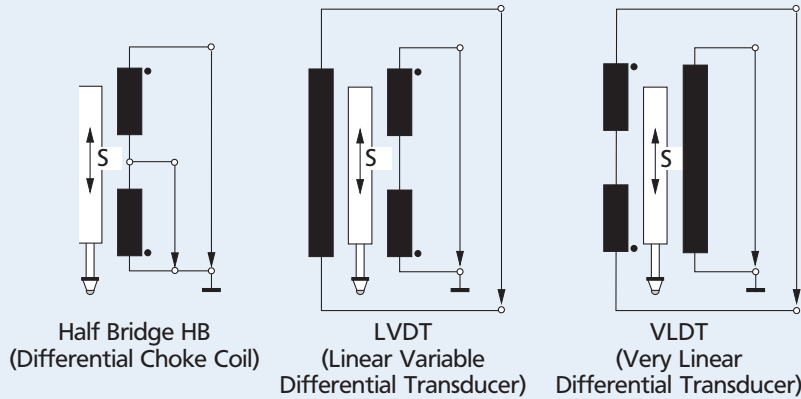


# Millimar. Electrical Length Measuring Instruments

## General Technical Data of Inductive Probes

The measuring principle of inductive probes is based on the change of position of a magnet's conductive core moving within a coil system, generally this is distinguished between a half bridge and LVDT's.

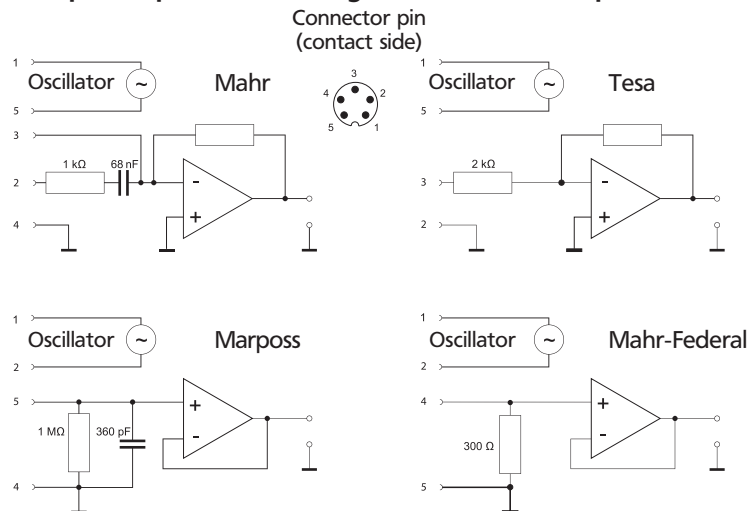
The new Mahr P2000 series of probes applies a high linear, patented VLDT transducer which is similar to an LVDT transducer. This also operates according to a differential transformer principle.



### Electrical specification of various compatibilities

		Type	Mahr	Tesa	Marposs	Mahr-Federal
Carrier frequency	KHz		19.4	13	7.5	5
Sensitivity	mV/V/mm	P2001 P2004 P2104	192	73.75	115	78.74
		1300 1301 1303 1304 K 1318	192	–	–	–
		P2010	19.2	29.5	11.5	7.874
		1310	19.2	–	–	–
Amplitude	V <sub>eff</sub>		5	3	3.5	2

### Schematic drawings of Mahr input amplifiers according to the various compatibilities



## Inductive Probe Millimar P2000-Series



### Technical Data

Probe type	P2001	P2004	P2004 A	P2004 B
Measuring range	± 0.5 mm / ± 0.020"	± 2.0 mm / ± 0.079"		
Distance of lower stop <sup>1)</sup>		- 2.2 ... 0 mm / -0.09 ... 0"		
Distance of upper stop <sup>1)</sup>		2.2 ... 4.4 mm / 0.09 ... 0.173"		
Lifter/Retraction	-	-	Vacuum lifter	Compressed air (max. 1 bar)
Measuring force at the electrical zero point	0.75 N ± 0.15 N	0.75 N <sup>2)</sup> ± 0.15 N	0.75 N <sup>2)</sup> ± 0.15 N	depending on air pressure
Increase in measuring force	0.1 N / mm	0.2 N / mm	0.2 N / mm	-
Sensitivity deviation	0.3 %	0.3 %		
Repeatability f <sub>w</sub>	0.15 μm / 6 μin	0.1 μm / 4 μin		
Linearity deviation with corrected sensitivity				
within the range ± 0.1 mm	0.6 μm / 24 μin	-		
within the range ± 0.5 mm	1.5 μm / 60 μin	0.4 μm / 16 μin		
within the range ± 1.0 mm	-	1.5 μm / 60 μin		
within the range ± 2.0 mm	-	3.0 μm / 120 μin		
Protection class according to DIN VDE 0470 part 1 / EN 60529	IP40	IP64		
Cable length	2.5 m / 8ft <sup>3)</sup>	2.5 m / 8ft <sup>3)</sup>		
Order no.	P2001	P2004	P2004 A	P2004 B
Compatibility- Mahr (red)	5323040	5323010	5323020	5323030
Compatibility- Tesa (yellow)	5323041	5323011	5323021	5323031
Compatibility- Marposs (blue)	5323043	5323013	5323023	5323033
Compatibility- Federal (white)	5323044	5323014	5323024	5323034

<sup>1)</sup> Relative to the electrical zero point. Adjustable; lower and upper stops are simultaneously adjusted

<sup>2)</sup> Measuring force springs are exchangeable, additional measuring force springs are available (0.25; 0.5; 1; 1.25; 1.5 N)

<sup>3)</sup> Extension cables are available, see Accessories

## Inductive Probe Millimar P2000-Series



### Technical Data

Probe type	P2010 A	P2010 B	P2104 A	P2104 B
Measuring range	± 5.0 mm / ± 0.197"		± 2.0 mm / ± 0.079"	
Distance of lower stop	- 5.3 mm / -.20"	- 5.3 mm / -.20"	- 2.2 ... 0 mm / -0.09 ... 0" <sup>1)</sup>	
Distance of upper stop	+ 5.3 / +.20"	+ 5.3 / +.20"	8.4 ... 10.4 mm / -0.33 ... 0.41" <sup>1)</sup>	
Lifter/Retraction	Vacuum lifter	Compressed air (max. 1 bar)	Vacuum lifter	Compressed air (max. 1 bar)
Measuring force at the electrical zero point	0.75 N ± 0.15 N <sup>2)</sup>	depending on air pressure	0.75 N ± 0.15 N <sup>2)</sup>	depending on air pressure
Increase in measuring force	0.1 N / mm	-	0.1 N / mm	-
Sensitivity deviation	0.3 %		0.3 %	
Repeatability $f_w$	0.2 µm / 8 µin		0.2 µm / 8 µin	
Linearity deviation with corrected sensitivity				
within the range ± 0.5 mm	-		0.5 µm / 20 µin	
within the range ± 1.0 mm	-		2.0 µm / 80 µin	
within the range ± 2.0 mm	4.0 µm / 160 µin		4.0 µm / 160 µin	
within the range ± 5.0 mm	20.0 µm / 800 µin		-	
Protection class according to DIN VDE 0470 part 1 / EN 60529	IP64			
Cable length	2.5 m / 8ft <sup>3)</sup>		2.5 m / 8ft <sup>3)</sup>	
Order no.	P2010 A	P2010 B	P2104 A	P2104 B
Compatibility- Mahr (red)	5324020	5324030	5324070	5324080
Compatibility- Tesa (yellow)	5324021	5324031	5324071	5324081
Compatibility- Marposs (blue)	5324023	5324033	5324073	5324083
Compatibility- Federal (white)	5324024	5324034	5324074	5324084

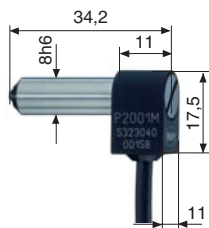
<sup>1)</sup> Relative to the electrical zero point. Adjustable; lower and upper stops are simultaneously adjusted

<sup>2)</sup> Measuring force springs are exchangeable, additional measuring force springs are available (0.25; 0.5; 1; 1.25; 1.5 N)

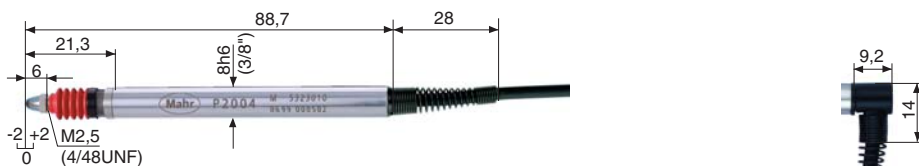
<sup>3)</sup> Extension cables are available, see Accessories

## Inductive Probe Millimar P2000-Series

### P2001

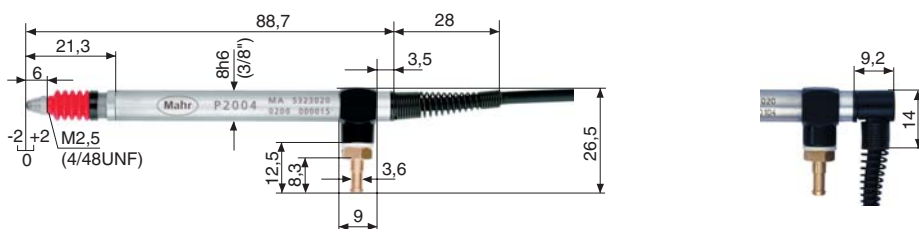


### P2004



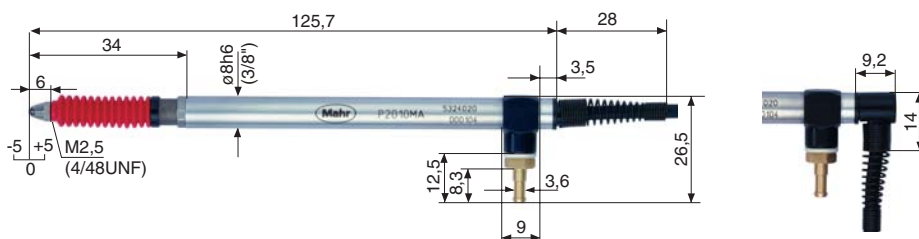
*Cable can be bent with the slip-on cap (included in the scope of supply)*

### P2004 A / P2004 B



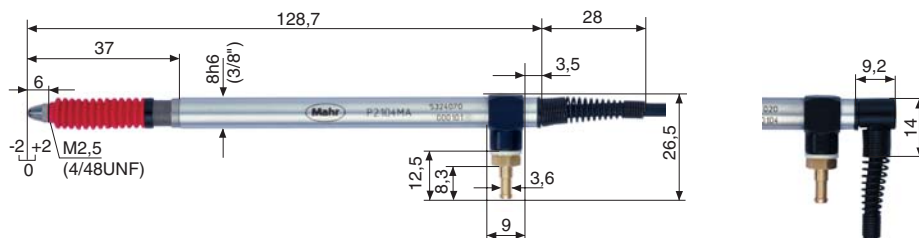
*Cable can be bent with the slip-on cap (included in the scope of supply)*

### P2010 A / P2010 B



*Cable can be bent with the slip-on cap (included in the scope of supply)*

### P2104 A / P2104 B



*Cable can be bent with the slip-on cap (included in the scope of supply)*

*Values shown in brackets apply to Federal-compatibility, all other dimensions and values are metric*

## Accessories

Extension cables		Mahr M	Tesa T	Marposs U	Mahr Federal F
Length	Description	Order no.	Order no.	Order no.	Order no.
2.5 m / 8 ft	C 2025	5323130	5323131	5323133	5323134
5 m / 16 ft	C 2050	5323140	5323141	5323143	5323144
7.5 m / 24 ft	C 2075	5323150	5323151	5323153	5323154
10 m / 32 ft	C 2100	5323160	5323161	5323163	5323164

Probe type	P2004	P2010	P2104	Order no.
<b>Measuring range</b>	$\pm 2 \text{ mm} / \pm 0.080''$	$\pm 5 \text{ mm} / \pm 0.20''$	$\pm 2 \text{ mm} / \pm 0.080''$	
<b>Air version</b>	- A B	A B	A B	
<b>Meas. force springs<sup>1)</sup></b>				
0.25 N	• •			7026827
0.50 N	• •			7026827
0.75 N	• •			7026828
1.00 N	• •			7026849
1.25 N	• •			7025579
1.50 N	• •			7025505
0.25 N		• •		7028212
0.50 N (0.25 N) <sup>2)</sup>		• •		7028212
0.75 N (0.50 N) <sup>2)</sup>		• •		7027764
1.00 N (0.75 N) <sup>2)</sup>		• •		7028213
1.25 N (1.00 N) <sup>2)</sup>		• •		7028214
1.50 N (1.25 N) <sup>2)</sup>		• •		7028215
<b>Sealing bellows</b>				
Short	• •			7021546
Short with ring				7028220
Long		•	•	7027758
Long with ring			•	7028221

<sup>1)</sup> All measuring forces (except 0.25 N) including the sealing bellows have a measuring spring force of approx. 0.25 N at zero point.

<sup>2)</sup> Probe P2104 has a measuring force where the electrical zero point is 3 mm lower than with the P2010

<b>Pneumatic Lifter 1340/1</b>	for connection with 1 Probe	5313420
<b>Pneumatic Foot Switch 1340/1F</b>	for connecting max. 4 Probes, types 1340, P2004xA, P2010xA, P2104xA, 1300 A, 1310 A	5313419

# Millimar. Electrical Length Measuring Instruments

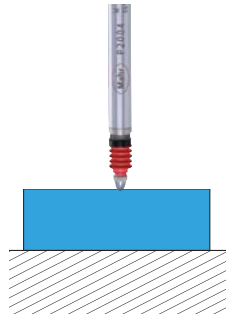
## Applications with Inductive Probes

### Single measurement with one probe

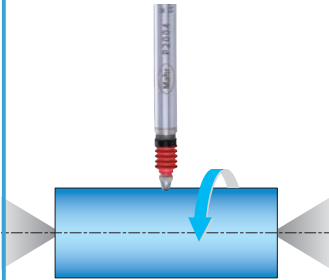
Indicating instrument instantly displays the measured value.

- Used for all kinds of direct measurements on cylindrical and flat work pieces
- Applied in the same way as dial indicators, dial comparators or test indicators

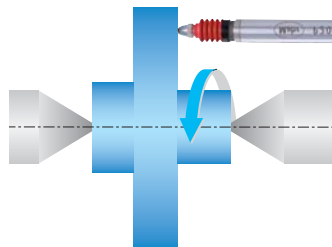
#### Thickness measurement



#### Radial run-out



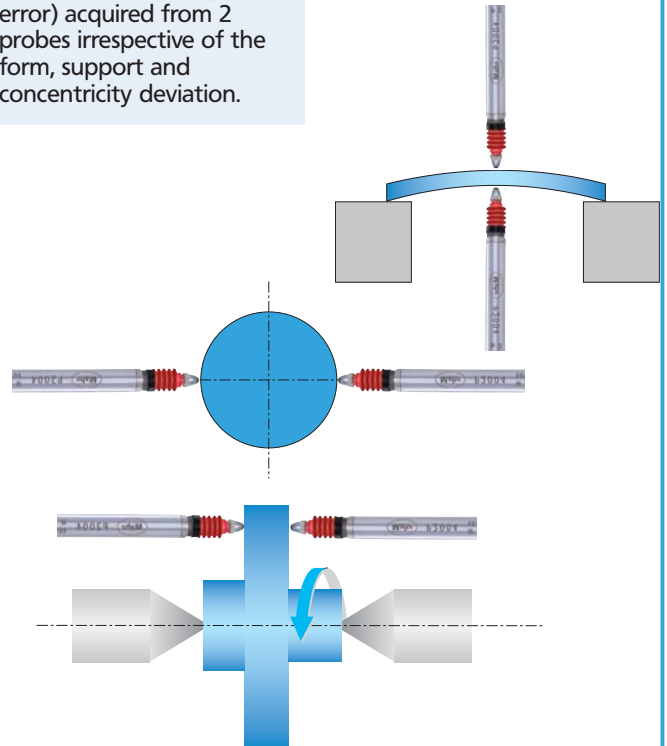
#### Axial run-out



### Sum measurement with 2 probes

Indicates the sum of deviation (total composite error) acquired from 2 probes irrespective of the form, support and concentricity deviation.

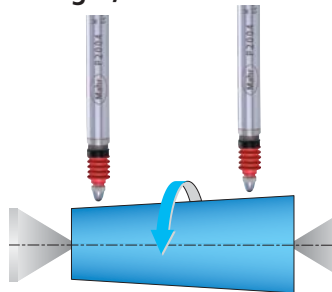
#### Thickness measurement



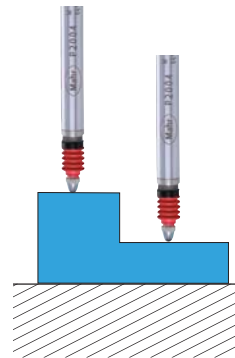
### Difference measurement with 2 probes

Shows the difference between the measured values acquired by 2 probes irrespective of the absolute dimension of the test piece. This is particularly suitable for dimensional comparison of two test points.

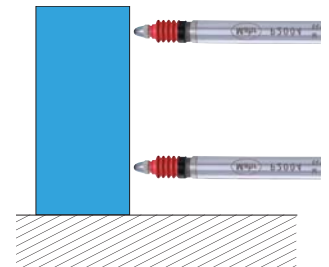
#### Form measurement of wedges, cones



#### Height difference between 2 steps



#### Perpendicularity measurement



#### Concentricity measurement on 2 shaft diameters

