

# 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



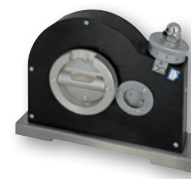
TESA CLINOBEVEL  
1 USB



TESA CLINOBEVEL 2



TESA NIVELTRONIC



Spirit clinometers with  
angle protractor



- DIN 2276 Part 2 (Form D)
- LCD angle display: Decimal or sexagesimal
- Inclinometer  
mm/m, in/10 or 12 in, mm or in/  
basis length, radian (mrad) and the like
- Capacitive measuring system with gravity pendulum
- 2' + 1 numerical interval
- 21 storable correction values (high accuracy)
- Flat face 4 x 90°
- 100 x 75 x 35 mm
- Anodised light alloy
- Response time ≈ 1 s
- Automatic shut down after 8 min
- Display lock
- RS485, asynchronous, 7 bits, 2 stop bits, no parity, 9600 bauds
- 1 1,5 V battery, type LRC 6, AA
- ≈ 150 hours
- IP65 (IEC 60529)
- EN 50081-1 / -2  
EN 50082-1 / -2
- 0,52 kg
- Inspection report with declaration of conformity

## INCLINOMETERS AND LEVELS

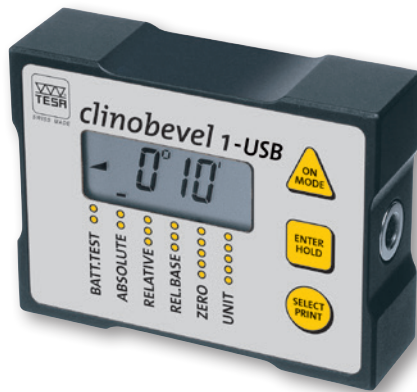
The TESA inclinometers and levels meet the most demanding applications not only in the machine building sector but also in the civil construction sector.

### Electronic Inclinometer - TESA CLINOBEVEL 1 USB

Compact universal instrument for direct and differential measurements – Measuring range  $\pm 45^\circ$  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.

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.



CLINOSOFT Software

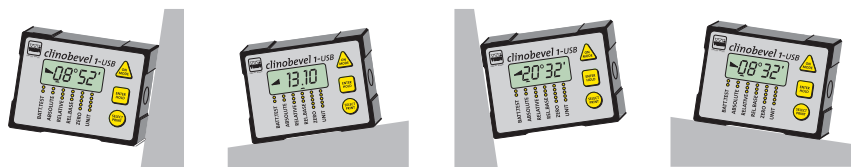


Measuring functions: A ; B ; A+B ; A-B



CLINOSOFT Software

CLINOBEVEL 1-USB, can be used on its 4 faces.



05330203	CLINOBEVEL 1 USB electronic inclinometer	$\pm 45^\circ$	$\geq 0,02$	mm/m mm 100 x 75 x 35	Livré avec: CLINOSOFT software plus USB cable to host computer
<b>OPTIONAL ACCESSORIES:</b>					
04768002	4 batteries LRC 6 AA, 1,5 V for CLINOBEVEL 1 USB, CLINOBEVEL 2, MICROBEVEL,				
05360006	External switch with cable, L = 2 m, for CLINOBEVEL 1 USB				
05360014	External switch, wireless, for CLINOBEVEL 1 USB				



## TESA CLINOBEVEL 2 Electronic Inclinometer

Portable precision inclinometer.

Measuring range  $\pm 45^\circ$  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.

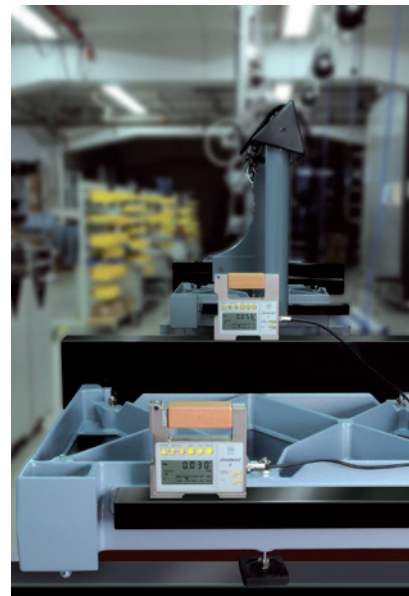
Microprocessor-based features for display setting and instrument adjustment.

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

-  DIN 2276 Part 2 (Form D)
-  LCD angle display: Decimal or sexagesimal Inclination mm/m, in/10 or 12 in, mm or in/ basis length, radian (mrad) and the like
-  Capacitive measuring system with gravity pendulum
-  10"  $\pm 0,03\%$  of the readout
-  2 flat measuring faces with V-slot for diameters from  $\varnothing 17$  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
-  IP65 (IEC 60529)
-  EN 50081-1 / -2 EN 50082-1 / -2
-  3 kg

				
<b>05330202</b>	Electronic Inclinometer TESA CLINOBEVEL 2	$\pm 45^\circ$	$\geq 5''$ (5 Arcsec = 0,025 mm/mm)	mm
<b>OPTIONAL ACCESSORIES:</b>				
<b>04768002</b>	4 batteries LRC 6 AA, 1,5 V for CLINOBEVEL 1 USB, CLINOBEVEL 2, MICROBEVEL,			
<b>05360004</b>	Connecting cable between 2 CLINOBEVEL 2, L = 2,5 m			
<b>S53070174</b>	Câble USB pour CLINOBEVEL 2, L=2,5 m			

- DIN 2276 Part 2 (Style D)
- See table for max. perm. errors
- LCD display according to table
- Fully encapsulated measuring system with gravity pendulum
- See table for max. perm. errors
- 2 flat measuring faces with V-slot for diameters from 20 to 120 mm
- Cast iron base. Chromium plated side faces. Aluminium housing, lacquered
- 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 based on the measuring range at 20 ± 5°C
- EN 50081-1 / -2 EN 50082-1 / -2

## 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.



Horizontal model



Square model

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

No	=				
		Range 1 or Range 2, mm/m	Base width, mm	Base height, mm	kg (with transport case)
05330003	TESA MICROBEVEL 1 horizontal base 110 x 45 mm	0,01 ou 0,001	110	45	1,8
05330004	TESA MICROBEVEL 1 horizontal base 150 x 45 mm	0,01 ou 0,001	150	45	2,1
05330005	TESA MICROBEVEL 1 square base 150 x 45 mm	0,01 ou 0,001	150	45	3,1

**OPTIONAL ACCESSORY:**

**04768002** 4 batteries LRC 6 AA, 1,5 V for CLINOBEVEL 1 USB, CLINOBEVEL 2, MICROBEVEL,

Range	mm/m	mm/m	mm	G = mm/m	
1	± 20	± 5	0,01	Flatness ≤ 5 mm/m G = 1 % of the measured value and min. 0,01 mm/m	Flatness > 5 mm/m G = 0,01 mm/m
2	± 2	± 2	0,001	Flatness ≤ 1 mm/m G = 1 % of the measured value and min. 0,001 mm/m	Flatness > 1 mm/m G = 1 % of (2x measured value -1)



## 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.



NIVELTRONIC square model with 2 prismatic bases



NIVELTRONIC horizontal model with flat base



NIVELTRONIC horizontal with granite base

- DIN 2276 Part 2 (Style D)
- See table
- Inductive measuring system with gravity pendulum
- As per DIN 2276: up to 0,5 \* measuring range: min. 0,001 mm/m, max. 1 % of the measured value from 0,5 \* measuring range: max. 1 % of (2 \* measured value - 0,5 \* total range.)
- 1 µm/m
- Horizontal model with a flat measuring face. Square model with 2 flat faces having a V-slot for Ø from 20 to 120 mm
- Cast iron body. Horizontal model with granite base.
- ≈ ± 0,2 V, impedance 4,5 kΩ
- 4 batteries AAA 1,5 V
- EN 50081-1 / -2 EN 50082-1 / -2



No	=				
		mm/m	Base length mm	Base width mm	kg
03130063	TESA NIVELTRONIC electronic level, horizontal, analogue display	0,05 / 0,01	150	45	6,0 / 3,7 *
03130060	TESA NIVELTRONIC electronic level, square, analogue display	0,05 / 0,01	200	45	6,5 / 4,4 *

\* With/without wooden case

### 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

Range	mm/m	"	mm/m	"
1	± 0,75	± 150"	0,05	10"
2	± 0,15	± 30"	0,01	2"

DIN 2276/1 (instrument) DIN 877 (graduation)

DIN 2276/1

Mounting with 2 or 3 screws

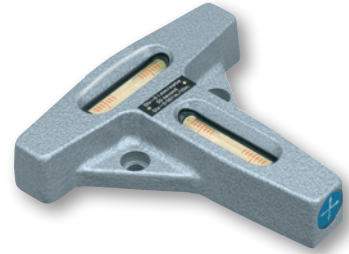
## TESA Crossed Spirit Levels – for Assembly

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.



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.

No		mm/m	Modele type	I x L mm	mm	H mm
05331500	Level, 2 vials, 2 to 5 mm/m, Ø 40	2 ÷ 5	B, Circular level with 2 vials, 3x M2, 35 g (level only)		Ø 40	11
05331502	Level, 2 vials. 0,3 mm/m, 0,3 Ø 60		B, Circular level with 2 vials, 3x M4, 85g (level only)		Ø 60	13
05331550	Level, 2 vials; 0,1 mm/m, 0,1 80 x 65 mm		C, T-shaped level with 2 vials, 2x M5, 250 g (level only)	80 x 65		17
05331551	Level, 2 vials; 0,3 mm/m, 0,3 80x65 mm		C, T-shaped level with 2 vials, 2x M5, 250 g (level only)	80 x 65		17



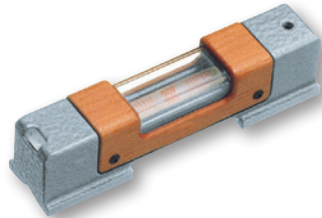
### TESA Precision Spirit Levels

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

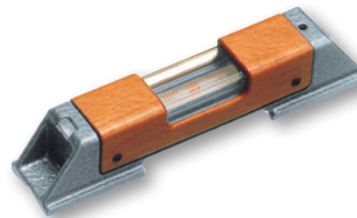
With an adjustment system for zero point and "twist" error.

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.



Model B: horizontal precision level



Model C: horizontal precision level

No	=		A	✳	⌒
		mm/m		For shafts Ø, mm	mm
05331050	Precision spirit level 0,02, L = 100 mm	0,02	B, 0,35 kg (level only)	17 ÷ 84	100 x 32 x 35
05331054	Precision spirit level 0,02, L = 150 mm	0,02	B, 0,65 kg (level only)	17 ÷ 94	150 x 35 x 38
05331058	Precision spirit level 0,02, L = 200 mm	0,02	C, 0,95 kg (level only)	19 ÷ 108	200 x 40 x 42
05331061	Precision spirit level 0,1, L = 200 mm	0,1	C, 0,95 kg (level only)	19 ÷ 108	200 x 40 x 42
05331063	Precision spirit level 0,02, L = 250 mm	0,02	C, 1,3 kg (level only)	19 ÷ 120	250 x 45 x 42

### 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.

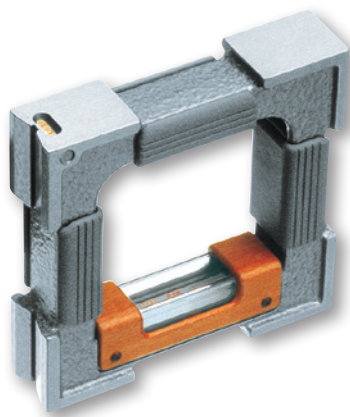
With adjustment system for zero point and "twist" error.

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

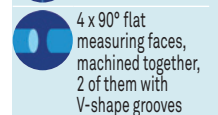
Side viewing slots for an excellent visibility of the top and side of the main vial.

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

3 insulating grips to avoid any thermal transfer.



No	=		✳	⌒
		mm/m	For shafts Ø, mm	mm
05331201	Precision spirit level with frame, 0,05/100 x 100 x 32 mm	0,05	17 ÷ 84	100 x 100 x 32
05331202	Precision spirit level with frame, 0,1/100 x 100 x 32 mm	0,1	17 ÷ 84	100 x 100 x 32
05331204	Precision spirit level with frame, 0,05/150 x 150 x 35 mm	0,05	17 ÷ 94	150 x 150 x 35
05331206	Precision spirit level with frame, 0,02/200 x 200 x 40 mm	0,02	19 ÷ 108	200 x 200 x 40
05331210	Precision spirit level with frame, 0,05/250 x 250 x 45 mm	0,05	19 ÷ 120	250 x 250 x 45



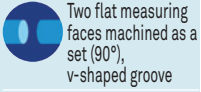




DIN 877



DIN 2276 Part 1



Two flat measuring faces machined as a set (90°), v-shaped groove



Longitudinal and cross vials

## TESA Precision Spirit Levels, Square Models with Magnetic Inserts

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

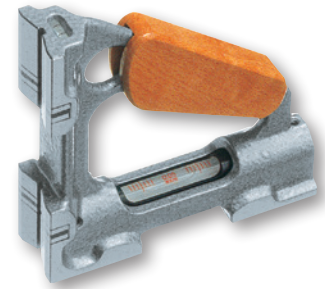
Instrument features: 2 prismatic faces (shafts  $\varnothing$  19 to 108 mm) with the vertical measuring face having magnetic inserts.




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.



No	=			
05331000	Magnetic square level 0,02/150 x 150 x 40 mm	0,02	19 ÷ 108	150 x 150 x 40
05331002	Magnetic square level 0,05/150 x 150 x 40 mm	0,05	19 ÷ 108	150 x 150 x 40

## 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  $\varnothing$  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.



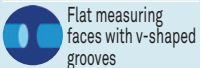
No	=			
05331450	Precision spirit level with micrometer element 0,02 / 150 x 45 x 45 mm	0,02	19 ÷ 120	150 x 45 x 45



DIN 877



DIN 2276 Part 1



Flat measuring faces with v-shaped grooves



Hardened and ground steel



Longitudinal and cross vials



### 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  $\varnothing$  17 to 80 mm) (DIN 877 + DIN 2276/1). Scale range:  $2 \times 180^\circ$ .

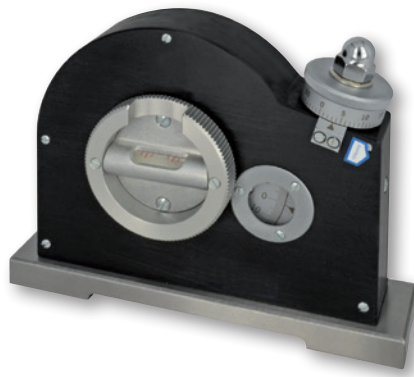
The adjustment is executed by disengaging the micrometer element by pressing in the direction indicated by the arrow. Afterwards the vial is oriented manually before engaging the micrometer element and executing the fine adjustment with the latter.

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



DIN 877



DIN 2276 part 1



Flat measuring faces with v-shaped groove



Hardened and ground steel base



Longitudinal and cross vials



1,6 kg (without case)  
2,1 kg (with case)



Scale division of micrometer element

1 Arcmin



Scale division of level

1 Arcmin (0,30 mm/m)



$2 \times 180^\circ$



For shafts  $\varnothing$ , mm

17 ÷ 80



mm

150 x 35 x 116

05331750

Spirit clinometer with angle protractor and micrometer element



## Accessories for Clinometers and Levels



<b>04768002</b>	4 batteries LRC 6 AA, 1,5 V for CLINOBEVEL 1 USB, CLINOBEVEL 2, MICROBEVEL,
<b>05360006</b>	External switch with cable, L = 2 m, for CLINOBEVEL 1 USB
<b>05360014</b>	External switch, wireless, for CLINOBEVEL 1 USB
<b>05360004</b>	Connecting cable between 2 CLINOBEVEL 2, L = 2,5 m
<b>04761059</b>	4 batteries LR03 AAA, 1,5 V for NIVELTRONIC
<b>03160007</b>	Granite base 200 x 50 mm for horizontal NIVELTRONIC
<b>03160008</b>	Granite base 250 x 50 mm for horizontal NIVELTRONIC
<b>03160009</b>	Granite base 500 x 50 mm for horizontal NIVELTRONIC
<b>03160048</b>	Holder with voltage regulator (4,65 V) and 4x LR03 AAA for NIVELTRONIC



## 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.



Bevelled edge

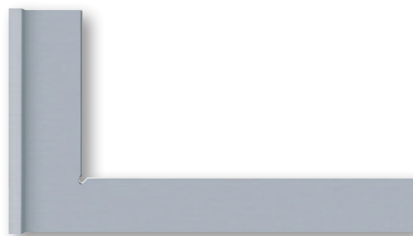
No	=	⊖	⊕
		μm	mm
0951750002	Bevelled straight edge	2	75
0951750003	Bevelled straight edge	2	100
0951750005	Bevelled straight edge	3	150
0951750006	Bevelled straight edge	3	200
0951750007	Bevelled straight edge	3	300

- DIN 874 T2, NF E 11-104
- Hardened steel to  $\geq 650$  HV 10
- Straight edges up to 200 mm in a plastic case,  $\geq 300$  mm in a wooden case.

## SQUARES

### ROCH Flat and Try Squares in Steel – Accuracy Class 1

Try square 90° flat in stainless steel, non-hardened



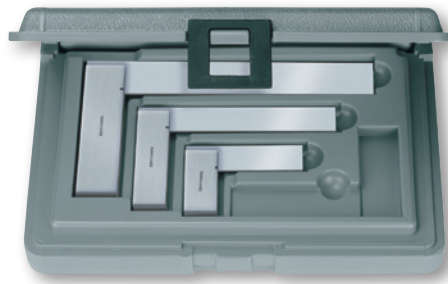
No	=	⊥	A	⊕	⊖
		μm		Length of beams, mm	Section mm
0951751605	Try-square steel	15	With 90° hook	100 x 70	20 x 5
0951751607	Try-square steel	18	With 90° hook	150 x 100	28 x 6

- Factory standard
- Accuracy class 1
- Accuracy class 1
- Stainless steel, hardness 200 HRB,



- Factory standard
- Hardened steel

### Brown & Sharpe Try Square Set



<b>No</b>	<b>=</b>		
06739001	Three square set B & S		
	<b>=</b>		
Consisting of:	mm	µm	
1 Try square	68 x 45	16	
1 Try square	120 x 70	16	
1 Try square	175 x 95	16	

- DIN 875 NFE 11-103
- Accuracy class 00
- Accuracy class 00
- Accuracy class 00
- Stainless steel, hardened to  $\geq 550$  HV 30

### ROCH Bevelled Edge Squares – Accuracy Class 00

Bevelled edge 90° squares in stainless steel, hardened



<b>No</b>	<b>=</b>			
		µm	Length of beams, mm	Section of beams mm
0951751533	Bevelled edge square, stainless			
0951751534	Bevelled edge square, stainless			
0951751535	Bevelled edge square, stainless			
		3	50 x 40	14 x 4,5
		3	75 x 50	16 x 4
		3	100 x 70	20 x 5



## ANGLE PROTRACTORS

### Angle Protractor with Digital Display

Measuring ranges 1x 360°, 2x 180°, 4x 90°

Large decimal or sexagesimal display

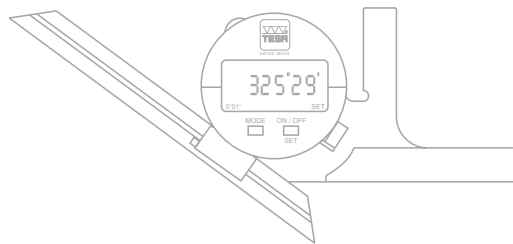
2 measuring directions

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

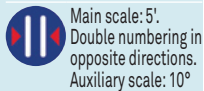
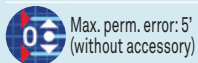
**04761062** Opto-USB cable, duplex, bidirectional communication

- Measuring ranges:  
1 x 360°, 2 x 180°,  
4 x 90°
- LCD, 5 digits + sign
- 0,01° / 1 minute  
of arc
- 8,5 mm
- Max. perm. error.: 4  
minutes of arc
- Stainless steel body,  
hardened
- Maximum rotation  
speed.: 1080°/s
- Preset to 0° or 180°
- RS232 opto-coupled
- 1x CR2032 3,0V
- 5000 hours
- IP51 (CEI 529)
- 410 g
- Wooden case (ISPM  
15 andt NIPM 15)





2 circular scales

Main scale: 5'  
Double numbering in  
opposite directions.  
Auxiliary scale: 10°Max. perm. error: 5'  
(without accessory)Hardened stainless  
steel

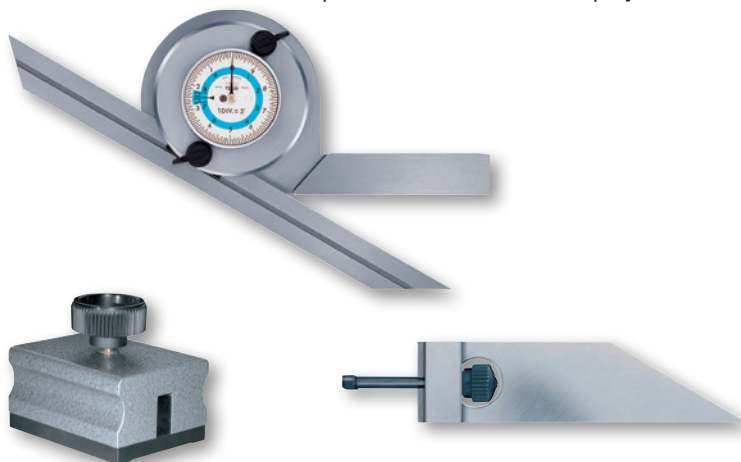
## EAC Angle Protractor with Dial

Circular scale with needle pointer

Easy reading on main and auxiliary scales



Very low hysteresis

Precision movement with compensation for mechanical play.



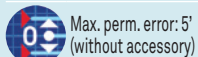
00610102

00610101

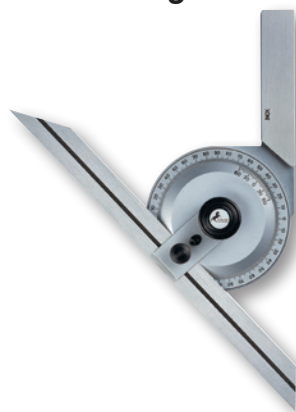
No	=		
00630001	EAC angle protractor with dial	4 x 90°	200
00630002	EAC angle protractor with dial	4 x 90°	300
OPTIONAL ACCESSORIES:			
00660002	Scale		200
00660003	Scale		300
00610102	Cast iron base with steel bottom surface, hardened		






5'

Max. perm. error: 5'  
(without accessory)Stainless steel,  
hardened

## ETALON Angle Protractor with Vernier Scale



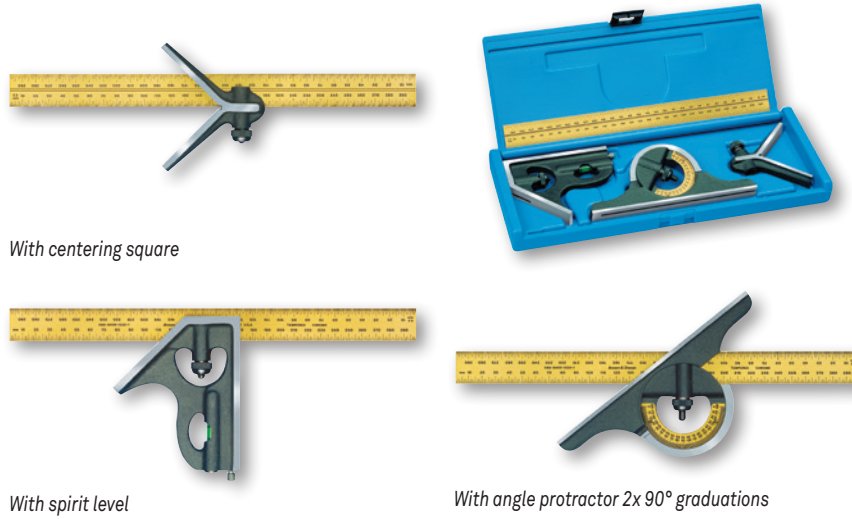
No	=			
076115566	ETALON angle protractor with vernier 200 mm	4 x 90°	No	200
076115567	ETALON angle protractor with vernier 300 mm	4 x 90°	No	300
OPTIONAL ACCESSORIES:				
00660002	Scale			200
00660003	Scale			300
00610102	Cast iron base with steel bottom surface, hardened			



### 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.

Hardened steel.  
Measuring faces specially treated against scratches

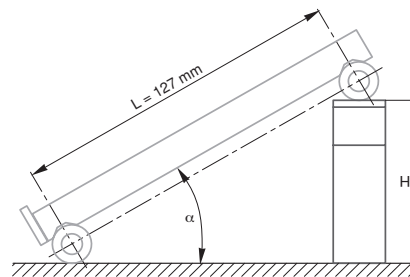
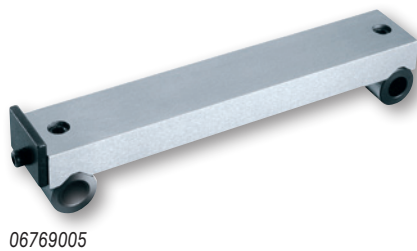


06719000	B&S angle protractor set with multiple combinations	Consisting of: - 1 Ruler graduated in millimetres, length 300 mm - 1 Angle protractor with 2 x 90° graduations - 1 Centering square - 1 Square head with scribe

### 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.



5  $\mu$ m  
 Hardened alloy steel  
 Removable front stop



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 (H/L)

Calculation for determining angle knowing H et L values:  
angle = arcsin ( 89,803 / 127 ) = arcsin ( 0,70711 ) = 45°

06769005	B&S Sine bar	L (centre distance), mm 127 ± 0,004	mm 123 x 25

