WHEEL MEASUREMENT SYSTEMS
WHEEL MEASUREMENT SYSTEMS

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ELECTRONIC WHEEL PROFILE GAUGE
FOR TRAIN AND TRAM WHEELS

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

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, $h$, $e_1$, $e_2$

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.
### Specifications:

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measured parameters:</td>
<td>Flange height h</td>
</tr>
<tr>
<td></td>
<td>Flange thickness e1/e2</td>
</tr>
<tr>
<td></td>
<td>Flange angle dimension qR</td>
</tr>
<tr>
<td>Ranges:</td>
<td>h 12.5 ÷ 39 mm</td>
</tr>
<tr>
<td></td>
<td>e1/e2 13 ÷ 30 mm</td>
</tr>
<tr>
<td></td>
<td>qR 0 ÷ 27 mm</td>
</tr>
<tr>
<td>Accuracy:</td>
<td>±0.1 mm</td>
</tr>
<tr>
<td>Operating conditions:</td>
<td>Temperature -20 ÷ 45°C</td>
</tr>
<tr>
<td></td>
<td>Humidity 15 ÷ 85%, no condensation</td>
</tr>
<tr>
<td>Memory capacity:</td>
<td>8000 measurement files</td>
</tr>
<tr>
<td>Weight:</td>
<td>1.6 kg</td>
</tr>
</tbody>
</table>
**Functionality:**

<table>
<thead>
<tr>
<th>Feature</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fast measurement</td>
<td>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</td>
</tr>
<tr>
<td>Easy and firm basing of the gauge on the wheel</td>
<td>Easy and firm basing of the gauge on the wheel</td>
</tr>
<tr>
<td>Display legible even in direct sunlight and in an inspection pit</td>
<td>Display legible even in direct sunlight and in an inspection pit, visual signalling of exceedings</td>
</tr>
<tr>
<td>Durable battery lasts up to 20 hours of continuous operation</td>
<td>Durable battery lasts up to 20 hours of continuous operation</td>
</tr>
<tr>
<td>Measurement data transfer to a PC via a USB Pendrive</td>
<td>Measurement data transfer to a PC via a USB Pendrive</td>
</tr>
<tr>
<td>Software for printing measurement reports, archiving and comparing measurement results</td>
<td>Software for printing measurement reports, archiving and comparing measurement results</td>
</tr>
</tbody>
</table>

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.
The electronic tram wheel wear caliper with digital readout and measurement data archiving capability, is designed for control of \( h \), \( e_1/e_2 \), and \( e_{1'}/e_{2'} \) parameters characterising the wear of the tram wheel flange, and also measures wheel flange thickness \( (e_{1}/e_{2} - e_{1'}/e_{2'}) \) and wheel diameter \( (d_1/d_2) \).

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:**

<table>
<thead>
<tr>
<th>Measured parameters:</th>
<th>Ranges:</th>
<th>Accuracy:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flange height ( h )</td>
<td>( h \ 13 - 24 \text{ mm} )</td>
<td>( \pm 0.2 \text{ mm} )</td>
</tr>
<tr>
<td>Flange thickness ( e_1/e_2, e_{1'}/e_{2'} )</td>
<td>( e_1/e_2 \ 6 - 26 \text{ mm} )</td>
<td></td>
</tr>
<tr>
<td>Diameter ( d_1/d_2 )</td>
<td>( e_{1'}/e_{2'} \ 0 - 24 \text{ mm} )</td>
<td></td>
</tr>
<tr>
<td></td>
<td>( d_1/d_2 \ 29 - 93.5 \text{ mm of the rim height} )</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Operating conditions:</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Temperature</td>
<td>-20 ÷ 45 °C</td>
</tr>
<tr>
<td>Humidity</td>
<td>15 ÷ 85%, no condensation</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Memory capacity:</th>
<th>8000 measurement files</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight:</td>
<td>1.6 kg</td>
</tr>
</tbody>
</table>

Caliper control panel with the measurement window
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

<table>
<thead>
<tr>
<th>Exemplary car types</th>
<th>rim base diameter [mm]</th>
<th>rolling diameter [mm]</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>mini</td>
</tr>
<tr>
<td>13Ni 105 N derived</td>
<td>550</td>
<td>610</td>
</tr>
<tr>
<td>116N</td>
<td>561</td>
<td>±0,3</td>
</tr>
<tr>
<td>123N</td>
<td>566</td>
<td>+0,4</td>
</tr>
<tr>
<td>120N</td>
<td>474</td>
<td>±0,25</td>
</tr>
<tr>
<td>120Na</td>
<td>506</td>
<td>+1</td>
</tr>
</tbody>
</table>

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...
The back-to-back gauge is designed for measurement of the dimension between the inner faces of wheels: $a_1$. 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.
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:

<table>
<thead>
<tr>
<th>Measured parameters: Back-to-Back dimension</th>
<th>Operating conditions:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Resolution: 0.1 mm</td>
<td>Temperature -20 ÷ 45°C</td>
</tr>
<tr>
<td>Accuracy: ±0.1 mm</td>
<td>Humidity 15 ÷ 85%, no condensation</td>
</tr>
<tr>
<td>Range: 1360 ± 15 mm</td>
<td>Memory capacity: 8000 measurement files</td>
</tr>
<tr>
<td></td>
<td>Weight: 2 kg</td>
</tr>
</tbody>
</table>

### 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

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**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

**Dimensions in mm**

**Exemplary dimensions measured by the system**

- FEJ: external face of the rim
- FIJ: internal face of the rim
- Z1: internal zone of flange \((H_2 - S)\)
- S: connection at the tip of the flange
- \(d_1, d_2\): wheel diameters

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![QR Code](QR_CODE_IMAGE)
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.
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:**

<table>
<thead>
<tr>
<th>Measured parameter: Diameter</th>
</tr>
</thead>
<tbody>
<tr>
<td>Resolution: 0.01 mm</td>
</tr>
<tr>
<td>Accuracy: ± 0.1 mm</td>
</tr>
<tr>
<td>Diameter ranges: 600 ÷ 1050 mm</td>
</tr>
<tr>
<td>650 ÷ 1250 mm</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Operating conditions:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temperature: -20 ÷ 45°C</td>
</tr>
<tr>
<td>Humidity: 15 ÷ 85%, no condensation</td>
</tr>
<tr>
<td>Memory capacity: 8000 measurement files</td>
</tr>
<tr>
<td>Weight: 3.4 kg</td>
</tr>
</tbody>
</table>

**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

Digital
Lightweight
Accurate
Reliable
Rain and frost resistant
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.

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:

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measured parameter</td>
<td>Diameter</td>
</tr>
<tr>
<td>Resolution</td>
<td>0.01 mm</td>
</tr>
<tr>
<td>Accuracy</td>
<td>±0.1 mm</td>
</tr>
<tr>
<td>Diameter range</td>
<td>600 ÷ 1020 mm</td>
</tr>
<tr>
<td></td>
<td>800 ÷ 1250 mm</td>
</tr>
<tr>
<td>Operating conditions</td>
<td>Temperature -20 ÷ 45°C</td>
</tr>
<tr>
<td></td>
<td>Humidity 15 ÷ 85%, no condensation</td>
</tr>
<tr>
<td>Memory capacity</td>
<td>8000 measurement files</td>
</tr>
<tr>
<td>Weight</td>
<td>3.4 kg</td>
</tr>
</tbody>
</table>

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.

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Specifications:

<table>
<thead>
<tr>
<th>Feature</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measurement range</td>
<td>22 ÷ 90 mm</td>
</tr>
<tr>
<td>Measurement accuracy</td>
<td>± 0.1 mm</td>
</tr>
<tr>
<td>Dimensions L x W x H</td>
<td>220 x 120 x 100 mm</td>
</tr>
<tr>
<td>Weight</td>
<td>1.1 kg</td>
</tr>
<tr>
<td>Memory capacity</td>
<td>8000 wheelsets</td>
</tr>
<tr>
<td>Operating temperature</td>
<td>-20 ÷ +45°C</td>
</tr>
<tr>
<td>Humidity (no condensation)</td>
<td>15 ÷ 85%</td>
</tr>
<tr>
<td>Display</td>
<td>Backlit and legible even in direct sunlight</td>
</tr>
<tr>
<td>Battery</td>
<td>Lasts up to 20 hours of continuous operation</td>
</tr>
</tbody>
</table>
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.

www.graw.com
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.: 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.
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 ÷ 45C
Humidity 15 ÷ 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:**

<table>
<thead>
<tr>
<th>Wheel flange height</th>
<th>Tread surface condition, including:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wheel flange width</td>
<td>- current list of defects</td>
</tr>
<tr>
<td>Wheel diameter</td>
<td>- list of cars without valid measurements</td>
</tr>
<tr>
<td>Differences of wheel flange widths in a bogie</td>
<td>- car condition report</td>
</tr>
<tr>
<td>Differences of wheel diameters in an axle</td>
<td>- train condition report</td>
</tr>
</tbody>
</table>
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.

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.

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) $q_R$, 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.

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.
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
- $Z1$: internal zone of flange (H2 - 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.

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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