...→ Analog bar display → Logic of output signal
 5. Press the center key to return to the parameter setting.

NOTE · When the power is shut down during setup, the content being set up will be deleted.



Items available in OTHERS

Other functions (Item No.)	Settings
SIGNAL(1) Logic of output signal	Selecting Negative/Positive logic of output signal
RULER(2) Analog bar display	Selecting ON/OFF of analog bar display
RESET(3) All reset	Executing all reset

3.3.6.1 SIGNAL(1): Logic of output signal

The product switched between positive and negative logics regarding judgment output signals. (Default: Negative logic)

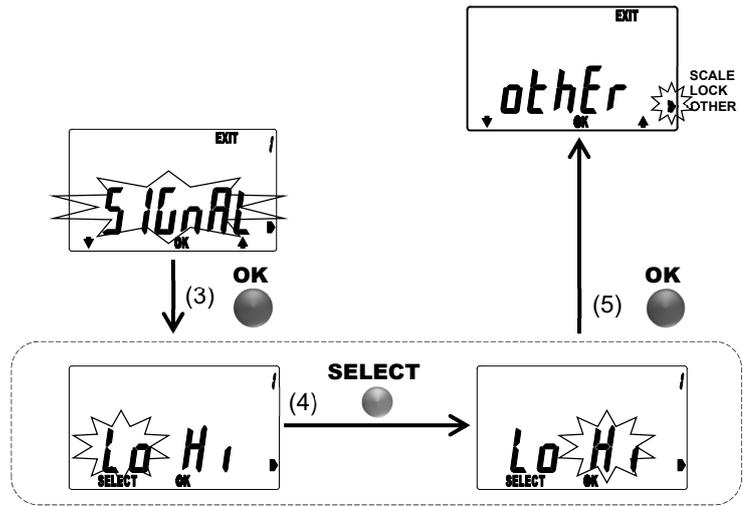
The output signal at each signal logic, refer to "4.2 tolerance judgment output signal."

- Changing to the positive logic
 1. Press the upper right key in the measurement mode to move the setup mode, and select OTHER functions. (Refer to "3.3.6 OTHER: Other functions".)
 2. Press the lower left or lower right key until "SIGNAL" is blinking.
 3. Press the center key to move the selecting the logic of output signal.
 4. Press the lower left key to select "Hi".
 5. Press the center key to the positive logic and return to the parameter setting. (Refer to "3.3 Setup Mode".)

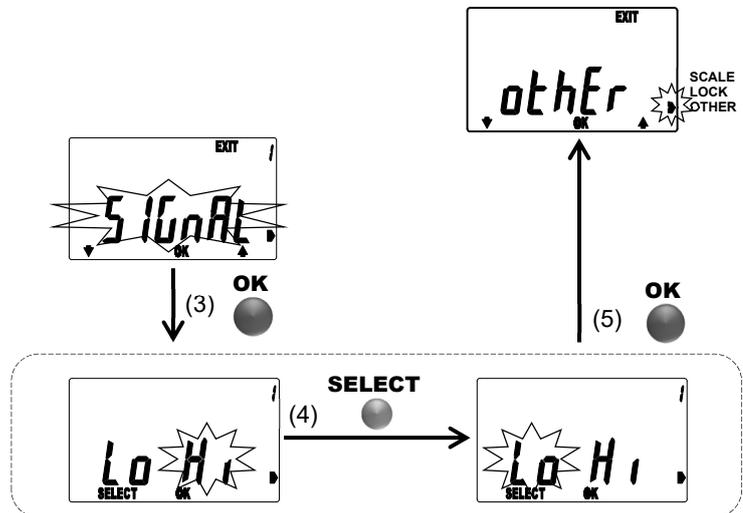
- Changing to the negative logic
 1. Press the upper right key in the measurement mode to move the setup mode, and select OTHER functions. (Refer to "3.3.6 OTHER: Other functions".)
 2. Press the lower left or lower right key until "SIGNAL" is blinking.
 3. Press the center key to move the selecting the logic of output signal.
 4. Press the lower left key to select "Lo".
 5. Press the center key to the negative logic and return to the parameter setting. (Refer to "3.3 Setup Mode".)

NOTE ▪ During measurement, the output logic is not displayed. Therefore, it is recommended to check the setting before starting measurement.

Changing to the positive logic



Changing to the negative logic



3.3.6.2 RULER(2): Analog bar display

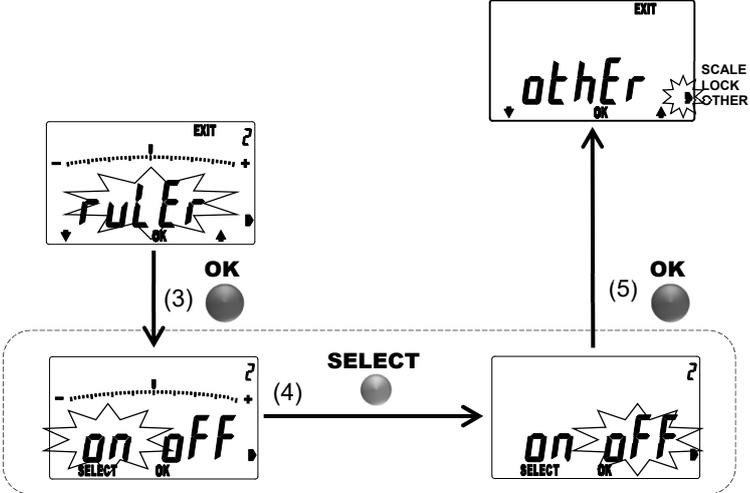
Analog bar can be set up displayed or hidden.

- 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 "3.3.6 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".)

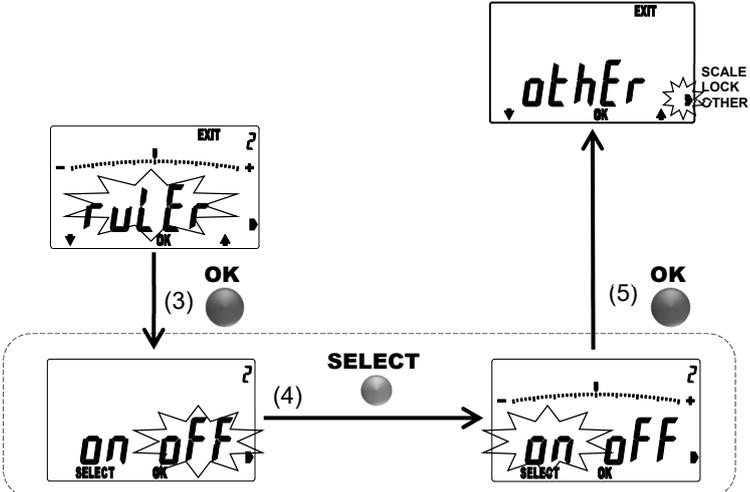
- Displaying the analog bar
 1. Press the upper right key in the measurement mode to move the setup mode, and select OTHER functions. (Refer to "3.3.6 OTHER: Other functions".)
 2. Press the lower left or lower right key until "RULER" is blinking.
 3. Press the center key to move the ON/OFF selection of the analog bar display.
 4. Press the lower left key to select "ON".
 5. Press the center key to display 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 "3.3.4 SCALE: Selecting analog bar graduation".)

Hiding the analog bar



Displaying the analog bar



3.3.6.3 RESET(3): 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 "3.3.6 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 power supply is installed.

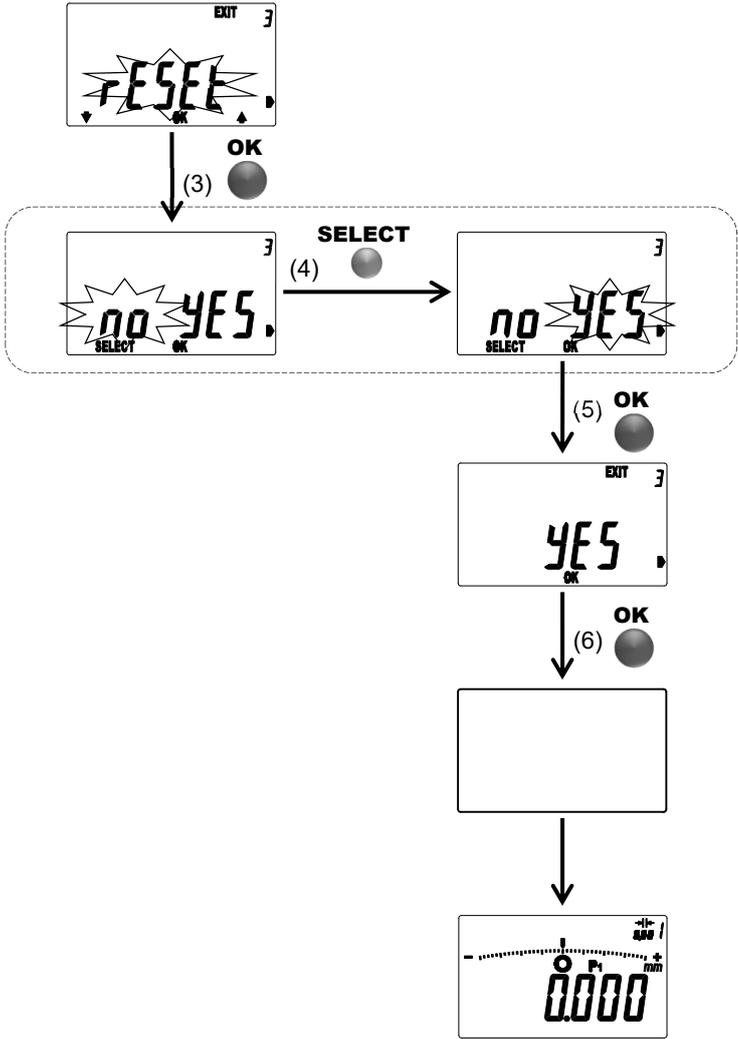
IMPORTANT ▪ The setting before executing all reset cannot be restored.

NOTE ▪ Press the upper right key in step 5, to stop on the way the all reset execution.

Factory default

Setting items		Settings
Preset	Preset No.	P1
	Preset value	Zero (P1,P2 and P3)
Measuring system		ABS
Unit		mm models :mm inch models :in
Counting direction		Plus (When pushed the spindle)
Peak detection mode		OFF
Center position of the analog bar		Centered at zero
Tolerance judgment		Tolerance judgment (upper limit/lower limit): Zero for all
Resolution		mm models :0.001 mm inch models :0.00005 in
		OFF
Calculation function	Calculation coefficient	A=1.0000
Analog bar graduation		Auto
Key-lock		OFF
Logic of output signal		Negative logic
Analog bar display		ON

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. In this mode, the display value can be output according to the output request (REQ) from the data processor since the output signal is converted to the position data. (Signals of tolerance judgment result cannot be output.) Also, connect an external device that is capable of supplying power, since this unit requires a power supply of 5 to 24 V DC via a cable.

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 models :mm inch models :in
Resolution	mm models :0.001 mm inch models :0.00005 in
Other	Tolerance judgment :OFF Calculation function :OFF Key-lock :OFF Analog bar display :OFF

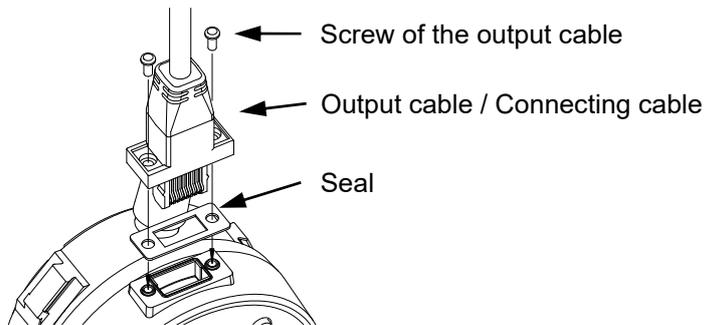
Key function for the calibration mode

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

3.4.1 Desorption of cable

Follow the steps below to removing or connecting the cable.

1. Using a Philips screwdriver (No.0), remove the fixing screw of the output cable, and disconnect the cable.
2. Attach a seal to the connecting cable (optional accessories No.21EAA194(1m) or No.21EAA190(2m)), and connect it with the unit facing the terminal to the front side.
3. Connect the connecting cable using the screw removed in step 1.
4. When the calibration is complete, replace the output cable in the same procedure.



IMPORTANT

- When connecting the cable, make sure that the terminal faces to the front side.
 - Please tighten the setscrews at a torque of approximately 5 to 10 N·cm.
 - Unless the connecting cable and the seal are set properly, it may cause incorrect display or loss of waterproof quality.
-

3.4.2 Starting and stopping the calibration mode

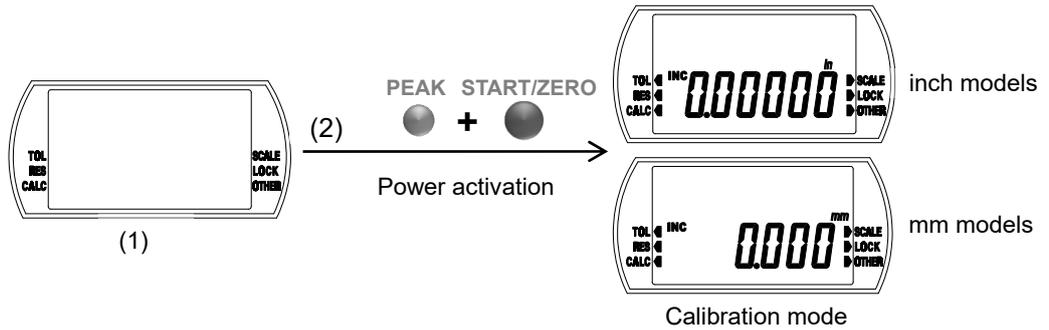
- Starting the calibration mode

While pressing the lower left key and center key, supplies the power from the cable. This instrument will be started up in the calibration mode.

- Stopping the calibration mode

Disconnect the power supply, so it means stopping the calibration mode. The measurement mode (the normal mode) will be restarted when the power is supplied again (Refer to 2. SETUP).

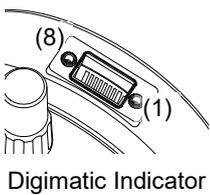
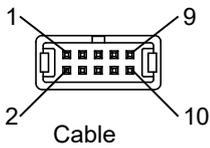
IMPORTANT Other settings and parameters are held with the former setting which moves to this mode.



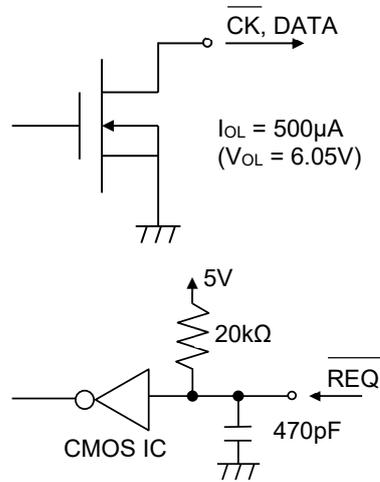
3.4.3 Data output

In the calibration mode, the output data becomes the position data.

3.4.3.1 Output connector

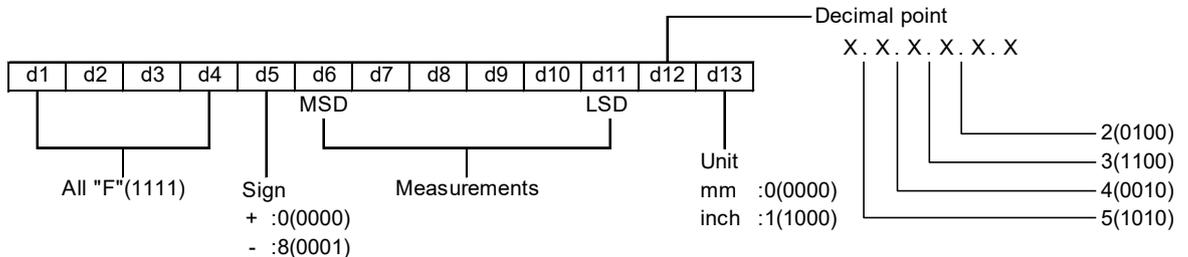


Pin No.		Signal	I/O
Cable	Indicator		
1	1	GND	-
2	2 *1	DATA	O
3	3 *1	$\overline{\text{CK}}$	O
4	6	N.C.	-
5	4 *2	$\overline{\text{REQ}}$	I
6	5	N.C.	-
7	-	-	-
8	-	-	-
9	7	+V	-
10	8	N.C.	-



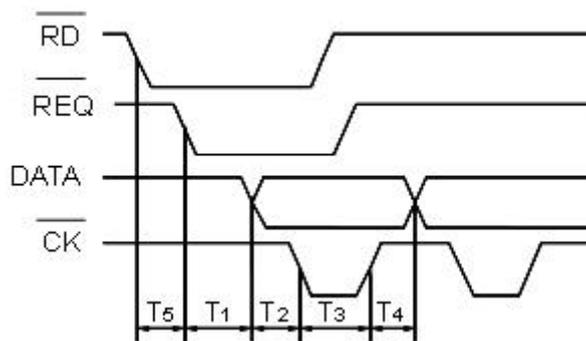
IMPOTANT

- 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.
-

3.4.3.2 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).

3.4.3.3 Timing chart

$0.7 \text{ ms} \leq T1 \leq 1.2 \text{ ms}$
 $100 \mu\text{s} \leq T2 \leq 200 \mu\text{s}$
 $200 \mu\text{s} \leq T3 \leq 300 \mu\text{s}$
 $100 \mu\text{s} \leq T4 \leq 200 \mu\text{s}$
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.
-

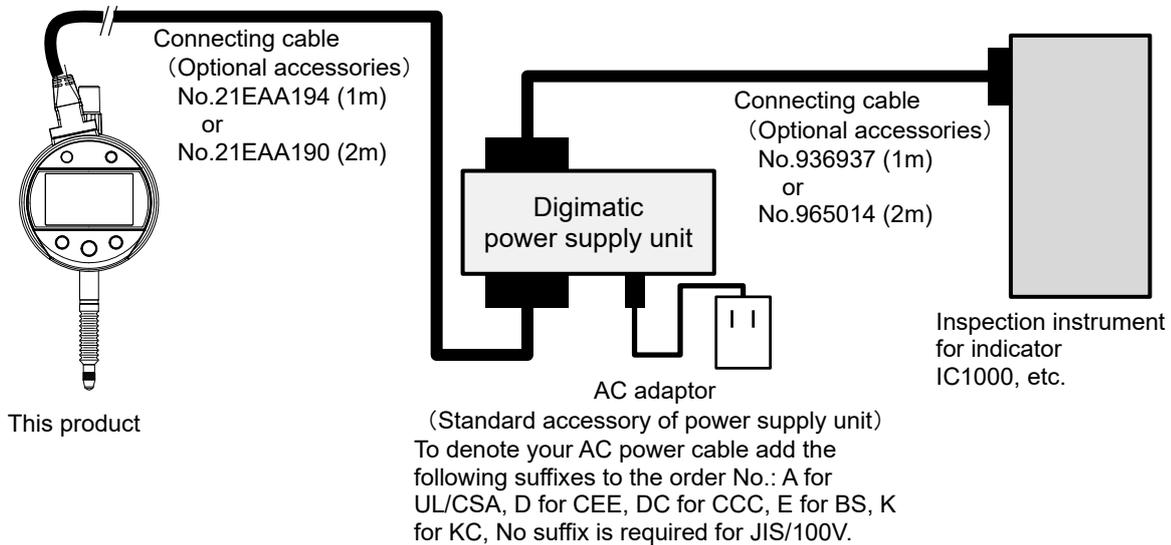
NOTE

- 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.
-

3.4.4 Use of the Digimatic power supply unit

The digimatic power supply unit (optional accessory: No.21EZA345) is available when performing an inspection or calibration using an instrument that allows digimatic input, such as inspection instrument for indicator i-Checker IC1000.

Connect the cables correctly referring to the connection diagram below and the operation manual of the digimatic power supply unit.



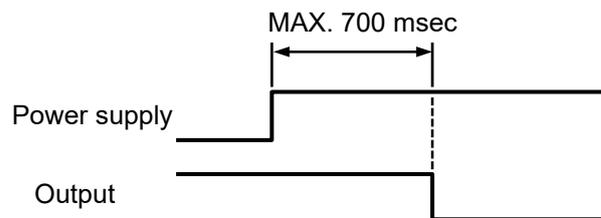
4

OUTPUT AND INPUT SPECIFICATIONS

This chapter describes the input and output specifications (timing chart).

4.1 Output response time after power-on

It takes a maximum of 700 msec before normal operation is started after turning the power on. During this time interval the display and output signal is uncertain. Do not start measurement and operation before the product is in the normal state.



4.2 Tolerance judgment output signals

The time interval between measured data detection and tolerance judgment result output is 20 ms or less. (Following table) The logic of output signal can be switched. (Refer to "3.3.6.1 SIGNAL(1) :Logic of output signal")

Normal mode, Maximum value detection mode, Minimum value detection mode

Logic of output signal	Signal name	Tolerance judgment results			Sensor signal synthesizing error Overflow error of display value
		-NG	OK	+NG	
Negative logic	$\overline{-NG}$ (Orange)	Low	High	High	High
	\overline{OK} (Green)	High	Low	High	High
	$\overline{+NG}$ (Brawn)	High	High	Low	High
Positive logic	$\overline{-NG}$ (Orange)	High	Low	Low	Low
	\overline{OK} (Green)	Low	High	Low	Low
	$\overline{+NG}$ (Brawn)	Low	Low	High	Low

Run-out detection mode

Logic of output signal	Signal name	Tolerance judgment results		Sensor signal synthesizing error Overflow error of display value
		OK	NG	
Negative logic	$\overline{-NG}$ (Orange)	High	Low	High
	\overline{OK} (Green)	Low	High	High
	$\overline{+NG}$ (Brawn)	High	Low	High
Positive logic	$\overline{-NG}$ (Orange)	Low	High	Low
	\overline{OK} (Green)	High	Low	Low
	$\overline{+NG}$ (Brawn)	Low	High	Low

Setup mode mode, Error display

Logic of output signal	Signal name	Setup mode Error display
Negative logic	$\overline{-NG}$ (Orange)	High
	\overline{OK} (Green)	High
	$\overline{+NG}$ (Brawn)	High
Positive logic	$\overline{-NG}$ (Orange)	Low
	\overline{OK} (Green)	Low
	$\overline{+NG}$ (Brawn)	Low

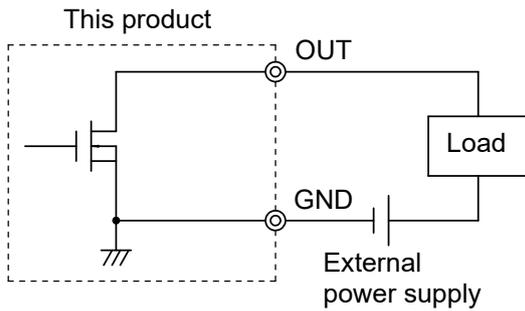
IMPORTANT

- When the signal output pattern is in a state other than those of tolerance judgment results, it may probably be a malfunction due to interference such as noises or an abnormality in the sensor unit. Therefore, take an appropriate action including the emergency stop to protect the user system against damage.
- If sensor signal synthesizing error occurs, all output signals becomes same level.

NOTE

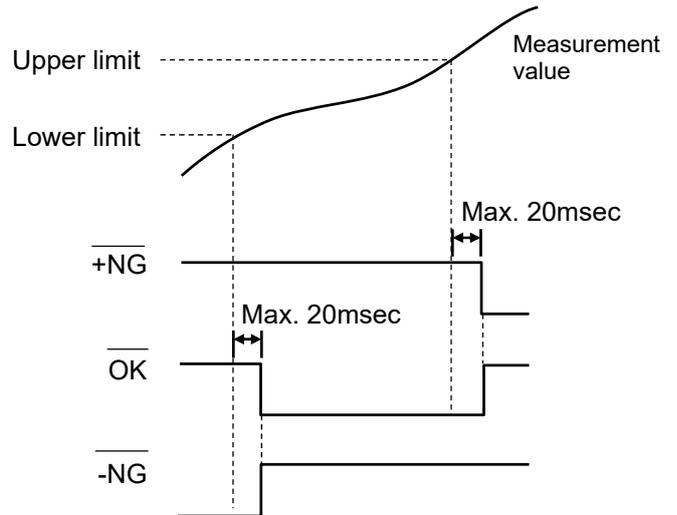
- In the calibration mode, tolerance judgment will not be output due to position data output. (Refer to "3.4 Calibration Mode".)

Output circuit



Load voltage : 5~24 V DC
Maximum load current : 100 mA or less

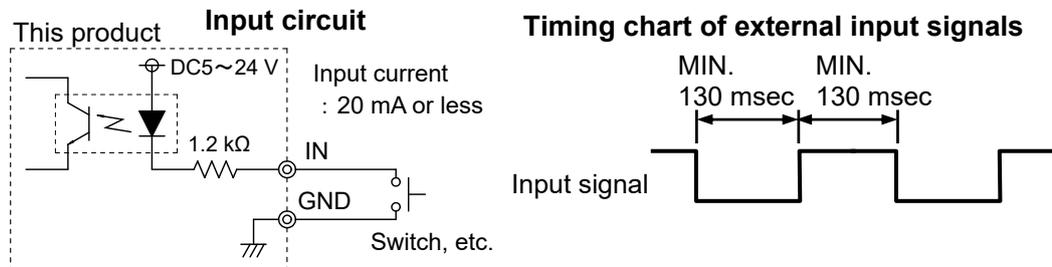
Timing chart of tolerance judgment output signals



4.3 External input signals

The signals require at least 130 ms of low level to be retained. Also, it is necessary to allow a minimum of 130 ms before inputting the next signal. The functions of each signal are as follows.

The contents of each functions refer to “3.2.5 External PRESET-Recall/Zero-set” and “3.2.7 Peak-start (External switches)”.



The presence or absence of functions in operating mode and measurement system

Operating mode	Measurement system	PRESET_RECALL/ ZERO	PEAK_START
Normal mode	ABS	✓	—
	INC	✓	—
Run-out detection mode	ABS	—	✓
	INC	—	✓
Maximum value detection mode	ABS	✓	✓
	INC	✓	✓
Minimum value detection mode	ABS	✓	✓
	INC	✓	✓
Setup mode	—	—	—
Calibration mode	—	—	—

✓ : Will function

— : Not function

- IMPORTANT**
- Avoid functioning two input terminals simultaneously.
 - After the function has been executed, please return the external input signal to the high level.

- NOTE**
- PRESET_RECALL / ZERO and PEAK_START are available in operation mode and measuring system in the table above in the case of display value overflow error. However, cannot be used error during the display of otherwise.

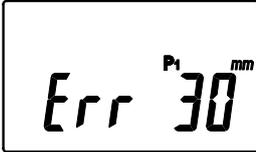
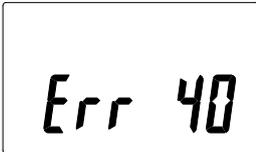
5

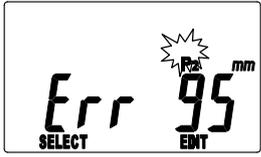
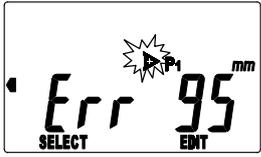
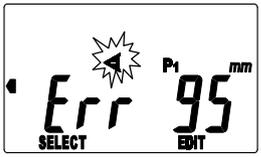
ERROR MESSAGE AND ACTION

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
	<p>Low voltage error</p> <ul style="list-style-type: none">Measurement cannot be performed due to low power supply voltage.	<ul style="list-style-type: none">It is possible that the voltage of the supplied power is low or unstable. Check the voltage of the supplied power.
	<p>Sensor signal synthesizing error</p> <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".) Move the Setup mode to reset the calculation coefficient.
	<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 measurement mode. Perform re-setting after confirming the setting value.
	<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"> Cycle the power, and check each setting. Then retry the setting. If it occurs often, it is possible that the power supplied unstable. If the same error occurs after cycling the power, it is possible that the product is damaged. In this case, contact your dealer or Mitutoyo sales office.
	<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.

Display	definition	Actions
	<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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