OUTSIDE MICROMETERS

Definition
Micrometer for external measurements (EN ISO 3611)
“Measuring instrument which gives the evaluation of a dimensional quantity of an external feature of a workpiece on the basis of movement of a spindle with a measuring face, moving relatively to a material measure and an anvil, with the movement generated by a screw thread.”

Application
One-handed operation with QuantuMike, a ratched thimble micrometer. This is a micrometer with a 2 mm spindle pitch, offering movement four times as fast as a standard micrometer. This is a micrometer with a 2 mm spindle pitch, offering movement four times as fast as a standard micrometer.

Application in a micrometer stand. Keeps both hands free for operating the micrometer and positioning the workpiece.

Standard
EN ISO 3611
Geometrical product specifications (GPS) – dimensional measuring equipment: Micrometers for external measurements – design and metrological characteristics.

How to Read an Analog Micrometer
Micrometer with standard scale (graduation: 0.01 mm)
The thimble scale can be read directly to 0.01 mm, as shown above, but may also be estimated to 0.001 mm when the lines are nearly coincident because the line thickness is 1/5 of the spacing between them.

Parallax Error
Look directly at the fiducial line when taking a reading against the thimble graduations. If the graduations are viewed from an angle, the reading will be incorrect due to parallax error.

Measuring Force Control
To promote consistent and accurate measurement, it is recommended that the ratchet mechanism is used (if fitted) so that the measuring force is held constant. Operating the ratchet three times between finger and thumb is sufficient.

Dedicated Micrometers (Sample Assortment)

Type | One-handed operation | Remarks
--- | --- | ---
Ratchet stop | Unsuitable | Audible clicking operation causes micro-shocks
Ratchet thimble | Suitable | Audible operation provides confirmation of constant measuring force

Zero setting of analog micrometer
If the error is ±0.01 mm. Clamp the spindle and use the key spanner to turn the sleeve with the fiducial line to zero position of the thimble.

Calibration
For micrometers gauge blocks or gauge block combinations should be selected. Refer to EN ISO 3611, the following gauge blocks are suitable for micrometer thread pitches of 0.5 mm and 1 mm.

<table>
<thead>
<tr>
<th>Block allocation</th>
<th>2.5 mm</th>
<th>5.1 mm</th>
<th>7.6 mm</th>
<th>10.2 mm</th>
<th>12.7 mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.05 mm</td>
<td>±15 μm</td>
<td>±15 μm</td>
<td>±15 μm</td>
<td>±15 μm</td>
<td>±15 μm</td>
</tr>
<tr>
<td>0.10 mm</td>
<td>±25 μm</td>
<td>±25 μm</td>
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<td>±25 μm</td>
</tr>
<tr>
<td>0.15 mm</td>
<td>±30 μm</td>
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**Definition**

Electronic digital-indicator gauge (EN ISO 13102)

“Measuring instrument in which the axial displacements of a plunger are obtained by a transducer and converted into an electronic signal by suitable electronic means and transmitted to a physically integrated digital display.” (1)

Mechanical dial gauge (dial indicator) (EN ISO 463)

“Measuring instrument in which the axial displacements of a plunger are transmitted and magnified by suitable mechanical means to a pointer which rotates in front of an analogue circular scale. It may also be provided with a revolution-counting device, e.g. in which a pointer rotates in front of a scale which indicates the number of revolutions of the pointer or the axial displacement of the plunger.” (2)

**Application**

Multifunction digital indicator in a gauge stand

**Standard**

EN ISO 13102

Geometrical product specifications (GPS) – dimensional measuring equipment: Electronic digital indicator – design and metrological characteristics.

EN ISO 463

Geometrical product specifications (GPS) – dimensional measuring equipment: Dial gauges – design and metrological characteristics.

**Mounting an Indicator**

<table>
<thead>
<tr>
<th>Mounting method</th>
<th>Example</th>
</tr>
</thead>
</table>
| Clamping the stem directly with a screw | ![](mounting_method_example)
| Clamping the stem by split-clamp/locking | ![](mounting_method_example)

**Tolerance Judgment**

Tolerance judgment with pointer and limit indicators

**Different Dials**

- Scale graduation: 0.01 mm
- Scale graduation: 0.001 mm

**Spindle Lifting Function**

Spindle lifting lever

Spindle lifting knob

Spindle lifting cable

Spindle lifting handle

**Instructions of Application**

Correct mounting: To maintain a minimum measuring circuit (prevent applied forces), the dial indicator should be clamped as close as possible to the stand column.

**Calibration**

It is recommended to use an gauge calibration equipment (I-Checker) with software support. The calibration should evaluate the performance of the indicators within the measuring range using both directions of displacement of the plunger.

**One Revolution Dial Indicator**

Tolerance judgment ± NG / GO red / green LCD backlight

Should the workpiece be approx. 1 mm larger than nominal dimension, the part is assessed as good if the smaller pointer is ignored. Fault-free identification of rejects. If the workpiece is approx. 1 mm larger or smaller the pointer goes to the red area of the dial.
GAUGE BLOCKS

Definition
Gauge blocks are used for setting and calibrating measuring instruments and are the most important means for connection to the length unit meter at company level. They embody a certain length with a high degree of accuracy – hence the term material measure.

Application
Checking the accuracy of measuring tools

Setup of measuring devices

Standard
EN ISO 3650
Geometrical product specifications (GPS) – length standards – gauge blocks

Certificates
ILAC
The International Laboratory Accreditation Cooperation is an international cooperation of laboratory and inspection accreditation bodies. The member bodies signed the ILAC Mutual Recognition Arrangement (MRA) which guarantees a cross approval of certificates from accredited laboratories from other countries. Signatories to the ILAC arrangement are almost all European countries.

JCSS
Mitutoyo gauge block sets can be delivered with a JCSS certificate of calibration (Japan Calibration Service System). A JCSS certificate of calibration is comparable to a Certificate of Calibration in the Member Bodies of the ILAC System. A JCSS certificate of calibration is comparable to a Certificate of Calibration in the Member Bodies of the ILAC System. A JCSS certificate of calibration is comparable to a Certificate of Calibration in the Member Bodies of the ILAC System. A JCSS certificate of calibration is comparable to a Certificate of Calibration in the Member Bodies of the ILAC System. A JCSS certificate of calibration is comparable to a Certificate of Calibration in the Member Bodies of the ILAC System. A JCSS certificate of calibration is comparable to a Certificate of Calibration in the Member Bodies of the ILAC System.

Grade and Application


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<td>Checking the accuracy of instruments</td>
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<tr>
<td>K or 0</td>
<td>Checking the accuracy of gauges for inspection</td>
</tr>
<tr>
<td>1</td>
<td>Calibrating instruments</td>
</tr>
<tr>
<td>2</td>
<td>Manufacturing gages</td>
</tr>
</tbody>
</table>

Building up a Stack

When building up a stack (e.g. 55.826 mm) don’t pick the big blocks first by working on the first digit. That way is harder and you may run out of combinations. Work from right to left by obtaining the last digit first. The last digit in this case is 6, so pick 1.006 mm. Work through the rest of the dimension by picking the largest blocks that fit the next digit(s), as shown.

Perfect Wringing of Gauge Blocks

Wringing should always be performed in a clean place on a soft pad. If gauge blocks slip from your hand, they will not be damaged.

Wipe off the oil film from the gauge blocks using a soft cloth and petroleum ether.

After this “rough” cleaning the surfaces are cleaned with a cosmetic brush mixed with petroleum ether and then “blown free” with an air blower.

Never use alcohol or common benzine for cleaning. Common benzine contains too many impurities and alcohol always leaves aqueous components which may cause corrosion.

Best-suited for wiping gauge blocks are microfiber cloths.

Check the cleaned gauge blocks for rust and scratches.

If there are any burrs on the measuring surface remove them carefully using a special ceraston for gauge blocks. Move the dry gauge block over the ceraston exerting very low pressure.

In case the measuring surfaces are in good condition, but wringing is still difficult, you may wipe them with medical cotton wool. Its oily components will improve the grip of the measuring surfaces.

Advantages of Ceramic Gauge Blocks

1. Corrosion resistant
   Anti-corrosion treatment is not required when handled normally (i.e. with fingers, resulting in simple maintenance and storage).

2. No burns caused by dents, etc.
   Since the CERA Blocks are very hard, they will not scratch and are highly resistant to burns. If a dent is formed, it can easily be removed with a ceramic/deraudion stone (ceration).

3. Abrasion resistant
   CERA Blocks have 10 times the abrasion resistance of steel gauge blocks.

Wear Resistance of Different Materials

- CERA Block
  - Abrasion resistant
  - Tungsten carbide
  - Carbide
  - Tungsten carbide
  - Carbide
  - Carbide

Temperature Characteristics of Different Materials

- CERA Block
  - High wear resistance
  - High wear resistance
  - High wear resistance
  - High wear resistance

9. Highly resistant to dropping and impact
   The CERA Block material is one of the toughest ceramics. It is extremely difficult to crack a CERA Block in normal use.

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This is a clear advantage. The gauge blocks should have a coefficient close to that of the measuring instrument. Otherwise there would be an error due to different amounts of thermal expansion, e.g. under workshop conditions.

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