



WHEEL MEASUREMENT SYSTEMS





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A-B

ELECTRONIC WHEEL PROFILE GAUGE FOR TRAIN AND TRAM WHEELS



Digital
Reliable
Accurate
Durable

Specifications:

Measured parameters:	Wheel profile; determination of parameters h, e1/e2, qR
Resolution:	0.01 for parameters h, e1/e2, qR
Accuracy:	±0.1 mm for the reproduction of profile and parameters h, e1/e2, qR
Range:	Flange thickness - max 145 mm
Flange height:	max 37 mm
Operating conditions:	Temperature: -20 ÷ 45°C Humidity: 15 ÷ 85%, no condensation Memory capacity: 8000 measurement files Weight: 2 kg



After detaching the control panel from the gauge, one can view the measurements saved in the gauge memory and transfer them to a PC disk via a USB Pendrive. PC software allows to compare the measured profile with the reference profiles, to compare multiple measurement results obtained at different times, dimensioning profiles' drawings, and also annotating them. This software allows the saving, visualising and printing of reports with

Functionality:

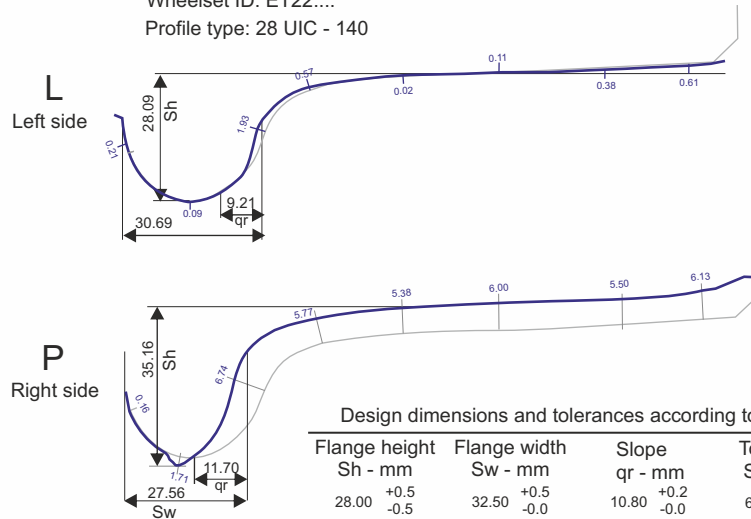
- Display legible even in direct sunlight
- Durable battery (lasts up to 20 hours of continuous operation)
- Measurement data transfer to a PC via a USB Pendrive
- Software for printing measurement reports, archiving and comparing measurement results

Car type: ET22.....
 Car ID:.....

MEASUREMENT REPORT OF WHEELSET TIRES TREAD PROFILE

WHEELSET IDENTIFICATION DATA

Wheelset ID: ET22....
 Profile type: 28 UIC - 140



Design dimensions and tolerances according to Mt11

Flange height Sh - mm	Flange width Sw - mm	Slope qr - mm	Total widths Swl + S wr
28.00 +0.5 -0.5	32.50 +0.5 -0.0	10.80 +0.2 -0.0	65.00 +1.0 -0.0

Profile permissible deviations - mm

running surface	flange top	flange width
0.5	1.0	0.5

Vehicle (car) side

Measurement results [mm]

Vehicle (car) side	Flange height Sh - mm	Flange width Sw - mm	Slope qr - mm	Total widths Swl + S wr
L	28.09	30.69	9.21	58.24
P	35.16	27.56	11.70	

Assessment of measurement results

Measurement place and date

Name and signature of the person who made the measurement



The electronic wheel profile gauge is designed for measurement of the continuous tread profile of train and tram wheels. Measurements can be performed directly on vehicles, i.e. without rolling the wheelsets out. The operator fixes the gauge to the wheel with its magnetic foot and guides the spherical measuring tip along the wheel tread. Thanks to the contact-based method, the measurement is not encumbered with errors caused by weather conditions (e.g. raindrops), grease stains or sunlight reflections. Measurement results are saved in the gauge memory capable of storing information about several thousand profiles. Preliminary evaluation of the measured profiles is possible immediately after the measurement, on the big graphic display of the gauge control panel, on which the wear-related parameters, h, e1/

The gauge can be used in planning of machining on underfloor lathes, for verification of the correctness of the machined profile and for recording the wheel wear progress during their operation - for maintenance services and for research.

The software delivered with the gauge makes it also possible to collect the measurement data from all GRAW wheel measurement devices and generate the summary reports.

Measurement results can also be entered into an optional P&D system rolling stock wheel data management system within a transport company.





Digital
Reliable
Accurate
Durable

Specifications:

Measured parameters: Flange height h
Flange thickness $e1/e2$
Flange angle dimension qR

Ranges: h 12.5 ÷ 39 mm
 $e1/e2$ 13 ÷ 30 mm
 qR 0 ÷ 27 mm

Accuracy: ± 0.1 mm

Operating conditions: Temperature -20 ÷ 45°C
Humidity 15 ÷ 85%, no condensation

Memory capacity: 8000 measurement files

Weight: 1.6 kg

Functionality:

Fast measurement: 2 seconds after the initiation of a measurement cycle, during which the measuring tips touch the wheel surface at points specified by related railway regulations

Easy and firm basing of the gauge on the wheel

Display legible even in direct sunlight and in an inspection pit, visual signalling of exceedings

Durable battery lasts up to 20 hours of continuous operation

Measurement data transfer to a PC via a USB Pendrive

Software for printing measurement reports, archiving and comparing measurement results

The electronic wheel wear caliper is designed for measurement of h , $e1/e2$ and qR parameters, characterising the wheel tread wear. Measurements can be performed directly on vehicles, i.e. without rolling the wheelsets out. The electronic caliper is very easy to use and reliable. Prior to measurement, the operator fixes the device to the wheel with its magnetic foot and presses the button initiating the automatic measurement cycle. During measurements, the moving measuring tips touch the measured surface precisely at points specified by the railway regulations. Values of h , $e1/e2$, and qR parameters appear on the gauge panel display within two seconds after the initiation of the measurement and are clearly visible both in direct sunlight and in a dark inspection pit.

The gauge is equipped with a control panel with the GRAW-style, colour backlit display, and a comfortable keyboard. Measurement results and information about the exceedings of the limit values are clearly visible even in a dark inspection pit.

The gauge is delivered with PC software that allows for: archiving of measurement results, comparison of results, as well as printing of measurement reports. Measurement data can be exported to MS Word, MS Excel and PDF formats. The software delivered with the gauge also allows for collecting measurement results from all GRAW wheel measurement devices and generating aggregate reports.



SVT5

ELECTRONIC TRAM WHEEL WEAR CALIPER



Caliper control panel with the measurement window

The electronic tram wheel wear caliper with digital readout and measurement data archiving capability, is designed for control of h , $e1/e2$, and $e1'/e2'$ parameters characterising the wear of the tram wheel flange, and also measures wheel flange thickness ($e1/e2 - e1'/e2'$) and wheel diameter ($d1/d2$).

Measurements with the caliper can be performed directly on vehicles, i.e. without rolling the wheelsets out. The caliper magnetic foot makes it easy to base it firmly basing on the inner face of the measured wheel and the visual verification of its correct mounting ensures the wheel rim parameters' measurement according to technical requirements. After mounting the caliper and its indirect wheel diameter measurement add-on, the operator initiates an automatic measurement. The caliper is delivered with the test blocks (to verify the correctness of indications).

Specifications:

Measured parameters:	<ul style="list-style-type: none"> Flange height h Flange thickness $e1/e2$, $e1'/e2'$ Diameter $d1/d2$ 	Operating conditions:	<ul style="list-style-type: none"> Temperature $-20 \div 45 \text{ }^\circ\text{C}$ Humidity $15 \div 85\%$, no condensation
Ranges:	<ul style="list-style-type: none"> h $13 \div 24 \text{ mm}$ $e1/e2$ $6 \div 26 \text{ mm}$ $e1'/e2'$ $0 \div 24 \text{ mm}$ $d1/d2$ $29-93.5 \text{ mm}$ of the rim height 	Memory capacity:	8000 measurement files
Accuracy:	$\pm 0.2 \text{ mm}$	Weight:	1.6 kg

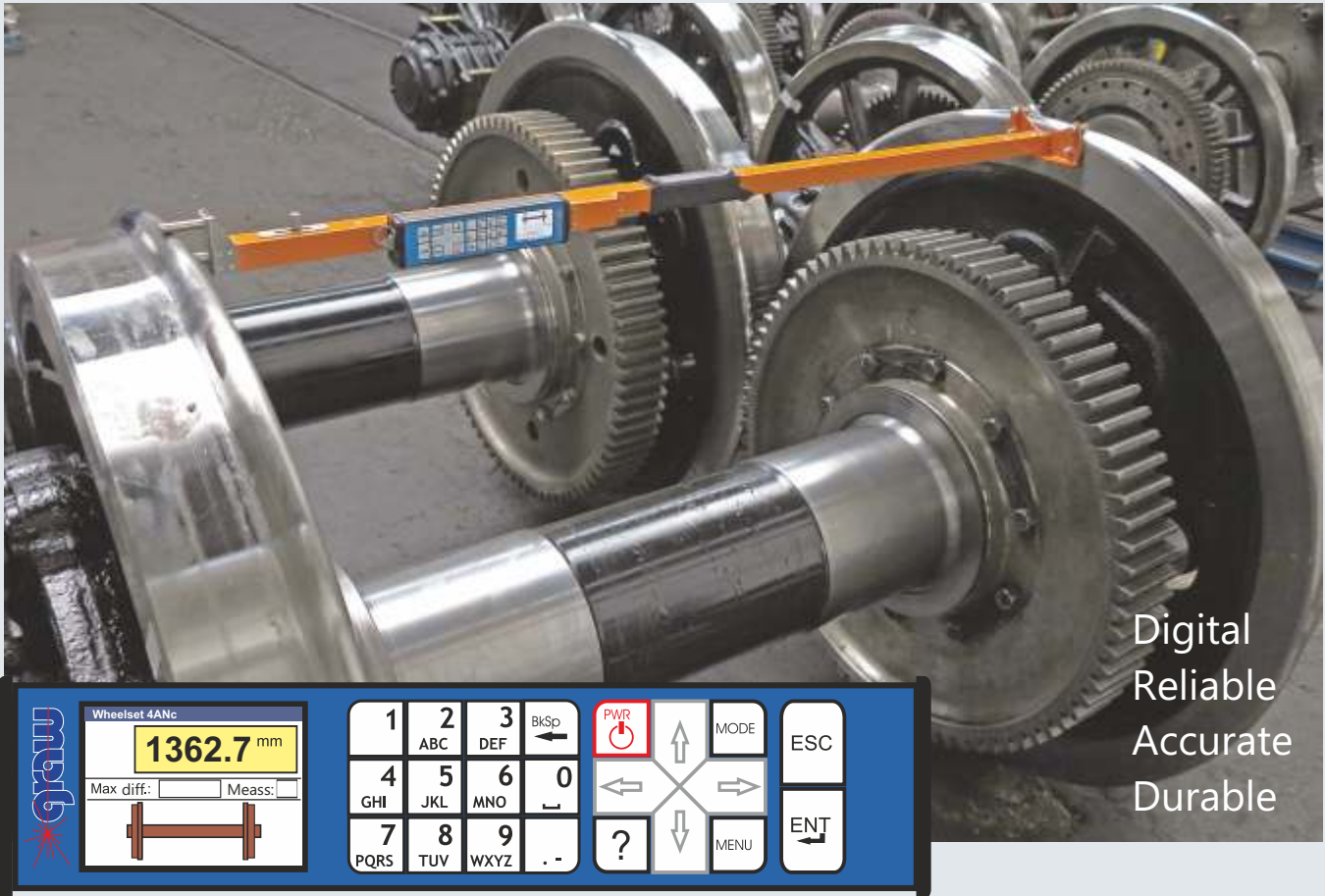
The gauge is equipped with a control panel with the GRAW-style, colour backlit display, and a comfortable keyboard. Measurement data is transferred to the caliper's control panel wirelessly using Bluetooth technology. Measurement results and information about the exceedings of the limit values are clearly visible even in a dark inspection pit.

Functionality:

Display legible even in direct sunlight and in an inspection pit, visual signalling of exceedings
Laser measurement
Easy and firm basing of the caliper on the wheel
Battery lasts up to 7 hours of continuous operation
Measurement data transfer to a PC via a USB Pendrive
Wireless communication with the control panel
Software for printing measurement reports, archiving and comparing measurement results

Exemplary car types	rim base diameter [mm]		rolling diameter [mm]	
			mini	maxi
13Ni 105 N derived	550	+0,5	610	654
116N	561	±0,3	610	650
123N	566	+0,4	610	654
120N	474	±0,25	540	600
120Na	506	+1	520	600

The caliper is delivered with PC software that allows for: archiving of measurement results, comparison of results, as well as printing of measurement reports. Measurement results can be exported to MS Word, MS Excel and PDF formats. The software delivered with the gauge also allows for collecting measurement results from all GRAW wheel measurement devices and generating



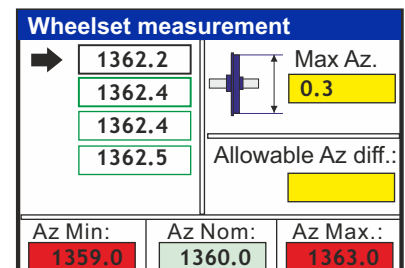
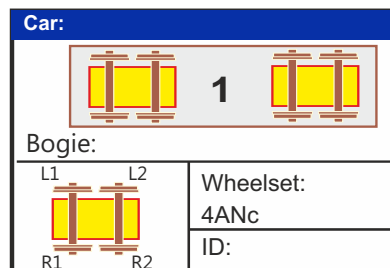
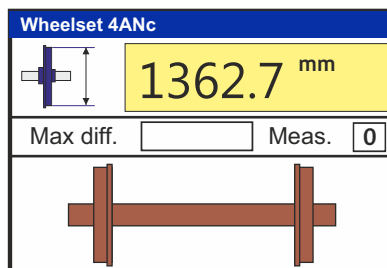
Digital
Reliable
Accurate
Durable

Gauge control panel with the wheelset measurement option.

The back-to-back gauge is designed for measurement of a1 dimension in wheelsets. The gauge is lightweight, accurate, and reliable regardless of weather conditions. During the measurements, measuring tips touch the wheelset wheels' faces precisely at points specified by railway regulations.

The gauge is equipped with a control panel with the GRAW-style, colour backlit display, and a comfortable keyboard. Measurement results and information about the exceedings of the limit values are clearly visible even in a dark inspection pit.

The gauge control panel can be detached from the gauge, making it easier to review the results after the measurements have been completed. The transfer of data to a PC is performed via a USB Pendrive.

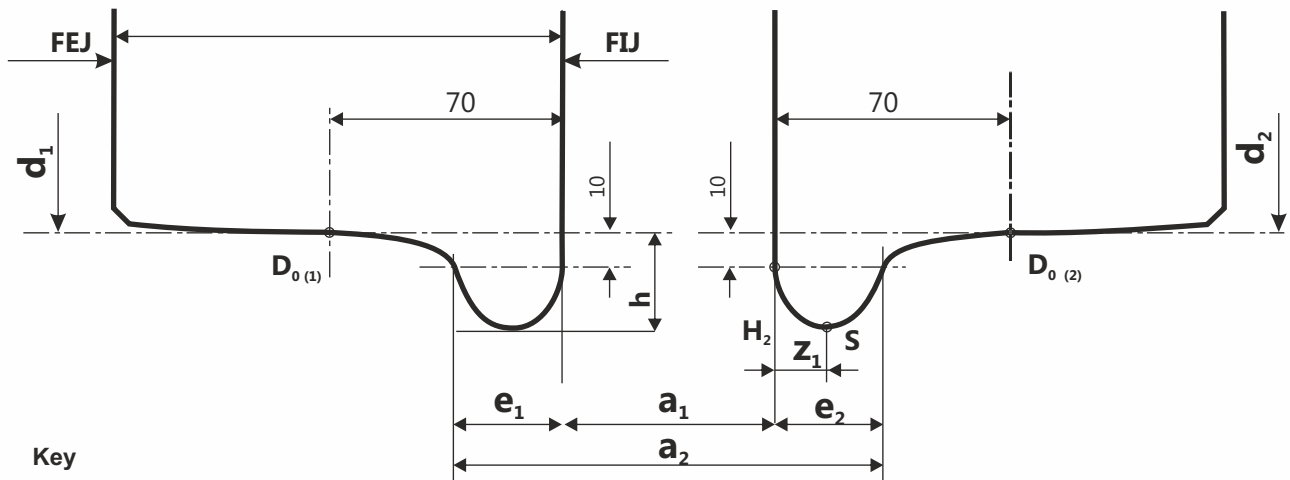


The back-to-back gauge is designed for measurement of the dimension between the inner faces of wheels: Az and Az'. Window of (wheelset) measurement preview.

Exemplary dimensions measured by the system

EN 15313:2016 (E)

Dimensions in mm



Key

a_1	back-to back dimension	L	rim nominal width
a_2	front-to-front dimension ($a_1 + e_1 + e_2$)	Z_1	internal zone of flange ($H_2 - S$)
D_0	location of the wheel tread, 70 mm from its internal face. (1) wheel 1, (2) wheel 2	FEJ	external face of the rim
e_1, e_2	flange thicknesses	FIJ	internal face of the rim
h	flange height	S	connection at the tip of the flange
		d_1, d_2	wheel diameters

Specifications:

Measured parameters: Back-to-Back dimension	Operating conditions: Temperature $-20 \div 45^\circ\text{C}$ Humidity $15 \div 85\%$, no condensation
Resolution: 0.1 mm	Memory capacity: 8000 measurement files
Accuracy: ± 0.1 mm	Weight: 2 kg
Range: 1360 ± 15 mm	

Functionality:

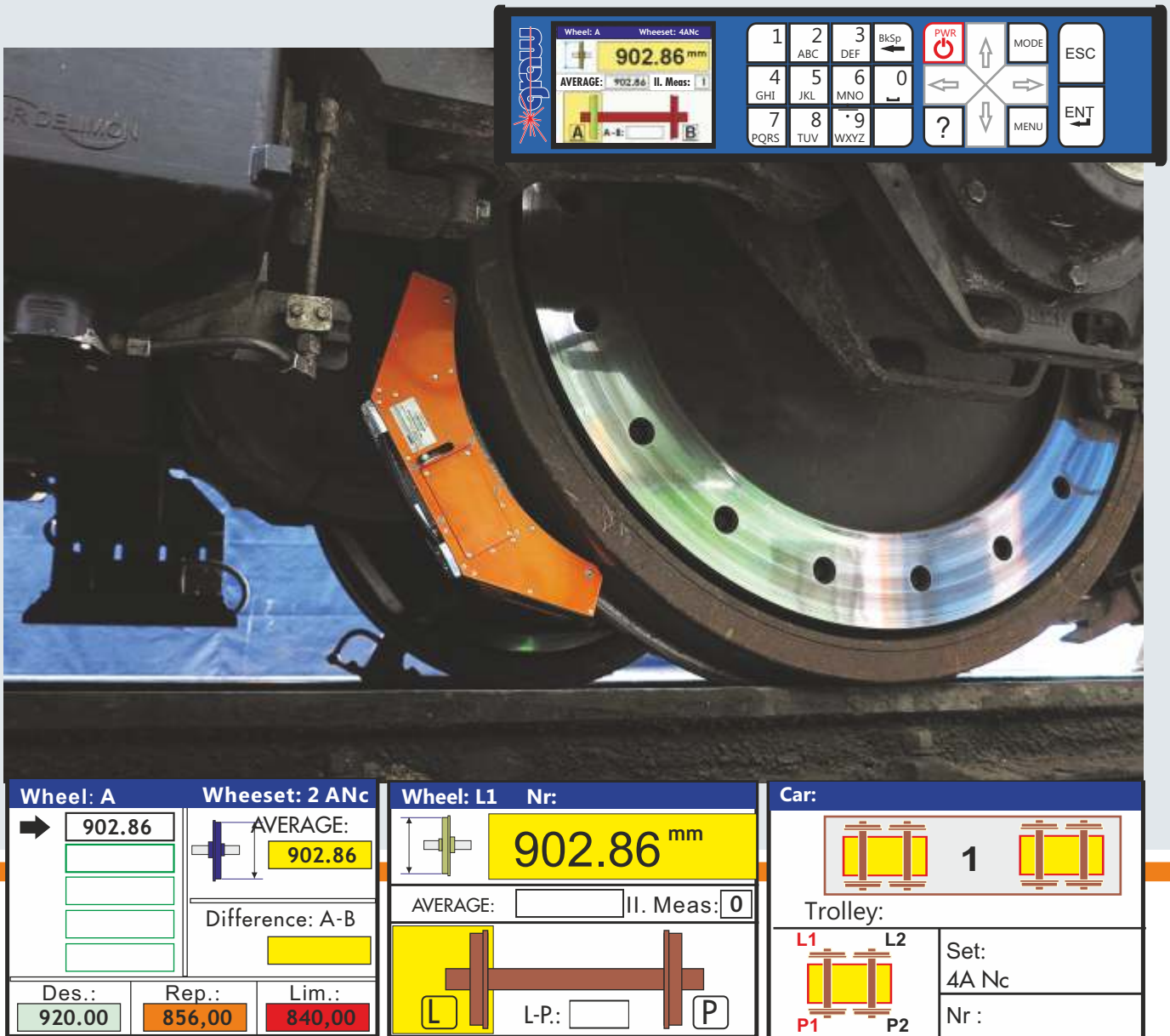
Display legible even in direct sunlight
Assessment of measurement results
Durable battery (lasts up to 20 hours of continuous operation)
Measurement data transfer to a PC via a USB Pendrive
Software for printing measurement reports, archiving and comparing measurement results

The gauge is delivered with PC software that allows for: archiving of measurement results, comparison of results, as well as printing of measurement reports. Measurement results can be exported to MS Word, MS Excel and PDF formats. The software delivered with the gauge also allows for collecting measurement results from all GRAW wheel measurement devices and generating aggregate reports.



WM-3

ELECTRONIC THREE-POINT WHEEL DIAMETER GAUGE



Masures diameters of both wheels and calculates their difference

Calculates average diameter value from many measurements

Difference of wheel diameters in wheel set, bogie and car

Gauge control panel with the wheelset measurement option.

The electronic three-point wheel diameter gauge for measurements without the bogie roll-out. The easy-to-use gauge made in many sizes designed for different rolling stock types, improves performance by saving the wheelset wheels' diameter measurement results, calculating the mean of several measurements and comparing them with measurement results of other wheels of a given axle, bogie or the car.

The gauge is equipped with a control panel with the GRAW-style, colour backlit display, and a comfortable keyboard. Measurement results and information about the exceedings of the limit values are clearly visible even in a dark inspection pit.

The gauge control panel can be detached from the gauge, making it easier to review the results after the measurements have been completed. The transfer of data to a PC is performed via a USB Pendrive.

Digital
Lightweight
Accurate
Reliable
Rain and frost resistant

Specifications:

Measured parameter:	Diameter
Resolution:	0.01 mm
Accuracy:	± 0.1 mm
Diameter ranges:	600 ÷ 1050 mm 650 ÷ 1250 mm
Operating conditions:	
Temperature:	-20 ÷ 45°C
Humidity:	15 ÷ 85%, no condensation
Memory capacity:	8000 measurement files
Weight:	3.4 kg

Functionality:

Assessment of measurement results for wheelsets, bogies and cars

Display legible even in direct sunlight and in the inspection pit

Durable battery lasts up to 20 hours of continuous operation

Measurement data transfer to a PC via a USB Pendrive

Software for printing measurement reports, archiving and comparing measurement results

The gauge is delivered with PC software that allows for: archiving of measurement results, comparison of results, as well as printing of measurement reports. Measurement results can be exported to MS Word, MS Excel and PDF formats. The software delivered with the gauge also allows for collecting measurement results from all GRAW wheel measurement devices and generating aggregate reports.



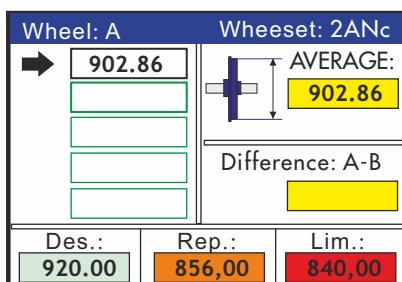
WM-3 Carbon ELECTRONIC THREE-POINT WHEEL DIAMETER GAUGE



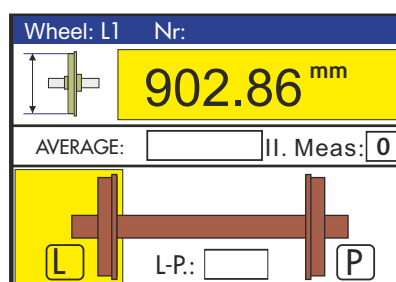
The state-of-the-art electronic three-point wheel diameter gauge is made of carbon fibre composite, with extremely high stability, designed for measurements performed in the inspection pit. During the measurements, the gauge body is based on the inner surface of the wheel, most of whose circumference being usually easily accessible. This feature makes this kind of wheel diameter gauge useful in measurements of various rolling stock wheel types. The fully automatic, measurement cycle makes the measurement results independent on operator's skill level, which increases the accuracy and comfort of use.

The easy-to-use WM-3 Carbon wheel diameter gauge improves performance by saving the wheelset wheels' diameter measurement results, calculating the mean of several measurements and comparing them with measurement results of other wheels of a given axle, bogie or the car.

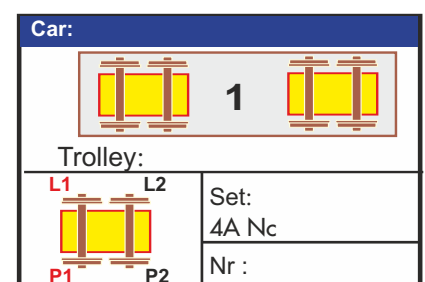
The gauge is equipped with a control panel with the GRAW-style, colour backlit display, and a comfortable keyboard. Measurement results and information about the exceedings of the limit values are clearly visible even in a dark inspection pit.



Calculates average diameter value from many measurements



Masures diameters of both wheels and calculates their difference



Difference of wheel diameters in wheel set, bogie and car

Gauge control panel with the wheelset measurement option

The gauge control panel can be detached from the gauge, making it easier to review the results after the measurements have been completed. The transfer of data to a PC is performed via a USB Pendrive.

Digital
Lightweight
Accurate
Reliable
Resistant to rain and frost

Specifications:

Measured parameter:	Diameter
Resolution:	0.01 mm
Accuracy:	±0.1 mm
Diameter range:	600 ÷ 1020 mm 800 ÷ 1250 mm
Operating conditions:	Temperature -20 ÷ 45°C Humidity 15 ÷ 85%, no condensation
Memory capacity:	8000 measurement files
Weight:	3.4 kg

Functionality:

Assessment of measurement results for wheelsets, bogies and cars

Fully automatic measurement cycle

Display legible even in direct sunlight and in the unlit inspection pit

Durable battery (lasts up to 9 hours of continuous operation)

Measurement data transfer to a PC via a USB Pendrive

Software for printing measurement reports, archiving and comparing measurement results

The gauge is delivered with PC software that allows for: archiving of measurement results, comparison of results, as well as printing of measurement reports. Measurement results can be exported to MS Word, MS Excel and PDF formats. The software delivered with the gauge also allows for collecting measurement results from all GRAW wheel measurement devices and generating aggregate reports.

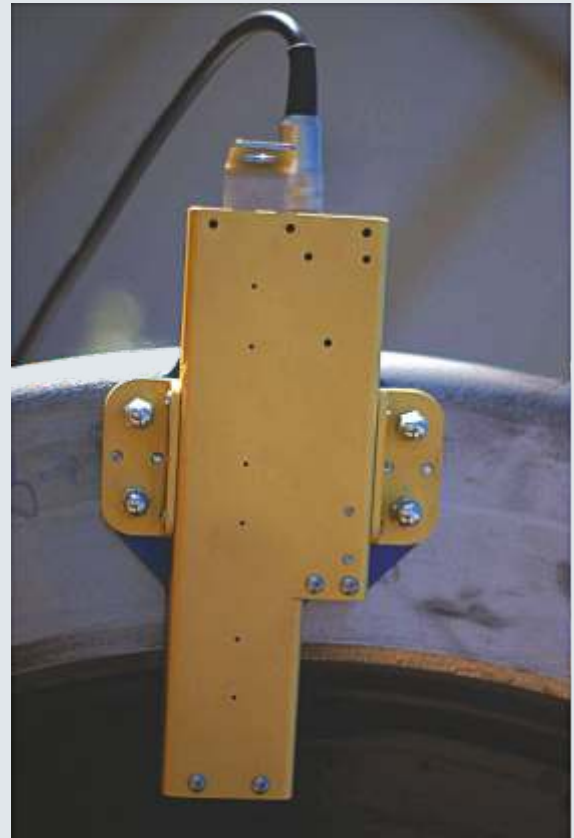




Specifications:

Measurement range:	22 ÷ 90 mm	Operating temperature:	-20 ÷ +45°C
Measurement accuracy:	± 0.1 mm	Humidity (no condensation):	15 ÷ 85%
Dimensions L x W x H:	220 x 120 x 100 mm	Display	backlit and legible even in direct sunlight
Weight:	1.1 kg	Battery	lasts up to 20 hours of continuous operation
Memory capacity:	8000 wheelsets		

Digital
Reliable
Accurate
Durable



The gauge is designed for quick and accurate wheel tyre thickness measurement. Measurement results can be stored in the gauge electronic memory. The gauge is lightweight, accurate and reliable regardless of weather conditions (rain and frost-proof).

The gauge comes with a large colour display and comfortable keyboard. The operator may specify the limit values of the parameters in accordance with the requirements of the relevant railway regulations. The value of the measured parameter exceeding the tolerance is displayed red.

[09.04] After detaching the control panel from the gauge, it is possible to review the measurements saved in its memory and transfer them to a PC disk via a USB Pendrive.

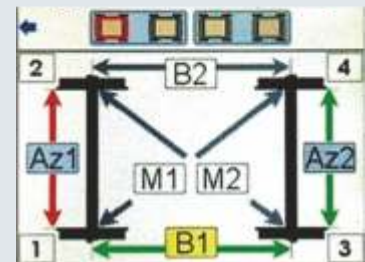
The gauge is delivered with diagnostic software for PCs that allows managing a straightforward analysis of the performed measurements, as well as for the efficient generation of measurement reports. This software allows the saving, visualising and printing of reports with results. Measurement data can be exported to MS Word, MS Excel and PDF formats.

Measurement results can also be entered into an optional P&D system rolling stock wheel data management system within a transport company.





Measurement modes



Automatic assessment of measurement results

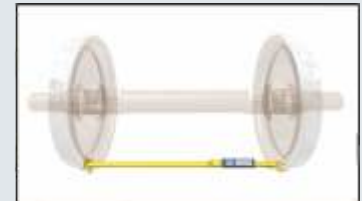
Checkup of bogie geometry parameters



Measurement of wheel base



Measurement of diagonals



Pomiar rozstawu kół

Specifications:

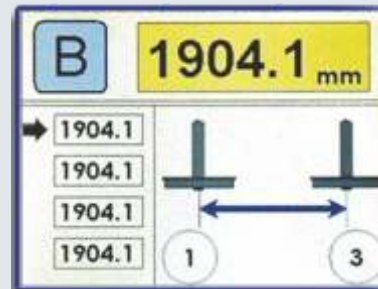
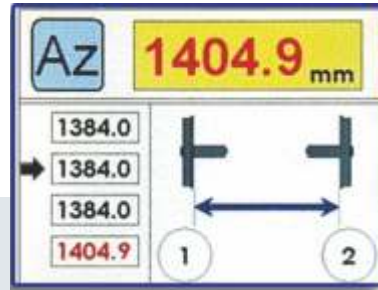
The gauge is designed for measuring geometrical parameters of tram bogies; as follows:

- M1 and M2: lengths of car bogie diagonals (ranges: 2350 ± 25 mm and 2270 ± 25 mm)
- B1 and B2: car bogie wheel base values (ranges: 1900 ± 25 mm and 1800 ± 25 mm)
- Ad_1 : back to back distance values for rims and wheels

The measurements may be done for the full range of wheel rolling diameters: new and worn out to the limit of wear: from 540 mm to 660 mm. The equipment is designed for use by a single operator working in an inspection pit.

The gauge is equipped with a control panel with the GRAW-style, colour backlit display, and a comfortable keyboard. Measurement results and information about the exceedings of the limit values are clearly visible even in a dark inspection pit.

The diagnostic PC software for PC delivered with the equipment makes management of the measurement data possible, its analysis, and generating reports efficiently from the measurement data.



	Bogie:A				Car: 1 →
	Pom.1	Pom.2	Pom.3	Pom.4	
Az1	1384.7	1384.7	1384.7	1384.7	
Az2	1374.5	1374.5	1374.5	1374.5	
B1	1900.5	1900.4	1900.4	1900.4	
B2	1913.1	1912.9	1913.0	1913.0	
M1	2355.9	2355.9	2355.9	2356.0	
M2	2355.6	2355.6	2355.6	2355.7	

Functionality:

Display legible even in direct sunlight and in an inspection pit, visual signalling of exceedings

Easy and firm basing of the gauge on the wheels.

Durable battery lasts up to 20 hours of continuous operation.

Measurement data transfer to a PC via a USB Pendrive.

Software for printing measurement reports, archiving and comparing measurement results.

Specifications:

Measured parameters:

Lengths of car bogie diagonals: M1 and M2

Car bogie wheel base values: B1 and B2

Back-to-Back dimension: a1

Ranges: M1; M2 2350 ± 25 mm and 2270 ± 25 mm

B1; B2 1900 ± 25 mm and 1800 ± 25 mm

a1: 1385 ± 15 mm

Measurement ranges are agreed with every customer

Accuracy: ± 0.2 mm

Operating conditions: Temperature $-20 \div 45$ C

Humidity $15 \div 85\%$, no condensation

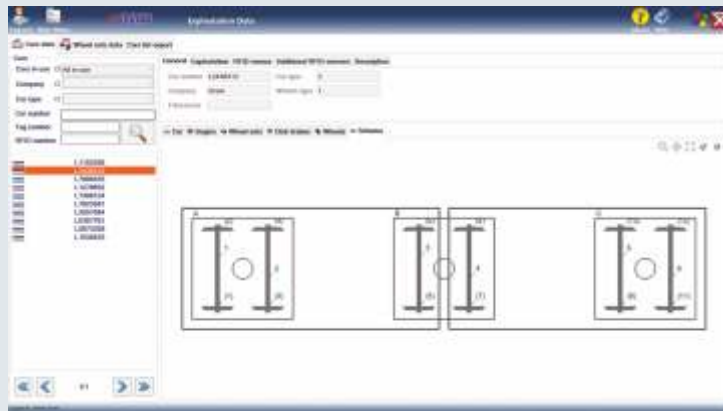
Memory capacity: 8000 measurement files

Weight: 6 kg



The system was designed for storing information about wheel profiles and diameters, as well as about flats and build-ups on the wheel tread.

The system makes it possible to define the required information about cars, logging of the distance covered by each wheel, as well as allows for the visualisation of wheel wear over time and repairs, including generation of reports documenting wheel wear.



The system can integrate all wheel measurement data collected by many units of a given transport company.

Measurement results of wheel geometry obtained using portable gauges and from other sources are archived in a database with the powerful graphic user interface. In addition, information about bogie measurements and other car service operations defined by the system user are also saved.

The P&D system integrates measurement results obtained using all wheel and wheelset geometry measurement gauges and systems made by GRAW (manually-operated and automatic) and others. The system database makes it possible to print wheel wear reports according to user-selected criteria, e.g., presenting lists of wheels, bogies and cars sorted according to

Specifications:

- Wheel flange height
- Wheel flange width
- Wheel diameter
- Differences of wheel flange widths in a bogie
- Differences of wheel diameters in an axle

- Tread surface condition, including:
 - current list of defects
 - list of cars without valid measurements
 - car condition report
 - train condition report

Report

PKP INTERCITY

Car exploitation history

Car number: 1
 Car type: 1
 Company belonging:
 Current mileage: 0.0[km]

Operation date	Employee	Operation symbol	Operation description	Comment
8/8/2016	Admin Graw			Changes were made in definition of car (SN = L115225); SN: L115225 -> L1152258;
8/8/2016	Admin Graw			Changes were made in definition of car (SN = 115225); SN: 115225 -> L115225;
8/8/2016	Admin Graw			Changes were made in definition of car (SN = 1); SN: 1 -> 115225; company: missing -> Graw;
8/8/2016	Admin Graw			Przejazd wagonu (SN = 1, id car = 2) via track: , id measurement set = 7, car number in measurement set = 1; ride date = 12-06-16 07:22:46
8/8/2016	Admin Graw			Przejazd wagonu (SN = 1, id car = 2) via track: , id measurement set = 8, car number in measurement set = 1; ride date = 12-03-16 12:28:29
8/8/2016				Przejazd wagonu (SN = , id car = 10) via track: , id measurement set = 8, car number in measurement set = 1; ride date = 01-01-01 00:00:00
8/8/2016				Created car: SN = ; id = 10
8/8/2016				Przejazd wagonu (SN = , id car = 9) via track: , id measurement set = 7, car number in measurement set = 1; ride date = 01-01-01 00:00:00
8/8/2016				Created car: SN = ; id = 9
8/8/2016				Przejazd wagonu (SN = 1, id car = 2) via track: , id measurement set = 5, car number in measurement set = 1; ride date = 21-04-16 07:13:47
8/8/2016				Przejazd wagonu (SN = , id car = 7) via track: , id measurement set = 5, car number in measurement set = 1; ride date = 01-01-01 00:00:00
8/8/2016				Created car: SN = ; id = 7
8/8/2016				Przejazd wagonu (SN = 1, id car = 2) via track: , id measurement set = 1, car number in measurement set = 1; ride date = 01-08-16 14:31:44
8/8/2016				Przejazd wagonu (SN = , id car = 3) via track: , id measurement set = 1, car number in measurement set = 1; ride date = 01-01-01 00:00:00
8/8/2016				Created car: SN = ; id = 3
8/8/2016				Utworzono wagon: SN = 1; id = 2

KARTA POMIARÓW. PARAMETRYCZNA PRZEGLĄDÓW
 Pomiar czepów kolowych

Właściciel parku kolowego	Dokumentacja Techniczna	System	Utrzymanie	Strefa	88/08
"LABOR SŁOŃCOWY" OPOLE S.A.	Opisowy	"LABOR SŁOŃCOWY" OPOLE S.A.		Arkusze (EPK)	
	Data	Nr	Obmiarownik	Załącznik (strona)	EP (15)

Wzrost (mm)	Średnica zewnętrzna (mm)	Średnica wewnętrzna (mm)	Średnica zewnętrzna (mm)	Średnica wewnętrzna (mm)	Średnica zewnętrzna (mm)	Średnica wewnętrzna (mm)	Średnica zewnętrzna (mm)	Średnica wewnętrzna (mm)	Średnica zewnętrzna (mm)	Średnica wewnętrzna (mm)
Ø	Ø ₁	Ø ₂	Ø ₃	Ø ₄	Ø ₅	Ø ₆	Ø ₇	Ø ₈	Ø ₉	Ø ₁₀
40	32*	25	38	5,5	5,5	52*	1387	1381	1230	1010

* w zależności od A₁ i w granicach 30
 ** w zależności od 2,5 mm między walcami + 0,2mm
 Ø₁ - grubość śruby koła obręczy koła przawo
 Ø₂ - grubość śruby koła obręczy koła przawo

Proven system deployment effects:

- Effective derailment prevention
- Reduction of the allowed wheel diameter differences
- Reduction of noise level in urban areas





The automatic measurement system enables the classification of wheel tread surface condition by detecting wheel flats and out-of-round wheels (i.e. wheel build-ups). The software delivered with the system enables the management of the rolling stock-related information, collection of information on car life history, visualization of the out-of-roundness wheel classes, and generation of wheel wear reports.

Id wagonu	Pr-ufa	Osena	L-wal	Osena-1	Osena-2	Data gotowy	Data nie gotowy	Status	
1	1125	4	4	25	4	4	2005-04-25	2005-05-05	--
2	1125	3	4	1	2	3	2005-04-26	2005-05-05	--
3	1125	7	3	7	2	2	2005-05-04	2005-05-05	--
4	1125	1	1	4	1	1	--	2005-05-05	--
5	1125	2	1	4	1	1	--	2005-05-05	--
6	1125	5	1	4	1	1	--	2005-05-05	--
7	1125	6	1	4	1	1	--	2005-05-05	--
8	1125	8	1	4	2	2	--	2005-05-05	--
9	626	7	4	2	4	1	2005-05-04	2005-05-05	--
10	626	8	2	2	3	1	2005-05-04	2005-05-05	--
11	626	3	2	1	1	1	2005-05-05	2005-05-05	--
12	626	1	1	3	1	1	--	2005-05-05	--
13	626	2	1	3	1	1	--	2005-05-05	--
14	626	4	1	3	1	4	--	2005-05-05	--
15	626	5	1	3	1	1	--	2005-05-05	--
16	626	6	1	3	1	1	--	2005-05-05	--
17	476	8	4	1	--	--	2005-05-04	2005-05-04	--
18	476	4	3	1	--	--	2005-05-04	2005-05-04	--

The measurement system built into the track is maintenance-free. Measurement signals are stored and analysed by the autonomous control system. The measurement results are collected automatically via a wireless link by the operator's computer software. Cars are identified automatically and measurement results are saved for each wheel individually. The system stores archived measurement results and other information regarding the life history and the servicing of wheels, including the turning of bogies.

Exemplary logged wheel service operations

- Removal of flats, build-ups or ovality
- Turning of bogies
- Measurement of wheel diameter and profile
- Measurement of wheel build-ups and flats
- Reprofiling of wheels on the underfloor lathe
- Replacement of wheels and bogies

System makes generation of various reports possible

- System can generate various reports
- Proven system deployment effects,
- Improvement of wheel use management,
- Reduction of noise in urban areas.



The image shows a screenshot of a software-generated report titled "Drehlauf ragen". The report contains multiple tables of data, likely representing different wheel service events. Each table includes columns for various parameters such as date, time, location, and technical specifications. The data is presented in a structured, tabular format typical of a database export or a specialized reporting tool.

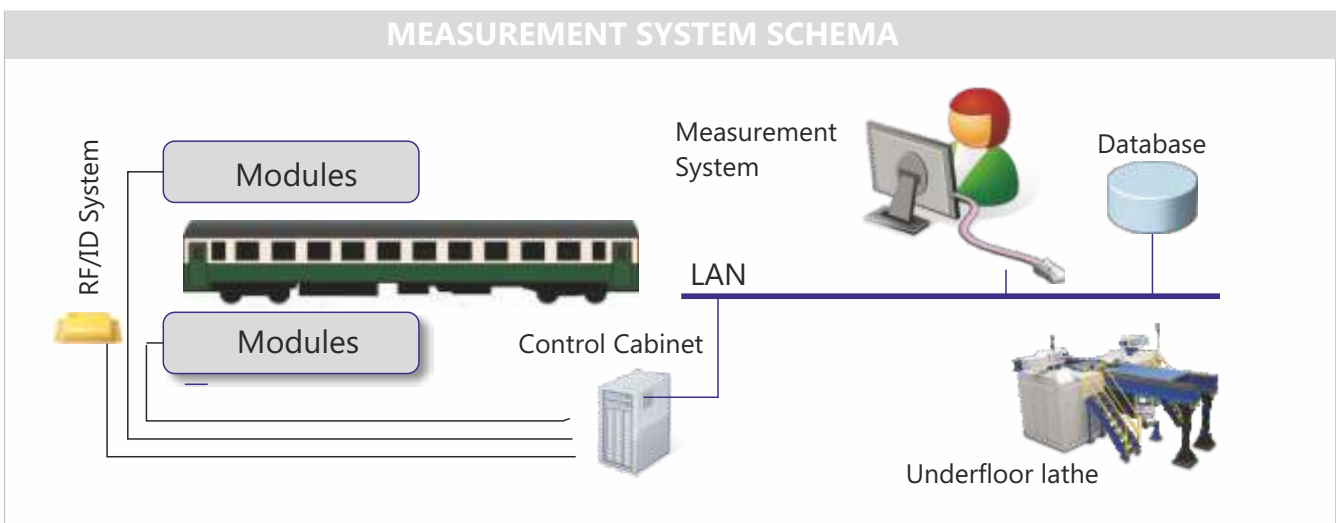
Example of a custom report





The laser system is designed for depots to perform wheel measurements at a maximum speed of 10 km/h. Wheel geometry parameters are determined based on the reproduced wheel tread profiles. The measured wheel geometry parameters include the entire wheel tread profile, flange height h , flange thicknesses e_1 , e_2 , flange angle dimension (slope) qR , wheel diameters d_1 , d_2 and the back-to-back dimension a_1 . Wheels of the railway or tram vehicles can be measured according to the Customer's requirements.

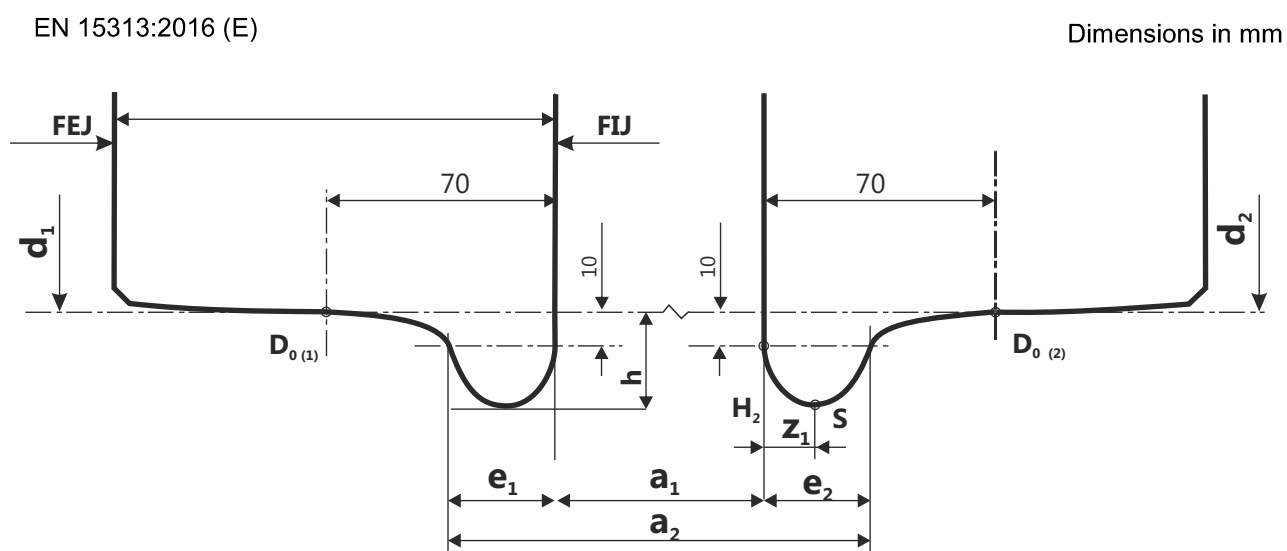
MEASUREMENT SYSTEM SCHEMA



The measurement system is an entirely autonomous and non-contact one, therefore, it has no parts subject to wear. Solutions are implemented to provide the required climatic conditions to the system elements protecting them from dirt and mechanical damage. The measurement system transfers in real time information about wheel defects and can optionally be provided with a train speed measurement system displaying its speed. Measurement results can be used by an underfloor lathe.

Optionally, identification of the individual cars is possible after mounting of RF/ID tags on them - this way all measurement results can be assigned to individual wheels for further analysis and reporting.

Exemplary dimensions measured by the system



Key

- a_1 back-to-back dimension
- a_2 front-to-front dimension ($a_1 + e_1 + e_2$)
- D_0 location of the wheel tread, 70 mm from its internal face. (1) wheel 1, (2) wheel 2
- e_1, e_2 flange thicknesses
- h flange height
- L rim nominal width
- Z_1 internal zone of flange ($H_2 - S$)
- FEJ external face of the rim
- FIJ internal face of the rim
- S connection at the tip of the flange
- d_1, d_2 wheel diameters

Figure 8 - Interface dimensions - Wheelset functional references

5.2.2 Wheel functional references

The essential dimensional references of the wheel are defined in Figure 9.

Measured values and their accuracy:

Wheel diameter: new/worn out - according to agreement

Wheel diameter measurement accuracy: ± 0.6 mm

Wheel flange height measurement accuracy: ± 0.2 mm

Wheel rim width measurement accuracy: ± 0.2 mm

Wheel back-to-back dimension measurement accuracy: ± 0.3 mm

Wheel tread profile reproduction accuracy: ± 0.2 mm

Flange angle dimension (slope) measurement accuracy: ± 0.3 mm

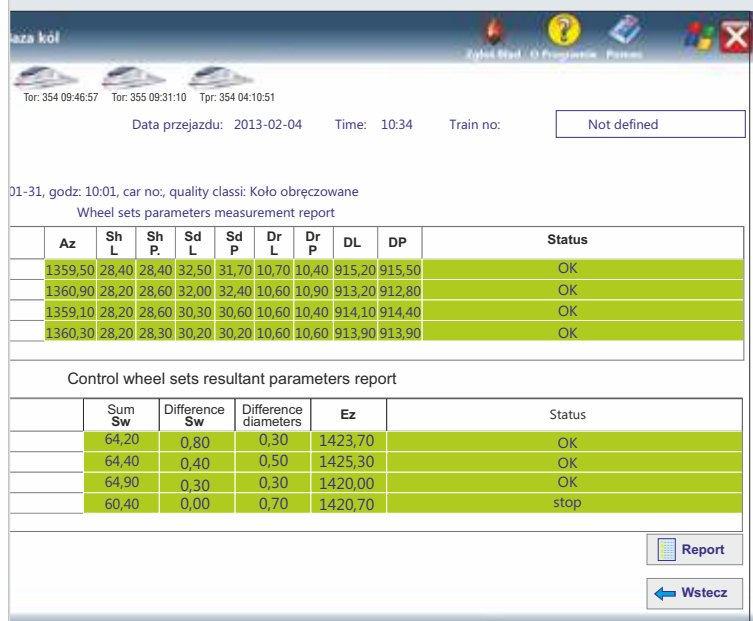
The measurement system provides the entire wheel tread profile, regardless of the wheel position during its measurement, therefore, it has the following advantages:

- all profile defects and types of wear can be seen on the entire cross-section of the wheel tread profile,
- all profile wear parameters are determined in full conformity with their geometric definitions,
- wheel diameter is determined on a required plane in relation to the wheel face surface

Measurement results can be analysed and stored in the database to assess the progress of wheel wear. The system software warns about the exceeding of the permissible wear for the currently measured wheelset. The relevant wheel wear-related analysis takes into consideration the history of each wheel and one can make decision concerning its reprofiling. Measurement results can be transferred directly to the underfloor lathe.



Exemplary user interface window



01-31, godz: 10:01, car no:, quality class: Koło obręczowane

Wheel sets parameters measurement report

	Az	Sh L	Sh P	Sd L	Sd P	Dr L	Dr P	DL	DP	Status
	1359,50	28,40	28,40	32,50	31,70	10,70	10,40	915,20	915,50	OK
	1360,90	28,20	28,60	32,00	32,40	10,60	10,90	913,20	912,80	OK
	1359,10	28,20	28,60	30,30	30,60	10,60	10,40	914,10	914,40	OK
	1360,30	28,20	28,30	30,20	30,20	10,60	10,60	913,90	913,90	OK

Control wheel sets resultant parameters report

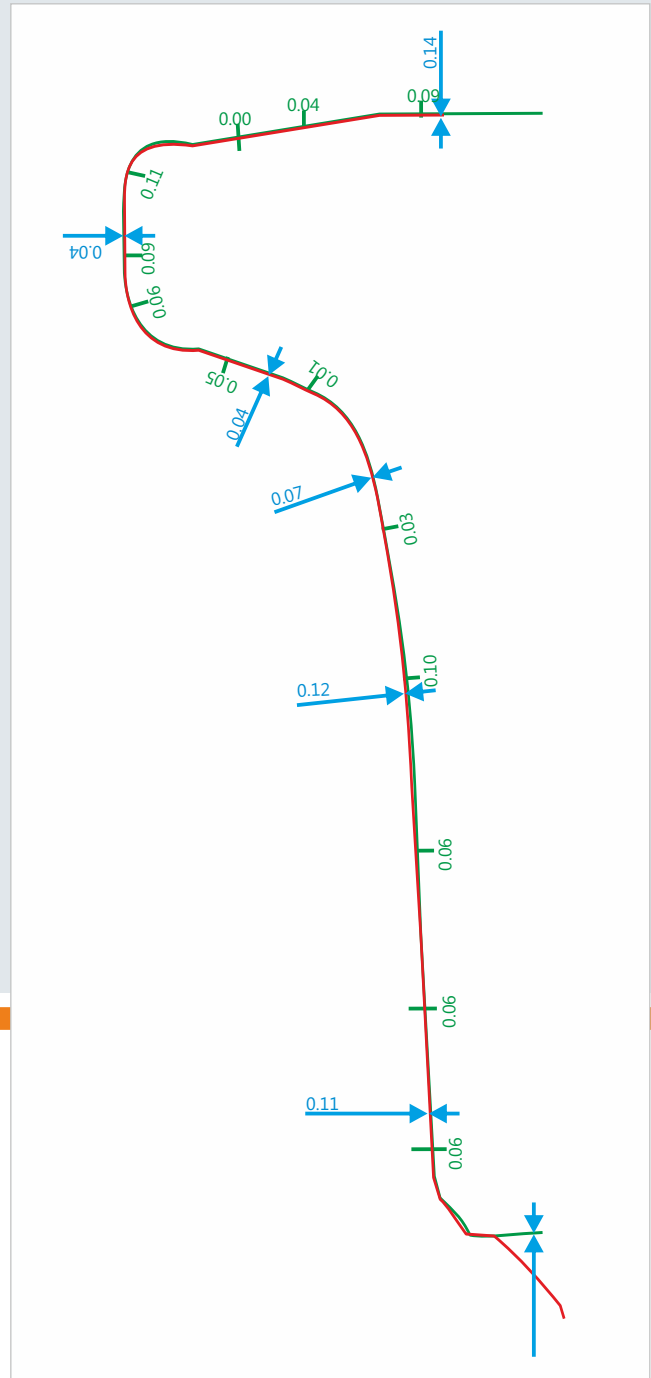
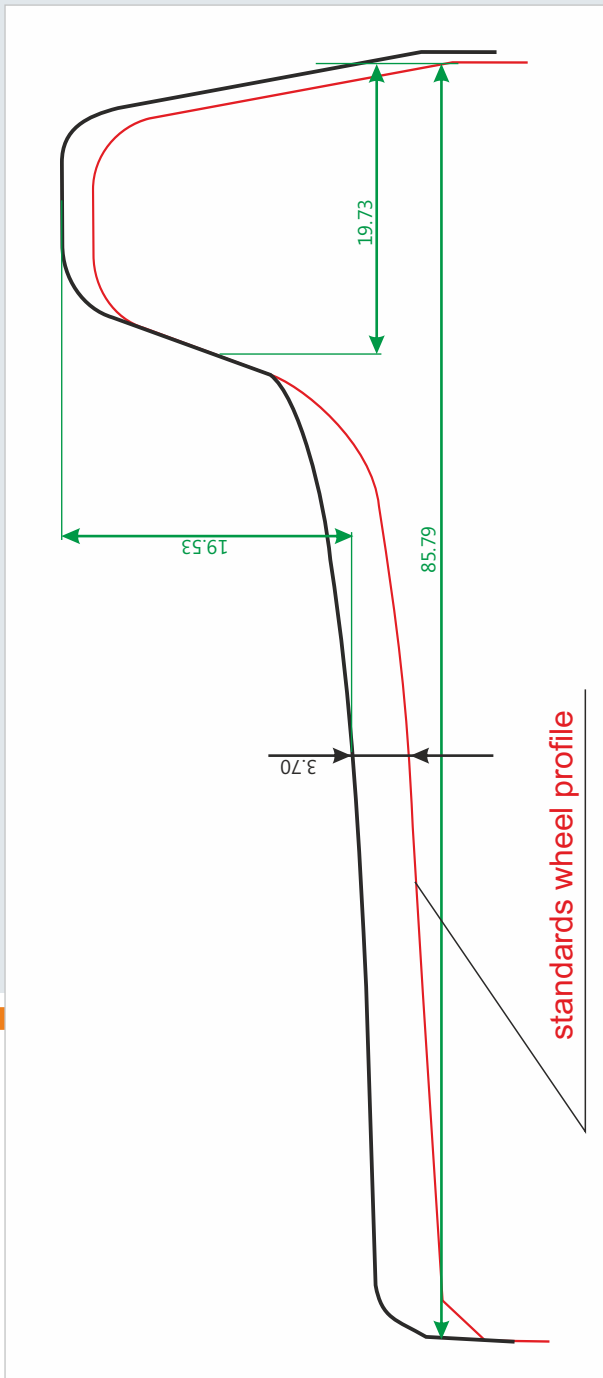
	Sum Sw	Difference Sw	Difference diameters	Ez	Status
	64,20	0,80	0,30	1423,70	OK
	64,40	0,40	0,50	1425,30	OK
	64,90	0,30	0,30	1420,00	OK
	60,40	0,00	0,70	1420,70	stop

Buttons: Report, Wstecz

Measurement results generated by the system may be used for selection of machining parameters on the underfloor lathe, which increases its productivity significantly and makes machining of up to 24 wheels per shift (8 hours) possible.

Example of use of measurement results for a tram wheel work planning on the underfloor lathe

Comparison of the optical measurement results for the tram wheel with measurements obtained using the contact method.



Laser wheel measurement system: repeatability of six wheel optical measurements and difference between them and measurement results obtained with the portable devices.





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