RIFTEK
Sensors & Instruments

PORTABLE RAIL PROFILOMETER

PRP Series

User's manual

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Contents

1. Safety precautions and measurement conditions

- Prior to mounting the profilometer onto the rail, areas of contact and laser scanning of the rail surface should be thoroughly cleaned from dirt.
- When mounting the module on the rail, do not allow heavy shocks of its support against the rail.
- The output windows of the laser sensor must be carefully inspected and cleaned.
- Do not use laser module in locations close to powerful light sources.

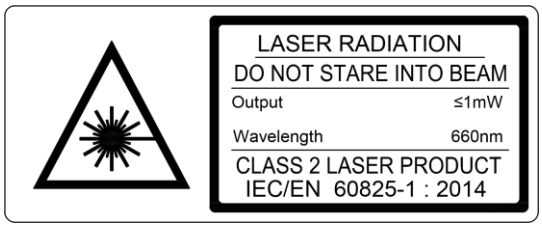
2. CE compliance

The profilometer 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 profilometer makes use of a c.w. 660 nm wavelength semiconductor laser. Maximum output power is 1 mW. The device belongs to the 2 laser safety class. The following warning label is placed on the profilometer body:



The following safety measures should be taken while operating the profilometer:

- Do not target laser beam to humans.
- Do not disassemble the sensor.
- Avoid staring into the laser beam.

4. General information

Portable Rail Profilometer (PRP) is designed for non-contact registration of the cross-section of the railhead acting face.

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.

4.1. Controlled parameters

- Railhead vertical wear (Hv).
- Side wear (Hh), that is measured 13 mm lower the top of railhead and side wear (Hh_{R45}), that is measured at 45 degrees relative to the rail symmetry axes at the point that passes through the center of lateral working fillet.
- Reduced head wear, that is determined as vertical one + the half of lateral wear, namely: Hr = Hv + 0,5Hh or Hr = Hv + 0,5$Hh_{\llcorner R45}$.

5. Basic technical data

Parameter	Value
Railhead vertical wear, mm	from -15.0 to +20.0
Lateral railhead wear, mm	from -15.0 to +20.0
Redused railhead wear, mm	up to 20.0
Scanning angle inside the rail track, degrees	108
Scanning angle outside the rail track, degrees	108
Measurement error, not more than, mm	±0.1
Scanning time, sec	10-12
Laser module dimensions, mm	Fig. 3
Power supply, laser module	3.7V Li-ion battery, 6800mAh
Power supply, PDA	3.7V Li-polymer battery, 3300mAh
Number of measurements that can be taken before battery recharge, not less than	500
PDA memory capacity	100 000 measurements
Interface between a laser module and PDA	Bluetooth

6. Complete set to be supplied

Designation	Name	Quantity	Weight, kg
RF303	PDA	1	0.4
RF570	Laser scanning module	1	4.0
RF570.40	Charging device 5V 1.0A for PDA and laser module	2	0.2
RF570.42	Universal cable (USB-port)	1	
RF570.43	Bluetooth-adapter	1	
RF570.30	Packing case	1	1.5
PRP_DB	Database management system (CD)	1	
RF570UM	User's manual	1	
	Calibration tools (optional):		
RF570.20.100	Calibration unit		3
RF570Calibr	Software		

* The profilometer may be supplied without a PDA. In this case, to operate the gauge, an Android-based device (smartphone or tablet) with licensed software (paid license) is required. The software can be downloaded from the website:
https://riftek.com/upload/medialibrary/d15/rnhed80h13jb9ndrvl9n3ycnyar96wc6/prp.zip

The software for maintaining the electronic database of rail wear is available on the website for free download:
https://riftek.com/upload/medialibrary/e3d/dif6fhqwej3kzdhmlltw71tn8bwkdkex/Install_Prp_db_6.15.3.1_b182.zip

The laser profilometer is supplied in a special protective case that prevents the device from being damaged during transportation.

6.1. PDA software licensing

By default, the PDA is configured to operate with the PRP device it was supplied with. One software license allows the PDA to connect to a single PRP device.

A single PDA can support an unlimited number of licenses for operation with an unlimited number of devices.

A single license can be installed on an unlimited number of PDAs.

7. Structure and operating principle

7.1. Basic components of the device and their functions

Figure 1 shows basic components of the device.

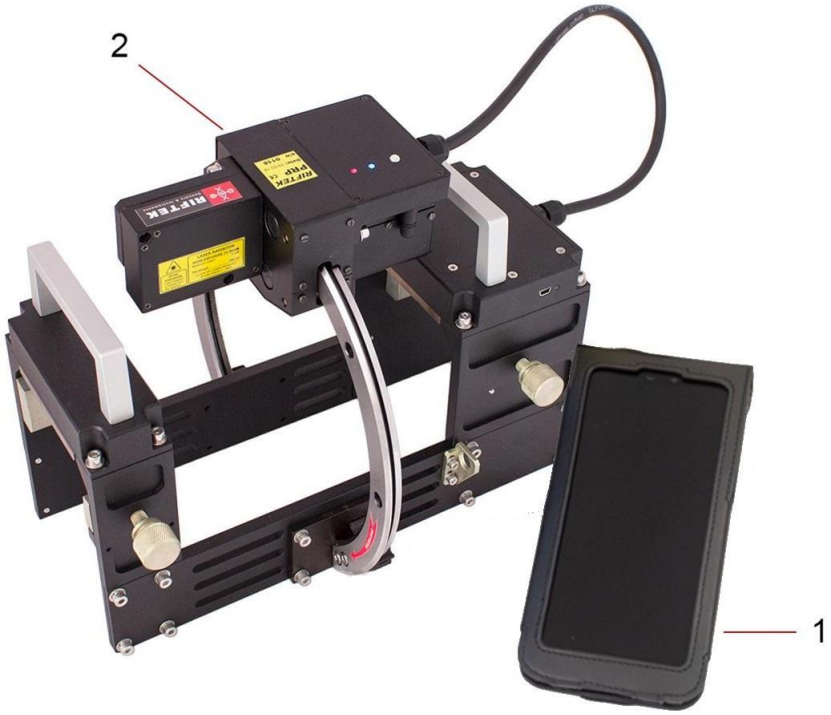


Figure 1

(1) Display device (personal digital assistant, PDA).
(2) Laser scanning module

7.1.1. Laser scanning module

The module is intended for laser scanning of rail surface.

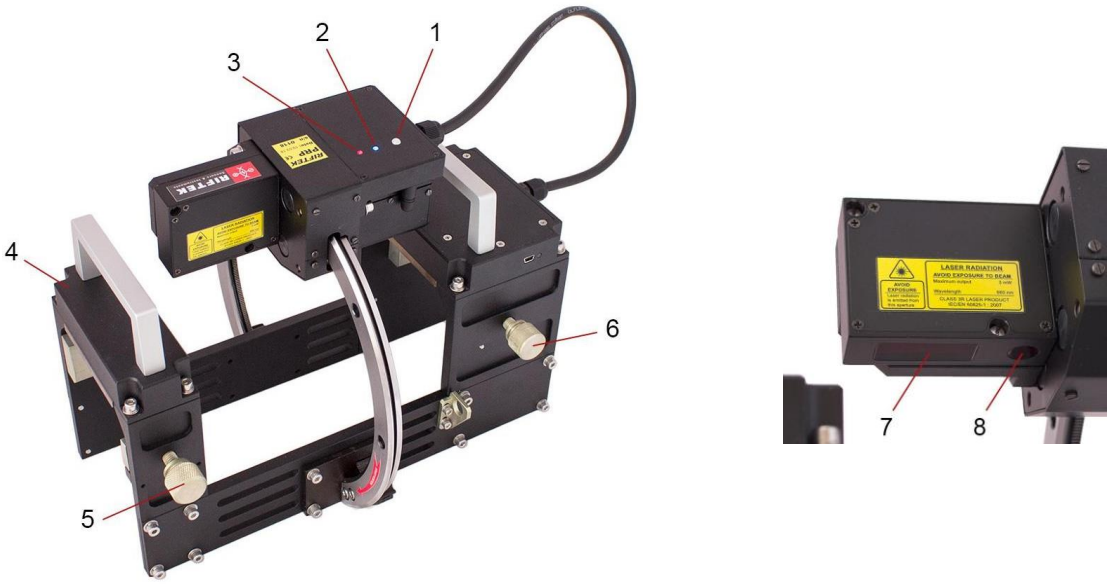


Figure 2

(1) ON/OFF button
(2) Indicator of Bluetooth connection (blue LED)
(3) Indicator of turn ON (red LED)
(4) Support for mounting of the device on the rail
(5-6) Clamps for mounting of the device on the rail head
(7) Input window of laser sensor
(8) Output window of laser sensor
Overall dimensions of scanning module are shown in Figure 3.

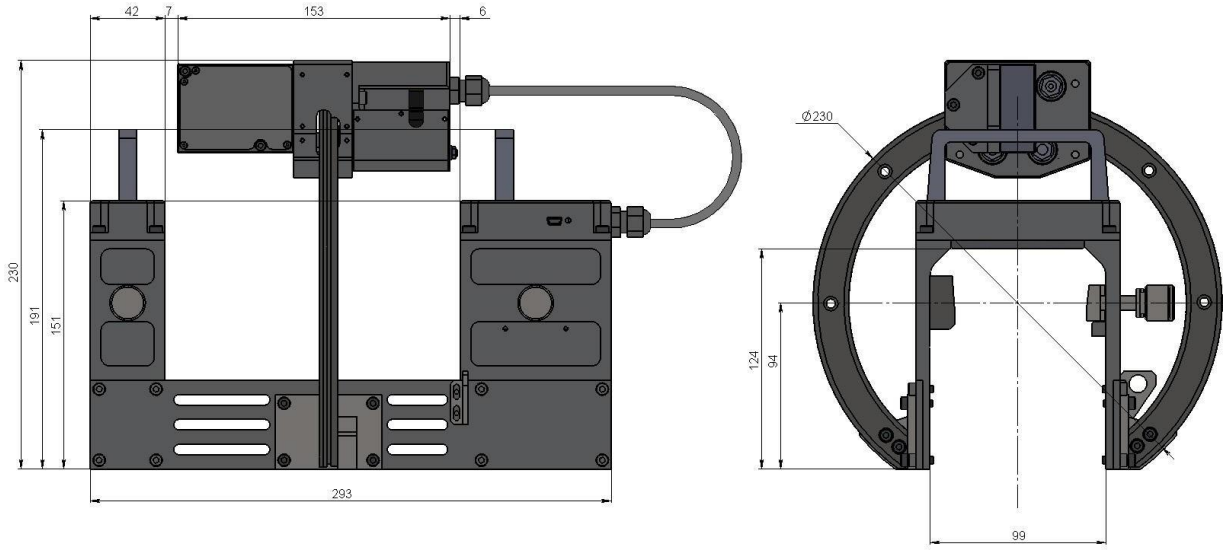


Figure 3

7.1.2. Display device (PDA)

The display device (PDA) is designed to control the laser scanning module, receive data from the scanning module, display measurement results, input parameters, and store data.

Figure 4

Figure 4 shows the following:
1 – Power button.
2 – Charging port.

8. Operating principle

The operator mounts the laser scanning module onto the railhead to be measured. Upon command from the PDA or PC, the laser module performs a non-contact scan of the rail surface. The measurement results (geometrical parameters and surface profile) are displayed on the PDA screen, can be saved in the PDA memory, and transferred to the PC database. Additional parameters are also saved, including the measurement date, operator code, track distance, track number, rail type, etc.

9. Rail parameters under control

9.1. L-parameters

Geometric parameters of the rail are calculated automatically after laser scanning of the rail is completed. To calculate geometric parameters, use is made of reference points on the railhead. Location of the reference points is shown in Figure 5 and is defined by **L-parameters**. Values of L-parameters preset in PDA are given in Table 1 and can be changed by user.

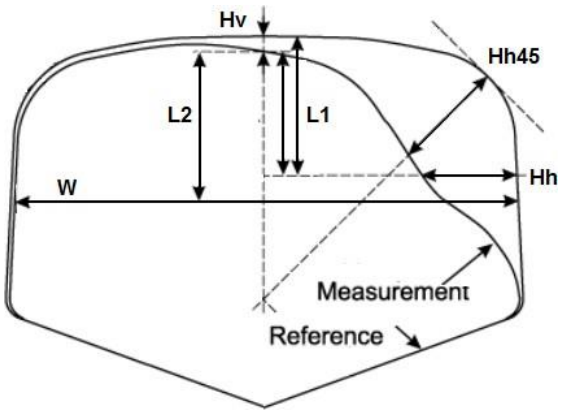


Figure 5

Table 1.

L-parameter	Default value	Description
L1	13 mm	Used for calculation of lateral railhead wear.
L2	20 mm	Used for calculation of railhead width.

9.2. Geometric parameters of the rail under control

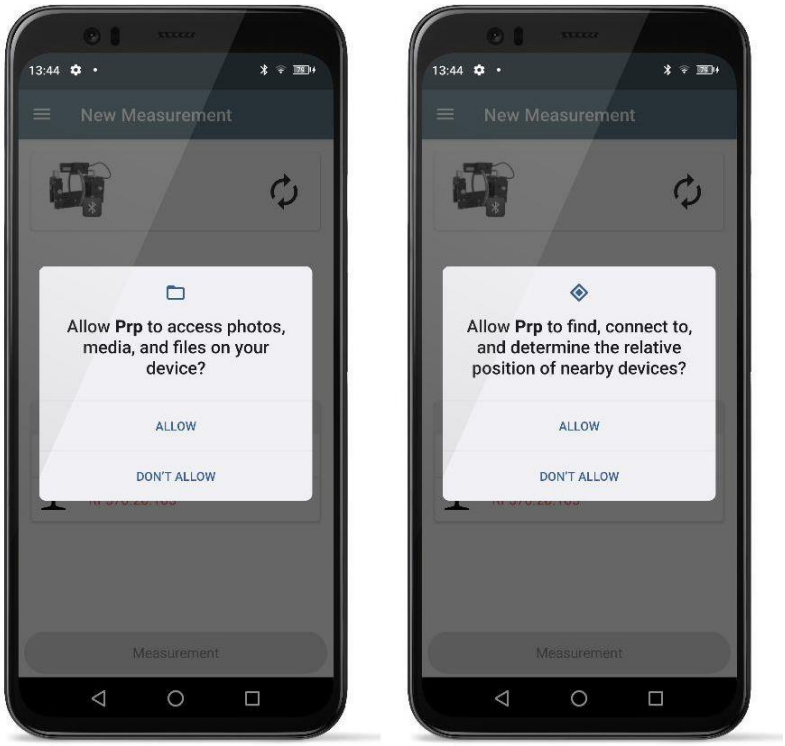
The parameters under control and respective calculation methods are given in Table 2.

Table 2.

Parameter	Designation	Calculation method
Railhead vertical wear	Hv	is calculated as a difference between the measured value and nominal value of new rail in direction of rail axis of symmetry
Lateral railhead wear	Hh	is measured at the height of L1 = 13 mm from the rolling surface of rail head
Lateral railhead wear at the angle of 45 degrees	Hh45	is measured at 45 degrees relative to the rail symmetry axis at the point that passes through the center of lateral working fillet
Reduced railhead wear	Hr	is determined as vertical one + the half of lateral wear, namely: Hr = Hv + 0,5Hh.
Reduced railhead wear at 45 degrees	Hr45	is determined as vertical one + the half of lateral wear at 45 degrees, namely: Hr45 = Hv + 0,5Hh45
Railhead width	W	is measured at the height of L2 from the rolling surface of rail head

10. Application installation

If the PRP was supplied without a PDA, to install the application, run the file **prp.apk** and grant all required permissions.

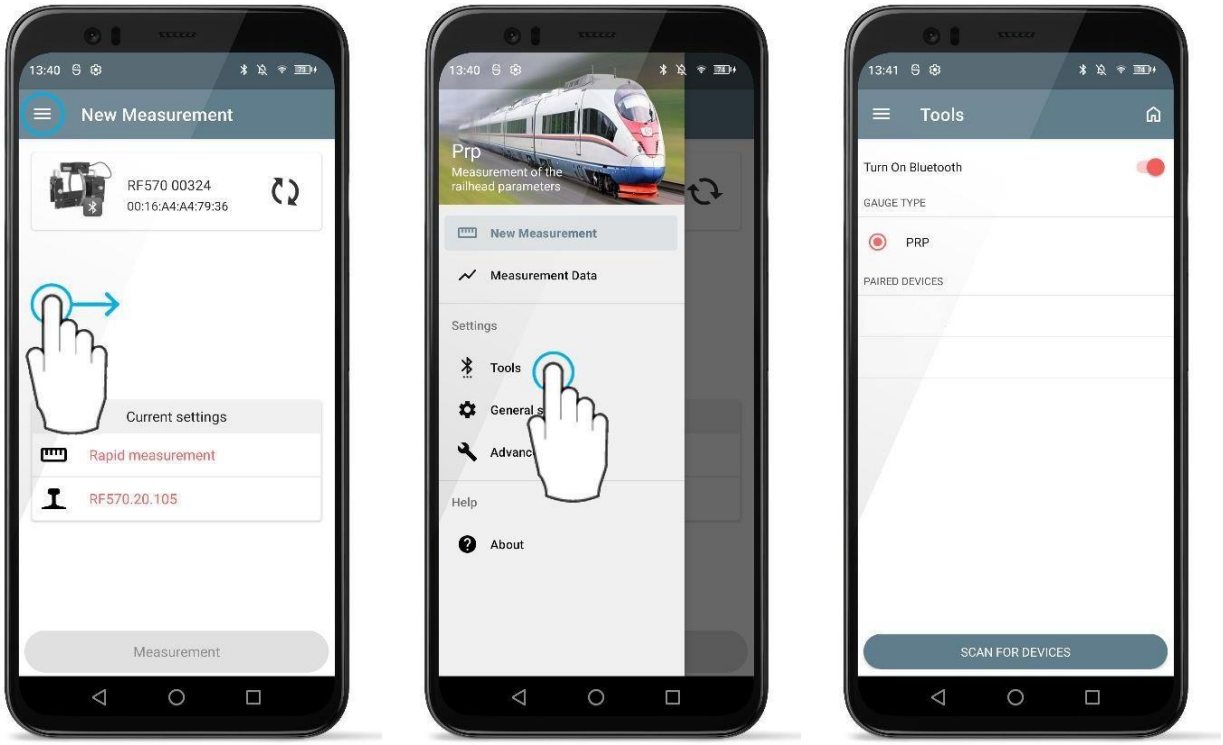


If the permissions are denied, the device will not function properly, and a warning message will be displayed.

11. Adding and selecting a measuring device

By default, the PDA is configured to operate with the PRP device it was supplied with. To add a new device, follow the instructions provided below.

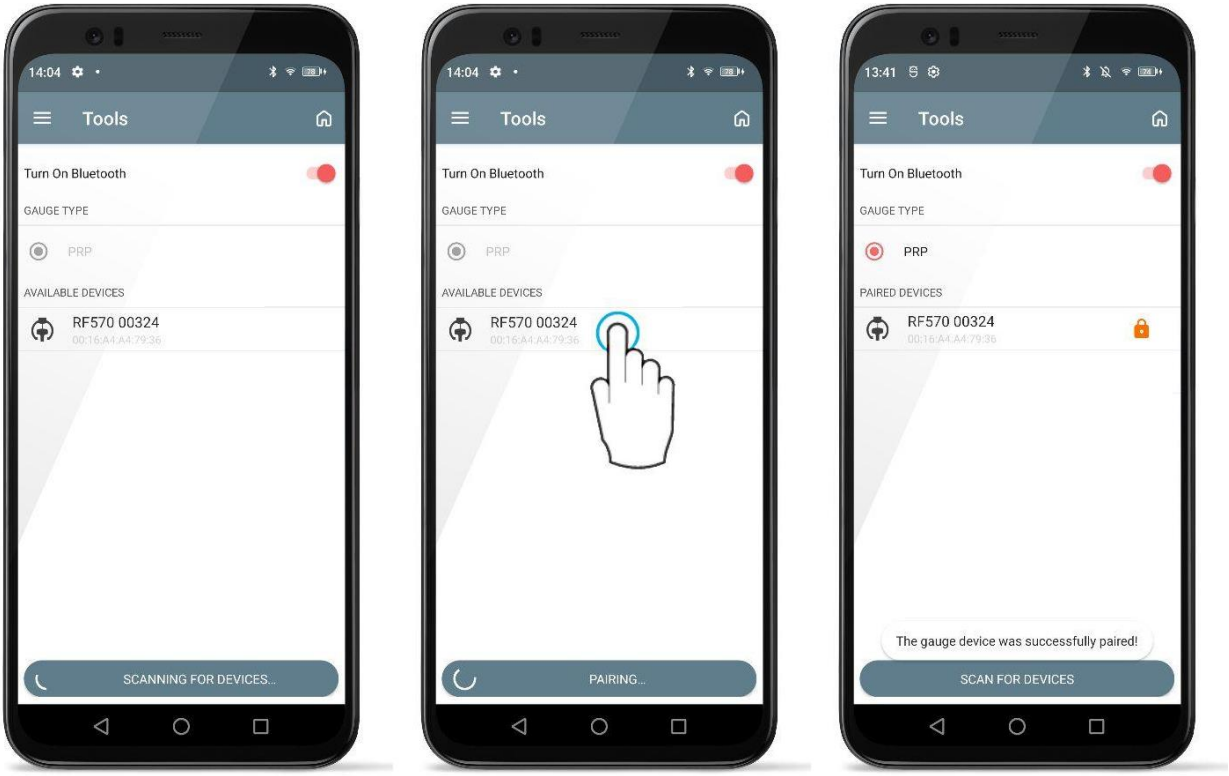
Go to the **Tools** menu by either tapping the menu icon or swiping from the left edge of the device toward the center of the screen.



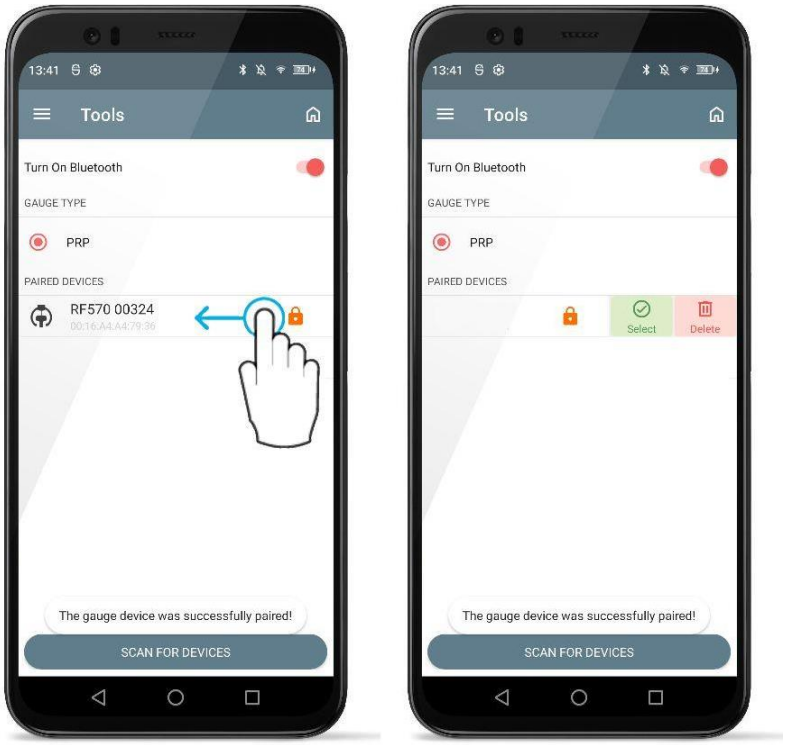
Here you can enable or disable Bluetooth, select the type of measuring device (default is IKP), and add a new measuring device depending on the selected type.

To add a device, turn it on and tap the **SCAN FOR DEVICES** button.

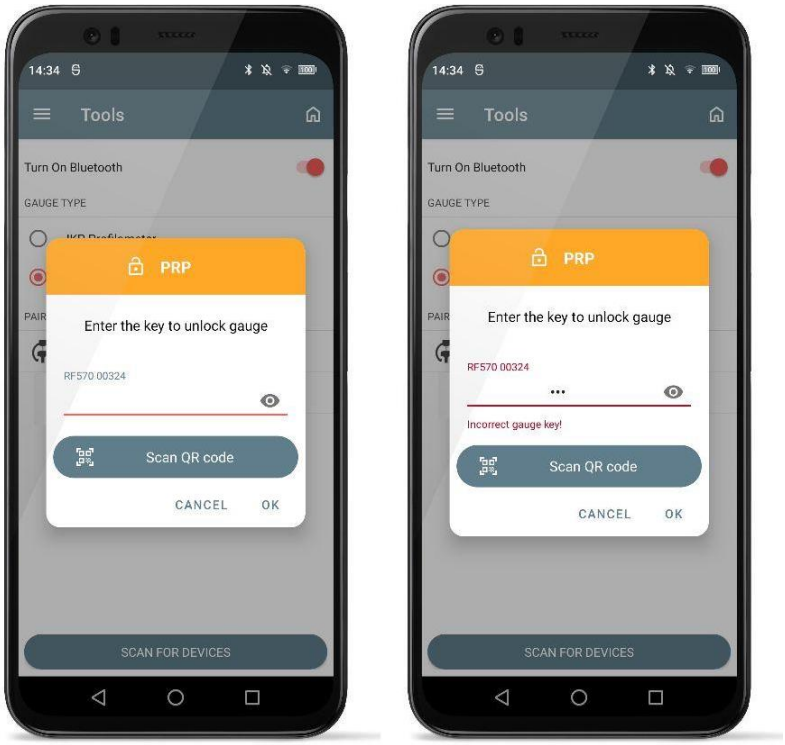
If the search is successful, the device will be added to the **AVAILABLE DEVICES** list. To pair, tap on the detected device.



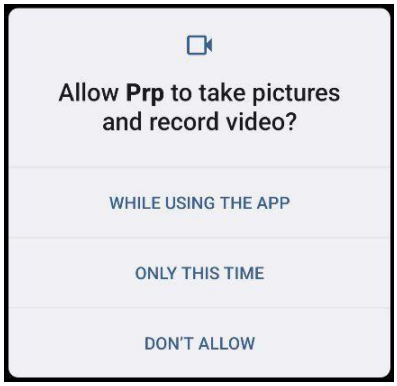
The device will be paired but locked for selection as the primary device for synchronization (). To unlock it and set it as the primary, swipe the entry from right to left and tap the **SELECT** button.



In the pop-up window, you must enter the key or scan the QR code. The unique key or QR code is provided with the measuring device or upon request. If the key is incorrect, an error message will appear.

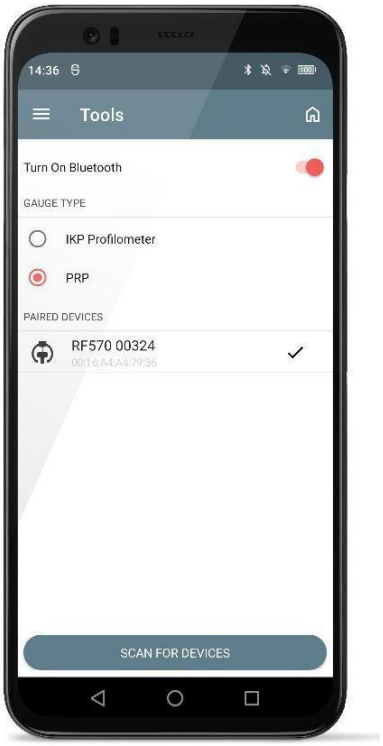


To scan the QR code, you must allow the application to take photos and videos.

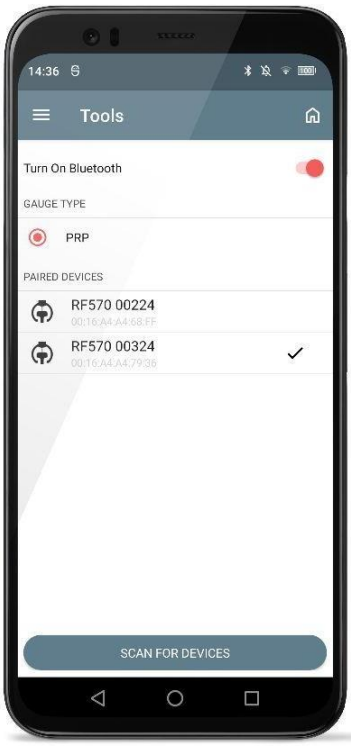


13

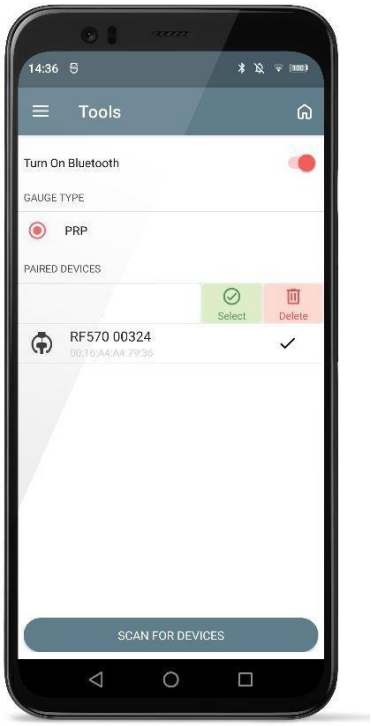
If the correct key is entered, the lock icon will disappear, and a check mark (✓) will appear on the selected device.

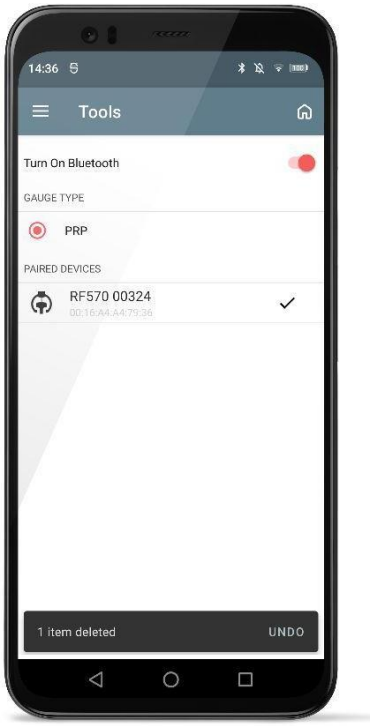


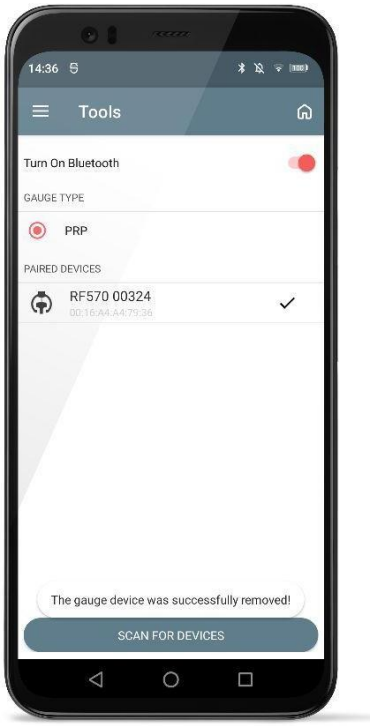
The selected device will connect automatically when the application starts. Later, if the desired device is listed (and unlocked), it can simply be selected.



If the measuring device will no longer be used, it can be removed from the list of available devices by unpairing it. To do this, swipe the entry from right to left and tap the **Delete** button.

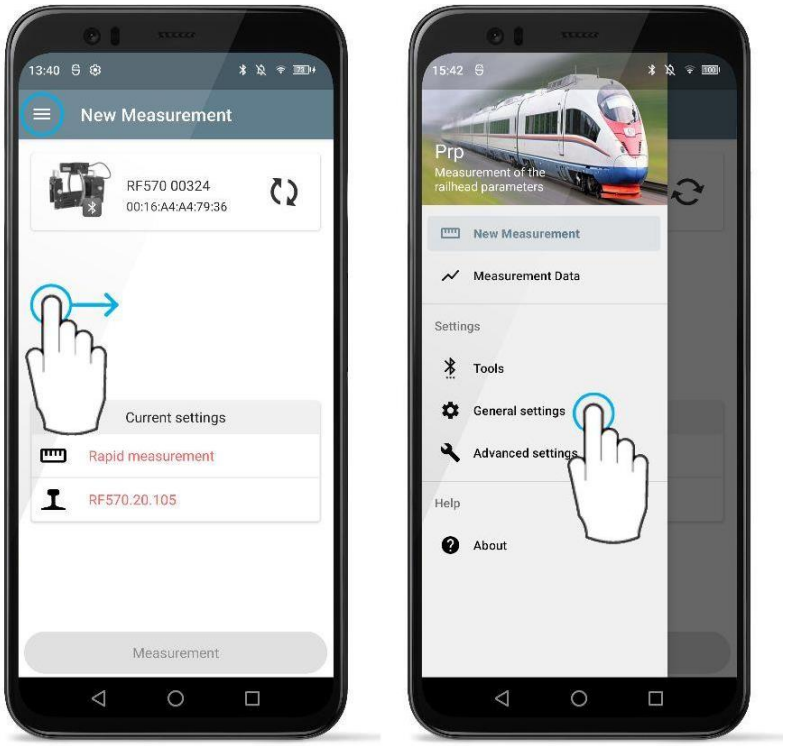






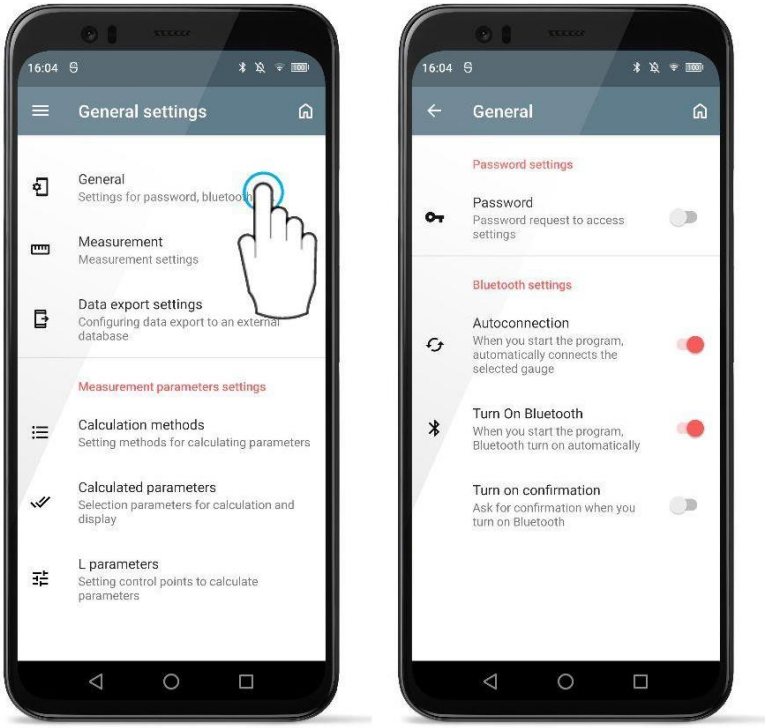
12. Setting up PDA software

Before starting work with the device, the software must be configured. To do this, select the **General settings** item in the menu:



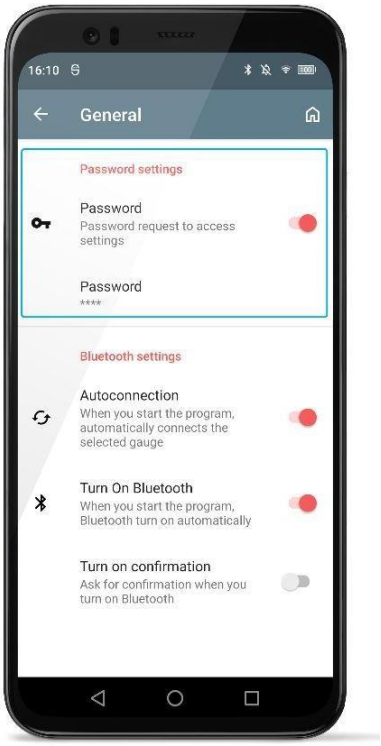
12.1. General settings

Selecting the **General** item opens a window for setting up the password and Bluetooth connection:

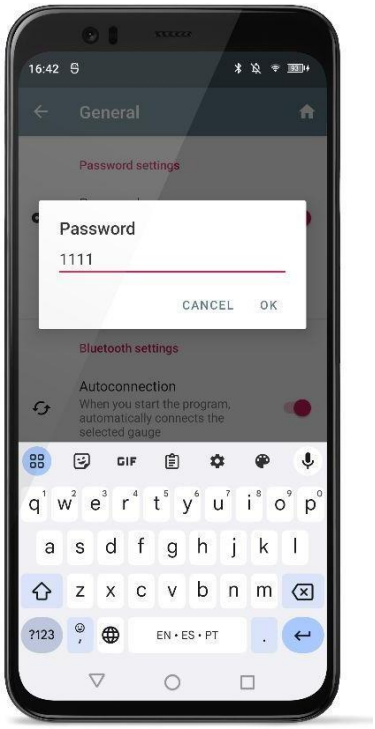


12.1.1. Password

The **Password settings** item allows you to set a password to access all basic settings.

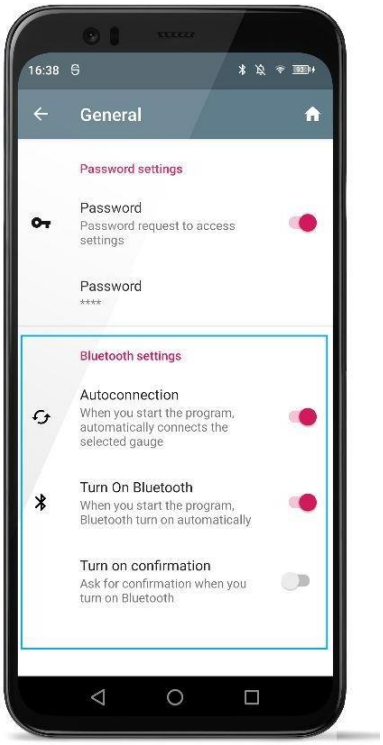


To set a password, you need to select the **Password** item, enter the password and confirm the entry. The default password is "1111".



12.1.2. Bluetooth

The **Bluetooth settings** section allows you to configure the Bluetooth activation mode and the connection behavior of the selected measuring device when the application starts.



Autoconnection – if this option is enabled, the application will attempt to connect to the measuring device selected in the settings upon startup (see Adding and selecting a measuring device).

If this option is disabled, to establish a connection with the device, you must tap the synchronization icon in the main window of the application.

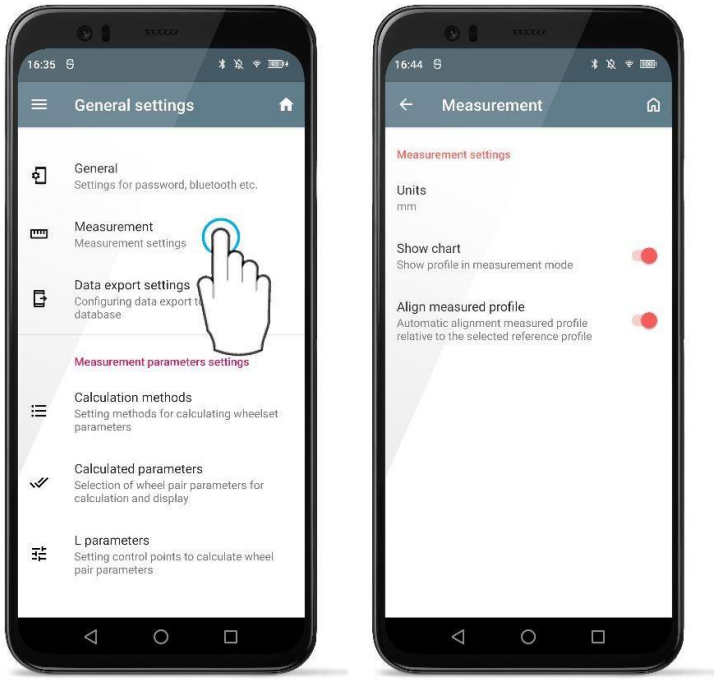
Turn on confirmation – this option becomes available only if the **Autoconnection** option is selected. When enabled, the application will prompt for confirmation to enable Bluetooth at startup.

12.1.3. Language

Changing the application language is performed upon request to the manufacturer (info@riftek.com) and is a free service.

12.2. General measurement parameters

Selecting the **Measurement** item opens a window for configuring the measurement parameters.



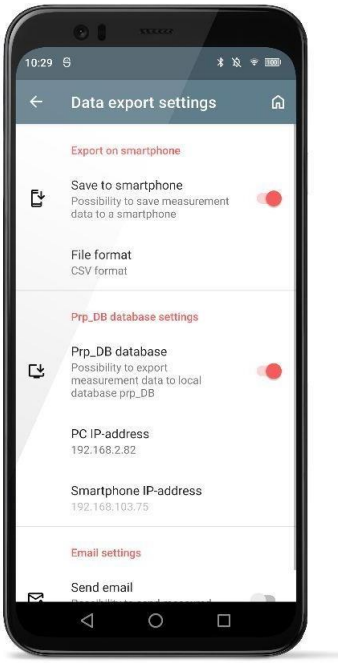
Units – you can choose mm or inches.

Show chart – this option allows the measured rail profile image to be displayed.

Align measured profile – automatic alignment of the measured profile with the selected reference profile. If the option is not selected, no alignment is performed after the measurement. The profile's tilt angle and its displacement along the X and Y axes are calculated based on the device calibration.

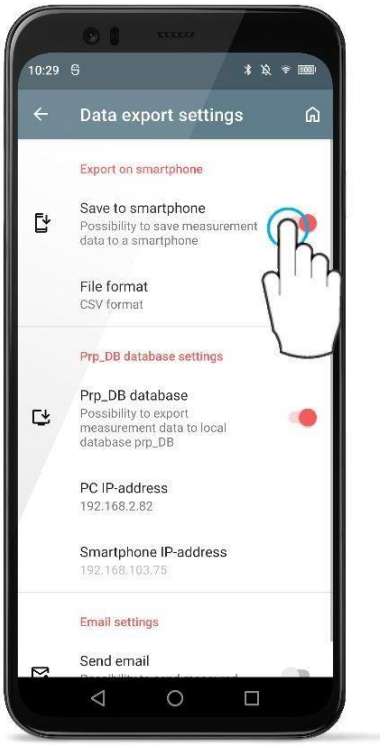
12.3. Data export

Selecting the **Data export settings** item opens a window to configure options for exporting saved data:

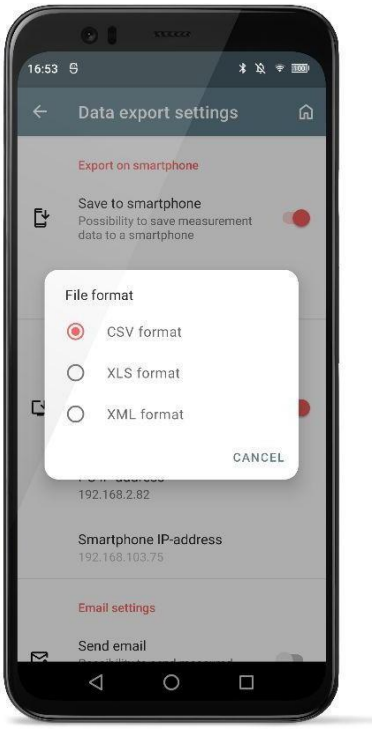


12.3.1. Export to PDA

To enable data file saving on the smartphone, check the **Save to smartphone** option.

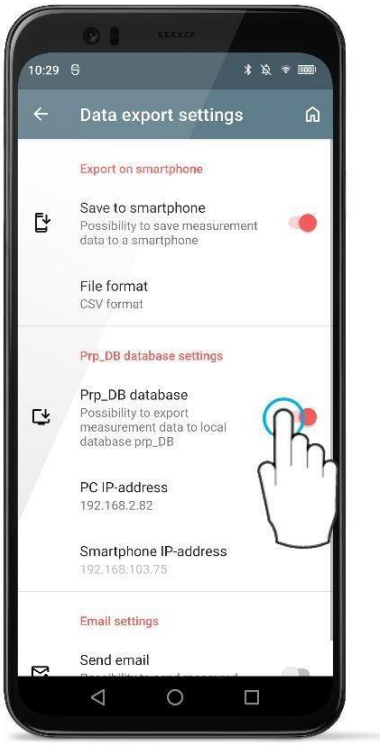


Next, select the desired file format (CSV, XLS, XML).



12.3.2. Export to PC database

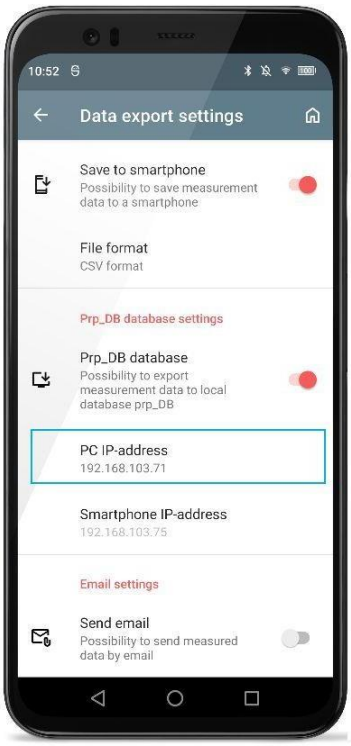
To enable data export, select the **PRP_DB database** option.



To enable data transfer between the mobile device and the PC, the PC's IP address must be configured. Data exchange is carried out via Wi-Fi. The PC and the mobile device must be connected to the same Wi-Fi network. This can be either a dedicated network created on the Android device (a virtual hotspot) or any home/office network.

12.3.2.1. PC server settings

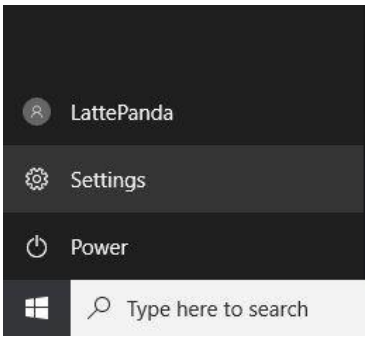
To transfer data to the PC, you must specify the IP address of the server running in **Prp_DB**. Download link for the **Prp_DB** application:
https://riftek.com/upload/medialibrary/e3d/dif6fhqwej3kzdhmlltw71tn8bwkdkex/Install_Prp_db_6.15.3.1_b182.zip



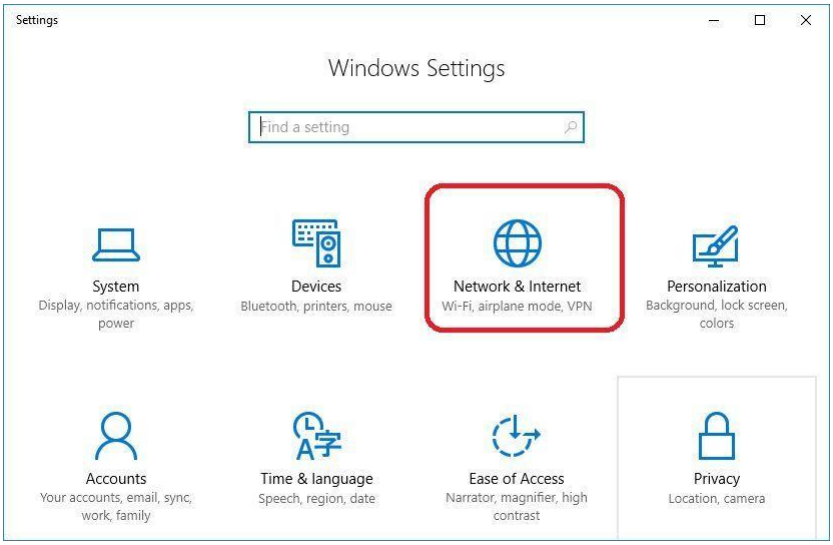
The IP address can be determined on the PC. There are two ways to find your IP address in Windows.

Method 1. Find the IP address using the **Settings** app (Windows 10).

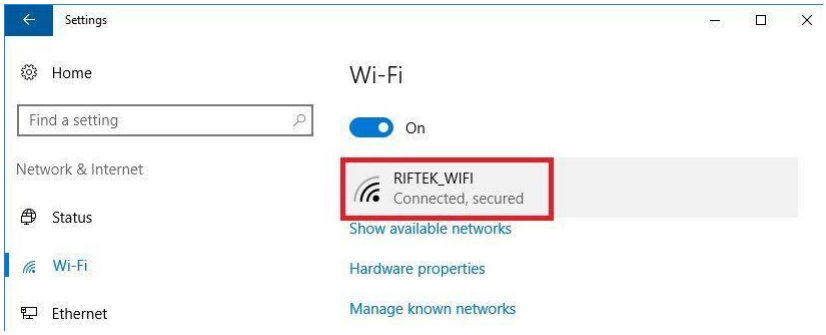
1. Select **Start > Settings**.



2. Select **Network & Internet**.



3. In the left panel, select **Wi-Fi**.

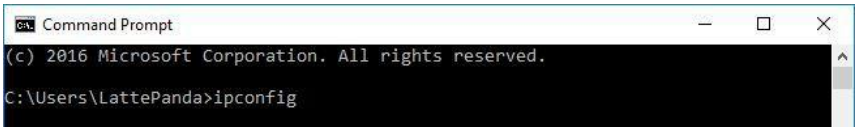


4. Click on your network or connection name.
5. Scroll down to the IPv4 address – this is your IP address.

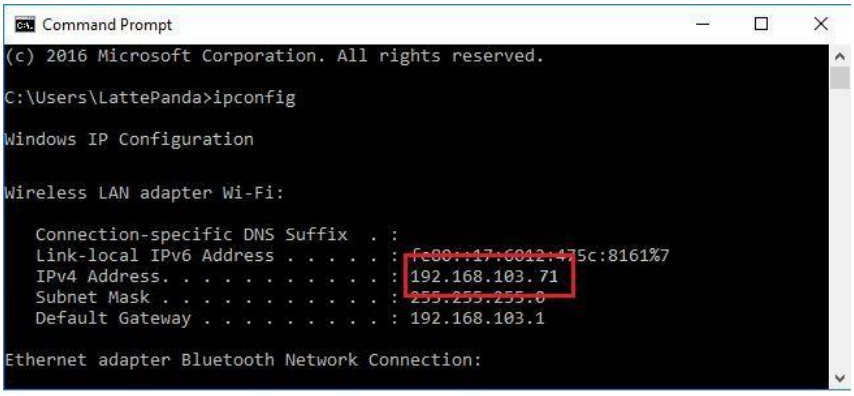
Method 2. Find the IP address using the command line.

1. Click **Start**, type *cmd* in the search bar and press **Enter**.

2. Type *ipconfig* and press **Enter**.

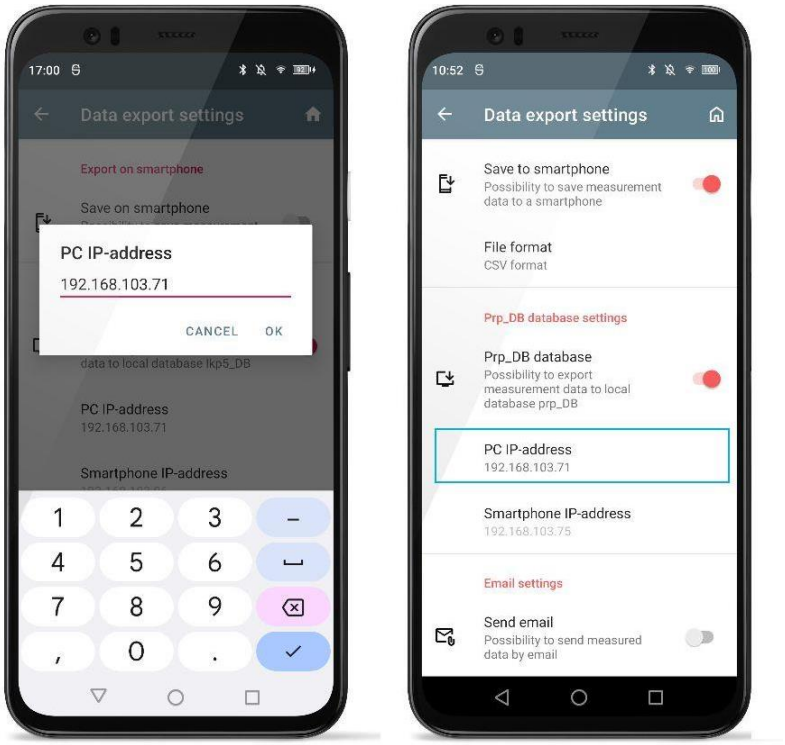


3. Find the IPv4 address – this is your IP address.



This IP address must be specified in the PC server settings.

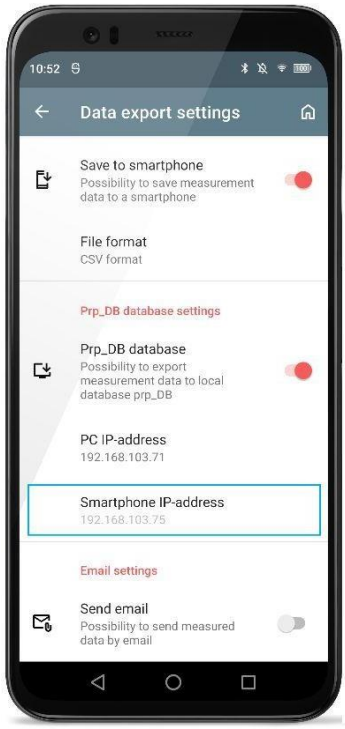
The port number is the same as in the settings of the **Prp_DB** program on the PC.



12.3.2.2. PDA server settings

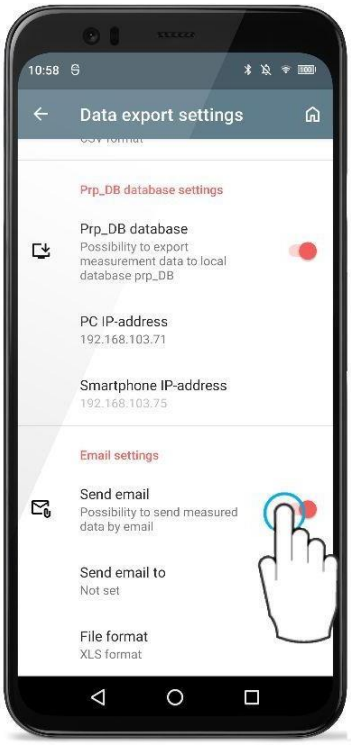
The server on the PDA is needed to transfer reference files and processing scheme files from the **Prp_DB** program.

The **IP address** field is unavailable for editing, it displays the IP address of the PDA in the Wi-Fi network. This IP address is used in the settings of the **Prp_DB** program (see Synchronization of PDA and PC).

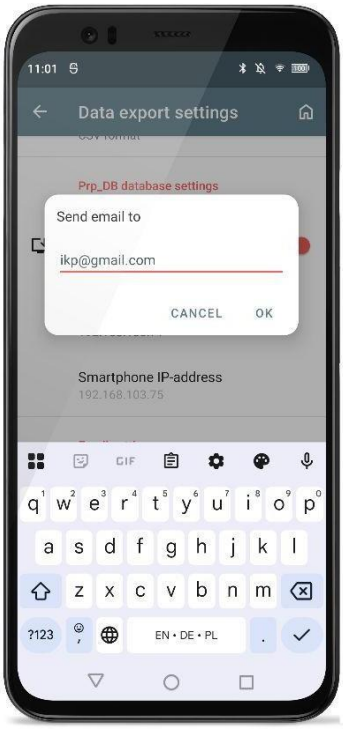


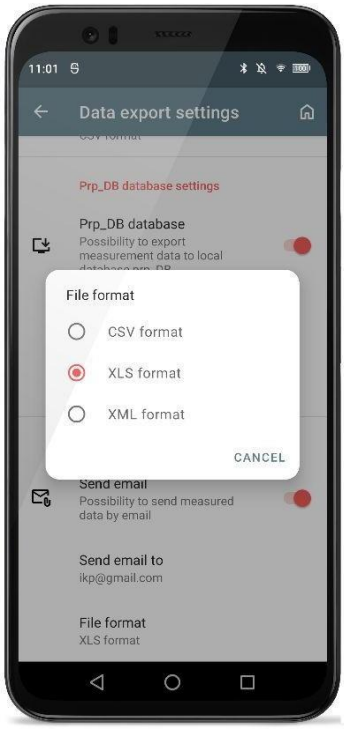
12.3.3. Sending data via email

To enable the option to send data files via email, check the **Send email** option.



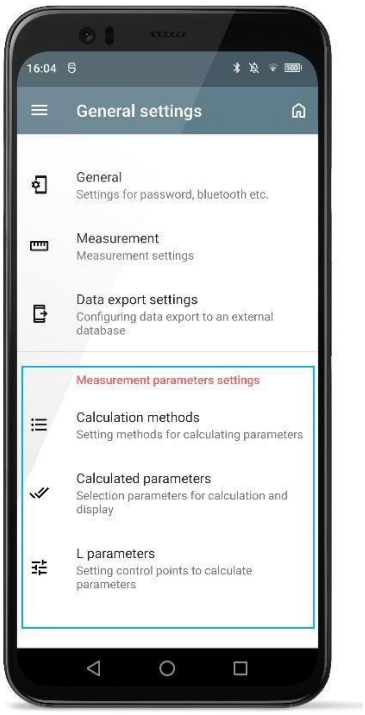
To send data, you need to enter the recipient's email address and select the file format (CSV, XLS, XML).





12.4. PRP measurement parameters

The **Measurement parameters settings** menu item is responsible for configuring the calculation of the controlled parameters of the rail head.



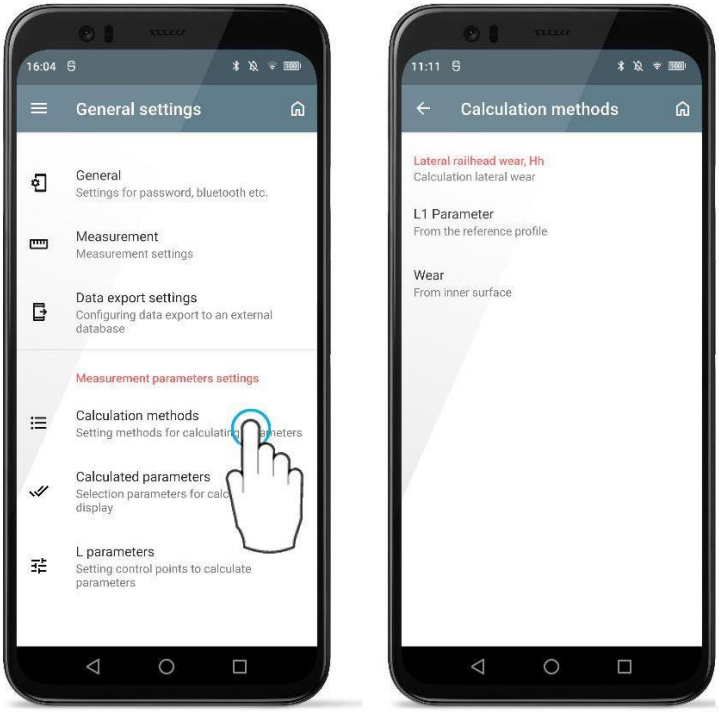
Calculation methods – configure the methods used to calculate rail head parameters.

Calculated parameters – select the rail head parameters to be calculated and displayed.

L parameters – set the reference point values for calculating rail parameters.

12.4.1. Calculation methods

Select the **Calculation methods** item:

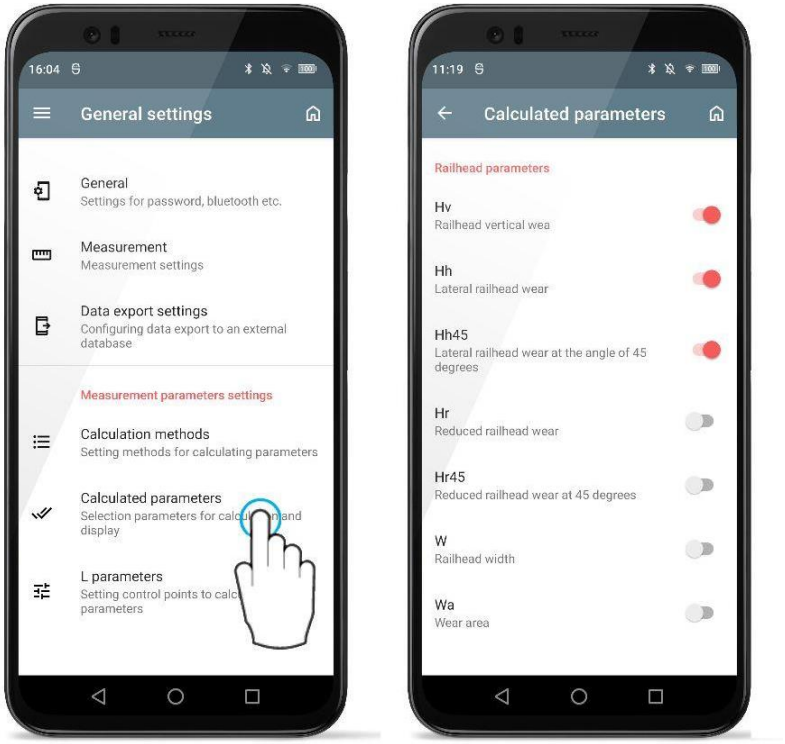


Lateral wear from:
Reference profile Wear is measured at a height of L1 from the running surface of the reference rail head.
Measured profile Wear is measured at a height of L1 from the running surface of the measured rail head.

Lateral wear:
Inner Lateral wear is measured on the inner side of the rail.
Outer Lateral wear is measured on the outer side of the rail.
Inner&Outer Lateral wear is measured on both the inner and outer sides of the rail. The maximum wear value will be displayed.

12.4.2. Calculated parameters

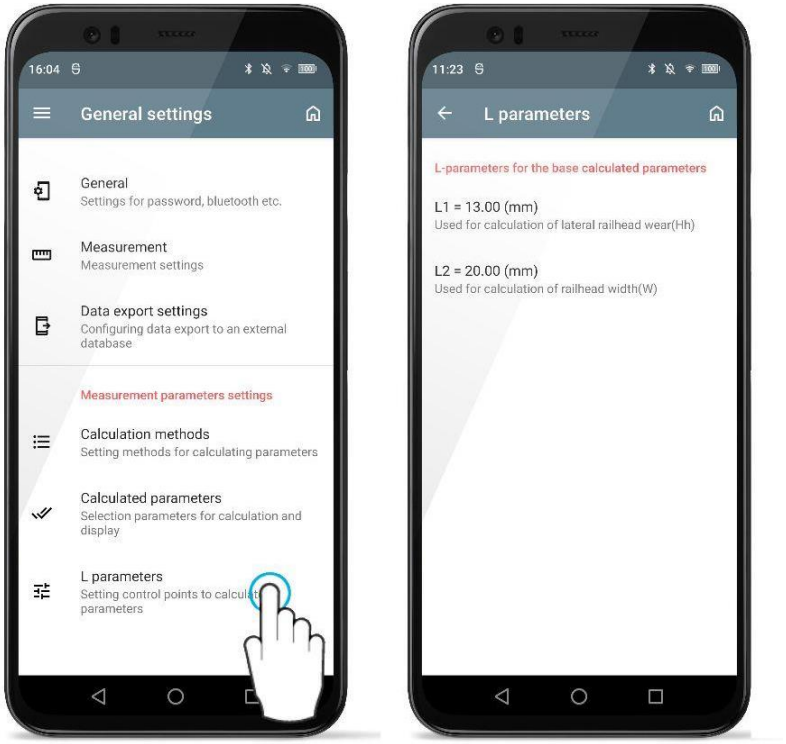
Select the **Calculated parameters** item:



To select or deselect a parameter, tap the desired item.
For parameter descriptions, see par. 9.2.

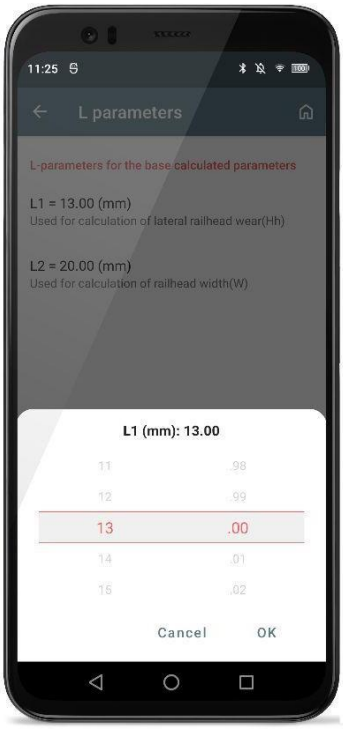
12.4.3. L parameters

Select the **L parameters** item:



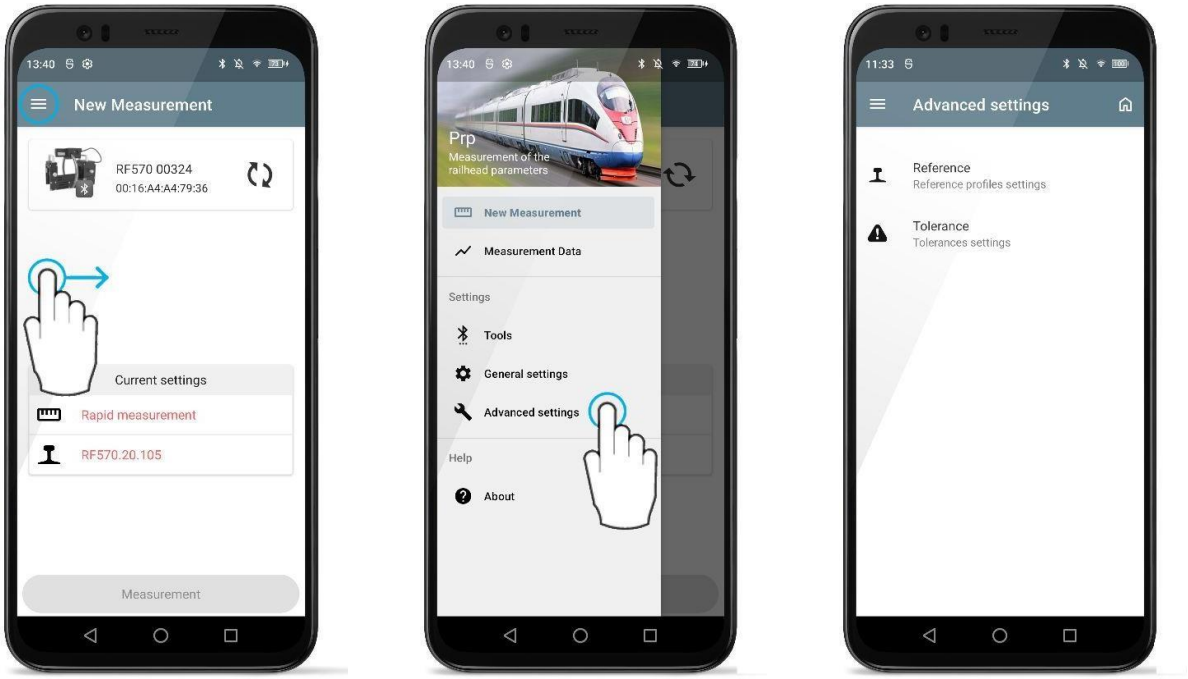
For parameter descriptions, see par. 9.1.

To edit a parameter, tap on the parameter and enter a new value in the window that appears. After entering, tap **OK**.



13. Setting reference profiles and tolerances

Swipe right from the left edge and select **Advanced settings**.



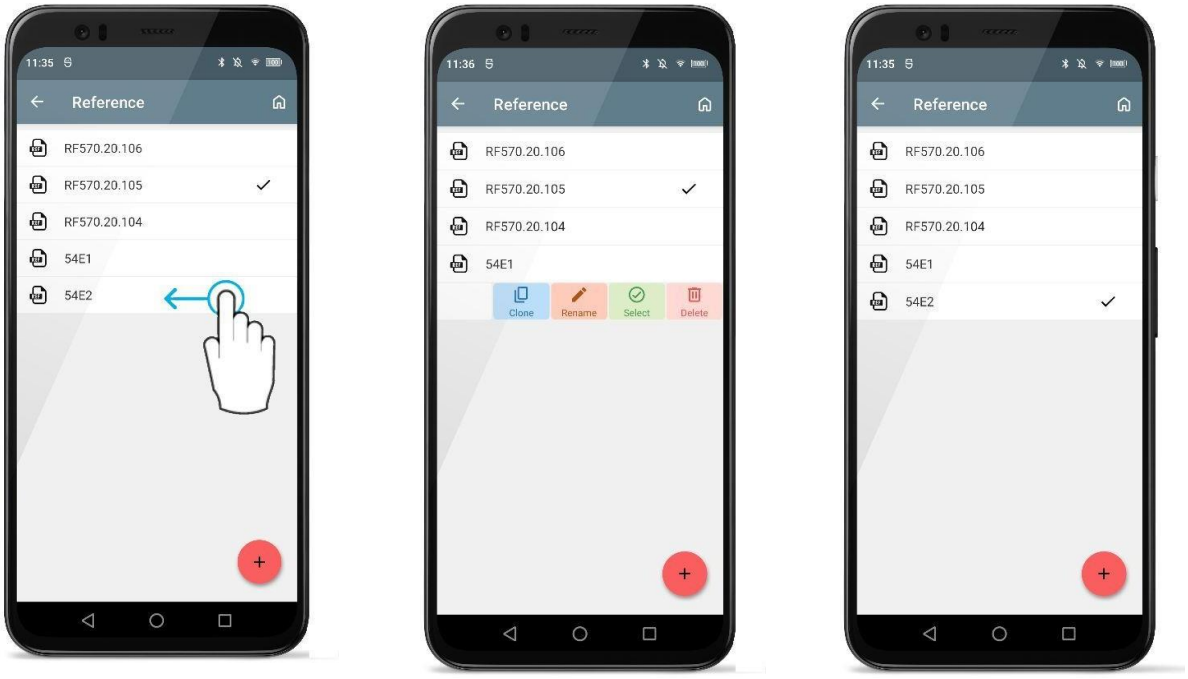
Reference – selection of reference profile.
Tolerance – tolerance settings for the measured parameters.

13.1. Reference profile

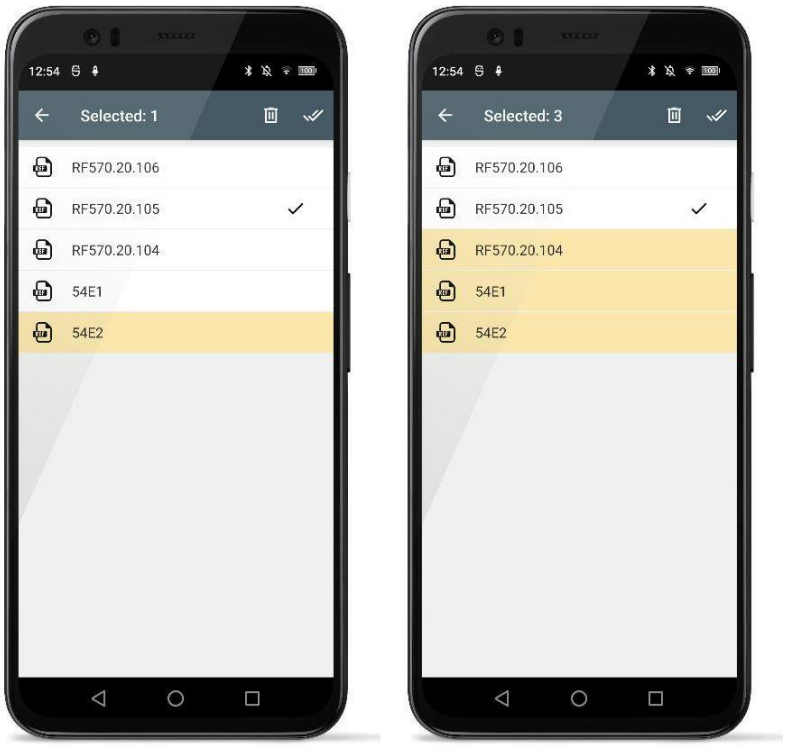
The application allows the scanned rail profile to be compared with the reference profile.

13.1.1. Selecting and deleting the reference profile

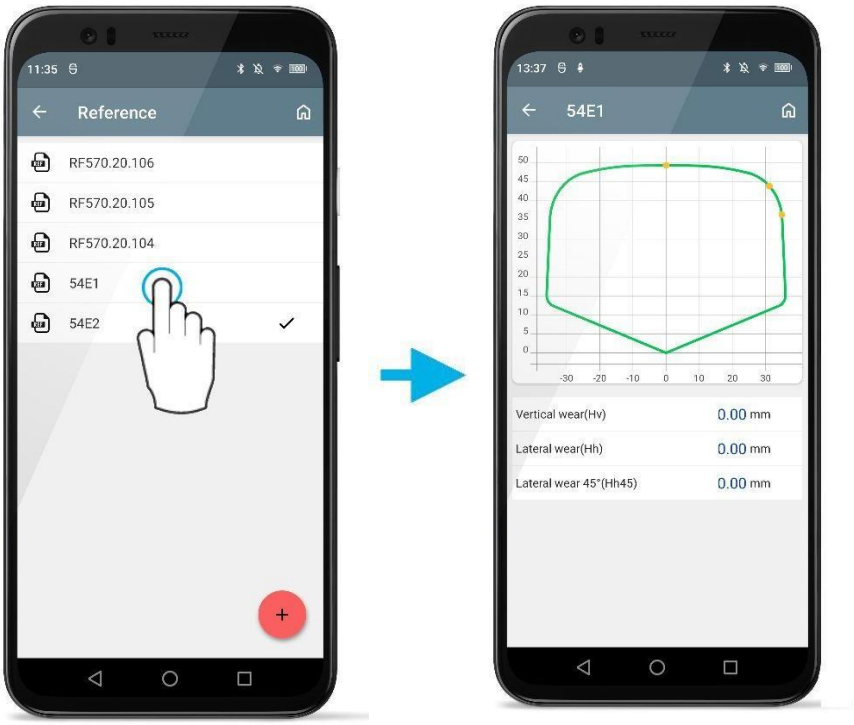
To select a reference as the main one, you need to swipe left from the right edge and tap **Select**. The selected reference will be marked with ✓.



To clone a reference profile, tap **Clone** and enter a new profile name.
To rename a reference profile, tap **Rename** and enter the new profile name.
To delete a reference profile, tap **Delete**.
To delete multiple or all reference profiles, perform a long press on the **Delete** button to activate multi-selection mode.



The menu includes the following buttons:
– Delete selected references.
– Select all references.
To view the profile and parameters of the reference, tap on the desired item.



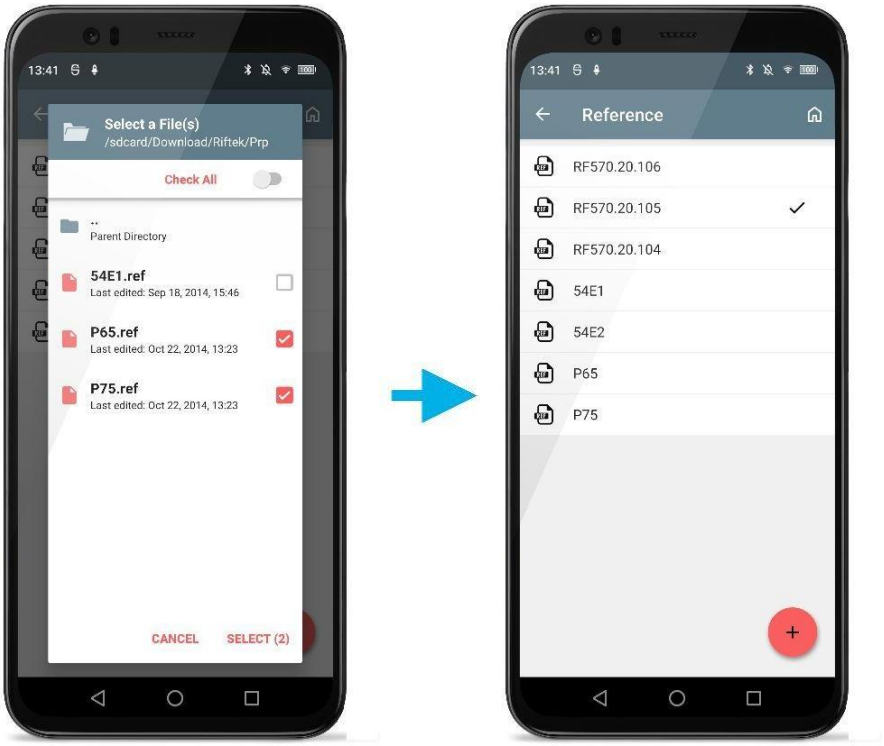
13.1.2. Uploading the reference profile to the database

The app comes with several pre-installed reference profiles.

If the required reference profile is not in the database, the user can request RIFTEK (free service) and then add the profile.

There are three ways to add a new reference to the database:

1. Copy the reference file to the device (in any standard way) and tap  . Select the files you need and tap **Select**.



2. Export a profile from the database of measured profiles.
3. Export the reference file from the **Prp_DB** program.

13.2. Tolerances

The application automatically monitors whether the measured geometrical parameters exceed the specified tolerances.

13.2.1. Viewing and deleting tolerances

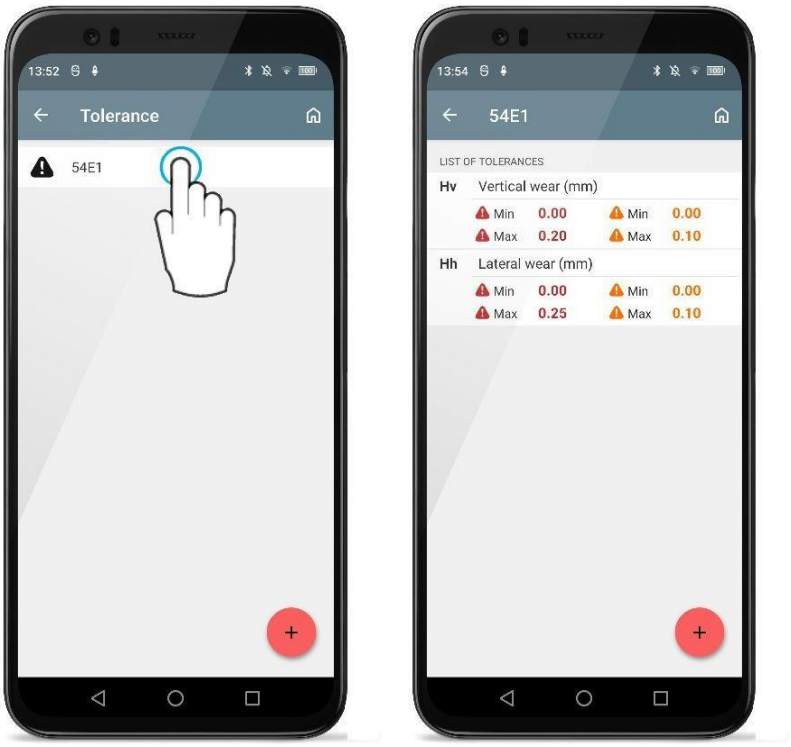
For tolerances, the selection of the main tolerance is not used, since tolerances are linked to reference profiles. For each reference profile, a tolerance for the calculated parameters of the rail head can be added.

In the example below, tolerances have been added for the "54E1" reference profile. When selecting "54E1" as the reference profile, the tolerance will be used with the name "54E1".

To view or edit the values, you need to tap on the name of the tolerance.

The table displays the tolerances only for the selected geometric parameters of the rail head.

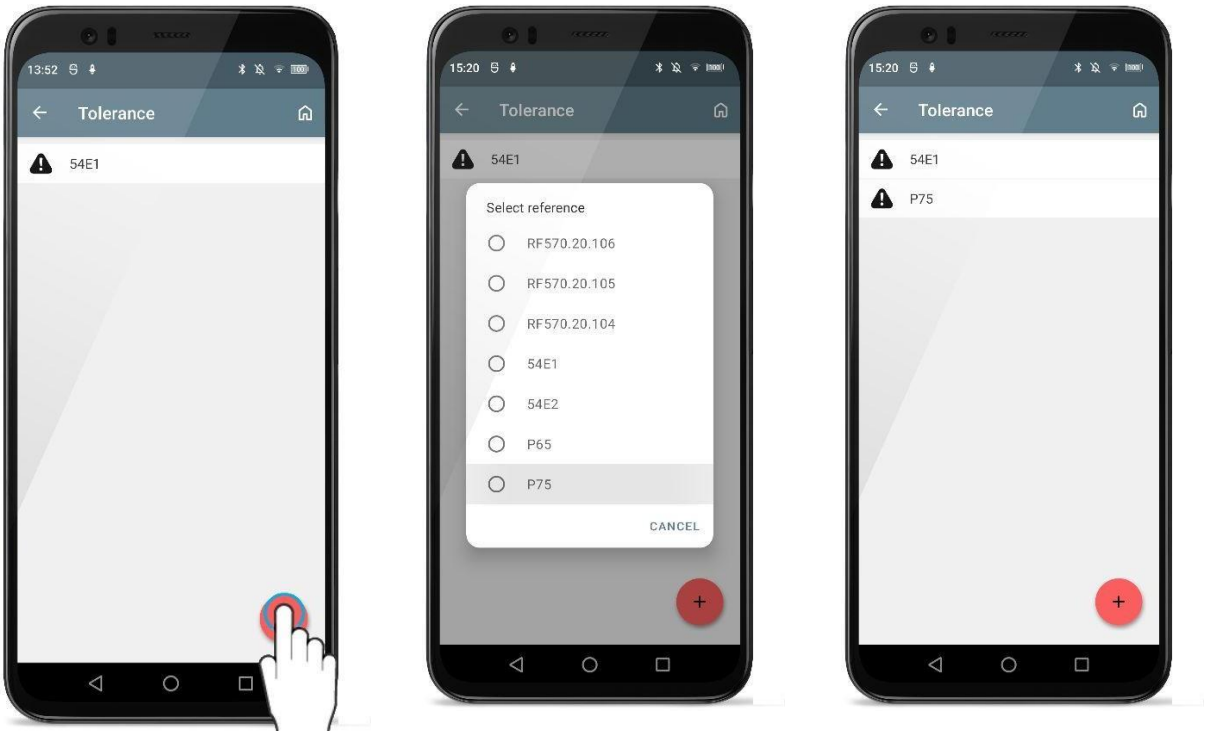
The maximum/minimum critical values of the parameters are displayed in red. The maximum/minimum values of the parameters, which are close to the critical values, are displayed in orange.



To delete a tolerance, you need to swipe left from the right edge and tap **Delete**, or tap and hold the item with the tolerance name (the procedure is the same as for the references - see par. Selecting and deleting the reference profile).

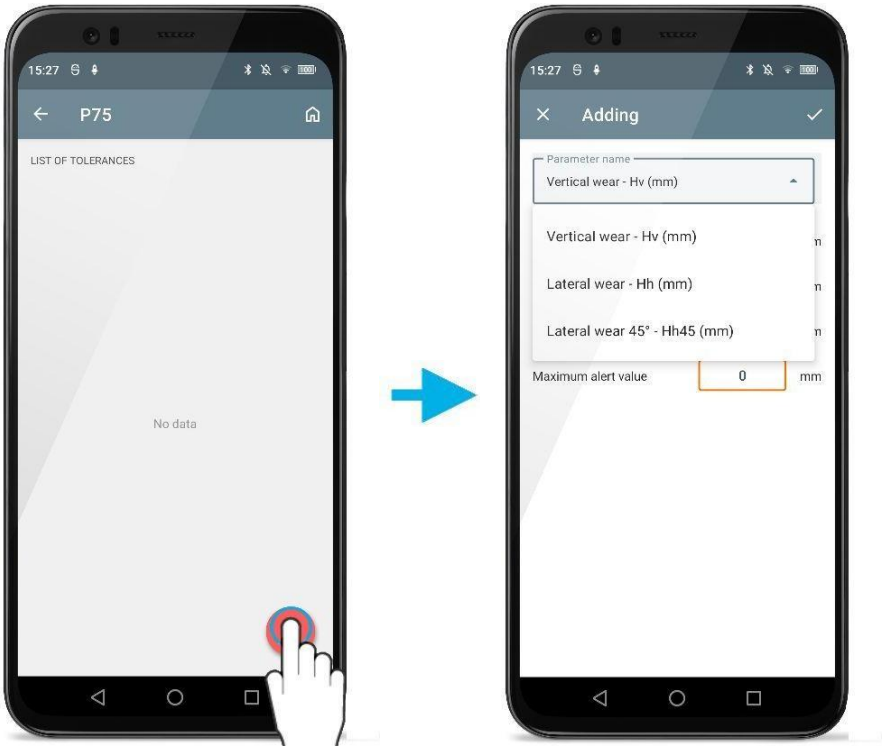
13.2.2. Adding tolerances

To add a tolerance, tap + and select a reference for which the tolerance will be set.

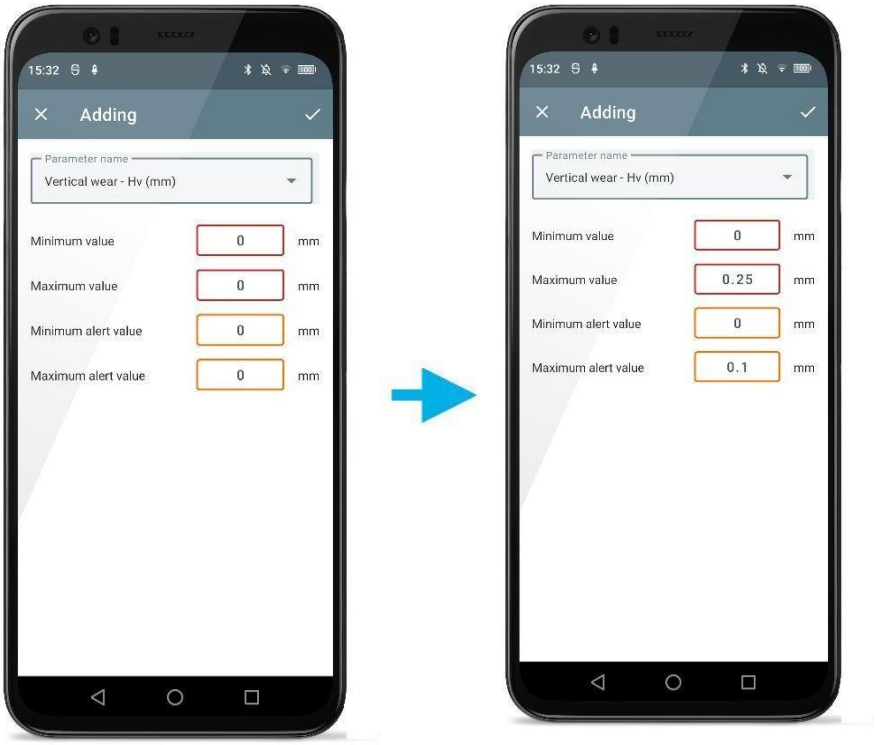


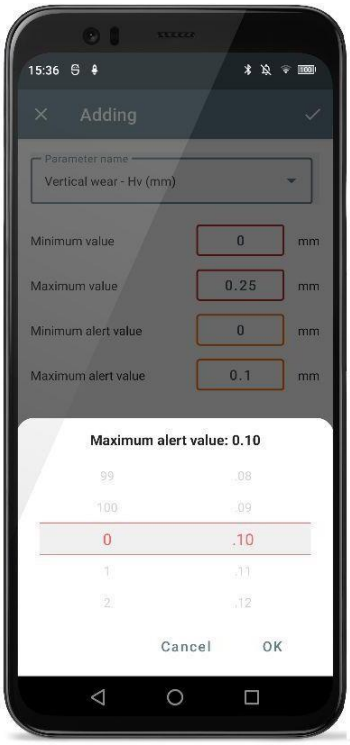
After adding a tolerance, you must enter the boundary values for the calculated rail parameters. To do this, click on the tolerance name and go to the mode for adding controlled parameters. Initially, the list is empty. To add a controlled parameter, you

must tap + and select the parameter for which tolerances will be entered from the drop-down list. The drop-down list contains only those parameters that have been selected for calculation (see Calculated parameters).



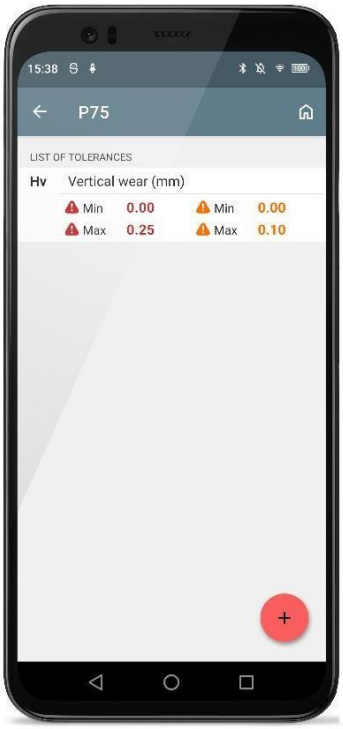
After selecting a parameter, the limit values must be entered.





To edit a tolerance, tap the input field and select the desired value.

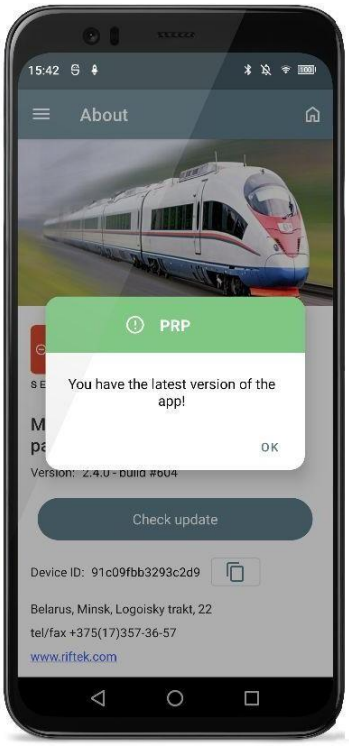
To save, tap ✓. The added tolerances for the selected parameter will appear in the list.



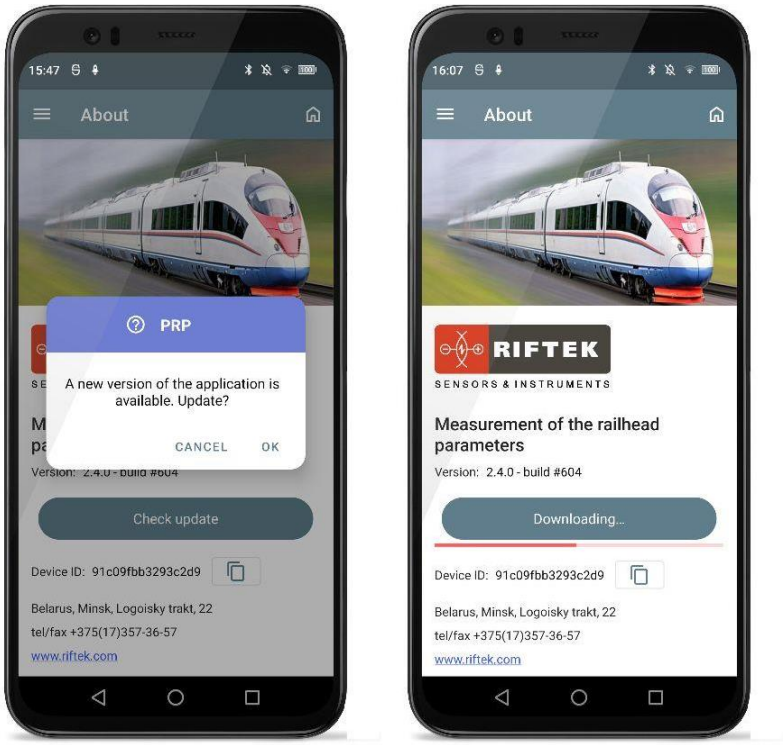
14. PDA software update

The software version is shown in the **About** window. To open the **About** window, tap ☰ or swipe right from the left edge and select **About**.

To check if you have the latest version, tap the **CHECK UPDATE** button. If you have the latest version installed, the app will display a corresponding message.



If you do not have the latest version installed, you will be prompted to update the application. Tap **OK** to update. The new version of the application will be downloaded and installed automatically.



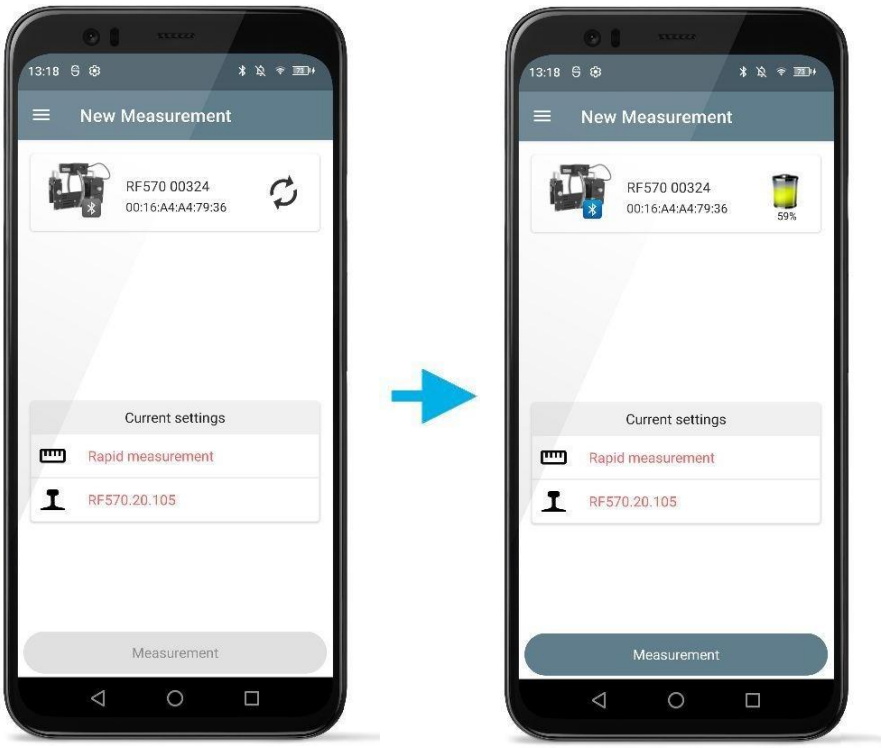
The latest version of the software can also be downloaded from the website: https://riftek.com/upload/medialibrary/d15/rnhed80h13jb9ndrvl9n3ycnyar96wc6/prp.zip

The update procedure is similar to installing the application.

15. Measurement procedure

15.1. Turning on the profilometer

- Before first use, charge the batteries of both the laser module and the PDA by connecting them to the charger.
- Turn on the laser module by pressing and holding the power button for a few seconds. When powered on, the red LED indicator on the laser module will flash.
- After the laser module is turned on, it will automatically establish a wireless connection with the PDA. During this process, the blue LED on the module will be lit. Once the connection is established, the LED will turn off.
- The main application window will be updated:



The **Measurement** button, as well as the Bluetooth connection and battery charge indicators, become active.

15.2. Mounting onto the rail

Attention!
When mounting the module onto the rail, avoid strong impacts of its supports against the rail, as this may cause the profilometer to malfunction.

You need to inspect periodically the output window and basic supports of the laser scanning module and to clean them of dirt.
Do not clean the glass by using abrasive and aggressive cleaning agents.

To perform the measurement:

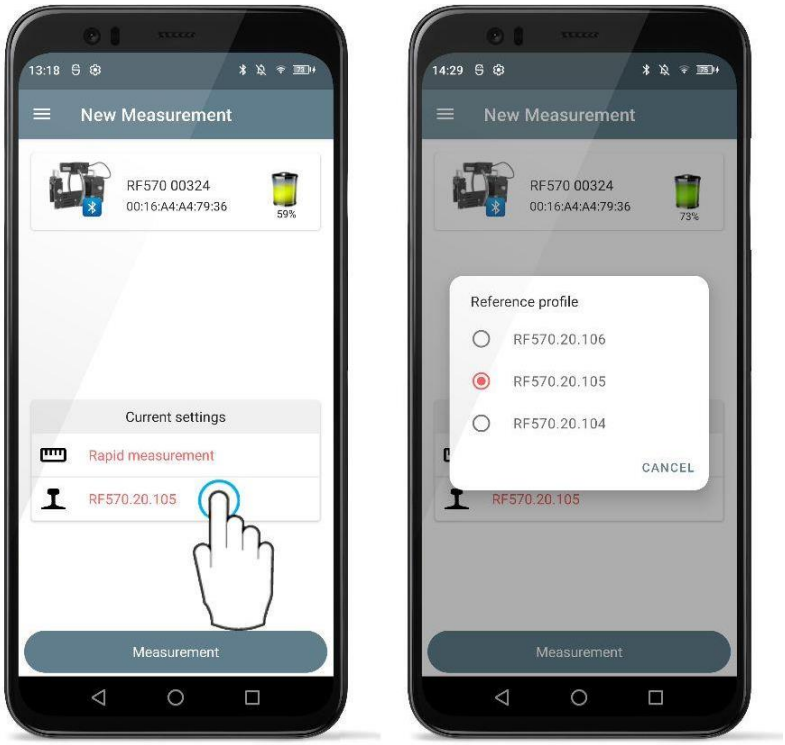
- Secure the laser module onto the rail using the clamps.

To reduce the scanning time, you can manually move the carriage to the start position.

15.3. Quick setup

The main window contains tools that allow the user to quickly configure the reference.

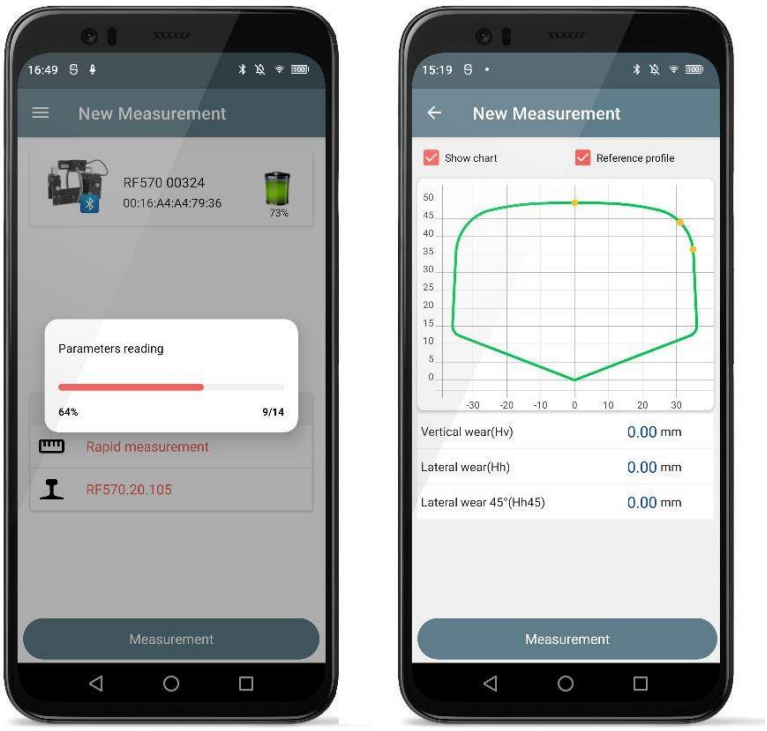
- To quickly select the reference, tap on the current reference ( ) and make a selection.



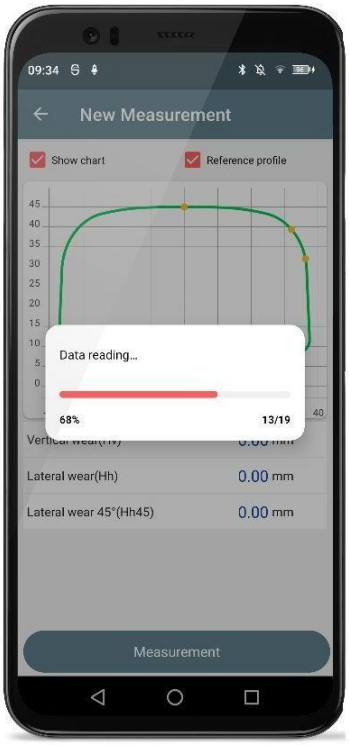
15.4. Measurement

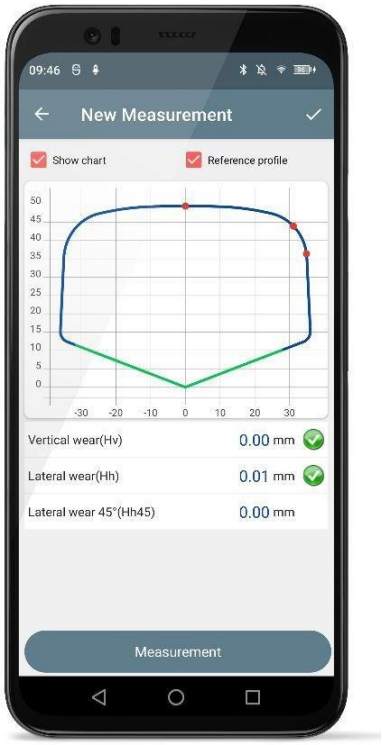
To reduce the scanning time, you can manually move the carriage to the start position.

- Tap the **Measurement** button on the PDA screen. The application will request the calibration parameters of the laser module, and if the parameters are successfully read, the measurement window will appear.



- When you tap the **Measurement** button, the laser module will scan the rail head surface. The scanning time is 10-12 seconds, during which the red LED lights up.
- After the scanning is complete, the PDA will show the values of the measured parameters selected for display:





If the tolerance for the selected reference is specified in the settings, the parameter value will be marked with a green icon. If the parameter exceeds the specified tolerance, the value will be marked with a red (orange) indicator:

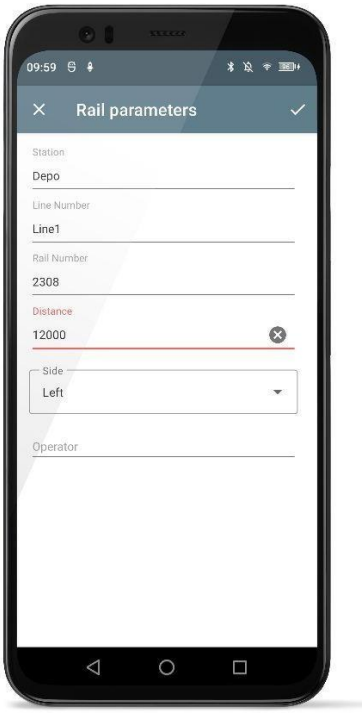
- When you tap the **Measurement** button, the laser module will re-scan the rail head surface (if required).

The application allows the user to display only the parameters of the measured profile and remove the graphical representation of the profile. To do this, uncheck the **Reference profile** and **Show chart**, respectively.

- If a calibration block or reference rail was scanned for verification, the scan results must not differ from the nominal values by more than 0.1 mm. In this case, the device is ready for operation. Otherwise, it must be calibrated according to the instructions.

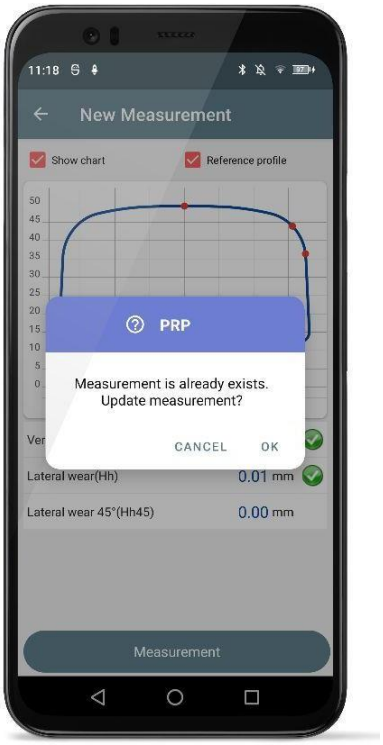
15.4.1. Saving the measured profile

- To save the measured profile, tap the **Save** button ( ) and enter the rail identification parameters.



The measurement will be saved to the database (see Viewing measurement results).

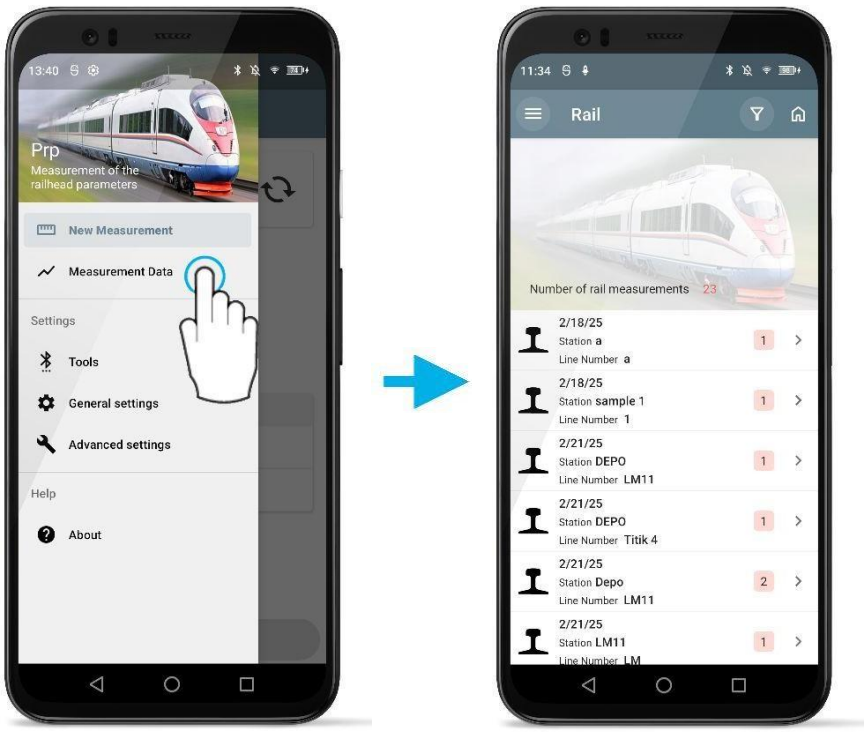
If a measurement with the entered parameters already exists in the database, a warning message will be displayed:



The new measurement can either overwrite the existing one or be canceled.

16. Browsing the database

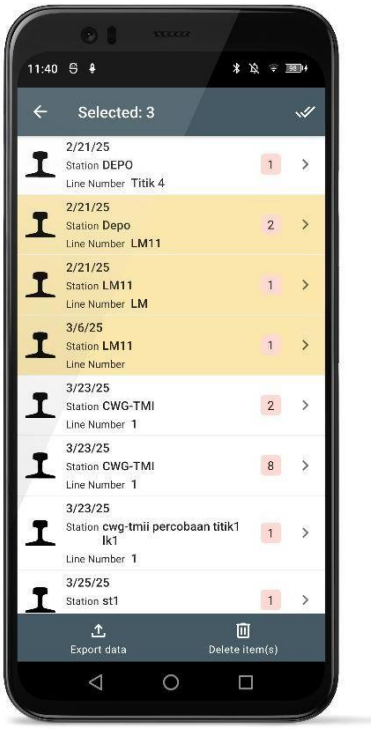
To view the saved data, go to the main menu (tap , or swipe right from the left edge of the screen) and select **Measurement Data**.



A list of saved rail measurements will be displayed on the screen.

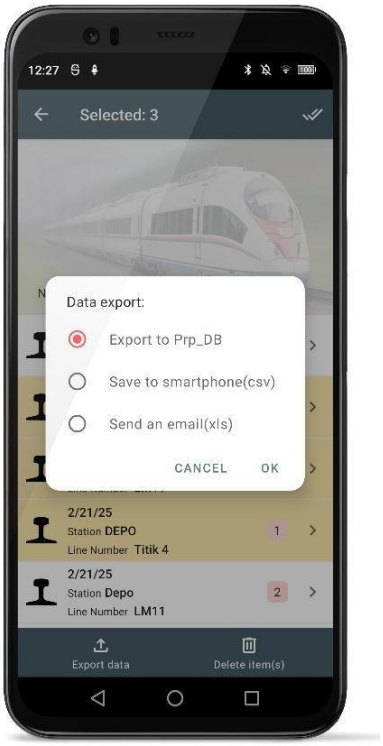
16.1. Data export

To export multiple or all measurements, perform a long press on the desired entry to activate multi-selection mode. You can optionally filter the required data beforehand (see Data filtering).



Next, select the data to be exported to the PC and tap the **Export data** button (Export data).

If multiple export options are selected in the export settings, a menu with export format options will appear on the screen.

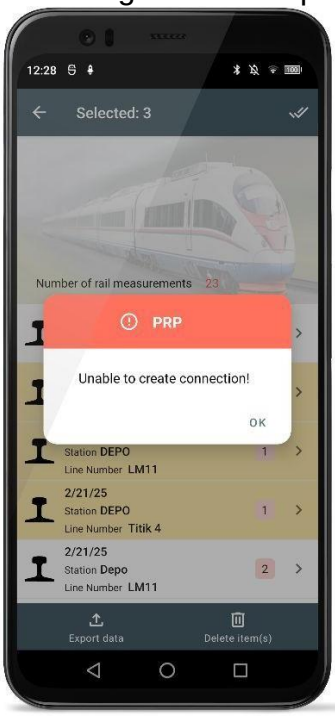


- To export to the PC, select **Export to Prp_DB**.

Attention!
For successful data export:
– The smartphone must be connected to a Wi-Fi network.
– The Prp_DB application must be running on the PC.
– The correct IP address must be set in the PC server settings (see PC server settings).

If the data is successfully transferred, a pop-up confirmation message will appear on the screen.

In case of failure, an error message will be displayed:



- To save data to the smartphone, select **Save to smartphone**.

The data will be saved to the internal memory in the **\\Download** folder.

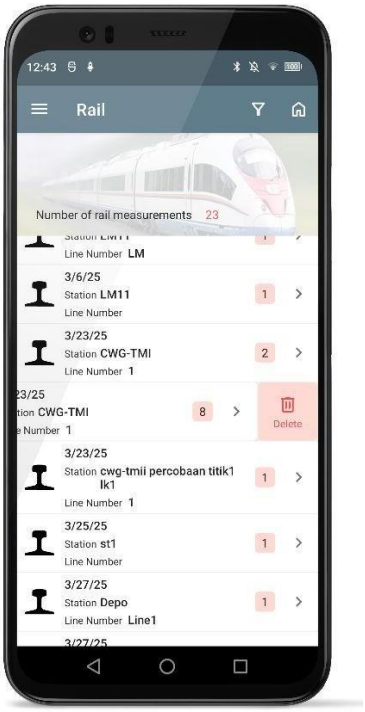
- To send data by email, select **Send email**.

The data will be sent to the email address specified in the settings.

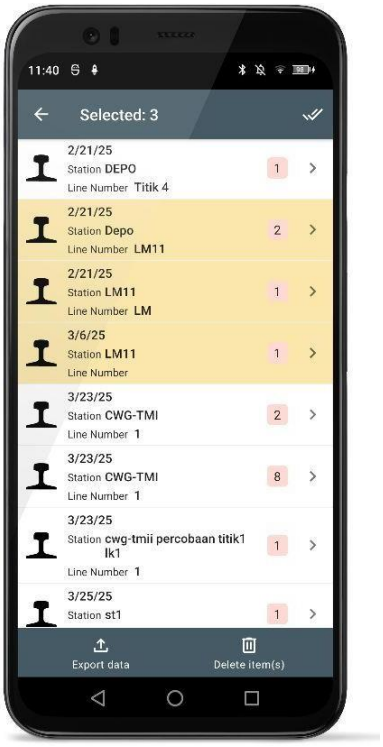
Attention!
For successful data transmission, the smartphone must be connected to the internet via a wireless network.

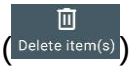
16.2. Data deletion

To delete a locomotive/car, swipe left from the right edge and tap **Delete**.



To delete multiple or all entries, perform a long press on an entry to activate multi-selection mode.



Next, select the data to be deleted and tap the **Delete item(s)** button (

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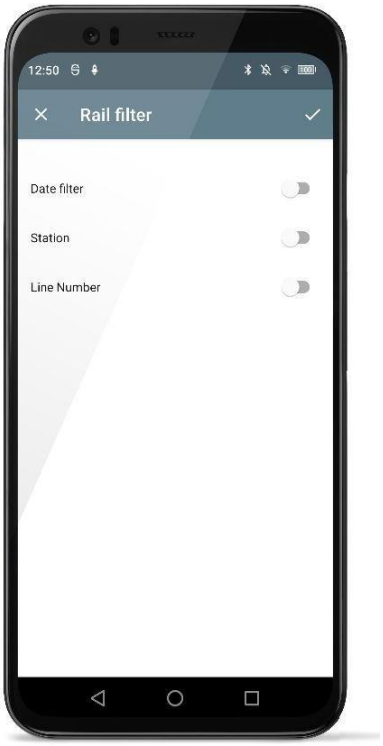
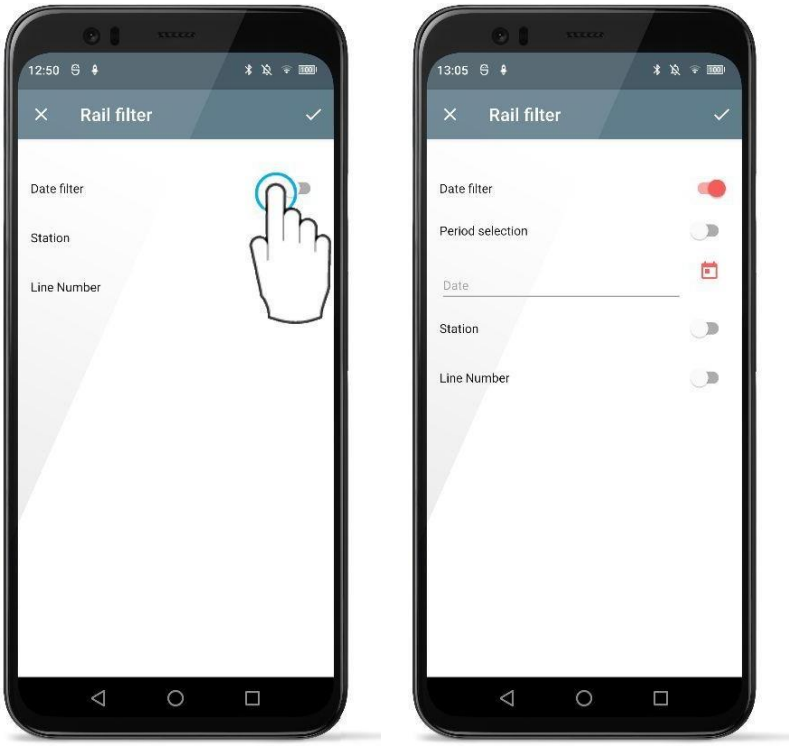
16.3. Data filtering

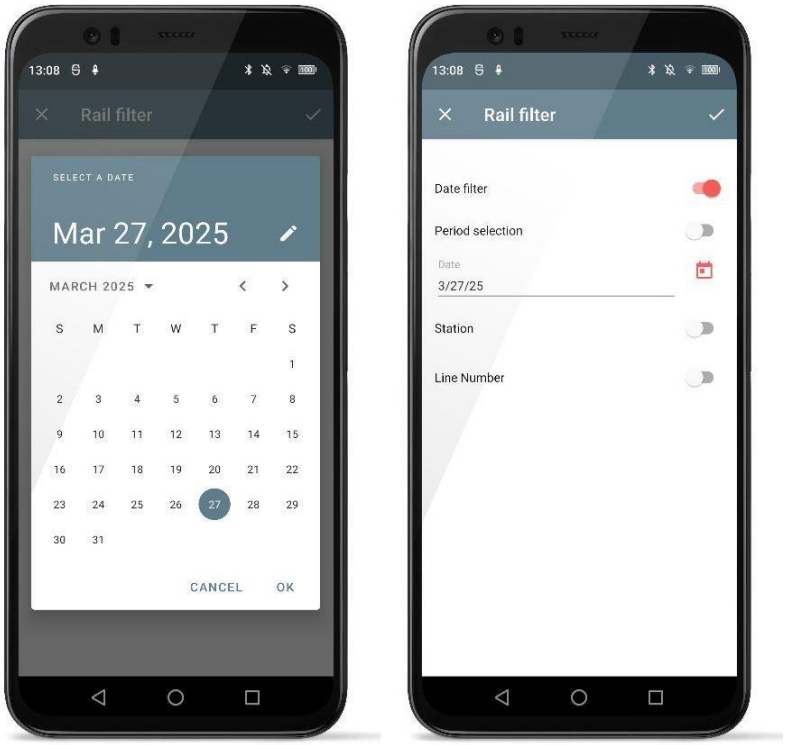
To add a filter, tap the **Filter** button ( ), and then select the fields by which the data will be filtered. Filtering can be performed by date, station, and line number.



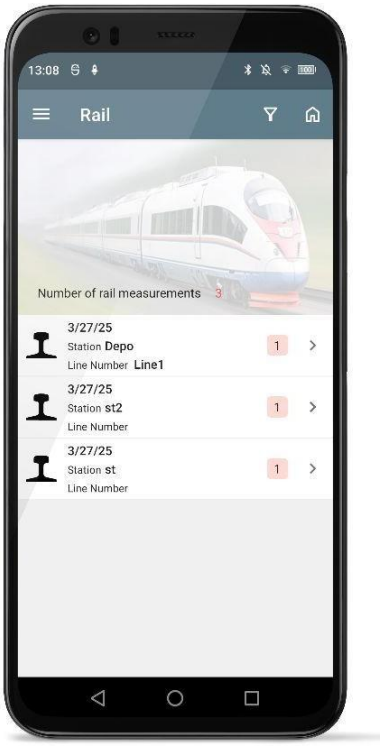
Example of filtering by the **Date** parameter:



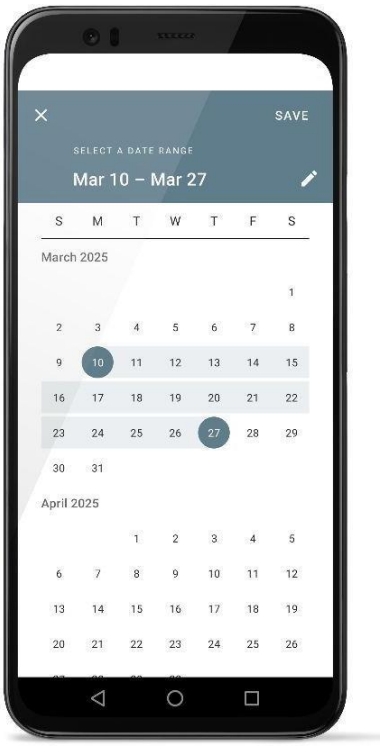
Next, tap the date selection icon ( ) and choose the desired date.



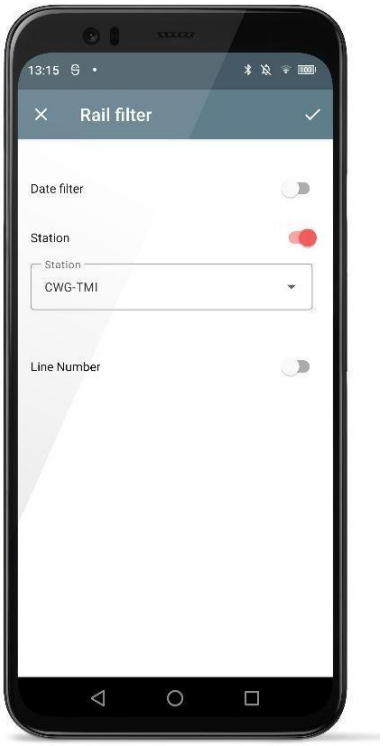
To apply the filter, tap ✓. The list will display only the measurements that match the filter criteria.



You can also filter the data for a specific time period. To do this, activate the **Period selection** toggle and choose the desired time range in the calendar.



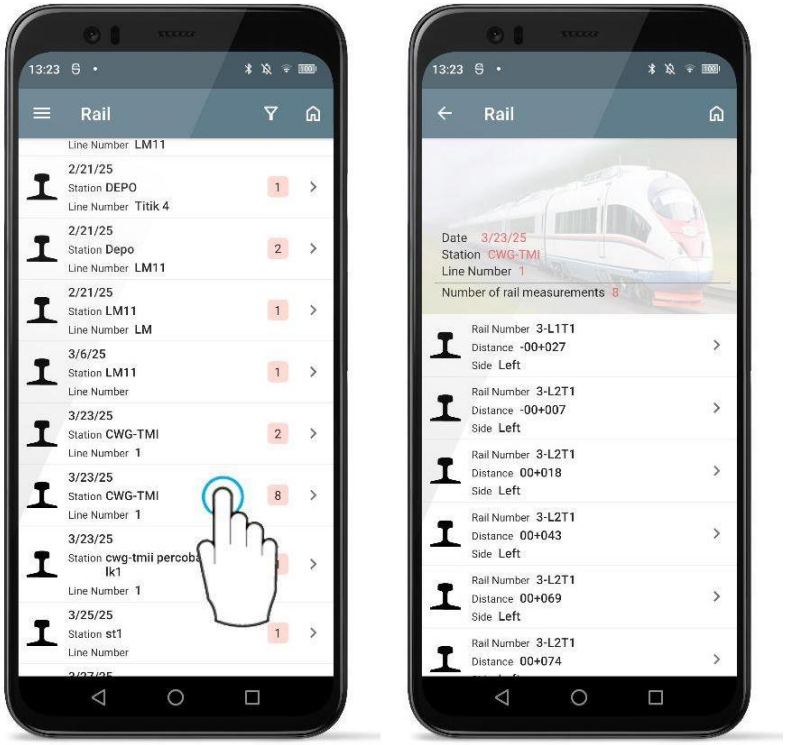
To add a filter by **Station** or **Line Number** of the locomotive/wagon, select the desired value from the dropdown list.



To remove the current filter, tap the **Filter** button ( ) and deactivate the toggle switch.

16.4. Viewing measurement results

To view measurement results, tap on the desired entry. A list of measurements will open.



In this mode, it is also possible to delete and export data.

16.4.1. Saving a profile as a reference

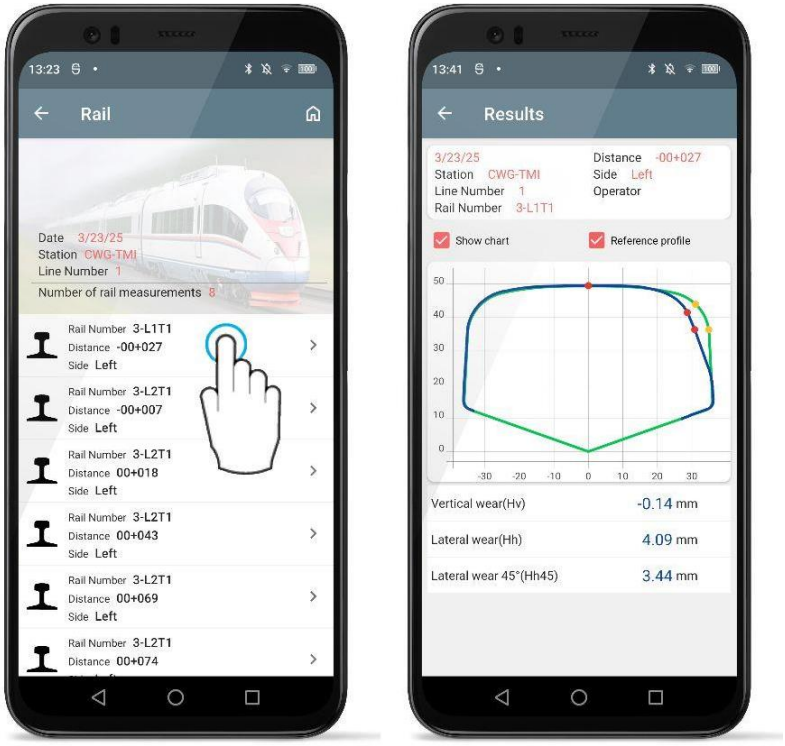
You can also save the profile of the selected rail as a reference. To do this, swipe the entry from right to left and tap **Save**.

Next, enter the reference profile name and tap ✓ to save it.

The saved reference profile can be viewed in the reference profile database (**Advanced settings > Reference**, see Reference profile).

16.4.2. Viewing rail parameters

To view the parameters and profile of the selected rail, tap on the corresponding entry.

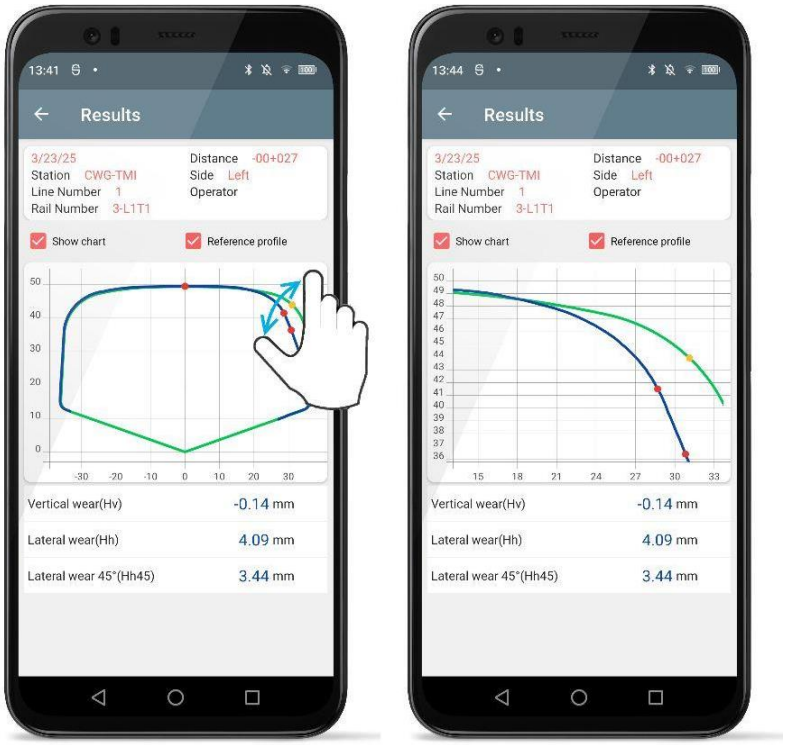


The window displays the identification data of the measured rail, the measured profile, and the calculated parameters.

There is an option to hide the reference profile display – simply uncheck the **Reference profile** option.

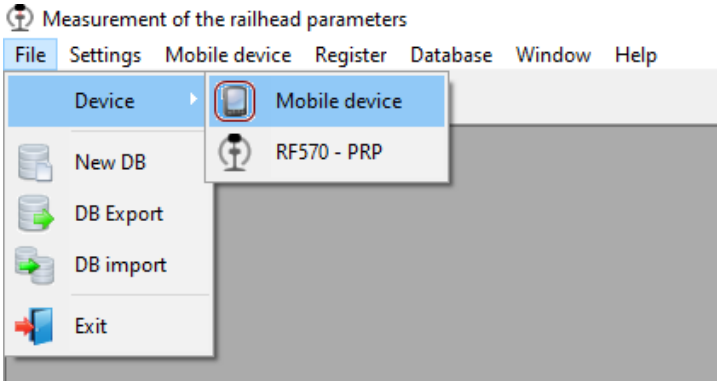
16.4.3. Graphic representation of the rail profile

The profile can be zoomed in by placing two fingers on the profile simultaneously and spreading them apart without lifting them from the screen.



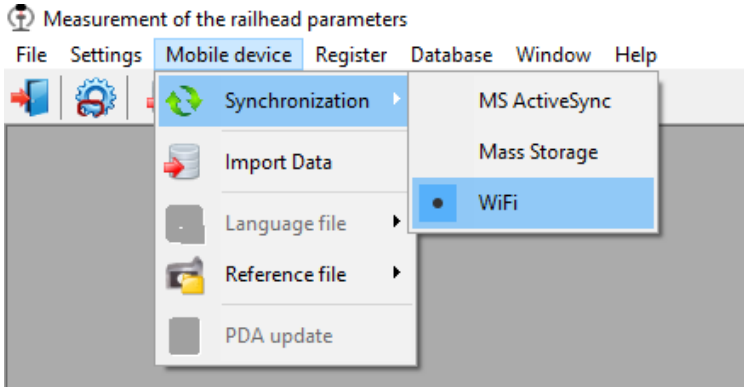
17. Data exchange between smartphone and PC

To exchange data between the mobile device and the PC, select the device by navigating to **File > Device > Mobile Device**.

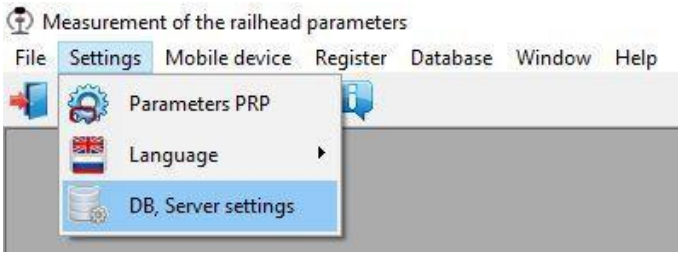


17.1. Wi-Fi data transfer settings

Wi-Fi is used for data transfer between the mobile device and the PC.
To establish the connection, follow these steps:
1. Select the synchronization type: **Mobile device > Synchronization > WiFi**.



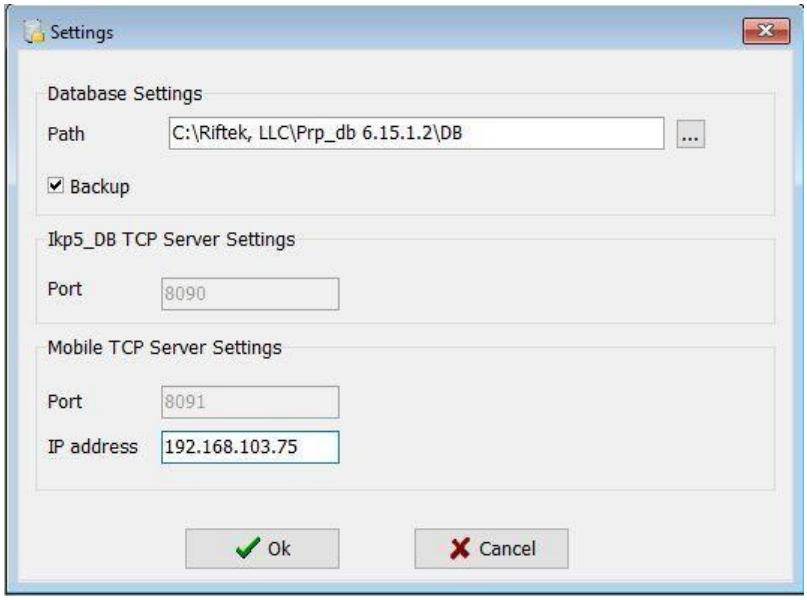
2. Go to the server settings: **Settings > DB, Server settings**.



For data transfer, the PC and the mobile device must be connected to the same Wi-Fi network. This can be a dedicated network created on the Android device (a virtual hotspot) or any home/office network.

Prp_DB server port settings:

Port (non-editable) – the port number used to connect the mobile device (default: **8090**).



Mobile device server settings:

Port (non-editable) – the port number (default: **8091**).

IP address – the IP address of the mobile device on the network, used by the **Prp_DB** program to connect.

The IP address must match the value specified in the mobile application settings.

17.2. Wireless data transfer

When the Wi-Fi synchronization type is selected, the following data exchange options with the mobile device become available:

- Transfer of the database file.
- Transfer of the reference profile file.

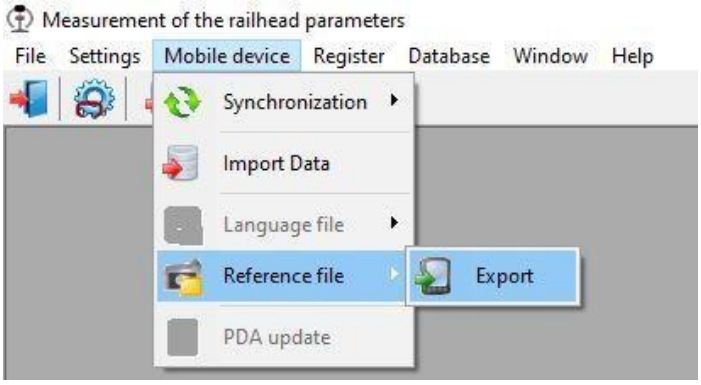
17.2.1. Transferring the database file to the PC

During Wi-Fi synchronization, the measured data is exported from the PRP mobile application.

17.2.2. Transferring the reference profile file

To transfer a reference profile file from the PC to the PDA, follow these steps:

- Select **Mobile device > Reference file > Export**.



- Select the desired file with the **.ref** extension.

If the transfer is successful, a confirmation message will appear:

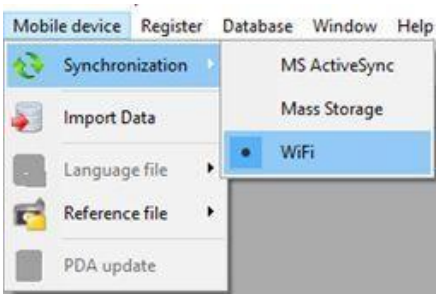
17.2.3. Importing the Railset.xml file

If a wireless network is unavailable, the measured data can be exported to a file on the smartphone or sent via email.

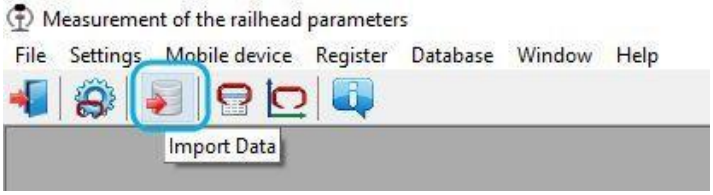
> **Attention!**
> To import into the **Prp_DB** database, the file must be in XML format (**Railset.xml**).

Next, copy the **Railset.xml** data file to the PC and import it into the **Prp_DB** database.

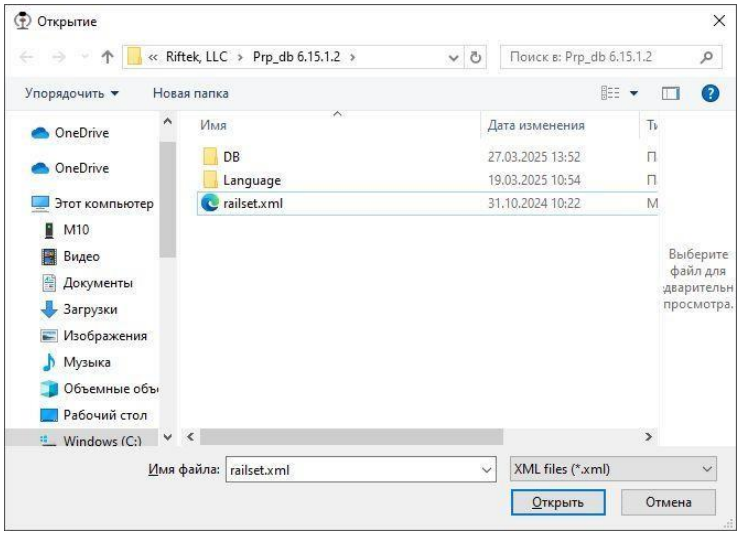
– Select **Synchronization > WiFi**.



– Select **Mobile device > Import Data**, or click the **Import Data** button.



– Select the **Railset.xml** data file.



The measured profiles will be imported into the database.

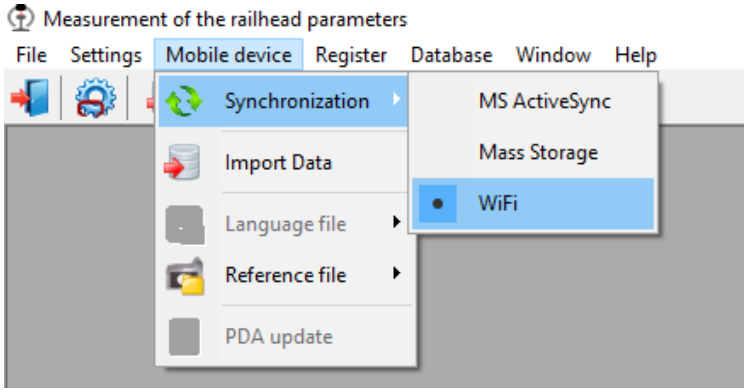
18. Installing software on PC

18.1. Database support software installation

The **PRP_DB** software is intended for maintaining the rail wear database on a personal computer.

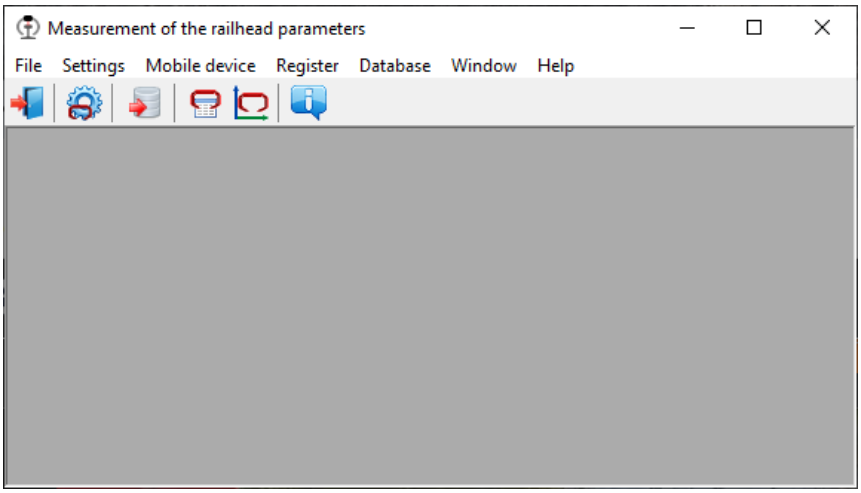
To install the software, insert a compact disk to PC CD drive, select and start **Install_PRP.exe** file in the **Software** folder. Follow instructions of the installation wizard. By default, the program is installed in **C:\Program Files (x86)\Riftek, LLC\Prp_DB**.

18.2. Synchronization of mobile device and PC



18.3. Launching the software

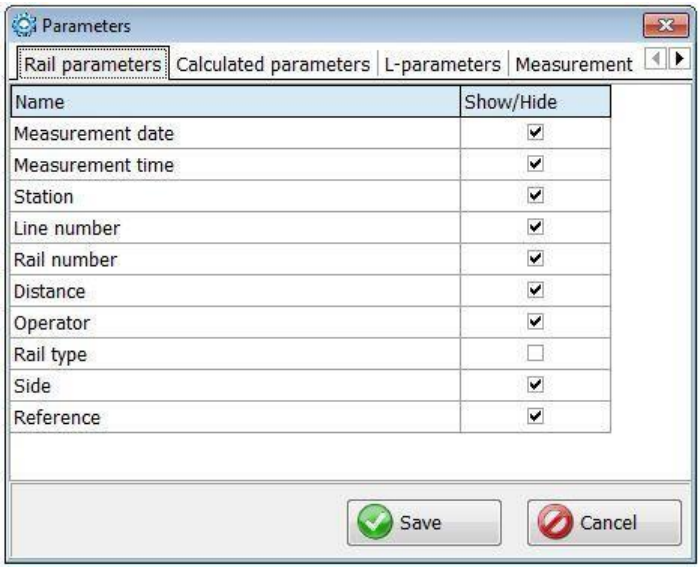
To launch the program, select:
Start > All programs > Riftek, LLC > PRP_DB > Prp_db.exe
The main window appears as follows:



19. User settings of the program

19.1. Parameter settings

Select **Settings > Parameters** in the main window, or click .

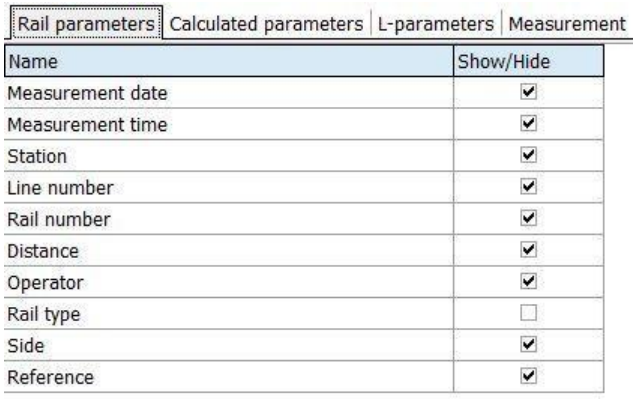


The **Parameters** window contains four tabs:

- Rail parameters
- Calculated parameters
- L-parameters
- Measurement method

19.1.1. "Rail parameters" tab

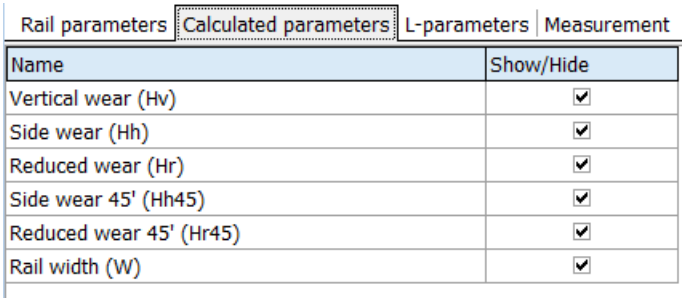
In this tab, you can select parameters, which will be displayed on the screen when browsing the database.



If the parameter is selected, its value will be shown in the table of results and in the table of profiles.

19.1.2. "Calculated parameters" tab

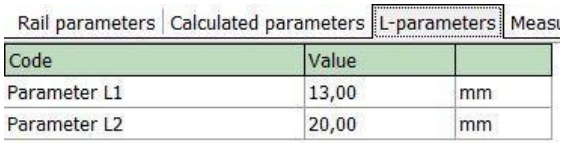
In this tab, you can select the geometrical parameters, which will be calculated and displayed on the screen when browsing the database.



The description and functions of parameters see in par. 9.2.

19.1.3. "L-parameters" tab

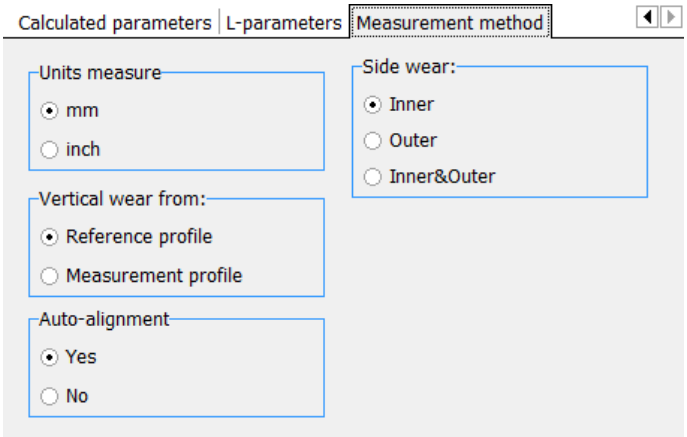
In this tab, you can set the values of L-parameters.



The description and functions of L-parameters see in par. 9.1.

19.1.4. "Measurement method" tab

In this tab, you can select the measurement method.



The description and functions of measurement methods see in par. 12.1.

19.1.4.1. Selection of measurement units

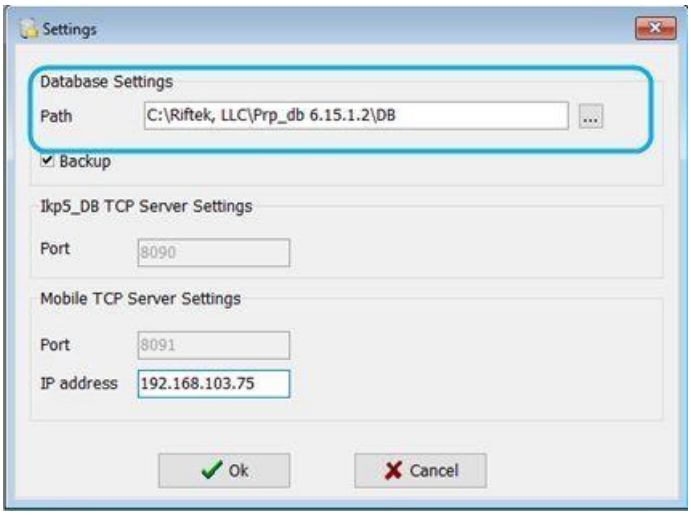
All parameters and measurement results can be in the Metric system (millimeters), or in the English system (inches).

To set the units of measurement, you need to select **mm** or **inches** in the **Units of measurement** field. After saving the changes, all information will be displayed in the selected units of measurement.

19.2. Database settings

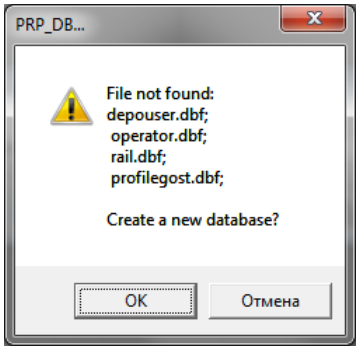
19.2.1. Setting the path to database

It is possible for the user to change the drive and the directory of the profiles database storage. In the main window, select **Settings > DB, Server settings**.

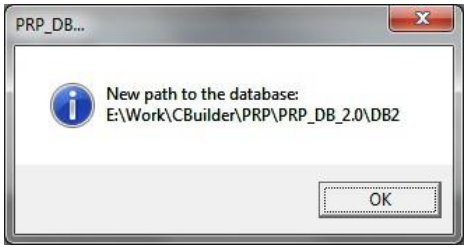


Next:

- Click **Ok**.
- Specify a new path to the database.
- Confirm the creation of a new database.

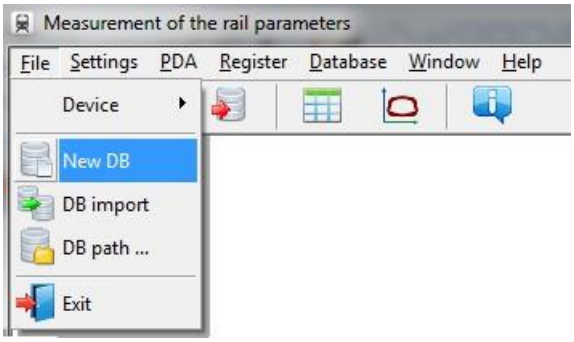


All database files will be copied to the specified path.



19.2.2. Creation of empty database

To create an empty database, select **File > New DB**.

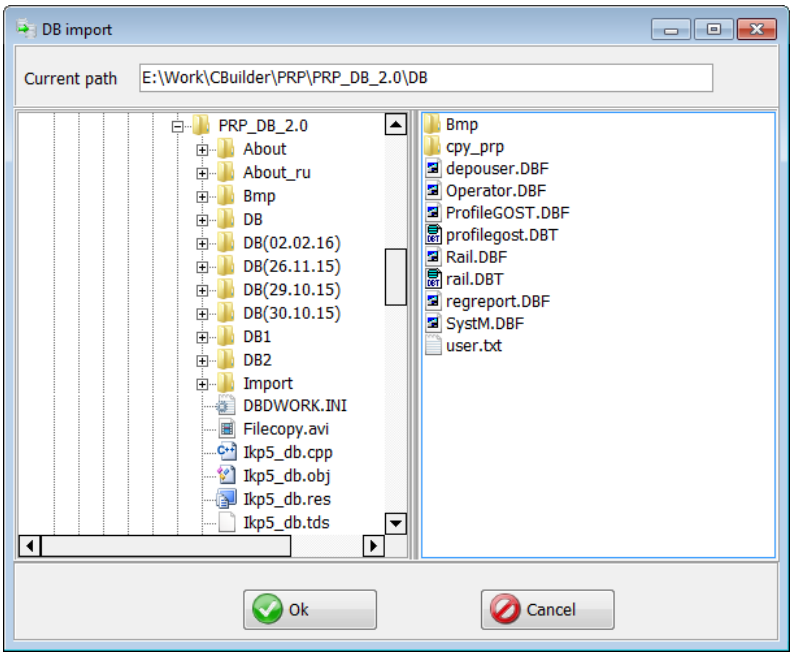


All data except the reference files will be deleted from the database. At the same time, the **DB(dd.mm.yy)** directory will be created in the installation directory whereto all the deleted data will be copied (**dd.mm.yy** – current date). If necessary, these data can be restored.

19.2.3. Import of database

To import data to the database from the other database, you need to:

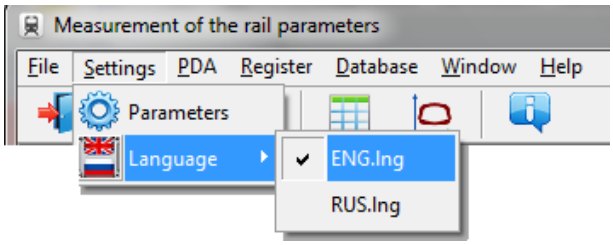
- Select **File > Import Data**.
- Select the directory with DB files in the left window. All files will appear in the right window:



- Click **OK** to import data.

19.2.4. Language selection

To change the language, select **Settings > Language** and select the required language support file.



19.2.4.1. Preparation and installation of the language support file

The user can change the language, form his own language support files as well as change/edit the terminology used. Language support files are located in the directory used in the process of installation. By default, the following directory is used: **C:\Program Files (x86)\Riftek, LLC\Ikp5_db\Language**.

The directory contains two files, **RUS.lng** and **ENG.lng**, to support Russian and English languages respectively.

To create the support file for any other language, it is necessary to:

- copy one of the existing files, for example - **ENG.lng**, under the other name, for example - **DEU.lng**;
- edit the renamed file by using any text processor, namely, change all terms and phrases to analogous ones from the required language;
- save the edited ***.lng** file in the **Language** directory.

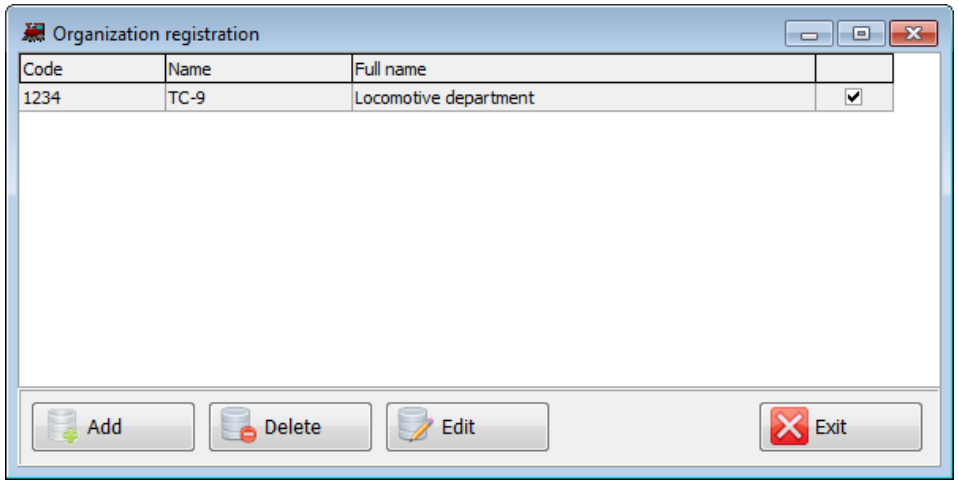
To edit the terminology, it is necessary to:

- edit the corresponding language file by using any text processor;
- save the edited ***.lng** file in the **Language** directory.

19.3. Registration data

19.3.1. Registration of organizations

To add/chose the user organization, select **Registration > Organization**. Subsequently, this information will be used in automatic generation of reports.

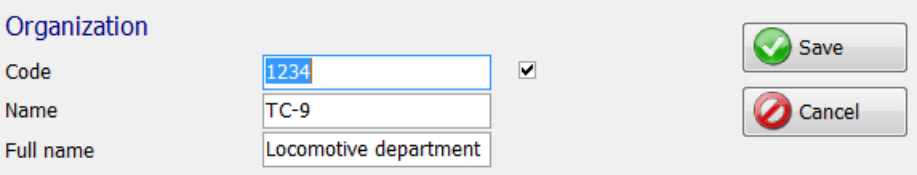


Buttons:

Add	Add a new organization
Delete	Delete the selected organization
Edit	Edit the selected organization
Exit	Exit the mode

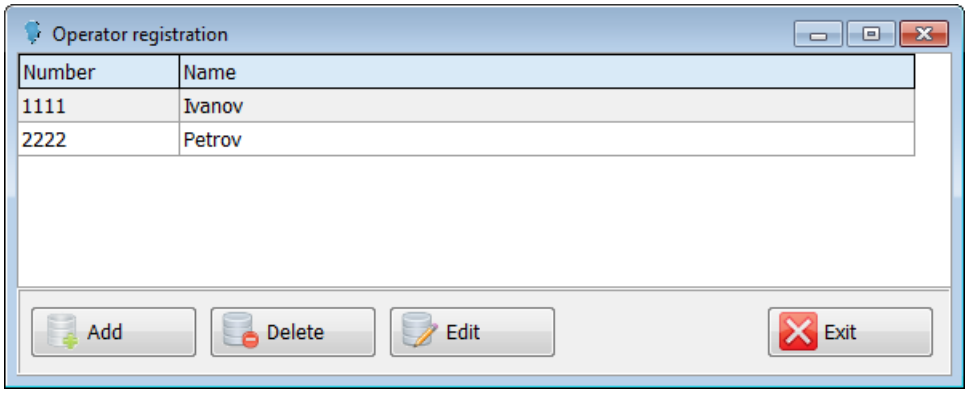
To select a current organization:

- Click **Edit**.
- Tick the depot.
- Click **Save**.



19.3.2. Registration of operators

Steps to follow: **Registration > Operator**. Operators data are used for identifying operators by **Number**.

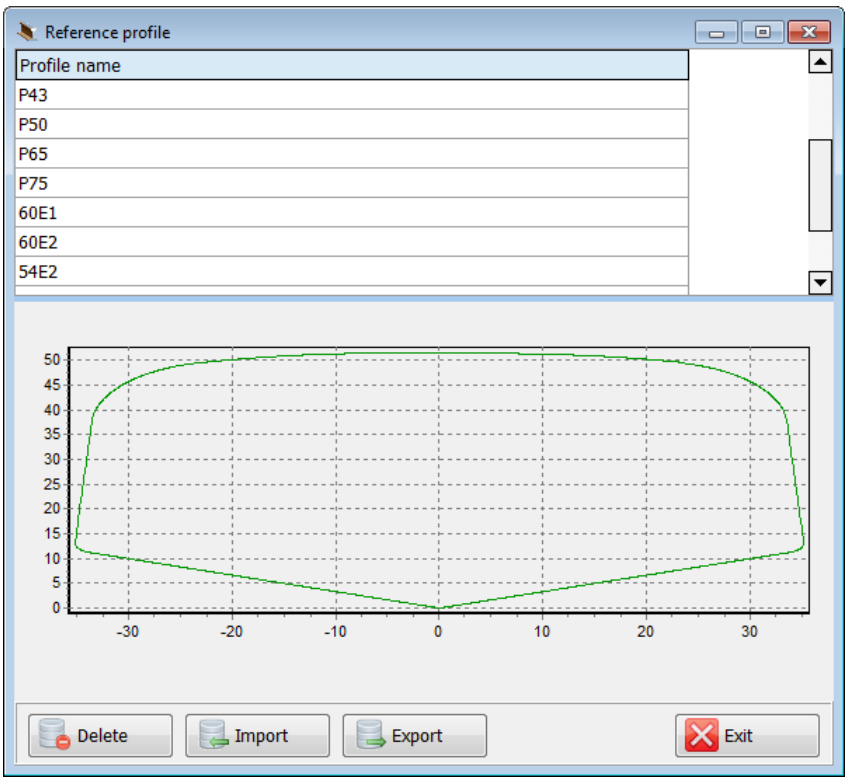


Functions of buttons are similar to those in par. 19.3.1.

19.3.3. Registration of reference profiles

The program comes with several preset profiles. In addition, the user can form a description of the required profile himself or request it from **RIFTEK** (free service).

To browse available profiles, select **Registration > Reference**:



The window of profiles displays the table with the list of reference profiles saved to database, and a graphical view of selected profile.

Buttons:

Delete	Delete the reference profile
Import	Import the reference profile from ***.ref** file
Export	Export the reference profile to ***.ref** file
Exit	Exit the mode

19.3.3.1. Request and registration of the profile file

To get the **.ref** file of the reference profile, send the drawing of profile to **RIFTEK** (info@riftek.com). Register the received **.ref** file as follows:

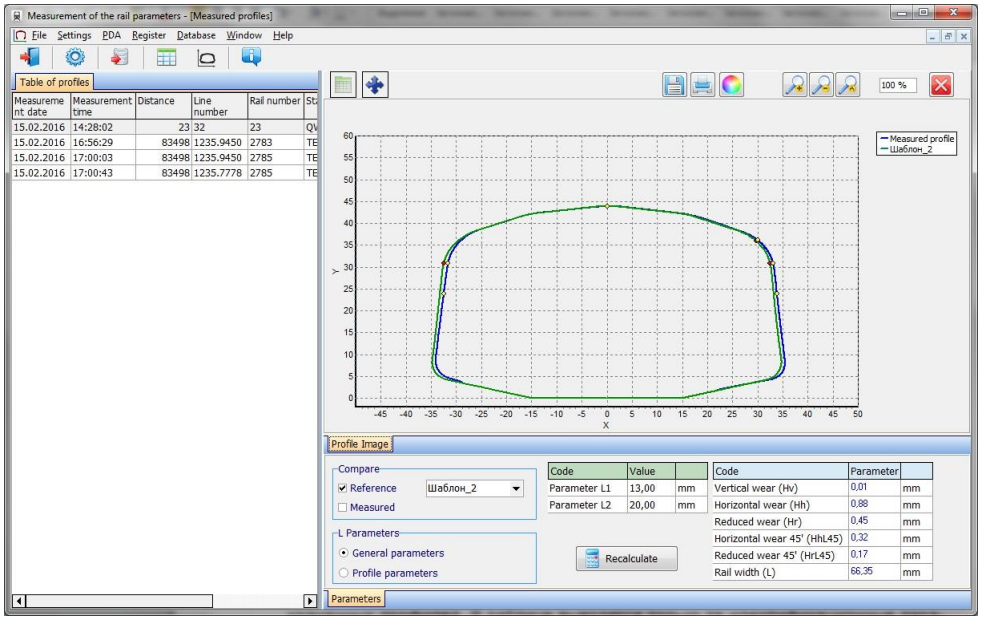
- Click **Import**.
- In the window appeared indicate the way to the **.ref** file.
- Click **Open**.

The profile will be added to the base of reference profiles.

20. Working with profilograms and wear calculations

20.1. Browsing the graph and profile coordinates

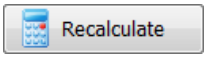
To browse the saved profiles, select **Database > Profiles**, or click the **Profiles** button -  .



At the left side of the window you can see the **Table of profiles** tab, which contains a list of saved profiles. The table displays only those identification parameters that were selected in the parameters window (see par. 19.1).

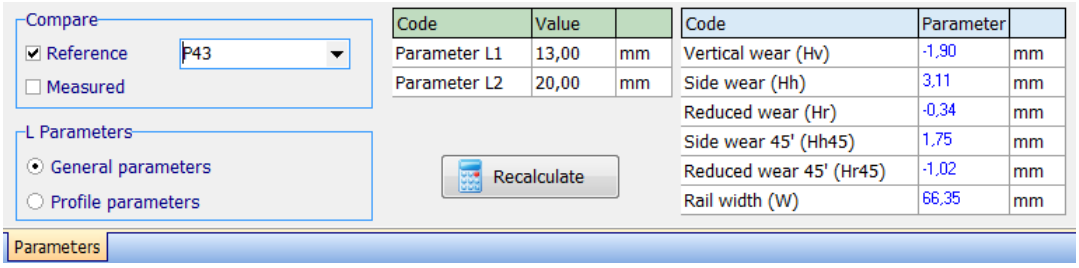
When selecting a profile, it is possible to browse a graphical image and geometric parameters of the measured rail. To browse the coordinates of the selected profile, you need to click the **Profile Values** button. After that, an additional tab will appear.

Buttons:

	Show/hide the **Profile Values** tab
	Show/hide the **Profile alignment** tab
	Save the profile image to file (**.bmp** file)
	Print the profile image
	Change the background color of the graph
	Zoom in/out the profile graph
	Calculate geometric parameters

20.2. "Parameters" tab

Calculated geometric parameters of the profile as well as L-parameters values are displayed on the **Parameters** tab, which is at the bottom of the window.



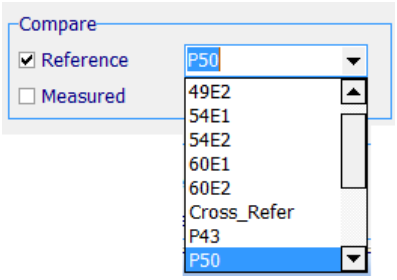
20.2.1. Selecting a profile to compare

There are two ways to compare:

- with the reference profile,
- with the measured profile.

To compare the measured profile with the reference one, it is necessary to tick the **Reference** box.

When comparing with the reference profile, select the required reference profile in the drop-down list.



To compare two measured profiles, it is necessary to tick the **Measured** box. The **Table of profiles** tab will show an additional table for selecting a profile to compare.

20.2.2. Selecting L-parameters values

When calculating the geometric parameters, the specified support points are used. There are two variants of L-parameters:

- General parameters
- Profile parameters

When selecting **General parameters**, values of L-parameters will be taken from the default parameters file (see par. 19.1.3).

When selecting **Profile parameters**, values of L-parameters will be taken from the profile file, i.e. the values, which were set in PDA when measuring the rail.

Values of L-parameters are displayed on the screen in the table of parameters.

Code	Value	
Parameter L1	13,00	mm
Parameter L2	20,00	mm

If necessary, it is possible to edit any value and to recalculate values of geometric parameters of the flange. To do it, click **Calculate**. Parameters of the measured profile and selected reference will be recalculated.

20.2.3. Geometric parameters of the profile

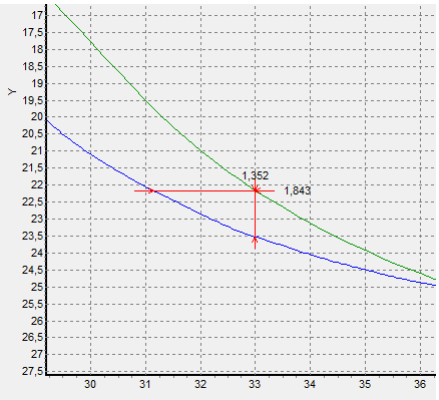
The table of calculated geometric parameters displays only those parameters, which were selected in the parameters window (see par. 19.1.2).

Code	Parameter	
Vertical wear (Hv)	-1,90	mm
Side wear (Hh)	3,11	mm
Reduced wear (Hr)	-0,34	mm
Side wear 45' (Hh45)	1,75	mm
Reduced wear 45' (Hr45)	-1,02	mm
Rail width (W)	66,35	mm

20.3. Wear calculation

20.3.1. Fast wear calculation

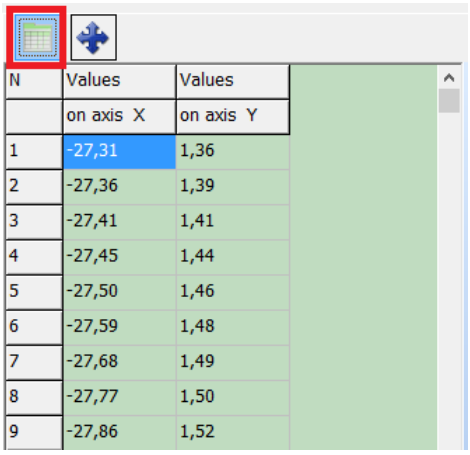
To obtain fast calculation of the profile wear at a certain point relative to the reference, put cursor bar to any of the profiles, and when a cross-like (+) mouse cursor appears press the left mouse key. The resulting screen will show the value of the coordinate difference between profiles taken along X- and Y-axes, as shown by arrows:



To remove size indication from the screen, it is necessary to put cursor to any of the profiles and press the right mouse key.

20.4. Browsing and saving a profile

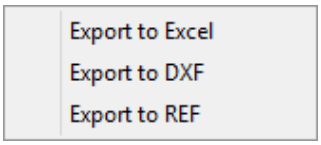
To browse the table of values, it is necessary to select **Profile Values > Wear**. The table will show deviations of the selected profile from the reference profile in two directions (X and Y).



N	Values on axis X	Values on axis Y
1	-27,31	1,36
2	-27,36	1,39
3	-27,41	1,41
4	-27,45	1,44
5	-27,50	1,46
6	-27,59	1,48
7	-27,68	1,49
8	-27,77	1,50
9	-27,86	1,52

20.4.1. Export to Excel, DXF, REF

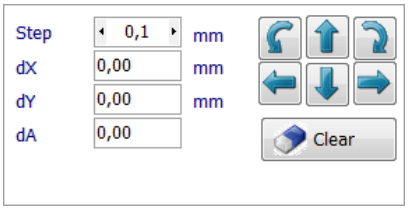
To export the table to the Excel or DXF format or to create the reference file (REF), it is necessary to right-click on the table. The pop-up menu will appear:



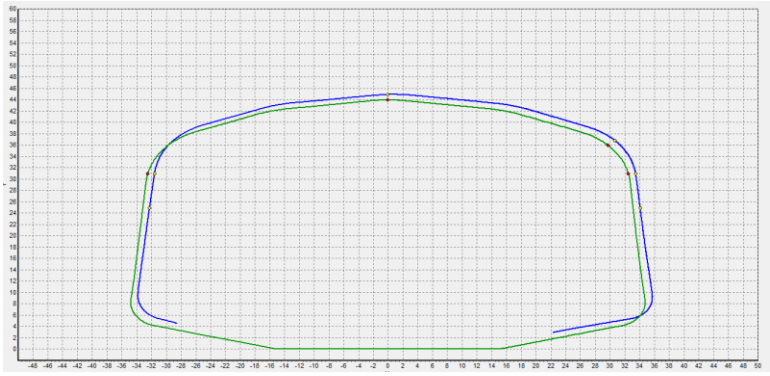
Select the needed menu item.

20.5. Alignment of profiles

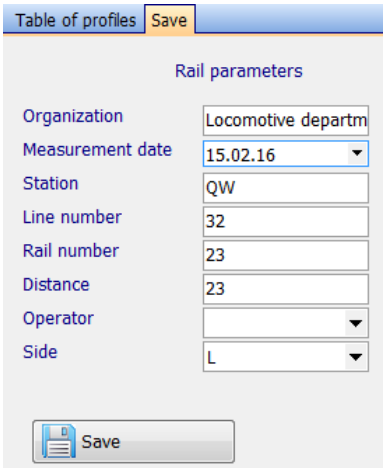
To align the profiles relative to the reference profile, you need to click the **Alignment** button. The program will display an additional tab, where you can move the selected profile to the required position by using the arrows.



Next, specify the translation step and move the profile by using the **Up/Down**, **Left/Right** buttons.



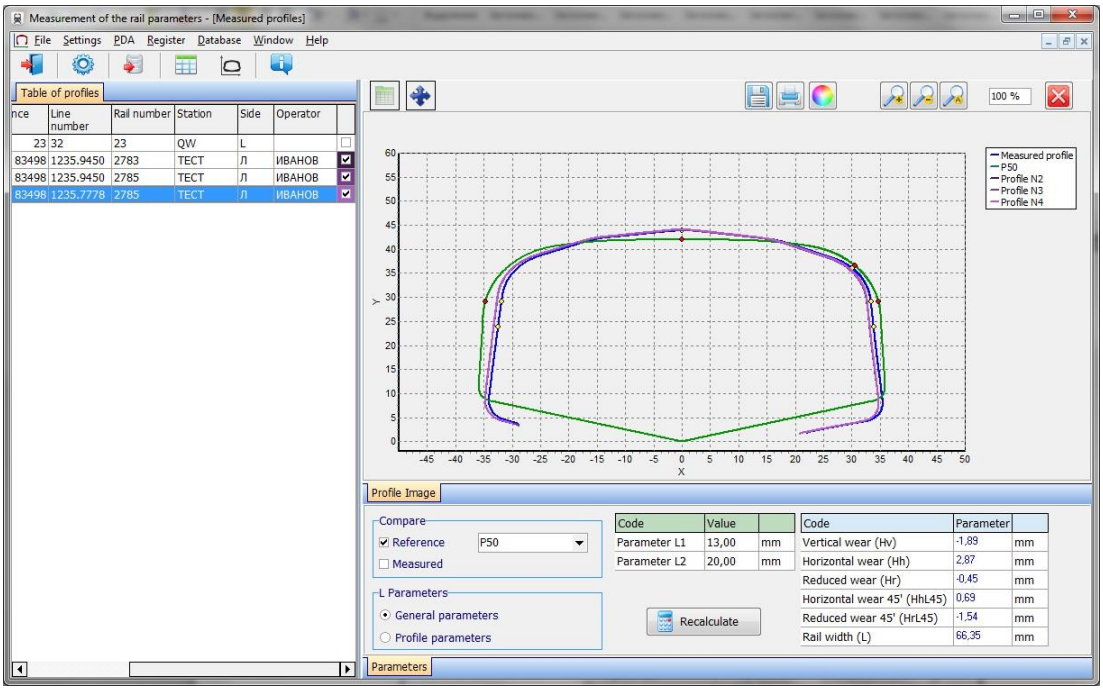
To save the changed profile, go to the tab of identification parameters of the profile and click **Save**.



To create a new profile, it is necessary to change the identification parameters of the profile.

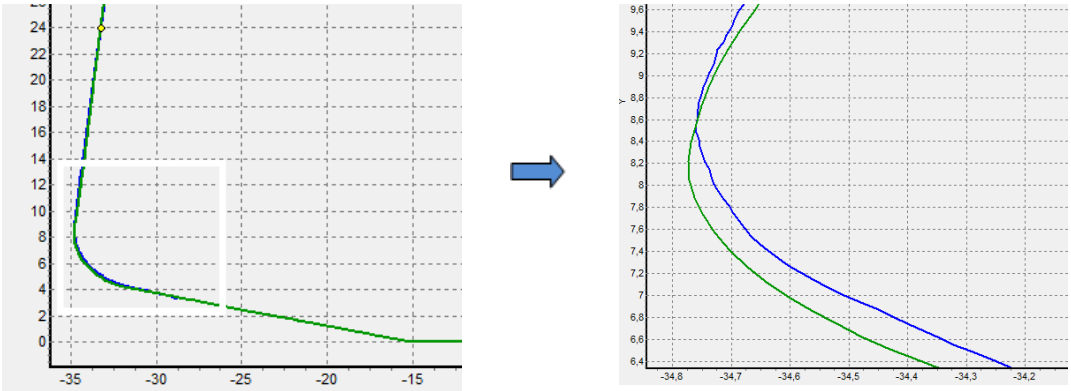
20.6. Superposition of profiles

To superimpose several changed profiles, you need to tick the required profiles in the left table. Selected profiles will be displayed in different colors.



20.7. Rescaling

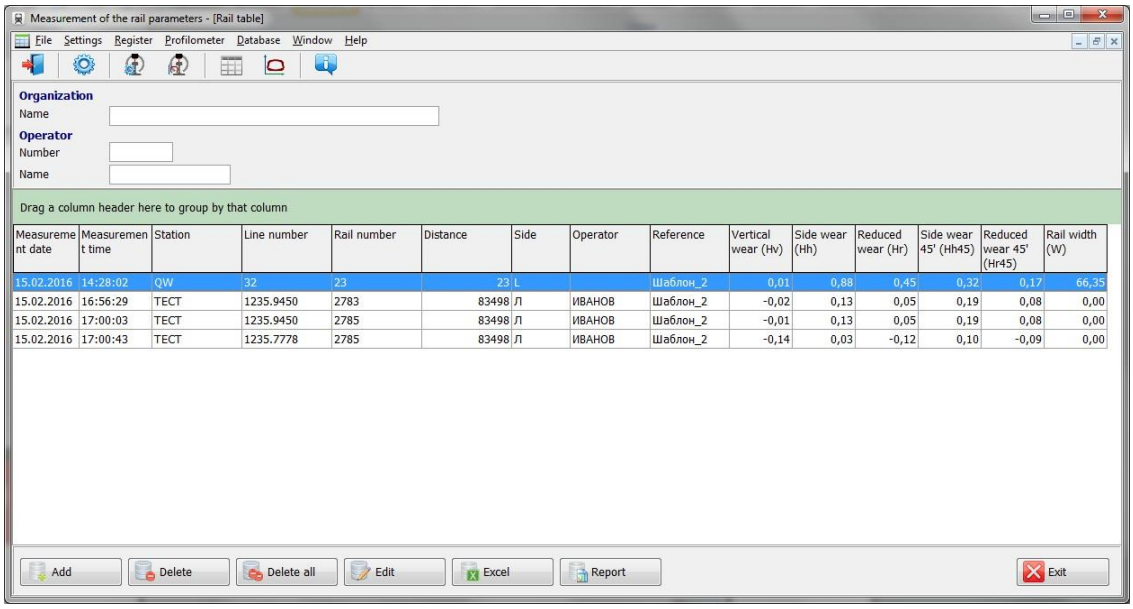
To change the image scale, mark a part of the image with the left mouse key, move the image by holding it with the right mouse key pressed, or with buttons **Increase** - , **Decrease** - and **Show all** - .



21. Viewing and editing data

21.1. Viewing and filtering data

Select **Database > Table** in the menu or click the **Table** button -  . The form with results will be as follows:



- ***Hide/show the field***

The table displays the identification and geometric parameters of the rail, which are selected for displaying in the parameters settings (see par. 19.1.1 and 19.1.2).

- ***Data sorting***

To sort data for any of the fields, click the left mouse key on the header of the field column:

Measurement date	Measurement time	Line number
15.02.2016	14:28:02	32
15.02.2016	16:56:29	1235.9450
15.02.2016	17:00:03	1235.9450
15.02.2016	17:00:43	1235.7778

Measurement date	Measurement time	Line number △
15.02.2016	17:00:43	1235.7778
15.02.2016	16:56:29	1235.9450
15.02.2016	17:00:03	1235.9450
15.02.2016	14:28:02	32

To cancel data sorting, press the **Ctrl** key and click the left mouse key on the header of the field column.

- ***Data filtering***

In order to filter data in any of the fields, click the left mouse key on the header of the field grouping, and select the required value in the emerged drop-down list:

Measurement date	Measurement time	Line number △
15.02.2016	17:00:43	
15.02.2016	16:56:29	
15.02.2016	17:00:03	
15.02.2016	14:28:02	

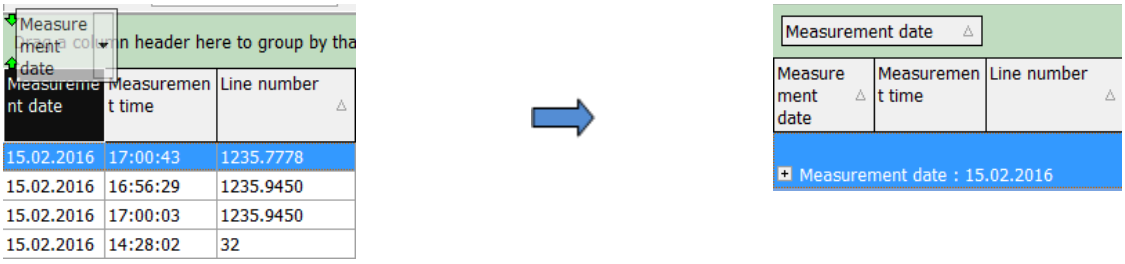
(All)
(Custom...)
☐ 1235.7778
☐ 1235.9450
☐ 32

Measurement date	Measurement time	Line number △
15.02.2016	17:00:43	1235.7778

To cancel filtering, all steps should be taken in the reverse order.

- ***Data grouping***

To group data for any of the fields, click the left mouse key on the header of the field column, and, with the mouse key pressed, drag it onto the table header:



- ***Changing of the field position order***

To change the field position, click the left mouse key on the header of the field column and, with the mouse key pressed, drag it to the required position:

Buttons:

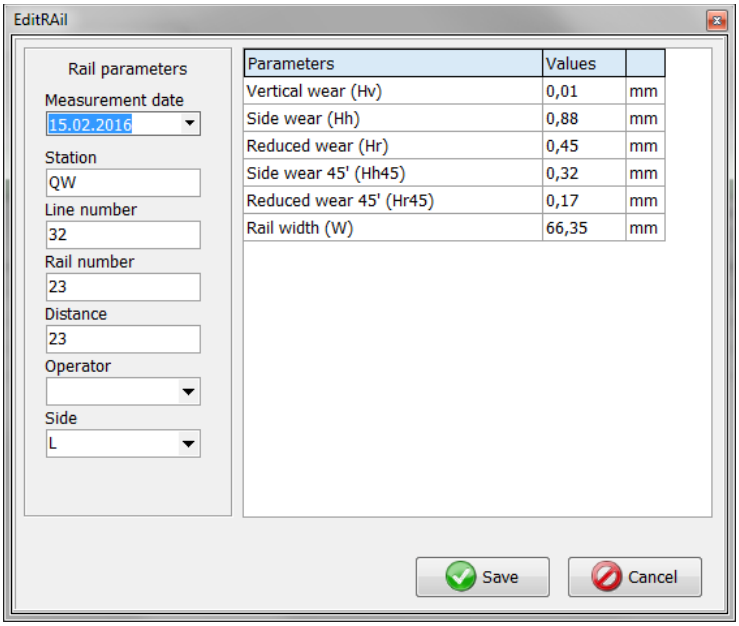
Add	Add a profile
Delete	Delete the selected profile
Delete all	Delete all profiles
Edit	Edit the selected profile
Excel	Export the profile coordinates to the Excel format
Report	Report preparation

21.2. Editing data

You can edit, add and delete data in/from the database.

- ***Editing data***

To edit the current entry, click Edit and input/change the values of parameters. Click the **Save** button.



- ***Adding data***

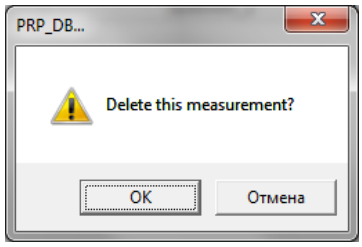
To add a new data entry, click 

and type the values of parameters. Click the **Save** button.

- ***Deleting data***

To delete the current entry, click 

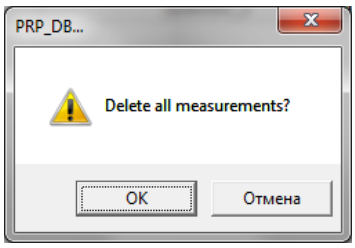
and confirm the deletion.



- ***Deleting all selected data***

If it is necessary to delete not only one entry but several entries combined by some condition, filter the data according to the corresponding attribute (see par. 22.1), click 

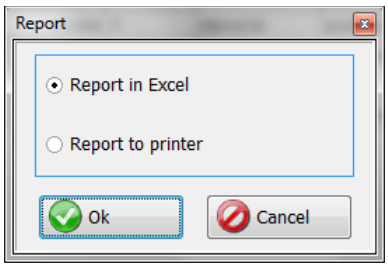
and confirm the deletion.



21.3. Report preparation

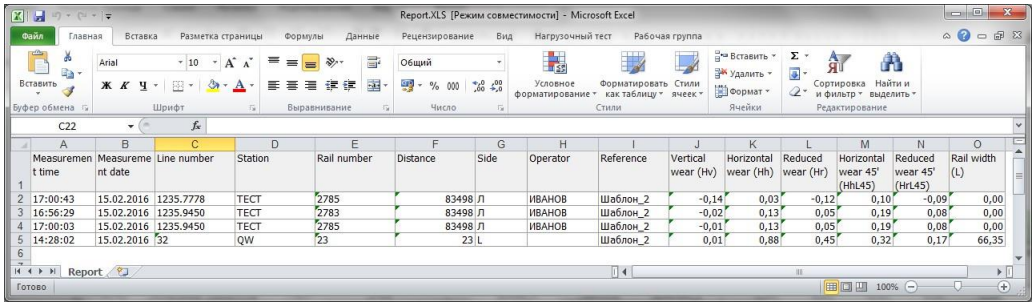
When staying in the mode of scanning and editing data, the user can prepare reports in **Excel, RTF, PDF** formats, or print out reports. When preparing the report, the sorting used at the moment is taken into account.

To generate a report, press the **Report** button. The program will offer to select the following options:



21.3.1. Excel-format report

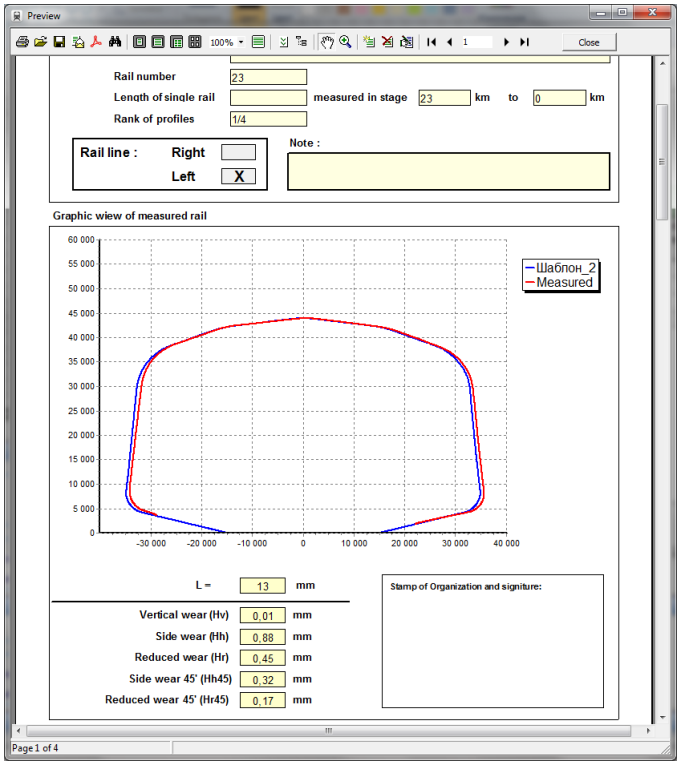
To prepare a report in Excel format, select **Report in Excel** and click **OK**.



	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
1	Measurement time	Measurement date	Line number	Station	Rail number	Distance	Side	Operator	Reference	Vertical wear (Hv)	Horizontal wear (Hh)	Reduced wear (Hr)	Horizontal wear 45' (HhL45)	Reduced wear 45' (HrL45)	Rail width (L)
2	17:00:43	15.02.2016	1235.7778	ТЕСТ	2785	83498	Л	ИВАНОВ	Шаблон_2	-0,14	0,03	-0,12	0,10	-0,09	0,00
3	16:56:29	15.02.2016	1235.9450	ТЕСТ	2783	83498	Л	ИВАНОВ	Шаблон_2	-0,02	0,13	0,05	0,19	0,08	0,00
4	17:00:03	15.02.2016	1235.9450	ТЕСТ	2785	83498	Л	ИВАНОВ	Шаблон_2	-0,01	0,13	0,05	0,19	0,08	0,00
5	14:28:02	15.02.2016	32	QW	23	23	L		Шаблон_2	0,01	0,88	0,45	0,32	0,17	66,35
6															

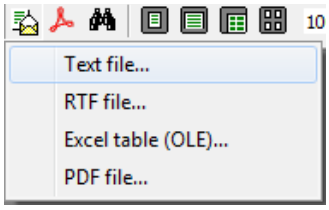
21.3.2. Report for printout

To prepare the report for printout, select **Report for printout** and click **OK**. Data will be presented in the form of report ready for printout.



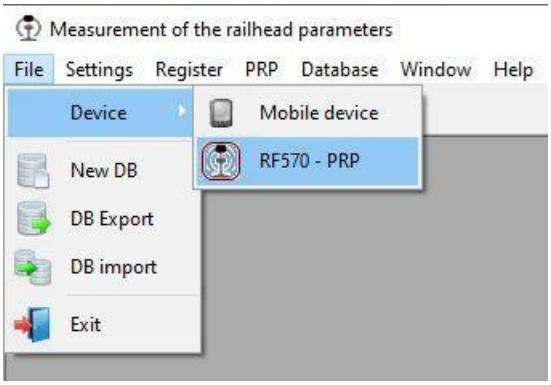
The top toolbar contains the following buttons for operating with reports:

- To printout the report, click  .
- To save in PDF format, click  .
- To save in Excel, RTF or PDF, click  and select the format you need:

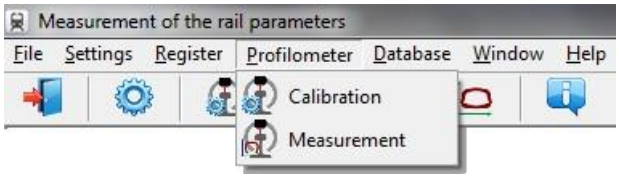


22. Taking measurements under PC control (without PDA)

The laser scanning module (RF570) can work under direct control of PC without PDA. To work under direct control of PC, it is necessary to select **File > Device > Profilometer**.



In the main menu of the program, the **PDA** tab will be replaced with the **Profilometer** tab.



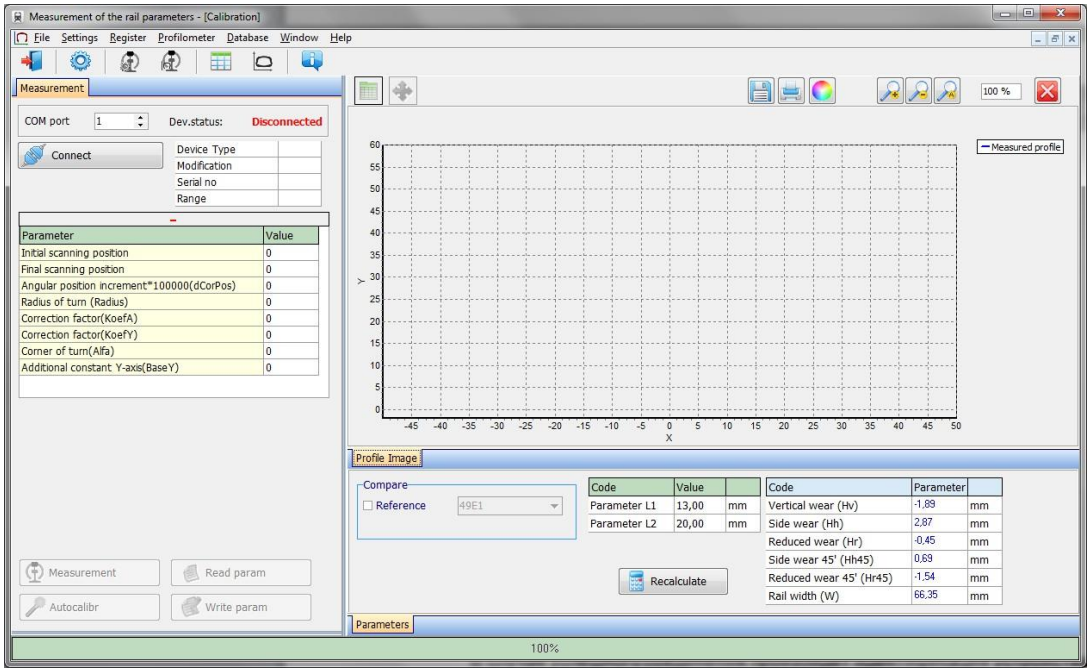
The menu contains two available items:

- Calibration
- Measurement

Before you start working with the profilometer, it is necessary to set the COM port for Bluetooth connection between the laser scanning module and PDA. The procedure is described in the User's manual that comes with the Bluetooth adapter.

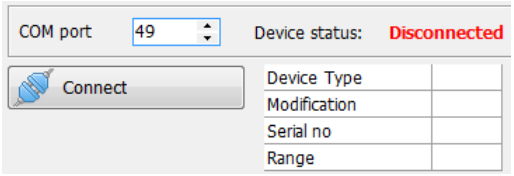
22.1. Calibration

To calibrate the device, select **Profilometer > Calibration**, or click  .

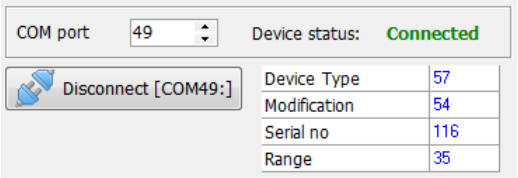


22.1.1. Bluetooth connection

Select the COM port and click the **Connect** button.



If the connection is successful, the device will be identified, and calibration parameters will be obtained. The status will be changed to **Connected**.



The table of calibration parameters:

Parameter	Value
Initial scanning position	1
Final scanning position	1955
Angular position increment*100000(dCorPos)	10856
Radius of turn (Radius)	5244
Correction factor(KoefA)	21
Correction factor(KoefY)	10000
Corner of turn(Alfa)	-87
Additional constant Y-axis(BaseY)	1000

Buttons:

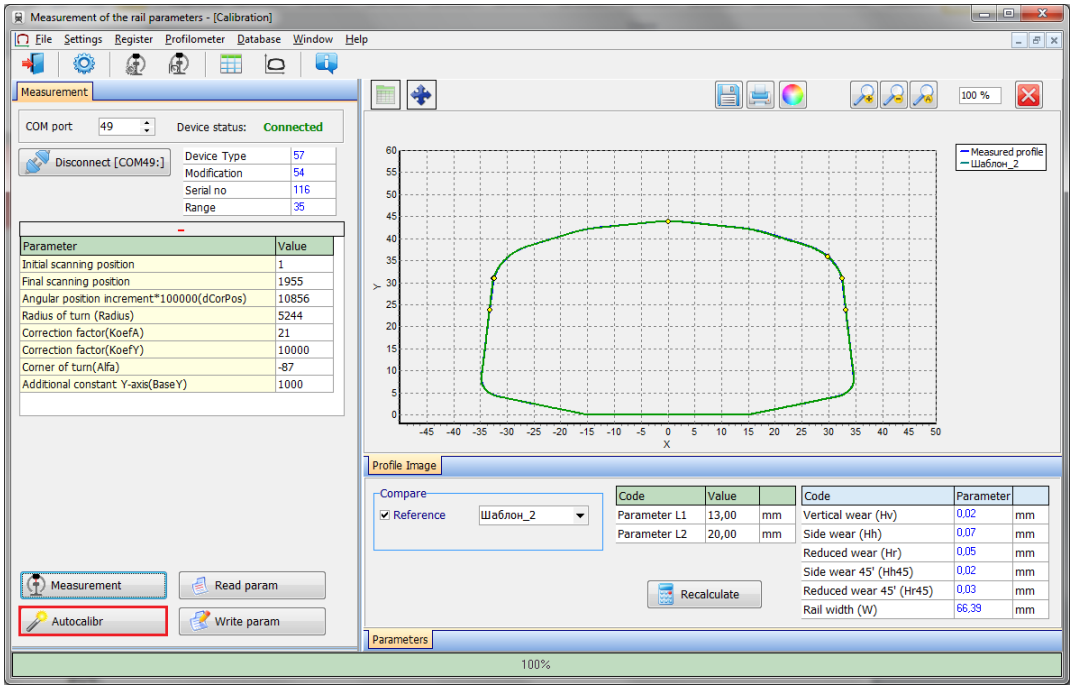
Measurement	Measurement

Read param	Reading calibration parameters
Write param	Writing calibration parameters
Autocalibr	Automatic setting of calibration parameters

The **Auto calibration** button will be active, if at least one measurement of the profile is performed and the reference profile is selected.

22.1.2. Calibration of the profilometer

- Place the profilometer on the calibration block.
- Select the reference profile from the list (**Compare > Reference**).
- Perform the measurement (the **Measurement** button)
- Perform the calibration (the **Autocalibr** button).
- Save calibration parameters (the **Write param.** button).



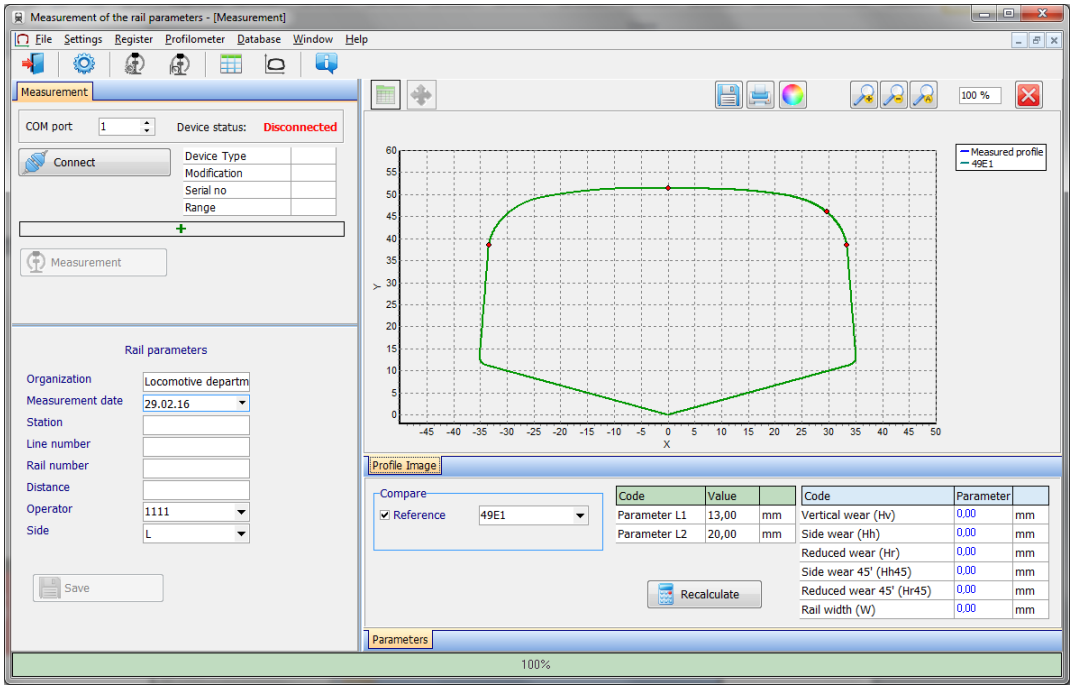
Calibration parameters can be set manually. To do it, click the left mouse key on the field of the required parameter value, and enter the new one.

Attention! Writing incorrect values of some parameters can lead to the incorrect work of the device.

Buttons functions, work with profiles and calculation of required parameters are described in par. 20.

22.2. Measurement by using PC

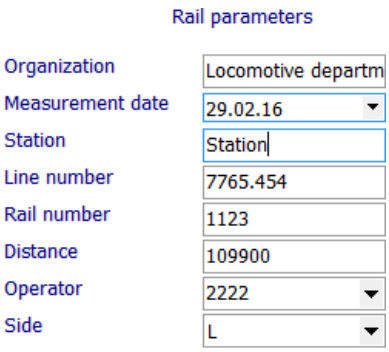
Select **Profilometer > Measurement**, or click  .

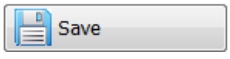


When the Bluetooth connection is established (see par. 22.1.1), the **Measurement** button is active.

22.2.1. Saving data

- Place the profilometer on the rail.
- Perform the measurement (the **Measurement** button).
- Enter the identification parameters of the rail.





- To save results, click **Save**.
- The measured profile will be saved to the database.

Button functions, work with profiles and calculation of required parameters are described in par. 20.

23. Annex 1. Charging procedure

- Switch off the PDA (laser module).
- Connect the charging device to PDA (laser module).
- Connect the charging device to 220V AC.
- Time of charging: PDA - 4 hours, laser module - 5 hours. Full-charge indication: PDA - blue LED is lit; laser module - green LED is lit.
- Disconnect the charging device from 220V AC.
- Disconnect the charging device from PDA (laser module).

Attention! Please follow the sequence of these points.

24. Annex 2. Testing and calibration

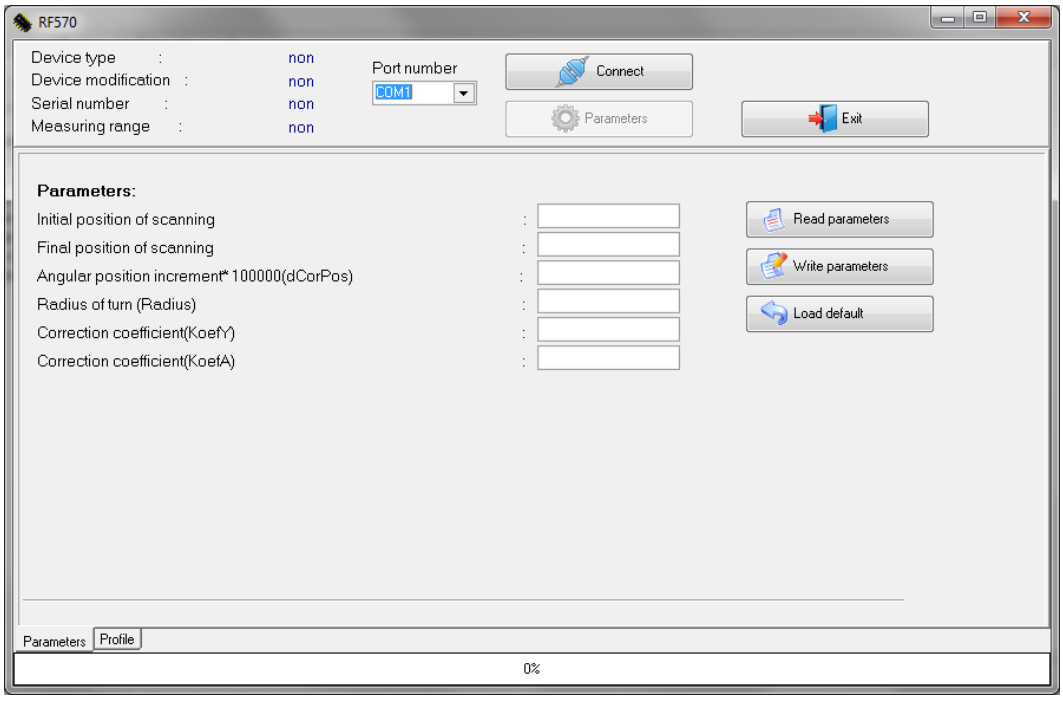
We can supply the profilometer complete with the RF570.20.100 calibration-rail simulation unit (Fig. 1A) and the **RF570Calibr** calibration program, which are designed for periodic testing and calibration of the profilometer.

Instead of the calibration unit, use can be made of the rail with known profile entered to the database.

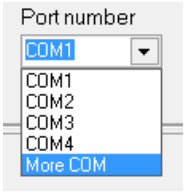
Before start the testing and calibration process, it is necessary to set the COM port for Bluetooth connection between the laser scanning module and PDA. The procedure is described in the user manual that comes with the Bluetooth adapter.

24.1. Preparation for testing/calibration

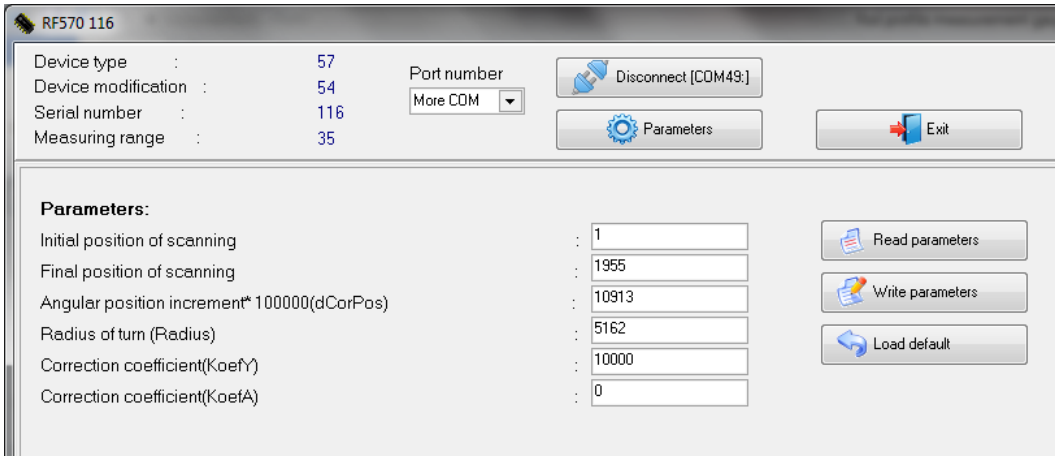
- Install the **RF570Calibr** program on the PC.
- Install Bluetooth-connection between the scanning module and PC.
- Place the profilometer on the calibration unit.
- Start the **RF570Calibr** program.



- To establish the Bluetooth connection, select the required port.

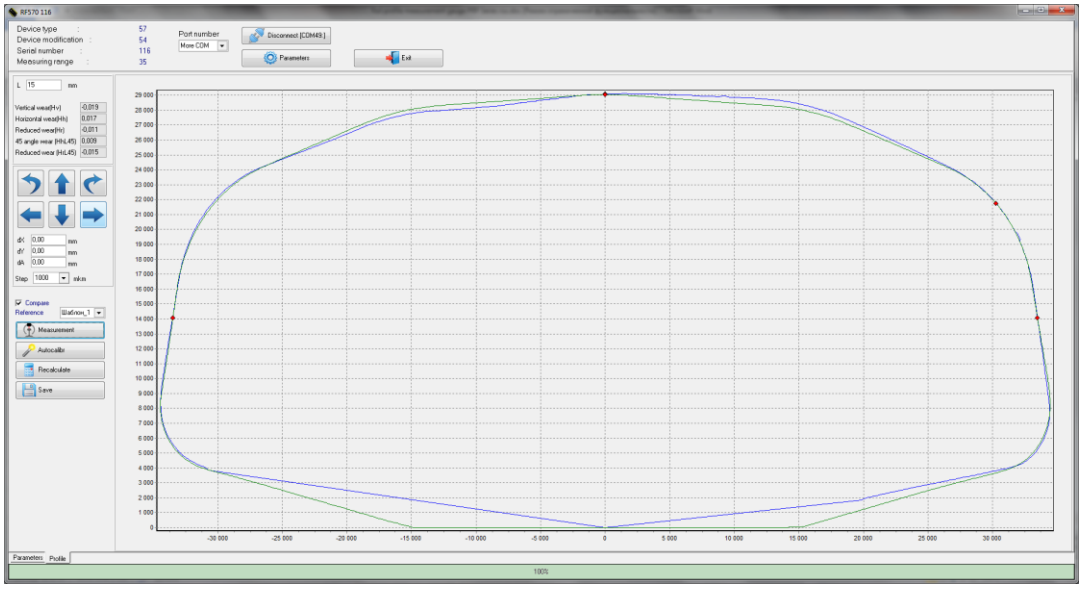


The device will be identified, and calibration parameters will be read.



To perform the measurement:

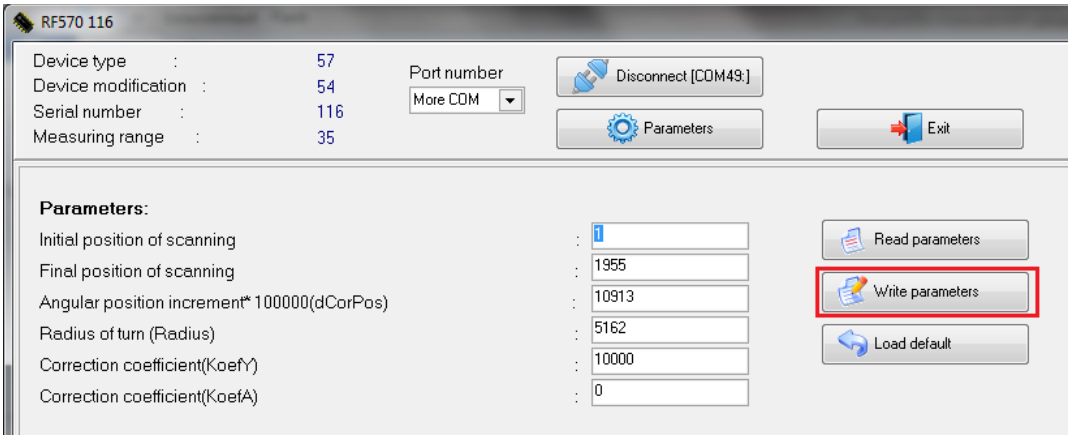
- Go to the **Profile** tab.
- Select the reference profile: tick **Compare** and select the required reference profile from a drop-down list.
- Click the **Measurement** button.



24.2. Calibration

To carry out the automatic calibration, follow the steps below:

- Select the reference profile from the list.
- Perform the measurement (the **Measurement** button).
- Perform the calibration (the **Autocalibr** button).
- Go to the **Parameters** tab and save parameters (the **Write parameters** button).



If, for some reason, the parameters have incorrect values (negative or zero), you must restore the factory settings by pressing the **Load default** button. After that, recalibrate the profilometer.

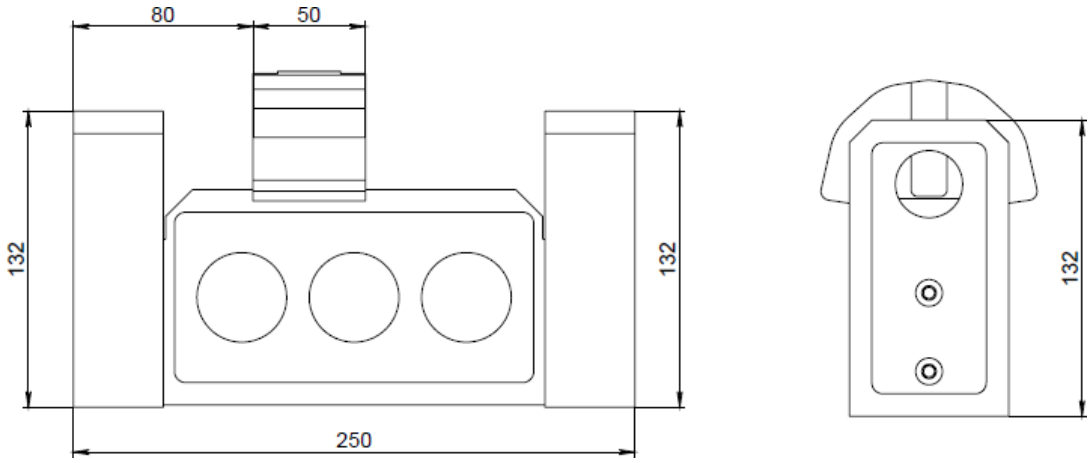


Figure 1A

25. Warranty policy

Warranty assurance for the Portable Rail Profilometer PRP Series – 24 months from the date of putting in operation; warranty shelf-life – 12 months.

26. Revisions

Date	Revision	Description
30.05.2012	1.0.0	Starting document.
15.03.2018	2.0.0	Updated the PRP description and the software description.

27. Distributors

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28. 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 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.

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.