

# LINEAR & ANGULAR MEASUREMENTS

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Course : Metrology & Measurements

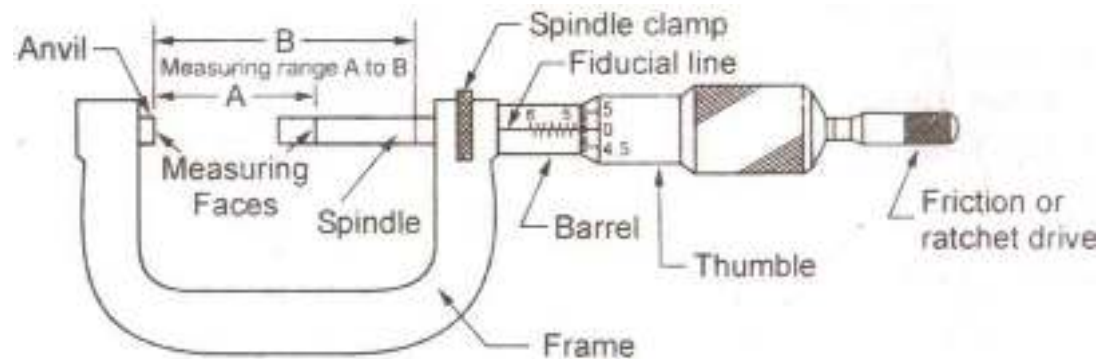


# MICROMETERS

Micrometer is one of the most widely used precision instruments. It is primarily used to measure external dimensions like diameters of shafts, thickness of parts etc. to an accuracy of 0.01 mm.

The essential parts of the instruments consist of

- (a) Frame
- (b) Anvil and spindle
- (c) Screwed spindle
- (d) Graduated sleeve or barrel
- (e) Thimble
- (f) Ratchet or friction stop
- (g) Spindle clamp





# MICROMETERS TERMS

## **Backlash**

It is the lack of motion or lost motion of the spindle when the rotation of thimble is changed in direction.

## **Measuring Range**

It is the total travel of the measuring spindle for a given micrometer.

## **Cumulative Error**

It is the deviation of measurement from the nominal dimension determined at any optional point of the measuring range. It includes the effect of all possible individual errors such as errors of the thread, errors of measuring faces etc. It can be determined by using slip gauges.





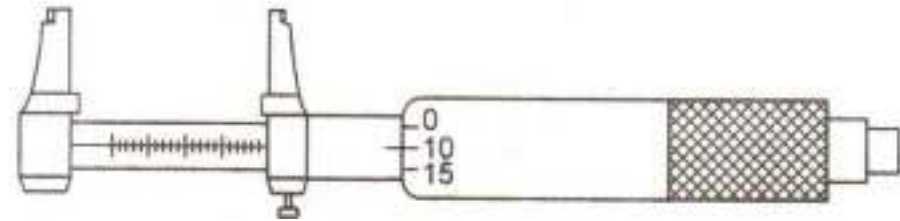
# LINEAR MEASUREMENTS

## Inside Micrometer

The inside micrometer is intended for internal measurement to an accuracy of 0.001 mm. In principle, it is similar to an external micrometer and is used for measuring holes with a diameter over 50 mm.

It consists of :

- (a) measuring unit
- (b) extension rod with or without spacing collar, and
- (c) handle.

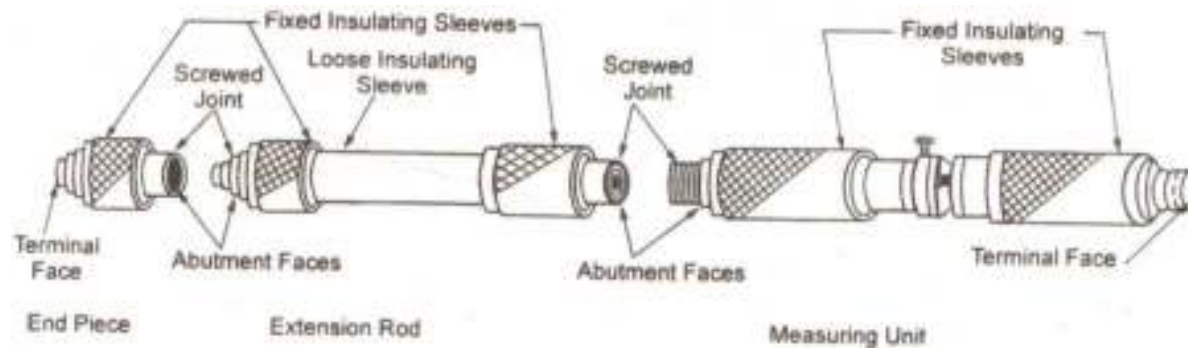




# LINEAR MEASUREMENTS

## Stick Micrometers

- Stick micrometers are used for measurement of longer internal length. A series of extension rods will permit continuous range of measurement up to the required length.
- It is connected with a 150 mm or 300 mm micrometer unit fitted with a micrometer of 25 mm range and having rounded terminal faces.

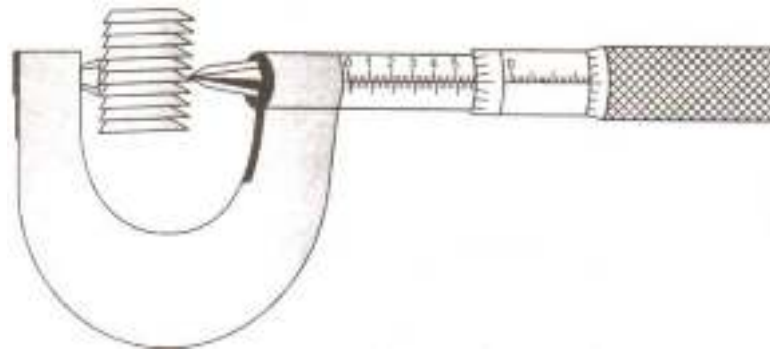




# LINEAR MEASUREMENTS

## Screw Thread Micrometer Caliper

▪The shape of a Screw thread Micrometer is more or less like an ordinary micrometer with the difference that it is equipped with a pointed spindle and a double V-anvil, both correctly shaped to contact the screw thread of the work to be gauged.



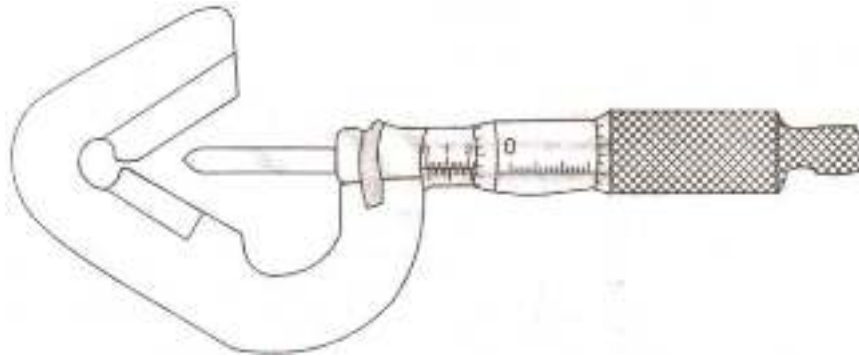


# LINEAR MEASUREMENTS

## V-anvil Micrometer Caliper

This is a special purpose micrometer used for checking out-of-roundness condition in centre less grinding and machining operations, odd-fluted taps, milling cutters, reamers etc.

## Blade Type Micrometer

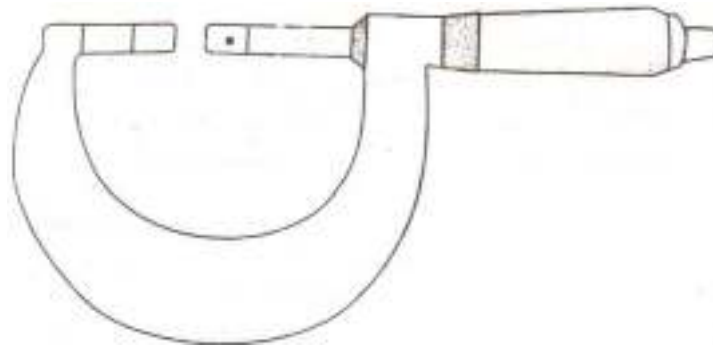




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## Blade Type Micrometer

- It is ideally suited for fast and accurate measurement of circular formed tools, diameters and depth of all types of narrow grooves, slots, keyways, recesses etc.
- It has non-rotating spindle which advances to contact the work without rotation.







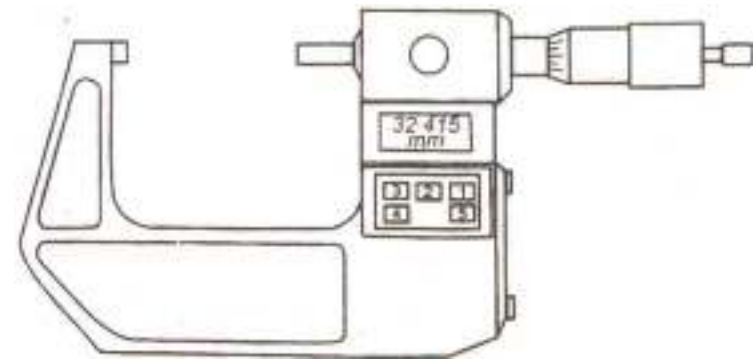
[How to Read a Vernier Micrometer \(how to use a Mitutoyo micrometer\) - YouTube](#)



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## Digital Micrometer

- Digital micrometer is capable of giving direct reading up to 0.001 mm.
- The spindle thread is hardened, ground and lapped in this type of micrometers.
- The positive locking clamp ensures locking of spindle at any desired setting.
- Operation is very simple with push button controls for “Zero” reset and indication hold”.

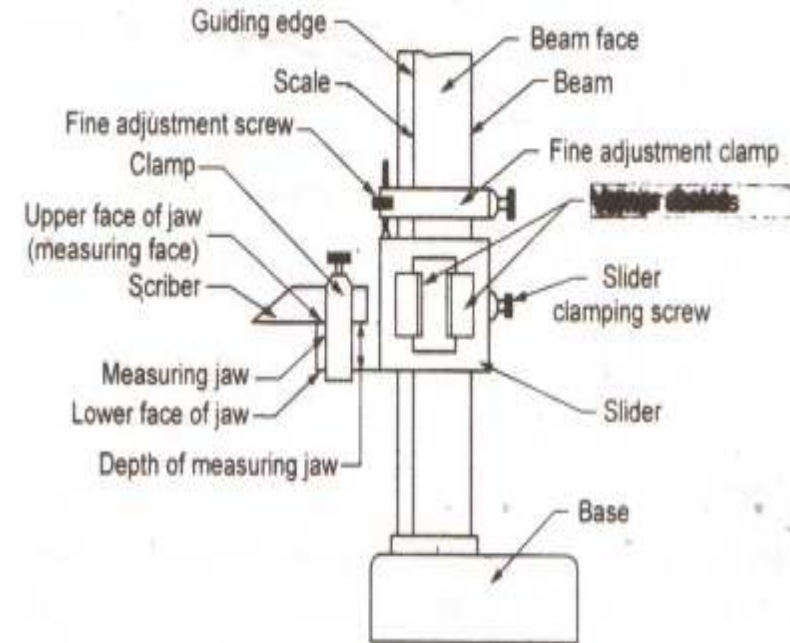




# LINEAR MEASUREMENTS

## Height Gauge

- This also uses the same principle of vernier caliper and is used especially for the measurement of height. It is equipped with a special base block, sliding jaw assembly and a removable clamp.
- The upper and lower surfaces of the measuring jaws are parallel to the base, which make possible to measure both over and under surfaces.





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## Slip Gauges

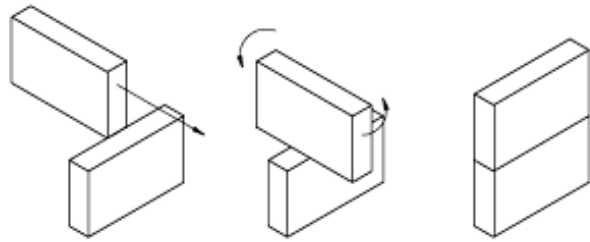
- Slip gauges are rectangular blocks of steel having a cross-section of about 30 by 10 mm.
- The essential purpose of slip gauges is to make available end standards of specific lengths by temporarily combining several individual elements, each representing a standard dimension, into a single gauge bar.





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- The combination is made by pressing the faces into contact and then imparting a small twisting motion while maintaining the contact pressure. This is called wringing.
- Wringing occurs due to molecular adhesion between a liquid film (thickness about  $6\ \mu\text{m}$  to  $7\ \mu\text{m}$ ) and the mating surface.



*Wringing of Slip Gauges*

Range	Step	Pieces
1.001 to 1.009	0.001	9
1.01 to 1.09	0.01	9
1.1 to 1.9	0.1	9
1 to 9	1	9
10 to 90	10	9
Total		45



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## **Selection of Slip Gauges**

Standard procedure is followed in selecting slip gauges. It should be such that minimum number of slip gauges is chosen for combination of blocks depending on the type of set available.



[Slip Gauges, and Setting a Quick Change Tool Post to Centre Height - YouTube](#)



# REFERENCES

1. Gupta. I.C., "Engineering Metrology", Dhanpatrai Publications, 2005.
2. Jain R.K. "Engineering Metrology", Khanna Publishers, 2009.

