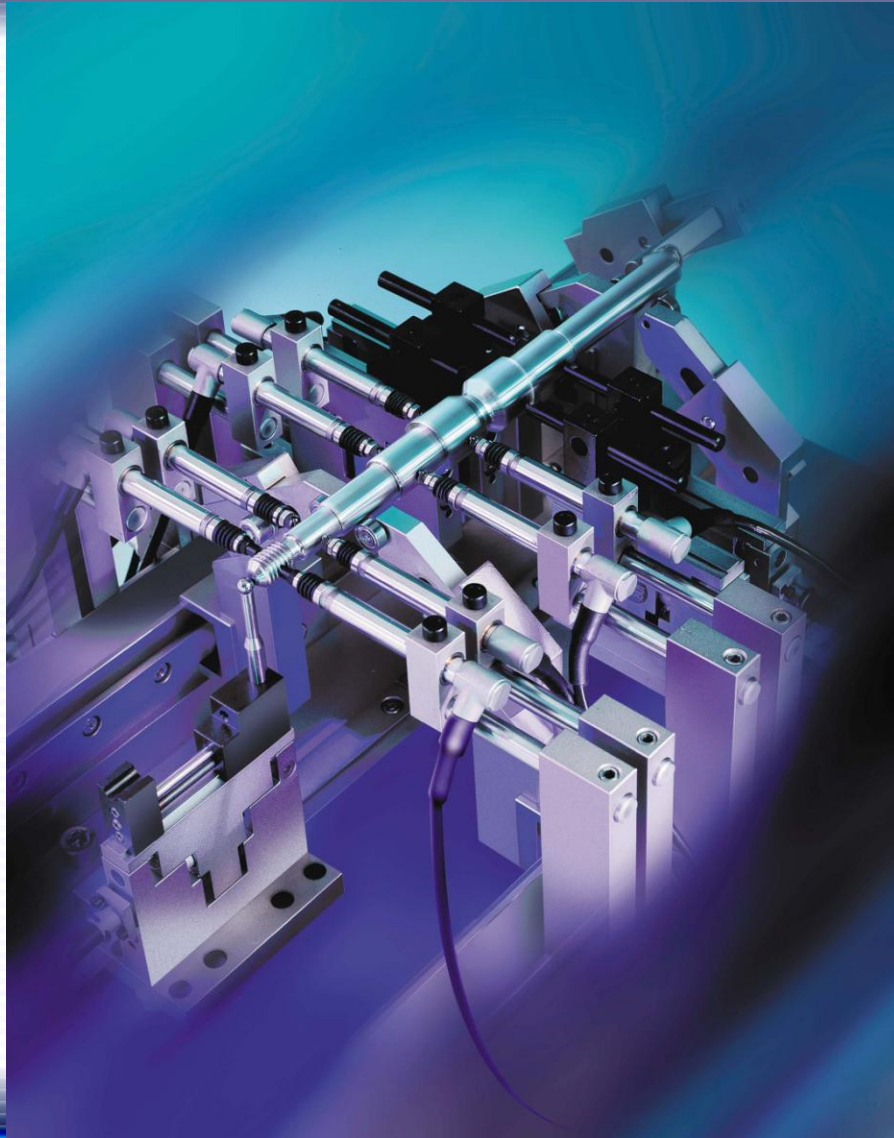




# Electronic Length Measuring Equipments

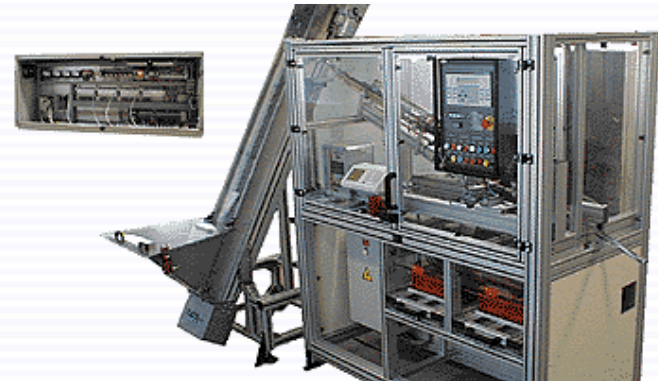


HEXAGON METROLOGY

Blaise Vuille  
Blaise Vuille



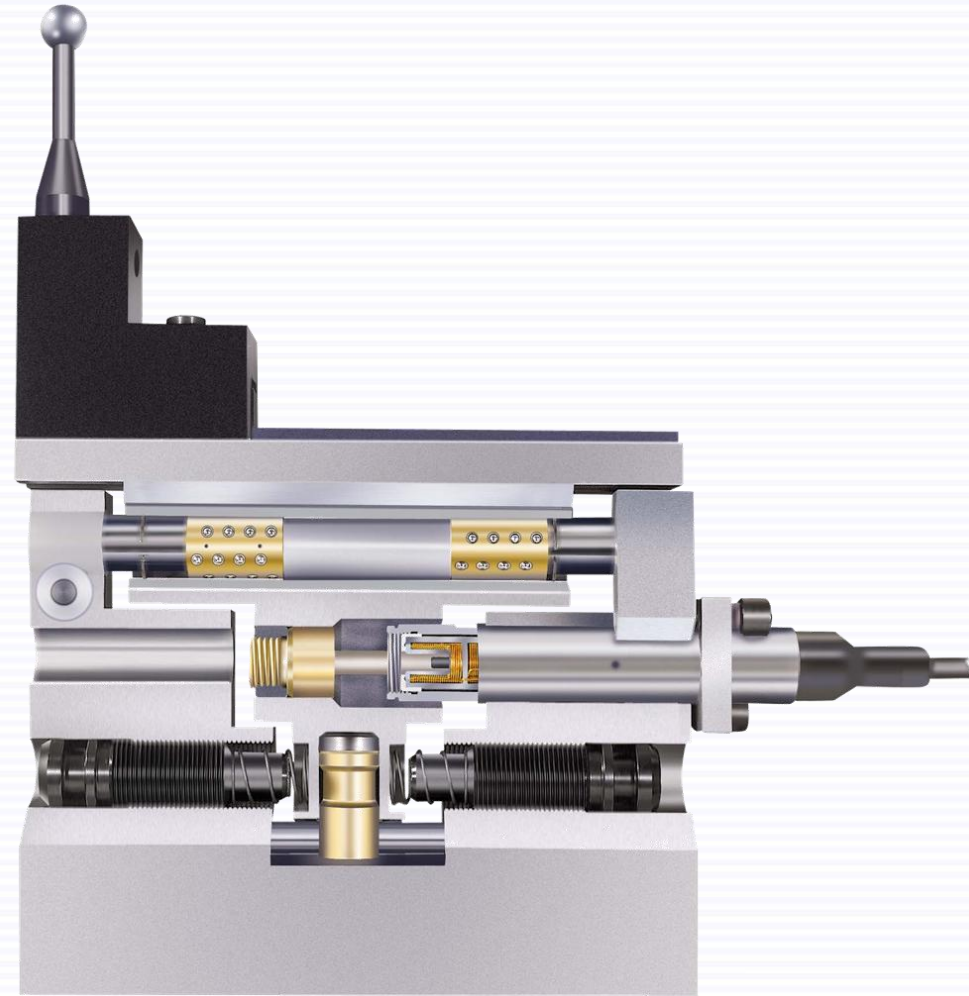
- Component sales program
- Very fast measurements (100% control)
- High accuracy measurements
- Full range of probes and electronic
- Swiss made



# TESA Probes GT Type



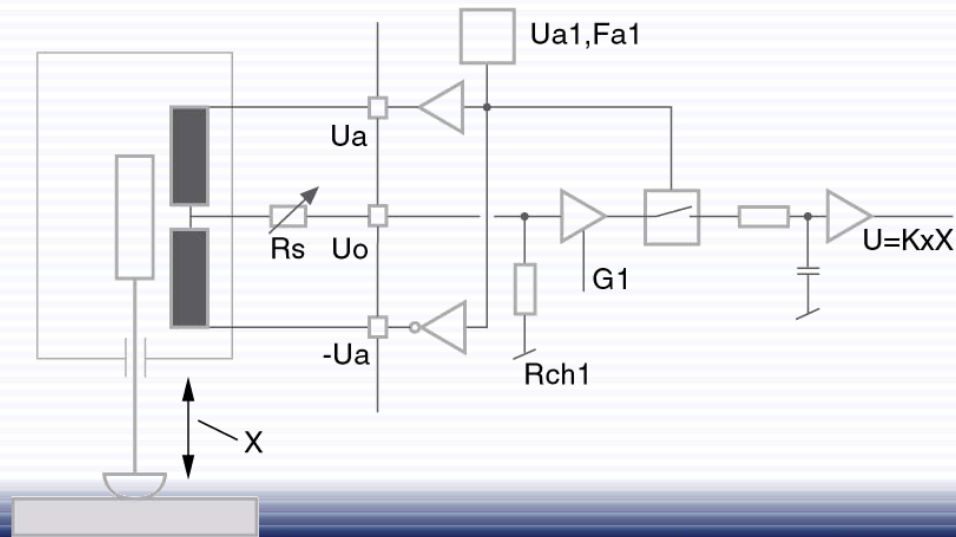
# FMS Type



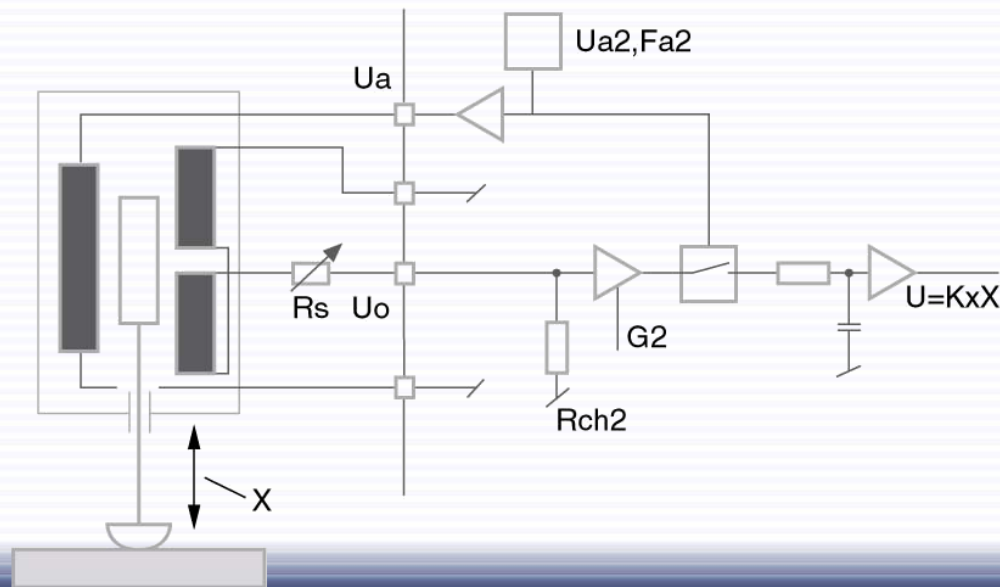
# Standard TESA Half-Bridge



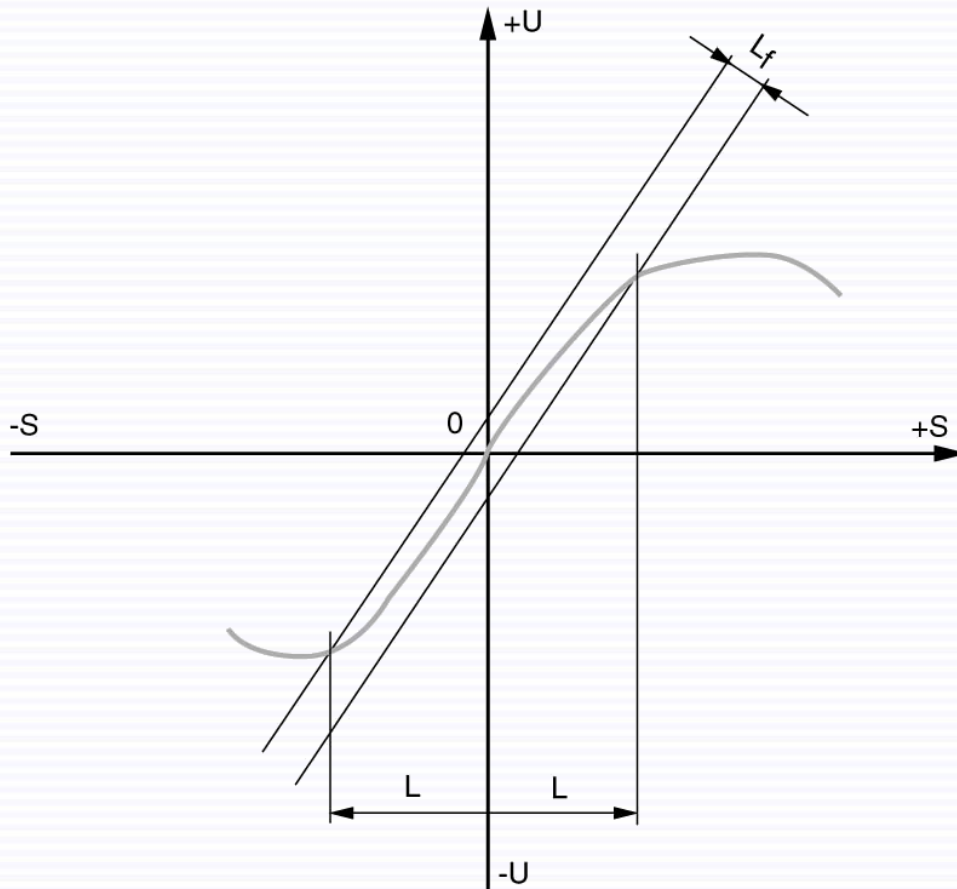
- Drive voltage 3 V
- Drive frequency 13 kHz
- Adjustment load 2 k $\Omega$
- Sensitivity 73,75 mV/V/mm



- Drive voltage 3 V
- Drive frequency 5 kHz
- Adjustment load 100 k $\Omega$
- Sensitivity 150 mV/V/mm
- **Delivery without connector**



# Probes Linearity error



- S travel
- U output current
- O electrical zero
- L linearity range
- L<sub>f</sub> linearity error

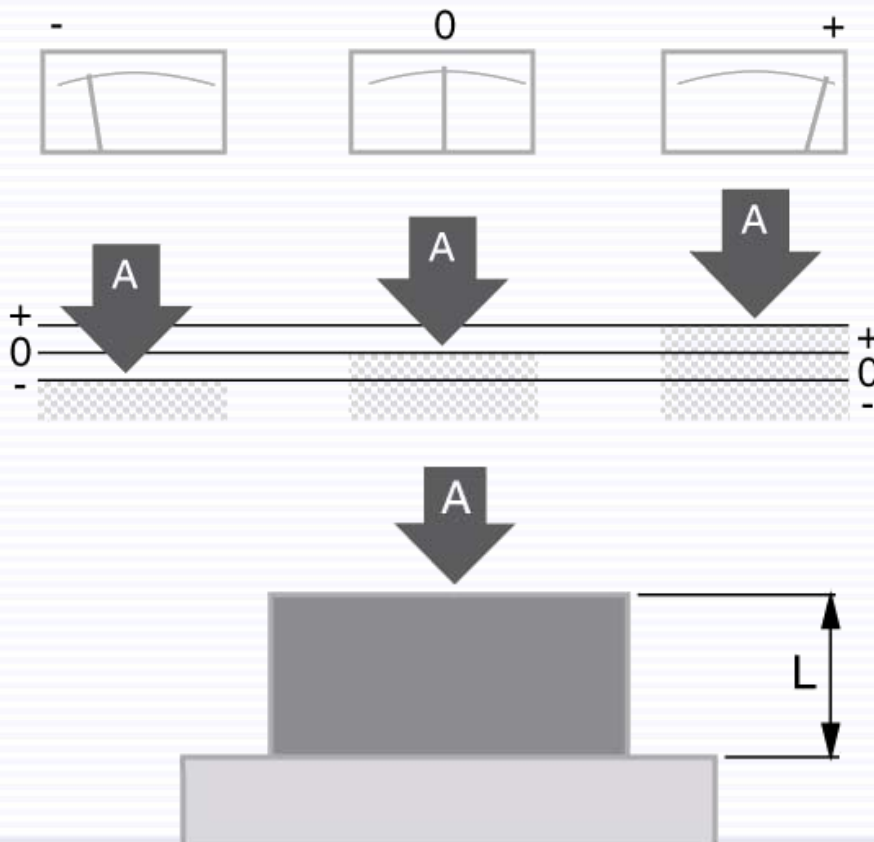


# General Overview:



## Measuring Functions:

Single measurements with positive polarity sign (+A)

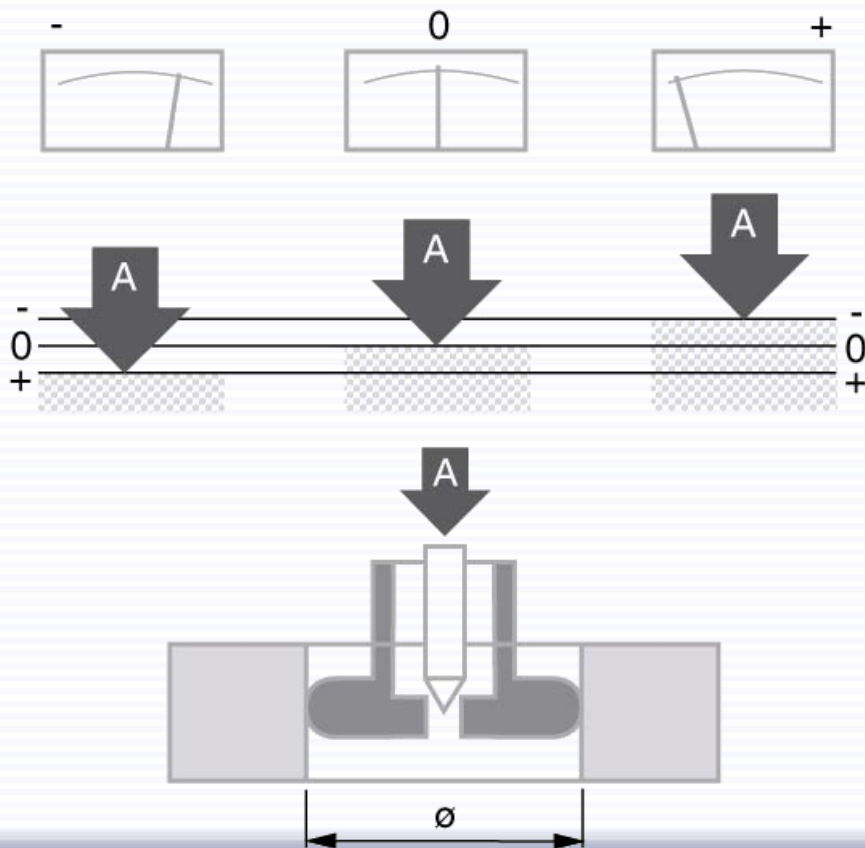


# General Overview:



## Measuring Functions:

Single measurements with negative polarity sign (-A)

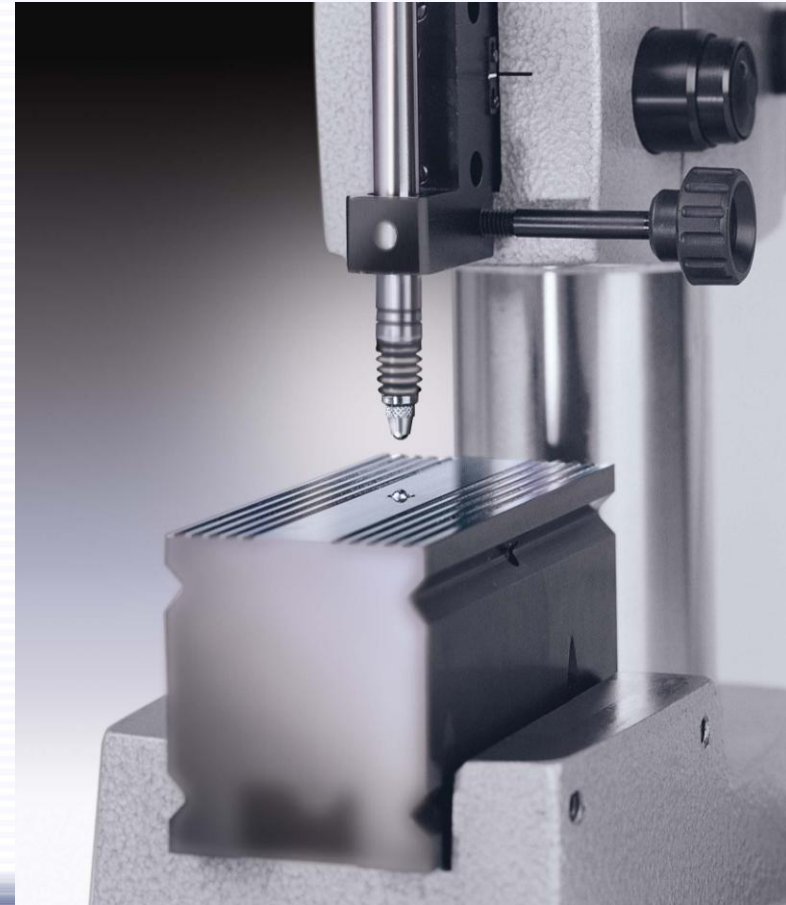
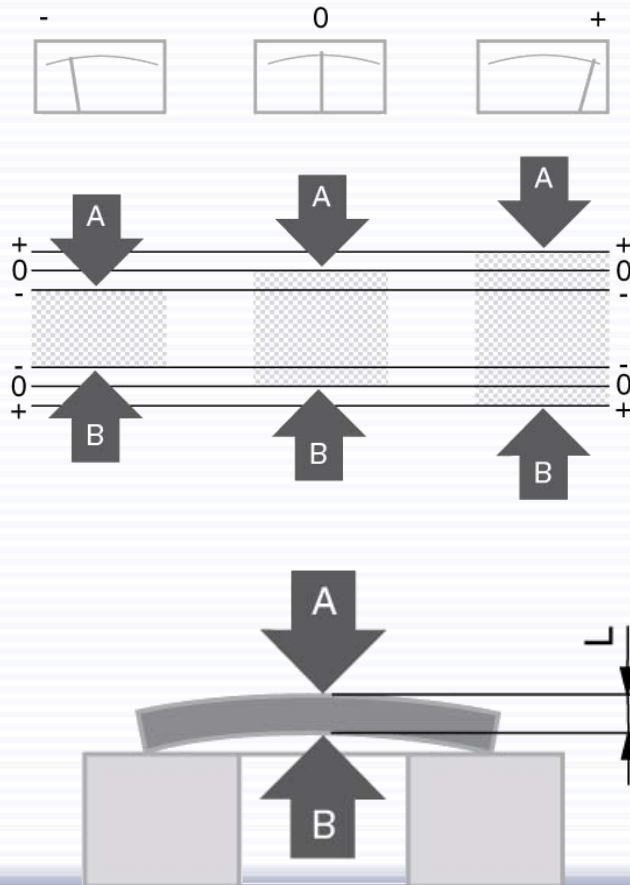


# General Overview:



## Measuring Functions:

Sum measurements with positive polarity signs (+A+B)

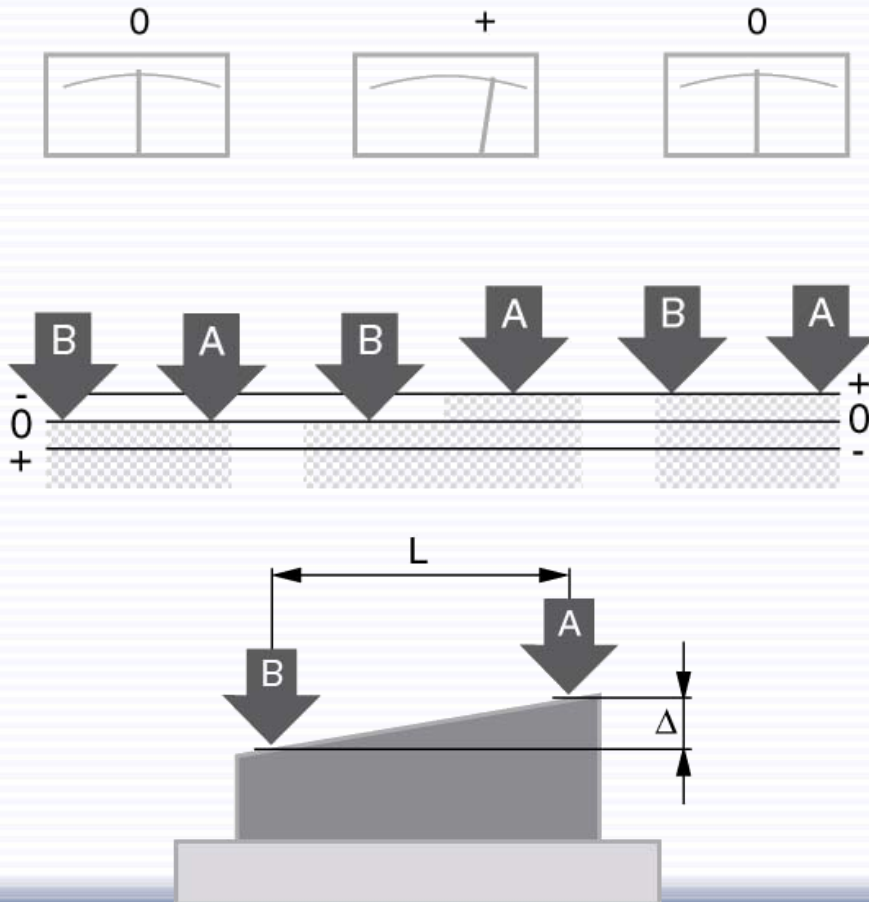


# General Overview:



## Measuring Functions:

Difference measurements with opposite polarity signs (+A-B)

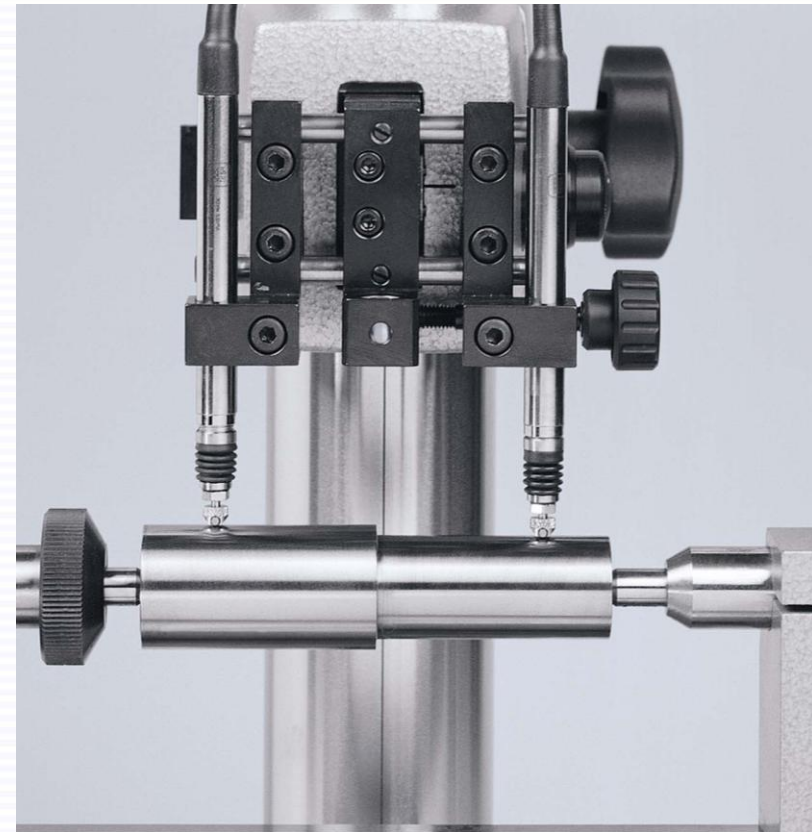
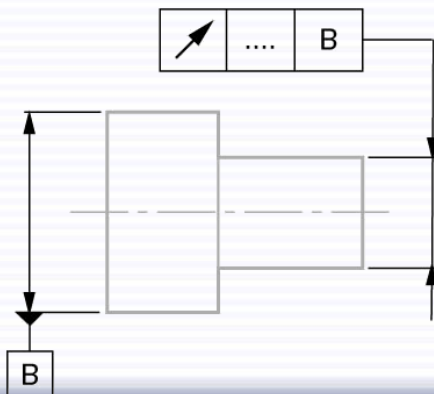
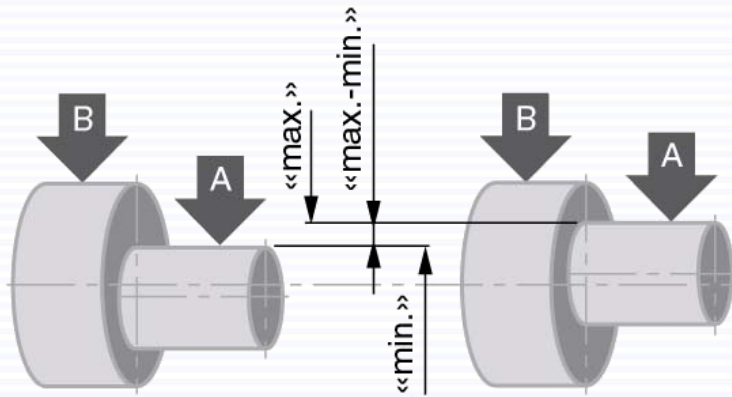


# General Overview:



## Measuring Functions:

Difference measurements with opposite polarity signs (+A-B)












## 8 mm Diameter Axial Probes with Ball-Bearing Measuring Bolt

						Measuring bolt retraction	Sealing bellows
<i>Standard probes</i>							
	03210904	GT 21	± 2	4,3	axial	mechanical	Nitrile
	03210924	GT 22	± 2	4,3	radial	by vacuum	Nitrile
	03230057	GTL 21	± 2	4,3	axial	mechanical	Viton
	03230072	GTL 211	± 2	4,3	axial	by vacuum	Viton
	03230056	GTL 22	± 2	4,3	radial	by vacuum	Viton
<i>Standard high-precision probes</i>							
	03230036	GT 21HP	± 0,2	4,3	axial	mechanical	Nitrile
	03230021	GT 22HP	± 0,2	4,3	radial	by vacuum	Nitrile
<i>Standard long-travel probes</i>							
	03230027	GT 27	± 2	10,3	axial	mechanical	Viton
	03230073	GT 271	± 2	10,3	axial	by vacuum	Viton
	03230026	GT 28	± 2	10,3	radial	by vacuum	Viton
<i>Probes with extended measuring range</i>							
	03230041	GT 61	± 5	10,3	axial	mechanical	Viton
	03230074	GT 611	± 5	10,3	axial	by vacuum	Viton
	03230042	GT 62	± 5	10,3	radial	by vacuum	Viton

... with Activation of the Measuring Bolt by pneumatic Pressure






						Pressure (bar)		
			Measuring range (mm)	mm	Cable exit	nominal	maximum	Sealing bellows
<i>Standard probes</i>								
	03230060	GTL 212	± 1,5	3,2	axial	0,7	1,0	Viton
	03230054	GTL 222	± 1,5	3,2	radial	0,7	1,0	Viton
	03230067	GTL 212-A	± 1,5	3,2	axial	0,25	6,0	none
	03230063	GTL 222-A	± 1,5	3,2	radial	0,25	6,0	none
<i>Long-travel probes</i>								
	03230061	GT 272	± 2	10,3	axial	1,1	1,5	Viton
	03230053	GT 282	± 2	10,3	radial	1,1	1,5	Viton
	03230068	GT 272-A	± 2	10,3	axial	1,0	6,0	none
	03230069	GT 282-A	± 2	10,3	radial	1,0	6,0	none
<i>Probes with extended measuring range</i>								
	03230062	GT 612	± 5	10,3	axial	1,1	1,5	Viton
	03230055	GT 622	± 5	10,3	radial	1,1	1,5	Viton
	03230070	GT 612-A	± 5	10,3	axial	1,0	6,0	none
	03230071	GT 622-A	± 5	10,3	radial	1,0	6,0	none

## 8 mm Diameter Miniature Probes





						Measuring bolt retraction	Sealing bellows
			Measuring range mm	mm	Cable exit		
<i>Measuring bolt hanging from diaphragm springs</i>							
	03230001	GT 41	± 0,3	0,7	axial	without	Nitrile
	03230002	GT 42	± 0,3	0,7	radial	vacuum	Nitrile
<i>Measuring bolt mounted on a plain bearing</i>							
	03230035	GT 43	± 1	2,1	axial	mechanical	Viton
	03230017	GT 44	± 1	2,1	radial	vacuum	Viton









Axial probes with measuring bolt mounted on ball-bearing, with no brand name

						Measuring bolt retraction	Sealing bellows
<i>Standard probes</i>							
	<b>03230490</b>	<b>490</b>	± 1,5	4,3	axial/radial	mechanical	Viton
	<b>03230491</b>	<b>491</b>	± 1,5	4,3	radial	vacuum	Viton
<i>Standard probes with short body</i>							
	<b>96410012</b>	<b>410</b>	± 1	2,5	axial/radial	mechanical	Nitrile
	<b>96411014</b>	<b>411</b>	± 1	2,5	radial	vacuum	Viton
<i>Standard probes with short body, 6 mm dia. fixing shank</i>							
	<b>96160013</b>	<b>160</b>	± 1	3,3	axial	mechanical	Viton
<i>Miniature probes, 8 mm dia. fixing shank</i>							
	<b>96430029</b>	<b>430</b>	± 0,5	1,25	axial	mechanical	Nitrile
	<b>96441041</b>	<b>451</b>	± 0,5	2,1	radial	vacuum	Nitrile

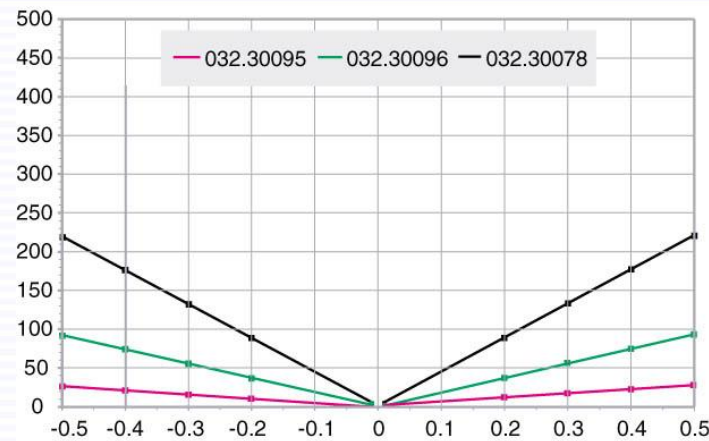
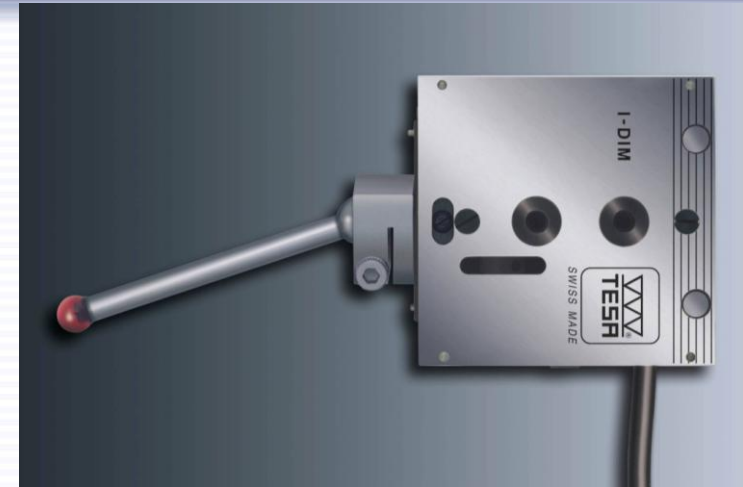
## Lever Probes

						Measuring bolt retraction	Sealing bellows
	96420004	420	± 0,2	0,525	parallel	without	none
	96499007	499	± 0,5	1,2	parallel	without	none

## Probe with inclinable lever

						Measuring bolt retraction
	03210802	GT 31	± 0,3	0,7	angled	without

## Universal probe I-DIM



## FMS probes with parallel guiding

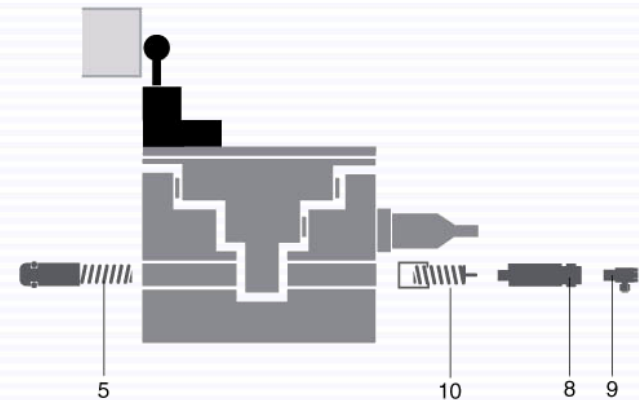
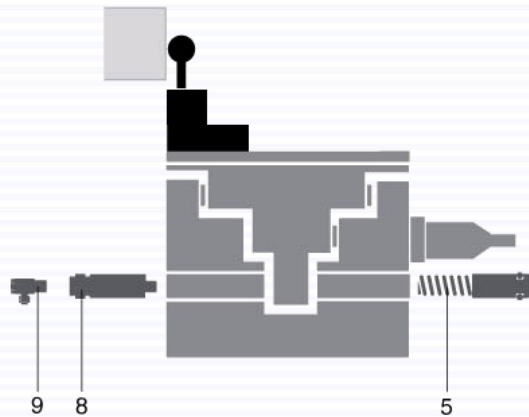
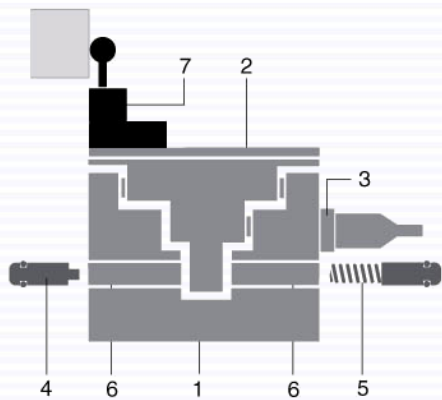
						
			Measuring range (mm)	mm	Cable exit*	Measuring bolt retraction (accessory)
<i>Standard probes</i>						
	03230019	FMS 100	± 2	5,8	parallel	air pressure
	03230028	FMS 102	± 2	5,8	angled	air pressure
	03230049	FMS 130	± 2,9	5,8	parallel	air pressure
	03230050	FMS 132	± 2,9	5,8	angled	air pressure
<i>Probes «FMS Protected»</i>						
	03230037	FMS 100-P	± 2	5,8	parallel	air pressure
	03230038	FMS 102-P	± 2	5,8	angled	air pressure
	03230051	FMS 130-P	± 2,9	5,8	parallel	air pressure
	03230052	FMS 132-P	± 2,9	5,8	angled	air pressure

## FMS probes

A: no pneum.

B: Retract. by pneum.

C: Avan. by pneum.






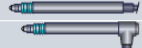
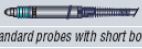


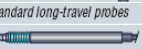
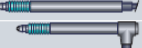

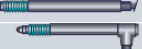

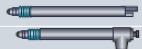
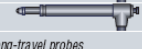
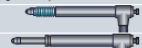

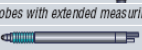
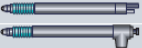







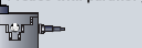
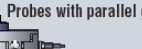

## Axial probes with measuring bolt mounted on ball-bearing

						Measuring bolt retraction	Sealing bellows	
			Measuring range mm	Measuring range mm	Cable exit			
<i>Standard probes</i>								
	03230029	GT 21 LVDT	± 1,5	4,3	axial	mechanical	nitrile	
	03230030	GT 22 LVDT	± 1,5	4,3	radial	vacuum	nitrile	
<i>Standard long-travel probes</i>								
	03230031	GT 27 LVDT	± 1,5	10,3	axial	mechanical	Viton	
	03230032	GT 28 LVDT	± 1,5	10,3	radial	vacuum	Viton	
<i>Probes with extended measuring range</i>								
	03230046	GT 61 LVDT	± 5	10,3	axial	mechanical	Viton	
	03230048	GT 62 LVDT	± 5	10,3	radial	vacuum	Viton	
<i>... with activation of the measuring bolt by pneumatic pressure</i>								
						Pressure (bar)	Sealing bellows	
			Measuring range mm	Measuring range mm	Cable exit	nominal value	highest value	
	S32020269	GT 222 LVDT	± 1,5	3,2	radial	0,7	1,0	Viton

## probes with parallel guiding

						Measuring bolt retraction (accessory)
			Measuring range mm	mm	Cable exit *	
<i>Standard probes</i>						
	03230033	FMS 100 LVDT	± 1,5	5,8	parallel	air pressure
	03230034	FMS 102 LVDT	± 1,5	5,8	angled	air pressure
<i>Probes «FMS Protected»</i>						
	03230039	FMS 100-P LVDT	± 1,5	5,8	parallel	air pressure
	03230040	FMS 102-P LVDT	± 1,5	5,8	angled	air pressure

## Compatibility of TESA Probes with Electronic Equipments from Other Makers

																
		Measuring range (mm)	TESA Half-bridge	MERCER Half-bridge	DATAMYTE Half-bridge	ETAMIC (ZCB) LVDT	ETAMIC (ZDB) LVDT	MAHR Half-bridge	MARPOSS LVDT	MARPOSS Half-bridge	METEM Half-bridge	PRETEC Half-bridge	SIGMA Half-bridge	SOLARTRON Half-bridge	SOLARTRON LVDT	
<b>8 mm diameter axial probes with measuring bolt mounted on a ball-bearing</b>																
<i>Standard probes</i>																
	GTL21	± 2	03230057			03290119	03251021	03290143	03253021	03253001	03254021	03259021	03255021	03257001	03257021	
	GTL22 (491)	± 2	03230056	03236491		03290120	03251022	03290144	03253022	03253002	03254022	03259022	03255022	03257002	03257022	
	490	± 1,5	03230490	03236490	03258490									03257490		
<i>Standard probes with short body</i>																
	410	± 1	96410012	96410010			96410101	96410111	96410033	96410136	96410031	96410171	96410093	96410044	96410211	
	411	± 1	96411014	96411011			96411101	96411111	96411131	96411136	96411141	96411171	96411181	96411201	96411211	
<i>Standard long-travel probes</i>																
	GT27	± 2	03230027			03290121	03251027	03252027	03253027	03253005	03254027		03255027	03257005	03257027	
	GT28	± 2	03230026			03290122	03251028	03252028	03253028	03253006	03254028		03255028	03257006	03257028	
<i>Probes with extended measuring range</i>																
	GT61	± 5	03230041	03236061	03258061		03251061	03252061	03253061	03253011	03254061		03255061	03257011	03257061	
	GT62	± 5	03230042	03236062			03251062	03252062	03253062	03253012	03254062		03255062	03257012	03257062	
<b>8 mm diameter axial probes with activation of the measuring bolt by pneumatic pressure</b>																
<i>Standard probes</i>																
	GTL212	± 1,5	03230060		03258212			03290145			03254212					
	GTL222	± 1,5	03230054		03258222		03251222	03290146	03253222	03253003	03254222		03255222	03257003	03257222	
	GTL222-A	± 1,5	03230063	03236492	03258223		03251223	03252223	03253223	03253004	03254223		03255223	03257004	03257223	
<i>Long-travel probes</i>																
	GT282	± 2	03230053		03258282		03251282	03252282	03253282	03253007	03254282		03255282	03257007	03257282	
	GT282-A	± 2	03230069		03258283		03251283	03252283	03253283	03253008	03254283		03255283	03257008	03257283	
<i>Probes with extended measuring range</i>																
	GT612	± 5	03230062		03258612						03254612					
	GT622	± 5	03230055				03251622	03252622	03253622	03253013	03254622		03255622	03257013	03257622	
	GT612-A	± 5	03230070		03258613						03254613					
	GT622-A	± 5	03230071				03251623	03252623	03253623	03253014	03254623		03255623	03257014	03257623	
<b>Probes with short body, ball-bearing measuring bolt</b>																
<i>Standard probes with a 6 mm fixing shank diameter</i>																
	160	± 1	96160013	96160011			96160101	96160111	96160169	96160136	96160141	96160171	96160015	96160021	96160211	
<i>Miniature probes with a 8 mm fixing shank diameter</i>																
	430	± 0,5	96430029	96430028			96430101	96430111	96430131	96430136	96430030	96430171	96430181	96430033	96430211	
	451	± 0,5	96441041	96441015			96441101	96441054	96441131	96441136	96441032	96441058	96441093	96441077	96441211	
<b>Lever probes</b>																
	420	± 0,2	96420004	96420001			96420101	96420003	96420131	96420136	96420006	96420007	96420011	96420012	96420211	
	499	± 0,5	96499007	96499004			96499101	96499111	96499020	96499136	96499141	96499018	96499010	96499021	96499211	
<b>Probes with parallel guiding</b>																
	FMS100	± 2	03230019			03290123					03254100					
	FMS102	± 2	03230028			03290124					03254102					



# TESA DC Probes



		Measuring range (mm)	Output voltage V	Sensitivity V/mm	µm	(L in mm) µm*

## Standard probes

03230059	GTL 21 DC	± 2	± 2	1	0,1	$0,2 + 3,5 \cdot L^2$
S32080457	GTL 21 DC ±10 V	± 1	± 10	10	0,1	$0,2 + 3,5 \cdot L^2$
03230058	GTL 22 DC	± 2	± 2	1	0,1	$0,2 + 3,5 \cdot L^2$
S32080722	GTL 22 DC ±10 V	± 1	± 10	10	0,1	$0,2 + 3,5 \cdot L^2$
S32080723	GTL 22 DC ±10 V	± 2	± 10	5	0,1	$0,2 + 3,5 \cdot L^2$

## Standard long-travel probes

03230079	GT 27 DC	± 2	± 2	1	0,1	$0,2 + 3 \cdot L^3$
S32180358	GT 27 DC 5 V/mm	± 2	± 10	5	0,1	$0,2 + 3 \cdot L^3$
03230080	GT 28 DC	± 2	± 2	1	0,1	$0,2 + 3 \cdot L^3$

## Probes with extended measuring range

03230086	GT 61 DC	± 5	± 5	1	0,1	$1 + 4 \cdot L$
03230087	GT 62 DC	± 5	± 5	1	0,1	$1 + 4 \cdot L$

## Probes with activation of the measuring bolt by pneumatic pressure

03230088	GTL 222 DC	± 1,5	± 1,5	1	0,1	$0,2 + 3,5 \cdot L^2$
S32080728	GTL 222 DC 5 V/mm	± 1,5	± 7,5	5	0,1	$0,2 + 3,5 \cdot L^2$
S32080729	GTL 222 DC ±10 V	± 1	± 10	10	0,1	$0,2 + 3,5 \cdot L^2$
03230089	GT 282 DC	± 2	± 2	1	0,1	$0,2 + 3 \cdot L^3$
03230090	GT 622 DC	± 5	± 5	1	0,1	$1 + 4 \cdot L$

## Miniature probes with measuring bolt hanging from a diaphragm spring

03230082	GT 41 DC	± 0,3	± 0,3	1	0,1	$0,2 + 5 \cdot L^3$
03230083	GT 42 DC	± 0,3	± 0,3	1	0,1	$0,2 + 5 \cdot L^3$

## Miniature probes with measuring bolt mounted on a plain bearing

03230084	GT 43 DC	± 1	± 1	1	0,1	$0,2 + 5 \cdot L^3$
03230085	GT 44 DC	± 1	± 1	1	0,1	$0,2 + 5 \cdot L^3$

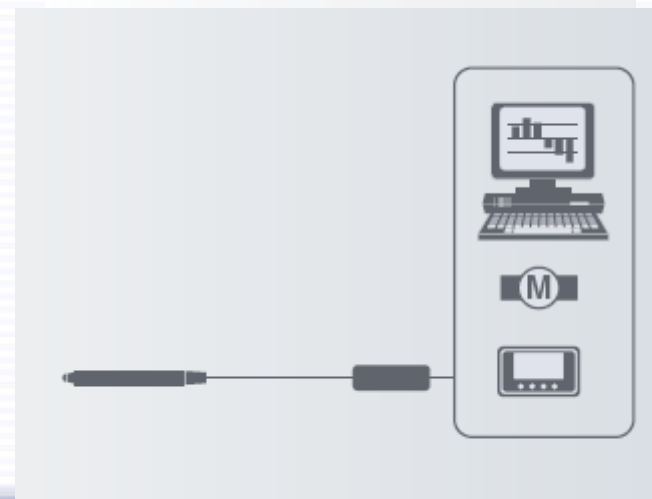
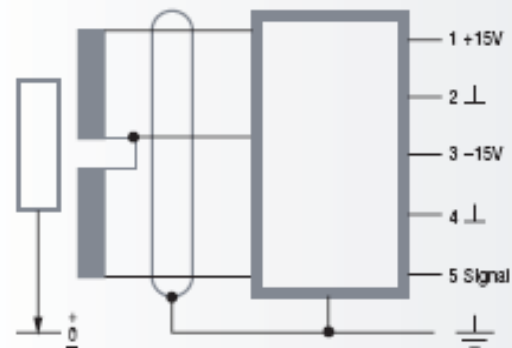
## Probes with inclinable lever

03230081	GT 31 DC	± 0,3	± 0,3	1	0,1	$0,2 + 50 \cdot L^2$
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## Probes with parallel guiding

03230091	FMS 100 DC	± 2	± 2	1	0,5	$0,2 + 3 \cdot L^3$
03230092	FMS 102 DC	± 2	± 2	1	0,5	$0,2 + 3 \cdot L^3$
S32080007	FMS 102 DC ±10 V	± 1	± 10	10	0,5	$0,2 + 3 \cdot L^3$
03230093	FMS 130 DC	± 2,9	± 2,9	1	0,5	$0,2 + 3 \cdot L^3$
03230094	FMS 132 DC	± 2,9	± 2,9	1	0,5	$0,2 + 3 \cdot L^3$

## Operating scheme







- 1 Probe input
- 1 Characteristic



- 2 Probe inputs
- 1 Characteristic



- 2 Probe inputs
- 1 Characteristic
- Dynamic measuring
- Analogue output



- 2 Probe inputs
- 1 Characteristic
- Dynamic measuring
- Analogue output
- High-resolution  
0.01 μm



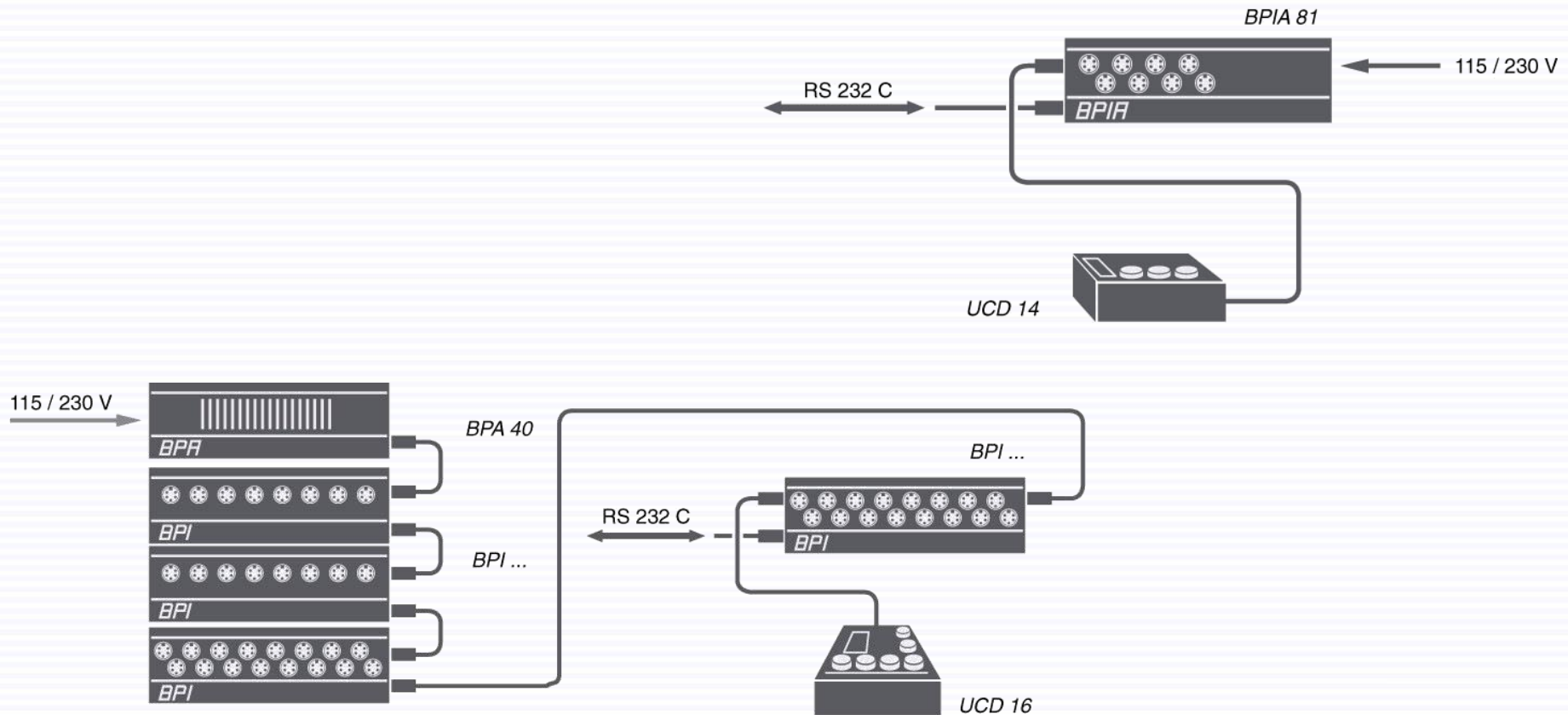
- 2 Probe inputs
- 1 Characteristic
- High-resolution  
0.001 μm
- UPC measuring mode
- Dynamic measuring
- Analogue output

Output Signal : RS 232, digital

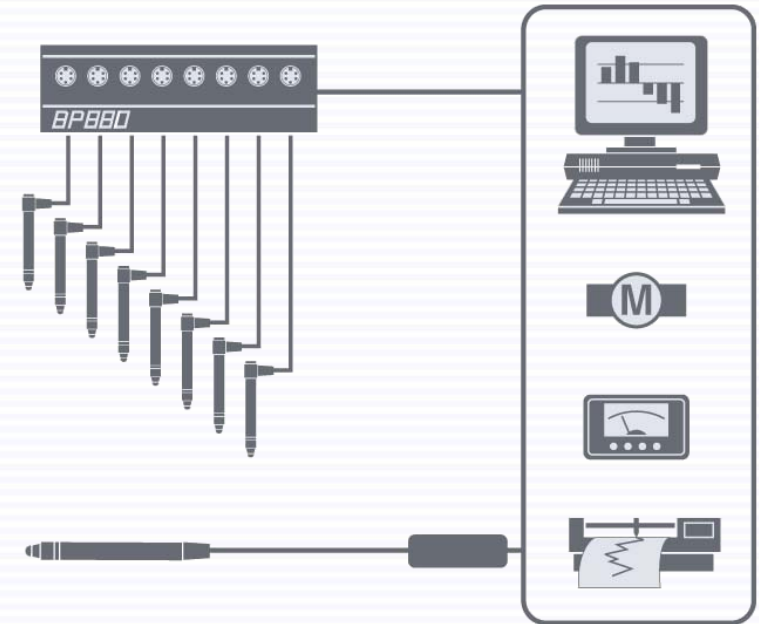




## Output Signal : RS 232, digital

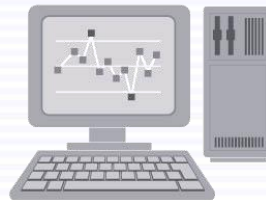
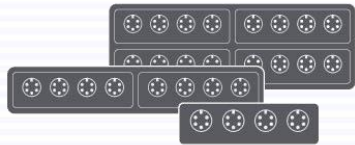
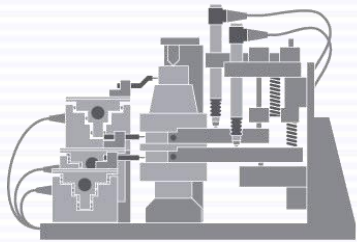
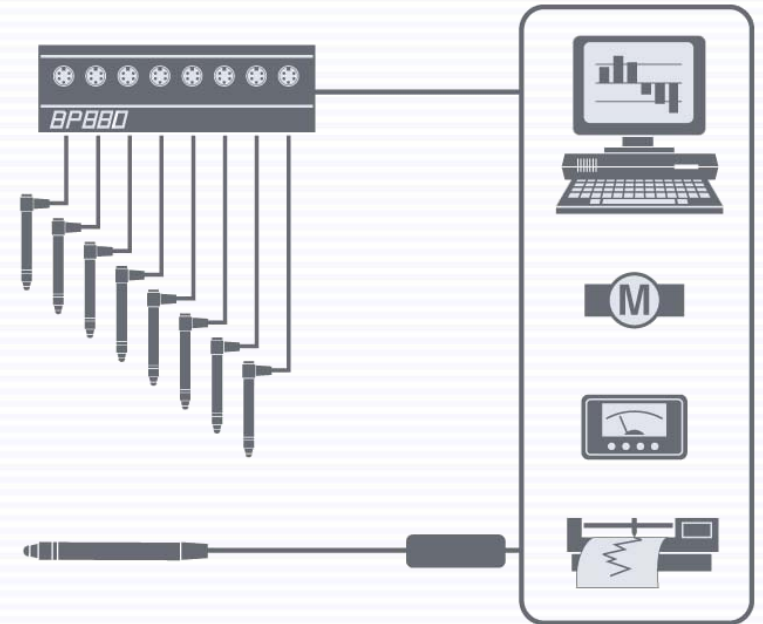


## Output Signal : Analogue





## Output Signal : Analogue



# TESA TG



# Digital measuring system

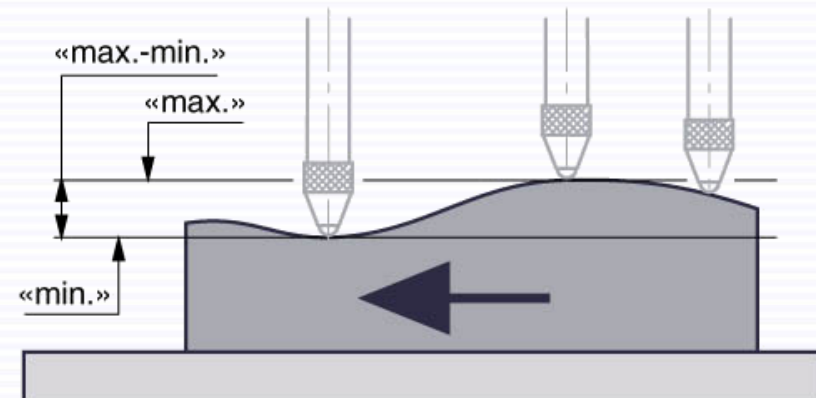
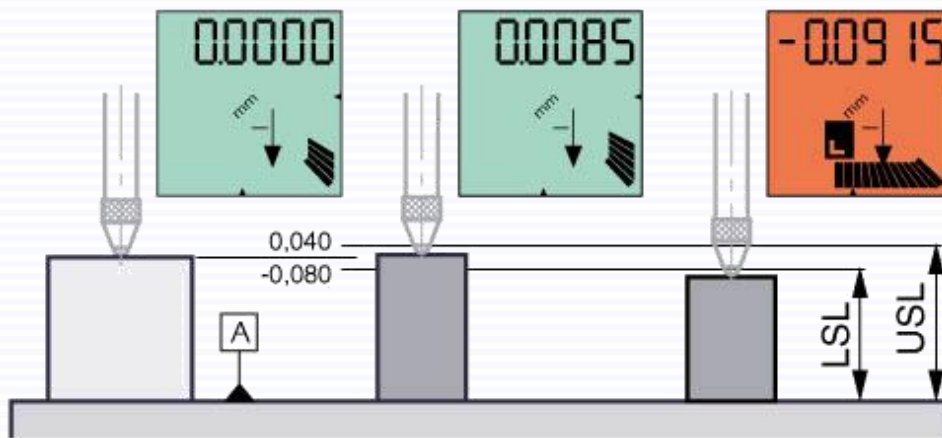


HEXAGON METROLOGY

Blaise Vuille  
Blaise Vuille



- 1 Probe input
- 1 Characteristic
- Input – output signal





- Measuring span:  
30 and 60 mm
- Max. perm. Error:  
1 and 2  $\mu\text{m}$



- Very aggressive prices from Hirt and Solartron
- TESA is very strong where the TESA half-bridge standard is established
- TESA probes have technical advantages again Solartron and Marposs, comparisons are available



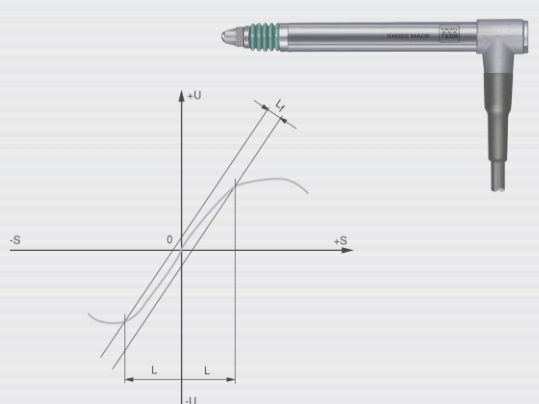
- Through OEM, who has the capability to do gauging system
- Research of automation manufacturer
- Formation of the new distributors






## TESA USB probes

- Easy to use
- Compatible
- Versatile
- Accurate
- Approved mechanic



The diagram shows a probe tip on the right and a graph on the left. The graph has a vertical axis labeled 'A+U' and a horizontal axis labeled '-S' and '+S'. A curve is plotted, and a straight line is drawn through it. The distance from the origin to the intersection of the line and the horizontal axis is labeled 'L' on both sides. The vertical distance from the origin to the line is labeled 'U'.

Need display or calculation box between probe and computer



A rectangular black box with a silver front panel. It has 16 circular ports on the front, numbered 1 to 16. There are also two red ports on the right side.

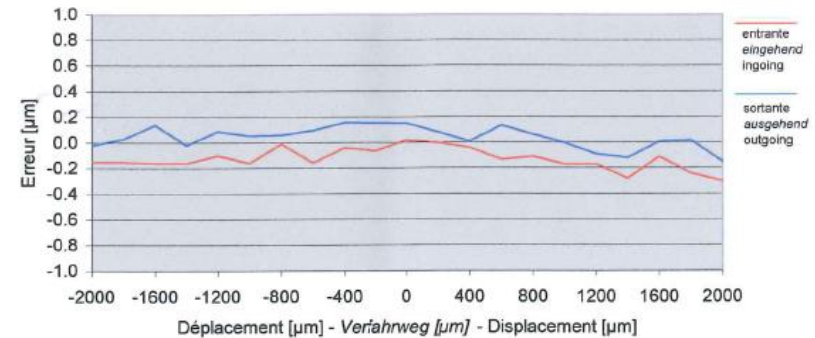


A long, thin probe with a blue and silver tip, connected to a black cable that ends in a USB connector. A small black box is attached to the cable.


**USB**  
UNIVERSAL SERIAL BUS

Direct link between probe and computer

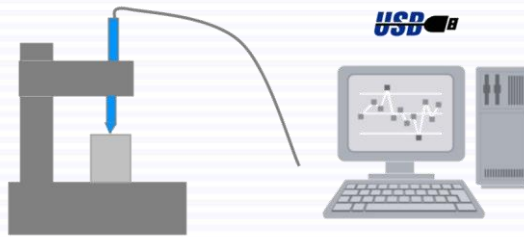




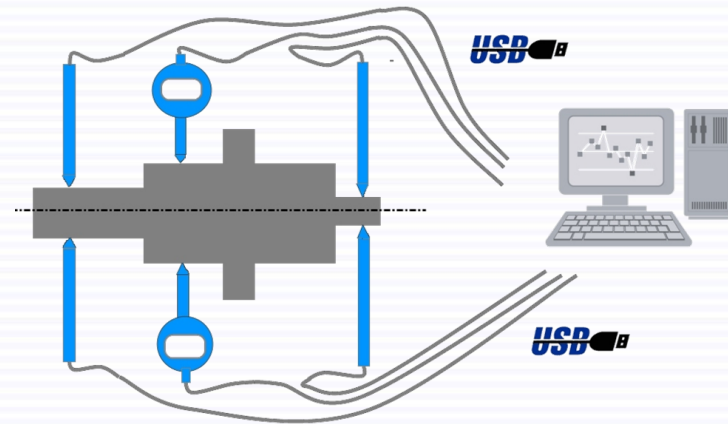
Linearized probe for high accuracy over the entire measuring range

				
GTL 21 USB	03230200	+/- 2 mm	0.4um +0.6 *L	0.10um
GTL 22 USB	03230201	+/- 2 mm	0.4um +0.6 *L	0.10um
GT 61 USB	03230204	+/- 5 mm	0.8um +0.6 *L	0.24um
GT 62 USB	03230205	+/- 5 mm	0.8um +0.6 *L	0.24um
FMS..				

- Large application range

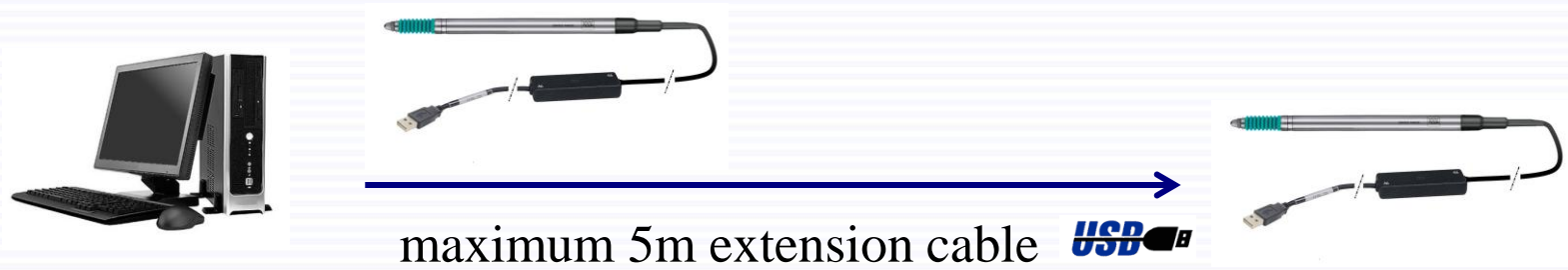


Single stand for accurate measurements



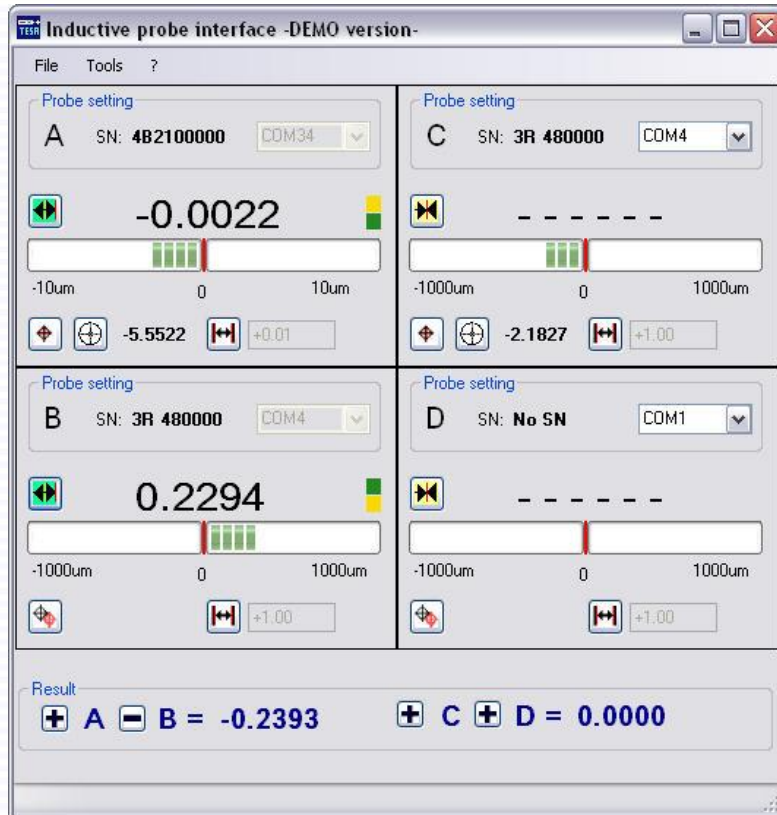
Flexible multigauging for static measurements

## Direct link or 5m extension

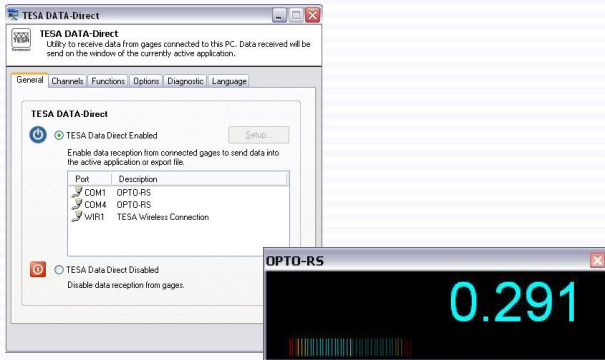


## USB Hub or amplifier to increase range until 10m





- Standard communication protocol (RS232)
- Virtual COM port for compatibility
- ASCII commands for continuous sending of data
- Computer limit to 128 USB ports
- Delivered with setting utility



DataDirect transfer to other software, various inputs and live value display



StatExpress statistical analysis with various inputs, settings and output possibilities.



## TESA USB probes

- High accuracy
- Less components for complete measuring system
- Easy to connect and use
- Standard communication protocol (RS232)
- Same dimensions and accessories than non USB models
- New application range





- TESA probes are proof products
- Large range of products, high quality
- Establish a sales strategy for each market
- Research of OEM's and fixture manufacturers



Thank You