Straightness, Angle and Inclination Measurement
INCLINOMETERS AND PRECISION LEVELS

Irrespective of whether they are spirit or electronic inclinometers, all precision levels are based on the same perfectly reliable reference but also cost-free: the centre of the earth’s gravity.

Under the force of gravity, the gas bubble in the liquid or the pendulum inclines itself according to this natural physical principle.

The position of the pendulum with respect to the measuring faces of the instrument body can then be measured. Based on this perfect principle, these instruments offer a great number of measuring applications of high precision. The horizontal and vertical positioning of the measuring faces enable the detection of form errors in the geometrical elements on the workpiece to be measured. These errors often result from deviations in straightness, flatness, position, parallelism and squareness.

Indication of values may vary depending on the type of level, the values typically displayed are:
- inclination (mm/m or in/10 in);
- radian in mrad;
- decimal angle (e.g. 12,37°);
- sexagesimal angle in degrees (°), minutes (’) and seconds (”) e.g. 15° 30’ 45’’. 

TESA MICROBEVEL 1  TESA CLINOBEVEL 1 USB  TESA CLINOBEVEL 2  TESA NIVELTRONIC  Spirit clinometers with angle protractor
MULTIPLE APPLICATIONS ARE POSSIBLE, NOTABLY THE MEASUREMENT OF 2 FLAT SURFACES BY COMPARING THE MEASURED VALUES WITH THE HELP OF 2 INSTRUMENTS. AUTOMATIC GENERATION OF INSPECTION REPORTS USING MICROSOFT EXCEL SPREADSHEET SOFTWARE.

INCLINOMETERS AND LEVELS
The TESA inclinometers and levels meet the most demanding applications not only in the machine building sector but also in the civil construction sector.

Electronic Inclinometer - TESA CLINOBELVE 1 USB
Compact universal instrument for direct and differential measurements – Measuring range ±45° with display of measured angles or inclinations – Reinforced aluminium housing, eloxide surface – Large digital display for error free interpretation of readings.

Supplied with CLINOSOFT software permitting the visualisation and storage of measurements as well as the USB cable to host computer.

CLINOBELVE 1-USB, can be used on its 4 faces.
**TESA CLINOBEVEL 2 Electronic Inclinometer**

Portable precision inclinometer.

Measuring range ±45° with indication of angle or inclination. Integrated temperature compensation 2 prismatic measuring faces. Spirit level integrated in transverse direction to eliminate "twist" error. Simple and rapid calibration: correction of gain by the 3-point method and software integrated in the instrument. Microprocessor-based features for display setting and instrument adjustment.

The CLINOBEVEL 2 can be used on its two reference faces. It can also be connected to a second CLINOBEVEL 2 instrument for a differential measurement (Comparative): one of the two instruments operates as a reference without the need to connect to a computer. The integrated RS 232 interface enables the connection of the instrument to a computer. Magnetic inserts can be integrated on the measuring faces on request as a special execution.

When 2 CLINOBEVEL 2 are connected, one of the instruments becomes the reference.

<table>
<thead>
<tr>
<th>No.</th>
<th>Description</th>
<th>±45°</th>
<th>≥ 5° (5 Arcsec = 0,025 mm/mm)</th>
<th>mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>05330202</td>
<td>Electronic Inclinometer TESA CLINOBEVEL 2</td>
<td>±45°</td>
<td>≥ 5° (5 Arcsec = 0,025 mm/mm)</td>
<td>100 x 150 x 35</td>
</tr>
</tbody>
</table>

**OPTIONAL ACCESSORIES:**
- 04768002: 4 batteries LRC 6 AA, 1,5 V for CLINOBEVEL 1 USB, CLINOBEVEL 2, MICROBEVEL
- 05360004: Connecting cable between 2 CLINOBEVEL 2, L = 2,5 m
- SS3070174: Câble USB pour CLINOBEVEL 2, L=2,5 m

**Specifications:**
- **DIN 2276 Part 2 (Form D)**
- LCD angle display: Decimal or sexagesimal
- Inclination: mm/m, in/10 or 10 in, mm or in/ basis length, radian (mrad) and the like
- Capacitive measuring system with gravity pendulum
- 10° +0,03 % of the readout
- 2 flat measuring faces with V-slot for diameters from Ø 17 to 94 mm
- 150 x 150 x 35 mm
- Rust inhibiting housing
- Response time: < 5 s
- Automatic shut down after 8 min
- RS 232 asynchronous. 7 bits, 2 stop bits, no parity, 9600 bauds
- 2 batteries 1,5 V, type LRC 6, AA
- 40 to 60 hours
- 0 to 40°C
- -20 to 70°C
- IP65 (IEC 60529)
- EN 50081-1 / -2
- EN 50082-1 / -2
- 3 kg
- Plastic case
- Identification number
- Declaration of conformity
**TESA MICROBEVEL 1 Inclinometer**

TESA MICROBEVEL 1 is particularly suited for measuring slightly inclined surfaces such as the measuring of flatness of surfaces or the geometrical characteristics (deviation, rotation etc.) of a machine tool.

Suited for operation under the most rugged conditions, protected by an aluminium case.

Power supplied by a single standard battery AA 1,5 V for at least 100 hours of operation.

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Models with steps 0,05 to 0,005 mm/m available on request

<table>
<thead>
<tr>
<th>No.</th>
<th>Range 1 or Range 2, mm/m</th>
<th>Base width, mm</th>
<th>Base height, mm</th>
<th>kg (with transport case)</th>
</tr>
</thead>
<tbody>
<tr>
<td>05330003</td>
<td>TESA MICROBEVEL 1 horizontal base 110 x 45 mm</td>
<td>0,01 ou 0,001</td>
<td>110</td>
<td>45</td>
</tr>
<tr>
<td>05330004</td>
<td>TESA MICROBEVEL 1 horizontal base 150 x 45 mm</td>
<td>0,01 ou 0,001</td>
<td>150</td>
<td>45</td>
</tr>
<tr>
<td>05330005</td>
<td>TESA MICROBEVEL 1 square base 150 x 45 mm</td>
<td>0,01 ou 0,001</td>
<td>150</td>
<td>45</td>
</tr>
</tbody>
</table>

**OPTIONAL ACCESSORY:**

<table>
<thead>
<tr>
<th>No.</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0478002</td>
<td>4 batteries LRC 6 AA, 1,5 V for CLINOBHEVEL 1 USB, CLINOBHEVEL 2, MICROBEVEL,</td>
</tr>
</tbody>
</table>

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**Specifications:**

- **Response time:** < 3 s
- **Automatic shut down after 55 min**
- 1 mV per unit (100 kΩ)
- 1,5 V battery, type LRC 6, AA
- 100 to 140 hours
- ≤ 0.1 °C/°C based on the measuring range at 20 °C ± 5 °C
- 0 to 40°C
- -20 to 70°C
- EN 50081-1 / -2
- EN 50082-1 / -2
- According to table, inclusive case
- Plastic case
- Identification number
- Declaration of conformity

**Flatness:**

- ≤ 5 mm/m: G = 1 % of the measured value and min. 0,01 mm/m
- > 5 mm/m: G = 0,01 mm/m

<table>
<thead>
<tr>
<th>Range</th>
<th>Flatness</th>
<th>G = mm/m</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>≤ 5</td>
<td>0,01</td>
</tr>
<tr>
<td>2</td>
<td>≤ 2</td>
<td>0,001</td>
</tr>
</tbody>
</table>

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**Parameters:**

- **Base width:**
- **Base height:**
- **kg (with transport case):**

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Horizontal model

Square model
**TESA NIVELTRONIC Electronic Levels with Analogue Display and Integrated Galvanometer**

Electronic levels with analogue display and integrated galvanometer. These instruments are known for a remarkable stability at zero point. They are used for the inspection and alignment of horizontal and vertical surfaces. They are also suitable for the measurement of slight inclinations, specially for the inspection of flatness of granite surface plates.

The square model is particularly suited for the measurement of flat or cylindrical parts thanks to its prismatic base.

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**NIVELTRONIC square model with 2 prismatic bases**

**NIVELTRONIC horizontal model with flat base**

**NIVELTRONIC horizontal with granite base**

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<table>
<thead>
<tr>
<th>No.</th>
<th>Description</th>
<th>Range</th>
<th>mm/m</th>
<th>°</th>
<th>mm/m</th>
<th>°</th>
</tr>
</thead>
<tbody>
<tr>
<td>03130063</td>
<td>TESA NIVELTRONIC electronic level, horizontal, analogue display</td>
<td>1</td>
<td>±0.75</td>
<td>±150</td>
<td>0.05</td>
<td>10°</td>
</tr>
<tr>
<td>03130060</td>
<td>TESA NIVELTRONIC electronic level, square, analogue display</td>
<td>2</td>
<td>±0.15</td>
<td>±30</td>
<td>0.01</td>
<td>2°</td>
</tr>
</tbody>
</table>

* With/without wooden case

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**OPTIONAL ACCESSORIES:**

- **03160007** Granite base 200 x 50 mm for horizontal NIVELTRONIC**
- **03160008** Granite base 250 x 50 mm for horizontal NIVELTRONIC**
- **03160009** Granite base 500 x 50 mm for horizontal NIVELTRONIC**
- **03160048** Holder with voltage regulator (4.65 V) and 4x LR03 AAA for NIVELTRONIC
- **04761059** 4 batteries LR03 AAA, 1.5 V for NIVELTRONIC

**For horizontal model**
**TESA Crossed Spirit Levels – for Assembly**

For the inspection and alignment of flat surfaces.

The 2 vials permit a simultaneous alignment in the X and Y axes.

The level can be screwed on to a surface.

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**Model B: Circular level with cross vials, 3-point mounting. Aluminium alloy protection case, anodised.**

**Model C: T-shaped level with cross vials, 2-point mounting. Manually lapped measuring base to ensure a much higher precision of the level.**

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**Table:**

<table>
<thead>
<tr>
<th>No.</th>
<th>Description</th>
<th>Accuracy</th>
<th>Diameter</th>
<th>Length</th>
<th>Width</th>
<th>Height</th>
</tr>
</thead>
<tbody>
<tr>
<td>05331500</td>
<td>Level, 2 vials, 2 to 5 mm/m, Ø 40</td>
<td>2 ÷ 5</td>
<td>Ø 40</td>
<td>11</td>
<td></td>
<td></td>
</tr>
<tr>
<td>05331502</td>
<td>Level, 2 vials, 0.3 mm/m, Ø 60</td>
<td>B, Circular level with 2 vials, 3x M2, 35 g (level only)</td>
<td>Ø 60</td>
<td>13</td>
<td></td>
<td></td>
</tr>
<tr>
<td>05331550</td>
<td>Level, 2 vials, 0.1 mm/m, 80 x 65 mm</td>
<td>C, T-shaped level with 2 vials, 2x M5, 80 x 65, 250 g (level only)</td>
<td>17</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>05331551</td>
<td>Level, 2 vials, 0.3 mm/m, 80 x 65 mm</td>
<td>C, T-shaped level with 2 vials, 2x M5, 80 x 65, 250 g (level only)</td>
<td>17</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
**TESA Precision Spirit Levels**

For checking and aligning flat or cylindrical surfaces in the horizontal position.

With an adjustment system for zero point and "twist" error.

Prismatic measuring base, manually lapped finish, enabling a higher precision for the level.

Insulating grip in wood essential for reducing heat transfer due to manual handling.

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### TESA Precision Spirit Levels with a Frame

For checking and aligning flat or cylindrical surfaces in horizontal and vertical positions.

Instrument features: 4 measuring faces, 2 prismatic faces (shafts Ø 17 to 135 mm) et 2 smooth flat faces.

With adjustment system for zero point and "twist" error.

Longitudinal vial with sensitivity of 0,02 to 0,1 mm/m, depending on the model.

Side viewing slots for an excellent visibility of the top and side of the main vial.

Cross vial with sensitivity of 2-5 mm/m for easy adjustment.

3 insulating grips to avoid any thermal transfer.
**TESA Precision Spirit Levels, Square Models with Magnetic Inserts**

For inspecting and aligning flat or cylindrical surfaces in horizontal and vertical positions.

Instrument features: 2 prismatic faces (shafts Ø 19 to 108 mm) with the vertical measuring face having magnetic inserts.

Equipped with an adjustment system for zero point and “twist” error.

Longitudinal vial with a sensitivity from 0,02 to 0,05 mm/m, depending on the model.

Cross vial with a sensitivity of 2-5 mm/m for an easy adjustment.

A quality wooden grip reduces thermal transfer during manual handling.

<table>
<thead>
<tr>
<th>No</th>
<th>Description</th>
<th>mm/m</th>
<th>For shafts Ø, mm</th>
<th>mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>05331000</td>
<td>Magnetic square level 0,02/150 x 150 x 40 mm</td>
<td>0,02</td>
<td>19 ÷ 108</td>
<td>150 x 150 x 40</td>
</tr>
<tr>
<td>05331002</td>
<td>Magnetic square level 0,05/150 x 150 x 40 mm</td>
<td>0,05</td>
<td>19 ÷ 108</td>
<td>150 x 150 x 40</td>
</tr>
</tbody>
</table>

**TESA Precision Spirit Level with Micrometric Adjustment**

Precision spirit level with micrometer adjustment.

For the measurement of inclinations from -20 to +4 mm/m.

1 division = 0,02 mm/m

Instrument features:

+ 1 micrometer rotation = + 2 mm/m (100 divisions)
+ 2 micrometer rotations = + 4 mm/m
- 10 micrometer rotations = - 20 mm/m

Prismatic measuring face (shafts Ø 19 to 120 mm).

Longitudinal vial with sensitivity of 0,02 mm/m

Cross vial with sensitivity of 2-5 mm/m for easy horizontal adjustment.

With side thermal insulators to reduce heat transfers to the instrument during manual handling.

<table>
<thead>
<tr>
<th>No</th>
<th>Description</th>
<th>mm/m</th>
<th>For shafts Ø, mm</th>
<th>mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>05331450</td>
<td>Precision spirit level with micrometer element 0,02 / 150 x 45 x 45 mm</td>
<td>0,02</td>
<td>19 ÷ 120</td>
<td>150 x 45 x 45</td>
</tr>
</tbody>
</table>
**TESA Spirit Inclinometer with Protractor and Micrometer Element**

Enables the measurement of angular deviations in any position of a cylindrical or flat surface.

Instrument features: prismatic measuring face (shafts Ø 17 to 80 mm) (DIN 877 + DIN 2276/1). Scale range: $2 \times 180^\circ$.

The adjustment is executed by disengaging the micrometer element by pressing in the direction indicated by the arrow. Afterwards the vial is oriented manually before engaging the micrometer element and executing the fine adjustment with the latter.

1 scale division = 1 degree.

1 division of the micrometer element = 1 Arcmin

Vial with sensitivity of 0.3 mm/m (= 1 Arcmin).

Error limit = 1.5 Arcmin

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<table>
<thead>
<tr>
<th>No</th>
<th>Description</th>
<th>Scale division of micrometer element</th>
<th>Scale division of level</th>
<th>For shafts Ø, mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>05331750</td>
<td>Spirit clinometer with angle protractor and micrometer element</td>
<td>1 Arcmin</td>
<td>1 Arcmin (0,30 mm/m)</td>
<td>17 ÷ 80</td>
</tr>
</tbody>
</table>
## Accessories for Clinometers and Levels

<table>
<thead>
<tr>
<th>No</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>04768002</td>
<td>4 batteries LR03 AAA, 1,5 V for niVELTRONIC</td>
</tr>
<tr>
<td>05360006</td>
<td>External switch with cable, L = 2 m, for CLINOBEVEL 1 USB</td>
</tr>
<tr>
<td>05360014</td>
<td>External switch, wireless, for CLINOBEVEL 1 USB</td>
</tr>
<tr>
<td>05360004</td>
<td>Connecting cable between 2 CLINOBEVEL 2, L = 2,5 m</td>
</tr>
<tr>
<td>04761059</td>
<td>4 batteries LR03 AAA, 1,5 V for NIVELTRONIC</td>
</tr>
<tr>
<td>03160007</td>
<td>Granite base 200 x 50 mm for horizontal NIVELTRONIC</td>
</tr>
<tr>
<td>03160008</td>
<td>Granite base 250 x 50 mm for horizontal NIVELTRONIC</td>
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<tr>
<td>03160009</td>
<td>Granite base 500 x 50 mm for horizontal NIVELTRONIC</td>
</tr>
<tr>
<td>03160048</td>
<td>Holder with voltage regulator (4,65 V) and 4x LR03 AAA for NIVELTRONIC</td>
</tr>
</tbody>
</table>
FLATNESS MEASUREMENT

ROCH Bevelled Straight Edges
Models with 1 bevelled edge, with insulating grip to limit the transfer of thermal heat during manual handling for optimal precision.

<table>
<thead>
<tr>
<th>№</th>
<th>Description</th>
<th>μm</th>
<th>mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>0951750002</td>
<td>Bevelled straight edge</td>
<td>2</td>
<td>75</td>
</tr>
<tr>
<td>0951750003</td>
<td>Bevelled straight edge</td>
<td>2</td>
<td>100</td>
</tr>
<tr>
<td>0951750005</td>
<td>Bevelled straight edge</td>
<td>3</td>
<td>150</td>
</tr>
<tr>
<td>0951750006</td>
<td>Bevelled straight edge</td>
<td>3</td>
<td>200</td>
</tr>
<tr>
<td>0951750007</td>
<td>Bevelled straight edge</td>
<td>3</td>
<td>300</td>
</tr>
</tbody>
</table>

SQUARES

ROCH Flat and Try Squares in Steel – Accuracy Class 1
Try square 90° flat in stainless steel, non-hardened

<table>
<thead>
<tr>
<th>№</th>
<th>Description</th>
<th>μm</th>
<th>A</th>
<th>Length of beams, mm</th>
<th>Section mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>0951751605</td>
<td>Try-square steel</td>
<td>15</td>
<td>With 90° hook</td>
<td>100 x 70</td>
<td>20 x 5</td>
</tr>
<tr>
<td>0951751607</td>
<td>Try-square steel</td>
<td>18</td>
<td>With 90° hook</td>
<td>150 x 100</td>
<td>28 x 6</td>
</tr>
</tbody>
</table>
**Brown & Sharpe Try Square Set**

![Image of Brown & Sharpe Try Square Set]

**ROCH Bevelled Edge Squares – Accuracy Class 00**

Bevelled edge 90° squares in stainless steel, hardened

![Image of ROCH Bevelled Edge Squares]

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**Table: ROCH Bevelled Edge Squares**

<table>
<thead>
<tr>
<th>No.</th>
<th>Description</th>
<th>µm</th>
<th>Length of beams, mm</th>
<th>Section of beams, mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>0951751533</td>
<td>Bevelled edge square, stainless</td>
<td>3</td>
<td>50 x 40</td>
<td>14 x 4,5</td>
</tr>
<tr>
<td>0951751534</td>
<td>Bevelled edge square, stainless</td>
<td>3</td>
<td>75 x 50</td>
<td>16 x 4</td>
</tr>
<tr>
<td>0951751535</td>
<td>Bevelled edge square, stainless</td>
<td>3</td>
<td>100 x 70</td>
<td>20 x 5</td>
</tr>
</tbody>
</table>
**ANGLE PROTRACTORS**

**Angle Protractor with Digital Display**
Measuring ranges 1x 360°, 2x 180°, 4x 90°
Large decimal or sexagesimal display
2 measuring directions
Fine setting with adjustment screw
Locking system
Scale L = 200 mm (300 or 500 mm available as options)
RS232 data output

00630010 Angle protractor with digital display. Supplied with a scale of L = 200 mm

**OPTIONAL ACCESSORIES:**

- 00660004 Scale 200 mm
- 00660005 Scale 300 mm
- 00660006 Scale 500 mm
- 00660007 Supporting base with 1 flat measuring face and 1 prismatic measuring face
- 00660008 Square for measuring sharp angles
- 01961000 Lithium battery, 3V, CR 2032
- 04761062 Opto-USB cable, duplex, bidirectional communication
**EAC Angle Protractor with Dial**

Circular scale with needle pointer  
Easy reading on main and auxiliary scales  
Very low hysteresis  
Precision movement with compensation for mechanical play.

**ETALON Angle Protractor with Vernier Scale**

<table>
<thead>
<tr>
<th>No</th>
<th>Description</th>
<th>Auxiliary scale</th>
<th>mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>076115566</td>
<td>ETALON angle protractor with vernier 200 mm</td>
<td>No</td>
<td>200</td>
</tr>
<tr>
<td>076115567</td>
<td>ETALON angle protractor with vernier 300 mm</td>
<td>No</td>
<td>300</td>
</tr>
</tbody>
</table>

**OPTIONAL ACCESSORIES:**

- 00660002 Scale 200 mm
- 00660003 Scale 300 mm
- 00610102 Cast iron base with steel bottom surface, hardened
Brown & Sharpe Angle Protractor - Multiple Combinations
This angle protractor combination set can be used as a scale, depth gauge, try square, centering tool, marker or even as a spirit level.

Consisting of:
- 1 Ruler graduated in millimetres, length 300 mm
- 1 Angle protractor with 2 x 90° graduations
- 1 Centering square
- 1 Square head with scriber

Brown & Sharpe Sine Bar
Suited for setting ranges from 0 to 60°
Sine function for establishing the angle that needs to be set on the basis of the length dimensions obtained from parallel gauge blocks.

Example for the calculation of an angle
Given:  
H = height of combination gauge blocks in mm  
L = length of B&S sine bar in mm  

Formula:  
H = L \cdot \sin(\alpha)  
\sin(\alpha) = H/L  
angle = \arcsin \left( \frac{H}{L} \right)

Calculation for determining angle knowing H et L values:  
angle = \arcsin \left( \frac{89,603}{127} \right) = \arcsin \left( 0,70711 \right) = 45°

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