

# Screw Gauge

## Introduction

Imagine the need to measure the thickness of a thin wire or the diameter of a small ball bearing with high accuracy. A common ruler won't do the job effectively. This is where a **screw gauge**, also known as a **micrometer screw gauge**, becomes essential. Used in physics and engineering labs, it provides extremely precise measurements, making it indispensable in scientific and industrial applications. In this article, we are going to discuss the working principle, construction, formulas, uses, and examples of a screw gauge.

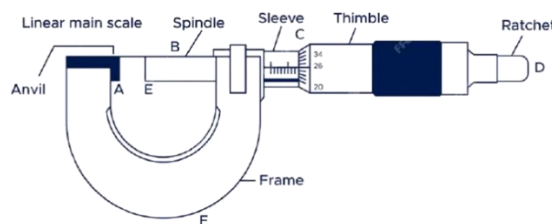
## Definition & Explanation of Screw Gauge

A screw gauge is a mechanical instrument employed to measure extremely small thickness or diameters, usually between 0.01 mm and 0.001 mm. It is based on the principle of screw's linear movement per rotation, where the rotation of a finely threaded screw causes accurate linear movement.



## Parts of a Screw Gauge

1. **Frame** – The C-shaped frame that supports the anvil and spindle.
2. **Anvil** – A fixed surface upon which the object rests.
3. **Spindle** – A sliding cylindrical rod moving towards the anvil.
4. **Sleeve (Main Scale)** – A stationary scale graduated in millimeters.
5. **Thimble (Circular Scale)** – Rotating scale, offering finer divisions.
6. **Ratchet Stop** – Used to avoid force application beyond its required limit and thereby ensures reading precision.
7. **Locking Device** – Prevents rotation of the spindle.



## Working Principle of a Screw Gauge

A screw gauge works on the principle of a screw's linear motion per rotation. As the thimble of the screw gauge is turned, the screw advances or recedes along its axis. The distance by which the screw travels with every complete turn is referred to as the pitch of the screw.

The screw gauge has two scales:

- Main Scale – A stationary linear scale graduated along the sleeve.
- Circular Scale – A rotating scale calibrated on the thimble.

By combining the main scale reading (which provides the whole millimeters) and the circular scale reading (which provides finer divisions), very accurate measurements for small objects like the thickness of a sheet or wire can be achieved. The resultant measurement is calculated through the formula:

$$\text{Final Reading} = \text{Main Scale Reading} + \left( \frac{\text{Circular Scale Reading} \times \text{Least Count}}{1} \right)$$

This mechanism allows for measurements with accuracy up to 0.01 mm, making the screw gauge an essential tool in laboratories, engineering, and manufacturing.

## Formulae Used in Screw Gauge Measurements

1. **Least Count (LC):** The smallest measurement a screw gauge can accurately record is given by:

$$\text{Least Count} = \frac{\text{Pitch}}{\text{Number of divisions on circular scale}}$$

Example: If pitch = 1 mm and the circular scale has 100 divisions,  $LC = \frac{1}{100} = 0.01 \text{ mm}$

2. **Total Reading:** Total Reading = Main Scale Reading + (Circular Scale Reading × Least Count)
3. **Zero Error and Zero Correction:**
  - If the zero mark of the circular scale is **above** the reference line, the error is **positive**.
  - If the zero mark is **below**, the error is **negative**.
  - The correction is applied accordingly to the total reading.

## Examples & Applications

**Example Calculation:** A student measures the thickness of a wire using a screw gauge:

Main Scale Reading = 2 mm

Circular Scale Reading = 45 divisions

Least Count = 0.01 mm

Zero Error = +0.02 mm (to be subtracted)

Total Reading:  $2 + (45 \times 0.01) - 0.02 = 2 + 0.45 - 0.02 = 2.43 \text{ mm}$

## Applications

- **Engineering:** Taking measurements of small parts in mechanical and automotive sectors.
- **Physics Experiments:** Finding wire thickness or small object diameters.
- **Medical Industry:** Taking precision parts measurements in surgical equipment.
- **Jewellery Making:** Maintaining accurate gold and silver thickness measurements.

## Comparison with Vernier Callipers

Feature	Screw Gauge	Vernier Callipers
Least Count	0.01 mm or better	0.1 mm
Measurement Range	Small objects (wires, sheets)	Larger objects (rods, cylinders)
Accuracy	Higher	Moderate
Ease of Use	Requires skill	Easier to use

## Conclusion

A screw gauge is a very accurate device employed in different scientific and industrial applications for measuring very small dimensions. By knowing its principle, construction, and calculations, one can get very accurate readings. It is very important for students, engineers, and researchers working with fine measurements to master this tool.

## Frequently Asked Questions (FAQs)

1. **What is the least count of a typical screw gauge?**

Most screw gauges have a least count of **0.01 mm**, but specialized versions can go up to **0.001 mm**.

2. **What is the function of the ratchet stop?**

The ratchet stop prevents excess force from being applied, thereby preventing deformation of the object and providing accurate measurement.

3. **How is zero error corrected in a screw gauge?**

When the zero mark gets misaligned, the final reading has a correction factor applied to it.

4. **Why is a screw gauge more precise than vernier callipers?**

With its finer pitch and larger number of divisions, a screw gauge offers a better resolution than a vernier calliper.