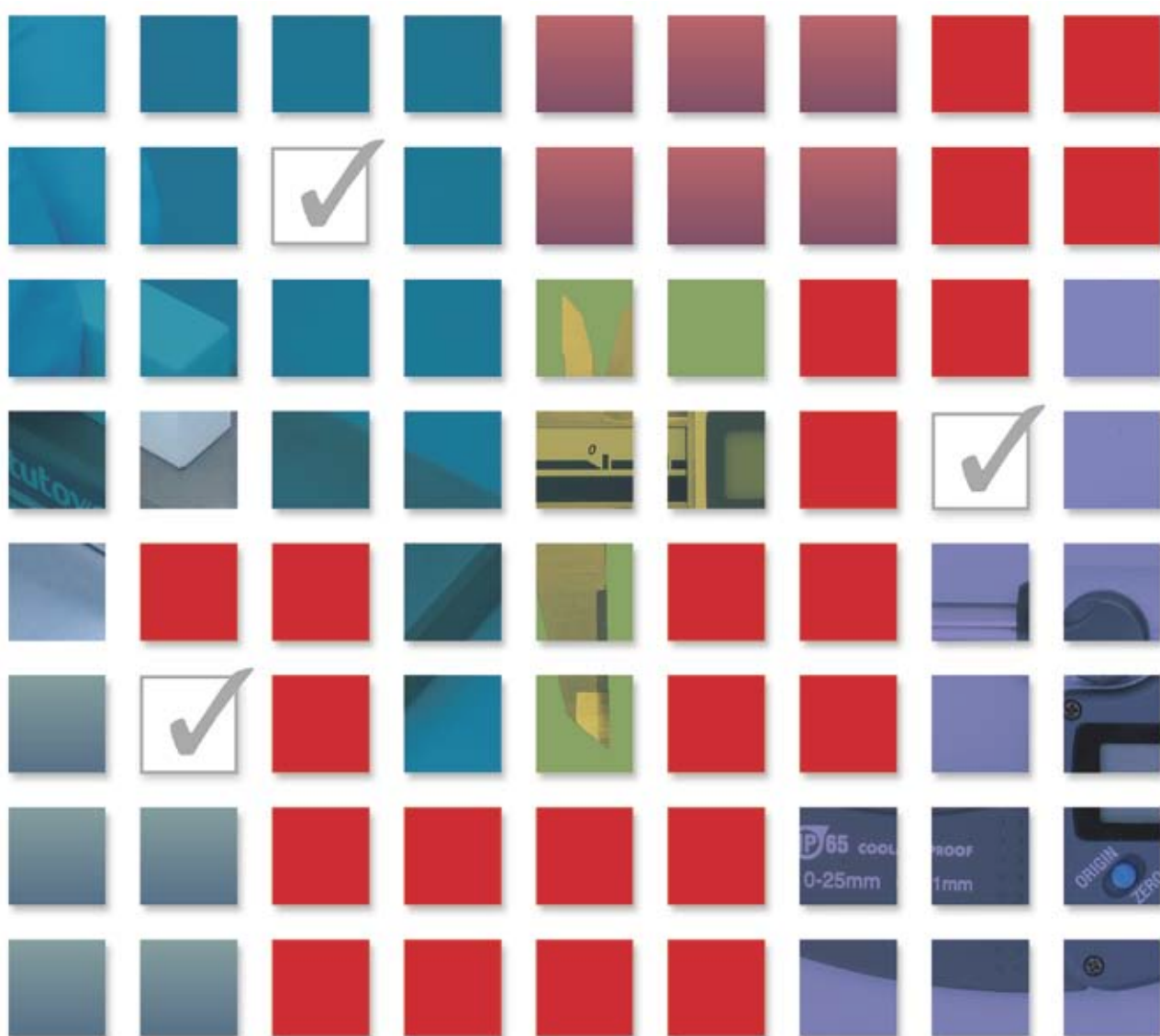


Check Points for Measuring Instruments



Introduction

Measurement... the word can mean many things.

In the case of length measurement there are many kinds of measuring instrument and corresponding measuring methods.

For efficient and accurate measurement, the proper usage of measuring tools and instruments is vital.

Additionally, to ensure the long working life of those instruments, care in use and regular maintenance is important.

We have put together this booklet to help anyone get the best use from a Mitutoyo measuring instrument for many years, and sincerely hope it will help you.

CONVENTIONS USED IN THIS BOOKLET

The following symbols are used in this booklet to help the user obtain reliable measurement data through correct instrument operation.










correct



incorrect

CONTENTS

	Products Used for Maintenance of Measuring Instruments	1
	Micrometers	
	Digimatic Outside Micrometers (Coolant Proof Micrometers)	2
	Outside Micrometers	3
	Holtest	
	Digimatic Holtest (Three-point Bore Micrometers)	4
	Holtest (Two-point/Three-point Bore Micrometers)	5
	Bore Gages	
	Bore Gages	6
	Bore Gages (Small Holes)	7
	Calipers	
	ABSOLUTE Coolant Proof Calipers	8
	ABSOLUTE Digimatic Calipers	9
	Dial Calipers	10
	Vernier Calipers	11
	ABSOLUTE Inside Calipers	12
	Offset Centerline Calipers	13
	Height Gages	
	Digimatic Height Gages	14
	ABSOLUTE Digimatic Height Gages	15
	Vernier Height Gages	16
	Dial Height Gages	17
	Indicators	
	Digimatic Indicators	18
	Dial Indicators	19
	Dial Test Indicators (Lever-operated Dial Indicators)	20
	Thickness Gages	21
	Gauge Blocks	
	Rectangular Gauge Blocks	22

Products Used for Maintenance of Measuring Instruments

Mitutoyo products

Micrometer oil

Lubrication and rust-prevention oil

Order No.207000



207000
(Volume: 30ml)

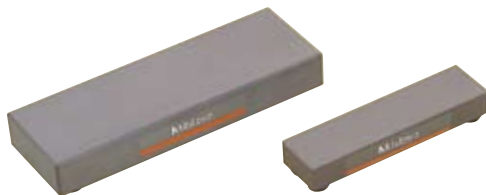
Measuring face cleaning paper

Cleaning paper for micrometer measuring faces (1,000 pieces)

Order No.04AZB581

Ceraston

Ceraston is a very flat abrasive ceramic block used for removing burrs on hard, flat, precision surfaces.



No.601644
150 (W) x 50 (D) x 20 (H) mm

No.601645
100 (W) x 25 (D) x 12 (H) mm

Maintenance kit for gauge blocks

Maintenance kit for gauge blocks includes all the necessary maintenance tools for removing burrs and contamination, and for applying anti-corrosion treatment after use, etc.



516-650

Order No.516-650

- Included items _____ Order No.
- (1) Rust-prevention oil (100ml, spray-can) _____ **600001**
Applicable to both steel and carbide gauge blocks.
 - (2) Ceraston (both sides finished by lapping) (100x25x12mm) _____ **601645**
 - (3) Optical flat **OF-45B** (ø45, thickness: 12mm, JIS Class 3) _____ **158-117**
An optical device for checking the wringing of thin gauge blocks and for the presence of burrs.
 - (4) Pin vise _____ **600004**
Useful for handling thin gauge blocks.
 - (5) Blower brush _____ **600005**
A brush to be used for blowing dust from measuring faces.
 - (6) Cleaning paper (lens paper) (82x304mm, 500 pieces) 600006 _____ **600006**
Papers for wiping off rust prevention oil and contamination. Lint free.
 - (7) Artificial leather mat (B4 size) _____ **600007**
For protecting gauge blocks from damage when handling on a bench top.
 - (8) Reagent bottle (polyethylene container, 100ml) _____ **600008**
A bottle of cleaning fluid.
(Mitutoyo employs n-Heptane for solvent.)
 - (9) Gloves 600009 _____ **600009**
Useful when handling large gauge blocks. Effective for the prevention of corrosion and thermal expansion.

Other products on the market (for reference)

Paper wipes KimWipes S-200

For removing contamination, such as dust, from instrument surfaces.

Contact: NIPPON PAPER CRECIA Co., LTD.



Glass cleaner PPC cleaner

For cleaning granite surface plates.

Contact: SANWAKOGYO CO., LTD



Digimatic Outside Micrometers (Coolant Proof Micrometers)



Before Use

1. Check to see whether the thimble moves smoothly without any jamming or unevenness by rotating it all the way through its range.
 2. Replace button cell with an SR44 type if necessary (**Order No.938882**).
 3. Clamp a sheet of lint-free paper between the anvil and spindle, as if measuring its thickness, and slowly draw it away to remove dust or dirt adhering to the measuring faces.
 4. Slowly bring the measuring faces into contact and:
 - rotate the ratchet stop (1.5 to 2 turns) to apply constant pressure 3 to 5 times for a zero-point check*.
 (**Photo 1.**) If constant pressure is applied roughly, the anvil side is pressed excessively, which may have effect on measurement accuracy.
 5. When tightening the output connector cover and battery cap, be careful not to let the rubber seal get trapped by the cap or cover. (**Fig. 1**)
- * Only for 0-25mm range micrometers.



Photo 1

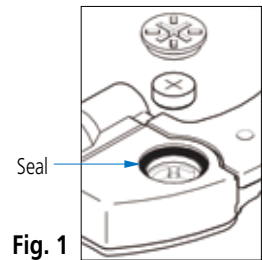


Fig. 1

During Use

1. Do not retract the spindle too far past the upper limit of the measuring range, as this can damage some types of digital micrometer. (**Fig. 2**)
2. If any error occurs or the count is displayed abnormally, remove the battery and reinstall it.
3. Make sure that the spindle is always protected from impact. (**Photo 2**)

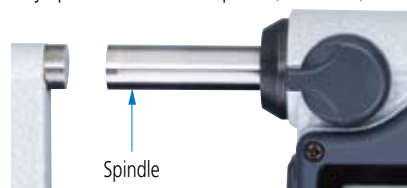


Photo 2

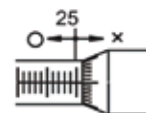


Fig. 2

4. If using the instrument for an extended period of time, regularly check (and if necessary adjust) the zero point to allow for thermal expansion.

If the instrument is damaged due to being dropped or struck hard, or for any other reason, do not use it and contact us for repair.

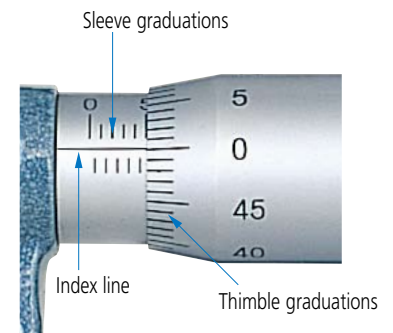
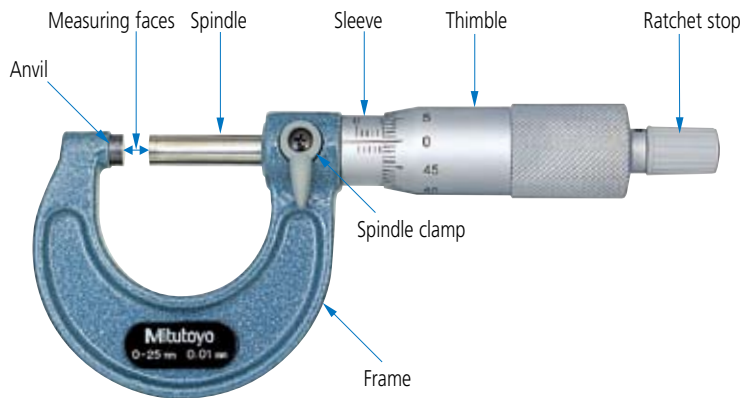
After Use

1. Check for damage to the micrometer and, if found, arrange for repair or replacement. Clean the instrument.
If the instrument was used at a place where soluble cutting oil contamination was likely, be sure to perform rust prevention treatment after cleaning.
2. Release the spindle clamp, separate the measuring faces by approximately 0.2 to 2 mm, and then store the instrument. (**Photo 3**)
3. Store the instrument in a room free of excessive heat and moisture, also dust and oil mist.
4. When storing the instrument for a long time, apply micrometer oil (**Order No. 207000**) to the spindle as a rust prevention treatment and remove the battery.



Photo 3

Outside Micrometers



Before Use

1. Check to see whether the thimble moves smoothly without any jamming or unevenness by rotating it all the way through its range.
 2. Clamp a sheet of lint-free paper between the anvil and spindle, as if measuring its thickness, and slowly draw it away to remove dust or dirt adhering to the measuring faces.
 3. Slowly bring the measuring faces into contact and:
 - Rotate the ratchet stop (1.5 to 2 turns) to apply constant pressure 3 to 5 times for a zero-point check*.

(Photo 1.)
If constant pressure is applied roughly, the anvil side is pressed excessively, which may have effect on measurement accuracy. **(Photo 1)**

 - If the zero point is off, reset by rotating the sleeve with the wrench, tapping the wrench gently with a hammer if necessary. **(Fig. 1)**
 4. When resetting the zero point of a large micrometer, perform the adjustment in the actual measurement orientation to minimize measurement uncertainty due to frame deflection.
- * Only for 0-25mm range micrometers.

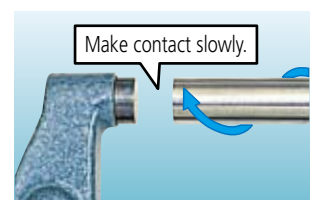


Photo 1

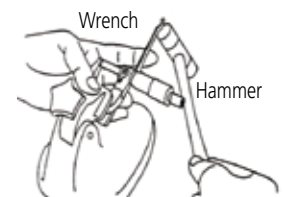


Fig. 1

During Use

1. Read the graduations seen directly from above to avoid parallax error. **(Fig. 2)**
2. The width of the graduation lines represent approximately $2\mu\text{m}$ to aid in reading to the nearest $1\mu\text{m}$. **(Fig. 3)**
3. Make sure that the spindle is always protected from impact. **(Photo 2)**

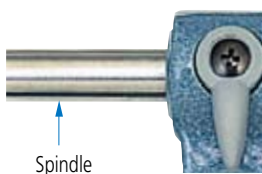


Photo 2

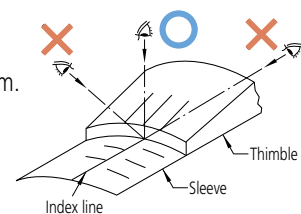


Fig. 2

Fig. 3

4. If using the instrument for an extended period of time, regularly check (and if necessary adjust) the zero point to allow for thermal expansion.

If the instrument is damaged due to being dropped or struck hard, or for any other reason, do not use it and contact us for repair.

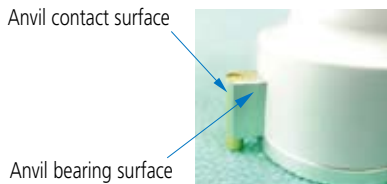
After Use

1. Check for damage to the micrometer and, if found, arrange for repair or replacement. Clean the instrument.
If the instrument was used at a place where soluble cutting oil contamination was likely, be sure to perform rust prevention treatment after cleaning.
2. Release the spindle clamp, separate the measuring faces by approximately 0.2 to 2 mm, and then store the instrument. **(Photo 3)**
3. Store the instrument in a room free of excessive heat and moisture, also dust and oil mist.
4. When storing the instrument for a long time, apply micrometer oil (**Order No.207000**) to the spindle as a rust prevention treatment.




Photo 3

Digimatic Holtest (Three-point Bore Micrometers)



Before Use

1. Remove dust or dirt from the contact surfaces.
2. Check to see whether the thimble moves smoothly without any jamming or unevenness by rotating it all the way through its range. Also check that the anvils move in and out smoothly with no sticking.
3. Perform the initial setting using the calibrated master gauge (if used).
4. If measuring using only the tip of the anvil, make sure to set the zero point at the same position of the tip. **(Fig. 1)**
5. Note that if the measuring head is replaced, the accuracy specification is no longer guaranteed.
6. When  is displayed, replace the SR44 battery (**Order No.938882**)
7. Enter the preset value (setting ring calibration value) if making absolute measurements.
8. When replacing the battery cap, make sure that the seal is properly seated. **(Fig. 2)**

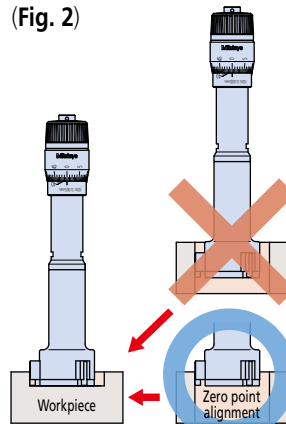


Fig. 1

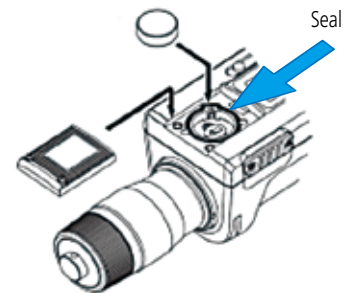


Fig. 2

During Use

1. To apply measuring force, bring the measuring face into light contact with the workpiece and hold there. Then operate the ratchet 5 to 6 times (giving 2 to 3 turns) to apply constant force. **(Fig. 3)**
2. Make sure that the bearing surfaces of the anvils are always protected from impact.
3. If any error occurs or the count is displayed abnormally, remove the battery and reinstall it.
4. **IMPORTANT:** Retracting the spindle too far past the upper limit of the measuring range will damage some types of digital micrometer. If resistance is felt do not retract spindle any further.

If the instrument is damaged due to being dropped or struck hard, or for any other reason, do not use it and contact us for repair.

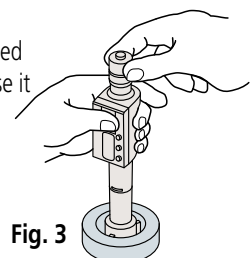
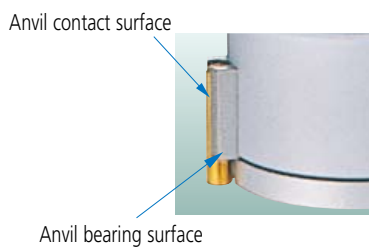
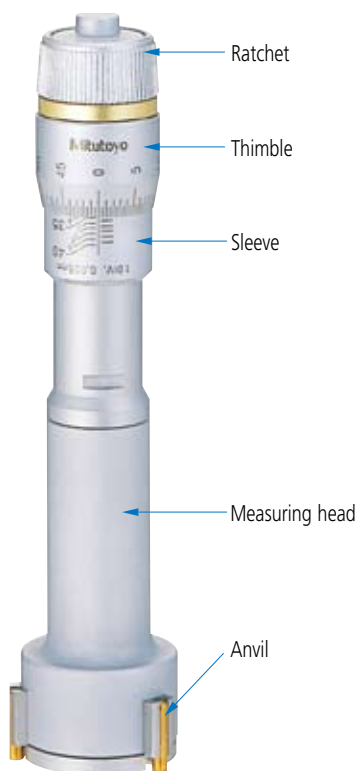


Fig. 3

After Use

1. Check for damage to the micrometer and, if found, arrange for repair or replacement. Clean the instrument.
2. Store the instrument in a room free of excessive heat and moisture, also dust and oil mist.
3. When storing the instrument for a long time, apply micrometer oil (**Order No.207000**) to the anvils and contact surfaces as a rust prevention treatment and remove the battery.



Before Use

1. Remove dust or dirt from the contact surfaces.
2. Check to see whether the thimble moves smoothly without any jamming or unevenness by rotating it all the way through its range. Also check that the anvils move in and out smoothly with no sticking.
3. Perform the initial setting using the calibrated master gauge (if used).
4. If measuring at the tip of the anvil, make sure to align the zero point at the same position of the tip. (**Fig. 1**)
5. Note that if the measuring head is replaced, the accuracy specification is no longer guaranteed.

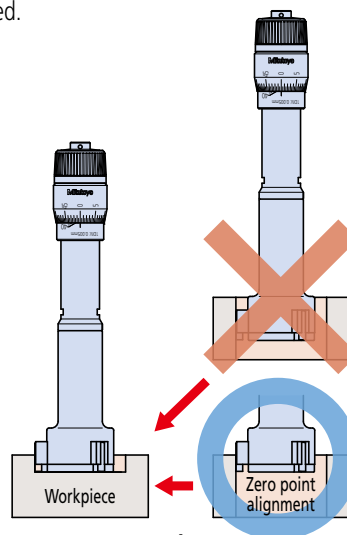


Fig. 1

During Use

1. To apply measuring force, bring the measuring face into light contact with the workpiece and hold there. Then operate the ratchet 5 to 6 times (giving 2 to 3 turns) to apply constant force. (**Fig. 2**)
2. Make sure that the bearing surfaces of the anvils are always protected from impact.
3. Only perform measurement within the measuring range. (**Fig. 3**)



Fig. 2

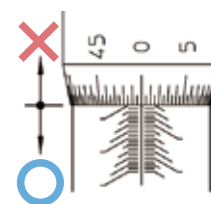


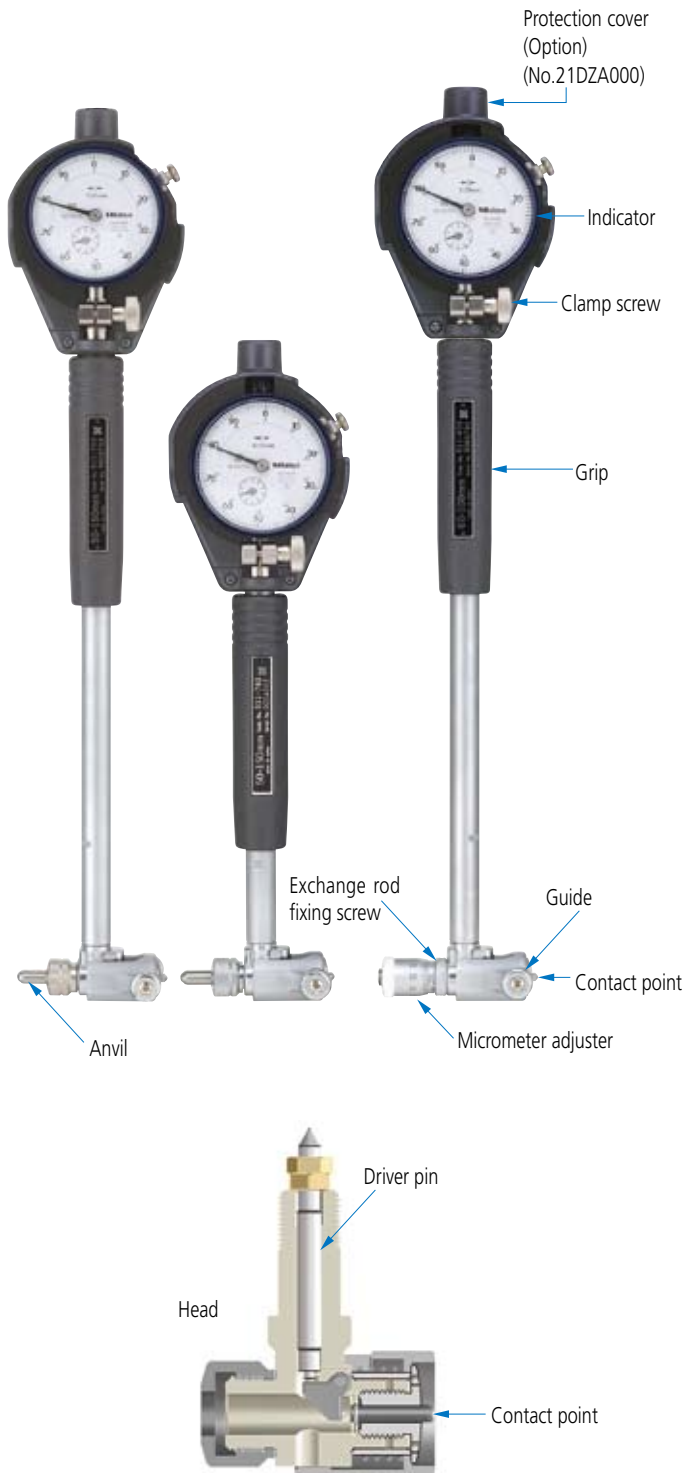
Fig. 3

If the instrument is damaged due to being dropped or struck hard, or for any other reason, do not use it and contact us for repair.

After Use

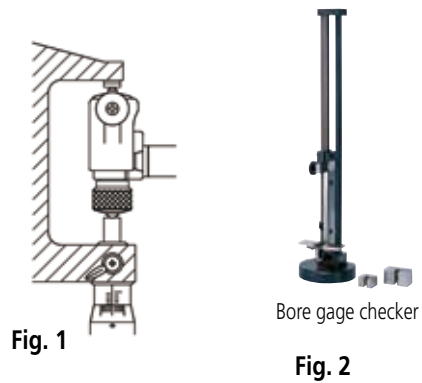
1. Check for damage to the micrometer and, if found, arrange for repair or replacement. Clean the instrument.
2. Store the instrument in a room free of excessive heat and moisture, also dust and oil mist.
3. When storing the instrument for a long time, apply micrometer oil (**Order No.207000**) to the anvils and contact surfaces as a rust prevention treatment.

Bore Gages



Before Use

1. Clean the contact point and anvil with a dry cloth.
2. Securely tighten the clamp screw to lock the gage in position. If the gage still moves, clean the gage stem and clamp screw.
3. Set the zero point before starting measurement.
To perform initial setting with an outside micrometer, position the micrometer in the vertical orientation with the spindle of the micrometer and anvil of the gage as shown. (Fig. 1)
4. Mitutoyo provides a useful tool, the bore gage checker (Order No.515-590), for zero-point adjustment. (Fig. 2)



During Use

1. To insert the bore gage into the hole to be measured, or a setting ring, tilt the handle so that the guides enter first followed by the anvil as shown. (Fig. 3)

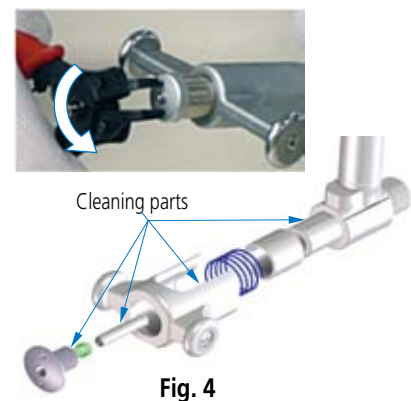


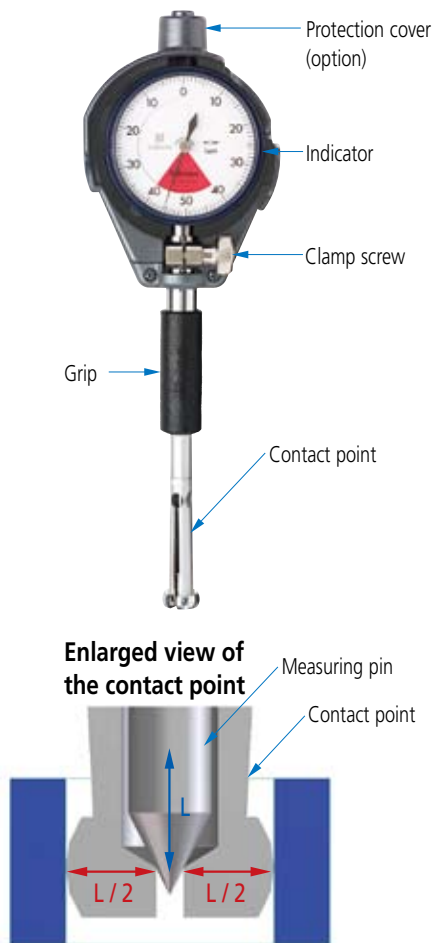
2. If the measuring face is scratched by bore gage measurement, it may be covered by special treatment provided by Mitutoyo, such as measuring force or guide supporting force adjustment or replacement of the contacting sphere. Please contact us.

If the instrument is damaged due to being dropped or struck hard, or for any other reason, do not use it and contact us for repair.

After Use

1. Check for damage to the gage and, if found, arrange for repair or replacement. Clean the instrument.
2. If it is suspected that contamination is present inside the measuring or the sliding section, clean the inside of the head with an alcohol solution after disassembling using snap-ring pliers. (Fig. 4) After cleaning, dry completely and apply a film of micrometer oil (Order No.207000) to the contact point and the driver pin.
3. Store the instrument in a room free of excessive heat and moisture, also dust and oil mist.





Before Use

1. Clean the contact point with a dry cloth.
2. Avoid large temperature changes such as may occur when transferring the instrument from outside a room to inside, or vice versa. Otherwise condensation may form and corrode the contact point and/or measuring pin, which may result in malfunction.
3. Securely tighten the clamp screw to lock the gage in position. If the gage still moves, clean the gage stem and clamp screw.
4. Set the zero point before starting measurement. To set the zero point with an outside micrometer, position the micrometer in the vertical orientation with the spindle of the micrometer as shown. (Fig. 1)

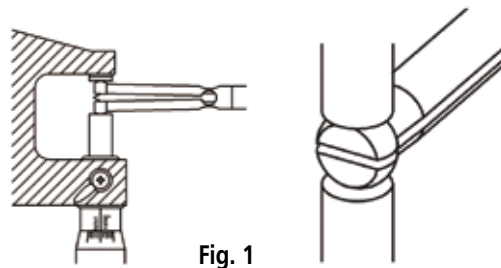


Fig. 1

During Use

1. When replacing the contact point, use the special spanner. (Fig. 2)

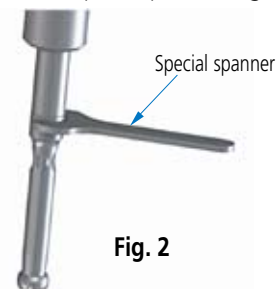


Fig. 2

2. Perform initial setting with a ring gage or master part before starting measurement.
3. When replacing the contact point, hold the screw end so that the contact point does not close. (Photo 1)



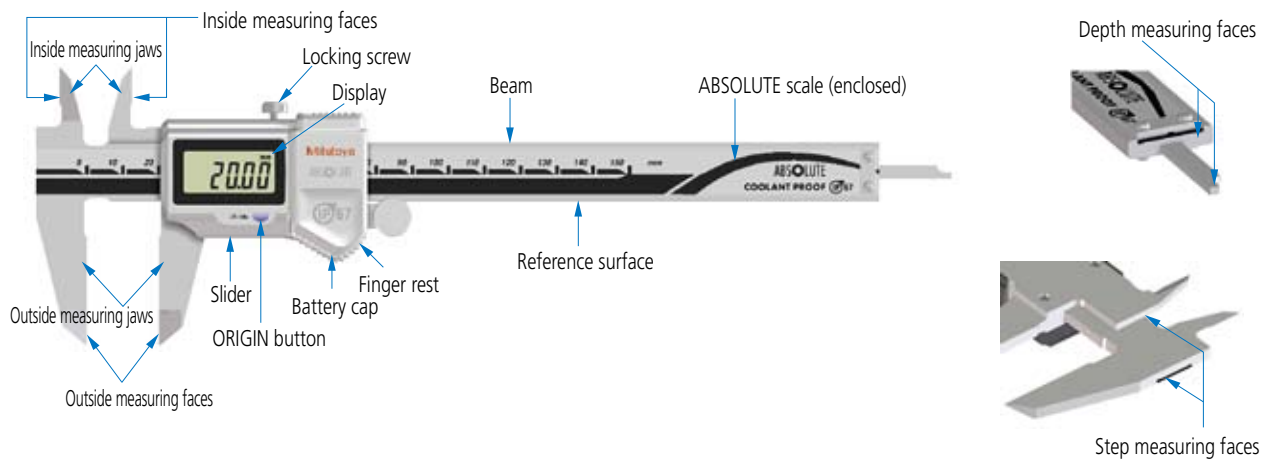
Photo 1

If the instrument is damaged due to being dropped or struck hard, or for any other reason, do not use it and contact us for repair.

After Use

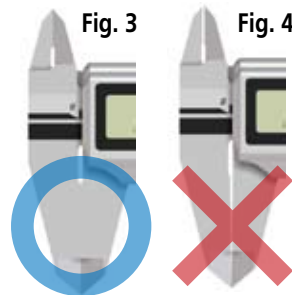
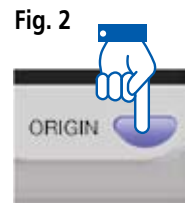
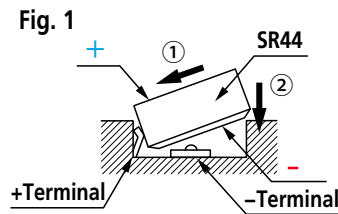
1. Check for damage to the gage and, if found, arrange for repair or replacement. Clean the instrument.
2. If it is suspected that contamination is present inside the measuring section, remove the contact point using the special spanner, and clean the contact point by dipping into an alcohol solution. After cleaning, dry completely and apply a thin layer of micrometer oil (Order No.207000) to the contact point. (Fig. 2)
3. Store the instrument in a room free of excessive heat and moisture, also dust and oil mist.

ABSOLUTE Coolant Proof Calipers



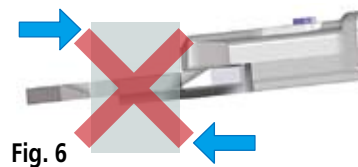
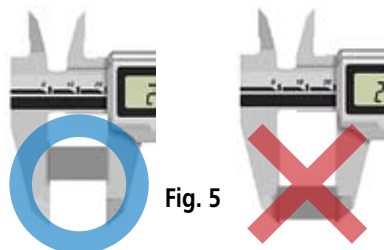
Before Use

1. Use a small amount of Micrometer oil (**Order No.207000**) to wipe the reference surface of the beam.
2. Move the slider all the way along the main beam to check whether the slider moves smoothly without jamming.
3. Install an SR44 battery (**Order No.938882**) with the positive side of the battery uppermost. (**Fig. 1**)
4. After the battery is replaced, clean the measuring faces and bring them into contact. Then press the ORIGIN button to perform the zero point setting. (**Fig. 2**)
5. Close the measuring faces after cleaning, and check the following:
 - Outside measuring faces: They are in good condition if light cannot be seen between them when they are held to the light. (**Fig. 3**)
 - If contamination or burrs exist on the faces they will not close together and light will be seen between them. (**Fig. 4**)
 - Inside measuring faces: They are in good condition if a small amount of light can be seen between them when they are held to the light.



During Use

1. Make sure to apply constant force during measurement, and measure an object as close as possible to the root of the jaws. (**Fig. 5**)
2. Do not measure an object with the measuring faces tilted. (**Fig. 6**)



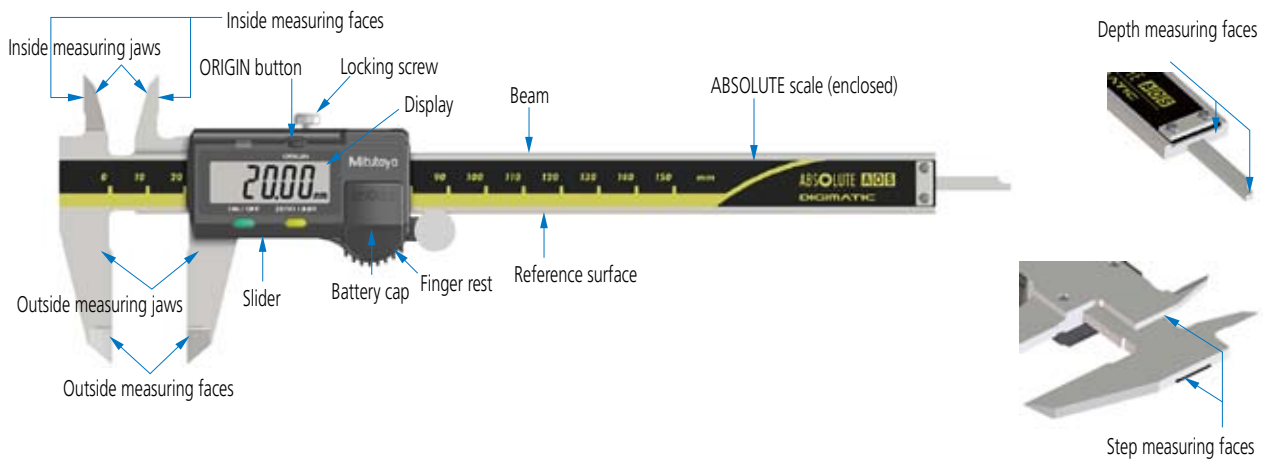
If the instrument is damaged due to being dropped or struck hard, or for any other reason, do not use it and contact us for repair.

After Use

1. Check for damage to the caliper and, if found, arrange for repair or replacement. Clean the instrument. If the instrument is used at a place where soluble cutting oil or the like is used, be sure to perform rust prevention treatment after cleaning.
2. Open the outside measuring jaws by approximately 0.2 to 2 mm, leave the locking screw untightened, and then store the instrument. (**Fig. 7**)
3. Store the instrument in a room free of excessive heat and moisture, also dust and oil mist.
4. When storing the instrument for a long time, be sure to remove the battery.

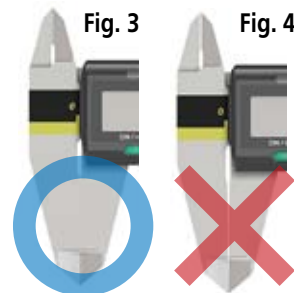
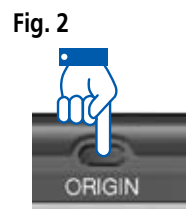
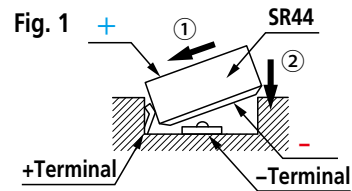


ABSOLUTE Digimatic Calipers



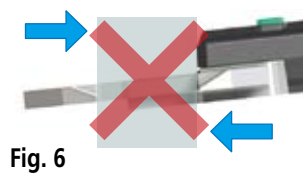
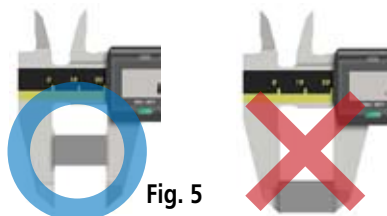
Before Use

1. Use a small amount of Micrometer oil (**Order No.207000**) to wipe the reference surface of the beam.
2. Move the slider all the way along the main beam to check whether the slider moves smoothly without jamming.
3. Install an SR44 battery (**Order No.938882**) with the positive side of the battery uppermost. (**Fig. 1**)
4. After the battery is replaced, clean the measuring faces and bring them into contact. Then press the ORIGIN button to perform the zero point setting. (**Fig. 2**)
5. Close the measuring faces after cleaning, and check the following:
 - Outside measuring faces: They are in good condition if light cannot be seen between them when they are held to the light. (**Fig. 3**)
 - If contamination or burrs exist on the faces they will not close together and light will be seen between them. (**Fig. 4**)
 - Inside measuring faces: They are in good condition if a small amount of light can be seen between them when they are held to the light.



During Use

1. Make sure to apply constant force during measurement, and measure an object as close as possible to the root of the jaws. (**Fig. 5**)
2. Do not measure an object with the measuring faces tilted. (**Fig. 6**)



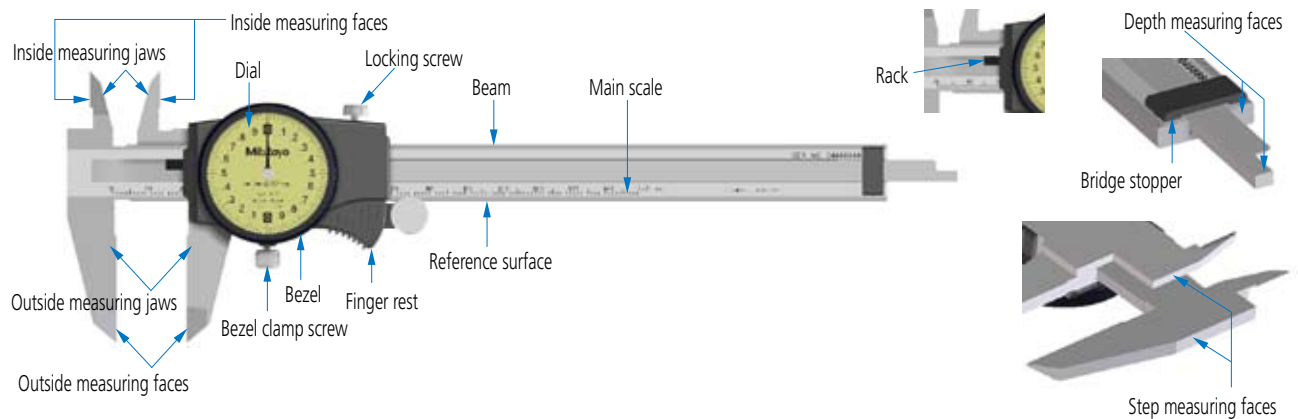
If the instrument is damaged due to being dropped or struck hard, or for any other reason, do not use it and contact us for repair.

After Use

1. Check for damage to the caliper and, if found, arrange for repair or replacement. Clean the instrument.
2. Open the outside measuring jaws by approximately 0.2 to 2 mm, leave the locking screw untightened, and then store the instrument. (**Fig. 7**)
3. Store the instrument in a room free of excessive heat and moisture, also dust and oil mist.
4. When storing the instrument for a long time, be sure to remove the battery.

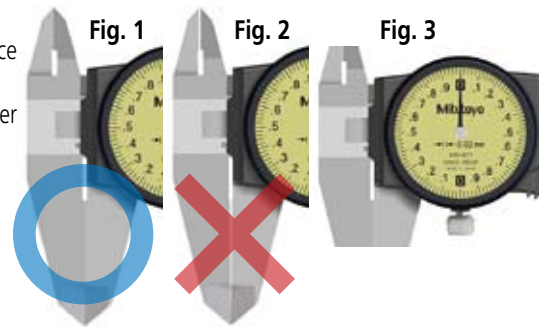


Dial Calipers



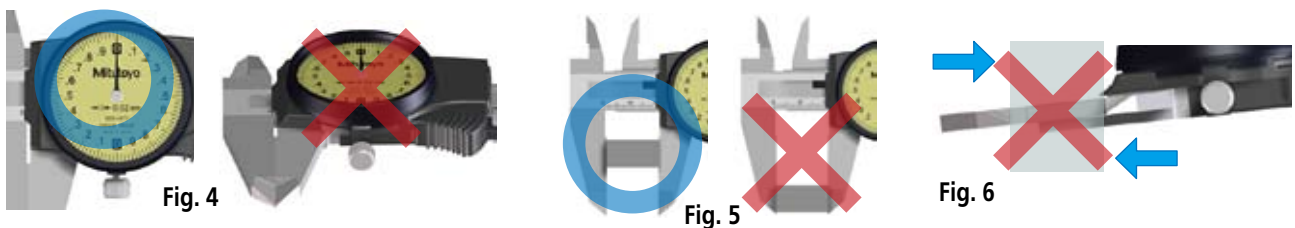
Before Use

1. Use a small amount of Micrometer oil (**Order No.207000**) to wipe the reference surface of the beam.
2. Move the slider all the way along the main beam to check whether the slider moves smoothly without jamming.
3. Close the measuring faces after cleaning, and check the following:
 - Outside measuring faces: They are in good condition if light cannot be seen between them when they are held to the light. (**Fig. 1**)
If contamination or burrs exist on the faces they will not close together and light will be seen between them. (**Fig. 2**)
 - Inside measuring faces: They are in good condition if a small amount of light can be seen between the faces when they are held to the light.
 - Check the zero point. (**Fig. 3**)



During Use

1. Read the graduations from directly above the dial to avoid parallax error. (**Fig. 4**)
2. Make sure to apply constant force during measurement, and measure an object as close as possible to the root of the jaws. (**Fig. 5**)
3. Do not measure an object with the measuring faces tilted. (**Fig. 6**)



If the instrument is damaged due to being dropped or struck hard, or for any other reason, do not use it and contact us for repair.

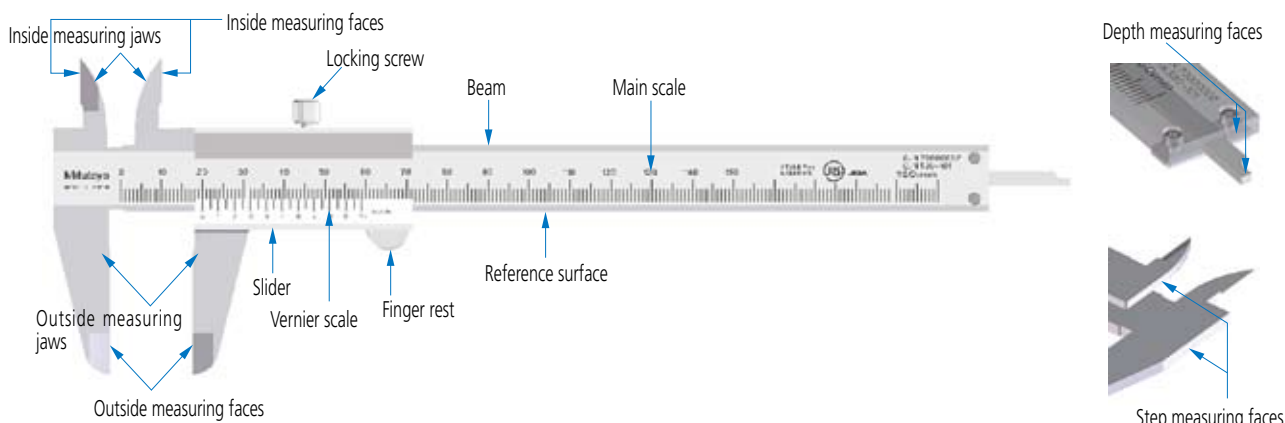
After Use

1. Check for damage to the caliper and, if found, arrange for repair or replacement. Clean the instrument. If the instrument is used at a place where soluble cutting oil or the like is used, be sure to perform rust prevention treatment after cleaning.
2. Open the outside measuring jaws by approximately 0.2 to 2 mm, leave the locking screw untightened, and then store the instrument. (**Fig. 7**)
3. Store the instrument in a room free of excessive heat and moisture, also dust and oil mist.



Fig. 7

Vernier Calipers



Before Use

1. Use a small amount of Micrometer oil (**Order No.207000**) to wipe the reference surface of the beam.
2. Move the slider all the way along the main beam to check whether the slider moves smoothly without jamming.
3. After cleaning, check the following by closing the measuring faces:
 - Outside measuring faces: They are in good condition if light cannot be seen between them when they are held to the light. (**Fig. 1**)
If contamination or burrs exist on the faces they will not close together and light will be seen between them. (**Fig. 2**)
 - Inside measuring faces: They are in good condition if a small amount of light can be seen between the faces when they are held to the light. (**Fig. 1**)
 - Check the zero point. (**Fig. 3**)

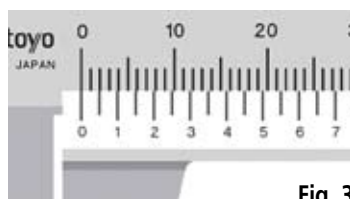
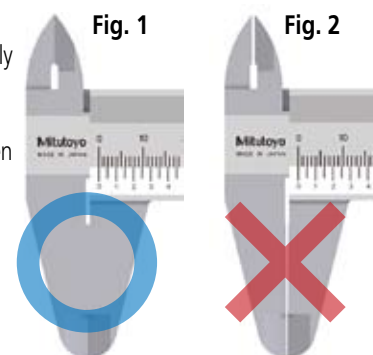


Fig. 3

During Use

1. Read the scale graduations from directly above the dial to avoid parallax error. (**Fig. 4**)
2. Make sure to apply constant force during measurement, and measure an object as close as possible to the root of the jaws. (**Fig. 5**)
3. Do not measure an object with the measuring faces tilted. (**Fig. 6**)

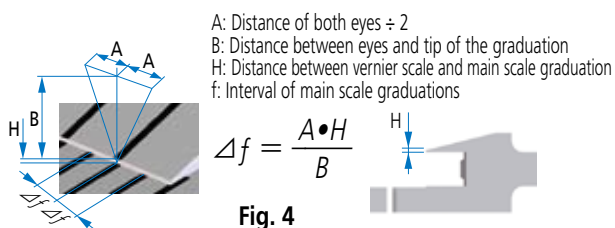


Fig. 4

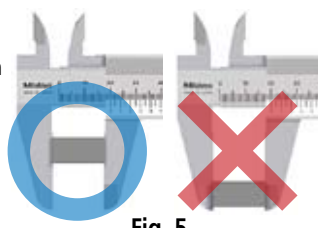


Fig. 5

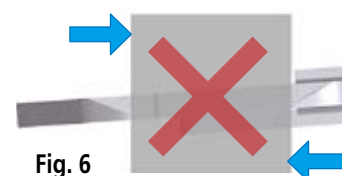


Fig. 6

If the instrument is damaged due to being dropped or struck hard, or for any other reason, do not use it and contact us for repair.

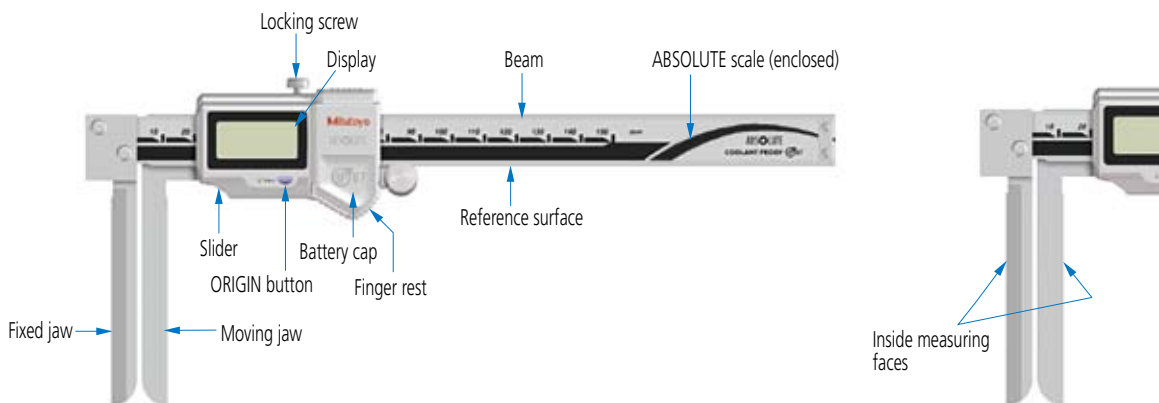
After Use

1. Check for damage to the caliper and, if found, arrange for repair or replacement. Clean the instrument.
If the instrument is used at a place where soluble cutting oil or the like may attach, be sure to perform rust prevention treatment after cleaning.
2. Open the outside measuring jaws by approximately 0.2 to 2 mm, leave the locking screw untightened, and then store the instrument. (**Fig. 7**)
3. Store the instrument in a room free of excessive heat and moisture, also dust and oil mist.



Fig. 7

ABSOLUTE Coolant Proof Inside Calipers



Before Use

1. Use a small amount of Micrometer oil (**Order No.207000**) to wipe the reference surface of the beam.
2. Move the slider all the way to check whether the slider moves smoothly without jamming.
3. Install an SR44 battery (**Order No.938882**) with the positive side of the battery uppermost. (**Fig. 1**)
4. After the battery is replaced, clean the measuring faces and move the slider to the limit of its travel so the measuring faces are aligned. Then press the ORIGIN button to set the zero point. (**Fig. 2**)
5. After cleaning, check the following by closing the measuring faces:
 - They are in good condition if light cannot be seen between them when they are held to the light. (**Fig. 3**)
 - If contamination or burrs exist on the faces they will not close together and light will be seen between them. (**Fig. 4**)

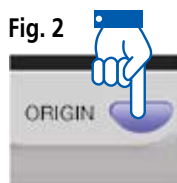
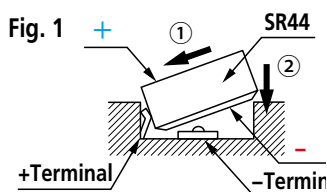


Fig. 3

Fig. 4

During Use

1. Make sure to apply constant force during measurement, and measure an object as close as possible to the root of the jaws. (**Fig. 5**)
2. Do not measure an object with the measuring faces tilted. (**Fig. 6**)

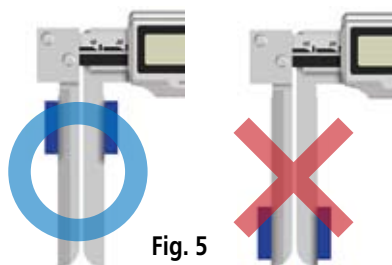


Fig. 5

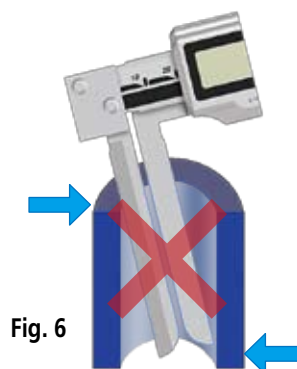


Fig. 6

If the instrument is damaged due to being dropped or struck hard, or for any other reason, do not use it and contact us for repair.

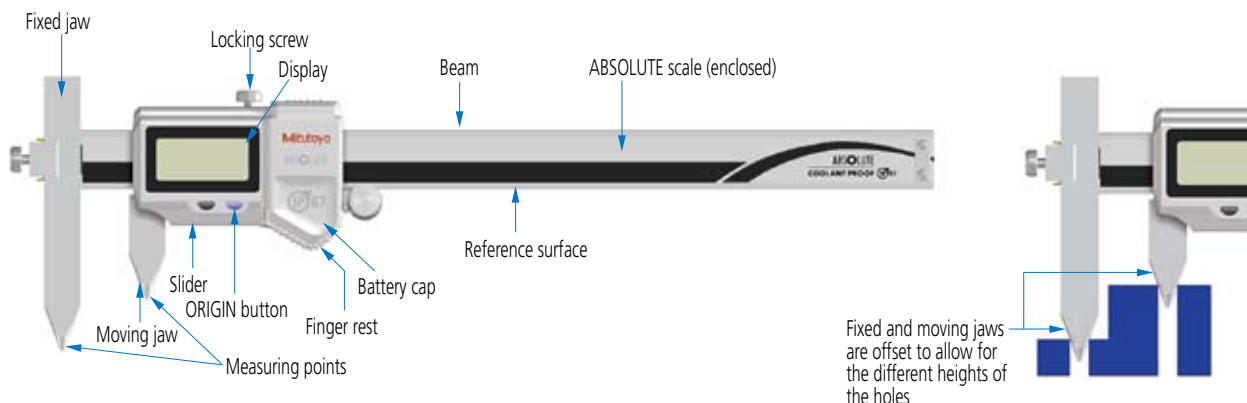
After Use

1. Check for damage to the caliper and, if found, arrange for repair or replacement. Clean the instrument. If the instrument is used at a place where soluble cutting oil or the like is used, be sure to perform rust prevention treatment after cleaning.
2. Open the outside measuring jaws by approximately 0.2 to 2 mm, leave the locking screw untightened, and then store the instrument. (**Fig. 7**)
3. Store the instrument in a room free of excessive heat and moisture, also dust and oil mist.
4. When storing the instrument for a long time, be sure to remove the battery.



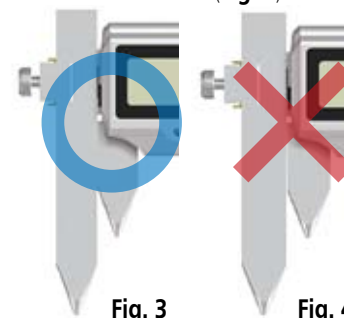
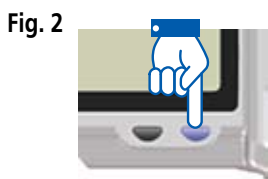
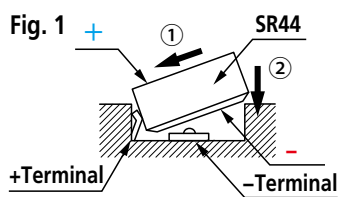
Fig. 7

ABSOLUTE Coolant Proof Offset Centerline Calipers



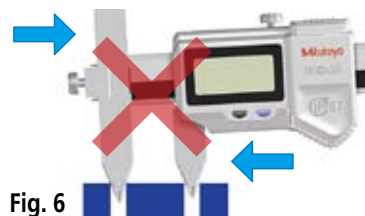
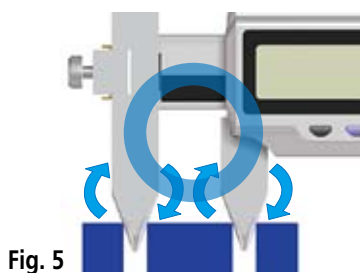
Before Use

1. Use a small amount of Micrometer oil (**Order No.207000**) to wipe the reference surface of the beam.
2. Move the slider all the way to check whether the slider moves smoothly without jamming.
3. Install an SR44 battery (**Order No.938882**) with the positive side of the battery uppermost. (**Fig. 1**)
4. After the battery is replaced, clean the measuring faces and move the slider to the limit of its travel so the measuring faces are aligned. Then press the ORIGIN button to set the zero point. (**Fig. 2**)
5. Check the following by contacting the fixed jaw and the moving jaw:
 - Contact surfaces: They are in good condition if light cannot be seen between them when they are held to the light. (**Fig. 3**)
 - If contamination or burrs exist on the faces they will not close together and light will be seen between them. (**Fig. 4**)



During Use

1. Make sure to apply consistent force on all measurements, and stabilize the measuring faces. (**Fig. 5**)
2. Do not measure an object with the measuring faces tilted. (**Fig. 6**)



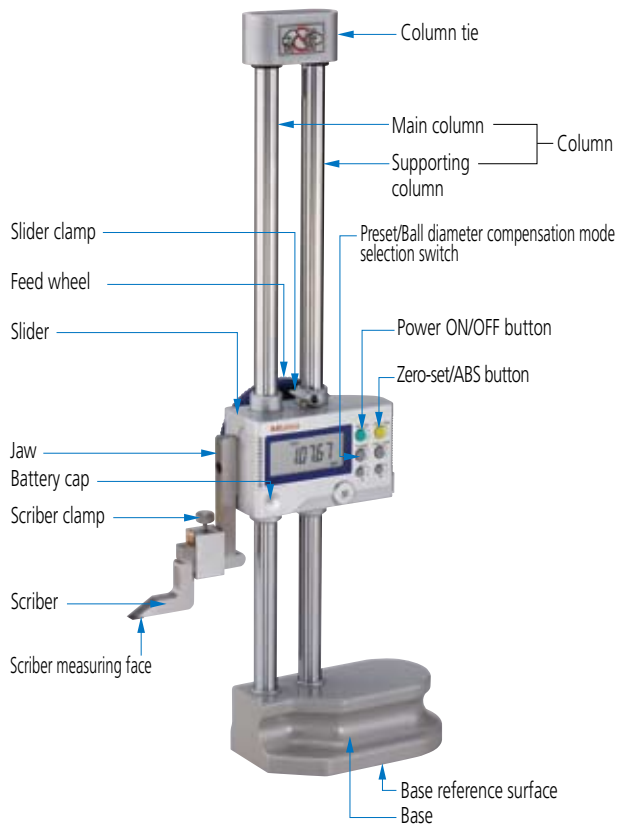
If the instrument is damaged due to being dropped or struck hard, or for any other reason, do not use it and contact us for repair.

After Use

1. Check for damage to the caliper and, if found, arrange for repair or replacement. Clean the instrument. If the instrument is used at a place where soluble cutting oil or the like is used, be sure to perform rust prevention treatment after cleaning.
2. Open the moving jaws by approximately 0.2 to 2 mm, leave the locking screw untightened, and then store the instrument. (**Fig. 7**)
3. Store the instrument in a room free of excessive heat and moisture, also dust and oil mist.
4. When storing the instrument for a long time, be sure to remove the battery.

Fig. 7





Before Use

1. Set the scriber as close to the main column as possible.
 2. Clean the columns, base reference surface, scriber mounting surface, and scriber measuring face.
 3. Clean the precision granite surface plate on which the height gage will be used.
 4. Move the slider throughout its range to check that the movement is smooth without jamming.
 5. Install an SR44 battery (**Order No.938882**) with the positive side of the battery uppermost. (**Fig. 1**)
 6. After the battery is replaced, bring the measuring face of the scriber into contact with the surface plate and press the PRESET button to perform the zero point setting.
- * When carrying the instrument hold it with both hands with one on the slider, and the other on the base. (**Photo 1**)

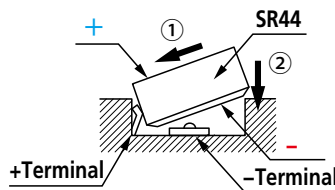


Fig. 1



Photo 1

During Use

1. During measurement, rotate the feed wheel slowly when applying a constant measuring force. (**Photo 2**)
- **Coarse/fine feed switching**
Coarse feed or fine feed can be selected by pulling or pushing the handle of the slider feed wheel. (**Fig. 2**)

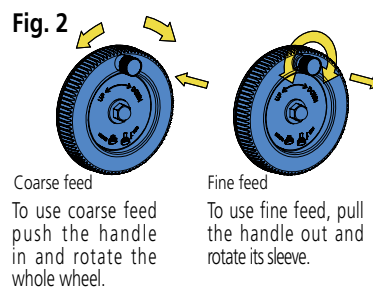


Photo 2

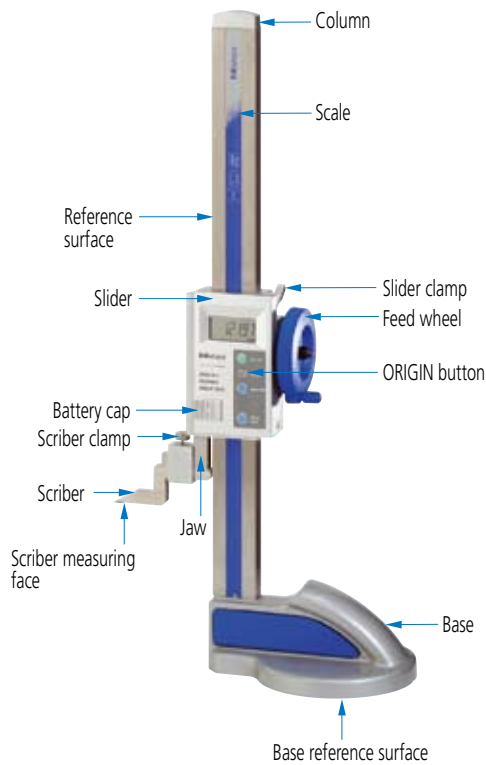
If the instrument is damaged due to being dropped or struck hard, or for any other reason, do not use it and contact us for repair.

After Use

1. Check for damage to the gage and, if found, arrange for repair or replacement. Clean the instrument.
2. When the height gage will not be used for some time leave the scriber unclamped and just above, but not touching, the surface plate. This is to avoid risk of personal injury by accidental contact with the scriber tip.
3. Be especially careful not to let the scriber protrude over the edge of the surface plate at any time. (**Photo 3**)
4. Be sure to turn off the power before storing.
5. Store the instrument in a room free of excessive heat and moisture, also dust and oil mist.
6. If the instrument will not be used for a long time, remove the battery before storage and cover the unit with the supplied dust cover.



Photo 3



Before Use

1. Set the scriber as close to the column as possible.
 2. Clean the reference surface, base reference surface, scriber mounting surface, and scriber measuring face.
 3. Clean the precision granite surface plate on which the height gage will be used.
 4. Move the slider throughout its range to check that the movement is smooth without jamming.
 5. Install an SR44 battery (**Order No.938882**) with the positive side of the battery uppermost. (**Fig. 1**)
 6. After the battery is replaced, bring the measuring face of the scriber into contact with the surface plate and press the ORIGIN button to perform the zero point setting.
- * When carrying the instrument hold it with both hands with one on the slider, and the other on the base. (**Photo 1**)

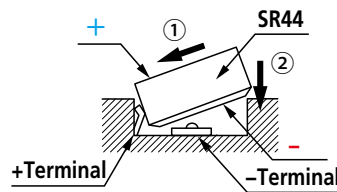


Fig. 1



Photo 1

During Use

1. During measurement, rotate the feed wheel slowly when applying a constant measuring force. (**Photo 2**)



Photo 2

If the instrument is damaged due to being dropped or struck hard, or for any other reason, do not use it and contact us for repair.

After Use

1. Check for damage to the gage and, if found, arrange for repair or replacement. Clean the instrument.
2. When the height gage will not be used for some time leave the scriber unclamped and just above, but not touching, the surface plate. This is to avoid risk of personal injury by accidental contact with the scriber tip.
3. Be especially careful not to let the scriber protrude over the edge of the surface plate at any time. (**Photo 3**)
4. Be sure to turn off the power before storing.
5. Store the instrument in a room free of excessive heat and moisture, also dust and oil mist.
6. If the instrument will not be used for a long time, remove the battery before storage and cover the unit with the supplied dust cover.

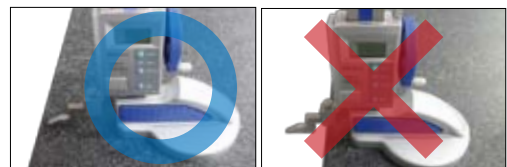
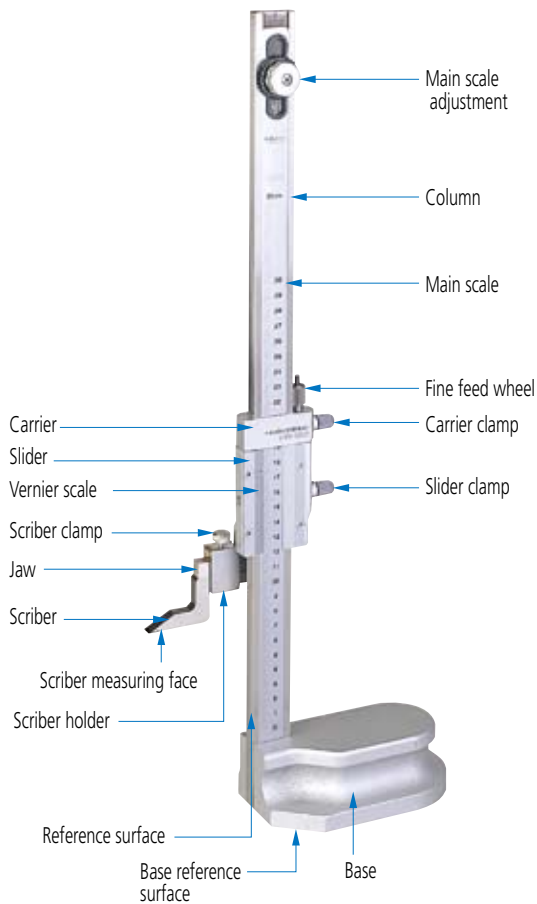


Photo 3



Before Use

1. Set the scriber as close to the column as possible.
2. Clean the reference surface, base reference surface, scriber mounting surface, and scriber measuring face.
3. Clean the precision granite surface plate on which the height gage will be used.
4. Move the slider throughout its range to check that the movement is smooth without jamming.
5. Bring the scriber measuring face into contact with the surface plate, and use the main scale adjustment to set the zero-point. **(Photo 1)**

* When carrying the instrument hold it with both hands with one on the slider, and the other on the base. **(Photo 2)**



Photo 1



Photo 2

During Use

1. Read the scale graduations from directly above to avoid parallax error. **(Fig. 1)**

A: Distance of both eyes ÷ 2
 B: Distance between eyes and tip of the graduation
 H: Distance between vernier scale and main scale graduation
 f: Interval of main scale graduations

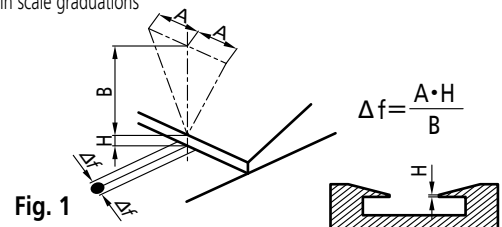


Fig. 1

2. During measurement, apply constant measuring force.

If the instrument is damaged due to being dropped or struck hard, or for any other reason, do not use it and contact us for repair.

After Use

1. Check for damage to the caliper and, if found, arrange for repair or replacement. Clean the instrument. If the instrument is used at a place where soluble cutting oil or is used, be sure to perform rust prevention treatment after cleaning.
2. When the height gage will not be used for some time leave the scriber unclamped and just above, but not touching, the surface plate. This is to avoid risk of personal injury by accidental contact with the scriber tip.
3. Be especially careful not to let the scriber protrude over the edge of the surface plate at any time.
4. If the instrument will not be used for a long time, cover the unit with a dust cover.
5. Store the instrument in a room free of excessive heat and moisture, also dust and oil mist.

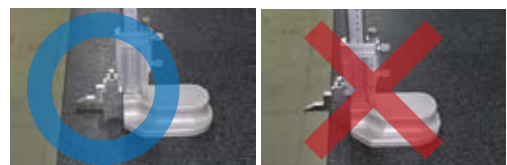
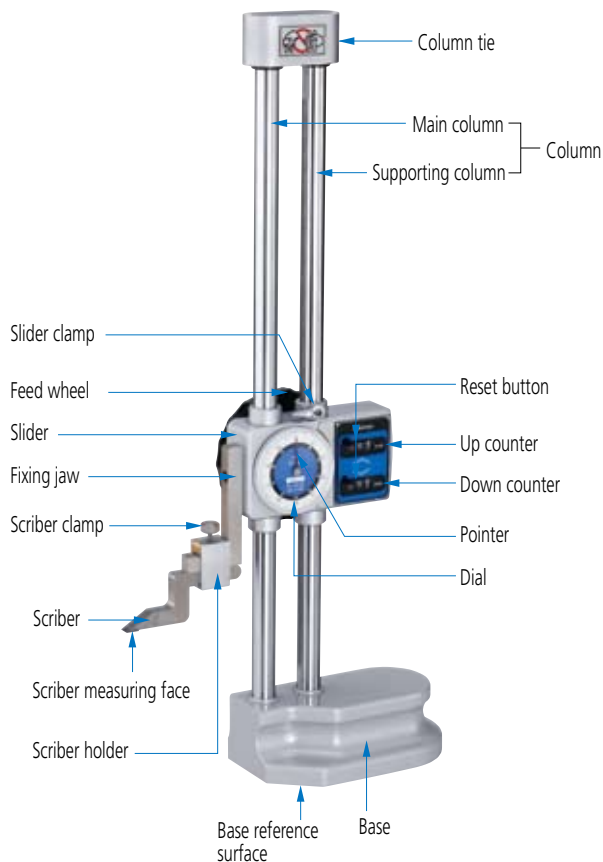


Photo 3



Before Use

1. Set the scriber as close to the main column as possible.
2. Clean the columns, base reference surface, scriber mounting surface, and scriber measuring face.
3. Clean the precision granite surface plate on which the height gage will be used.
4. Move the slider throughout its range to check that the movement is smooth without jamming.
5. Bring the measuring face of the scriber into contact with the surface plate and set the dial pointer and counters at zero to perform the zero point setting.

* When carrying the instrument hold it with both hands with one on the slider, and the other on the base. **(Photo 1)**

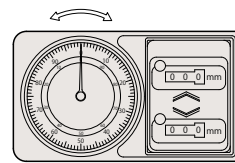


Fig. 1



Photo 1

During Use

1. Read the dial graduations from directly above to avoid parallax error. **(Fig. 2)**
2. During measurement, rotate the feed wheel slowly when applying a constant measuring force. **(Photo 2)**



Photo 2

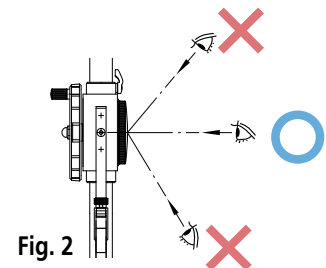


Fig. 2

If the instrument is damaged due to being dropped or struck hard, or for any other reason, do not use it and contact us for repair.

After Use

1. Check for damage to the gage and, if found, arrange for repair or replacement. Clean the instrument.
If the instrument is used at a place where soluble cutting oil or the like is used, be sure to perform rust prevention treatment after cleaning.
2. When the height gage will not be used for some time leave the scriber unclamped and just above, but not touching, the surface plate. This is to avoid risk of personal injury by accidental contact with the scriber tip.
3. Be especially careful not to let the scriber protrude over the edge of the surface plate at any time. **(Photo 3)**
4. If the instrument will not be used for a long time, cover the unit with the supplied dust cover.
5. Store the instrument in a room free of excessive heat and moisture, also dust and oil mist.



Photo 3



Before Use

1. Use a dry cloth or a cloth moistened with alcohol to clean the spindle without lubrication.
2. Move the spindle throughout its range to check that the movement is smooth without stickiness or jamming.
3. Use an SR44 battery (**Order No.938882**).
4. When setting the zero point, retract the spindle at least 0.2mm from the rest position. (**Fig. 1**)
5. To avoid measuring error due to the cosine effect, ensure that the spindle is accurately aligned with the intended direction of measurement. (**Photo 1**) Also note that unevenness of the reference surface may cause measuring errors.
6. If the instrument is to be used in an environment thick with oil mist or dust, the water/dust-proof type is recommended.

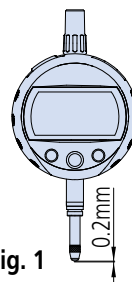


Fig. 1



Photo 1

During Use

1. Do not move the spindle rapidly nor apply force in the transverse direction, otherwise operation and accuracy may be adversely affected. (**Fig. 2**)
2. Use a holding fixture that will not deflect significantly during normal use.
3. Clamp the lug so that the spindle is square to the measuring face. (**Fig. 3**)
We offer lifting levers and releases to operate the spindle.
4. The letter "E" appearing temporarily at the end of the display while the spindle is moving is normal. However, if it is displayed continuously when the spindle is at rest then repair is necessary. (**Fig. 4**)

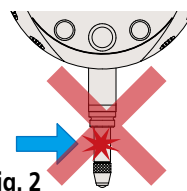


Fig. 2

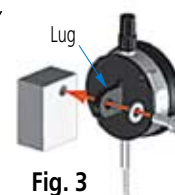


Fig. 3

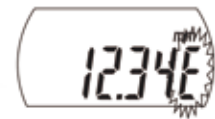
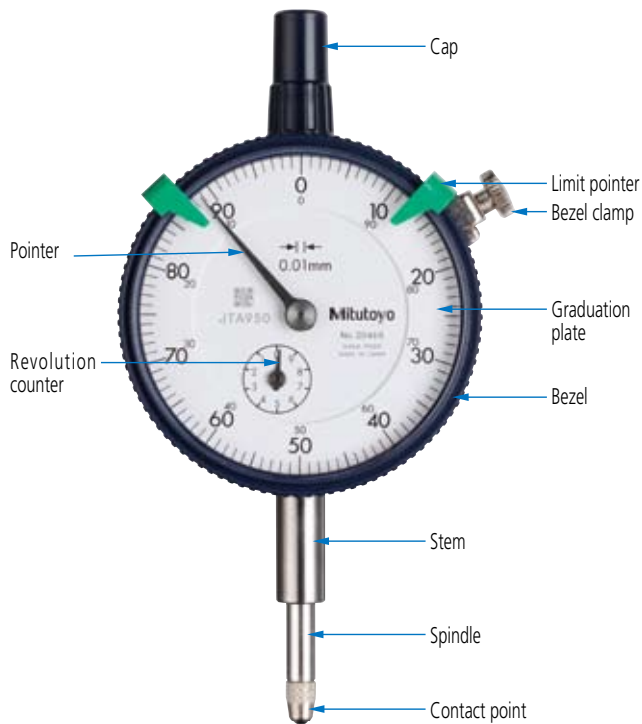


Fig. 4

If the instrument is damaged due to being dropped or struck hard, or for any other reason, do not use it and contact us for repair.

After Use

1. Check for damage to the indicator and, if found, arrange for repair or replacement. Clean the instrument.
2. Do not lubricate the spindle.
3. If the instrument will not be used for a long time, remove the battery before storage.
4. Store the instrument in a room free of excessive heat and moisture, also dust and oil mist.



Before Use

1. Use a dry cloth or a cloth moistened with alcohol to clean the spindle without lubrication. (Fig. 1)
2. Make sure that the pointer and the spindle move smoothly.
3. If the pointer and revolution counter are significantly out of position at the rest point (where the spindle is fully extended) (see Fig. 2), the spindle or works may be damaged. Contact Mitutoyo for repair without trying to disassemble any part of the works yourself. (Fig. 3)
4. If the instrument is to be used in an environment thick with oil mist or dust, the water/dust-proof type is recommended.

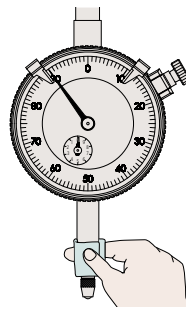


Fig. 1



Fig. 2

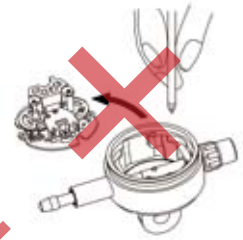


Fig. 3

During Use

1. Do not move the spindle rapidly nor apply force in the transverse direction, otherwise operation and accuracy may be adversely affected. (Fig. 4)
2. Use a holding fixture that will not deflect significantly during normal use.. (Fig. 5)
3. Clamp the lug so that the spindle is square to the measuring face. (Fig. 6)

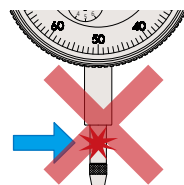


Fig. 4



Fig. 5

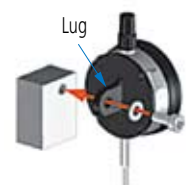


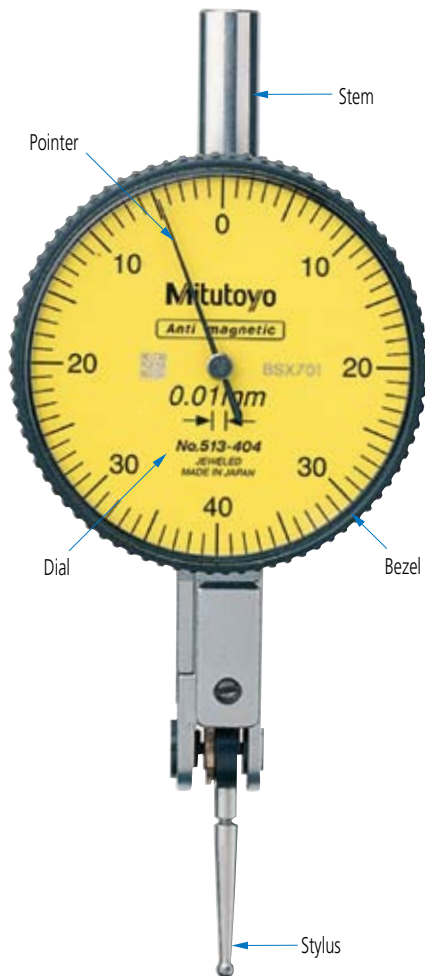
Fig. 6

If the instrument is damaged due to being dropped or struck hard, or for any other reason, do not use it and contact us for repair.

After Use

1. Check for damage to the indicator and, if found, arrange for repair or replacement. Clean the instrument.
2. Do not lubricate the spindle.
3. Store the instrument in a room free of excessive heat and moisture, also dust and oil mist.

Dial Test Indicators (Lever-operated Dial Indicators)



Before Use

1. Clean the contact point with a dry cloth.
2. Move the stylus throughout its range to check that the movement is smooth without stickiness or jamming.
3. Be sure to use the stylus with standard length according to models, otherwise a large measuring error may be caused. (Fig. 1)



Fig. 1

During Use

1. Use a holding fixture that will not deflect significantly during normal use. (Fig. 2)
2. Do not disassemble or modify the indicator. Failure to observe this may cause inaccuracy or malfunction.
3. A Dial Test Indicator's scale factor depends on the angle between the directions of movement of contact point and workpiece, and is only unity when these are aligned. In practice, to avoid significant error, if the angle θ (see Fig. 3) is kept less than 10° during measurement then the effect of a change in scale factor can be ignored. If this angle cannot be kept small then a factor can be applied to the dial reading to compensation for this 'cosine effect' as per the table below.

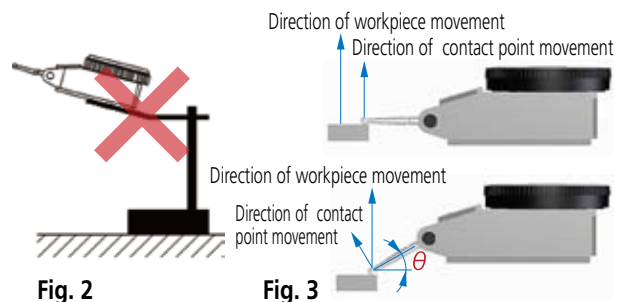


Fig. 2

Fig. 3

Angle (θ)	Comp. coefficient (k)
10°	0.98
20°	0.94
30°	0.86
40°	0.76
50°	0.64
60°	0.5

True value (approx. value) = Scale reading \times Comp. coefficient

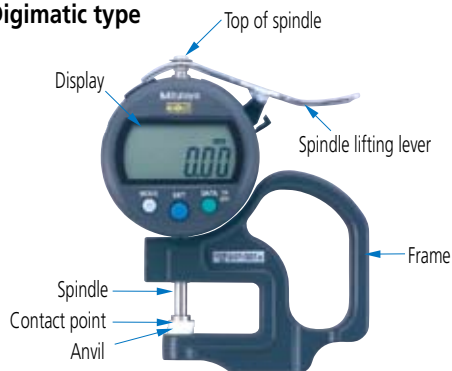
If the instrument is damaged due to being dropped or struck hard, or for any other reason, do not use it and contact us for repair.

After Use

1. Check for damage to the indicator and, if found, arrange for repair or replacement. Clean the instrument.
2. Store the instrument in a room free of excessive heat and moisture, also dust and oil mist.

Thickness Gages

Digimatic type



547-301



7301

CAUTION: Do not loosen the stem clamping screw unless replacing the indicator.

Before Use

1. Clean the spindle, contact point, and anvil with a dry cloth or one moistened with alcohol.
2. Make sure that a washer is used between the spindle lifting lever and the spindle. **(Photo 1)**
3. Do not loosen any retaining screws unnecessarily. (The contact point, anvil, back lid, top of spindle, spindle lifting lever, and indicator fixing part)
4. Move the spindle throughout its range to check that the movement is smooth without stickiness or jamming.
5. Check that zero is indicated when the contact point and the anvil are in contact.

Photo 1



During Use

1. Do not move the spindle rapidly nor apply force in the transverse direction, otherwise operation and accuracy may be adversely affected. **(Fig. 1)**
2. The letter "E" appearing temporarily at the end of the display while the spindle is moving is normal. However, if it is displayed continuously when the spindle is at rest then repair is necessary. **(Fig. 2)**
3. If the zero-point is displaced during measurement, clean the contact point and anvil and reset the zero point.
4. Do not loosen the spindle stem clamping screw.
5. Do not attempt to replace the flat type of contact point. Contact Mitutoyo if replacement is needed.
6. If the instrument is in use for an extended period, regularly reset the zero point to allow for the effect of temperature change on the frame.

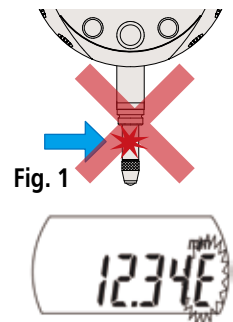


Fig. 2

If the instrument is damaged due to being dropped or struck hard, or for any other reason, do not use it and contact us for repair.

After Use

1. Check for damage to the indicator and, if found, arrange for repair or replacement. Clean the instrument.
2. Do not lubricate the spindle.
3. To prevent a flat contact point from wringing to the anvil, insert a piece of oiled paper between them before storage. **(Photo 2)**
4. Store the instrument in a room free of excessive heat and moisture, also dust and oil mist.



Photo 2

Rectangular Gauge Blocks

Before Use

1. To obtain maximum benefit from the very high accuracy of gauge blocks, use them in a thermally stable environment. Apply compensation to measurements if the ambient temperature is significantly different from 20°C and the workpiece does not possess a similar coefficient of thermal expansion to the blocks.
2. Clean the measuring faces of all gauge blocks in use to prevent dust or dirt contamination affecting measurement results. (**Cleaning paper : Order No.600006**).
3. Check if there are burrs on the measuring faces using an optical flat (**Order No.158-118**). (**Photo 1**)
4. If burrs exist, remove them using a Ceraston (**Order No.601645**) or Arkansas stone. (**Photo 2**)

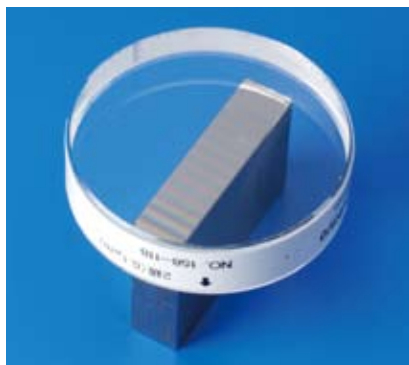


Photo 1

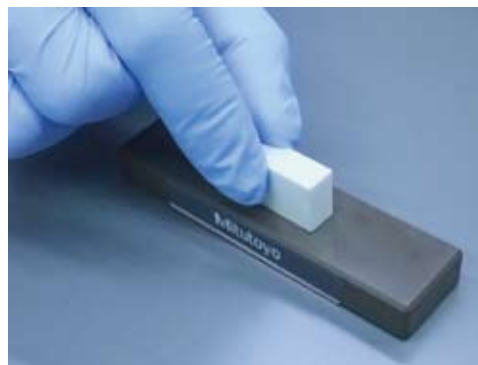


Photo 2

During Use

1. Handle gauge blocks with great care to avoid damage to the measuring surfaces due to impact with each other or by being dropped (**Fig. 1**). Damage, such as burrs, will adversely affect the accuracy of any measurements made.
2. To bring two gauge blocks together, apply thin grease or oil to the measuring surfaces and wipe off the excess leaving only a very thin layer adhering. Note that if there is insufficient oil or grease then wringing may be ineffective and block wear accelerated over time.

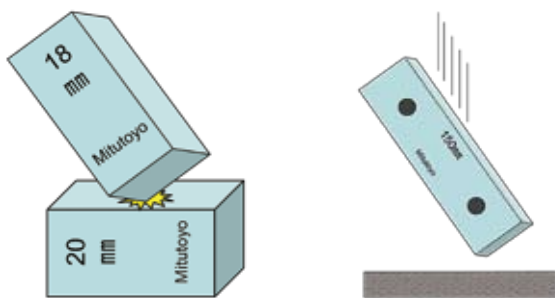


Fig. 1

After Use

1. Check for damage to the blocks and, if found, recondition them by the method described above. If this is ineffective, arrange for replacement.
2. After using steel gauge blocks, clean and then apply rust prevention treatment using a cloth moistened with anti-corrosion oil (**Order No.600001**).
3. A convenient kit (**Order No. 516-650**, see page 1) is available for gauge block maintenance and cleaning before storage.
4. Store the instrument in a room free of excessive heat and moisture, also dust and oil mist.



Export permission by the Japanese government may be required for exporting our products according to the Foreign Exchange and Foreign Trade Law. Please consult our sales office near you before you export our products or you offer technical information to a nonresident.

- Coordinate Measuring Machines
- Vision Measuring Systems
- Form Measurement
- Optical Measuring
- Sensor Systems
- Test Equipment and Seismometers
- Digital Scale and DRO Systems
- Small Tool Instruments and Data Management

Specifications are subject to change without notice.

Note: All information regarding our products, and in particular the illustrations, drawings, dimensional and performance data contained in this pamphlet, as well as other technical data are to be regarded as approximate average values. We therefore reserve the right to make changes to the corresponding designs, dimensions and weights. The stated standards, similar technical regulations, descriptions and illustrations of the products were valid at the time of printing. Only quotations submitted by ourselves may be regarded as definitive. Our products are classified as regulated items under Japanese Foreign Exchange and Foreign Trade Law. Please consult us in advance if you wish to export our products to any other country. If the purchased product is exported, even though it is not a regulated item (Catch-All controls item), the customer service available for that product may be affected. If you have any questions, please consult your local Mitutoyo sales office.

Mitutoyo Corporation
 20-1, Sakado 1-Chome,
 Takatsu-ku, Kawasaki-shi,
 Kanagawa 213-8533, Japan
 T +81 (0) 44 813-8230
 F +81 (0) 44 813-8231
<http://www.mitutoyo.co.jp>

