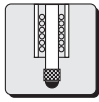


Inductive Probe Millimar P2000-Series



Technical Data

Probe type	P2001	P2004	P2004 A	P2004 B
Measuring range	$\pm 0.5 \text{ mm} / \pm 0.020''$		$\pm 2.0 \text{ mm} / \pm 0.079''$	
Distance of lower stop ¹⁾	–		$-2.2 \dots 0 \text{ mm} / -0.09 \dots 0''$	
Distance of upper stop ¹⁾	–		$2.2 \dots 4.4 \text{ mm} / 0.09 \dots 0.173''$	
Lifter/Retraction	–	–	Vacuum lifter	Compressed air (max. 1 bar)
Measuring force at the electrical zero point	$0.75 \text{ N} \pm 0.15 \text{ N}$	$0.75 \text{ N}^{2)}$ $\pm 0.15 \text{ N}$	$0.75 \text{ N}^{2)}$ $\pm 0.15 \text{ N}$	depending on air pressure
Increase in measuring force	$0.1 \text{ N} / \text{mm}$	$0.2 \text{ N} / \text{mm}$	$0.2 \text{ N} / \text{mm}$	–
Sensitivity deviation	0.3 %		0.3 %	
Repeatability f_w	$0.15 \mu\text{m} / 6 \mu\text{in}$		$0.1 \mu\text{m} / 4 \mu\text{in}$	
Hysteresis f_u	$0.2 \mu\text{m} / 8 \mu\text{in}$		$0.5 \mu\text{m} / 20 \mu\text{in}$	

Linearity deviation with corrected sensitivity

within range $\pm 0.1 \text{ mm}$	$0.6 \mu\text{m}$		–	
within range $\pm 0.5 \text{ mm}$	$1.5 \mu\text{m} / 60 \mu\text{in}$		$0.4 \mu\text{m} / 16 \mu\text{in}$	
within range $\pm 1.0 \text{ mm}$	–		$1.5 \mu\text{m} / 60 \mu\text{in}$	
within range $\pm 2.0 \text{ mm}$	–		$3.0 \mu\text{m} / 120 \mu\text{in}$	
Protection class according to DIN VDE 0470 Part 1 / EN 60529	IP40		IP64	
Cable length	$2.5 \text{ m} / 8 \text{ ft}^{3)}$		$2.5 \text{ m} / 8 \text{ ft}^{3)}$	

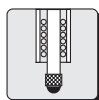
Order no.	P2001	P2004	P2004 A	P2004 B
Compatibility - Mahr	5323040	5323010	5323020	5323030
Compatibility - Tesa	5323041	5323011	5323021	5323031
Compatibility - Marposs	5323043	5323013	5323023	5323033
Compatibility - Federal	5323044	5323014	5323024	5323034

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

²⁾ Measuring force springs are interchangeable, additional measuring force springs are available (0.25; 0.5; 1; 1.25; 1.5 N)

³⁾ 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" ¹⁾	
Distance of upper stop	+ 5.3 / + .20"	+ 5.3 / + .20"	8.4 ... 10.4 mm / -0.33 ... 0.41" ¹⁾	
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 ²⁾	depending on air pressure	0.75 N ± 0.15 N ²⁾	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	
Hysteresis f_u	1 µm / 40 µin		0.5 µm / 20 µin	
Linearity deviation with corrected sensitivity				
within range ± 0.5 mm	-		0.5 µm / 20 µin	
within range ± 1.0 mm	-		2.0 µm / 80 µin	
within range ± 2.0 mm	4.0 µm / 160 µin		4.0 µm / 160 µin	
within range ± 5.0 mm	20.0 µm / 800 µin		-	
Protection class according to DIN VDE 0470 Part 1 / IEC 60529	IP64			
Cable length	2.5 m / 8 ft ³⁾		2.5 m / 8 ft ³⁾	
Order no.	P2010 A	P2010 B	P2104 A	P2104 B
Compatibility - Mahr	5324020	5324030	5324070	5324080
Compatibility - Tesa	5324021	5324031	5324071	5324081
Compatibility - Marposs	5324023	5324033	5324073	5324083
Compatibility - Federal	5324024	5324034	5324074	5324084

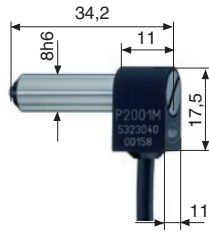
¹⁾ Relative to the electrical zero point. Adjustable; lower and upper stops are simultaneously adjusted

²⁾ Measuring force springs are interchangeable, additional measuring force springs are available (0.25; 0.5; 1; 1.25; 1.5 N)

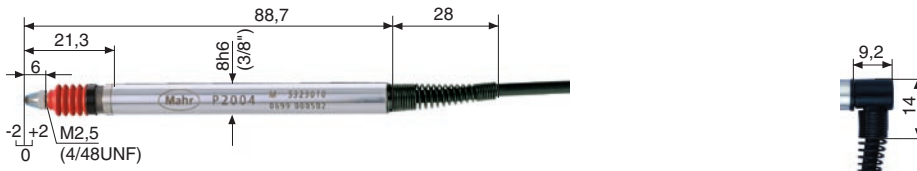
³⁾ Extension cables are available, see accessories

Inductive Probe Millimar P2000-Series

P2001

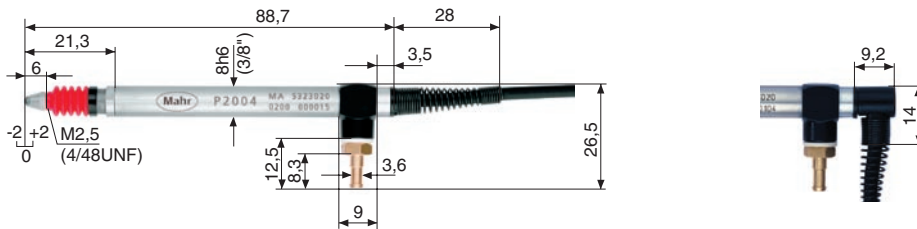


P2004



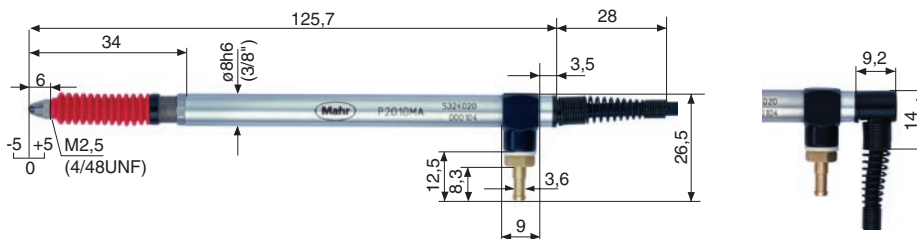
With the supplied slip-on cap, the cable can be flexed to 90° (vertical to horizontal)

P2004 A / P2004 B



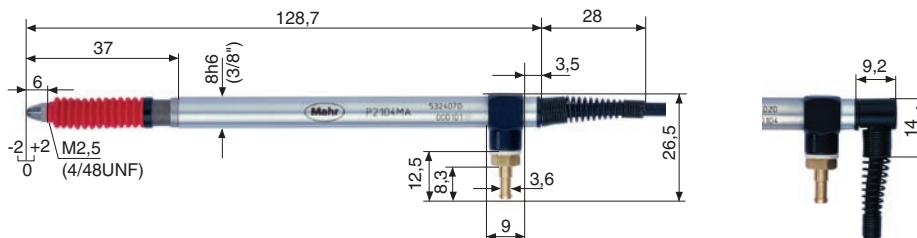
With the supplied slip-on cap, the cable can be flexed to 90° (vertical to horizontal)

P2010 A / P2010 B



With the supplied slip-on cap, the cable can be flexed to 90° (vertical to horizontal)

P2104 A / P2104 B



With the supplied slip-on cap, the cable can be flexed to 90° (vertical to horizontal)

*Values shown in brackets apply to Federal-compatibility
All 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	C 2025	5323130	5323131	5323133	5323134
5 m	C 2050	5323140	5323141	5323143	5323144
7.5 m	C 2075	5323150	5323151	5323153	5323154
10 m	C 2100	5323160	5323161	5323163	5323164

Order no.		Order no.	
Measuring force springs¹⁾ for P2004 and 2004 A		Measuring force springs¹⁾ for P2010 A	
0.25 N	7026827	0.25 N	7028212
0.50 N	7026827	0.50 N	7028212
0.75 N	7026828	0.75 N	7027764
1.00 N	7026849	1.00 N	7028213
1.25 N	7025579	1.25 N	7028214
1.50 N	7025505	1.50 N	7028215
<i>1) All measuring forces (except 0.25 N) include the sealing bellows have a measuring spring force of approx. 0.25 N in zero position.</i>		<i>1) All measuring forces (except 0.25 N) include the sealing bellows have a measuring spring force of approx. 0.25 N in zero position.</i>	

Order no.		Order no.	
Measuring force springs¹⁾ for P2104 A		Sealing bellows for	
0.25 N	7028212	2004, 2004 A	7021546
0.50 N	7027764	2004 B	7028220
0.75 N	7028213	2010 A, 2104 A	7027758
1.00 N	7028214	2010 B, 2104 B	7028221
1.25 N	7028215		
<i>1) All measuring forces include the sealing bellows</i>			

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

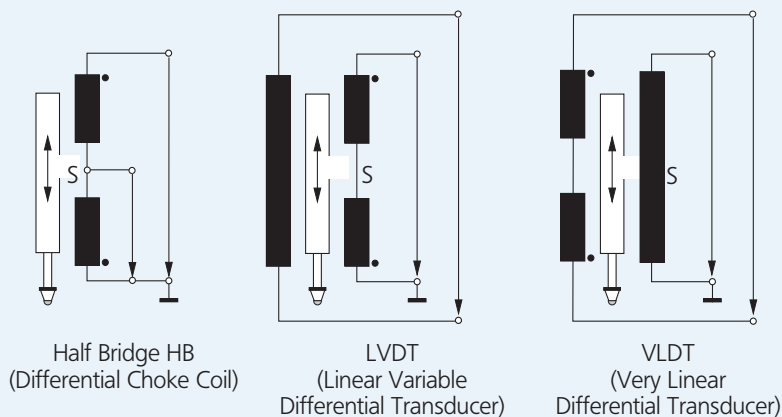
Temperature specifications

Temperature coefficient ftT	0.15 µm / °C
Working temperature range	+ 10 ... + 55 °C
Operating temperature range	- 10 ... + 80° C
Information regarding chemical resistance	Resistant against oil, gasoline (petrol), water, alipate. Moderate against acids, alkaline solutions, solvents, ozone

General Technical Data of Inductive Probes

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

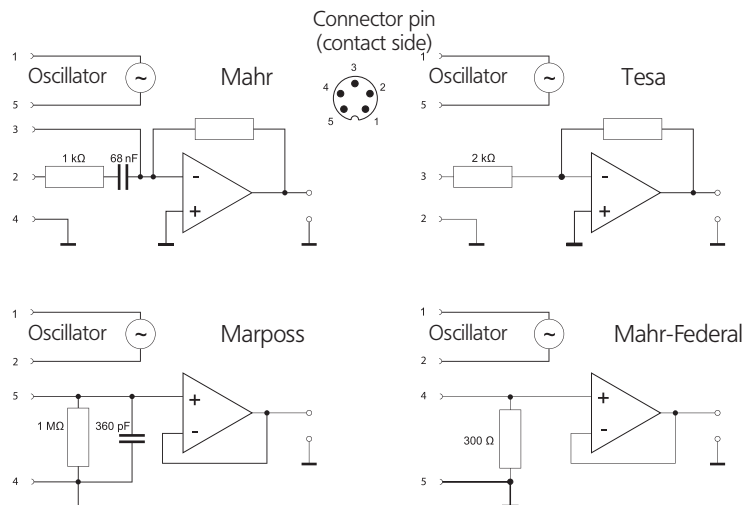
The Mahr P2000 series of probes applies a high linear, patented VLDT transducer which is similar to an LVDT transducer. This also operates according to a differential transformer principle.



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
		P1300 1300 1301 1303 1304 K 1318	192	–	–	–
		P2010	19.2	29.5	11.5	7.874
		1310	19.2	–	–	–
Amplitude	V _{eff}		5	3	3.5	2

Schematic drawings of Mahr input amplifiers according to the various compatibilities



Millimar. Electrical Length Measuring Instruments

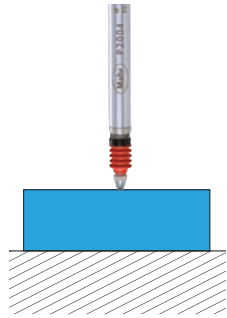
Applications with Inductive Probes

Single measurement with one probe

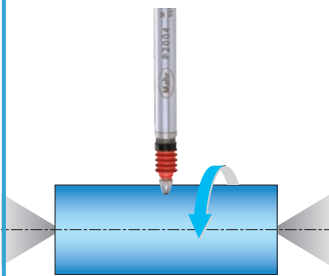
Indicating instrument instantly displays the measured value.

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

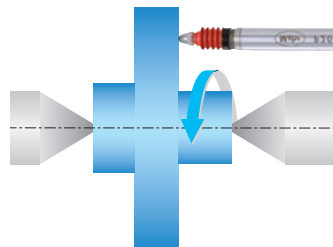
Thickness measurement



Radial run-out



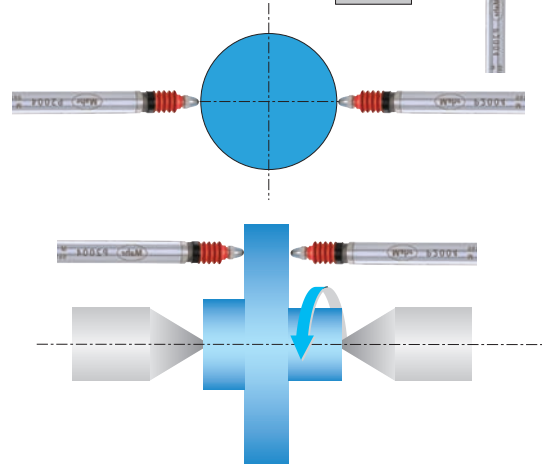
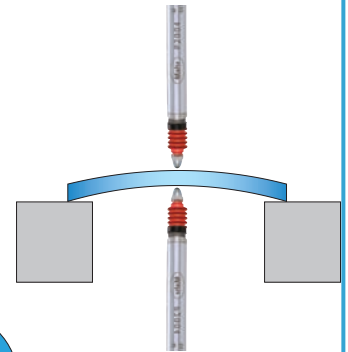
Axial run-out



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.

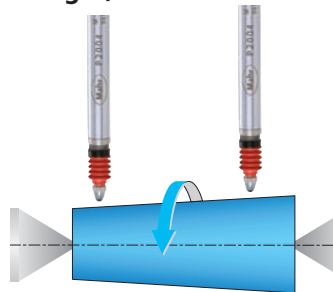
Thickness measurement



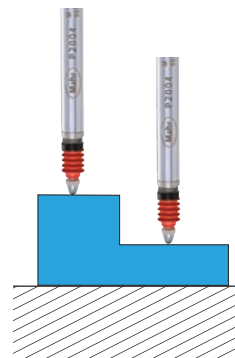
Difference measurement with 2 probes

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.

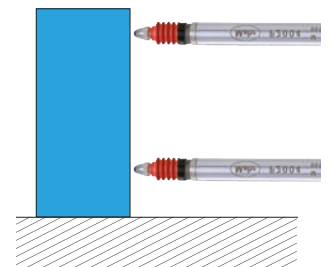
Form measurement of wedges, cones



Height difference between 2 steps



Perpendicularity measurement



Concentricity measurement on 2 shaft diameters

