

Coolant Proof Micrometer



Safety Precautions

To ensure operator safety, use this product in conformance with the directions and specifications given in this User's Manual.

Use under other conditions may compromise safety.



- Always keep batteries out of reach of children, and if swallowed, consult a physician immediately.
- Batteries should never be short-circuited, disassembled, deformed or come in contact with extreme heat or flames.
- If battery alkaline liquid comes in contact with the eyes, flush eyes immediately with clean water and consult a physician. If battery alkaline liquid comes in contact with the skin, flush the exposed area thoroughly with clean water.



- Never attempt to charge the primary battery or reverse the positive-negative terminals when mounting. Improper battery handling or mounting may cause the battery to explode, cause battery leakage and/ or serious bodily injury or malfunctioning.
- Always handle the sharp measuring faces of this product with care to avoid injury.

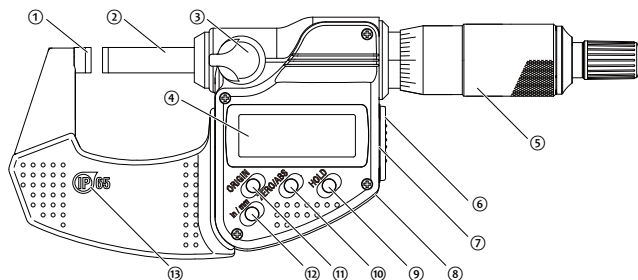
Notice

- Do not disassemble or modify this product. It can cause failure.
- Avoid using or storing this product where there is significant temperature change. Prior to use, thermally stabilize the product at room temperature.
- Avoid storing this product in a humid or dusty place.
- If this product is used where it will be directly splashed with coolant or the like, close the battery lid tightly. When mounting the output cable or the cover on a model with the output function, tighten the mount screws securely, leaving no gaps. After use, take rust prevention measures. Rust can cause failure.
- Do not use this product in a place where it is submerged in water, even the waterproof type, since the intrusion of coolant, etc. is unavoidable. Pay attention when using this product in a place where it is directly splashed with liquid, since the intrusion of coolant, etc. may be unavoidable depending on the conditions of use.
- Do not apply sudden shocks (such as dropping) or excessive force to this product.
- Be sure to perform reference point adjustment before measurement.
- Remove dust, chips, etc. before and after use.
- To clean this product, use a soft cloth soaked in a diluted neutral detergent. Do not use any organic solvent (thinner, etc.). It may deform or damage this product.
- The spindle cannot be removed by design. Do not move it backward beyond the limit of the measuring range. It can cause failure.
- Dirt on the spindle may cause operation failure. If the spindle is dirty, wipe the dirt off using a cloth slightly dampened with alcohol, and apply a small amount of oil for micrometer (part No. 207000).
- Do not use an electric engraver to put numbers or marks on the micrometer such. It can cause failure.
- The supplied battery is used to check functions and performance. It might not provide the specified life.
- If the micrometer will not be used for more than three months, remove the battery from and store it properly. Otherwise, liquid may leak from the battery and damage the micrometer.
- The warranty shall not apply if the product falls or is damaged as a result of fair wear and tear, including battery drain.

Icons of Key Operations



1. Part Names



- ① Anvil
- ② Spindle
- ③ Clamp
(used to lock the movement of the spindle)
- ④ Display unit
- ⑤ Thimble (varies depending on the model)
- ⑥ Cover (only for the type with output function)
- ⑦ Data output connector
(only for the type with output function)
- ⑧ Battery lid (back side)
- ⑨ [HOLD] key
- ⑩ [ZERO/ABS] key
- ⑪ [ORIGIN] key
- ⑫ [in/mm] key (in/mm product only)
- ⑬ Waterproof symbol (only for the waterproof type)

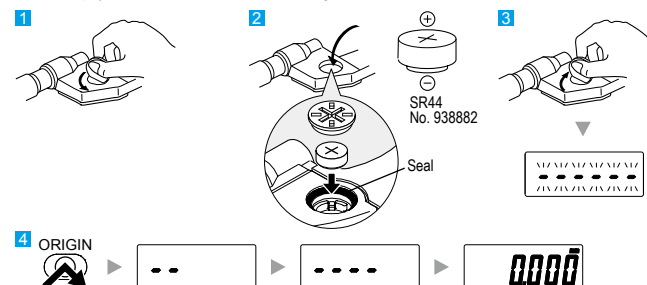
2. Setting the Battery

Notice

- Be sure to use SR44 (button-type silver oxide battery).
- Attach the battery lid so that the lid surely engages with the thread and the seal does not extend off the lid. If the battery lid and the seal are not attached properly, it may cause incorrect display or failure.
- Do not turn the thimble before the count value is displayed. Otherwise, the initial setting of the electrical section may fail, resulting in incorrect counting. If you turn the thimble by mistake, reinstall the battery again.
- When disposing the battery, comply with ordinances and regulations.

At purchase, the battery is not set in this product. Follow the procedure below to set the battery.

- 1 Rotate the battery lid counterclockwise to remove it.
- 2 Install the battery (SR44) with its positive side facing upward.
- 3 Put the battery lid on the product and rotate it clockwise to attach it. Continue to perform the ORIGIN (reference point) setting.
- 4 Press the [ORIGIN] key.



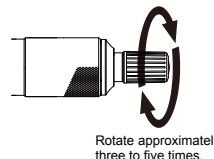
Tips

- When the battery is reinstalled, the ORIGIN (reference point) position is cleared. Set the reference point again. (See "4. ORIGIN (Reference Point) Setting".)
- If an abnormal display appears, such as an error display or count failure, remove the battery and then reinstall it again.

3. Precautions for Use

1) Measuring force

- Be sure to perform the measurement with a constant measuring force by using the ratchet stop.
- An appropriate measuring force can be applied by bringing the measuring surfaces into light contact with the workpiece, stopping spindle movement, and then rotating the ratchet stop approximately three to five turns with your fingers.
- The ratchet stop is generally used as a mechanism for applying a constant measuring force. However, the friction thimble and ratchet thimble are also provided for the same purpose.



2) Precautions after use

- After use, check for damaged parts and clean the product thoroughly. If this product is used in a place where water-soluble cutting oil can adhere to it, be sure to take rust prevention measures after cleaning.
- When storing this product, leave a gap of approximately 0.2 to 2 mm between the measuring surfaces and release the clamp.
- When storing this product for a long period, apply rust prevention measures to the spindle using oil for micrometer (part No. 207000).

4. ORIGIN (Reference Point) Setting

Notice

- Use a periodically inspected gauge block for reference point adjustment, or a setting standard for outside micrometer to perform the reference point adjustment.
- Use the same posture and conditions for both the reference point adjustment and the measurement, following the steps below.

1) ORIGIN (reference point) setting

- 1 Wipe off the measuring surfaces of both the anvil and spindle and also the gage (if it is used) to remove dirt and dust.
- 2 When the measuring range is 0 to 25 mm:
Bring the two measuring surfaces into light contact with each other, stop spindle movement, and then apply the specified measuring force. (See "1 Measuring force" in "3. Precautions for Use".)
When the measuring range is other than 0 to 25 mm:
Hold the gage between the two measuring faces, bring the spindle into light contact with the gage, stop the spindle movement, and then apply the specified measuring force. (See "1 Measuring force" in "3. Precautions for Use".)
- 3 Press the [ORIGIN] key.
>> Make sure that "P" is displayed flashing and the [ORIGIN] (reference point) value is displayed. (See "Tips" below.)
- 4 Press the [ORIGIN] key again.
>> "P" disappears, and the [ORIGIN] (reference point) value is set.

- When the measuring range is 0 to 25 mm



- When the measuring range is other than 0 to 25 mm (The example below is for a range of 25 to 50 mm)



Tips

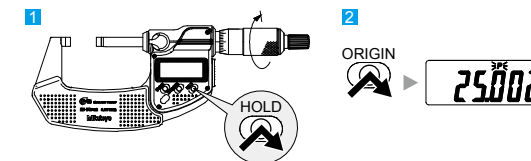
- If this product has been idle for 20 minutes or longer, the display automatically goes off. To turn on the display again, turn the thimble or press the [ZERO/ABS] key.
- If you press the [ORIGIN] key by mistake during measurement, press the [ZERO/ABS] key to restore the previous state. If the previous state cannot be restored, perform the ORIGIN (reference point) setting from the step 4.
- The table below shows the relationship between the measuring range and the ORIGIN (reference point) value.

Measuring range	ORIGIN (reference point) value	Measuring range	ORIGIN (reference point) value
0 - 25 mm	0.000 mm	0 - 1 in	0.00000 in
25 - 50 mm	25.000 mm	1 - 2 in	1.00000 in
50 - 75 mm	50.000 mm	2 - 3 in	2.00000 in
75 - 100 mm	75.000 mm	3 - 4 in	3.00000 in

2) ORIGIN (reference point) setting with reference other than the supplied setting standard for outside micrometer

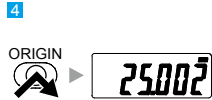
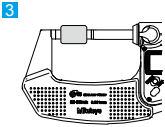
Follow the procedure below after setting the ORIGIN (reference point) using the supplied setting standard for outside micrometer.

- 1 Turn the thimble until the numerical value you want to set is displayed, and press the [HOLD] key to hold the value.
- 2 Press the [ORIGIN] key.
>> "P" is displayed flashing.



3 Hold the reference object between the measuring surfaces and apply the specified measuring force using a constant-force device. (See "1 Measuring force" in "3. Precautions for Use".)

4 Press the [ORIGIN] key again.
>> "P" disappears, and the setting is completed.



Tips

To restore the prescribed ORIGIN (reference point) value, reinstall the battery.

5. How to Measure

Bring the two measuring surfaces slowly into light contact with the workpiece with the same posture and conditions as when the reference point adjustment was made, and apply the specified measuring force to read the displayed value.

Notice

If you bring the measuring surface of the spindle strongly into contact with the workpiece, the workpiece may be deformed and the measurement result may be affected.

6. Functions of Keys

• [ZERO/ABS] key

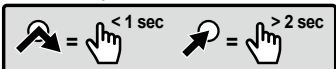
- Press the [ZERO/ABS] key short.
>> "INC" is displayed and the display is zero-set.
- Hold the [ZERO/ABS] key (for two seconds or longer).
>> "INC" disappears, and the length from the reference point (measuring surface of anvil) is displayed.

• [ZERO/ABS] key

- Press the [HOLD] key.
>> "H" is displayed, and the displayed value is held. Press the key again to release the hold.



Icons of Key Operations



7. Function Lock Function (Prevention of Incorrect Operations)

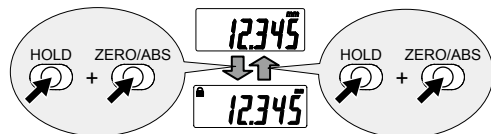
This product provides the function lock function which disables the ORIGIN and ZERO/ABS functions to prevent the reference point from being changed carelessly.

When the function lock is effective, "L" is displayed on the display unit, the [ORIGIN], [ZERO/ABS], and [in/mm] (only for the exported type) keys are disabled, and only the hold operation is enabled.

1 While holding down the [HOLD] key, hold down the [ZERO/ABS] key (for two seconds or longer).

>> "H" is displayed, and then "L" is displayed ("H" disappears).

* To release the function lock, perform the same operation.



8. Errors and Countermeasures

- "E" displayed
Indicates the voltage drop of the battery. Replace the battery immediately.
- "Err-oS" displayed
A counting error has occurred due to overspeed, noise, etc. Remove the battery and then reinstall it again.
- "Err-S" displayed
A counting error has occurred due to initial setting failure of the electrical section, abnormal sensor signals, etc. Remove the battery and then reinstall it again.

9. Specifications

1. Common Specifications

Resolution	: 0.001 mm (0.00005 in)
Display unit	: LCD display (six digits and minus sign)
Power supply	: Silver oxide battery (SR44 No.93888) 1 pc
Battery life	: Approx. 2.4 years
Temperature range	: 5 °C to 40 °C (operation temperature), -10 °C to 60 °C (storage temperature)
Standard accessories	: Spanner (No. 301336), setting standard for outside micrometer (supplied with the products that have the measuring range of 25 mm/1 in or longer)

2. Individual Specifications

Series No.	Maximum measuring length	Maximum permissible error J_{MPE}^{*1}	Measuring force	Coolant proof *2
293	25, 50 mm	$\pm 1 \mu\text{m}$	5 - 10 N (7 - 12 N) *4	✓
	75, 100 mm	$\pm 2 \mu\text{m}$		
	1, 2 in	± 0.00005 in		
	3, 4 in	± 0.0001 in		
323	25, 50 mm	$\pm 4 \mu\text{m}$	3 - 8 N	✓
	75, 100 mm	$\pm 6 \mu\text{m}$		
	1, 2 in	± 0.0002 in		
	3, 4 in	± 0.0003 in		
331	25 - 75 mm	$\pm 2 \mu\text{m}$	5 - 10 N	✓
	100 mm	$\pm 3 \mu\text{m}$		
	1 - 3 in	± 0.0001 in		
	4 in	± 0.00015 in		
342(CPM)	25 - 75 mm	$\pm 2 \mu\text{m}$	3 - 8 N	✓
	100 mm	$\pm 3 \mu\text{m}$		
	1 - 3 in	± 0.0001 in		
342(CHM)	4 in	± 0.00015 in	3 - 8 N	✓
	0.8 in	± 0.00015 in		
343	25 mm	$\pm 5 \mu\text{m}$	1 - 6 N	
	50 mm	$\pm 6 \mu\text{m}$		
	75 mm	$\pm 7 \mu\text{m}$		
	100 mm	$\pm 8 \mu\text{m}$		
	1 in	± 0.00025 in		
	2 in	± 0.0003 in		
	3 in	± 0.00035 in		
	4 in	± 0.0004 in		
369	25, 50 mm	$\pm 4 \mu\text{m}$	3 - 8 N	
	75, 100 mm	$\pm 6 \mu\text{m}$		
	1, 2 in	± 0.0002 in		
	3, 4 in	± 0.0003 in		
389	25, 50 mm	$\pm 4 \mu\text{m}$	3 - 8 N	✓
	1, 2 in	± 0.0002 in		
	25 - 75 mm	$\pm 2 \mu\text{m}$		
395 (BMS,BMD)	100 mm	$\pm 3 \mu\text{m}$	5 - 10 N	✓
	1 - 3 in	± 0.0001 in		
	4 in	± 0.00015 in		
	25 mm	$\pm 3 \mu\text{m}$		
395 (BMB) *2	1 in	± 0.00015 in	3 - 8 N	✓
	25 - 75 mm	$\pm 3 \mu\text{m}$		
406, 422	100 mm	$\pm 4 \mu\text{m}$	3 - 8 N	
	1 - 3 in	± 0.00015 in		
	4 in	± 0.0002 in		
	25, 50 mm	$\pm 4 \mu\text{m}$		
317	1, 2 in	± 0.00015 in	5 - 10 N	✓
	25, 50 mm	$\pm 3 \mu\text{m}$		

- *1: Maximum permissible error for indicated value via contact with full measuring face J_{MPE} (20 °C).
 *2: For the 395 series, the minimum diameter of the hole into which the anvil can be inserted is as follows:
 BMB1-MX: $\phi 2$ mm, BMB2-MX: $\phi 3.6$ mm, BMB3-MX: $\phi 4.8$ mm, BMB4-MX: $\phi 8.2$ mm
 *3: Protection class: IP65 (See IEC60529 for details.)
 - Against intrusion of foreign matter (class 6): No foreign matter enters the unit.
 - Against intrusion of water (class 5): Even when directly receiving water jet from any direction, the quantity of water that has a harmful effect on the unit does not enter.
 *4: () indicates the ratchet thimble type.

10. Output Function (Only for the Type with the Output Function)

1) External output of the display value

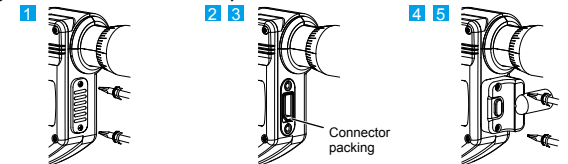
By connecting this product with an external device by the connection cable (option), the display value can be output to external.

Notice

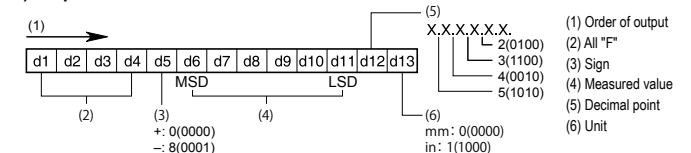
- When fastening or removing screws, be sure to use the No. 0 Phillips screwdriver (No. No.05CZA619) supplied with the connection cable (option) and tighten the screws with a torque of approximately 5 to 8 n·m.
- Mount the connector packing so that it does not protrude. If the packing is not mounted properly, the waterproof function degrades.

Follow the procedure below to set the connection cable.

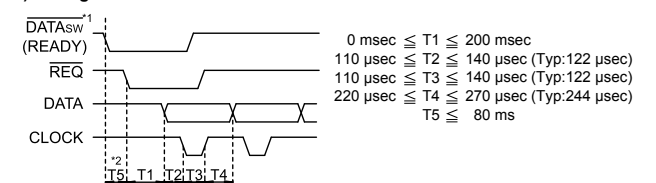
- Remove the cover mount screws (M1.7 × 0.35 × 2.5, No. 09GAA376) using the No. 0 Phillips screwdriver supplied with the connection cable.
- Remove the cover.
- Make sure that the connector packing (No. 04AAC126) is properly mounted in place. (Do not remove the connector packing.)
- Connect the plug of the connection cable.
- Hold the plug with your fingers and tighten it with the connection cable mount screws, producing no gap between the plug and the connector of the micrometer body.



2) Output format



3) Timing chart



*1: DATAsw is at the LOW level while the data output key is pressed.

*2: DATAsw changes to the LOW level. T5, the time to the input of REQ, depends on the performance of the data processor.

11. Options

- Connection cable (1 m): No.05CZA662
- Connection cable (2 m): No.05CZA663

12. Offsite Repair (Charged)

If any of the following problems occurs, the product needs to be done offsite repair (charged). Please contact the nearest distributor or Mitutoyo sales office.

- Spindle malfunction
If the spindle is scratched, the scratched part causes interference when the spindle moves backward, which causes malfunction.
Rust on the spindle would cause malfunction.
- Unstable measured values
If an impact is applied to the measuring surfaces, burrs and chippings are generated on the measuring surfaces and may affect the accuracy.
- Abnormal counting numbers/counting malfunction
If you move the spindle of this product backward too much, it may damage the internal sensor and cause a counting error or malfunction.