

# TESTING AND MEASURING INSTRUMENTS

FOR VEHICLE WHEELS



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## FOR VEHICLE WHEELS

**For more than 20 years MAKRA has been manufacturing measuring and testing equipment for the wheel industry.**

Long years of experience and intensive customer contacts in the branch have led to the development of the EXA product series. This series contains an extensive range of measuring instruments. Our modern processing methods enable advanced development and customer-specific solutions. Standardised solutions can be found on the following pages. The automotive industry demands more stringent tolerances for vehicle wheels – thus making greater manufacturing precision necessary. The production of vehicle wheels made of different materials requires different kinds of processing and working cycles. MAKRA has developed a series of measuring and testing instruments for numerous standardised intermediate working cycles during wheel production. Indispensable aids for workers and quality assurance tasks.

## Your Advantages

- ▶ **CERTIFIED MEASURING AND TESTING INSTRUMENT MANUFACTURER**  
MAKRA is among other product areas a measuring and testing instrument manufacturer according to ISO 9001:2008 and ISO 14001:2004 certified.
- ▶ **MANY YEARS OF PRACTICAL EXPERIENCE**  
Consistent customer orientation and the long-time dialogue with the end users allows that MAKRA developed and manufactured task-oriented and practical solutions for your measurement and testing tasks.
- ▶ **FOR EACH TESTING TASK THE RIGHT SOLUTION**  
Whether at the laboratory or in the workshop: In this brochure you will find appropriate measuring and test equipment. And if not you should talk to us. Based on your description of your application we develop the appropriate solution for you!
- ▶ **WORLDWIDE USE**  
Our measuring and test equipment have been proven in recent years internationally. The measurement and test equipment are worldwide in use and assist to secure and improve the quality of the wheel production
- ▶ **LONG LASTING QUALITY**  
Not only in our machines, even with the measuring and testing we are proud of the world-famous „MAKRA-quality“.

# HUMP AND TYRE SEAT

Quick measurement of the hump and tyre seat diameter using high-quality measuring instruments speeds up and simplifies work in the test laboratory, for set-up staff and quality assurance. MAKRA measuring instruments reduce set-up times by making on-site measurement possible, saving trips to the test laboratory.

## CALLIPER GAUGE FOR TYRE SEAT-Ø



Digital calliper gauge with round special measuring jaws for determining the tyre seat diameter, measuring jaws hardened, interface for data output, preset function.

Measuring jaw- Ø	Measuring range	Jaw length	Error limit	Read-off accuracy	Weight/g	Part no.
8	0-600, 23"	310	0,05	0,01	2400	113 016 004
16	0-600, 23"	310	0,05	0,01	2500	113 016 007

Due to the length of the measuring jaws, exact measurement is only possible when pressure is applied sensitively. The calliper gauge is a useful instrument for the machine set-up technician and is used as a set-up aid for turning work on wheels. The rim measuring tape should always be used to double-check.

**Accessories:** Data cable 200 cm, part no. 511 038 053. Battery SR 44, part no. 502 009 005.

## CALLIPER GAUGE FOR HUMP-Ø



Digital calliper gauge with flat special measuring jaws for determining the hump diameter, measuring jaws hardened, interface for data output, preset function.

Jaw width	Measuring range	Jaw length	Error limit	Read-off accuracy	Weight/g	Part no.
8	0-600, 23"	310	0,05	0,01	2000	113 016 005

Due to the length of the measuring jaws, exact measurement is only possible when pressure is applied sensitively. The calliper gauge is a useful instrument for the machine set-up technician and is used as a set-up aid for turning work on wheels. The rim measuring tape should always be used to double-check.

**Accessories:** Data cable 200 cm, part no. 511 038 053. Battery SR 44, part no. 502 009 005.

## STATIONARY MEASURING UNIT FOR TYRE SEAT-Ø



Hardened measuring jaws, with parallel movement, measuring force marking, contact pressure of the measuring jaws on the rim flange can be set, adjustable stop for rim flange width. Wheel mounted on hardened precision shafts, interface for data output, preset function.

Measuring jaw-Ø	Wheel-Ø	Max. wheel width	Error limit	Read-off accuracy	Weight/g	Part no.
16	13" - 24"	13"	0,05	0,01	250	113 010 004

**Accessories:** Data cable 200 cm, part no. 511 038 053. Battery SR 44, part no. 502 009 005.

## MEASURING TAPE FOR HUMP CIRCUMFERENCE



Flexible stainless steel measuring tape for determining the hump circumference and the hump diameter.

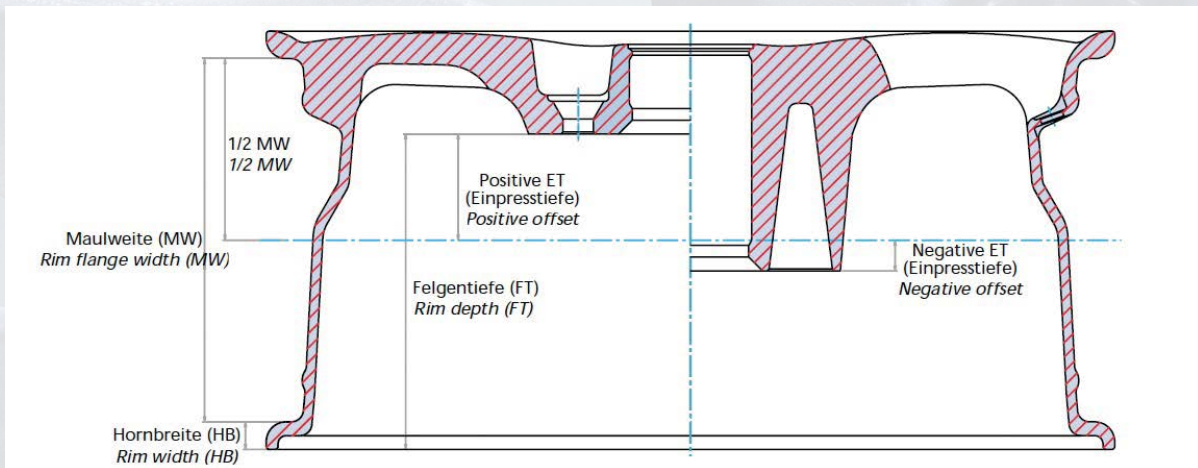
Diameter	Wheel size	Circumference	Tape width	Error limit	Read-off accuracy	Weight/g	Part no.
300-700	13" - 24"	940-2200	16	0,15	0,1	70	113 027 001

# OFFSET

Offset ET is the distance from the wheel attachment face to half the rim width. Upwards deviations (outside of wheel) are seen as positive, downwards deviations (inside of wheel) are seen as negative (see diagram).

## Formula for calculating offset

$$ET = (FT) \text{ mm} - \left( \frac{(MW) \text{ mm}}{2} + (HB) \text{ mm} \right)$$



## RIM WIDTH CALLIPER GAUGE

Digital calliper gauge with measuring cylinder for determining rim width. Measuring cylinder hardened, can be switched between mm and inches, interface for data output, measuring length 300\*/450 mm.

Measuring cylinder-Ø	Measuring length	Jaw length	Error limit	Read-off accuracy	Weight / g	Part no.
8*	300	75	0,03	0,01	410	113 016 027
16*	300	75	0,03	0,01	420	113 016 009
16	450	100	0,05	0,01	1140	113 016 011

**Accessories:** Data cable 200 cm, part no. 511 038 053. Battery SR 44, part no. 502 009 005.

\*Measuring length 300 mm, incl. offset function for direct rim width read-off, preset function for storing 2 pre-selected values.



## ANALOGUE RIM DEPTH CALLIPER GAUGE

Analogue calliper gauge for determining the rim depth in rugged workshop applications (e.g. in foundries), measuring bridge hardened, depth measuring rail secured against falling out in both directions.

Measuring bridge length	Measuring range	Error limit	Read-off accuracy	weight/g	Part no.
500	300	0,08	0,05	1200	113 016 014
610	300	0,08	0,05	1300	113 016 019
610	450	0,10	0,05	1350	113 016 021



## DIGITAL RIM DEPTH CALLIPER GAUGE

Digital calliper gauge for determining the rim depth for precise measurements in quality assurance areas and mechanical production, measuring bridges hardened, depth measuring rail secured against falling out in both directions, switchover between mm and inches possible, interface for data output, preset function.

Measuring bridge length	Measuring range	Error limit	Read-off accuracy	Weight/g	Part no.
500	300	0,04	0,01	950	113 016 029
610	300	0,04	0,01	1300	113 016 036
610	450	0,05	0,01	1350	113 016 038

**Accessories:** Data cable 200 cm, part no. 511 038 053. Battery SR 44, part no. 502 009 005.



## RIM FLANGE WIDTH CALLIPER GAUGE

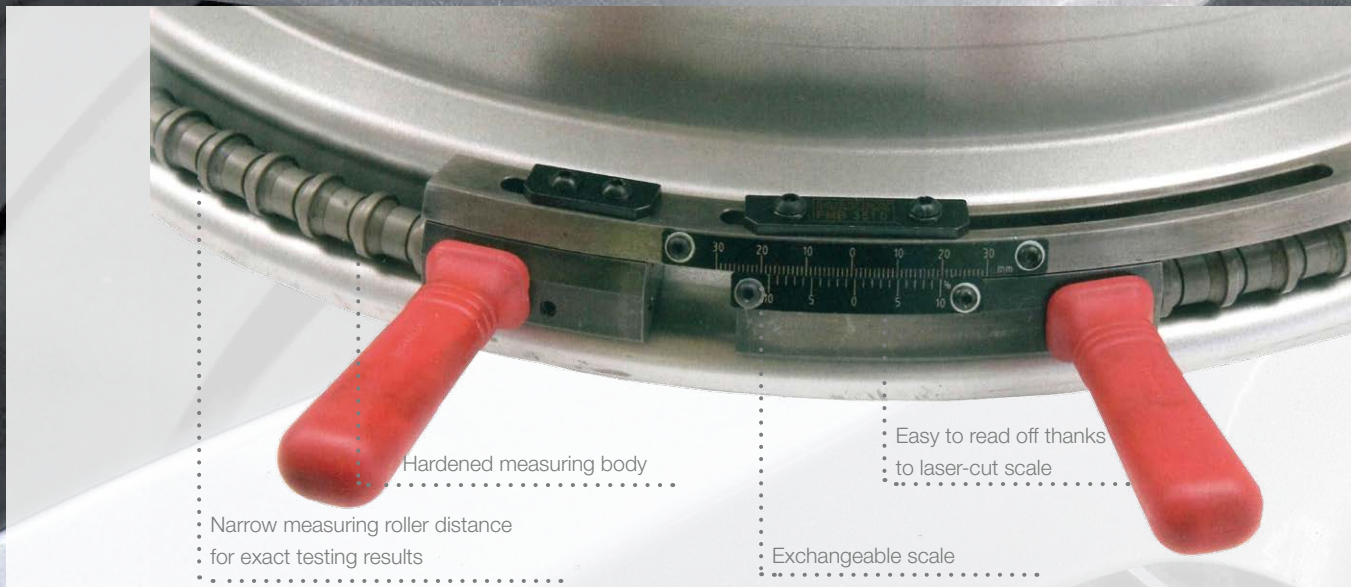
Digital calliper gauge with vertically adjustable measuring ball for determining rim flange width, measuring ball and stop plate hardened, interface for data output, preset function.

Measuring ball- Ø	Measuring length	Vertical ball adjustment	Stop plate	Error limit	Read-off accuracy	Weight /g	Part. no
8	150	26	40 x 160	0,03	0,01	470	113 016 045
16	150	26	40 x 160	0,03	0,01	470	113 016 035

**Accessories:** Data cable 200 cm, part no. 511 038 026. Battery CR 2032, part no. 502 009 006.

# BEAD SEAT CIRCUMFERENCE

Quick checking of the bead seat using a high-quality ball-tape speeds up and simplifies production activities. Wellknown vehicle and wheel manufacturers check their wheels using MAKRA high-precision wheel rim tape measures. Customized production on state-of-the-art machines and the use of top-quality materials guarantee high-level accuracy and a long service life under favourable conditions. Precision and a sturdy design are the features of these measuring instruments.



## BALL-TAPES FOR CAR WHEELS



Ball-tapes for determining the rim circumference with measuring ball  $\varnothing$  16 mm for rims with a rim bead seat taper of  $5^\circ$ , scale with vernier 0.1 mm, scale measuring range -10/+30 mm.

Wheel size	Type	Diameter D1	Circumference	Weight/g	Part no.
10"	-	251,87	791,3	1200	106 000 001
12"	A	302,67	950,9	1300	106 000 007
12"	B	304,26	955,8	1300	106 000 008
12"	C	307,43	965,8	1300	106 000 080
13"	-	328,07	1030,7	1450	106 000 011
14"	-	353,47	1110,5	1540	106 000 012
15"	A	378,87	1190,2	1630	106 000 013
15"	B	386,01	1212,7	1630	106 000 014
16"	-	404,27	1270,0	1730	106 000 017
17"	-	435,22	1367,3	1850	106 000 021
18"	-	460,62	1447,1	1950	106 000 025
19"	-	486,02	1526,9	2040	106 000 028
20"	A	511,42	1606,7	2150	106 000 032
20"	C	513,01	1611,7	2150	106 000 034
21"	C	536,82	1686,5	2250	106 000 036
22"	-	562,22	1766,3	2330	106 000 045
23"	-	587,62	1846,1	2450	106 000 047
24"	A	613,02	1925,9	2550	106 000 048
24"	B	614,61	1930,9	2550	106 000 050
25"	-	638,42	2005,67	2650	106 000 079
26"	-	663,82	2085,5	2750	106 000 053
28"	-	714,62	2245,1	2950	106 000 055
30"	-	765,42	2404,6	3150	106 000 057

Other sizes on request

## BALL TAPES FOR TRUCK-WHEELS



Ball-tapes for determining the rim circumference with measuring ball  $\varnothing$  16 mm for rims with a rim bead seat taper of  $15^\circ$ , scale with vernier 0.1 mm, scale measuring range -10/+30 mm.

Wheel size	Type	Diameter D1	Circumference	Weight/g	Part no.
17,5"	-	441,32	1386,5	1850	106 000 024
19,5"	-	492,12	1546,0	2040	106 000 031
22,5"	-	568,32	1785,4	2330	106 000 046
24,5"	-	619,12	1945,0	2550	106 000 052

Other sizes on request

## SETTING RING GAUGES FOR BALL-TAPES (CAR WHEELS)



Setting ring for MAKRA rim tape measures for car rims with a rim bead seat taper of  $5^\circ$ , made of artificially matured steel, hardened and ground.

Wheel size	Type	Diameter D1	Circumference	Weight/g	Part no.
10"	-	251,87	791,3	4,5	105 005 002
12"	A	302,67	950,9	5,0	105 005 004
12"	B	304,26	955,8	5,0	105 005 007
12"	C	307,43	965,8	5,0	105 005 006
13"	-	328,07	1030,7	7,0	105 005 008
14"	-	353,47	1110,5	8,1	105 005 009
15"	A	378,87	1190,2	9,5	105 005 010
15"	B	386,01	1212,7	9,5	105 005 011
16"	-	404,27	1270,0	10,9	105 005 012
17"	-	435,22	1367,3	12,8	105 005 017
18"	-	460,62	1447,1	14,2	105 005 020
19"	-	486,02	1526,9	16,8	105 005 023
20"	A	511,42	1606,7	17,7	105 005 026
20"	C	513,01	1611,7	17,7	105 005 071
21"	C	536,82	1686,5	19,9	105 005 029
22"	-	562,22	1766,3	24,4	105 005 032
23"	-	587,62	1846,1	26,6	105 005 035
24"	A	613,02	1925,9	22,4	105 005 037
24"	B	614,61	1930,9	22,4	105 005 038
25"	-	638,42	2005,67	24,5	105 005 072
26"	-	663,82	2085,5	24,5	105 005 042
28"	-	714,62	2245,1	32,8	105 005 043
30"	-	765,42	2404,6	34,9	105 005 045

## SETTING RING GAUGES FOR BALL-TAPES (TRUCK WHEELS)



Setting ring for MAKRA rim tape measures for truck rims with a rim bead seat taper of  $15^\circ$ , made of artificially matured steel, hardened and ground.

Wheel size	Type	Diameter D1	Circumference	Weight/g	Part no.
17,5"	-	441,32	1386,5	13,8	105 005 019
19,5"	-	492,12	1546,0	16,8	105 005 070
22,5"	-	568,32	1785,4	21,0	105 005 034
24,5"	-	619,12	1945,0	23,0	105 005 040

# CENTRE HOLE

MAKRA provides numerous testing and measuring instruments for the centre hole, enabling all the required dimensions to be determined quickly and precisely.



## HOLE CIRCLE MEASURING DEVICE

The hole circle measuring device is used to measure symmetrical and non-symmetrical hole circles. It is used to measure the hole circle of the retaining bolt holes in relation to the wheel hub bore. The hole circle measuring device is also used to check the graduated circle of the retaining bolt holes after drilling. Errors in hole circle offset caused by incorrect positioning of the fixture zero points and the hot run of the tooling machine can be determined on site. The measuring device for the set-up technician saves trips to the measuring room and makes quick intermediate tests possible.

Att. bore hole	Central bore	Hole circle	Error limit	Read-off accuracy	Weight/ g	Part no.
13-22	50-92	98-170	0,04	0,01	1800	113 006 011

**Accessories:** Data cable 200 cm, part no. 511 038 053. Battery CR 2032, part no. 502 009 006.



## DIVICE FOR MEASURING THE DISTANCE BETWEEN TWO HOLES

The device is intended for measuring the distance between the retaining bolt holes as well as between the pilot bores. It also complements the hole circle measuring device.

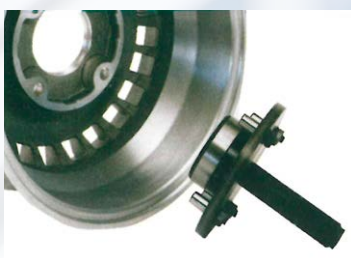
Att. bore hole	Hole circle	Erro limit	Read-off accuracy	Weight/ g	Part no.
13-22	98-170	0,02	0,01	210	113 006 028

**Accessories:** Data cable 200 cm, part no. 511 038 053. Battery CR 2032, part no. 502 009 006.



## LIMIT PLUG GAUGE FOR CENTRE HOLE

For testing the centre hole, differentiating between conform and scrap holes. The conform and scrap sides are hard chrome-plated. Customer wheel hole specifications are required for the production of the limit plug gauge.



## HOLE CIRCLE GAUGE

Measuring pin and central hole centring plug can be exchanged, hardened and ground version, several hole circles are possible on one gauge if required. The following customer specifications with tolerances are required:

- Centre hole bore  $\varnothing$
- Attachment hole circle  $\varnothing$
- Attachment bore holes





## WHEEL PEDESTAL

Use on 3D measuring machines for measuring the centre hole and the retaining bolt holes. For depth measurement of the wheel retaining bolt holes, in the vicinity of the production area. Steel annealed tension-free and artificially matured, precisely ground, weight reduced, support height 285 mm, diameter of support area 180 mm, diameter of base area 250 mm, part no. 101 041 002.



## DEPTH MEASURING DEVICE FOR RETAINING BOLT HOLE

Depth measuring device (either digital or analogue) for retaining bolt holes with ball or conical shaped seats. Digital dial gauge with interface for data output, preset function. Customer wheel retaining bolt hole specifications are required to produce these devices.



## SETTING MASTER FOR DEPTH MEASURING DEVICE

Hardened setting master for the depth measuring device. Customer wheel retaining bolt hole specifications are required.

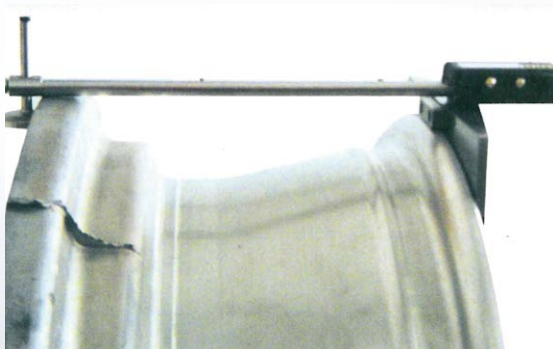


## BALL/CONE GAUGE

These gauges are used for contact pattern detection through spotting. Ball gauge made of carbide metal. Customer wheel retaining bolt hole specifications are required to produce these gauges.

## 2-SIDED PROCESSING

With 2-sided processing of aluminium wheels, the distance between the unworked cast surface (for the second operation) and the turned inner rim flange (of the first operation) is of major importance. The MAKRA wheel width calliper gauge permits measuring of the correct wheel width with the foreseen processing allowance for the 2nd turning work cycle. In addition, the plane parallelism of the unworked cast surface in relation to the inner rim flange can be measured. Plane offset of the raw cast part and plane faults caused by the clamping fixture can be determined.



Measuring from the raw cast wheel stop to the processed rim flange



Checking plane parallelism to the inner rim flange

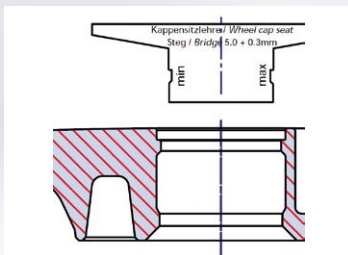
### WHEEL WIDTH CALLIPER GAUGE 1ST TURNING PROCESS

The ideal measuring instrument for the set-up technician. It is used after the first turning process to determine the wheel width and to check the processing allowance for the 2nd turning process. Digital calliper gauge, with hardened stop, measuring rail secured against falling out in both directions, switchover between mm and inches possible, interface for data output, preset function.

Measuring disc-Ø	Measuring range	Axial displacement of measuring disc	Stop size	Error limit	Read-off accuracy	Weight / g	Part.no
30	0-290	32	40 x 150	0,03	0,01	570	113 016 043
30	0-440	32	40 x 150	0,03	0,01	650	113 016 044

**Accessories:** Data cable 200 cm, part no. 511 038 026. Battery CR 2032, part no. 502 009 005.

## WHEEL CAP SEAT, BRAKE CLEARANCE, ATTACHMENT HOLE CIRCLE



### GAUGE FOR WHEEL CAP SEAT

Special steel gauges for cap seats according to customer requirements for testing the maximum and minimum measurement of the cap seat. Customer wheel specifications with dimensioned drawing are required to produce this gauge.



### BRAKE CLEARANCE GAUGE

Brake clearance gauges are made of pre-fabricated elements using a modular principle. Exchanging the templates and the centring pin guarantees high flexibility and reusability. Customer wheel specifications with dimensioned drawing as well as the brake contour dimension are required to produce this gauge.



### CLAMPING TABLE / POSITIONING DEVICE

Part-device for measuring the wheel bore holes in the horizontal wheel axis position in connection with a 2D vertical measuring device and a measuring table. Mechanical wheel clamping jig with stepped jaws 12" -24", part possibility 4 x 90°. Part no. 116 022 001

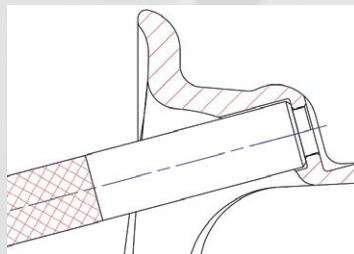
# VALVE BORE HOLES

The precision of the valve bore hole is of major importance for the air tightness of wheels.



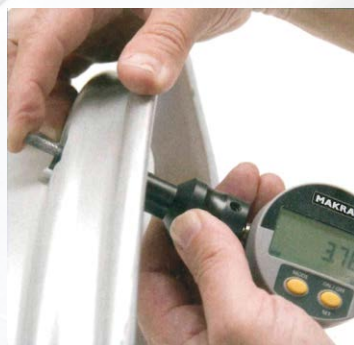
## LIMIT PLUG GAUGE FOR VALVE BORE HOLES

For testing the valve hole, differentiating between conform and scrap holes. For your inquiry and production we require the data of the valve bore hole.



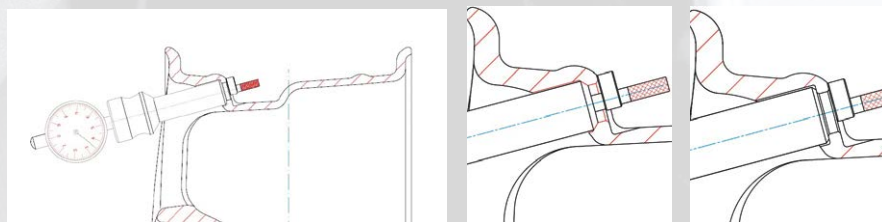
## GAUGE FOR VALVE WALL THICKNESS

For straightforward visual inspection of the valve wall thickness with combined conform and scrap gauge made of hardened steel and in a ground finish. For your inquiry and production we require the data of the valve bore hole.



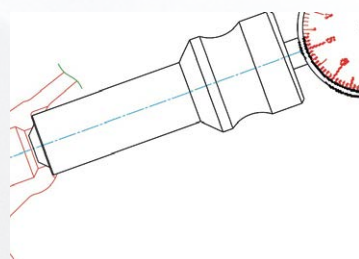
## WALL THICKNESS MEASURING DEVICE FOR VALVE SEAT

For measuring the wall thickness for the valve seat, available with analogue or digital dial gauge. Digital dial gauge with interface for data output.



Dial gauge	Measuring basis	Measuring range	Accuracy	Weight / g	Part no.
Analogue	Plane surface	20	0,1	330	113 006 002
Analog	Taper / Ø 11,5	20	0,1	330	113 006 003
Digital	Plane surface	20	0,01	330	113 006 012
Digital	Taper / Ø 11,5	20	0,01	330	113 006 013

**Accessories:** Data cable 200 cm, code no. 511 038 026. Battery CR 2032, part no. 502 009 006.



## BEVEL SIZE MEASURING DEVICE FOR VALVE SEAT

For measuring the bevel size of valve bore holes, incl. setting master for bore hole  $\varnothing$  11.5. Other diameters on request.

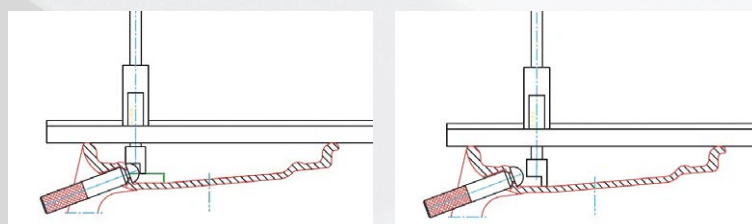
Dial gauge	Bevel size min.	Bevel size max.	Accuracy	Weight /g	Part no.
Analogue	0,1 x 45° at $\varnothing$ 11,5	1 x 45°	0,1	350	113 006 014
Digital	0,1 x 45° at $\varnothing$ 11,5	1 x 45°	0,01	350	113 006 021

**Accessories:** Data cable 200 cm, part no. 511 038 026. Battery CR 2032, part no. 502 009 006.



## VALVE HOLE POSITION MEASURING DEVICE

For measuring the installation dimension for valves with pressure sensor.



Scale	Beam length	Measuring range (Calliper gauge)	Accuracy	Weight /g	Part no.
Digital	400	150	0,01	1000	113 006 005

**Accessories:** Data cable 200 cm, part no. 511 038 026. Battery CR 2032, part no. 502 009 006.

## WALL THICKNESS

The wall thickness on wheels is an important safety-related testing feature. A wall thickness tester has been included to round off our product delivery range.



### WALL THICKNESS MEASURING DEVICE FOR RIM WELL

For measuring the wall thickness at the rim well, measuring probes made of hardened steel, digital dial gauge with interface for data output, preset function.

Dial gauge	Measuring range	Measuring depth	Accuracy	Weight / g	Part no.
Digital	0-60	190	0,04	470	113 006 008
Analogue	0-50	170	0,05	570	113 006 009

**Accessories for digital dial gauge:** Data cable with USB-Interface, part no. 511 038 066. Data cable with Mitutoyo-interface, part no. 511 0380 67. Battery AA 1,5 V, part no. 502 009 008.



### TEST SUPPORT FOR RIM WELL MEASUREMENT

Test support for measuring wheel and rim well on 3-D measuring machines, supporting shafts hardened and ground with one-sided stop.

Wheel-Ø	Measuring rollers Ø	Wheel width	Dimensions LxWxH	Weight / g	Part no.
12-26"	45	max. 15"	472 x 430 x 145	40	116 021 001

# WHEEL MOUNTING SURFACE

MAKRA offers a range of measuring instruments for testing the concavity of the wheel attachment face from a simple straightedge to convenient plane surface measuring devices with slide guide.



## CONTROL DEVICE FOR TESTING CONCAVITY

For quick control measurement of concavity during production. The measuring probe is positioned via a centring pin in the centre hole, equipped with either a digital or analogue dial gauge, interface for data output, preset function (digital dial gauge). We require the data for the centre hole and the wheel mounting surface for production.

Dial gauge	Measuring range	Wheel mounting surface	Error limit	Read-off accuracy	Weight / g	Part no.
Analogue	1	max. 200	0,03	0,001	2030	113 006 017
Digital	10	max. 200	0,02	0,01	2030	113 006 006

**Accessories:** Data cable 200 cm, part no. 511 038 026. Battery CR 2032, part no. 502 009 006.



## CONCAVITY MEASURING DEVICE FOR WHEEL ATTACHMENT FACE

The convenient measuring device with slide guide for measuring concavity of the wheel mounting surface, equipped with either a digital or analogue dial gauge, interface for data output, preset function (digital dial gauge).

Dial gauge	Measuring range	Wheel mounting surface	Measuring path	Error limit	Read-off accuracy	Weight / g	Part no.
Analogue	1	max. 200	130	0,03	0,001	2030	113 006 004
Digital	10	max. 200	130	0,02	0,001	2030	113 006 016

**Accessories:** Data cable 200 cm, part no. 511 038 026. Battery CR 2032, part no. 502 009 006.



## STRAIGHTEDGE FOR CONCAVITY TEST

For light gap test for concavity test on the wheel mounting surface, accuracy according to DIN 874, measuring areas hardened, ground and lapped. Wedge-shaped cross-section, pointed ends, with insulated handle, length 200 mm, in case. Part no. 113 006 010.

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