PORTABLE RAIL PROFILOMETER

PRP Series

User's manual

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</table>
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).

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:

![Warning Label]

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 laser rail profilometer (PRP) is designed for non-contact registration of cross-section of the railhead acting face. The main functions of PRP are as follows:
- obtaining the information on the cross-section profile of the working railhead surface;
- full profile scanning and analysis of the railhead acting face;
- visualization of the combined graphical images of actual and new cross-section railhead profiles on the display of system unit.

4.1. **Controlled parameters**

- Railhead vertical wear (Hv).
- Side wear (Hh), that is measured 13 mm lower the top of railhead and side wear (Hh₉₅), 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 + 0,5Hh₉₅.
5. Basic technical data

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Railhead vertical wear, mm</td>
<td>from -15.0 to +20.0</td>
</tr>
<tr>
<td>Lateral railhead wear, mm</td>
<td>from -15.0 to +20.0</td>
</tr>
<tr>
<td>Redused railhead wear, mm</td>
<td>up to 20.0</td>
</tr>
<tr>
<td>Scanning angle inside the rail track, degrees</td>
<td>108</td>
</tr>
<tr>
<td>Scanning angle outside the rail track, degrees</td>
<td>108</td>
</tr>
<tr>
<td>Measurement error, not more than, mm</td>
<td>±0.1</td>
</tr>
<tr>
<td>Scanning time, sec</td>
<td>10-12</td>
</tr>
<tr>
<td>Digital readout device (PDA) dimensions, mm</td>
<td>Fig. 5</td>
</tr>
<tr>
<td>Laser module dimensions, mm</td>
<td>Fig. 3</td>
</tr>
<tr>
<td>Power supply, laser module</td>
<td>3.7V Li-ion battery, 6800mAh</td>
</tr>
<tr>
<td>Power supply, PDA</td>
<td>3.7V Li-polymer battery, 3300mAh</td>
</tr>
<tr>
<td>Number of measurements that can be taken before battery recharge, not less than</td>
<td>500</td>
</tr>
<tr>
<td>PDA memory capacity</td>
<td>100 000 measurements</td>
</tr>
<tr>
<td>Interface between a laser module and PDA</td>
<td>Bluetooth</td>
</tr>
</tbody>
</table>

6. Complete set to be supplied

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

7.1. Basic components of the device and their functions

Figure 1 shows basic components of the device.

(1) PDA
(2) Laser scanning module
(3) Charging device

7.1.1. Laser scanning module

The module is intended for laser scanning of rail surface.
(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.

7.1.2. Digital readout device (PDA)

Digital readout device (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.
8. Operating principle

Operator mounts the laser scanning module onto the railhead to be measured. Having received a command from PDA or PC, the laser module performs non-contact scanning of rail surface. Measurement results (geometric parameters and profile of the surface) are displayed on PDA, can be saved in the PDA memory, and transferred to the PC database. Simultaneously, additional parameters can be saved: date, operator number, permanent way division, 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 6 and is defined by L-parameters. Values of L-parameters preset in PDA are given in Table 1 and can be changed by user.
### 9.2. Geometric parameters of the rail under control

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

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Designation</th>
<th>Calculation method</th>
</tr>
</thead>
<tbody>
<tr>
<td>Railhead vertical wear</td>
<td>Hv</td>
<td>is calculated as a difference between the measured value and nominal value of new rail in direction of rail axis of symmetry</td>
</tr>
<tr>
<td>Lateral railhead wear</td>
<td>Hh</td>
<td>is measured at the height of L1 = 13 mm from the rolling surface of rail head</td>
</tr>
<tr>
<td>Lateral railhead wear at the angle of 45 degrees</td>
<td>Hh45</td>
<td>is measured at 45 degrees relative to the rail symmetry axis at the point that passes through the center of lateral working fillet</td>
</tr>
<tr>
<td>Reduced railhead wear</td>
<td>Hr</td>
<td>is determined as vertical one + the half of lateral wear, namely: Hr = Hv + 0.5Hh</td>
</tr>
<tr>
<td>Reduced railhead wear at 45 degrees</td>
<td>Hr45</td>
<td>is determined as vertical one + the half of lateral wear at 45 degrees, namely: Hr45 = Hv + 0.5Hh45</td>
</tr>
<tr>
<td>Railhead width</td>
<td>W</td>
<td>is measured at the height of L2 from the rolling surface of rail head</td>
</tr>
</tbody>
</table>

### 10. Measurement procedure

#### 10.1. Activation
- Switch on the laser module by pressing the button (1), Fig. 2.
- Switch on the PDA by pressing the button (1), Fig. 4. The PDA screen will show the main program window containing: main menu; indicators of PDA and laser module charging degree; indicator of Bluetooth connection:
After the laser module is switched on, some time will pass until automatic wireless communication is set between the profilometer and the PDA, which is accompanied by blinking of a blue LED on the laser module. The LED goes out when the link is established.

The main window of the program is updated:

- The Measurement button, indicator of Bluetooth connection, laser module serial number and charging degree are active.

### 10.2. Measurement

There are two types of measurements:
1. Measurements without saving the results to database.
2. Measurements with saving results to database.

The measurement procedure by using type 2 is described in par. 16. How to select the measurement type, see par. 11.1.

Measurement by using the scheme (type 2) is used for full-featured work with the profilometer with maintaining the database of measurements.

**Attention!**
When installing the laser scanning module onto the wheel, avoid of strong impacts of its supports, because it can lead to incorrect operation of the profilometer.

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, it is necessary to:
- Fix the laser module on the rail by means of special clamps.
- Press the Measurement button on the PDA display.
- With the Measurement button pressed, the laser module will scan the rail surface. During scanning time of about 10-12 seconds, red LED is lit.
- When scanning is competed, the PDA will show values of measured parameters selected for presentation.
To look at the rail profile, press the Profile button, and the PDA will display the scanned rail profile as well as measured parameters:

### Rail parameters

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hv</td>
<td>-0.01 mm</td>
</tr>
<tr>
<td>Hh</td>
<td>0.01 mm</td>
</tr>
<tr>
<td>Hr</td>
<td>-0.01 mm</td>
</tr>
<tr>
<td>Hh45</td>
<td>0.08 mm</td>
</tr>
<tr>
<td>Hr45</td>
<td>0.03 mm</td>
</tr>
</tbody>
</table>

### PDA program setting

The Device window:

<table>
<thead>
<tr>
<th>Button</th>
<th>Assignment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measure type</td>
<td>Measurements with / without saving results to database</td>
</tr>
<tr>
<td>Units</td>
<td>Millimeters/inches</td>
</tr>
<tr>
<td>Date/Time</td>
<td>Date/time setting</td>
</tr>
<tr>
<td>Device type</td>
<td>Device selection</td>
</tr>
<tr>
<td>Language</td>
<td>Language selection</td>
</tr>
<tr>
<td>Synchronization</td>
<td>Synchronization with PC</td>
</tr>
</tbody>
</table>
11.1. Measurement type

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

To set the measurement type, press the Measure type button. Then select the measurement type: Rapid measurement or Measurement with saving. Press the Save button.

---

11.2. 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, press the Units button. Then select Millimeters (mm) or Inches (in), and press Save.
11.3. **Date and time settings**

Press the **Date/Time** button and set the date and time by using the buttons **.**

Press the **Save** button.

11.4. **Device selection**

The PDA Bluetooth-connection is automatically configured to work with the laser scanning module supplied with the PDA.

To connect another device, press the **Device type** button. You will see 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 press the **Select** button. The PDA will try to connect to the selected device.

To add a new device, press the **Add** button. The **Device searching** window will appear:
To search for devices, press **Start** and wait for the search to complete:

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

Select the device and press **Save**.

You can delete the device that you do not use anymore by pressing the **Delete** button.
11.5. Language setting

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, press the Language button. Next, select the required language support file and press the Select button.

If no such file is available, it is necessary to use the new files preparation procedure, which is described in par. 19.2.4.1., and then load a new language file from PC to PDA as it is shown in par. 20.1.2.

11.6. Synchronization with PC

To transfer data between PDA and PC, it is necessary to synchronize them. There are two ways of synchronization via 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, press the Synchronization button in the Device window. Next, select the required type and press Save.

To apply the changes, PDA will prompt you to restart. If you do not need to sync the PDA with PC currently, you can restart the PDA later.
12. Measurement parameters setting

The **Parameters** window:

<table>
<thead>
<tr>
<th>Button</th>
<th>Assignment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Settings</td>
<td>Calculation methods setting</td>
</tr>
<tr>
<td>Show param.</td>
<td>Selection of displayed parameters</td>
</tr>
<tr>
<td>L Parameters</td>
<td>L Parameters setting</td>
</tr>
</tbody>
</table>

12.1. Calculation methods setting

To select the calculation method, press the **Settings** button. The following window will appear:
**Side wear from:**

<table>
<thead>
<tr>
<th>Reference profile</th>
</tr>
</thead>
<tbody>
<tr>
<td>The wear is measured at the height L1 from the rolling surface of the reference head.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Measured profile</th>
</tr>
</thead>
<tbody>
<tr>
<td>The wear is measured at the height L1 from the rolling surface of the measured rail head.</td>
</tr>
</tbody>
</table>

**Side wear:**

<table>
<thead>
<tr>
<th>Inner</th>
</tr>
</thead>
<tbody>
<tr>
<td>The side wear is measured from the inside of the rail.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Outer</th>
</tr>
</thead>
<tbody>
<tr>
<td>The side wear is measured from the outside of the rail.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Inner&amp;Outer</th>
</tr>
</thead>
<tbody>
<tr>
<td>The side wear is measured from the inside and outside of the rail. The result is the maximum wear.</td>
</tr>
</tbody>
</table>

**Auto-alignment:**

<table>
<thead>
<tr>
<th>Yes</th>
</tr>
</thead>
<tbody>
<tr>
<td>After the measurement, the profile will be aligned relative to the selected reference profile.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>After the measurement, the alignment is not performed. The profile inclination angle and its parameters are calculated based on the device calibration.</td>
</tr>
</tbody>
</table>

After selecting the required parameters, press the **Save** button to save changes.

### 12.2. Selection of displayed parameters

To enter the mode, press the **Show param.** button.

<table>
<thead>
<tr>
<th>Name</th>
<th>Show/Hide</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vertical wear [Hv]</td>
<td>✔</td>
</tr>
<tr>
<td>Side wear [Hh]</td>
<td>✔</td>
</tr>
<tr>
<td>Reduced wear [Hr]</td>
<td>✔</td>
</tr>
<tr>
<td>Side wear 45° [Hh45]</td>
<td>✔</td>
</tr>
<tr>
<td>Reduced wear 45° [Hr45]</td>
<td>✔</td>
</tr>
<tr>
<td>Rail width [W]</td>
<td>✔</td>
</tr>
</tbody>
</table>

To select/deselect the parameter to display, double-click in the **Show/Hide** column opposite to the required parameter. After selecting, you need to press **Save**.
12.3. **L-parameters setting**

To set L-parameters, press the **L Parameters** button.

![L-parameters](image)

To edit the parameters, double-click in the **Value** column opposite to the required parameter, and enter a new value in the **Data Input** window. Press the **Enter** button.

![Data Input](image)

When you have set all parameters, press the **Save** button to save them.

13. **Setting the database parameters, tolerances and references**

The **Settings** window:

![Settings](image)
13.1. 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, press the **Database** button.

To create a new database, press 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:

Press the **Enter** button - 🔄.
To select a database from a list, activate the line and press **Select**. The selected file will be marked with "•".
To delete the database file, activate the line and press **Delete**. If you delete the current database, the error message will appear.

### 13.2. Reference profile selection and installation

The program allows to compare the scanned profile of the rail with the reference profile. To select the reference profile, press the **Reference** button.

To select the reference file, activate the line and press **Select**. The selected file will be marked with "•".
To delete the reference file, activate the line and press **Delete**. If you delete the current reference, the error message will appear.

#### 13.2.1. Writing the reference profile to the database

Reference profiles are stored in the PDA database as profile description files with .ref extension. The PDA is supplied with several pre-installed profiles.
If there is no required reference profile in the database, the user can request the missing profile from **RIFTEK** (free service), and then transfer the received profile to the PDA.

### 13.3. Setting of tolerances

The program automatically controls measured geometric parameters for going out beyond the tolerances set. 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, press the **Tolerance** button.
The table will show tolerances only for the selected geometric parameters.
The red color indicates the maximum critical values of deviation from the reference parameters.

To select the group of tolerances, activate the line and press Select. The selected file will be marked with "•".
To delete the tolerance, activate the line and press Delete. If you delete the current tolerance, the error message will appear.
To edit the tolerance, activate the line and press Edit.
To add a new tolerance, activate the line with the type name and press Add. You will see on the screen:

To change the type name, it is necessary to set cursor in the Name of Tolerance field, and to enter a new name in the appeared window. Then press the Enter button.
To edit the value, it is necessary to double-click on the Max column opposite to the specific parameter, and to enter a new value in the emerged window. Then press the Enter button. If any parameter has a zero value, the tolerance will not be used.
To save changes, press Save.

14. **Updating of PDA software**

You can view the software version in the main program window:

Procedure of PDA software updating is described in par. **20.1.5**.
15. **Shutdown**

To shutdown the PDA, press the **Shutdown** button - .

16. **Measurements with database maintenance**

There are two types of measurements:
1. Rapid measurements without saving the results.
2. Measurements with saving results to the database.

Procedure of rapid measurements is described in par. 10.2. How to select the measurement type, see par. 11.1.

When Bluetooth-connection is established, you can start to measure by pressing the **Measurement** button in the main program window. The window of rail parameters will appear on the screen:

It is necessary to enter parameters and then to press **Save**. The PDA will show the measurement window:
16.1. Measurement

Press the **Measure** button. Upon completion of the scanning process, the PDA will show the values of selected geometrical parameters.

When the value is beyond the tolerances, it will be highlighted in red:

The program allows to display only parameters of the measured profile. To hide the reference values, you need to untick the **Reference** box.

To view the profile, press the **View** button. The scanned profile and the selected reference profile will be displayed on the PDA screen.

For more information, see par. 17.2.

To repeat the measurement, press the **Measure** button.
When a satisfactory result is obtained, press the **Save** button to save it. When you measure the rail that was already measured, the program prompts you to replace the existing database file with the new one.

![Rail parameters screenshot]

### 17. Browsing the database

To browse the saved data, press the **Profiles** button in the main window. The PDA screen will display information about the current database, quantity of saved profiles, table with saved profiles, and measured values of selected parameters.

![Profiles screenshot]

**Buttons:**

- Browse the profile of selected wheel
- Delete the selected wheel
- Add a filter
- Delete a filter
- Save the reference file

#### 17.1. Data filtering

To apply filtering, press the **Filter** button and select the fields by which the data will be filtered.

An example of filtering by the **Line number** parameter is given below.
The filtered field will be highlighted in yellow:

17.2. **Visualization of the rail profile**

To browse the rail profile, you need to press the **Profile** button - ![Profile button]. The scanned rail profile and the profile of selected reference will be displayed on the PDA screen.

**Buttons:**

- ![Zoom in]
- ![Zoom out]
- ![Standard image scale]
18. Installation of software on PC and startup

18.1. Installation of database support software

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 PDA and PC

There are two ways of synchronization via USB cable to transfer data between PDA and PC:

- MS ActiveSync
- Mass Storage

When you select MS ActiveSync, synchronization with PC is performed via the ActiveSync software (Windows XP), or via Windows Mobile Device Center (Windows 7), which must be installed on PC. The installation files you can find on the supplied CD.

It is necessary to select MS ActiveSync as the synchronization type of PDA (see par. 11.6.).

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

It is necessary to select Mass Storage as the synchronization type of PDA (see par. 11.6.).

To check if the MS ActiveSync synchronization is correct, switch on the PDA and connect it to the USB port of the PC by the supplied cable. If the connection is successful, the message will appear on the screen:
18.3. Program startup

To start the program, click Start > All programs > Riftek, LLC > PRP_DB > Prp_db.exe. View of the main program window is shown below.

19. User settings of the program

19.1. Parameters setting

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 File > Path to DB...

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: \Program Files (x86)\Riftek, LLC\kp5_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/choose the user organization, select Registration > Organization. Subsequently, this information will be used in automatic generation of reports.
Buttons:

<table>
<thead>
<tr>
<th>Add</th>
<th>Add a new organization</th>
</tr>
</thead>
<tbody>
<tr>
<td>Delete</td>
<td>Delete the selected organization</td>
</tr>
<tr>
<td>Edit</td>
<td>Edit the selected organization</td>
</tr>
<tr>
<td>Exit</td>
<td>Exit the mode</td>
</tr>
</tbody>
</table>

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:**

<table>
<thead>
<tr>
<th>Button</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image" alt="Delete" /></td>
<td>Delete the reference profile</td>
</tr>
<tr>
<td><img src="image" alt="Import" /></td>
<td>Import the reference profile from *.ref file</td>
</tr>
<tr>
<td><img src="image" alt="Export" /></td>
<td>Export the reference profile to *.ref file</td>
</tr>
<tr>
<td><img src="image" alt="Exit" /></td>
<td>Exit the mode</td>
</tr>
</tbody>
</table>

### 19.3.3.1. Request and registration of the profile file

To get .ref file of 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. **Data exchange between PDA and PC**

   To exchange data between PC and PDA, you need to select the device: **File > Device > RF303M-PDA.**

   ![Screenshot of Device selection](image)

   Data exchange between PC and PDA is performed by means of direct cable connection of PDA to PC USB-port (special RF505.42 cable is supplied).

   There are two ways of synchronization via USB cable:
   - **ActiveSync**
   - **Mass Storage**

   For more details, see par. 11.6.

20.1. **ActiveSync synchronization**

   When you select this type of synchronization, additional features of data exchange with PDA will be available:
   - Transfer of database files to PC
   - Transfer of language files
   - Transfer of reference profile files
   - PDA software update

20.1.1. **Transfer of database file to PC**

   To transfer the database file from PDA to PC, it is necessary to:
   - select **PDA > Import Data**
   - mark the required files in the emerged window and click **OK**

   ![Screenshot of Import Data](image)

   Double-click on the selected file in order to see information about saved data.
20.1.2. Transfer of language file from PC to PDA

To transfer the language file from PC to PDA, it is necessary to:

- select PDA > Language file > Export

- select the required file
If transfer is successful, the screen will show:

![Resource’s file is transmitting successfully!](image)

20.1.3. **Transfer of language file from PDA to PC**

To transfer the language file from PDA to PC, it is necessary to:
- select **PDA > Language file > Import**
- select the required file

If transfer is successful, the selected files will be saved to the specified path.

20.1.4. **Transfer of reference profile files from PC to PDA**

To transfer the reference profile file from PC to PDA, it is necessary to:
- select **PDA > Reference file > Export**
• select the required .ref file
  If transfer is successful, the screen will show:

![Resource's file is transmitting successfully! Window](image)

20.1.5. Updating of PDA software

The latest software version can be downloaded from the RIFTEK's website. To transfer the update file to PDA, it is necessary to:
• select PDA > PDA update

![Synchronization Menu](image)

• select a file for transfer
  If transfer is successful, the following window will appear:

![Update transferred! Window](image)

20.2. Mass Storage synchronization

When you select this type of synchronization, PDA is detected as an external storage device. Therefore, the only Import Data item is active. Transfer of language/reference files from PDA to PC and back can be performed by simple copying.

![Import Data Menu](image)
To transfer database files from PDA to PC, it is necessary to:

- select **PDA > Import Data**
- specify the path to the database on PDA (by default, `C:\Program Files (x86) \Riftek, LLC\Prp_db\`)  

![Select a folder dialog](image)

- mark the required files in the emerged window and click **OK**

**Double-click on the selected file in order to see information about saved data.**
21. Working with profilograms and wear calculations

21.1. 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:**

<table>
<thead>
<tr>
<th>Icon</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>![Show/hide Profile Values tab]</td>
<td>Show/hide the Profile Values tab</td>
</tr>
<tr>
<td>![Show/hide Profile alignment tab]</td>
<td>Show/hide the Profile alignment tab</td>
</tr>
<tr>
<td>![Save profile image to file (.bmp file)]</td>
<td>Save the profile image to file (.bmp file)</td>
</tr>
<tr>
<td>![Print profile image]</td>
<td>Print the profile image</td>
</tr>
<tr>
<td>![Change background color of the graph]</td>
<td>Change the background color of the graph</td>
</tr>
<tr>
<td>![Zoom in/out profile graph]</td>
<td>Zoom in/out the profile graph</td>
</tr>
<tr>
<td>![Recalculate]</td>
<td>Calculate geometric parameters</td>
</tr>
</tbody>
</table>
21.2.  "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.

21.2.1. 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.

21.2.2. Selecting L-parameters values

When calculating the geometric parameters, the specified support points are used (see par. 12.3). 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 (see par. 12.3.).

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

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.
21.2.3. **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).

<table>
<thead>
<tr>
<th>Code</th>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vw</td>
<td>Vertical wear (V)</td>
<td>1.50</td>
</tr>
<tr>
<td>Sw</td>
<td>Side wear (S)</td>
<td>3.11</td>
</tr>
<tr>
<td>Rw</td>
<td>Reduced wear (R)</td>
<td>0.34</td>
</tr>
<tr>
<td>Sw45</td>
<td>Side wear 45° (S45)</td>
<td>1.25</td>
</tr>
<tr>
<td>Rw45</td>
<td>Reduced wear 45° (R45)</td>
<td>-1.02</td>
</tr>
<tr>
<td>Rw</td>
<td>Rail width (W)</td>
<td>96.75</td>
</tr>
</tbody>
</table>

21.3. **Wear calculation**

21.3.1. **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.

21.4. **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).
21.4.1. 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.

21.5. 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.
21.6. **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.

![Superposition of profiles](image1)

21.7. **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 - ![Increase](image2), Decrease - ![Decrease](image3) and Show all - ![Show all](image4).
22. Scanning and editing of data

22.1. Scanning and filtering of 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:

  ![Data sorting example](image1)

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

- **Data filtering**
  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:

  ![Data filtering example](image2)

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

22.2. Editing data

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

- Editing data

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

To add a new data entry, click ![Add](Image) and type the values of parameters. Click the **Save** button.

• **Deleting data**

To delete the current entry, click ![Delete](Image) 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 ![Delete all](Image) and confirm the deletion.

### 22.3. 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:
22.3.1. **Excel-format report**

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

22.3.2. **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:
23. **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.
23.1. Calibration

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

23.1.1. 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:
Buttons:

<table>
<thead>
<tr>
<th>Button</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image" alt="Measurement" /></td>
<td>Measurement</td>
</tr>
<tr>
<td><img src="image" alt="Read param" /></td>
<td>Reading calibration parameters</td>
</tr>
<tr>
<td><img src="image" alt="Write param" /></td>
<td>Writing calibration parameters</td>
</tr>
<tr>
<td><img src="image" alt="Autocalib" /></td>
<td>Automatic setting of calibration parameters</td>
</tr>
</tbody>
</table>

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

### 23.1.2. 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. 21.
23.2. **Measurement by using PC**

Select **Profilometer > Measurement**, or click ![Measurement button](image). When the Bluetooth-connection is established (see par. 23.1.1), the **Measurement** button is active.

23.2.1. **Saving of data**

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

![Measurement interface](image)

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

Buttons functions, work with profiles and calculation of required parameters are described in par. 21.
24. **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.


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.

**25.1. 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.

### 25.2. 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](image)

### 26. 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.

### 27. List of changes

<table>
<thead>
<tr>
<th>Date</th>
<th>Revision</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>30.05.2012</td>
<td>1.0.0</td>
<td>Starting document.</td>
</tr>
<tr>
<td>15.03.2018</td>
<td>2.0.0</td>
<td>Updated the PRP description and the software description.</td>
</tr>
</tbody>
</table>
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</tr>
<tr>
<td><strong>USA, CANADA, MEXICO</strong></td>
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</tbody>
</table>
29. RIFTEK’s measurement devices for railway transport

**Laser wheel profilometer. IKP Series**
A laser profilometer is designed for the measuring of:
- wheel flange height;
- wheel flange thickness;
- wheel flange slope;
- full profile scanning and analyze of wheel rolling surface;
- maintaining of electronic wear data base;
- control of tolerances and sorting in the course of checkup, examination, repair and formation of railway wheel sets.
Measurements are made directly on rolling stock without wheel set roll-out.

**Portable laser rail profilometer. PRP Series**
The main functions of PRP are:
- obtaining the information on the cross-section profile of the working railhead surface;
- full profile scanning and analyze of the railhead acting face;
- visualization of the combined graphical images of actual and new cross-section railhead profiles on the display of system unit.

**Wheel diameter measuring gauge. IDK Series**
Electronic gauge is designed for measuring wheel rolling circle diameter of railway, metro and tram wheel sets.
Measurements are made directly on rolling stock without wheel set roll-out.
Back-to-back distance measuring gauge. IMR Series

Gauge is designed for contactless measuring of back-to-back distance of railway, metro and tram wheels in the course of checkup, examination, repair and formation of wheel sets. Measurements are made directly on rolling stock without wheel set roll-out.

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

Gauge is designed for contactless measuring of back-to-back distance of railway, metro and tram wheels in the course of checkup, examination, repair and formation of wheel sets. Measurements are made directly on rolling stock without wheel set roll-out.

Disc brakes profile gauge, IKD Series

Laser disc brakes profilometer IKD Series is designed for disc brakes profile measuring. The main functions of IKD are:

- obtaining the information on the profile parameters of the working disc brakes surface;
- full profile scanning and analyze of the disc brakes acting face;
- visualization of the combined graphical images of actual and new disc brakes profiles on the display of system unit.

Automatic real-time system for measurement of wheelsets geometrical parameters

The system is designed for contactless 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 at any type of rail infrastructure.