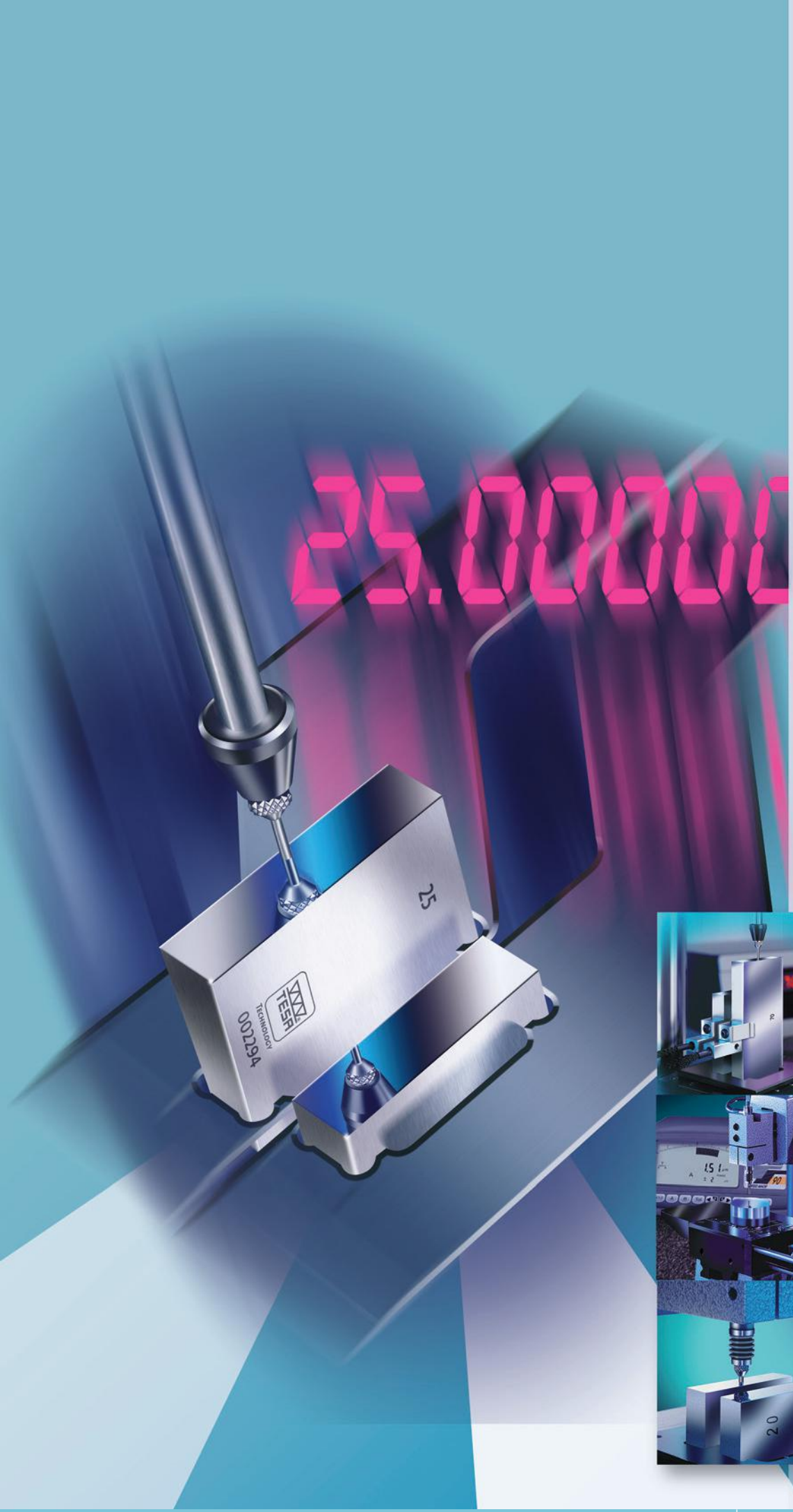
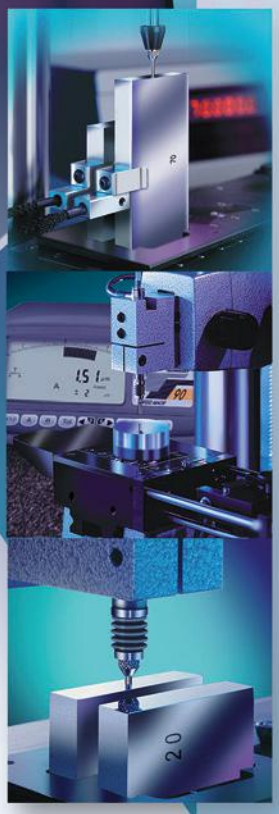
TESA TECHNOLOGY

Calibration Equipment





CONFIDENCE IS NOT ENOUGH...

The control of inspection and measuring equipment is an element of quality management that is now more important than ever before. The introduction of the ISO 9000 family of international standards has also led to major changes in this field. Amongst other things, ISO 9001 specifies that : "all inspection and measuring equipment than can affect product quality must be identified, calibrated and adjusted at prescribed intervals, or prior to use, against certified equipment having a known valid traceable relationship to internationally or nationally recognised standards".

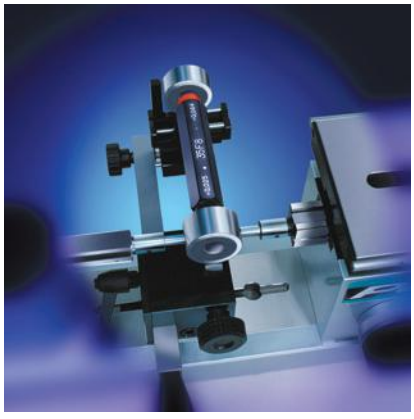
This standard also states that the supplier shall: "ensure that the inspection and measuring equipment is capable of the necessary accuracy and precision".

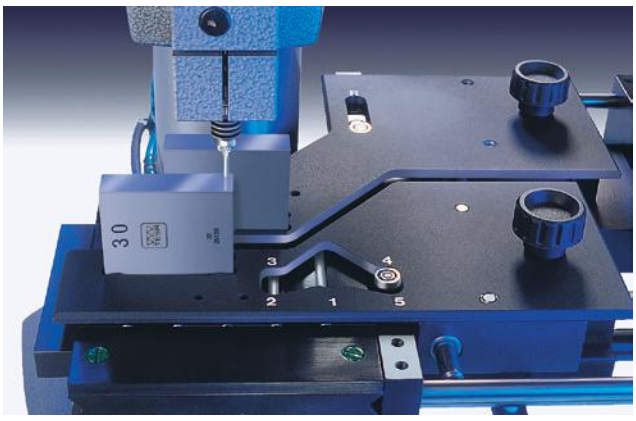
A Vast Choice

TESA can offer you the most varied methods of measurement specifically suited for the inspection and calibration of standards, handtools and plug gauges. Some of these are described in the various sections of this catalogue, in particular:

- *Gauge blocks*
- *Setting rings*
- *Cylindrical setting standards with outside diameters*
- *Optical flats*
- *Parallel optical flats*
- *Electronic levels for both straightness and flatness measurement*
- *Instruments for both squareness and perpendicularity measurement*
- *Calibration equipment for length measuring devices fitted with inductive probes.*

This section is devoted to measuring systems that serve to calibrate other inspection equipment, but they can also be used for high-accuracy measurement of precision parts.

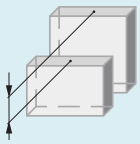
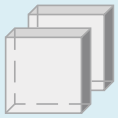




PRESENTATION OF TESA MEASURING GAGE BLOCKS

TESA offers two models, the operation of which is based on two different measurement procedures.

- TESA UPD directly measures gauge blocks within a measuring span of 25 mm/1 in.
- TESA UPC is used for comparative measurement of gauge blocks having a same nominal length.

TESA Gauge Block Comparators		UPD	UPC
Measuring procedures 			
– Comparison of different nominal lengths up to 25 mm		●	
– Number of reference gauge blocks required for the calibration of a set of 122 pieces: 9 blocks		●	
– Number of blocks required for the calibration of the device: 9 blocks + 6 pairs		●	
Comparative measurement 			
– Comparison of gauge blocks having the same nominal length		●	●
– Number of reference gauge blocks required for the calibration of a set of 122 pieces: 122 blocks		●	●
– Number of gauge blocks required for the calibration of the device: 6 pairs		●	●
Measuring errors Read also the explanations provided in this same chapter with regard to the measuring errors of each instrument			
Repeatability limit	0,015 µm	●	●
	0,025 µm		●
Measuring uncertainty	U = ± (0,05 + 0,5 · L) µm L in m	●	●
	U = ± (0,10 + 1,0 · L) µm		●
Range of application Nominal lengths	0,5 to 100 mm/0.02 to 4.0 in	●	●
	0,5 to 500 mm/0.02 to 20 in	▲	▲
Measuring range 25 mm/1 in			●
Sensors for capturing length dimensions			
– 2 axial probes in sum measurement		●	●
– Digital measuring system, opto-electronic with incremental divisions		●	
– Analogue measuring system, electronic and inductive			●
– Activation of the measuring force			
• electro-motorised		●	
• by spring force			●
– Retraction of the measuring bolt			
• electro-motorised		●	
• by vacuum			●
Template system			
– Single template system		●	●
– Dual template system		●	❍
Positioning of gauge blocks with a nominal length of up up 10 mm Suction loader with a an electric vacuum pump		❍	❍
TESA UPT temperature measuring device Measurement of the electrical resistance using 4 thermal sensors (4 wire type)		●	❍
TESA software for processing the measured values – TESA UP, WINDOWS 98, 2000, NT, XP, 7 (32 bits)		●	●

▲ Available on request ❍ Recommended option

GAUGE BLOCK COMPARATORS

In the hierarchical chain of dimensional measurements that can be traced back to the standard metre length unit, gauge blocks hold a key position. This makes them the most important material references used in metrology.

The application of the length unit, based on specific wavelengths of light, to gauge blocks is achieved in the first instance by fundamental interferential measurement. Using gauge blocks measured by interferometry, defined lengths are thus transferred to other gauge blocks in measurements further down the hierarchical chain.

TESA UPD – for Direct and Comparative Measurements

- Direct measurement of gauge blocks with a variation in nominal length of up to 25 mm or 1 in.
  - Enables the number of reference gauge blocks required to be reduced by nearly 80 %.
- Comparative measurement of gauge blocks having a same nominal length.
  - Enables lower measurement uncertainties to be achieved due to weaker influences of the systematic errors.
- Equipped with HEIDENHAIN high-precision incremental probes.
- Templates with a new concept for positioning the gauge blocks.
  - Single or dual template system to provide optimum ease of handling of the gauge blocks
- Integrated device for most accurate temperature acquisition.
- On-line transfer of both measured length and temperature values.
- Computer-aided data processing with all the corrections necessary included.

Dual template system for the maintenance of your reference gauge blocks (TESA patented)

- The simultaneous use of two templates allows you to "rest up" your gauge blocks until you need them.
- The application of this new concept turns into significant savings in both time and money.
- During measurement cycles carried out on a routine basis, the distance travelled over the measuring table is reduced by nearly 70 %.
  - This contributes to significant reductions of the risks of damaging and wearing the measurement faces.
- The double protection of your reference gauge blocks leads to significant cost savings through the reduction if the need for:
  - recalibration
  - restoration of the measuring faces
  - replacement of worn or damaged gauge blocks
  - increased downtime (whilst extending the life of your reference gauge blocks)

Single Template System

- Using this system your reference gauge blocks are moved together with those to be calibrated during the measurement cycles.

EN ISO 3650 (ASME B89.1.9-2002 on request)

For gauge blocks with nominal lengths from 0,5 mm to 100 mm / 0.02 in to 4 in (0,5 to 500 mm on request)

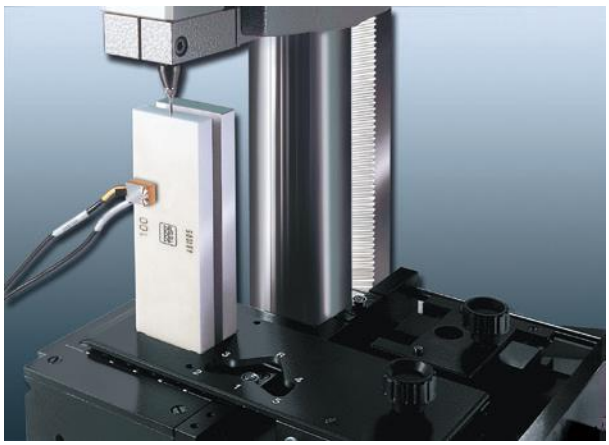
Measuring configuration
Two probes with mechanical contact with the measuring face to be probed are connected in sum measurement (function +A+B).

Measuring points
On the reference gauge block: at the centre of the measuring face (point R). On the gauge block to be measured: at the centre (point 1) as well as the four corners of the measuring face, each lying 2 mm away from the adjacent faces (points 2 to 5).

The central length l_c is determined by probing both points R and 1. For establishing lengths at any point, the measurements shall be carried out at points R plus 1 to 5.

The variation in length v is obtained from measurements taken at points 1 to 5.

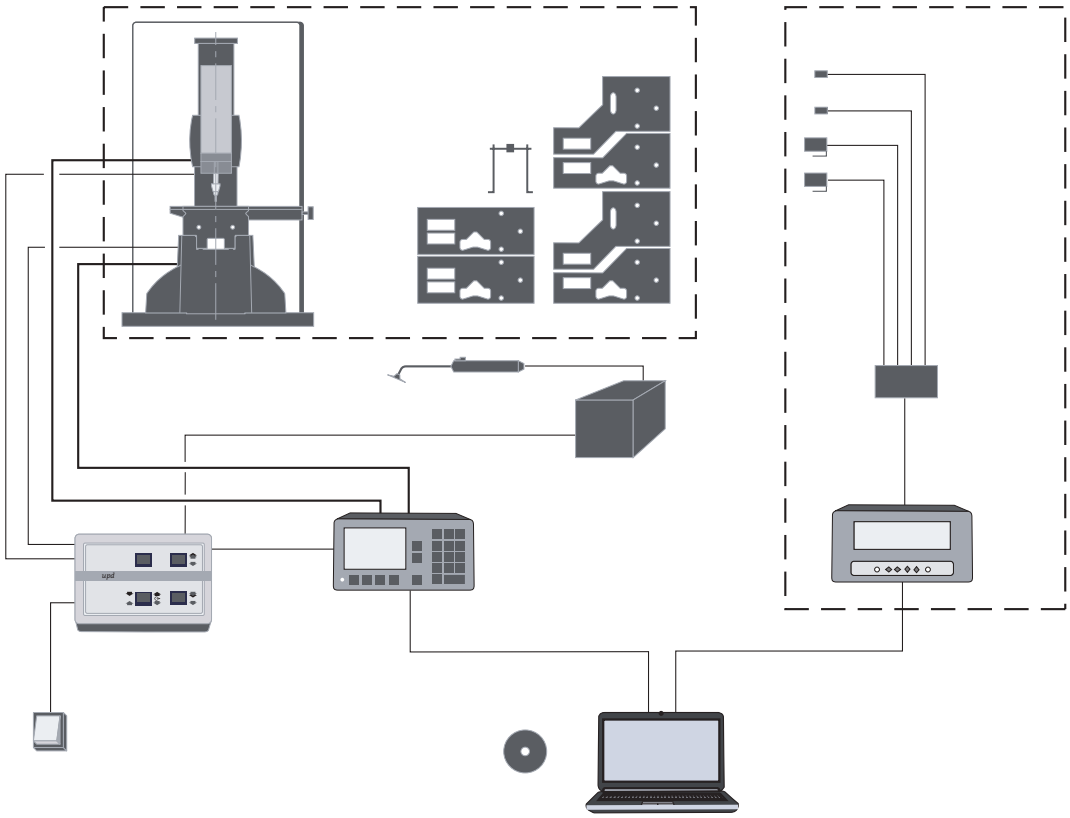
Calibration certificate from the supplier for the comparator or the Swiss Calibration Service for the temperature device.



2 different delivery programs

05930005	TESA UPD gauge block comparator with temperature device*		●
05930004	TESA UPD gauge block comparator without temperature device	●	
CONSISTENT OF:			
05930008	TESA UPD mechanical part	●	●
05960016	HEIDENHAIN computing counter ND 287 featuring 2 probe inputs	●	●
05960013	Control panel	●	●
05960014	Connecting cable for control panel to ND 287 computing counter	●	●
04768001	Foot switch	●	●
01660011	Suction loader		●
03260433	Electrical vacuum pump with external control, 230 VAC, 50 Hz		●
05960028	Connecting cable for electronic vacuum pump to control panel		●
05930011	TESA UPT temperature device, complete		●

Other delivery program available on request
* Special execution for 110 VAC, 60 Hz also available on request (ref. S32070030 instead of 03260433)



Errors of Measurement
Provided all metrological conditions are met, the reliability of the comparator used for direct measurement of steel gauge blocks is expressed as follows:

Repeatability limit (with no influence of external temperature): 0,015 µm

Uncertainty of measurement: U = ± (0,05 + 0,5 · L) µm (L in m)

Condition requires the use of reference standards whose measurement uncertainty is equal to:
U ≤ ± 0,015 µm for the comparator
U ≤ ± (0,02 + 0,2·L) µm (L in m) for the gauge blocks

TESA UPC – for Comparative Measurement

TESA UPC Gauge Block Comparator for Comparative Measurement

- Measures gauge blocks of same nominal length by comparison.
- Comes with the new template system for positioning the gauge blocks.
- Single or dual template system for optimum ease of gauge handling.
- Features TESA high-precision inductive probes.
- Allows ultra-precise temperature measurement, integrated.
- Transfers on-line all measured length and temperature values.
- Executes computer-aided data processing with all required correction values included.
- Performs calibrations that meet the requirements of both ISO standards and EA guidelines (EAL – European cooperation for Accreditation of Laboratories).
- Includes an execution for greater accuracy along with a calibration certificate (optional).

TESA UPC is specially designed for the calibration – or dimensional inspection – of gauge blocks with nominal lenghts ranging from 0,5 to 100 mm. The configuration, which consists of two probes aligned opposite one another, associated with both the concept and quality of the measuring system provides full guarantee for an extra low uncertainty of measurement. Although TESA UPC is mainly intended for manufacturers and end-users of gauge blocks, this comparator is also widely used in nationally accredited laboratories.

If specified, TESA can also provide the temperature device available as an option. This device has 4 PT100 platinum resistances, each capturing the temperature of the two gauge blocks along with that of both the measuring table and the support. Computer-aided data processing lets you carry out any calibration most reliably and rationally – for sure.

EN ISO 3650

For gauge blocks ranging from 0,5 mm to 100 mm or 0.02 in to 4 in (0,5 to 500 mm on request)

Comparative measurement procedure with transference of the length of a reference gauge block to the gauge block being measured.

Measuring configuration
2 probes connected in sum measurement (function +A+B) with mechanical contact with the measuring face.

Measuring points
On the reference gauge block: at the centre of the measuring face (point R). On the gauge block to be measured: at the centre (point 1) as well as the 4 corners of the measuring face, each lying 2 mm away from the adjacent faces (points 2 to 5).

Central length l_c is defined by probing both points R and 1.

Establishing lengths at any point requires measurements to be taken at points R plus 1 to 5.

Variation in length v is the result of measurements taken at points 1 to 5.

≈ 23 kg (comparator complete, but without computer).
≈ 4 kg (temperature device)

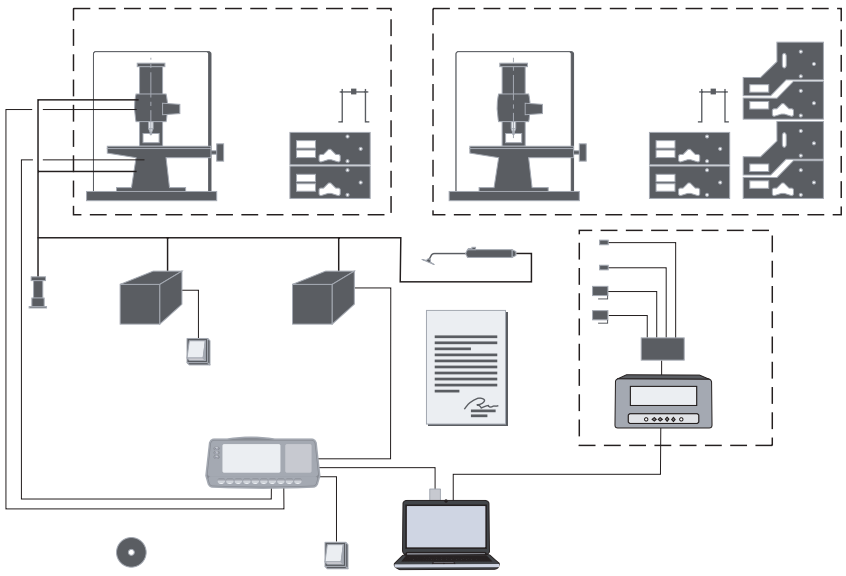
All instruments with the option for greater accuracy are delivered with serial numbers

In-house calibration certificate for the version with greater accuracy or declaration of conformity for the standard version. Temperature device with SCS certificate.

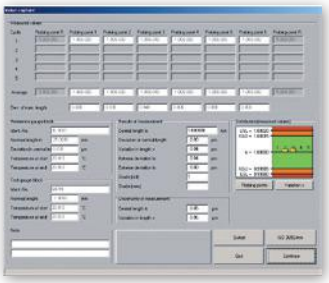
No						
TESA UPC GAUGE BLOCK COMPARATOR EQUIPPED WITH SINGLE TEMPLATE SYSTEM						
05930000	Standard execution without computer application				●	
05930003	Execution for greater accuracy, with computer application			●		
TESA UPC GAUGE BLOCK COMPARATOR EQUIPPED WITH SINGLE AND DUAL TEMPLATE SYSTEM						
05930013	Execution for greater accuracy without computer application		●			
05930015	Execution for greater accuracy, with computer application	●				
EACH VERSION CONSISTS OF:						
01610401	TESA UPC mechanical part equipped with the single template system			●	●	
05960030	TESA UPC mechanical part equipped with both single and dual template system	●	●			
03260401	Pneumatic retraction of the measuring bolt, manually operated				●	
03260432	Electric vacuum pump with foot switch		●			
03260433	Electric vacuum pump with external control	●		●		
01660011	Pneumatic suction loader	●	●	●		
04430012	TESATRONIC electronic unit TT90	●	●	●	●	
05960039	Set of TESA UPC accessories, including the components 04761049, 04760087 and 04761070					
04761049	Opto-RS cable, bidirectional	●		●		
04760087	Opto-RS interface	●		●		
04761070	Connecting cable TESATRONIC TT90 to vacuum pump	●		●		
04768000	Hand switch	●		●		
01690021	Option for greater accuracy with calibration certificate	●	●	●		

Error of Measurement

Provided all the metrological conditions are met, the reliability of the two standard executions No. 05930000 and 05930002 is expressed as follows:	Provided all the metrological conditions are met, the reliability of both executions No. 05930001 and 05930003 along with the option for greater accuracy (No. 01690021) is expressed as follows:
Repeatability limit (with no effect due to external temperature): 0,025 µm	Repeatability limit (with no effect due to external temperature): 0,015 µm
Measurement uncertainty* $U = \pm (0{,}10 + 1{,}0 \cdot L)$ µm (L in m)	Measurement uncertainty* $U = \pm (0{,}05 + 0{,}5 \cdot L)$ µm (L in m)
Condition involves the use of reference standards (see page L-14 and L-15) whose uncertainty is as follows: $U \leq \pm 0{,}030$ µm when calibrating the comparator $U \leq \pm (0{,}05 + 0{,}5 \cdot L)$ µm (L in m) when calibrating the gauge blocks	Condition involves the use of reference standards (see page L-14 and L-15) whose uncertainty is as follows: $U \leq \pm 0{,}015$ µm when calibrating the comparator $U \leq \pm (0{,}02 + 0{,}2 \cdot L)$ µm (L in m) when calibrating the gauge blocks
* Applicable to steel gauge blocks	



TESA UP – Software Programme for Value Processing



TESA UP programme for processing measured values suitable for both TESA gauge block comparators UPD and UPC as well as for comparators from other manufacturers.

- Choice of 10 languages.
- On-line processing of length and temperature values as transferred.
- Measurement cycles and result outputs according to EN ISO 3650.
- Flexible architecture for optimum adaptation to specific user's needs.
- Possible entry of limit values and accuracy grades peculiar to users.
- Surveillance of value dispersion or value drift throughout length and temperature measurements.
- Automatic execution of all relevant corrections. The programme makes allowances for actual sizes of the reference standards, flattening due to different materials used (steel, tungsten carbide, ceramic), compensation of temperature variations with reference to 20°C according to the varying coefficients of linear expansion – as typical examples.
- Assignment of gauge blocks to their relevant grade.
- Possible storage of gauge block set related data.
- Inch or metric value processing.
- Calibration certificate in several formats.

EN ISO 3650

Minimum profile requirements for the computer needed to run the TESA UP software programme Personal Computer
- Configuration without heat source to avoid disturbing the ambient temperature at the measurement spot
- Operating system: Windows 7 or earlier versions (32 bits)
- Processor: 650 MHz
- 1 Hard disc (6 GB)
- RAM capacity: 64 MB
- CD-ROM drive (24x)
- RS232 serial port 1 for length values 1 for temperature values
- 3 USB ports

NO		
05960025	TESA UP software programme for gauge block calibration	1 CD-ROM plus 1 USB key of protection

Gauge Blocks for the Calibration of Comparators

To calibrate both TESA gauge block comparators UPD and UPC, we recommend the use of the gauge block set described hereafter. The 9-piece set is alsoy required for calibrating TESA UPD.

Set composition including 11 steel gauge blocks, class K

Each pair is in full compliance with:

- EAL-G21 – Calibration of gauge block comparators – European cooperation for Accreditation of Laboratories
- DKD-R 4-1 – Guidelines of the German Calibration Service (DKD) for the calibration of gauge block comparators.

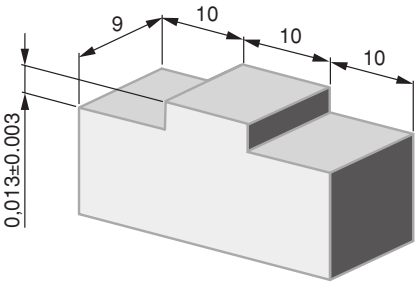
EN ISO 3650

Special high-alloy steel, wear resistant and stable.Exception: 6 mm special carbide gauge blocks.

The given expanded uncertainty k = 3 refers to the difference of central length of both gauge blocks A and B forming the pairs 1 to 5 as well as to the deviations f_o and f_u from the central length of gauge blocks forming both pairs 2 and 3. No need to calibrate those of pair No. 6.

NO		µm
S59110152	Set of 11 gauge blocks with PTB (Physikalisch Technische Budesanstalt) certificate	± 0,015
S59110489	Set of 11 gauge blocks with DAkkS certificate	± 0,030

Full tungsten carbide set also available on request



NO			
Pairs N°	Nominal length A mm	B mm	
1	0,5	0,5	
2	1,0	1,005	
3	1,0	1,01	
4	4,5	4,5	
5	100,0	100,0	
6	6,0	6,0 *	

* Special bridge-shaped gauge blocks (see drawing) used for establishing the measuring deviations of lower probe B.

EN ISO 3650

Special high-alloy steel wear resistant and stable

For calibration certificates, see opposite

Expanded uncertainty k = 2 is valid for that given

Additional Gauge Block Set for Calibration of the TESA UPD System

In order to achieve the lowest uncertainty of measurement, we recommend the use of grade K gauge blocks which have been measured directly by interferometry and are supplied with a calibration certificate, irrespective of any other requirement such as the ambient conditions.

NO		
S59300103	Set 9 gauge blocks with METAS certificate (Swiss)	± 0,02 + 0,2 · L µm (L in m)
S59300107	Set 9 gauge blocks with PTB certificate (Germany)	± 0,02 + 0,2 · L µm (L in m)
S59300104	Set 9 gauge blocks with SCS certificate	± 0,05 + 0,5 · L µm (L in m)

	Set composition (mm) 1 / 5 / 10 / 15 / 20 / 25 / 50 / 75 / 100
	Steel
	Accuracy grade K

Other set composition or carbide gauge blocks also available on request.

TESA UPT

Fully calibrated for the measuring ranges from 19°C up to 24°C with a numerical interval to 0,001°C.

Supplied with a calibration certificate issued by the Swiss Calibration Service (SCS). Uncertainty of measurement achieved during calibration U = ± 0,03°C.

NO	
05930011	Temperature measurement device
CONSISTING OF:	
05960018	Set of 4 temperature sensors PT 100
05960038	Meausring unit for temperature, FLUKE 1529
05960012	Interface Box 4 x PT 100
05960011	Connecting cable for adapter No. 05960012 to measuring unit No. 05960038
05960026	Connecting cable from UPC to computer (9-pin/m and 9-pin/f connector)

ETALON POLO HORIZONTAL MEASURING BENCH

A giant for small sizes – Specially designed for the control of measuring and test equipment in compliance with ISO 9000.

- Application range from 0 up to 100 mm for external dimensions of 2,5 up to 110 mm for internal dimensions – 50 mm measuring span.
- Resolution to 0,001 or 0,0001 mm – Metric/Inch conversion.
- Maximum permissible error of 0,5 µm.
- Measuring force from 0 to 4 N.
- Comes with a calibration certificate issued by the supplier.

Calibration of Standards:

- Cyllindrical test pins
- Setting standards with cylindrical, plane-parallel measuring faces
- Threaded reference gauges (calibrated using the 3-wire method)
- Setting masters
- Setting rings

Calibration of Plus Gauges:

- Limit plug gauges
- Plug gauges "GO"
- Plug gauges "NO GO"
- Plain plug gauges
- Ring gauges "GO"
- Ring gauges "NO GO"
- Threaded plug gauges

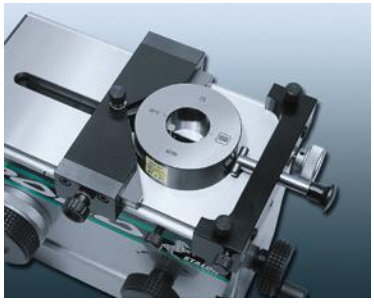
Workpiece Inspection:

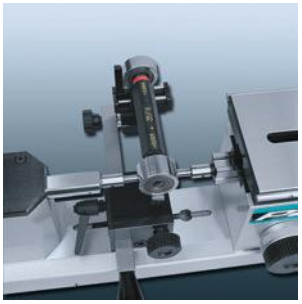
External dimensions

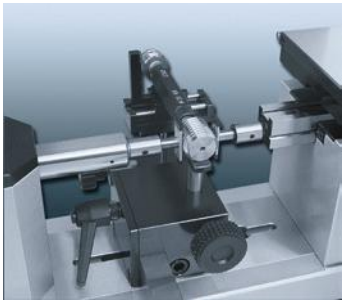
- Stepped shafts
- Cutting tools
- Cylindrical pins
- Ball tips
- Grooves
- Short centring shoulders
- Threads (measured according to the 3-wires method)

Internal dimensions

- Through bores
- Blind bores
- Centring grooves
- Slots
- Sliding guides







Max. perm. error within the measuring span: 0,5 µm with standard accessories

0,1 µm

Opto-electronic measuring system with incremental glass scale, type LIF – HEIDENHAIN

Tilting range of the floating table ± 0,5°

EN 50081-1
EN 50082-2
EN 61000-4-2
EN 61000-4-4

Setting 0 to 4 N

50 mm measuring span

19 kg net (main part alone, without table). Floating table: 2,8 kg net

8,0 • 10^{-6}/°C

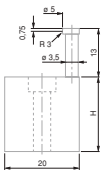
- 0 to 100 mm for external dimensions
- 10 to 110 mm with standard accessories
- 2,5 to 110 mm with optional accessories

ETALON POLO with Floating Resting Table

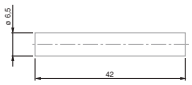
Calibration of measuring instruments

- Dial Gauges
- Lever Dial Test Indicators
- Electronic transducers

05939001	ETALON POLO measuring bench with floating table and electronic computing counter
CONSISTING OF:	
05919002	Main part
05969024	1 pair of inserts for external dimensions
05969015	Floating measuring table
05969029	HEIDENHAIN computing counter ND 287
DELIVERED WITH THE FOLLOWING ACCESSORIES:	
05969020	1 Pair of standard inserts for internal dimensions from 10 mm
05969030	Protective cover



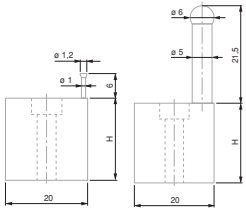
05969020



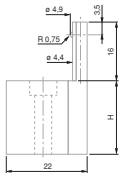
05969024

Pair of Standard Measuring Inserts for External and Internal Dimensions from 10 mm

NO	=	Description
05969020	1 Pair of standard inserts for internal dimensions from 10 mm	To be used with floating table N° 05960015, H = 20 mm
05969024	1 pair of inserts for external dimensions	6,5mm Ø carbide inserts with a flat face



05969021 05969022



05969023

Measuring Inserts for Internal Measurement used with the Floating Resting Table

Height H = 20 mm. M4 locking screw.

NO	=	Description
05969021	Internal measuring inserts from 2,5 mm	Barrel-shaped inserts with a 1,2 mm dia. carbide ball tip.
05969022	Internal measuring inserts from 13 mm	Fitted with a 6 mm dia. carbide ball tip.
05969023	Internal measuring inserts from 5 mm	Fitted with a 1,5 mm dia. carbide ball tip.

Bench Stand with Swivelling Plate

For raising the measuring bench form horizontal to vertical position. Accomodates a clamp lever. Length (upright): 295 mm, mass ≈ 20 kg.

NO	=
05969000	Bench stand with swivelling plate

Base for the Computing Counter

Base for raising up the HEIDENHAIN ND 287 counting unit, height 380 mm, weight 5,2 kg.

NO	=
05969001	Stand for computing counter

Floating Resting Table

Used for external measurement on oblong parts up to 60 mm in diameter; centres, L=160 mm; movable positioning fixture for parts having varying lengths, 3 freedom degrees.

NO	=
05969032	Resting table without vise
05969033	Vise for plug gauges
05969034	Floating table

Stands for Checking External Dimensions

NO	=
05969007	Ø 3 mm stand for external Ø
05969008	Ø 6 mm stand for external Ø

Stand with Ø 10 mm Fixing Bores

For H-shaped table (05969003) and for control system for lever-type indicator (05969004)

05969002	Stand with Ø 10 mm bore for 05969003 and 05969004

Centering Device

Allows the user to search for the transverse culmination point against the measuring direction. Used with either the fixed or floating table No. 05969014 or 05969015. Prismatic stop adjustable transversely, max. diameter 110 mm. Counter pressure piece finished with cylindrical stop pins.

05969012	Centering device for culmination point

Fixing Shank

For clamping the instruments that need to be calibrated such as dial gauges or precision indicators etc.

059690010

05969010	For fixing shafts with a Ø 8 mm
05969011	For fixing shafts with a Ø 3/8 in

Holder for a Dial Test Indicator (Lever-type)

Provided with 2 dovetail clamps, TESATAST-type or in compliance with BS 2795:1981

05969004	Holding device for test indicator

Spindle for Calibrating Dial Gauges, Dial Test Indicators and such like

Setting range = 50 mm, Spindle rotation = 0,5 mm

05969009	Spindle for calibrating dial gauges, dial test indicators and such like