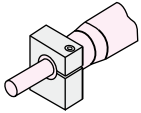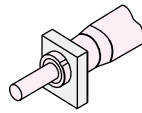# ✎ Micrometer Heads

Key Factors in Selection

Key factors in selecting a micrometer head are the measuring range, spindle face, stem, graduations, thimble diameter, etc.

### ■ Stem

Plain stem   Stem with clamp nut

- The stem used to mount a micrometer head is classified as a "plain type" or "clamp nut type" as illustrated above. The stem diameter is manufactured to a nominal Metric or Imperial size with an h6 tolerance.
- The clamp nut stem allows fast and secure clamping of the micrometer head. The plain stem has the advantage of wider application and slight positional adjustment in the axial direction on final installation, although it does requires a split-fixture clamping arrangement or adhesive fixing.
- General-purpose mounting fixtures are available as optional accessories.

■ Measuring Face
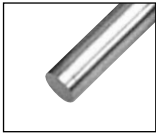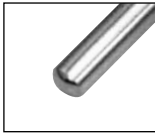
Flat face   Spherical face   Anti-rotation device

- A flat measuring face is often specified where a micrometer head is used in measurement applications.
- When a micrometer head is used as a feed device, a spherical face can minimize errors due to misalignment (Figure A). Alternatively, a flat face on the spindle can bear against a sphere, such as a carbide ball (Figure B).
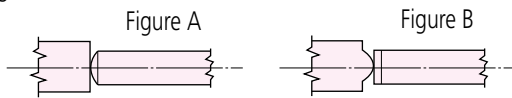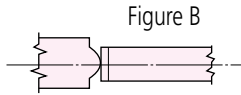
Figure A   Figure B

- A non-rotating spindle type micrometer head or one fitted with an anti-rotation device on the spindle (Figure C) can be used if a twisting action on the workpiece must be avoided.
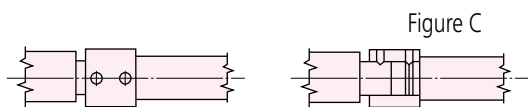
Figure C

- If a micrometer head is used as a stop then a flat face both on the spindle and the face it contacts provides durability.

■ Non-Rotating Spindle

A non-rotating spindle type head does not exert a twisting action on a workpiece, which may be an important factor in some applications.

■ Spindle Thread Pitch

- The standard type head has 0.5mm pitch.
- 1mm-pitch type: quicker to set than standard type and avoids the possibility of a 0.5mm reading error. Excellent load-bearing characteristics due to larger screw thread.
- 0.25mm or 0.1mm-pitch type
  This type is the best for fine-feed or fine-positioning applications.

■ Constant-force Device

- A micrometer head fitted with a constant-force device (ratchet or friction thimble) is recommended for measurement applications.
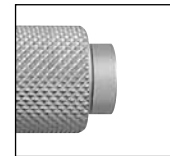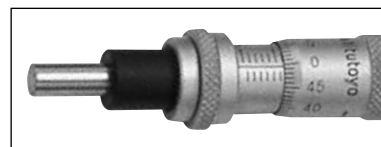

Micrometer head with   Micrometer head without
constant-force device   constant-force device (no ratchet)

- If using a micrometer head as stop, or where saving space is a priority, a head without a ratchet is probably the best choice.

■ Spindle Lock

- If a micrometer head is used as a stop it is desirable to use a head fitted with a spindle lock so that the setting will not change even under repeated shock loading.

■ Measuring Range (Stroke)

● When choosing a measuring range for a micrometer head, allow an adequate margin in consideration of the expected measurement stroke. Six stroke ranges, 5 to 50mm, are available for standard micrometer heads.

● Even if an expected stroke is small, such as 2mm to 3mm, it will be cost effective to choose a 25mm-stroke model as long as there is enough space for installation.

● If a long stroke of over 50mm is required, the concurrent use of a gauge block can extend the effective measurement range. (Figure D)

Gauge block   Figure D

Head's stroke

Obtained stroke
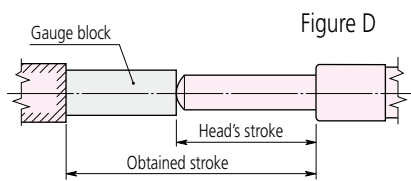
■ Ultra-fine Feed Applications

● Dedicated micrometer heads are available for manipulator applications, etc., which require ultra-fine feed or adjustment of spindle.

■ Thimble Diameter

● The diameter of a thimble greatly affects its usability and the "fineness" of positioning. A small-diameter thimble allows quick positioning whereas a large-diameter thimble allows fine positioning and easy reading of the graduations. Some models combine the advantages of both features by mounting a coarse-feed thimble (speeder) on the large-diameter thimble.
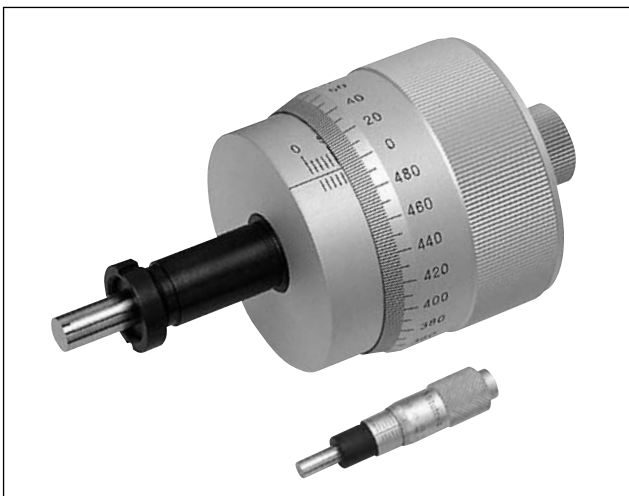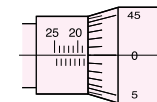

■ Graduation Styles

● Care is needed when taking a reading from a mechanical micrometer head, especially if the user is unfamiliar with the model.

● The "normal graduation" style, identical to that of an outside micrometer, is the standard. For this style the reading increases as the spindle retracts into the body.

● On the contrary, in the "reverse graduation" style the reading increases as the spindle advances out of the body.

● The "bidirectional graduation" style is intended to facilitate measurement in either direction by using black numerals for normal, and red numerals for reverse, operation.

● Micrometer heads with a mechanical or electronic digital display, which allow direct reading of a measurement value, are also available. These types are free from misreading errors. A further advantage is that the electronic digital display type can enable computer-based storage and statistical processing of measurement data.
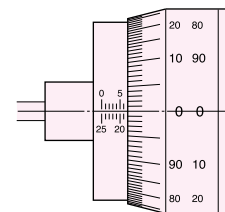
Normal
graduation style
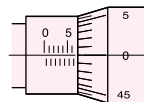
Reverse
graduation style
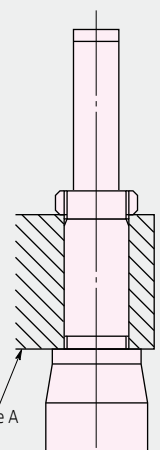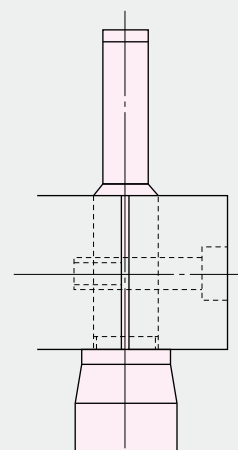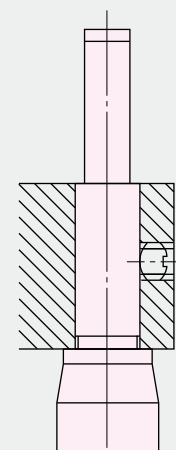

Bidirectional
graduation style

✎ Micrometer Heads

■ Guidelines for Self-made Fixtures

A micrometer head should be mounted by the stem in an accurately machined hole using a clamping method that does not exert excessive force on the stem. There are three common mounting methods as shown below. Method 3 is not recommended. Adopt methods (1) or (2) wherever possible.

(Unit: mm)

Mounting method	(1) Clamp nut				(2) Split-body clamp				(3) Setscrew clamp			
Points to keep in mind	Face A											
Stem diameter	ø9.5	ø10	ø12	ø18	ø9.5	ø10	ø12	ø18	ø9.5	ø10	ø12	ø18
Mounting hole Fitting tolerance	G7 +0.006 to +0.024		G7 +0.005 to +0.020		G7 +0.005 to +0.020		G7 +0.006 to +0.024		H5 0 to +0.006		H5 0 to +0.008	
Precautions	Care should be taken to make Face A square to the mounting hole. The stem can be clamped without any problem at squareness within 0.16/6.5.				Remove burrs generated on the wall of the mounting hole by the slitting operation.				M3x0.5 or M4x0.7 is an appropriate size for the setscrew. Use a brass plug under setscrew (if thickness of fixture allows) to avoid damaging stem.			

■ Maximum Loading Capacity on Micrometer Heads

The maximum loading capacity of a micrometer head depends mainly on the method of mounting and whether the loading is static or dynamic (used as a stop, for example). Therefore the maximum loading capacity of each model cannot be definitively specified. The loading limits recommended by Mitutoyo (at less than 100,000 revolutions if used for measuring within the guaranteed accuracy range) and the results of static load tests using a small micrometer head are given below.
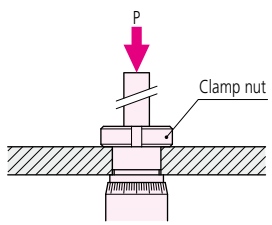
1. Recommended maximum loading limit

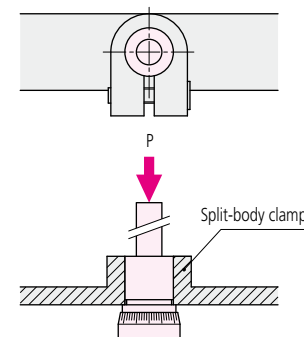|		Maximum loading limit
Standard type	(spindle pitch: 0.5mm)	Up to approx. 4kgf *
High-functionality type	Spindle pitch: 0.1mm/0.25mm	Up to approx. 2kgf
	Spindle pitch: 0.5mm	Up to approx. 4kgf
	Spindle pitch: 1.0mm	Up to approx. 6kgf
	Non-rotating spindle	Up to approx. 2kgf
	MHF micro-fine feed type (with a differential mechanism)	Up to approx. 2kgf

* Up to approx. 2kgf only for MHT

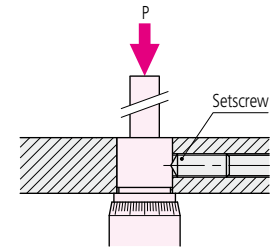### 2. Static load test for micrometer heads (using MHS for this test)

(1) Clamp nut

P

Clamp nut

(2) Split-body clamp

P

P

Split-body clamp

(3) Setscrew clamp

P

Setscrew

Test method
Micrometer heads were set up as shown and the force at which the head was damaged or pushed out of the fixture when a static load was applied, in direction P, was measured. (In the tests no account was taken of the guaranteed accuracy range.)
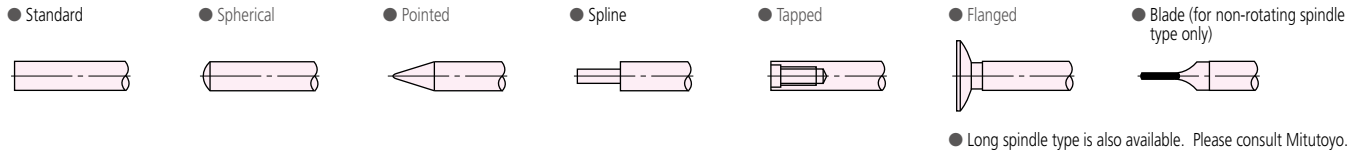
Mounting method	Damaging/dislodging load*
(1) Clamp nut	Damage to the main unit will occur at 8.63 to 9.8kN (880 to 1000kgf).
(2) Split-body clamp	The main unit will be pushed out of the fixture at 0.69 to 0.98kN (70 to 100kgf).
(3) Setscrew clamp	Damage to the setscrew will occur at 0.69 to 1.08kN (70 to 110kgf).

* These load values should only be used as an approximate guide.

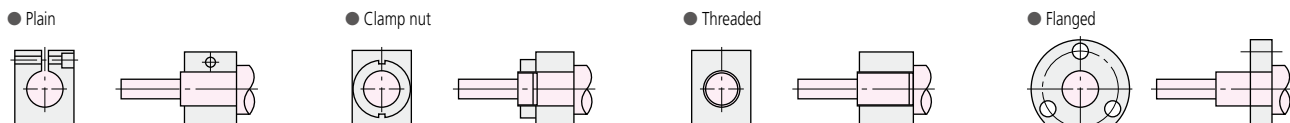# ■ Custom-built Products (Product Example Introductions)

Micrometer heads have applications in many fields of science and industry and Mitutoyo offers a wide range of standard models to meet customers' needs. However, in those cases where the standard product is not suitable Mitutoyo can custom build a head incorporating features better suited to your special application. Please feel free to contact Mitutoyo about the possibilities - even if only one custom-manufactured piece is required.

1. Spindle-end types

● Standard   ● Spherical   ● Pointed   ● Spline   ● Tapped   ● Flanged   ● Blade (for non-rotating spindle type only)

● Long spindle type is also available. Please consult Mitutoyo.

2. Stem types

A custom stem can be manufactured to suit the mounting fixture.

● Plain   ● Clamp nut   ● Threaded   ● Flanged

3. Scale graduation schemes

Various barrel and thimble scale graduation schemes, such as reverse and vertical, are available. Please consult Mitutoyo for ordering a custom scheme not shown here.
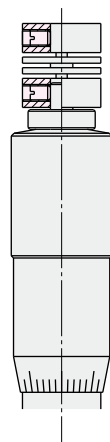
● Standard   ● Reverse   ● Vertical

● Reverse vertical   ● Offset zero   ● Graduations only
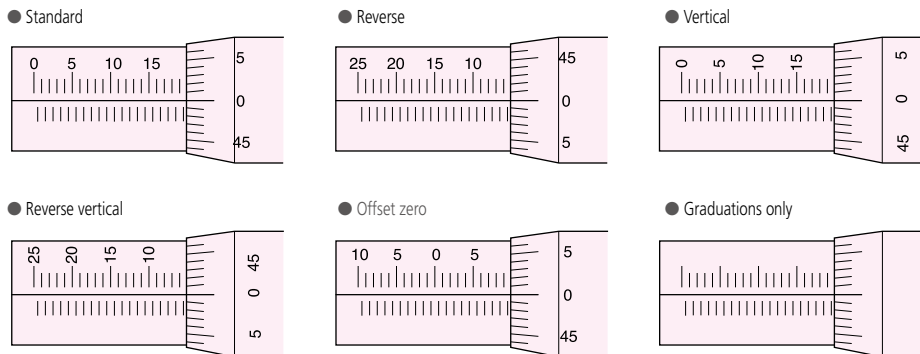
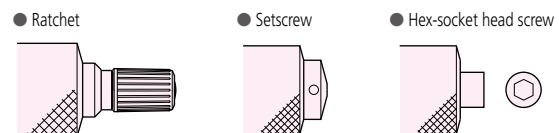## 4. Logo engraving

A specific logo can be engraved as required.

5. Motor Coupling

Couplings for providing motor drive to a head can be designed.

6. Thimble mounting

Thimble mounting methods including a ratchet, setscrew, and hex-socket head screw types are available.

● Ratchet   ● Setscrew   ● Hex-socket head screw

7. Spindle-thread pitch

Pitches of 1mm for fast-feed applications or 0.25mm for fine-feed can be supplied as alternatives to the standard 0.5mm. Inch pitches are also supported. Please consult Mitutoyo for details.

8. Lubricant for spindle threads

Lubrication arrangements can be specified by the customer.

9. All-stainless construction

All components of a head can be manufactured in stainless steel.

10. Simple packaging

Large-quantity orders of micrometer heads can be delivered in simple packaging for OEM purposes.