

Vernier Caliper, Depth Gage

Vernier Caliper (standard and long-size)
Depth Gage

User's Manual

No. 99MAC002A
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Safety Precautions

To ensure operator safety, use this product in conformance with the directions, functions and specifications given in this User's Manual. Use under other conditions may compromise safety.

⚠ CAUTION Shows risks that could result in minor or moderate injury.

- The outside and inside measuring jaws of this caliper have sharp edges. Handle it with great care to avoid injury.
- Do not measure the workpiece if it is rotating. There is a risk of injury due to being caught in the machine, etc.

■ Conventions and wording indicating prohibited and mandatory actions



Indicates concrete information about prohibited actions.



Indicates concrete information about mandatory actions.

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1 Type and Code Number

■ Caliper: Standard



Code number

530-101 530-108 530-109 530-100
530-102 530-501 530-502 530-320
530-321 530-322 530-335

■ Caliper: Long-size



Code number

160-130 160-131 160-132 160-133 160-134

● With Fine-Adjustment



Code number

160-127 160-128 160-101 160-104
160-110 160-113

● With Fine-Adjustment



Code number

532-101 532-102 532-103

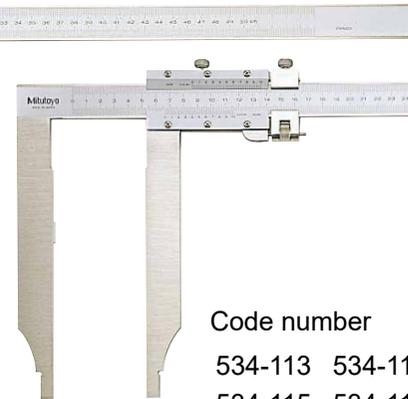
● Long-jaw



Code number

534-109 534-110

● Long-jaw with Fine-Adjustment



Code number

534-113 534-114
534-115 534-116

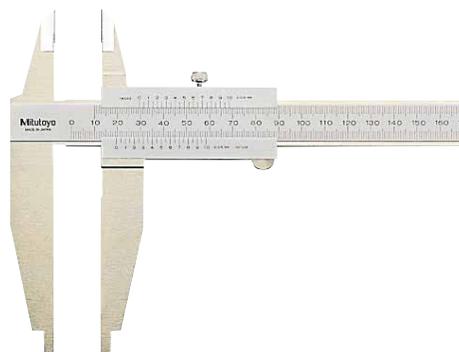
● With Automatic Clamp



Code number

531-101 531-102 531-103

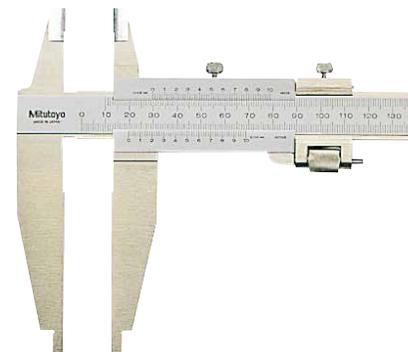
● Long-jaw



Code number

533-404 533-405 533-406

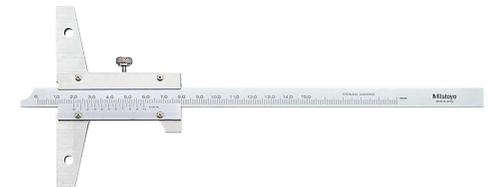
● Long-jaw with Fine-Adjustment



Code number

533-504 533-505 533-506

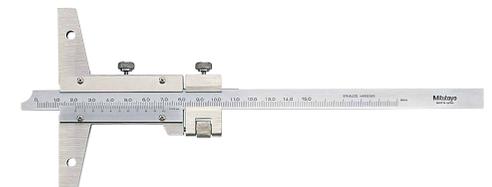
■ Depth Gage



Code number

527-201 527-202 527-203 527-204
527-205

● With Fine-Adjustment



Code number

527-101 527-102 527-103

2 Names of Components

● Caliper

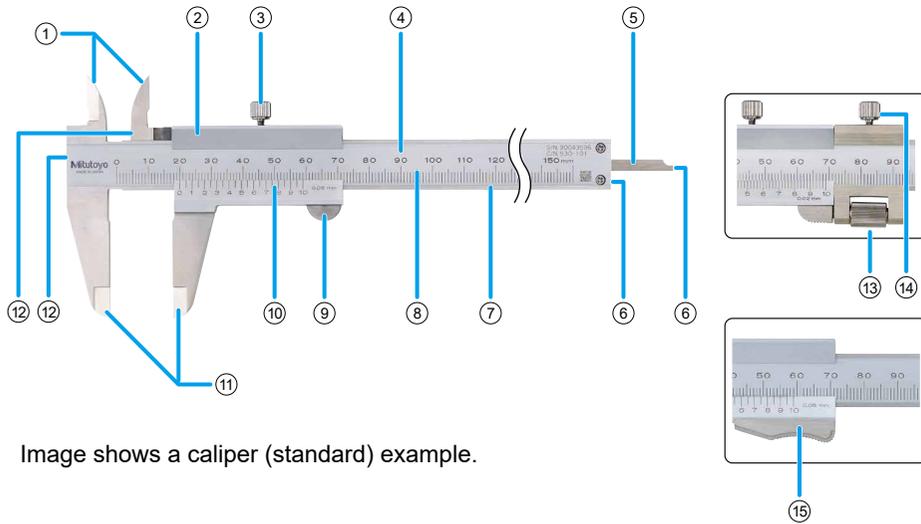
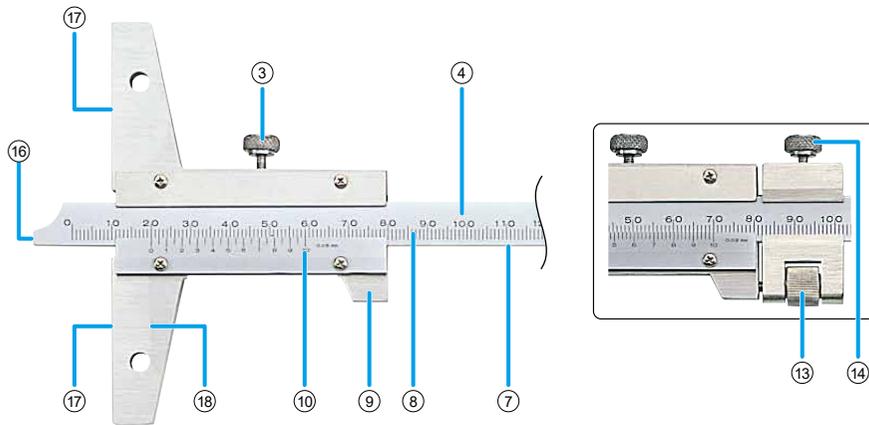


Image shows a caliper (standard) example.

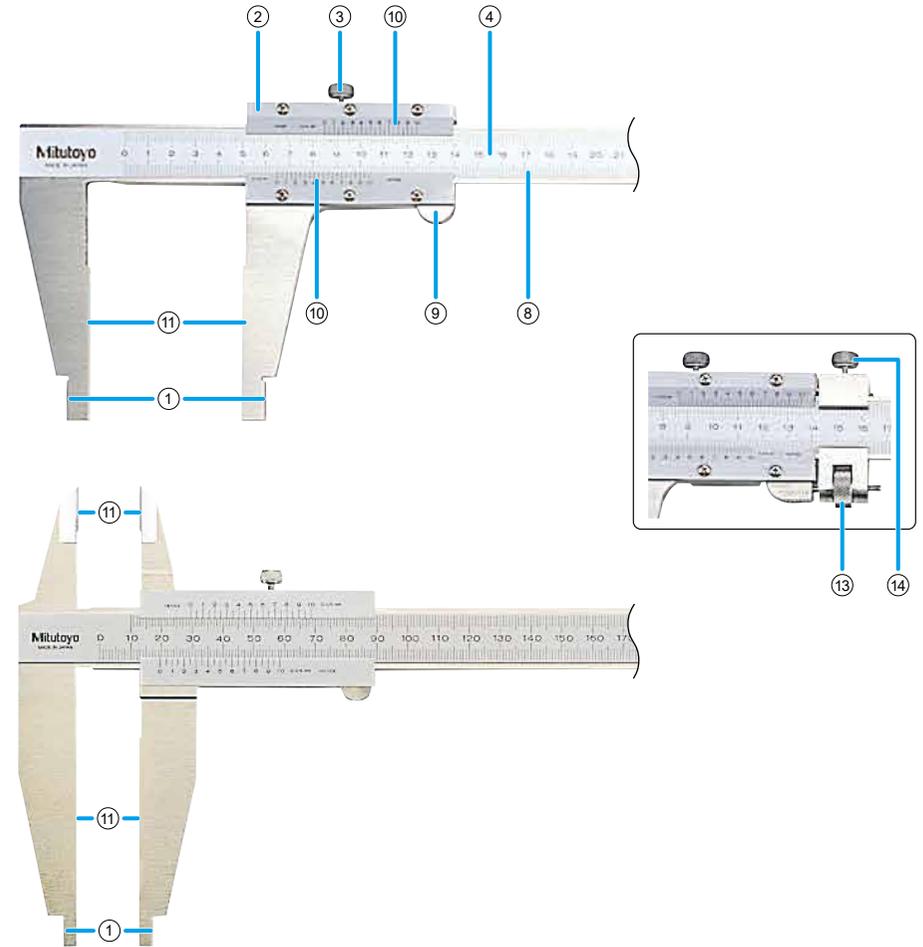
● Depth Gauge



- ① Inside measuring jaws
- ② Slider
- ③ Slider clamp screw
- ④ Beam
- ⑤ Depth bar

- ⑥ Depth measuring faces
- ⑦ Sliding surface (reference surface)
- ⑧ Main scale
- ⑨ Finger rest
- ⑩ Vernier graduation

● Caliper (long-size)

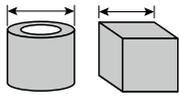


- ① Outside measuring jaws
- ② Step measuring faces
- ③ Fine-adjustment
- ④ Fine-adjustment clamp screw
- ⑤ Finger rest (automatic clamp)

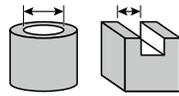
- ⑥ Measuring face
- ⑦ Reference surface
- ⑧ Base

3 Product Applications

Outside measurement



Inside measurement



Step measurement



Depth Measurement



	Outside measurement	Inside measurement	Step measurement	Depth Measurement
Caliper (standard) • With fine-adjustment • With automatic clamp	Yes	Yes	Yes	Yes
Caliper (long-size)	Yes	Yes	No	No
Depth gage	No	No	No	Yes

4 Precautions before Use

- Before using this product for the first time, wipe the rust preventive oil from the product with a soft cloth soaked with cleaning oil. If the rust preventive oil is left on the product, it will dry on and the motion may become stiff. In this case, wipe the sliding surface (reference surface) with a cloth to improve the motion further.
- If cutting chips or debris adhere to the beam, measuring faces, or graduations, wipe them off with chamois or gauze, etc.
- Apply clean oil to the beam, especially the sliding surface. This protects the sliding surface and improves the slider motion.
- Do not perform the adjustment at sites where the temperature will change abruptly. Thermally stabilize the instrument sufficiently at room temperature.

5 Basic Usage

■ Using the caliper/depth gage

For caliper

Grasp the beam lightly with your right hand, put your right thumb on the slider finger rest, and move the slider horizontally to measure.

For depth gage

With one hand, bring the base into close contact with the workpiece, and move the beam vertically with the other hand for measurement.

- Tips**
- For the measuring method details, refer to "7. Measurement Method".
 - For fine-adjustment models, tighten the fine-adjustment clamp and turn the fine-adjustment for fine motion of the slider (caliper) or beam (depth gage).

■ Fixing the slider/base

The main scale and vernier readings are usually taken with the workpiece clamped (or in close contact). However, depending on the measuring location, the orientation during measurement and so on, it may be difficult to get a reading in this position. In this case, tighten the slider clamp screw (caliper) or the clamping screw (depth gage), move the caliper/depth gage carefully away from the workpiece, and read the graduations.

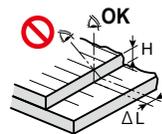
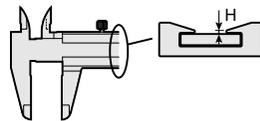
- Tips**
- For calipers with automatic clamp, the finger rest acts as the automatic clamp. Push the rest in the beam direction to release the clamp and allow the slider to move. Release the rest to fix the slider in that position.

■ Reading the graduations

Read the main scale and vernier graduations from the front.



- There is a slight level difference (H) between the main scale and the vernier. Therefore, if the graduations are read at an angle, parallax will cause measurement error (ΔL).
- If viewing at an oblique angle is unavoidable, we recommend a dial type or digital type without causing parallax.



6 Confirmation before Measurement

■ Confirming Slider Movement

- Confirm that there is no irregular slider movement and that the slider moves smoothly throughout the measurement range.
- Confirm that there is no play of the slider in the vertical direction against the sliding surface.

■ Confirming Main Scale and Vernier Zero Graduation Line Alignment

- For the caliper, close the measuring face of each jaw and confirm that the zero graduation lines are aligned.
- For the depth gage, use a surface plate, etc. to align the measuring face and reference surface, and confirm that the zero graduation lines are aligned.

■ Confirming Clearance (Wear) between Measuring Faces of Caliper

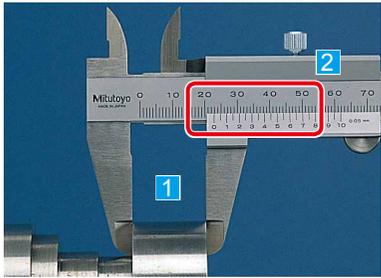
- When the outside measuring jaws are closed and held to the light, confirm that there is no slit observed between the jaws against the light, or that a faint light is uniformly visible. As well, confirm that the jaw tips are not deformed.
- When the inside measuring jaws are closed and held to the light, observing the jaws obliquely, confirm that a light is uniformly visible, and that the tips are not deformed.

7 Measurement Method

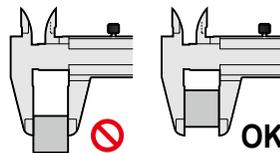
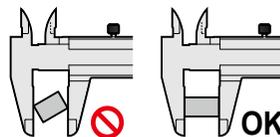
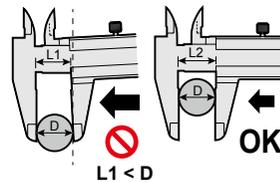
■ Precautions when measuring

-  Do not measure the workpiece with the caliper if it is rotating, etc. Measuring faces will be worn out.
-  The measurement position of long-size vernier calipers should be consistent if positional error is to be avoided. Measurements in vertical positions may differ from those in horizontal positions.

■ Outside measurement

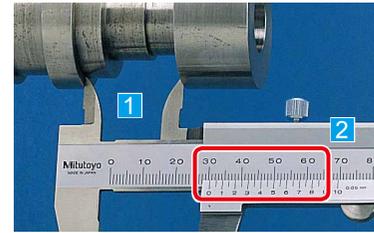


-  Do not apply excessive force to the workpiece. Excessive measuring force will cause measurement error because of the positional deviations of the jaws.
- Do not clamp the workpiece diagonally. Measurement error will ensue if tilted.
-  Clamp the workpiece as close to the sliding surface as possible. Measurement error is more likely to increase if clamped near the outside measuring jaw tips.

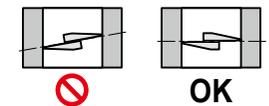
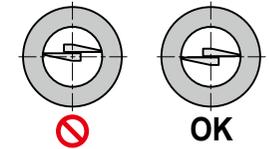
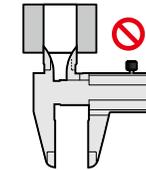
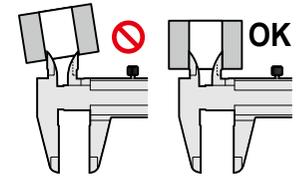


- 1 Insert the workpiece into the outside measuring jaws and bring jaws into close contact with the workpiece, using appropriate and uniform measuring force.
- 2 With the workpiece clamped, read the graduations.

■ Inside measurement



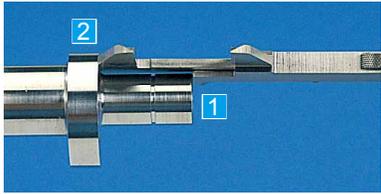
-  Insert the inside measuring jaws as deeply as possible into the workpiece.



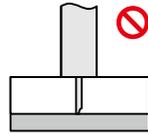
- For inner diameter measurement, bring the measuring faces into close contact, and read the value when the pointer indicated value is maximum: a direct line between the measuring faces passes through the center of the cross-section.
- For groove width measurement, bring the measuring faces into close contact, and read the value when the pointer indicated value is minimum: a direct line between the faces is perpendicular to the groove inner wall.

- 1 Insert the inside measuring jaws into the workpiece, and bring jaws into close contact with the workpiece interior using appropriate and uniform measuring force.
- 2 With the jaws inserted into the workpiece, take the reading.

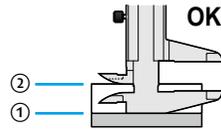
■ Step measurement



 Do not use a depth bar for step measurement, as the small contact area with the workpiece makes it difficult to retain a stable orientation



 For a stepped workpiece, bring the entire stepmeasuring surfaces (①, ②) into close contact with the workpiece



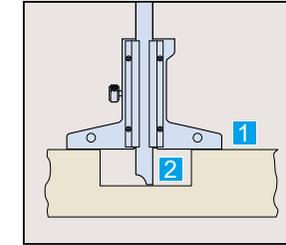
- 1** Bring the step measuring face (①, beam side) into close contact with the workpiece.
- 2** Move the slider until the step measuring face (②, slider side) strikes the workpiece (stepped surface).
- 3** With the measuring faces in close contact, take the reading.

■ Depth measurement

For caliper

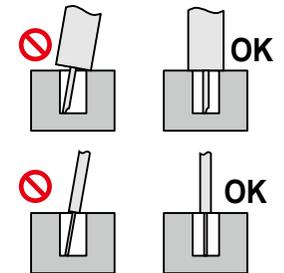


For depth gage



- 1** For the caliper, bring the depth measuring surface (beam side) into close contact with the workpiece.
For the depth gage, bring the base reference surface into close contact with the workpiece.

 The depth measuring face of the caliper is narrow and unstable. Bring it into contact perpendicular with the workpiece.

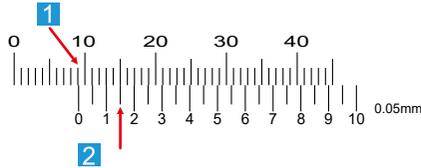


- 2** For the caliper, move the slider until the depth measuring surface (depth bar side) makes contact.
For the depth gage, move the beam until the measuring face makes contact.
- 3** With the measuring faces in close contact, take the reading.

8 Reading Measurements

The measurement value (C) is obtained by adding the vernier reading (B) that matches the main scale to the main scale reading (A) shown by the vernier zero graduation line.

■ For resolution: 0.05 mm



1 Take the main scale reading (A) shown by the vernier zero graduation line.

If the zero graduation line is between two graduations, read the smaller one. For example, if the zero graduation line is between 9 mm and 10 mm, read "9 mm".

$$A = 9 \text{ mm}$$

2 Read the vernier graduation (B) matching the main scale graduation.

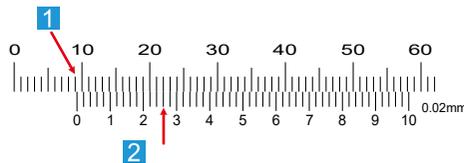
For example, if the third vernier graduation line matches the main scale graduation, read "Resolution x graduation = 0.05 x 3 = 0.15 mm".

$$B = 0.05 \text{ mm} \times 3 = 0.15 \text{ mm}$$

3 Add the main scale and vernier readings for the measurement value (C).

$$C = A + B = 9 \text{ mm} + 0.15 \text{ mm} = 9.15 \text{ mm}$$

■ For resolution: 0.02 mm



1 Take the main scale reading (A) shown by the vernier zero graduation line.

If the zero graduation line is between two graduations, read the smaller one. For example, if the zero graduation line is between 9 mm and 10 mm, read "9 mm".

$$A = 9 \text{ mm}$$

2 Read the vernier graduation (B) matching the main scale graduation.

For example, if the thirteenth vernier graduation line matches the main scale graduation, read "Resolution x graduation = 0.02 x 13 = 0.26 mm".

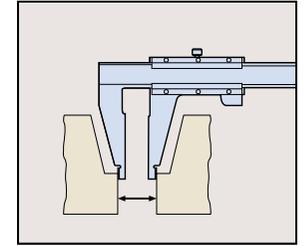
$$B = 0.02 \text{ mm} \times 13 = 0.26 \text{ mm}$$

3 Add the main scale and vernier readings for the measurement value (C).

$$C = A + B = 9 \text{ mm} + 0.26 \text{ mm} = 9.26 \text{ mm}$$

Tips

For those vernier calipers with a compensation value for inside measurement printed on the jaw, the measurement value (C) is obtained by adding the compensation value to the readings.



9 Precautions after Use

- If there is dirt on the measuring face, reference surfaces, sliding surface, etc., wipe it away with a dry cloth or a cloth slightly moistened with alcohol.
- For long-term disuse, wipe away any dirt carefully and apply a light coating of rust preventive oil before storage.
- Do not store in locations with high temperatures, low temperatures, high humidity, or exposure to direct sunlight.

10 Maximum Permissible Error of Indicated Values / Instrumental error

- (1) Maximum permissible error for the vernier caliper that is inscribed with JIS mark conforms to JIS B 7507:2016.
- (2) Permissible value of instrumental error for the vernier calipers other than (1) conforms to JIS B 7507-1993.
- (3) Maximum permissible error for the depth gage conforms to JIS B 7518.

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