RIFTEK
Sensors & Instruments

BACK-TO-BACK DISTANCE MEASURING GAUGE

IMR-L-BT Series

User's manual

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Contents

2

3

1. Safety precautions and measurement conditions

- The metering accuracy depends greatly on the wheel surface quality. Therefore it is necessary to carry out the check and presorting of the wheel flaws before measuring the distance.
- Prior to place the gauge is a need to cleanse the wheel parts that contact with the gauge and the place of laser beam hit.
- Do not allow hitting the gauge on the wheel when placing.
- It is necessary to inspect the gauge supports periodically and to cleanse them.
- To save the battery power, the display extinguishes if there were no buttons pressings for 60 seconds, at that only blinking dot is shown. Pressing any button just turns on the display and does not act in any other way in this case.

2. CE compliance

The gauge has been developed for use in industry and meets the requirements of the following Directives:

- EU directive 2014/30/EU. Electromagnetic compatibility (EMC).
- EU directive 2011/65/EU, "RoHS" category 9.

3. Laser safety

The gauge makes use of an c.w. 660 nm wavelength semiconductor laser. Maximum output power is 4.8 mW. The gauge belongs to the 3R laser safety class. The following warning label is placed on the body:

```
┌─────────────────────────────────────┐
│  ⚠        LASER  RADIATION           │
│          AVOID DIRECT EYE EXPOSURE   │
│          Output            ≤4.8mW    │
│                                      │
│          Wavelength        660nm     │
│          CLASS 3R LASER PRODUCT      │
│          IEC/EN  60825−1 : 2014      │
└─────────────────────────────────────┘
```
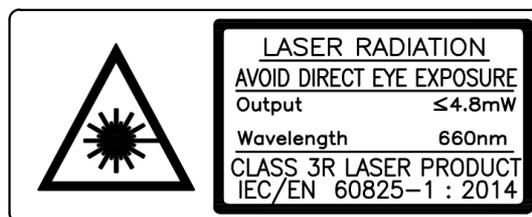
The following safety measures should be taken while operating the gauge:
- Do not target the laser beam at humans.
- Use protective goggles when operating the gauge.
- Avoid staring into the laser beam.
- Do not disassemble the gauge.

4. General information

Electronic gauge is designed to measure the back-to-back distance of railway, metro and tram wheels in the course of checkup, examination, repair and formation of wheelsets. Measurements are made directly on the rolling stock without rolling out the wheelset.

5. Basic technical data

Parameter	Value
Measurement range, mm	1340…1610 or on request (nominal distance ±15 mm)
Measurement error, mm	±0.2
Indication discreteness	0.1 mm, 0.01 mm * or 0.01 inch
Display	build-in, LED
Operating temperature, °C	-15…+50
Weigh, g	950
Dimensions	figure 1
Power supply	rechargeable batteries 4xAA, 1.2V
Connection to PC	Bluetooth

6. Complete set to be supplied

Name	Quantity
Back-to-back distance measuring gauge, IMR-L series	1 piece
Charger	1 piece
Manual	1 piece
Case	1 piece
Calibration tools (option)	on request

7. Example of item designation when ordering

IMR-L-D

Symbol	Description
D	Nominal back-to-back distance, mm.

Example: IMR-L-1360 - nominal back-to-back distance is equal to 1360 mm.

8. Design

8.1. Electronic gauge

The gauge (fig. 1) contains a magnetic support to place the gauge onto the internal surface of the wheel.

There are a digital numeric display and control buttons on the front panel of the gauge. The output window for laser radiation, input window, "Charge" connector are placed on the side panel of the gauge.

6
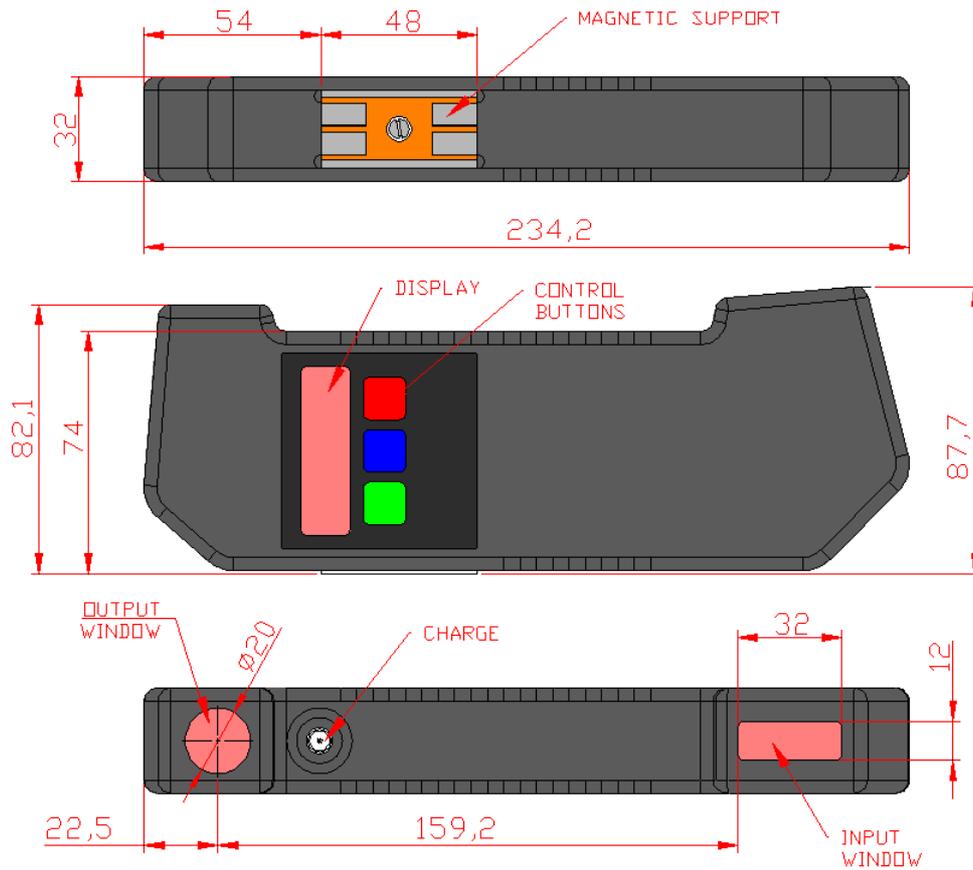
Figure 1

8.2. Indication device (option)

The PDA is designed for control of the laser scanning module, data reception from the scanning module, indication of measurement results, parameter input and data storage.

Figure 2

Figure 2 indicates:
(1) Turn-on button
(2) Charging indication, red/blue LED
(3) Connector to PC USB port or charging device
(4) Flash memory card connector
(5) Stylus
(6) Bluetooth antenna
Overall dimensions of the PDA are shown in figure 2.1.
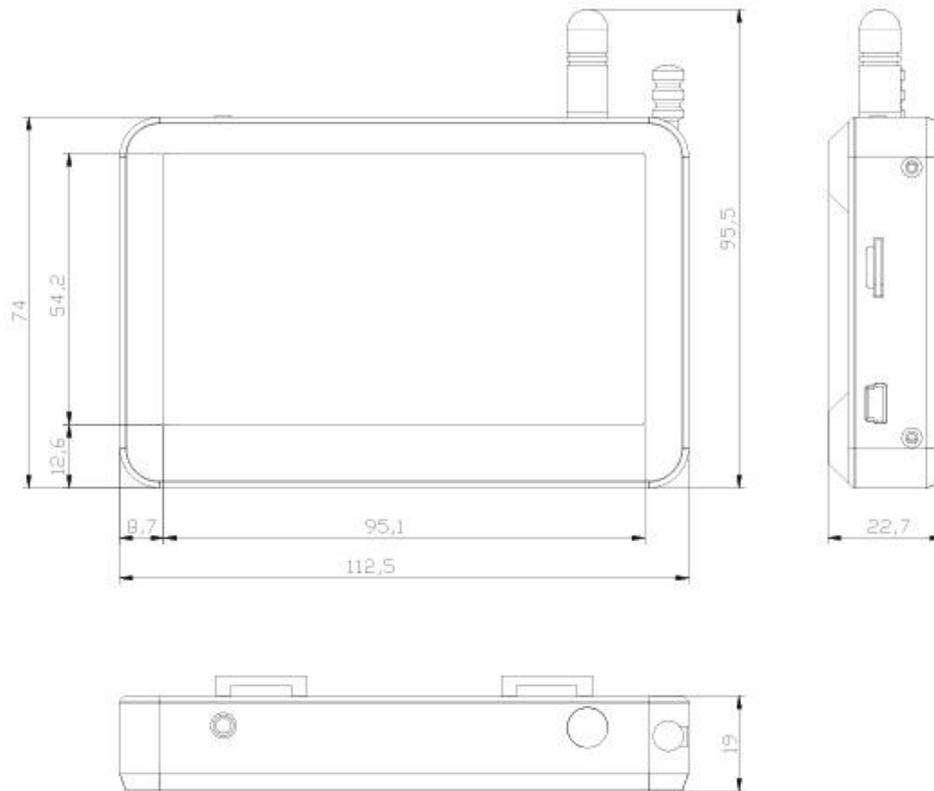
Figure 2.1

9. Operation principle

The method of back-to-back distance measurement is based on the direct measurement of the distance by the laser triangulation sensor built into the gauge.

10. Working with the gauge

10.1. Turning on the gauge

Press the **Red** button to turn on the power. The display shows "ErrP" message if the accumulator battery voltage became lower than the control level. For such a case it is necessary to change batteries.

10.2. Installation procedure

Follow the installation procedure below. It is important to avoid hitting the gauge against the wheel.

Place the gauge edge on the wheel	Gently tilt the device	Lock the gauge on the wheel
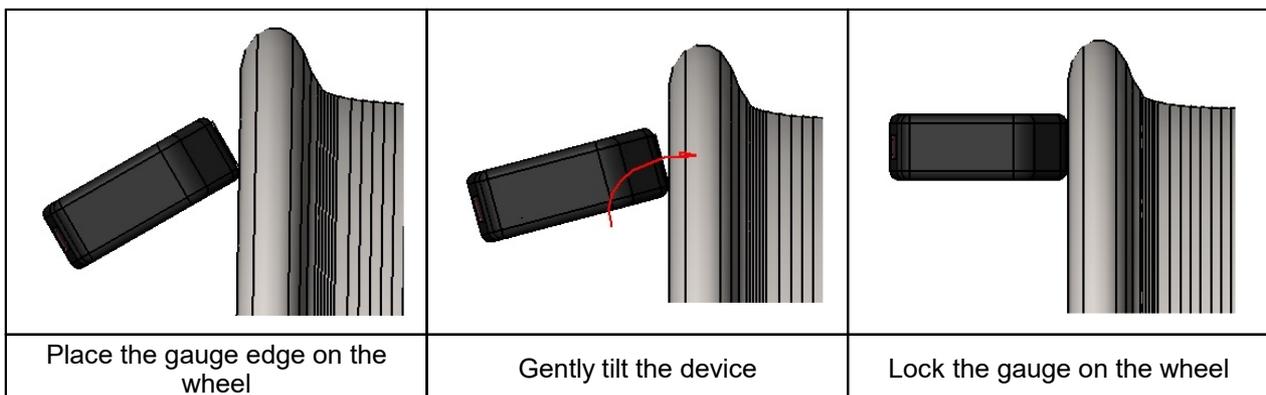
10.3. Single measurement

To perform measurement, it is necessary to:
- Turn the power on (press the **Red** button). The display shows **"- - - - -"**.
- Place the gauge on the inner surface of the wheel.
- Make sure that the magnetic support is tight against the surface of the wheel.
- Press the **Green** button.
- In 1 second the display will show the value of the back-to-back distance.

To view the measurement result with indication discreteness of **0.01 mm** (only available in direct indication mode), it is necessary to press the **Blue** button, thus the displayed result will be shifted to the left on one digit. Pressing the **Blue** button again will return the indication to a starting position.

10.4. Measurement with averaging

The program of the back-to-back distance calculation contains an averaging algorithm that allows eliminating the surface defects influence on the distance measuring result. All the results of metering, performed after the **Red** button pressing, are averaged. The measurement is meant to be the **Green** button pressing.

To carry out measurements, it is necessary to:
- Turn the power on (press the **Red** button). The display shows **"- - - - -"**.
- Place the gauge.
- Make sure the magnetic support is tight against the inner surface of the wheel.
- Press the **Green** button.
- Display shows the value of pressing counter **"n   x"**, where **x** – quantity of averaged values.
- In 1 second, the display shows an average value of the back-to-back distance.
- Move the gauge to a new position and repeat the measuring.
(The total quantity of measurements averaged in this way can run up to 9999.)
- Press the **Red** button to reset averaging result at switching to another wheel.

To view the measurement result with indication discreteness of **0.01 mm** (only available in direct indication mode), it is necessary to press the **Blue** button, thus the displayed result will be shifted to the left on one digit. Pressing the **Blue** button again will return the indication to a starting position.

10.5. Turning off the gauge

Shutdown occurs automatically. The display extinguishes if there were no buttons pressings for 60 seconds, at that only blinking dot is shown. If there were no button pressings for 4 more minutes, the gauge is turned off completely. You can turn the gauge off by long pressing the **Red** button (more than 3 sec.).

11. Setting indication parameters

11.1. Bluetooth ON/OFF

To turn Bluetooth ON, it is necessary to:
- Turn the power on.
- Press the **Blue** button and keep it pressed for more than 3 seconds.
Display will show **"bt On"**.
To turn Bluetooth OFF, press the **Green** button. Display will show **"bt OF"**.
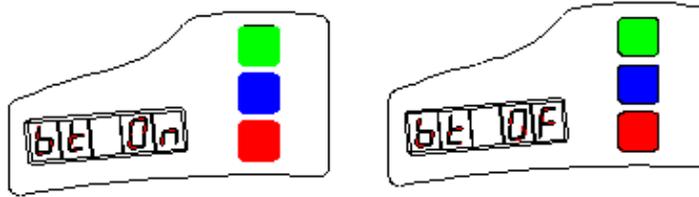
To save the changed parameters, press the **Red** button. The display shows the **"SAUE"** message. Press the **Green** button to confirm saving or the **Red** button to cancel saving of the changed parameters.
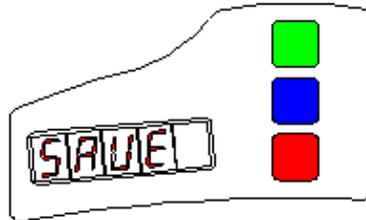
11.2. Image brightness

To change the display brightness, it is necessary to:
- Turn the power on (press the **Red** button).
- Press the **Blue** button and keep it pressed for more than 3 seconds. Display will show **"Up"**.
- Press the **Blue** button one more time, the image brightness set-up will be displayed **"brt"**.
- Choose the necessary brightness value by pressing the **Green** button.
- To save the changed parameters, press the **Red** button. The display shows the **"SAUE"** message. Press the **Green** button to confirm saving or the **Red** button to cancel saving of the changed parameters.

When choosing brightness, take into account that higher brightness increases power consumption and decreases the period till battery recharge moment.

11.3. Millimeters-Inches display

To change the mode, it is necessary to:
- Turn the power on (press the **Red** button).
- Press the **Blue** button and keep it pressed for more than 3 seconds.
- Display will show **"Up"**.
- Press the **Blue** button again until the either **"SI"** or **"Inch"** message appears on the display. **"SI"** – measurement results will be shown in mm, **"Inch"** – measurement results will be shown in inches.
- Choose the necessary value by pressing the **Green** button.

To save the changed parameters, press the **Red** button. The display shows **"SAUE"** message. Press the **Green** button to confirm saving or the **Red** button to cancel saving of the changed parameters.

NOTE: Discreteness of inch indication is two digits after point. The separation point is indicated at the top side of the screen in the reverse indication mode.

11.4. Image rotation

Image rotation depending on the gauge position is done automatically after pressing the **Measurement** button.

12. Device calibration

This section contains the description of the modes for the check of device efficiency and calibration. As erroneous actions in this mode can lead to invalid measurement results, only specially trained personnel should perform such operations.

12.1. Calibration conditions

Calibration of the device is not necessary in the current work. It is necessary only after producing, repairing and also after checking with negative result.

To perform calibration, the following means are necessary:

- Calibration tool RF260.90.000 (fig. 3).

10
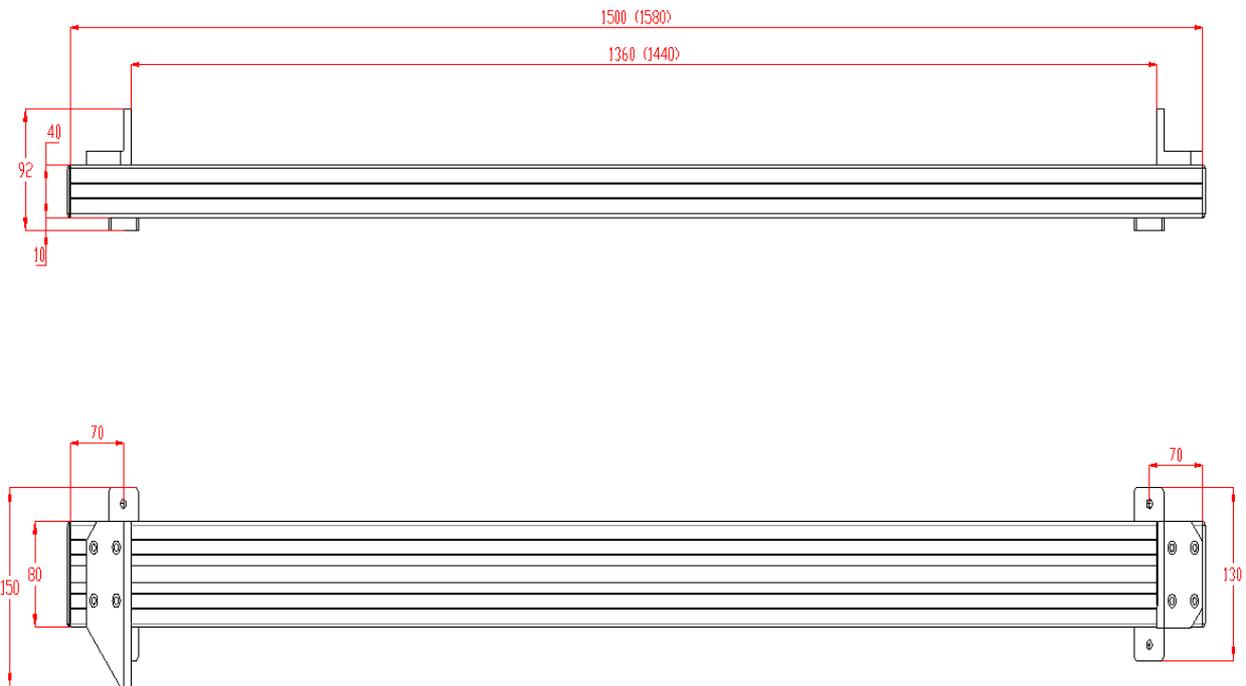
Figure 3

* - the length of the calibration tool is checked with accuracy of 0.01 mm.

12.2. Entering operating modes

- To enter the operating modes, it is necessary to turn off the device (press the **Red** button for more than 3 seconds).
- Keeping the **Green** button in pushed position turns on the device (press the **Red** button).
- Display shows **"CLbr.0"** message (the calibration mode of the sensor zero).
- To get into this mode, press the **Green** button.
- To exit the calibration mode, press the **Red** button.

12.3. Calibration of the sensor zero

- Zero calibration mode being enabled, the display shows the length of the calibration tool.
- If editing of the length value is not required, go to the next step. To edit the length value, press the **Blue** button, and the digit to be edited starts blinking. Changing over between the digits is made by pressing the **Blue** button while changing of values is made by pressing the **Green** button. When editing is finished, press the **Red** button and confirm or cancel saving of the parameter by pressing the **Green** button or **Red** button, respectively.
- Press the **Green** button, and the length value starts blinking, which means that the device must be placed onto calibration tool. The magnetic support of the gauge must be tightly fitted to the flat plates of calibration tool.
- Press the **Green** button, and the display shows current readings of the sensor in its own coordinate system.
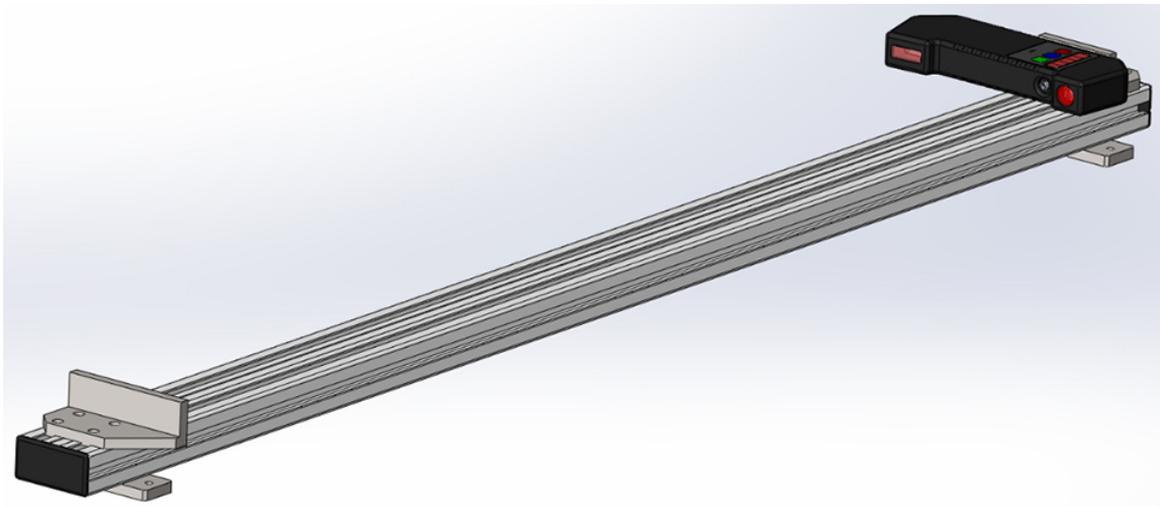
Figure 4

- If readings of the sensor are sufficiently stable, press the **Blue** button. Sensor zero position is calculated in the device coordinate system, and a prompt appears to save calibration results. Press the **Green** or **Red** button to confirm or cancel saving of the results, respectively.

13. Working with the gauge and PDA

13.1. Operation principle

Operator mounts the gauge on the inner surface of the wheel. Having received a command from PDA, the gauge performs the measurement of the back-to-back distance. Measurement result is displayed on PDA, can be saved in the PDA memory, and transferred to the PC database. Simultaneously, additional parameters can be saved: operator number, axis number, locomotive (carriage) number, etc.

13.2. Gauge and PDA activation

13.2.1. Turning on the gauge

See par. .

13.2.2. Turning on the PDA

Turn the PDA on by pressing the button (1), Fig. 2.

After the PDA is switched on, some time will pass until automatic wireless communication is set between the gauge and the PDA, which is accompanied by light of a blue LED (1) on the gauge. The LED goes out when the link is established.

The PDA screen will show the main program window containing: main menu; indicators of PDA charging degree; indicator of Bluetooth connection showing serial number of the gauge with which connection is established and the Measurement button.
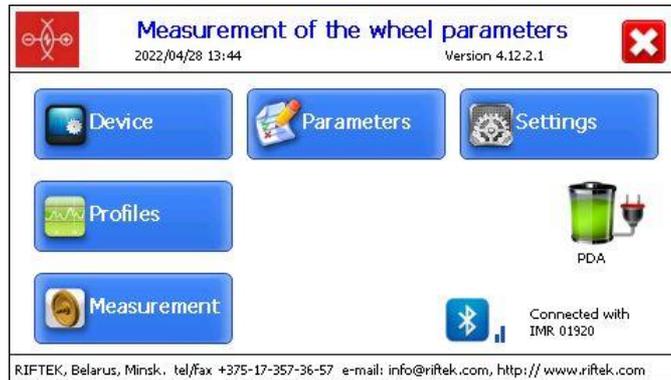
Button	Assignment
Device	Setting the PDA basic parameters
Parameters	Setting the measurement parameters
Settings	Setting parameters of database, tolerances, and others
Profiles	View the wheelset profile
Measurement	Start the measurement process

13.2.3. Online measurement

To take measurements:
- Turn on the gauge. The display shows **"- - - - -"**.
- Turn on the PDA.
- Tap the **Measurement** button on the PDA screen. The PDA is activated in measurement mode and the display shows:
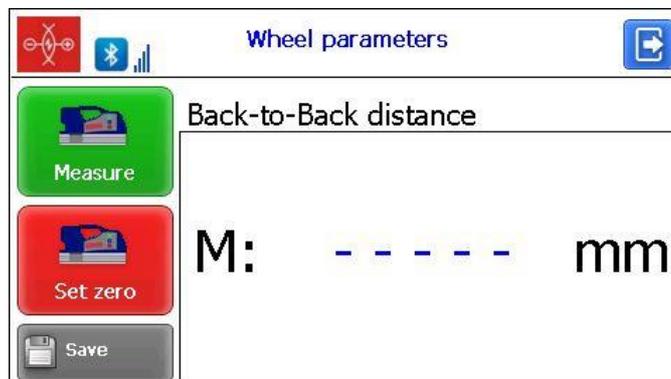
- Place the gauge on the inner surface of the wheel.
- Make sure that the magnetic support is tight against the wheel surface.

- Press the **Green** button. (**Note:** hereinafter, the button, marked green or red color, is a corresponding button on the gauge or PDA screen). In 1 second, the displays of the gauge and PDA will show the value of the back-to-back distance. When the back-to-back distance goes beyond set limits, its value is highlighted in red color:
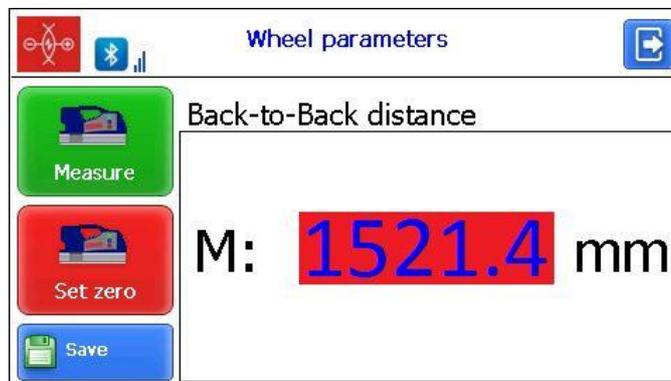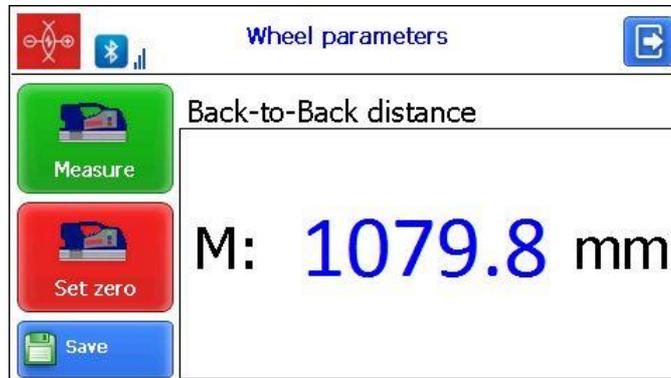
Buttons:

	Measurement of back-to-back distance
	Averaging reset («- - - - -»)

To continue measuring with averaging:
- Press the **Green** button.
- Display shows the value of pressing counter **"n   x"**, where **x** – quantity of averaged values.
- In 1 second, the display shows an average value over the set of metering (over the quantity of **Green** button pressings).
- Move the gauge to a new position and repeat the measurement. (The total quantity of measurements averaged in this way can run up to 9999.)
- Press the **Red** button to reset the averaging result at switching to another wheel.

13.2.4.   Measurements with database maintenance

A fully functional work with the gauge involves maintenance of the measurements database.

To take measurements:
- Tap the **Measurement** button. The window of parameters will appear:

14

- If necessary, fill in/edit the required fields.
- To save parameters, tap the **Save** button. The program will offer the selected measurement scheme:
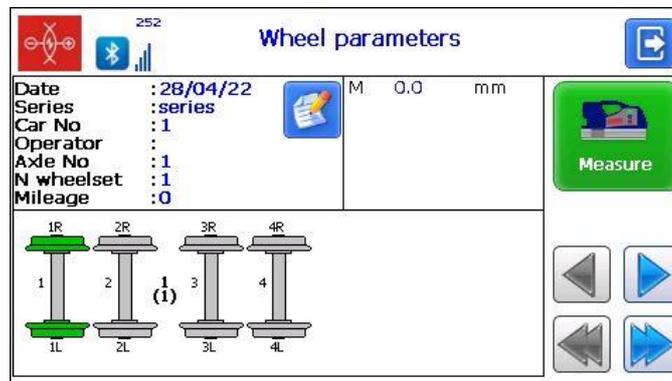
Designations:

1(1)	Ordinal number of the car to be measured (number of cars in the train).
	Editing wheel parameters.
	Previous/next wheel.
	Measured wheel.
	Wheel to be measured next time.
	Unmeasured wheel.
	Measured wheel to be measured again.
Measure	Measurement.

When navigating, the type of the scheme does not matter, and the navigation is carried out along the axes using the navigation buttons.

Depending on the measurement settings, the back-to-back distance can be measured at 1, 3 or 6 points on the wheel.

Measurement at one point is similar to online measurement. When measuring at 3 or 6 points, the screen displays the wheels with reference points at which the measurement will be made.

- Measure the wheel offered by the program (highlighted in green color).

After the measurement, the PDA will show the value of the back-to-back distance. When the value falls out of the specified tolerance, its value is indicated in red color.
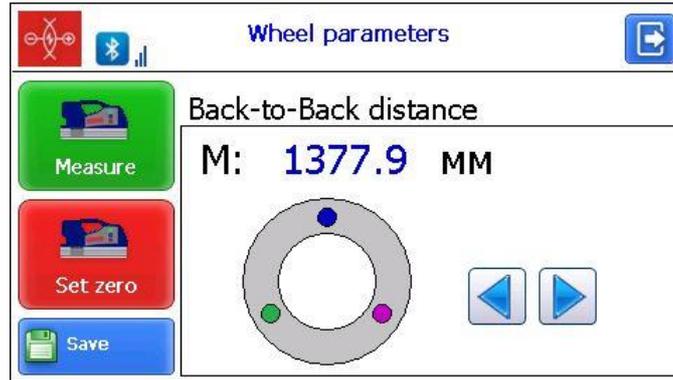
Designations:

	Previous/next measurement.
●	Measured reference point.
●	Reference point to be measured.
●	Unmeasured reference point.
●	Reference point to be measured again.

- To repeat the measurement, tap the **Measure** button.
- If a satisfactory result is obtained, tap the **Save** button to save the data.
- The program will prompt you to measure the next wheel in accordance with the measurement scheme.
- To view the results of the previous measurement, use the navigation arrows. If you select the measured distance, the saved values will be displayed on the screen.
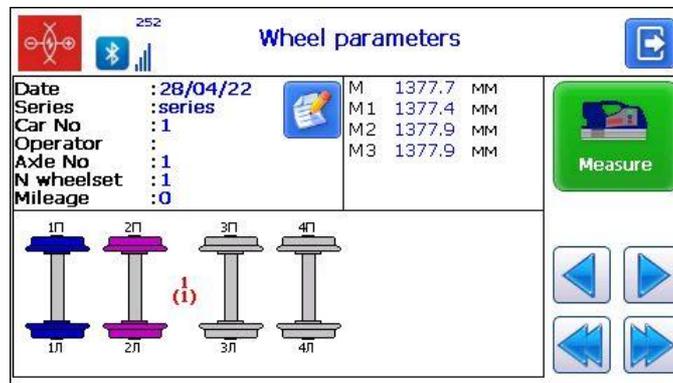
M1, M2, M3 – Values of back-to-back distance at reference points.
M – Average value at all reference points.

13.3. PDA program

Prior to starting work with the gauge, PDA program setting must be performed.

The window of basic parameters is called by tapping the **Device** button in the main program window:

Button	Assignment
Measure type	Rapid measurements/measurements with saving results to database
Units	Millimeters/inches
Date/Time	Date/time setting
Device type	Device selection (IKP, IDK, IMR)
Language	Language selection
Synchronization	Synchronization with PC

13.3.1. Measurement type

Two measurement types are available:
1. Rapid measurements without saving the results.
2. Measurements by using the selected scheme with saving results to database.

To set the measurement type, tap the **Measure type** button. Then select the measurement type: **Rapid measurement** or **Measurement by scheme**. Tap the **Save** button.
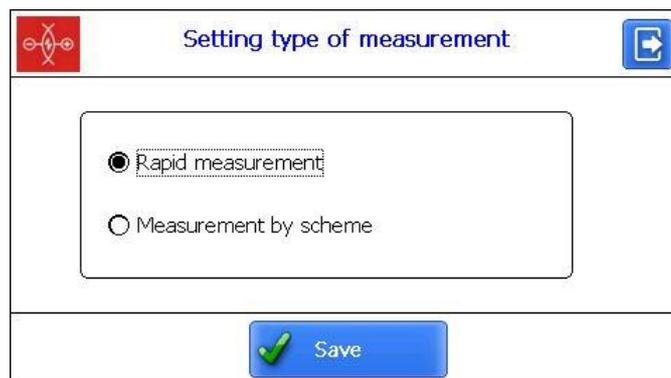
13.3.2. Units of measurement

All parameters as well as measurement results can be presented in the Metric system (millimeters), or in the English system of units (inches). To set the units of measurement, tap the **Units** button. Next, select **Millimeters (mm)** or **Inches (in)**, and tap **Save**.
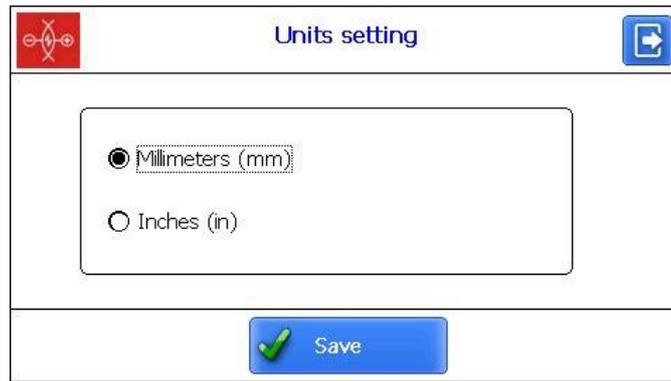
13.3.3. Date/Time

Tap the **Date/Time** button and set the date and time by using the buttons 🔺 🔻. Tap the **Save** button.
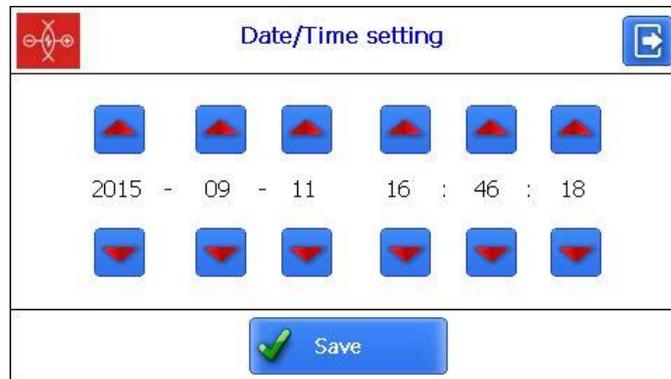
13.3.4. Device selection

The PDA Bluetooth connection is automatically configured to work with the gauge supplied with the PDA. To connect other devices, tap the **Device type** button.

There is a list of available devices with which the connection has been established earlier, and which have been saved in the PDA memory.
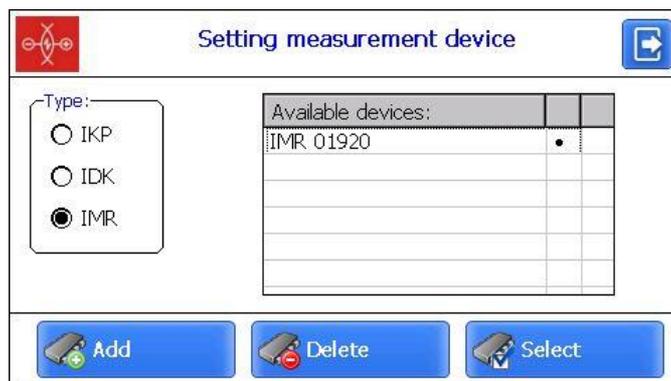
If the needed device is in the list, you can select it and tap the **Select** button. The PDA will try to connect to the selected device.

To add a new device, tap the **Add** button. The **Device searching** window will appear:

Back-to-Back Distance Measuring Gauge. IMR-L-BT Series

18

To search for devices, tap **Start** and wait for the search to complete:

Detected devices (with their serial numbers) will appear on the screen:

Next, select the device and tap the **Save** button to save the address of a new device.
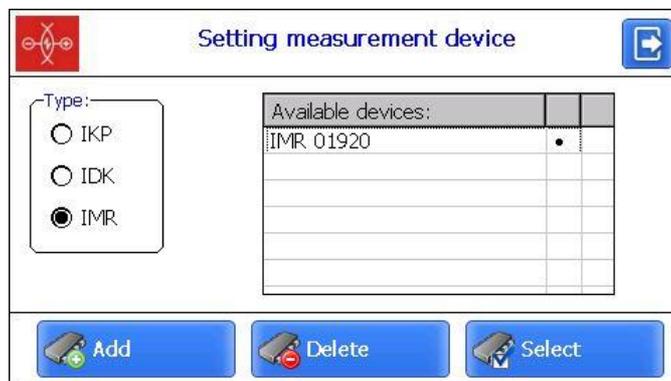
You can delete the device that you do not use anymore by tapping the **Delete** button.

19

13.3.5. Language

It is possible for the user to change the program language, form his own language support files as well as change/edit the terminology used.

To select the language, tap the **Language** button. Next, select the required language support file and tap the **Select** button.

13.3.6. Synchronization with PC

To transfer data between PDA and PC, it is necessary to synchronize them. There are two ways of synchronization via the USB cable.

When you select **MS ActiveSync**, synchronization with PC is performed via the ActiveSync software (Windows XP), or via Windows Mobile Device Center (Windows 7).

When you select **Mass Storage**, the device is detected in Windows as an external storage device.

To select the type of synchronization, tap the **Synchronization** button in the **Device** window. Next, select the required type and tap **Save**.
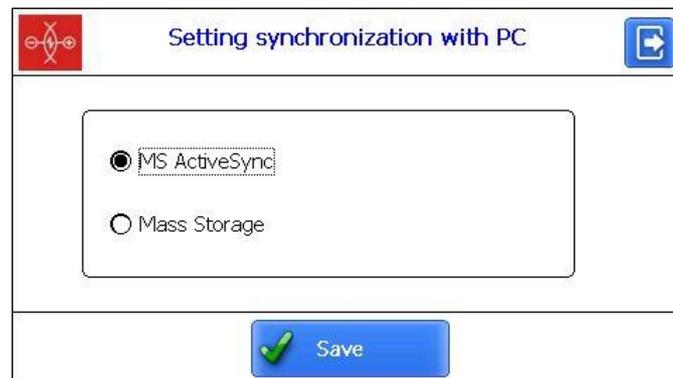
To apply the changes, the PDA will prompt you to restart. If you do not need to sync the PDA with PC currently, you can restart the PDA later.
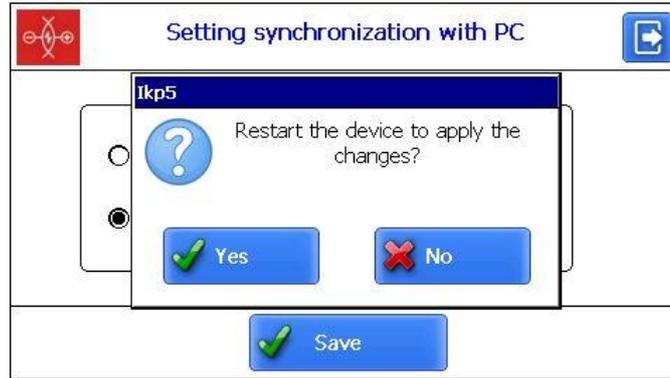
13.4.   Setting measurement parameters

The **Parameters** window, which is called from the main program window, is intended for calculation settings of controlled parameters.
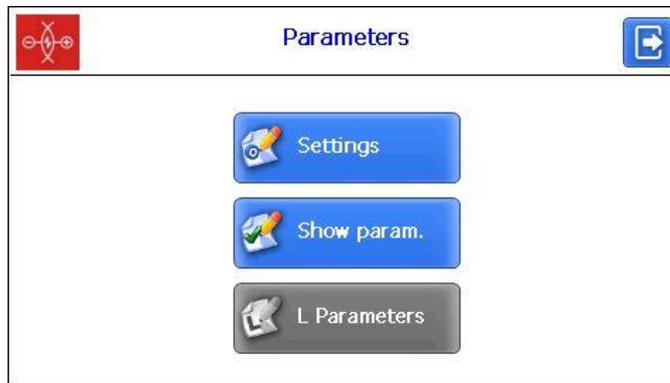
Button	Assignment
Settings	Calculation methods
Show param.	Selection of displayed parameters
L Parameters	Setting L-parameters (unable for IMR)

13.4.1.   Calculation methods

To select the calculation method, tap the **Settings** button. The following window will appear:
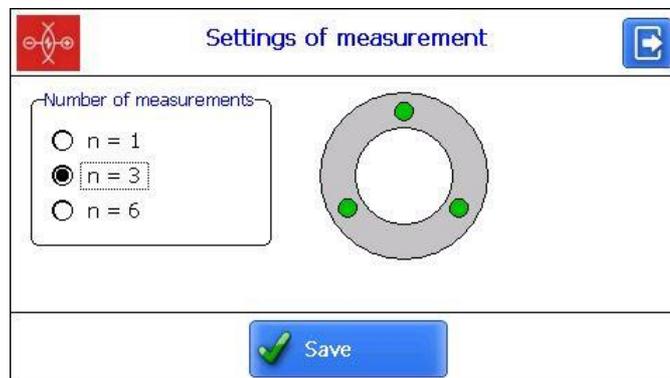
Depending on the measurement settings, the back-to-back distance can be measured at 1, 3 or 6 points on the wheel.

After selecting the calculation method, tap the **Save** button to save the changes.

13.4.2. Selection of displayed parameters

To select the parameters, tap the **Show param.** button. The following window will appear:
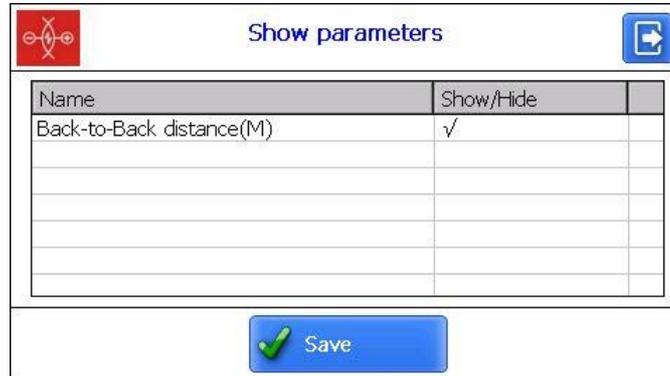
To select/deselect the parameter to display, double-tap in the **Show/Hide** column opposite to the required parameter. After selecting, you need to tap **Save**.

13.5. Setting database parameters, tolerances and measurement schemes

The **Settings** window is intended to set the database parameters, tolerances, measurement schemes, etc.

Button	Assignment
Database	Database selection
Scheme	Setting the measurement scheme
Tolerance	Setting tolerances

13.5.1. Selection of the current database

You can save the measurement results to the PDA database when it is necessary. The program makes it possible to create and to store several database files related to the date of measurement.

To select the database file, tap the **Database** button.
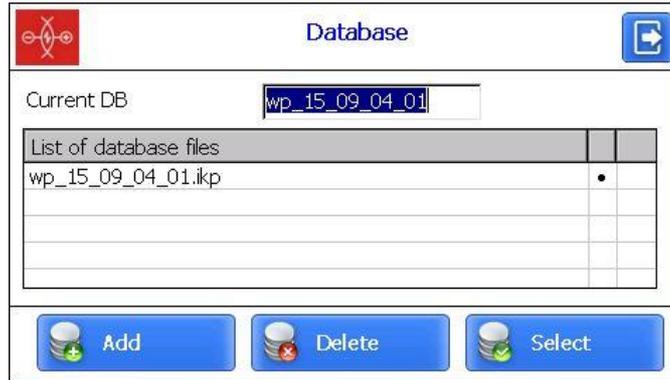
To create a new database, tap the **Add** button. The window for entering a name of a new database will appear.

By default, it will be prompted to form the database file with the name **wp_yy_mm_dd.ikp**, where **yy_mm_dd** is the current date:

yy – the last two digits of the year;

mm – month;

dd – day.

You can agree with this name, or enter another:
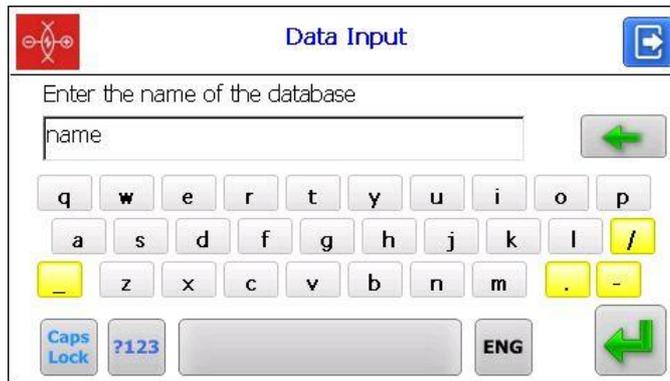
Tap the **Enter** button - .

To select a database from a list, activate the line and tap **Select**. The selected file will be marked with a "dot" symbol.

To delete the database file, activate the line and tap **Delete**. If you delete the current database, the error message will appear.

13.5.2. Selection and formation of the measurement scheme

The measurement scheme is meant as a sequence of making measurements/processing of wheels in the rolling stock with specified parameters of each wheelset (wheelset numbers, car numbers, series, etc.). The program automatically offers the operator to perform measurement of the wheel in accordance with the selected scheme of wheel processing. The program contains several preset schemes. Besides, the user can form his own measurement scheme.

13.5.2.1. Selection or removal of the measurement scheme

To select the measurement scheme file, tap the **Scheme** button.
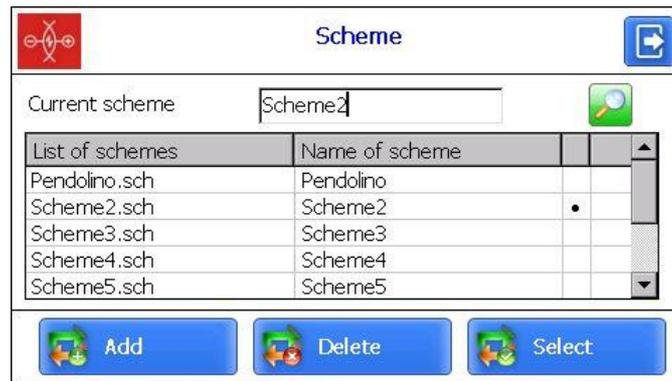
To view the scheme, you need to activate the line containing the scheme file name and tap the **View** button .
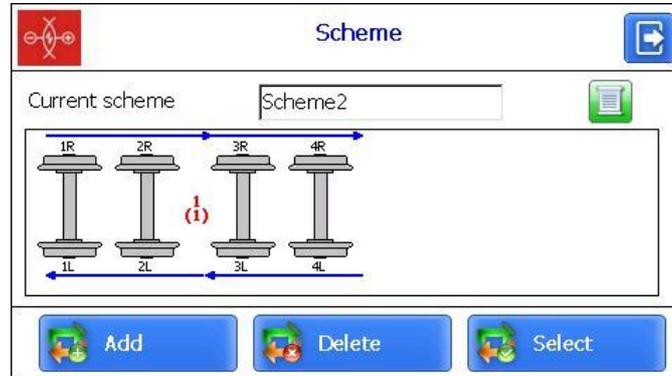
The arrows in the figure show a direction of processing the wheelsets as well as the names assigned to wheels (1L - first axis, left side; 2L - second axis, left side; 1R - first axis, right side, etc.).

To select the scheme file, activate the line and tap **Select**. The selected file will be marked with a "dot" symbol.

To delete the scheme file, activate the line and tap **Delete**. If you delete the current scheme, the error message will appear.

13.5.2.2. Formation of a new measurement scheme

To form a new measurement scheme, tap **Add**. The window for entering the measurement scheme name will appear.

Enter the scheme name by using the on-screen keyboard. Then tap the **Enter** button - .
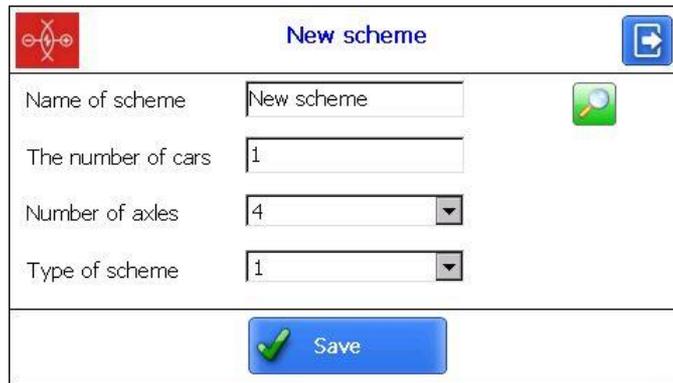
Next:
- Select the number of cars.
- Select the number of axles.
- Select the wheel processing scheme.
- Tap **Save**.

To look at the formed scheme, tap the **View** button - 🔍.

This method of the measurement scheme formation allows the user to create only simple schemes without specifying the wheelset numbers, car numbers, series, etc.

13.5.2.3. Setting tolerances

The program automatically controls the measured geometric parameters for going beyond the tolerances. It is possible for the user to create groups of tolerances. Control of parameters will be performed for a selected group.

To select the current group of tolerances, tap the **Tolerance** button.

The table will show the tolerances only for the selected geometric parameters of the wheel.

The red color indicates the maximum/minimum critical values of parameters. The orange color indicates the maximum/minimum values, which are close to critical values.

To select the group of tolerances, activate the line and tap **Select**. The selected file will be marked with a "dot" symbol.

To delete the tolerance, activate the line and tap **Delete**. If you delete the current file, the error message will appear.

To edit the tolerance, activate the line and tap **Edit**.

To add a new tolerance, activate the line and tap **Add**. You will see the following:

25
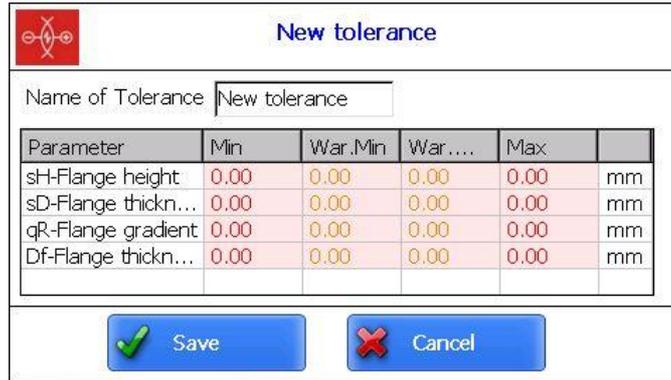
To change the name, it is necessary to set a cursor in the **Name of Tolerance** field and enter a new value in the window that appears. Then tap the **Enter** button - .

To edit the value, it is necessary to double-click on the **Min/Max/War.Min/War.Max** column opposite to the specific parameter and enter a new value in the window that appears. Then tap the **Enter** button. If any parameter has a zero value, the tolerance will not be used.

To save changes, tap **Save**.

13.6. PDA software update

You can view the software version in the main program window:
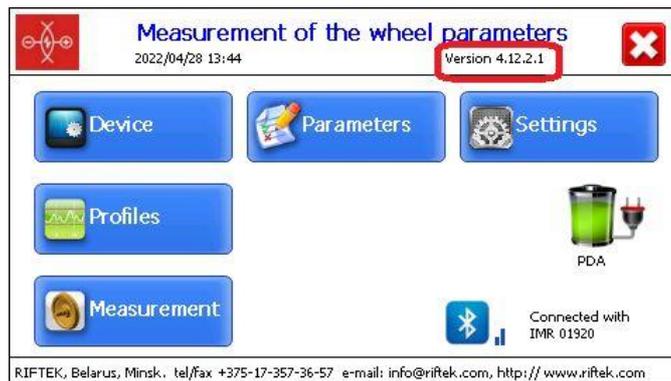
The latest software version can be downloaded from the website:
https://riftek.com/upload/iblock/b53/Ikp5_PDA_Software.ZIP

13.7. Shutdown

To turn off the PDA, tap the **Shutdown** button - .
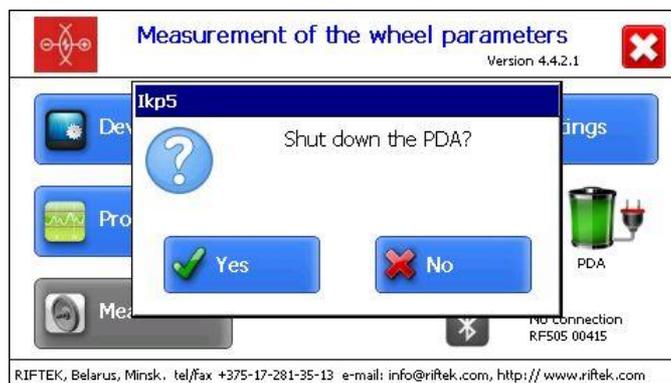
14. Charging of built-in accumulator battery

To charge the IMR battery, it is necessary to connect the charging device to the mains 85-250V and to the power connector on the top panel of the gauge.

The charging time is 15 hours.

To charge the PDA battery, it is necessary to connect the charging device to the mains 85-250V and to a mini-USB connector.

The charging time is 4 hours (full-charge indication: PDA - blue LED is lit).

15. Warranty policy

Warranty assurance for the Back-to-Back Distance Measuring Gauge IMR-L-BT Series - 24 months from the date of putting in operation; warranty shelf-life - 12 months.

16. Revisions

Date	Revision	Description
16.05.2022	1.0.0	Starting document.

17. Distributors

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Back-to-Back Distance Measuring Gauge. IMR-L-BT Series

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27

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18.   RIFTEK's measurement instruments for railway transport

Railway wheel profile gauge, IKP Series

Laser Profilometer IKP-5 Series is employed for:
- Measuring geometrical parameters of the wheel flange (thickness, slope, height), rim/tire thickness.
- Taking full profile of the wheel rolling surface.
- Maintaining the wear database.
- Tolerance control and sorting when checking, inspecting, repairing and forming railway wheelsets.

Measurements are made directly on the rolling stock without rolling out the wheelset.

Rail profile measurement gauge, PRP Series

The main functions of PRP are as follows:
- Obtaining information on the cross-section profile of the railhead acting face.
- Full profile scanning and analysis of the railhead acting face.
- Visualization of combined graphic images of the actual and new cross-section profiles of the railhead.

Back-to-Back Distance Measuring Gauge. IMR-L-BT Series

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31

Wheel diameter measuring gauge, IDK Series

Electronic gauge is designed to measure the wheel rolling circle diameter of railway, metro and tram wheelsets.
Measurements are made directly on the rolling stock without rolling out the wheelset.

Back-to-back distance measuring gauge, IMR Series

Electronic gauge is designed to measure the back-to-back distance of railway, metro and tram wheels in the course of checkup, examination, repair and formation of wheelsets. Measurements are made directly on the rolling stock without rolling out the wheelset.

Back-to-back distance measuring gauge, IMR-L Series

Electronic gauge is designed to measure the back-to-back distance of railway, metro and tram wheels in the course of checkup, examination, repair and formation of wheelsets. Measurements are made directly on the rolling stock without rolling out the wheelset.

Disc brakes profile gauge, IKD Series

Electronic gauge is employed for laser scanning and measurement of disc brakes wear parameters.
The main functions of IKD are as follows:

- Obtaining information on the profile of the disc brakes acting face.
- Full profile scanning and analysis of the disc brakes acting face.
- Visualization of combined graphic images of the actual and new disc brakes profiles.

Real-time wheels geometry measurement system 3DWheel

The system is designed for non-contact automatic measurement of geometrical parameters of railway wheels and uses a combination of 2D laser scanners mounted wayside in the track area.
The system can be easily installed on any type of railway infrastructure.

32