RIFTEK
Sensors & Instruments

LASER WHEEL PROFILOMETER

IKP-5, IKP-5R Series

User's manual

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1. Safety precautions and measurement conditions

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

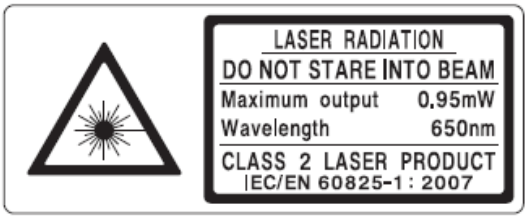
2. Electromagnetic compatibility

The profilometer have been developed for use in industry and meet the requirements of the following standards:

- EN 55022:2006 Information Technology Equipment. Radio disturbance characteristics. Limits and methods of measurement.
- EN 61000-6-2:2005 Electromagnetic compatibility (EMC). Generic standards. Immunity for industrial environments.
- EN 61326-1:2006 Electrical Equipment for Measurement, Control, and Laboratory Use. EMC Requirements. General requirements.

3. Laser safety

The profilometer make use of an 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

A laser profilometer IKP5 Series is designed for the measuring of

- wheel flange height
- wheel flange thickness
- wheel flange slope
- rim thickness
- 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.

5. Basic data and performance characteristics

Name of parameter	Value
Measurement range for the flange height, mm	20…45
-"- flange thickness, mm	20…40
-"- flange slope, mm	1…15
-"- rim thickness* , mm	30…90
Measurement error for the flange height, mm	± 0,1
-"- flange thickness, mm	± 0,1
-"- flange slope, mm	± 0,2
-"- rim thickness , mm	± 0,1
Discreteness of indication of the flange height, mm	0,01
-"- flange thickness, mm	0,01
-"- flange slope, mm	0,01
-"- rim thickness , mm	0,01
Profile measurement range – the whole profile between of the wheel tire faces (145 mm maximum)	
Discreteness of the profile formation, not worse than, mm	0,1
Digital readout device dimensions, mm	see Fig.5
Dimensions of laser scanning module (for the maximum scanning range), mm	see Fig.3
Power supply –rechargeable battery	4.8V
The number of measurements that can be taken before battery recharge is not less than	1000
PDA memory capacity, no less	1000 measurements
Interface to PC	USB, Bluetooth

***Rim thickness measurement is an option. Designation for the order is IKP-5R**

6. Complete set to be supplied

Designation	Name	Quantity	Weight kg
RF303	PDA	1	0,4
RF505	Laser scanning module	1	0,6
RF505.40	Charging device 9V 3.0A for PDA	1	0,2
RF505.41	Charging device 9V 3.0A for laser module	1	0,2
RF505.42	Universal cable USB – mini USB	1	
RF505.43	Bluetooth/USB - adapter	1	
RF505.30	Packing case	1	0,9
IKP5_DB	Database management system (CD)	1	
RF505UM	User's manual	1	
	Calibration tools (option):		
RF505.11	Wheel-simulator,		
РФ505.11	Calibration software		

7. Structure and operation principle

7.1. Basic components of the device and their functions

Fig. 1 shows basic components of the device.

Figure 1

(1) PDA.
(2) Laser scanning module.
(3) Calibration block
(4) Charging device
(5) Data cable

7.1.1. Laser scanning module

The module is intended for laser scanning of wheel surface.

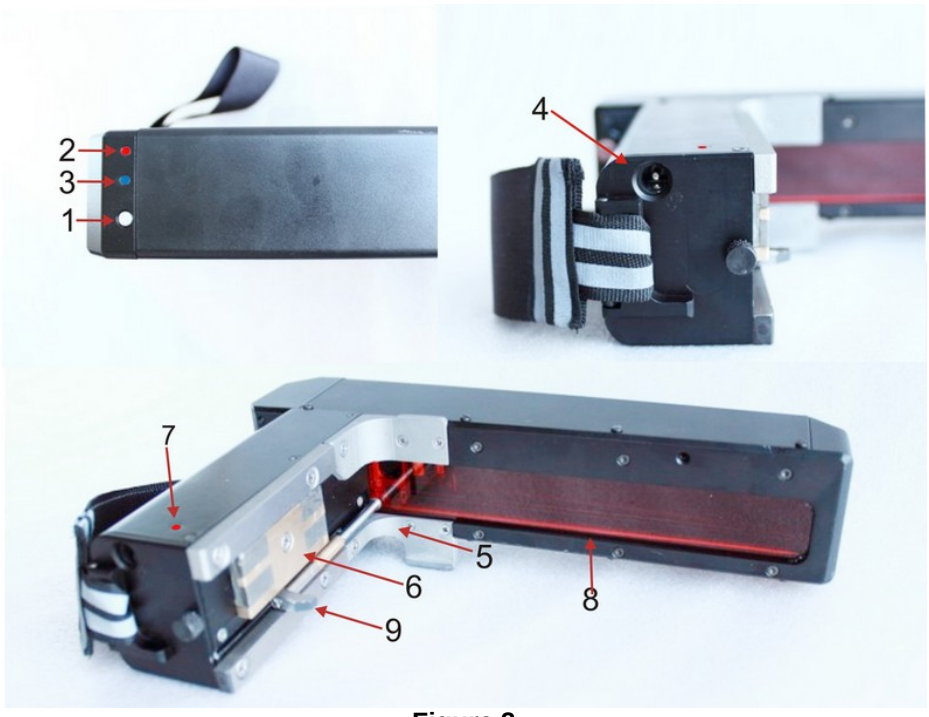


Figure 2

Fig. 2 indicates:
(1) Turn ON button
(2) Indicator of turn ON (red LED)
(3) Indicator of Bluetooth connection (blue LED)
(4) Charging device connector
(5) Support for mounting of the device on the wheel flange
(6) Magnetic support for mounting on the wheel side surface
(7) Charging indication, red/green LED
(8) Output window
(9) Rim measurement rod
Overall dimensions of scanning module are shown in figure 3.

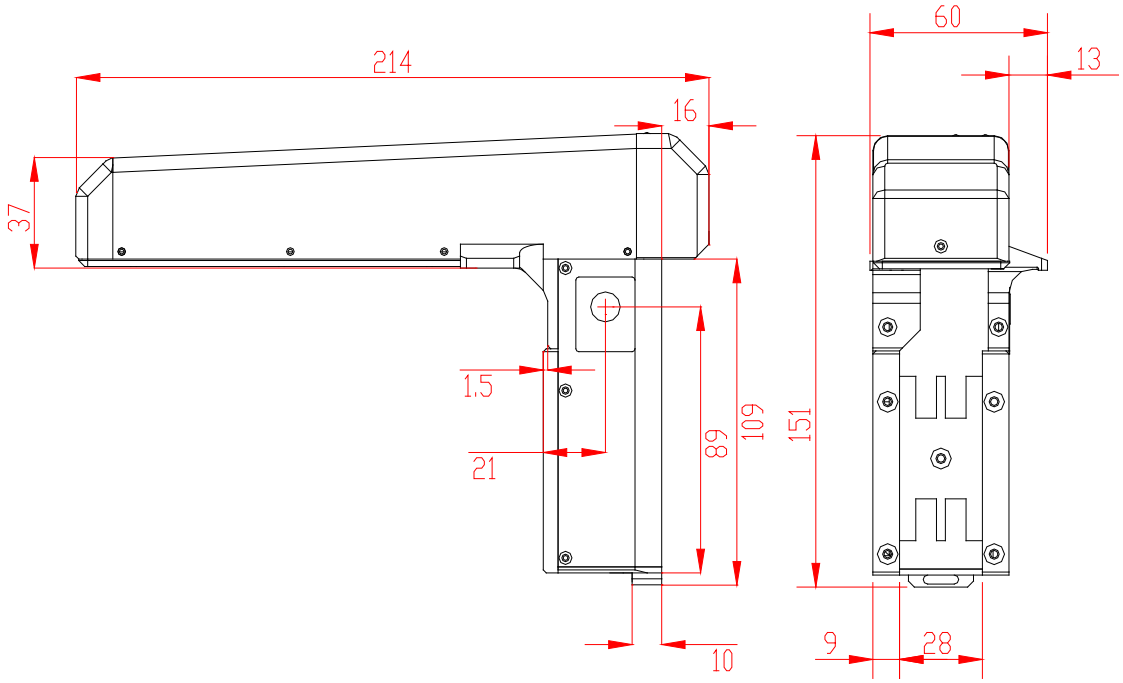


Figure 3

7.1.2. PDA

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

Figure 4

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

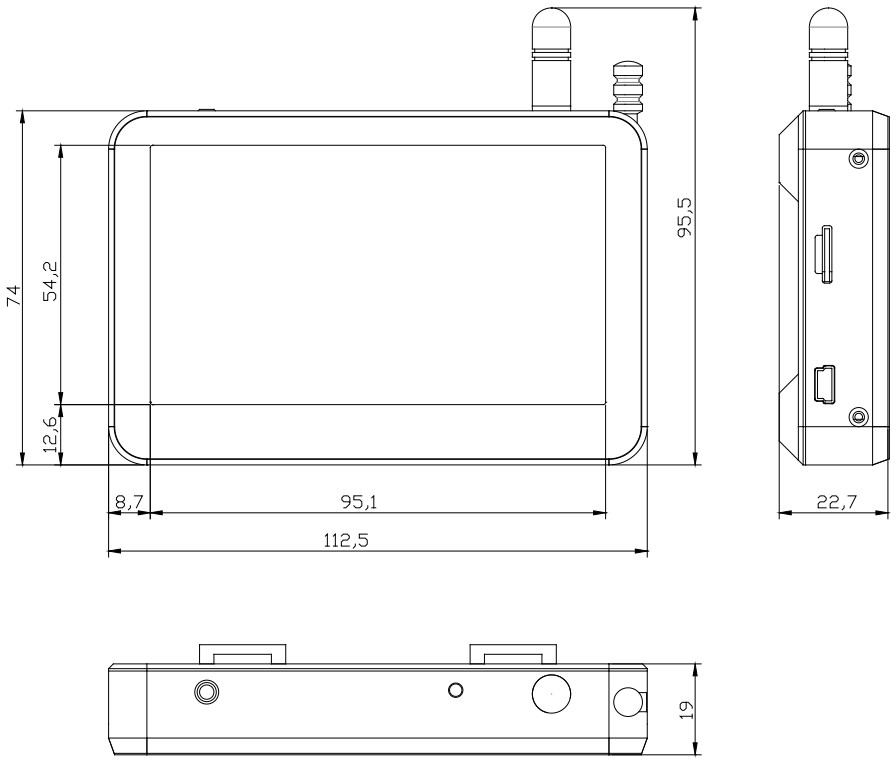


Figure 5

7.1.3. Calibration block

Calibration block is intended for calibration and tests of the profilometer. Calibration block is a metal imitator of the part of wheel with a definite profile.

Overall dimensions of calibration block are shown in figure 1A of paragraph 20**.** The suggested profiles are given in paragraph 23**.** Also possible is supply of a unit with a profile made to the customer's drawings.

7.2. Operation principle

Operator mounts the laser scanning module onto the wheel to be measured. Having received a command from PDA or PC, the laser module performs non-contact scanning of the wheel 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: operator

number, side identifier (left or right wheel), axis number, locomotive (carriage) number, wheel pair number, etc.

8. First activation and measurement procedure

8.1. Preparation for use

- Before using the device for the first time, it is necessary to remove the lock screw 2 and to twist in the screw 1 instead (Fig. 6).

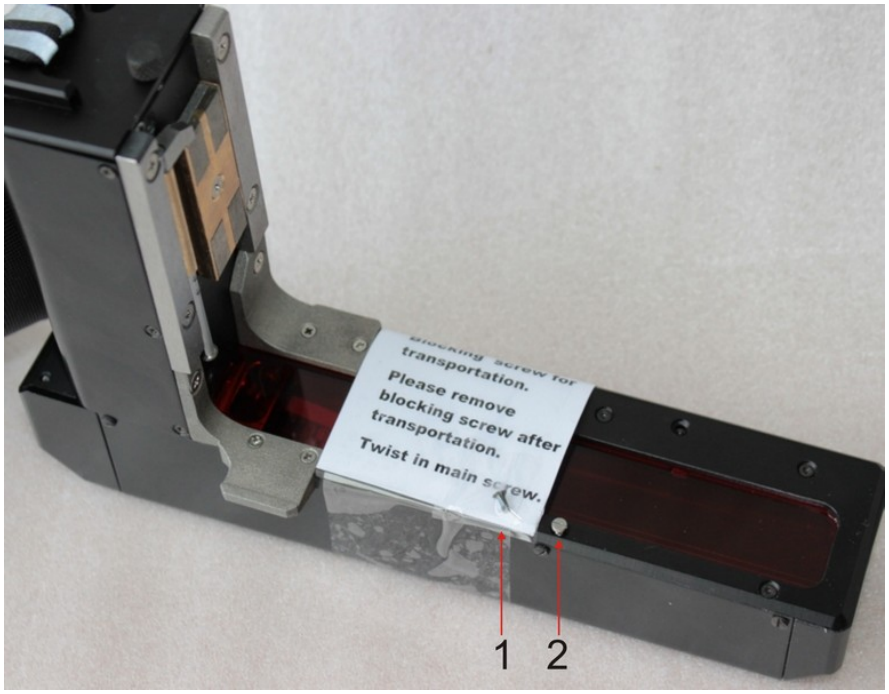
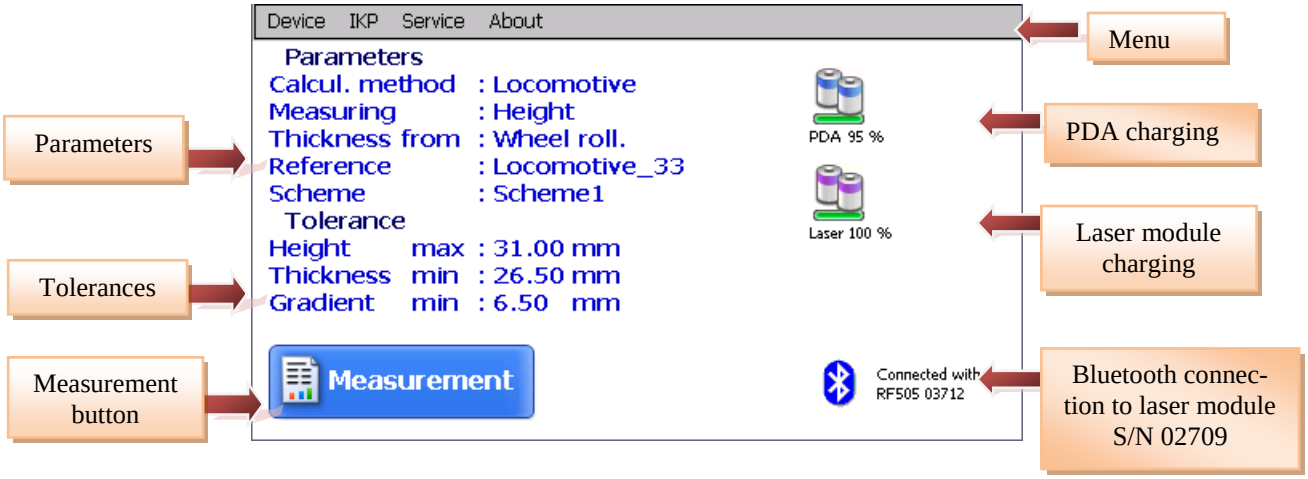


Figure 6

- Charge accumulators of the laser module and indication device by connecting them to charging devices (see par. 22.).

8.2. Activation

- Turn the PDA on by pressing the button (1), Fig. 4. Activation indication (2) will show a green LED lit.
- Switch the laser module on by pressing ON/OFF (1) button and holding it until red LED is lit
- 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 (3) on the laser module. The LED goes out when the link is established
- The PDA screen will show the main program window containing: main menu; indicators of PDA and laser module charging degree; indicator of Bluetooth connection showing serial number of the laser module with which connection is established; information panels of the selected working parameters and tolerances and the **Measurement** button:



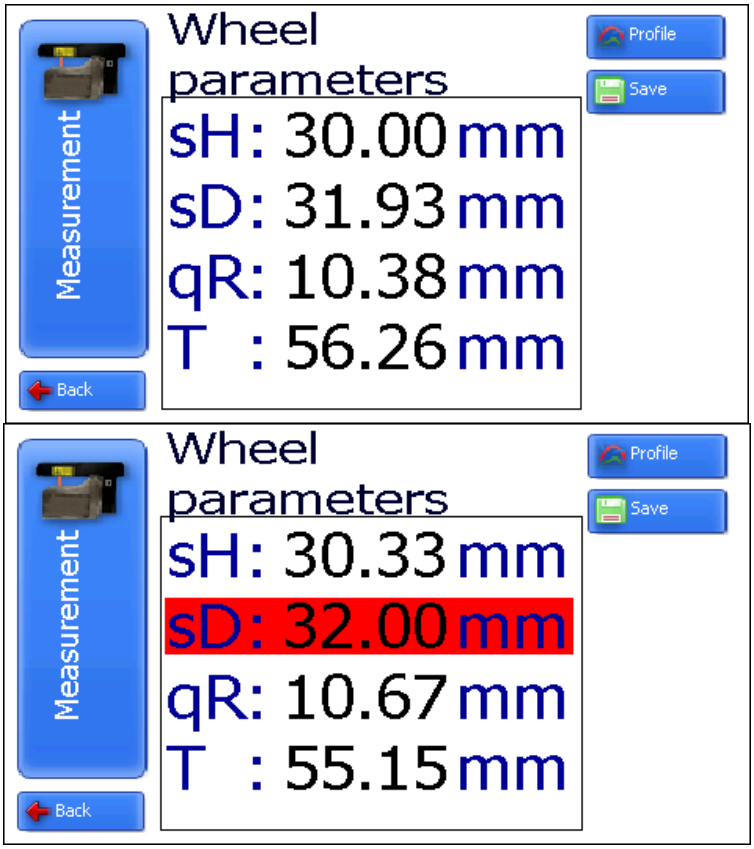
8.3. Measurement

To perform measurement, it is necessary to:

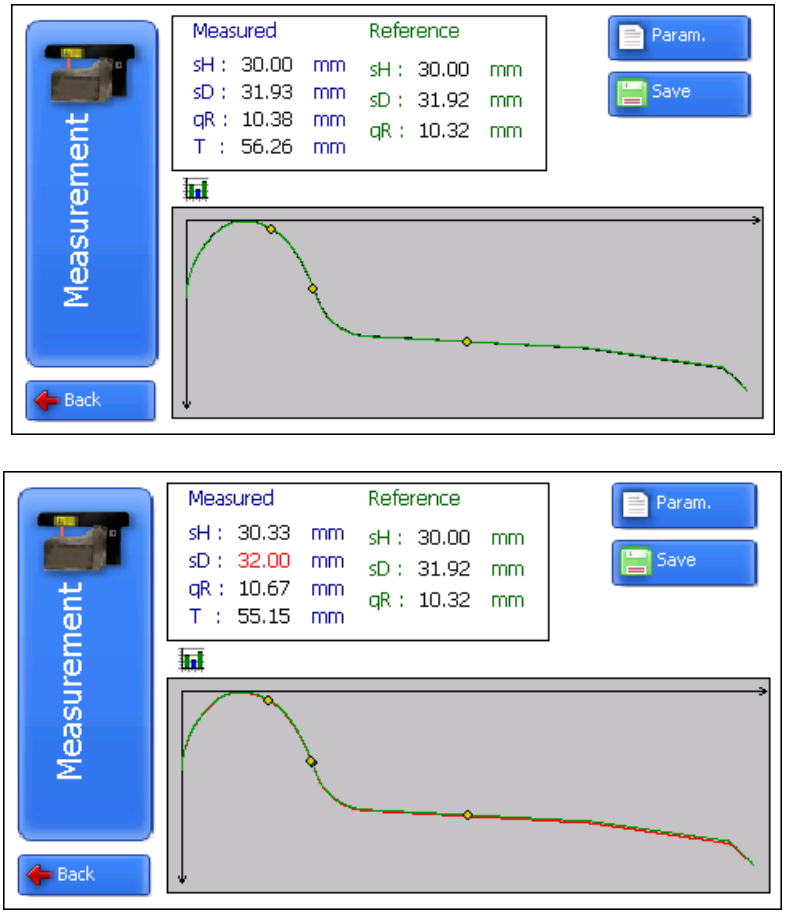
- Fix the laser module on the calibration unit or wheel by mounting the module support (5) onto the wheel flange and pressing magnetic support (6) to the internal face of the wheel;
- For rim measurement extract rim measurement rod and hitch it up to the rim

Figure 7

- Make sure that the module is mounted correctly without any misalignment and gaps;
- Press **Measurement** button on the PDA display;
- With the **Measurement** button pressed, the laser module will scan the wheel surface. During scanning time of about 1-2 seconds red LED (2) is lit.
- When scanning is competed, the PDA will show values of measured parameters selected for presentation (see par. 10.6.). When the parameter goes beyond set limits its value is highlighted with red color:



- To look at wheel profile, press the **Profile** button, and the PDA display will scanned wheel profile as well as measured parameters and parameters of calibration element (or a wheel chosen as a reference):



- If you scan calibration block or reference wheel and scanning results differ from the reference values by nor more than 0.1 mm, the device is ready for work, otherwise it must be calibrated in accordance with par. 20.

9. Wheel parameters under control. Terms and definitions

9.1. L-parameters

Geometric parameters of the wheel are calculated automatically after laser scanning of the wheel is completed. To calculate geometric parameters, use is made of reference points on the wheel profile. Location of the reference points is shown in Fig. 8 and is defined by **L-parameters** (parameters L1…L9). Values of L-parameters preset in PDA are given in Table 1 and can be changed by user (see par. 10.3.).

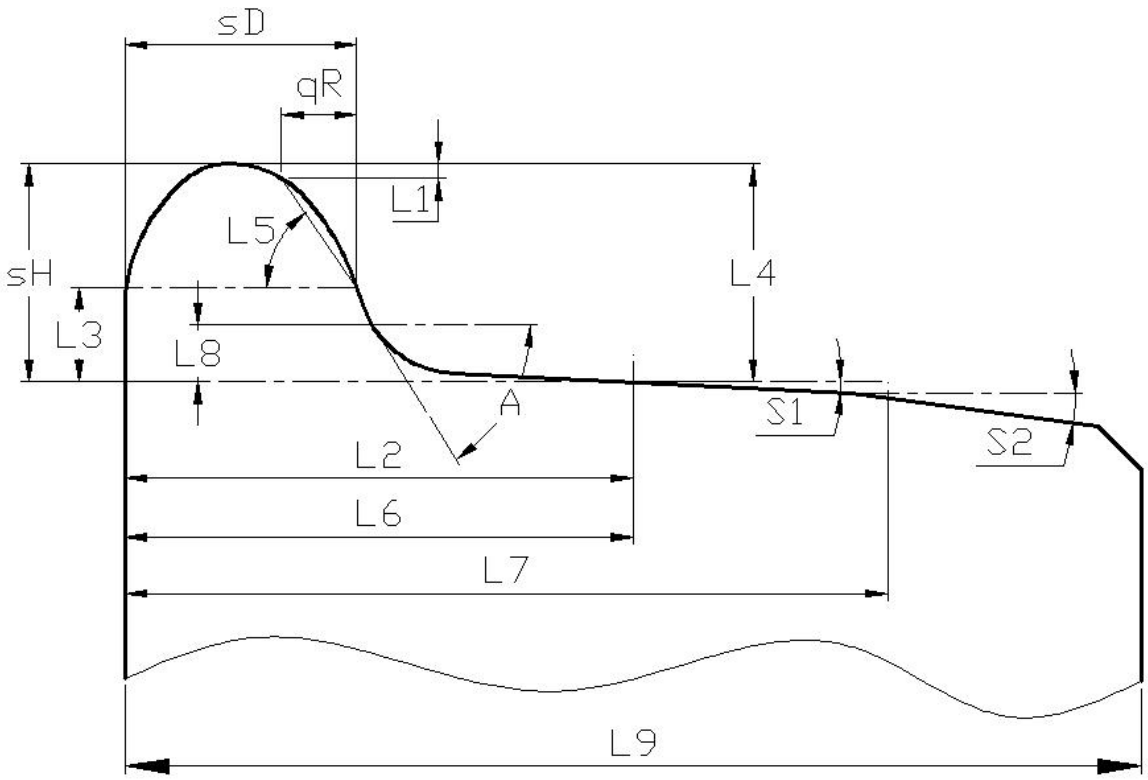


Figure 8

Table 1.

L-parameter	Default value		Purpose
	locomotive	MCRS *	
L1	2 mm	5 mm	Used for calculation of the flange slope
L2	70 mm		Defines position of the wheel rolling circle
L3	13 mm	18 mm	Used for calculation of the flange thickness
L4	30 mm	28 mm	Used for calculation of tyre roll wear and is equal to the height of flange of the reference profile
L5	-	60 deg	Slope of the reference profile
L6	70	70	Used for calculation of slope of the rolling surface section
L7	105	105	Used for calculation of slope of the rolling surface section
L8	0	0	Used for measurement of the profile inclination angle at the required point
L9	140	140	Used for inverting measurement direction

* MCRS – motor coach rolling stock

9.2. Geometric parameters of the wheel under control

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

Table 2.

Parameter	Designation	Calculation method
The flange thickness (calculation method #1) "From surface"	Sd (figure 8)	is determined as a distance measured horizontally at any pre-selected height (L3) from the surface of the wheel rolling surface between two points lying on the opposite sides of the flange top: one of which lies in the plane of the internal face of the wheel tire and the other - on the outer surface of the flange
The flange thickness (calculation method #2) "From the top"	Sd	is defined as the distance from the flange top measured along the horizontal line at a selected height L3 (factory setting is 18 mm)
The slope of flange (calculation method #1) "Locomotive"	qR (figure 8)	is calculated as a difference between the flange thickness at the any pre-selected height from the surface of the wheel rolling surface (L3) and that measured at the any pre-selected distance (L1) away from the flange top
The slope of flange (calculation method #2) "Railcar"	qR	is calculated as the difference between the angle of slope of the reference profile (parameter L5) and the slope of the measured profile. Slope of the measured profile is calculated as the inclination angle of a straight line passing through points on the wheel flange that are located at distances L1 and L3 from the flange top
The flange height	Sh	is determined as a distance measured vertically between the flange top and the point of wheel rolling surface at the any pre-selected distance (L2) away from the inner face of the wheel tire.
Roll wear	dW	is defined as the distance between the measured flange height and the nominal height determined by the parameter L4
Rim thickness	T	Is calculated as a distance between the edge of the rim and the point of wheel rolling surface at the any pre-selected dis-

		tance (L2) away from the inner face of the wheel tire.
Angle 1	Slope 1	is calculated as the inclination angle of the straight line passing through points on the wheel surface located at preset distance L6 from the wheel face and the distance L6+10mm from the wheel face
Angle 2	Slope 2	is calculated as the inclination angle of the straight line passing through points on the wheel surface located at preset distance L7 from the wheel surface and the distance L7+10mm from the wheel surface
Inclination	Angle	Is calculated as the profile inclination angle at a point with L8 co-ordinate

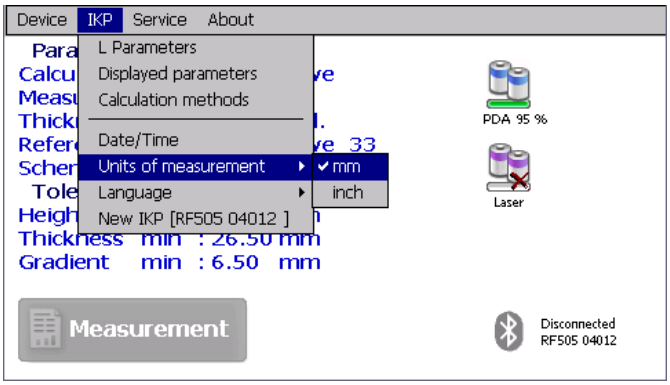
10. PDA program setting

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

10.1. Selection of measurement units

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 measurement units, it is necessary to

- select **IKP > Units of measuring > [mm/inch]**

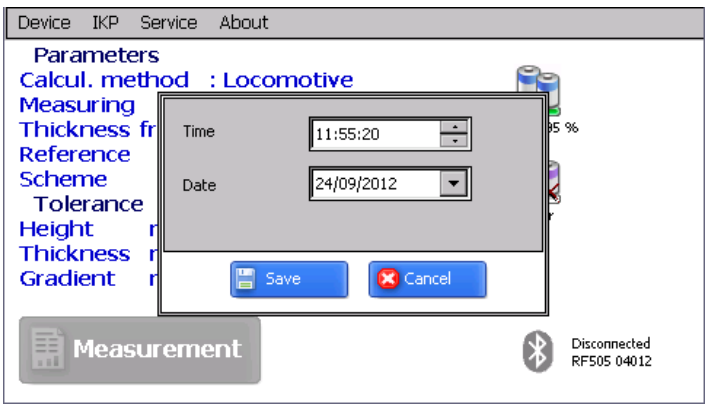


- select **mm** or **inch** options

10.2. Data and Time settings

To set data and time:

- select **IKP > Data/Time** in main window of the program. View on the PDA screen:



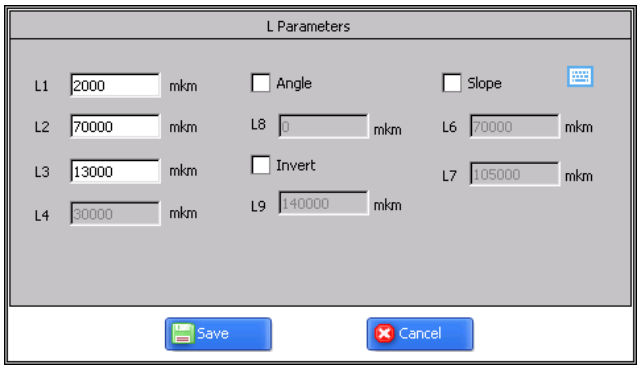
- write data and time

- press **Save**.

10.3. L-parameters settings

To change L-parameters:

- select **IKP** > **L Parameters**

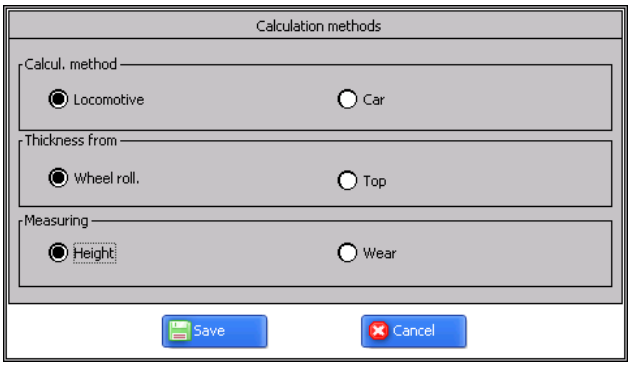


- write parameter's value
- press **Save**

10.4. Calculation methods setting

To set calculation methods (see. **Table 2**):

- select **IKP > Calculation methods**

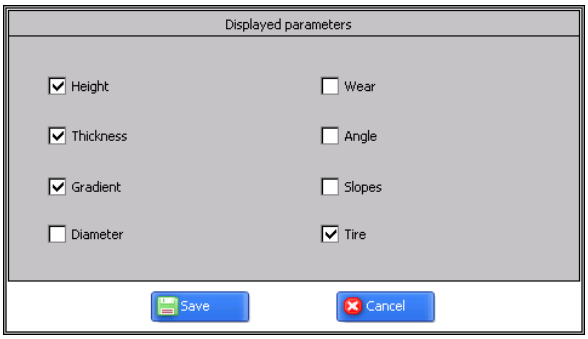


- set the parameters required
- press **Save**

10.5. Selection of displayed geometric parameters

To select geometric parameters to be displayed after scanning:

- select **Profilometer** > **Displayed parameters**

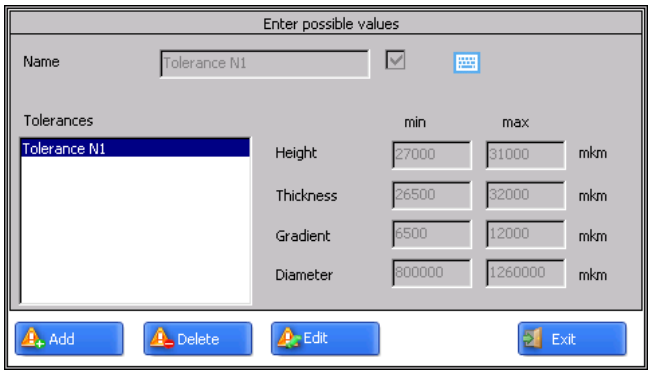


- mark the parameters whose values must be displayed
- press **Save**

10.6. Tolerances settings

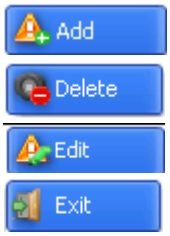
The program automatically controls measured geometric parameters for going out beyond the tolerances set. It is possible for the user to create groups of tolerances. Control of parameters will be performed for a selected group. To set tolerances it is necessary to:

- select **Service > Tolerances** in the main window. View on the screen:



- adjust tolerances in the selected group or add a new group of tolerances and write corresponding values. All values are in micrometers.

Buttons:



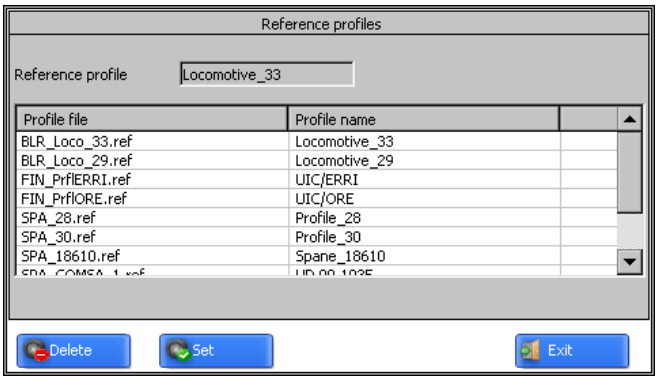
- add new group of tolerances;
- delete selected group of tolerances;
- edit selected tolerance;
- exit.

10.7. Reference profile selection and installation

The program lets compare scanned profile of the wheel with reference profile. Reference profiles are /stored in the PDA database as profile description files with extension **.ref**. PDA is supplied with several pre-installed profiles (see paragraph 23). If there is no required reference profile in the database, user can form profile description himself (methods of **.ref files** formation are described in par. 13.6.) or request the lacking profile from **RIFTEK** (free service).

10.7.1. Reference profile selection

To select reference profile press **Service > Reference profiles**:



- Activate the required profile and press the **Set** key;

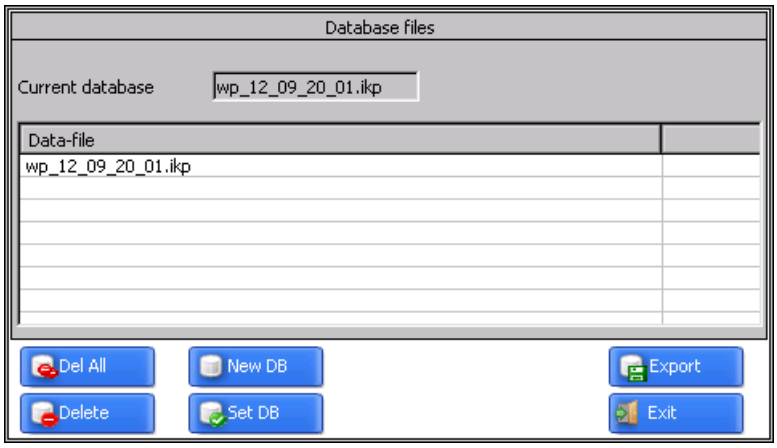
- To delete profile from the database, activate the line with selected profile and press the **Delete** key;
- To exit from the window, press the **Exit** key.

10.7.2. Writing reference profile to database

If there is no required reference profile in the database, profile description file can be formed by user with the help of one of the procedures described in par. 13.6. and transferred to the PDA as it is shown in par. 14.1.4.

10.8. Database selection

If necessary, measurement results are saved in the PDA database. The program makes it possible to simultaneously create and store several database files connected with a concrete date of taking measurements. To select a database file, choose **Service > DB files** in the main window menu. The screen will show:



- To create a new database, press **New DB**. File with the name **wp_yy_mm_dd.ikp** will be formed automatically, where **yy_mm_dd** is the current date;
- to select the available database, activate the line with the file name and press **Select DB**;
- to delete the selected file press **Delete**;
- to delete all files press **Delete all**;
- to save file in TXT form press нажать **Export**;
- to exit from the window press **Exit**.

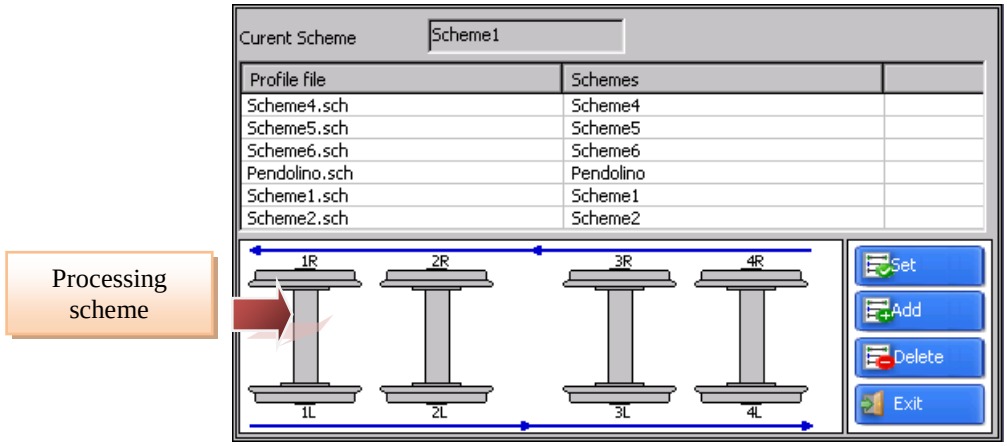
10.9. Selection and formation of measurement scheme

Measurement scheme is meant as a sequence of making measurements/processing of wheels in the rolling stock. The program automatically offers operator to perform measurement on a concrete wheel in accordance with selected scheme of wheel processing. The program contains several preset schemes. Besides, the user can form his own measurement scheme.

10.9.1. Selection or removal of the measurement scheme

To select a measurement scheme in the main window menu:

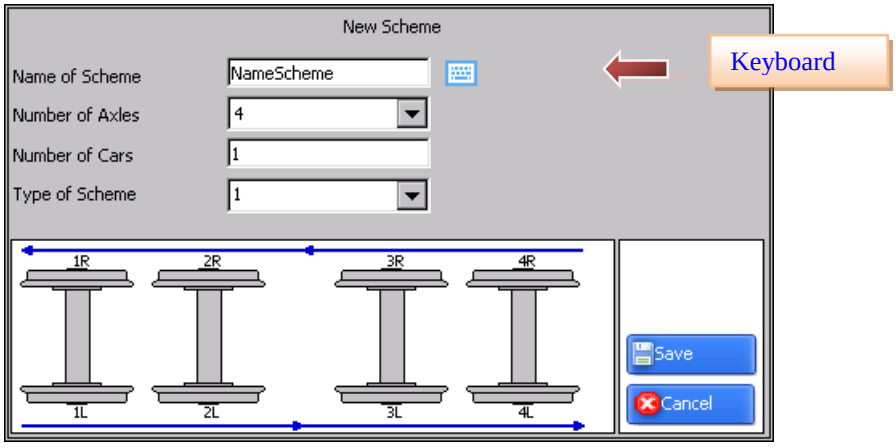
- select **Service** > **Schemes.** View on the screen:



- by activating lines containing the scheme file name it is possible to look at available wheel processing schemes. Arrows in the figure show direction of processing of wheel pairs as well as the names assigned to wheels (1L-first axis, left side; 2L-second axis, left side; 1R-first axis, right side, etc.);
- to set the selected scheme activate the respective line and press **Install**;
- to remove a scheme activate the respective line and press **Remove**.

10.9.2. Formation of a new measurement scheme

To form a new measurement scheme, press **Add**. The screen will show:



- by using on-screen keyboard type the scheme name;
- select the number of axles;
- select the number of coaches in the rolling stock (train);
- select the wheel processing scheme out of the options suggested
- press **Save**.

10.9.3. Loading of a new measurement scheme

If you can not form a new scheme in accordance with par. 10.9.2. , it is possible to use a special program for PC, see par. 21 and then load the scheme to the PDA as it is shown in par. 14.1.5.

10.10. Wheel type selection

If several wheels types are used it is possible to set definite measurement scheme, reference profile and L-parameters for every wheel type

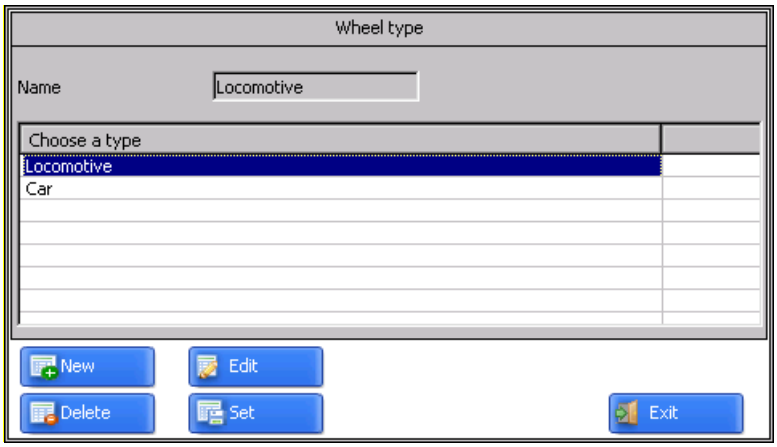
An example.

WheelType1: Scheme1, Reference1, L-Parameters1;
WheelType2: Scheme2, Reference 2, L-Parameters2;

WheelType3: Scheme3, Reference 3, L-Parameters3;

10.10.1. Wheel type selection and removal

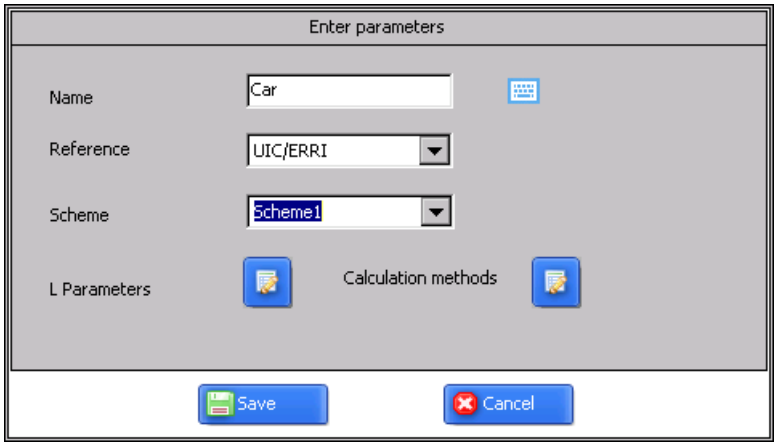
To select wheel type in the main window menu select **Service > Wheel type**, View on the screen:



- activate wheel type line you need and press **Set**;
- for wheel type removal activate wheel type line and press **Delete**.
- press **Edit** for wheel type edit;
- to add new wheel type activate the line and press для редактирования активировать строку и нажать **Add (**see p. 10.10.2**)**.

10.10.2. Wheel type addition

To add new type of the wheel press **New.** View on the screen:

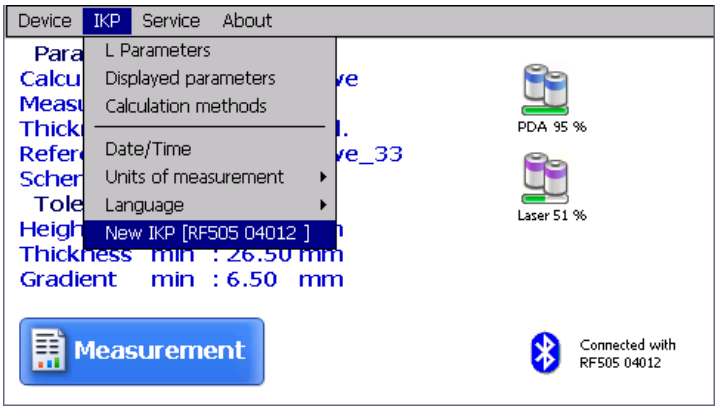


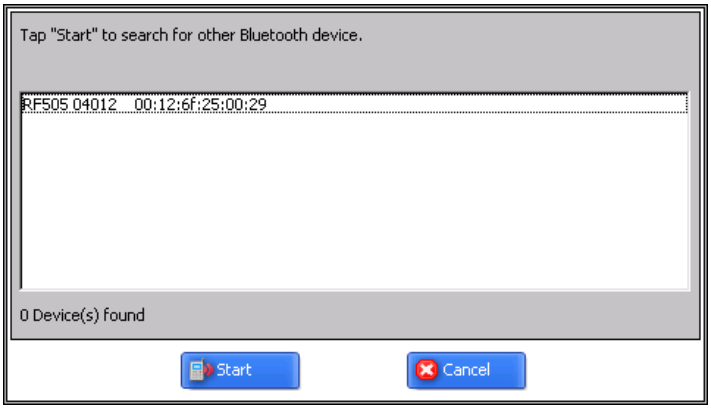
- use virtual keyboard to write type name (**Name**);
- select reference profile (**Reference**);
- select scheme (**Sheme**);
- write **L-parameters**( ) see. p. 10.3
- write **Calculation method**( ) see. p. 10.4
- press **Save**.

10.11. New laser module connection

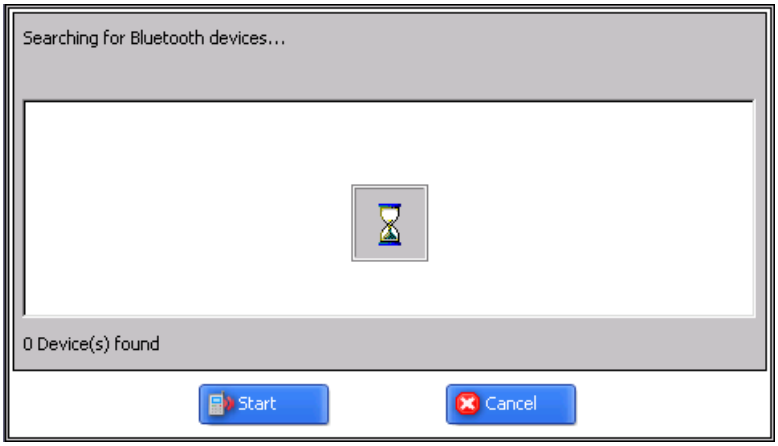
Bluetooth-connection of PDA is adjusted for work with the laser scanning module supplied with PDA complete package. To connect other scanning module it is necessary to:

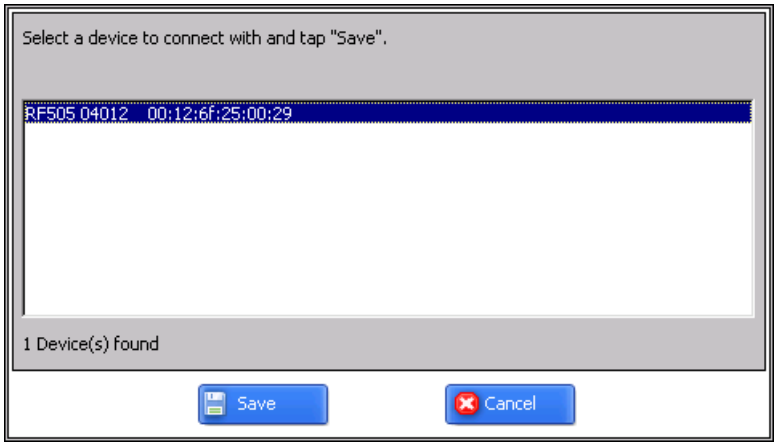
- select **IKP > New IKP**





- press **Start** and wait for new devices (with serial numbers) will appear on the screen





- select device and press **Save** to save new device address
- in the **Values** tab, press the **Save** button to save all parameters

10.12. Selection and changing of language and terminology

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 choose language in the main window menu, select **Profilometer > Language.** Select the required language support file.

If no such file is available, it is necessary to use new files preparation procedure which is described in par.12.3. and then load a new language file from PC to PDA as it is shown in par. 14.1.2.

10.13. Browsing and updating PDA software

To look at the software version in the main window menu, select **About Program** tab. The screen will show:

The updated software version can be downloaded from the site. Proceduire of PDA sofware updating is described in par. 14.1.6. of this manual.

11. Working with the profilometer

11.1. Activation

Switch on the PDA and scanning module as shown in par. 8.2.

11.2. On-line measurements

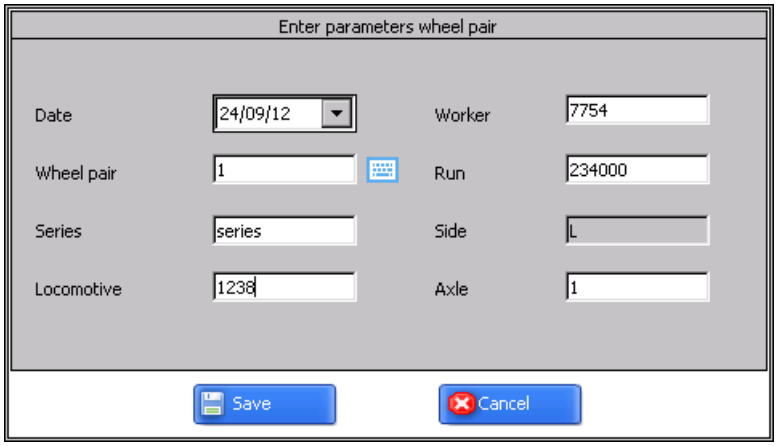
Procedure of on-line measurements is described in par. 8.3.

11.3. Measurements with database maintenance

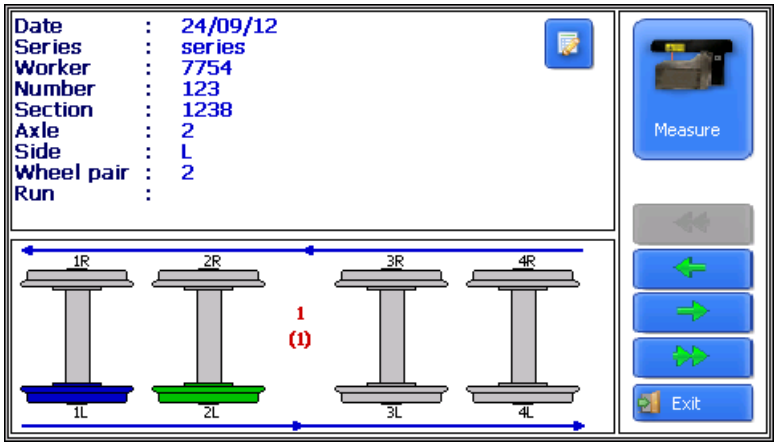
A fully functional work with the profilometer involves maintenance of the measurements database.

To take measurements:

- Select in the main menu **Profilometer > Measurement**, the window of parameters input will appear



- If necessary, fill in/edit the required fields
- to save parameters, press the **Save** button, and the program will offer the selected measurement scheme (see par.10.9.):



Designations:

1(1) - order number of the car to be measured (number of cars in the train);

4580 - number of the car to be measured;

- editing of the input wheel parameters;

- a previous/subsequent wheel;

- a measured wheel;

- a wheel to be measured next time;

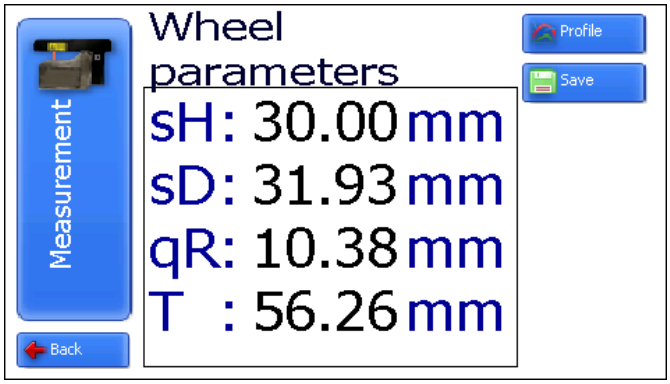
- a non-measured wheel;

- a measured wheel to be measured again

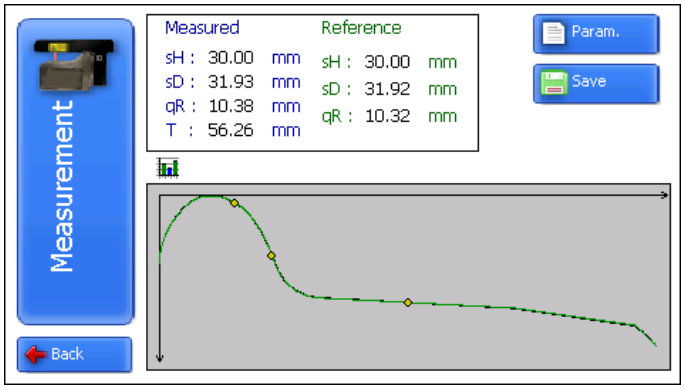
- measurement.

- Measure the wheel offered by the program (highlighted in green color), as it is shown in par. 8.3.
- after the wheel surface is laser-scanned, the PDA will show the value of selected geometrical parameters. When a parameter falls out of the specific tolerance, its value is indicated with red color

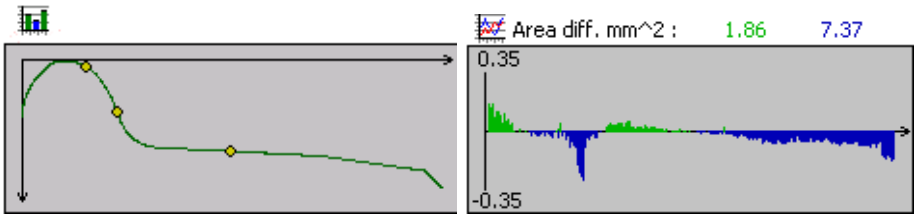
:



- to look at the profile press **Profile** button:



- to look at wear degree press button

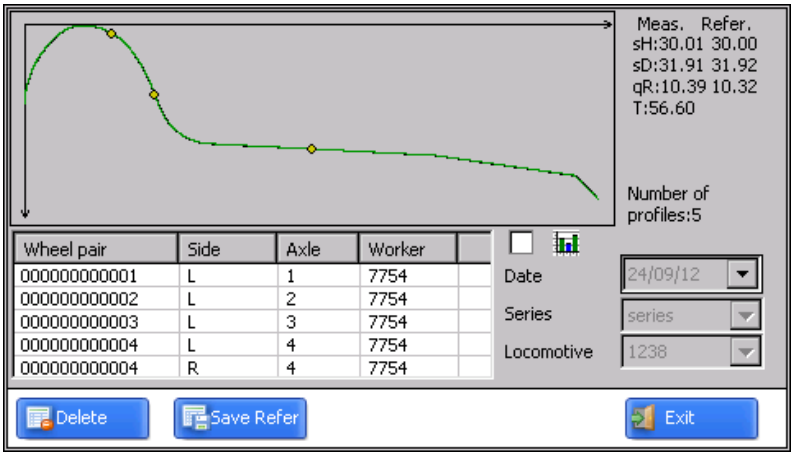


- when a satisfactory result is obtained, press **Save** on the display to save it
- the program will offer to pass to measurement of the next wheel in accordance with selected scheme of measurement

11.4. Browsing the database

To browse the database:

- select **Service > Profiles** in the main window. View on the screen:



- for data filtering select data, series and number of locomotive

Buttons:

– delete selected profile;

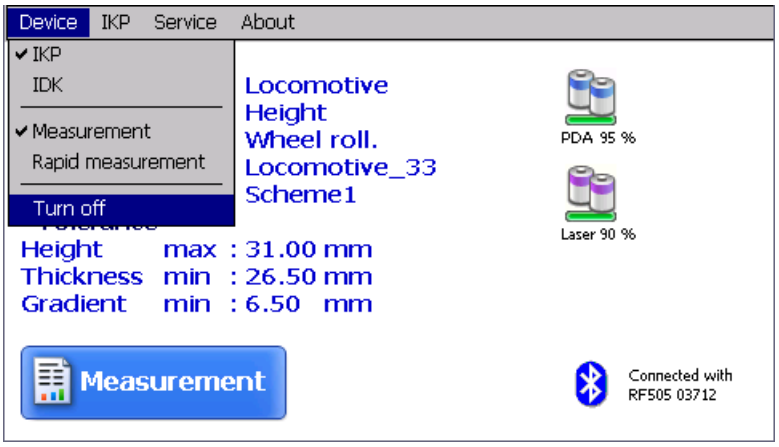
- when in this mode, it is possible to save the selected profile as a reference profile by pressing Save button:

– create reference profile **(profile_name.ref).**

- write profile name and press **Save**

11.5. Deactivation

To turn off the PDA, select **Device > Turn Off**. To turn off the laser module, press button 5, Fig. 2 and hold it down until red LED 2 goes out.



12. Installation of software on PC and startup

12.1. Installation of database support software

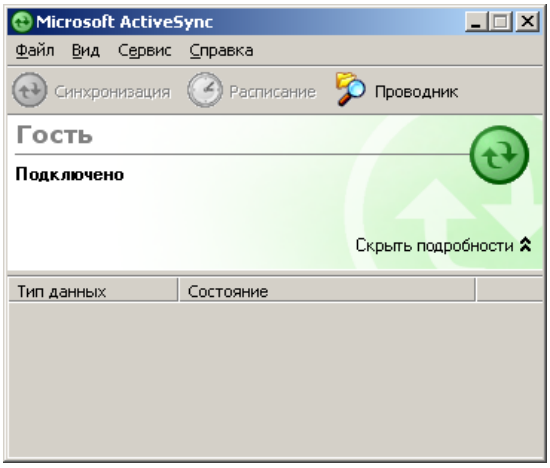
The **ikp5_DB** software is intended for maintaining wheel sets wear database on a personal computer (the updated version of the program can be downloaded from www.riftek.com).

To install the software, insert compact disk to PC CD drive, select and start **Install_Ikp5.exe** file in the **Software** folder. Follow instructions of the installation wizard. The program is installed in **C:\Program Files\RIFTEK** folder by default.

12.2. Installation of Microsoft Activesync

For combined work **PDA** and **PC**, it is necessary to install Microsoft Activesync. Proceed as follows:

- Start ActiveSync42.exe file from the **Software** folder on CD.
- Follow program installation instructions.
- Check for correctness of the installation by activating PDA and connecting it PC USB port using cable which is part of supply package. In case of successful connection the screen will show the following message:



NOTE: For PC with Microsoft Windows Vista or Microsoft Windows 7 installed, use **Windows Mobile Device Center** synchronization program instead of Microsoft Activesync.

12.3. Preparation and installation of language support file

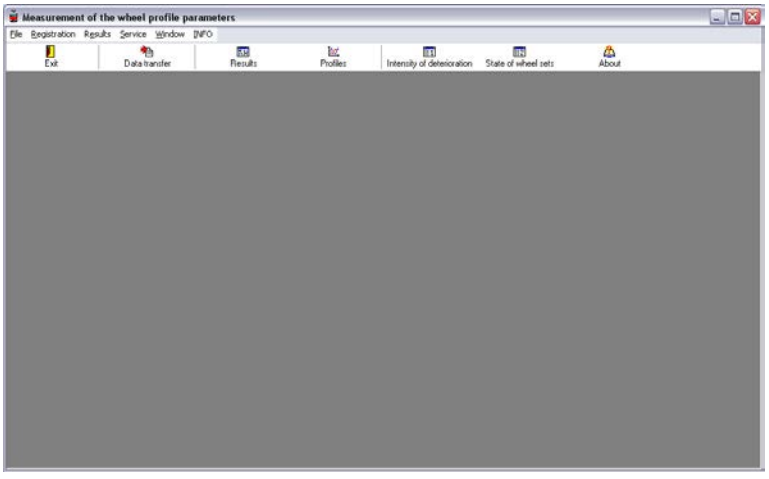
By default, working language of the program is English. User can change the language, form his own language support files as well as change/edit the terminology used. Language support files are located in the directory used in the process of installation. By default the following directory is used: **C:\Program Files\RIFTEK\Ikp5_db\Language**. The directory contains two files, **RUS.lng** and **ENG.lng,** to support Russian and English languages respectively.

To create 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, **GER.lng**
- edit the renamed files 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** folder
- To change and edit terminology, it is necessary to:
- edit the corresponding language file by using any text processor;
- save the edited ***.lng** file in the **Language** folder

12.4. Program starting

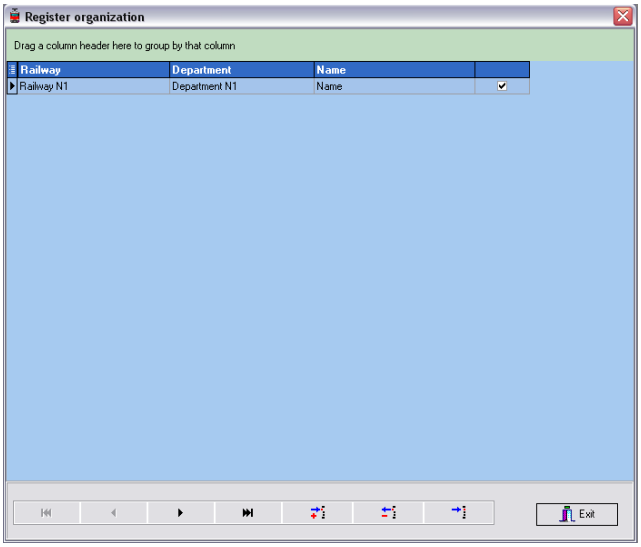
To start the program click **Start > All programs > IKP5 > IKP5_DB**. View of the main program window is shown in the figure.



13. User settings of the program

13.1. Registration of user organization

For registration user organization select **Registration > Organization.** Fill out the required fields in the opening window. Subsequently, the filled out information will be used in automatic generation of reports.



Buttons:

- add new body;

- edit selected body;

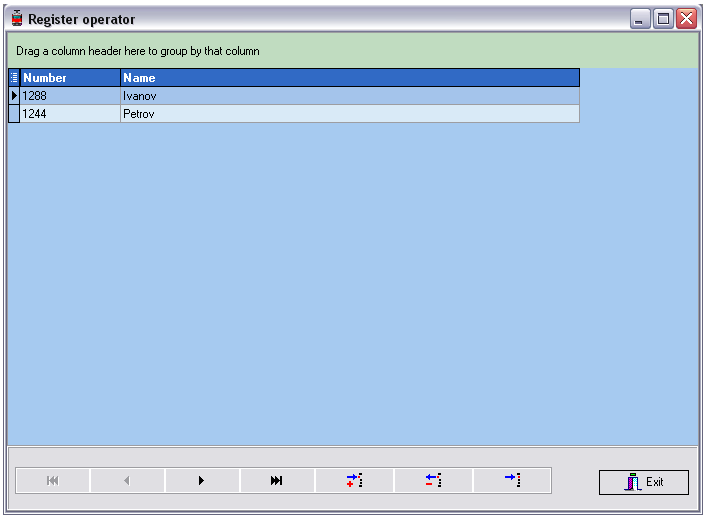
- delete selected body;

- exit;

If the list contains several users, only one of them can be active at the moment. Active user is selected by putting a " tick" in the **Organization** window.

13.2. Registration of operators

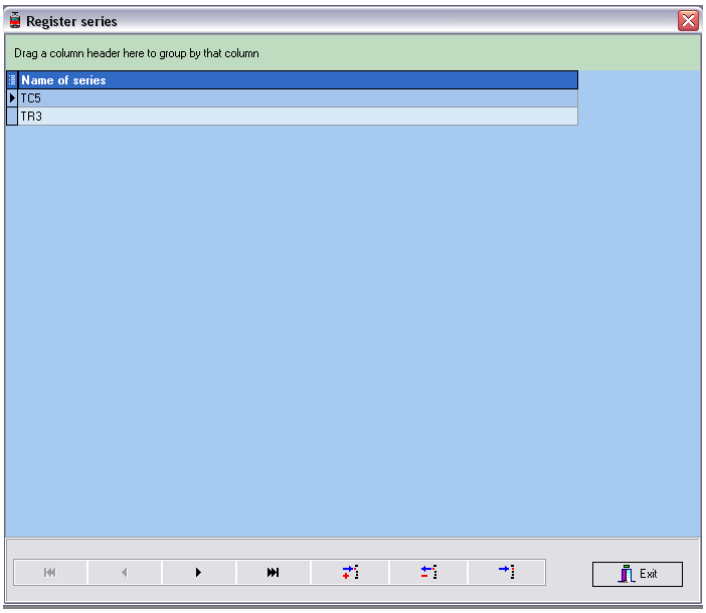
Steps to follow: menu **Registration > Operator**. Fill out the required fields in the opening window by assigning a unique digital identification cod (up to 4 digits) to each operator.



Functions of buttons are similar to those in par. 13.1.

13.3. Registration of locomotive series

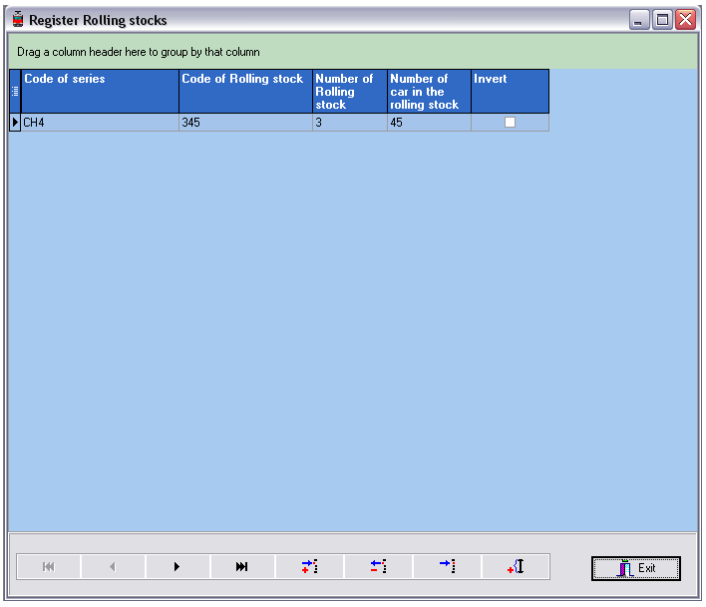
Steps to follow: menu **Registration > Series**. Enter the name of a series of locomotives under service



Functions of buttons are similar to those in par. 13.1.

13.4. Registration of locomotive numbers

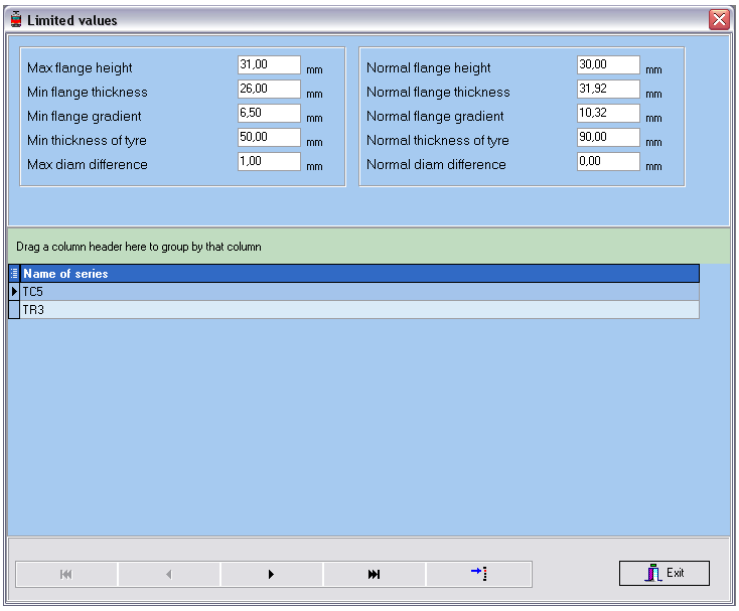
Steps to follow: menu **Registration > Locomotive/car**. In the emerging window type locomotive numbers to be serviced and their characteristics (locomotive number and series code).



Functions of buttons are similar to those in par. 13.1.

13.5. Registration of wear limiting values

Steps to follow: menu **Registration > Limiting values**. Enter limiting wear parameters for wheel set for each registered series of locomotives. Subsequently these parameters will be used for automatic control of allowable wear.



Buttons:

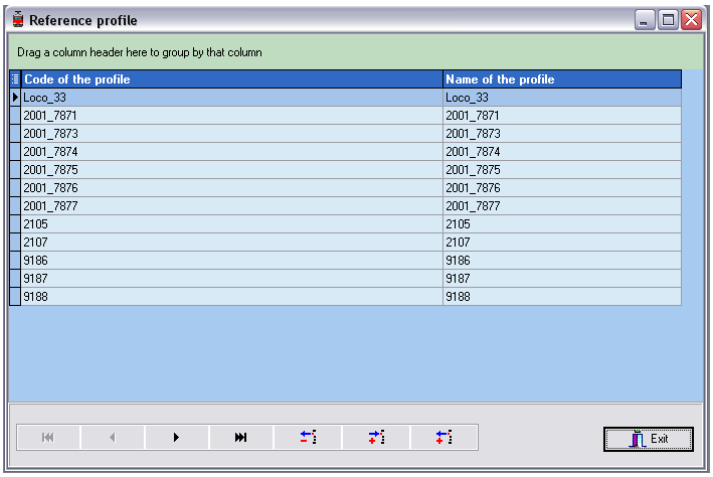
- edit limiting value for selected series;

- exit;

13.6. Registration of reference profiles

Reference profiles are stored in the database as profile description files with extension **.ref**. The program is supplied with several pre-set profiles (see par. 23). In addition, user can form a description of required profile himself or request it from **RIFTEK** (free service).

To browse available profiles, select menu **Registration > Profiles:**



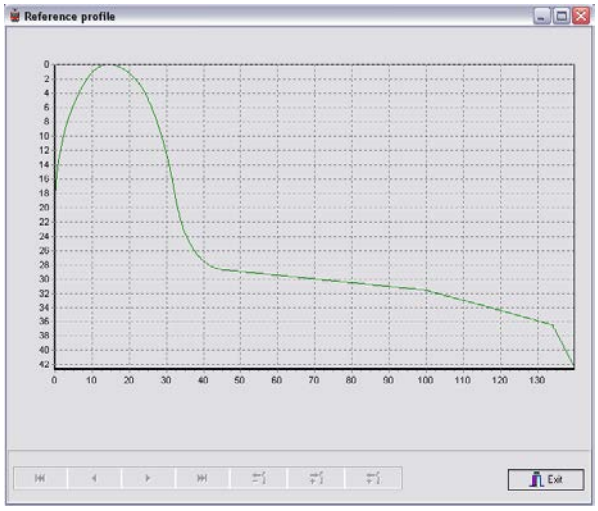
Buttons:

- import of reference profile from ***.ref** file;

- export of reference profile into ***.ref** file;

- delete reference profile;

For profile viewing make double click on selected profile or click right mouse button and press **Image**.



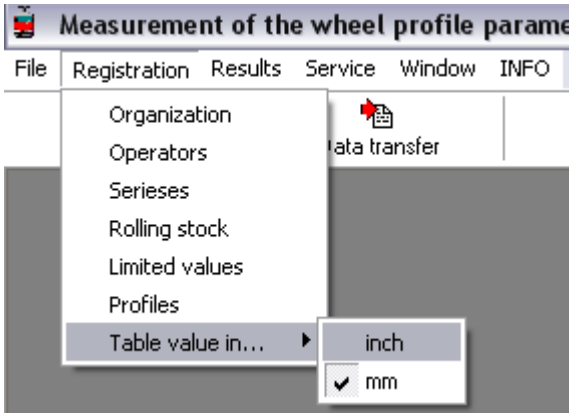
13.6.1. Request and registration of the reference profile file

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

- press button **Import**
- in the window appeared indicate the way to the **.ref**-file
- press button **Open**

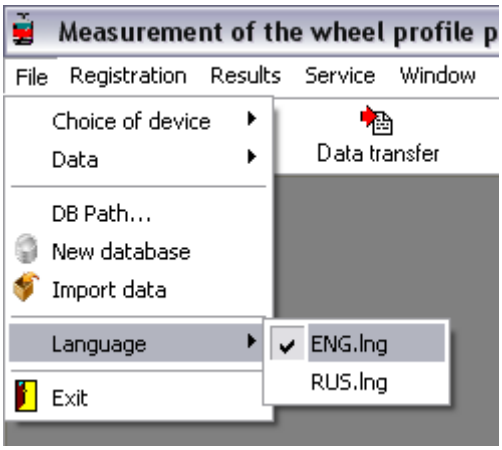
13.7. Selection of measurement units

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 measurement units, it is necessary to **select Registration > Values in... > mm** or **inch** in the main menu window. Upon the next program starting, information will be presented in the selected measurement units.



13.8. Selection of software language

To choose software language, select **File > Language** in the main window menu and set the required language support file.



14. Data exchange between PDA and PC

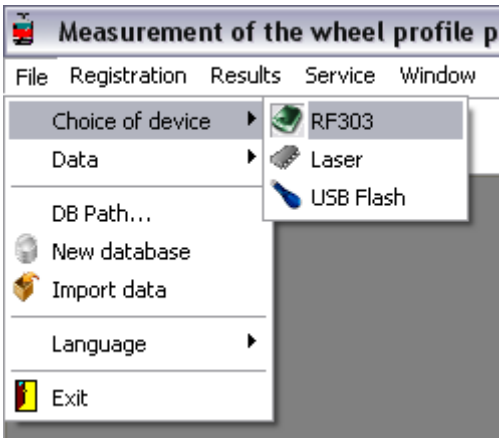
There are two possible methods of data exchange between PDA and PC:

- by means of direct cable connection of PDA to PC USB-port (special **RF505.42** cable is supplied)
- through flash memory card.

14.1. Data exchange through cable

To use cable exchange, it is necessary to:

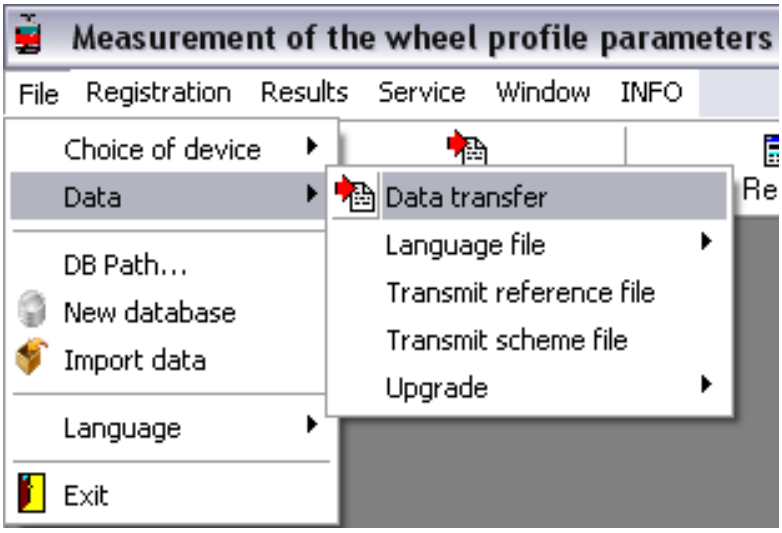
- activate PDA
- connect cable between PDA and PC (**note:** Microsoft Activesync must be installed on PC as shown in par. 12.2)
- select data exchange device by executing **File > Device selection >** select either **RF303**.



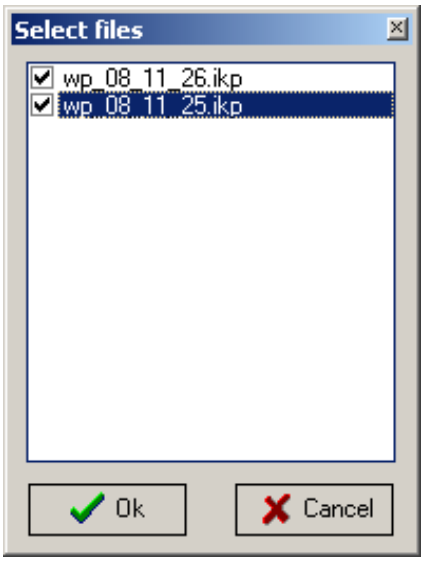
14.1.1. Transfer of database file to PC

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

- select **File > Data > Data transfer**



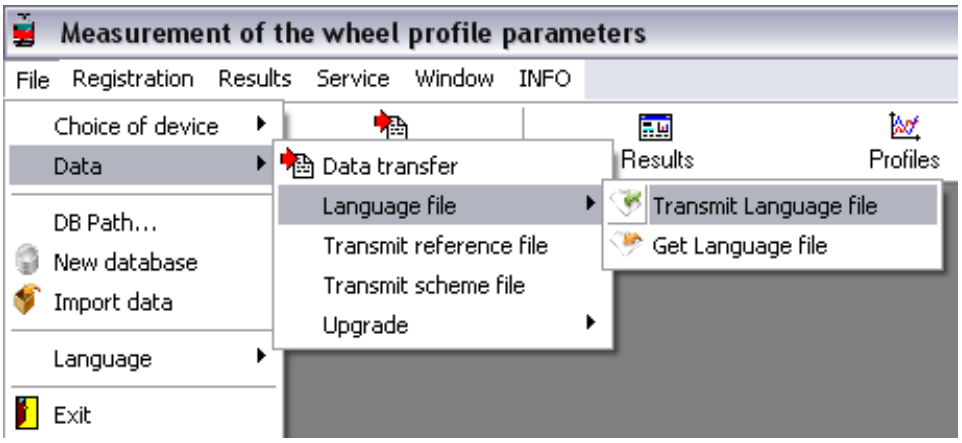
- mark the required files in the emerging window and click **OK**.



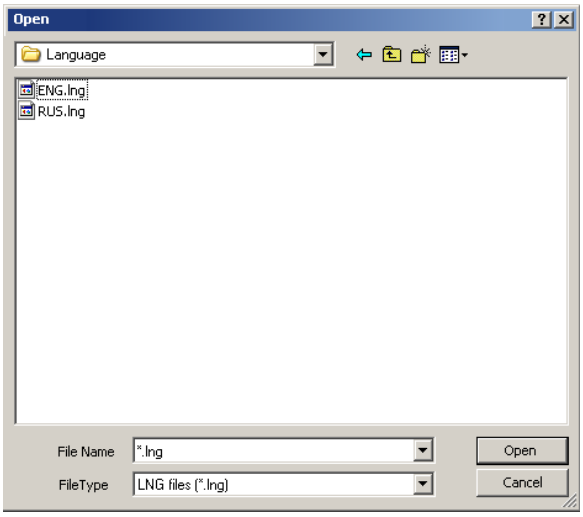
14.1.2. Transfer of language file from PC to PDA

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

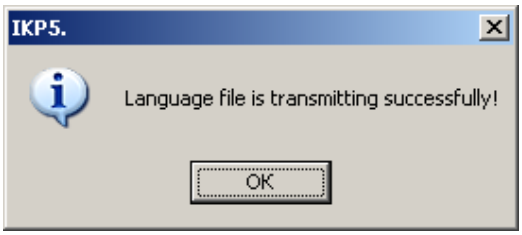
- select **File > Data > Resource file > Transfer resource file**



- select required file



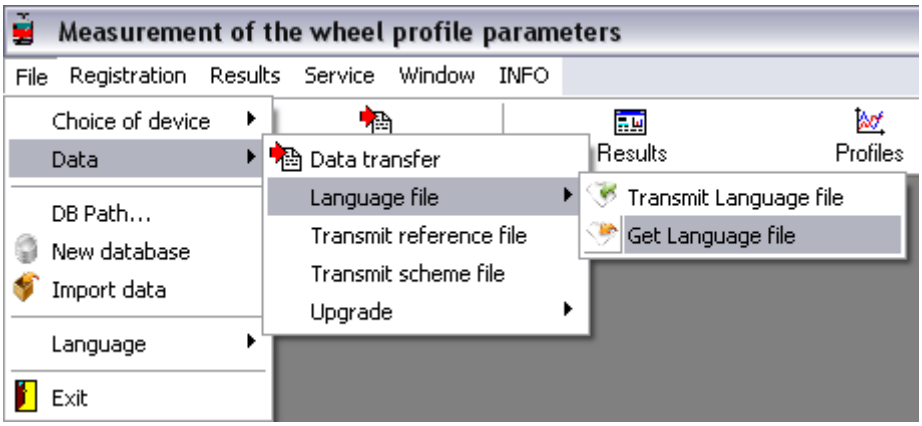
- if transfer is successful, the screen will show:



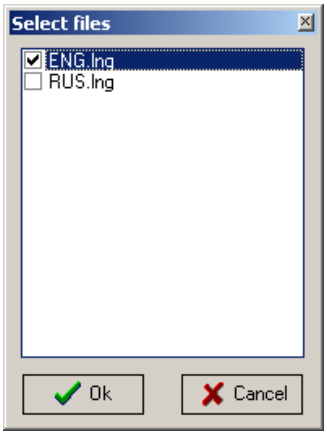
14.1.3. Transfer of language file from PDA to PC

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

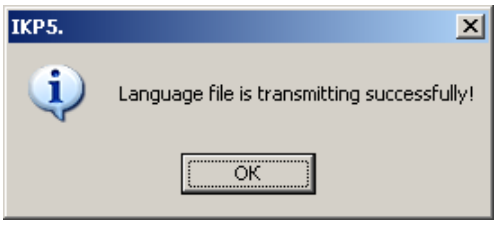
- select **File > Data > Resource file > Receive resource file**



- select required file



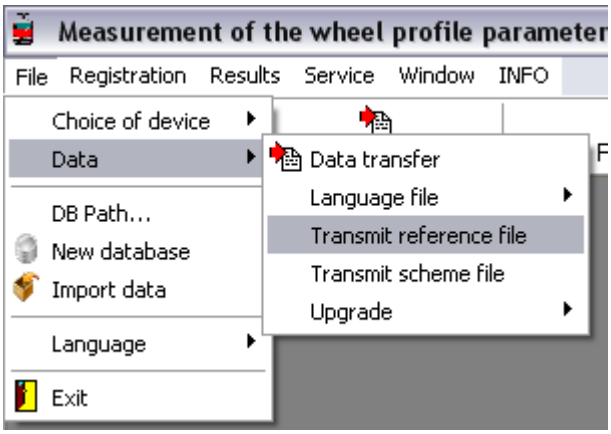
- if transfer is successful, the screen will show:



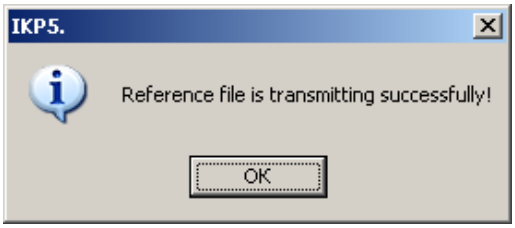
14.1.4. Transfer of reference profile files from PC to PDA

To transfer reference profile file from PC to PDA, it is necessary:

- select **File > Data > Transfer reference file**



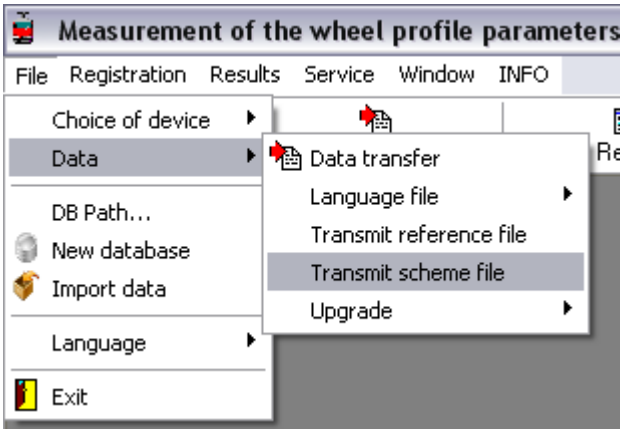
- select required file with extension **.ref**
- if transfer is successful, the screen will show the following message:



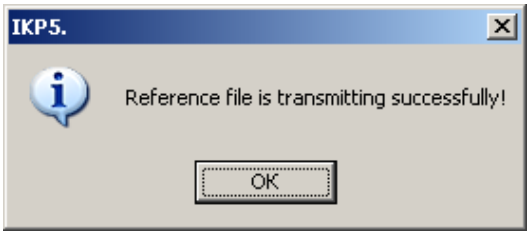
14.1.5. Transfer of processing scheme file from PC to PDA

To transfer processing scheme file from PC to PDAS, it is necessary to:

- select **File > Data > Transfer scheme file**



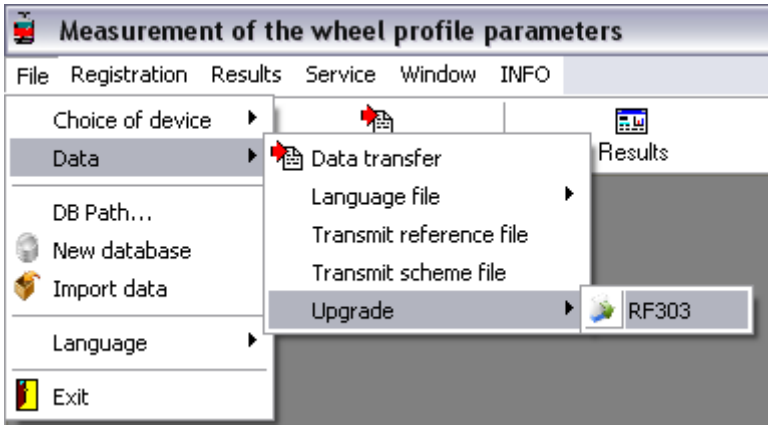
- select required file with extension **.sch**
- if transfer is successful, the screen will show:



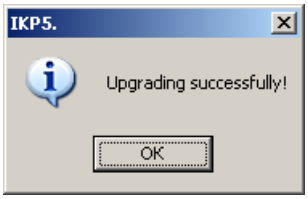
14.1.6. Updating of PDA software

The updated software version can be downloaded from ther site www.riftek.com. To transfer the update file to PDA, it is necessary to:

- select **File > Update > RF303**



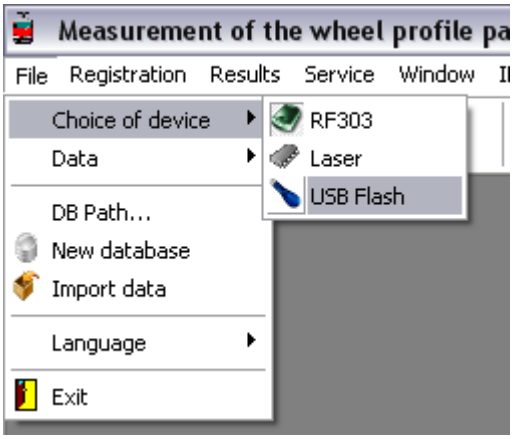
- select file for transfer
- if transfer is successful, the screen will show:



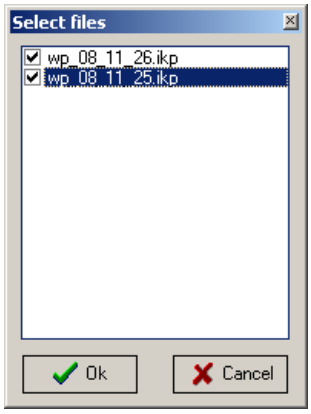
14.2. Data transfer by means of flash memory card

To transfer database files from PDA to PC by using flash memory card, it is necessary:

- insert flash card to PC USB-port
- select **File > Device selection > USB Flash**



- select database files folder
- select files and click **OK** for transfer



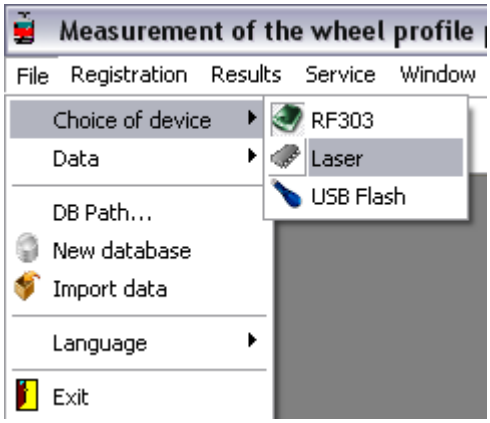
15. Taking measurements under PC control (without PDA)

The laser scanning module can work under direct control of PC without PDA.

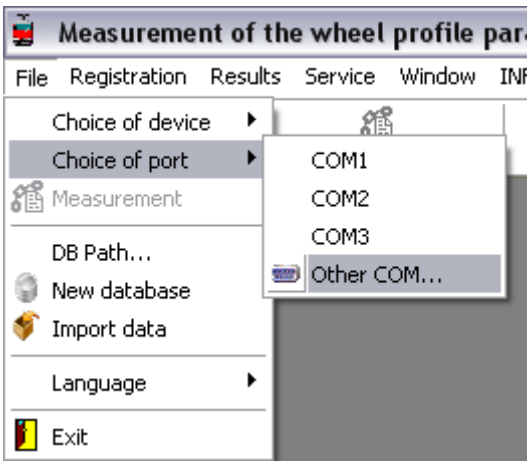
15.1. Preparation for taking measurements

To work under direct control of PC, it is necessary to:

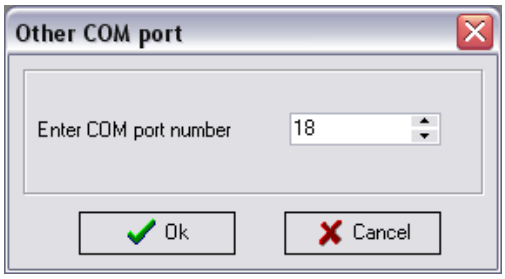
- install Bluetooth-connection between the scanning module and PC. The procedure is described in par. 19.
- select **File > Device selection > Profilometer** in the main window menu



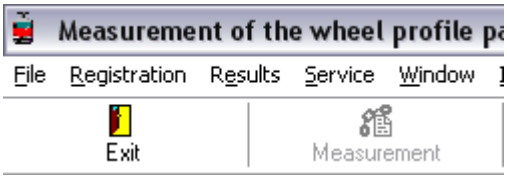
- select required port (see par. 19)

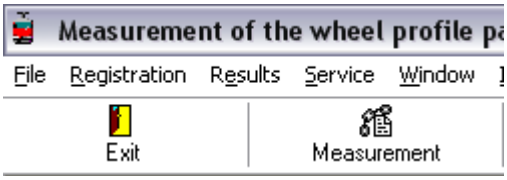


- click **OK** for connection

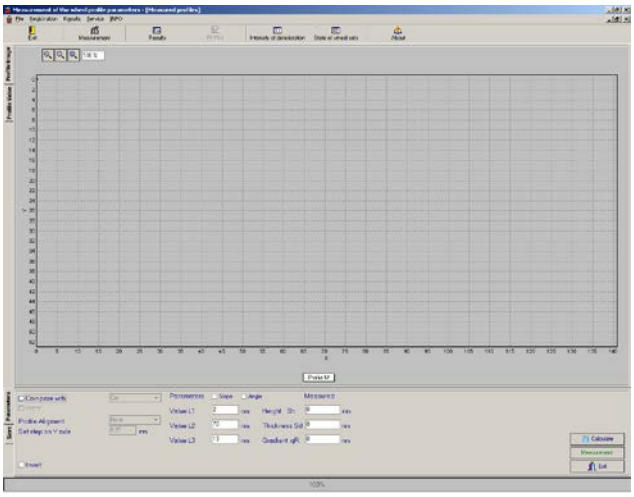


- If the connection is successful, the **Measurement** button in the main program window becomes active





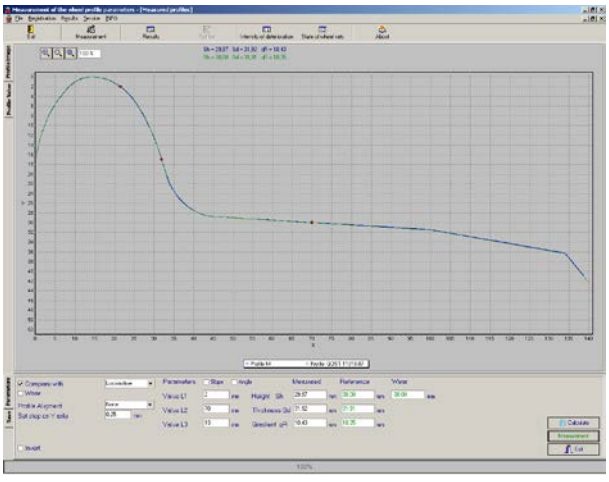
- Press the **Measurement** button or select **File > Measurement** in the menu. After the scanning module parameters are read, the program is ready for work:



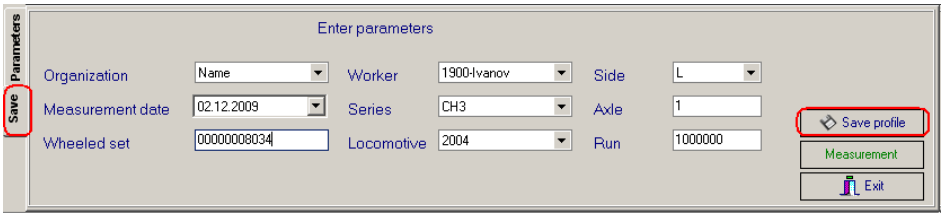
15.2. Measurement and saving of data

To measure the wheel profile, press the

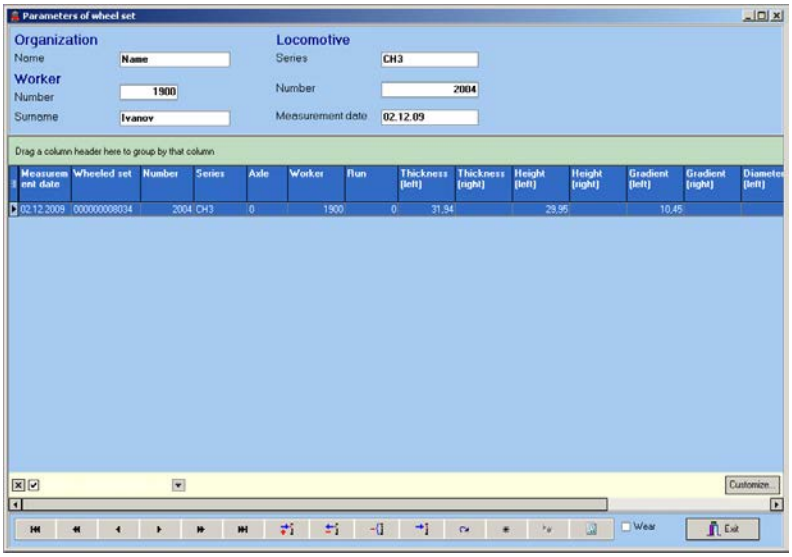
. button. Measurement being completed, the screen will show graphic image of the wheel profile and calculated profile parameters.



- the procedures of work with obtained data (**Value and Parameters** tabs) are described below.
- to save the results in the database, go to the **Save** tab.
- fill in the required parameter fields in the emerging window



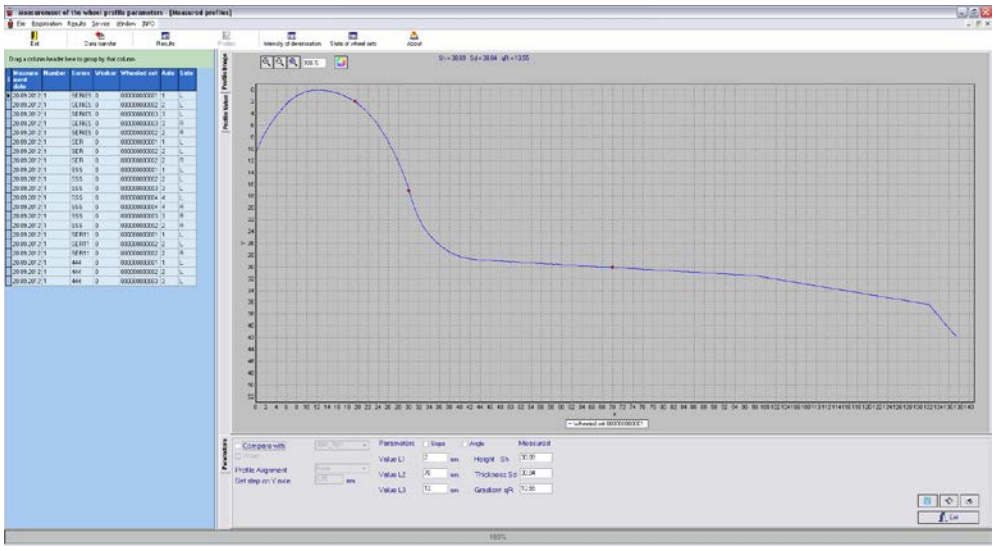
- after filling the fields press the button
- the profile measured will be saved in the database:



16. Working with profilograms and wear calculations

16.1. Profiles lookup

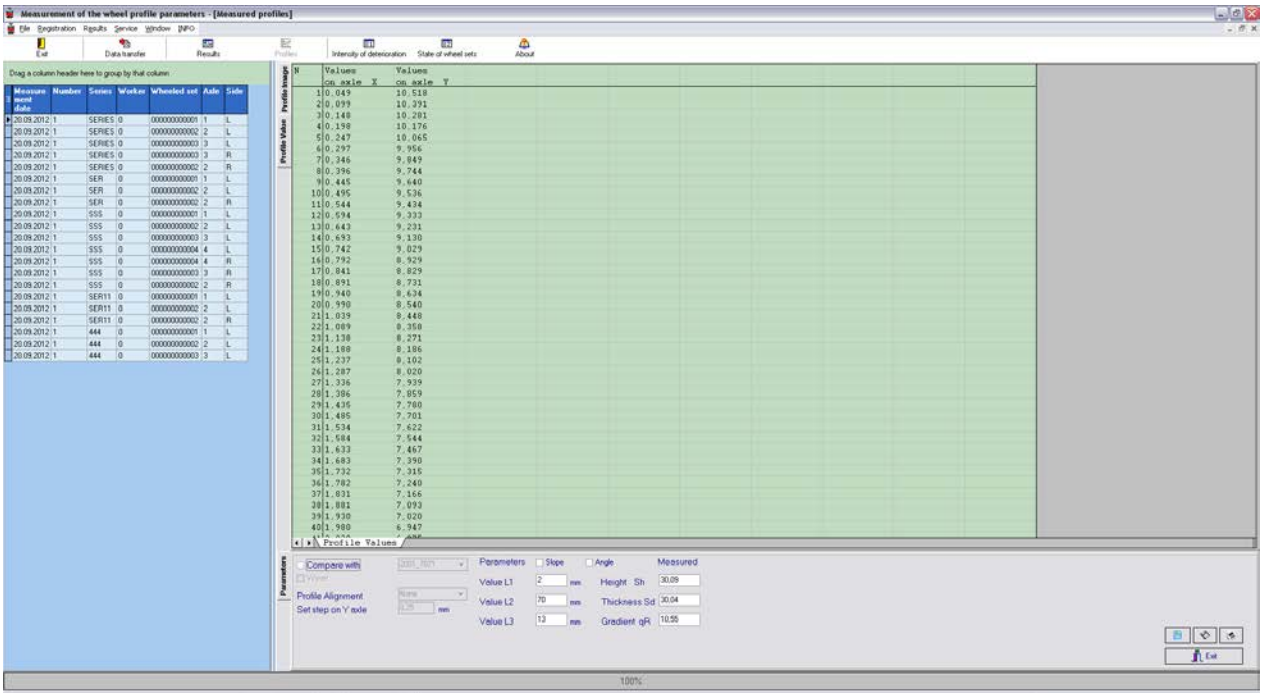
To look at rolling surface profiles select **Results > Profiles**, or press button **Profiles**



Select the required wheel pair from the table offered.

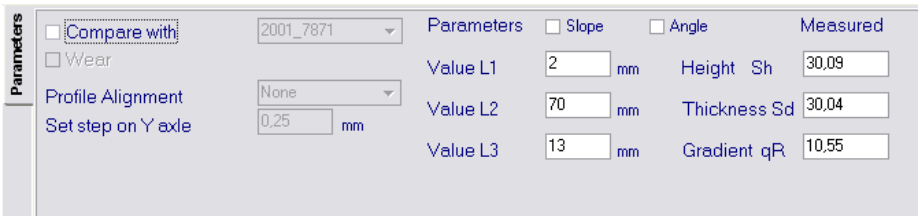
To print picture press button

To save picture in separate file (**.bmp** file) press button
To look at the points coordinates use **Values** bookmark

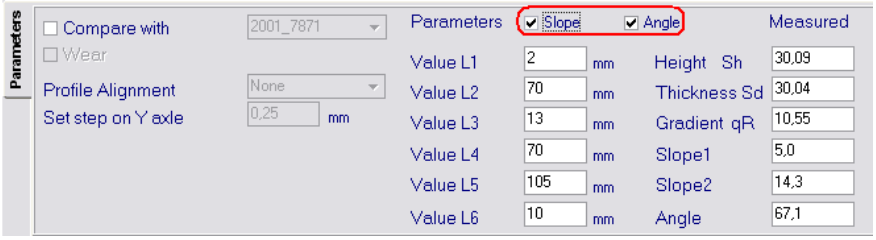


16.2. Browsing/recalculation of parameters

In this tab shows calculated profile parameters and the corresponding values of L-parameters.



By default, only the height (**Sh**), thickness (**Sd**) and steepness (**qR**) of selected profile are calculated. If necessary, values of **Slope** and profile inclination **Angle** can be obtained. To do so, put a “tick” on the field **Slope** and **Angle** respectively.



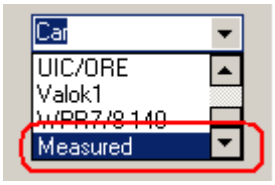
To recalculate values of flange parameters for other L-parameters, it is necessary to change values of L-parameters and press the **Calculate** button.

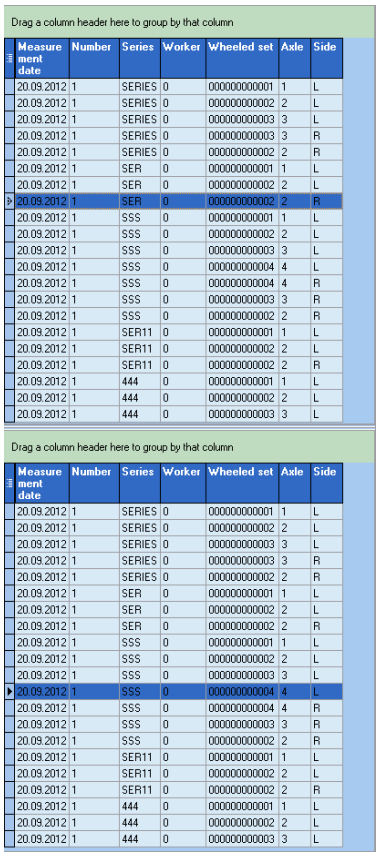
16.3. Comparing profiles

16.3.1. Selection of reference profile

To compare measured profile with the reference profile, select **Parameters** tab and tick the **Compare with** field. Select required reference profile in the pullout list.

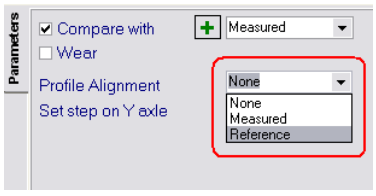
To compare two arbitrarily chosen profiles to each other (for example, profiles of left and right wheels), it is necessary to select **Measured** in the pullout list instead of the reference profile. In the case where measured profile is chosen as comparison profile, the **Profiles** tab shows additional table for selection of comparison profile out of a number of measured profiles. Then, select profile from the additional table.



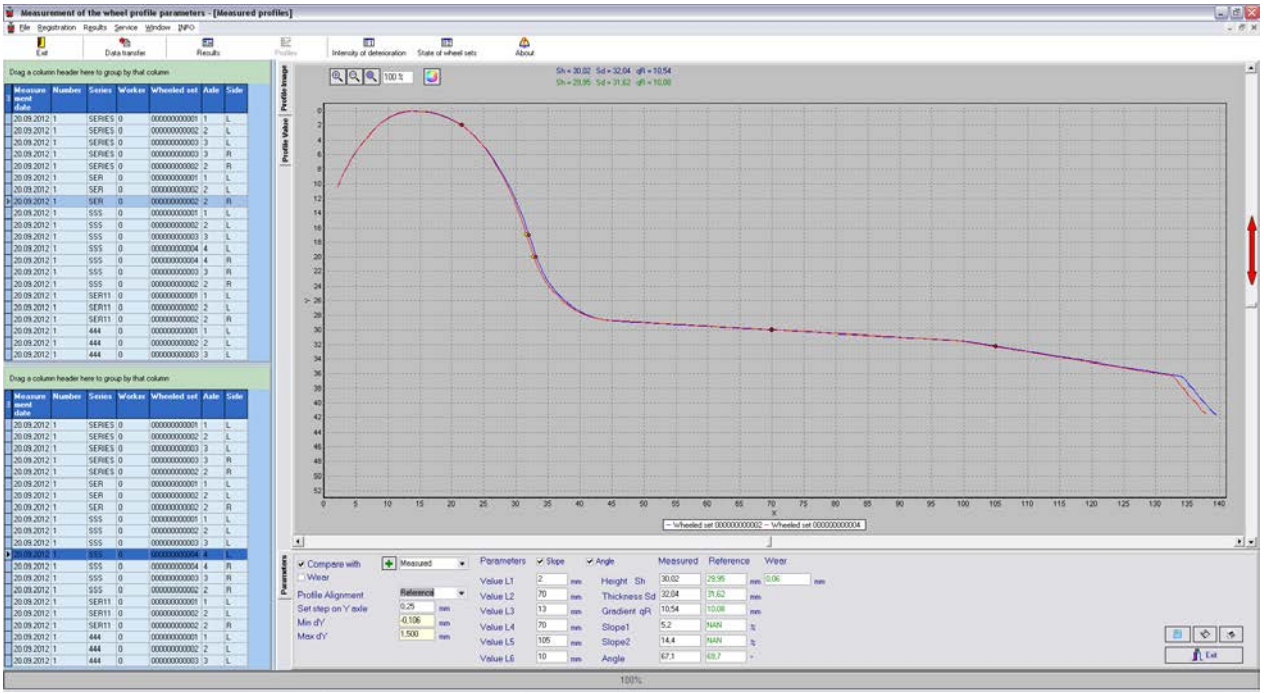


16.3.2. Superposition of profiles and rescaling

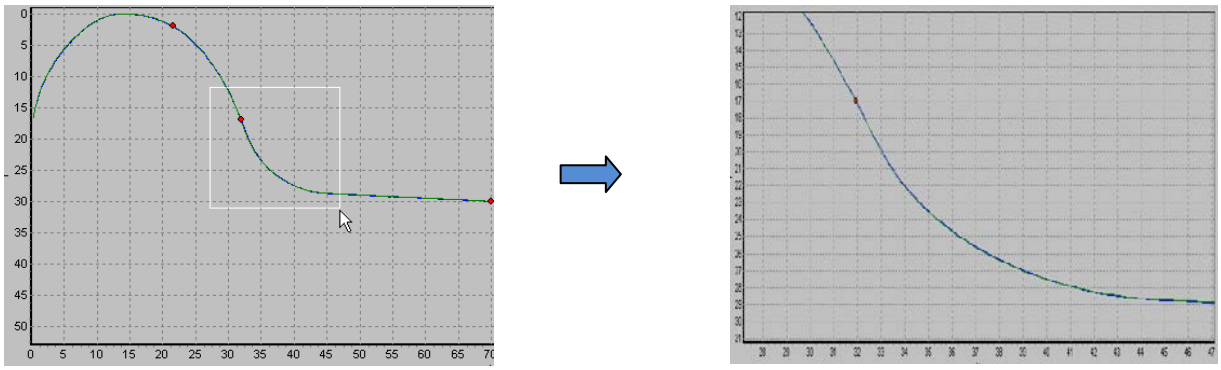
To superimpose profiles (by vertical translation), select profile to be translated in the **Matching** window: **Reference** or **Measured**.



Set the vertical translation step in the **Set step along Y axis** window. By pressing the left mouse key drag the profile to required value on the scrolling bar.

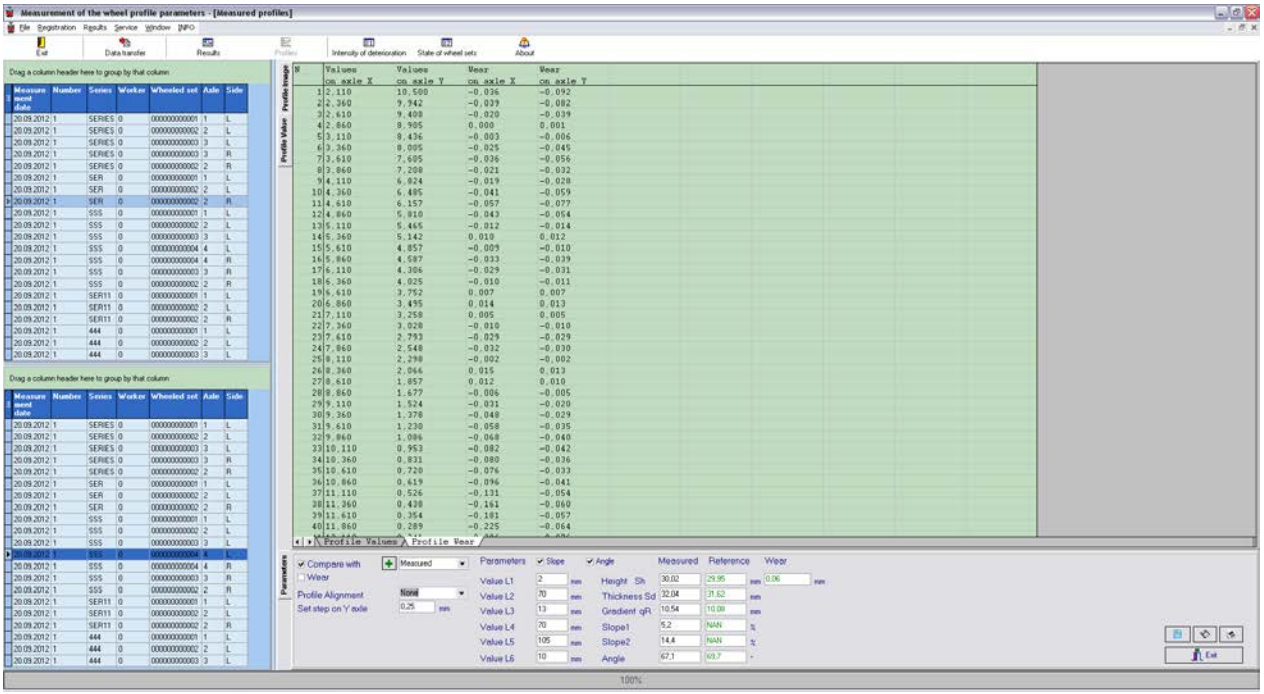


To change image scale, mark part of the image with the left mouse key, move the image by holding it with the right mouse key pressed or with buttons **Increase** - , **Decrease** - and **Show all** - .



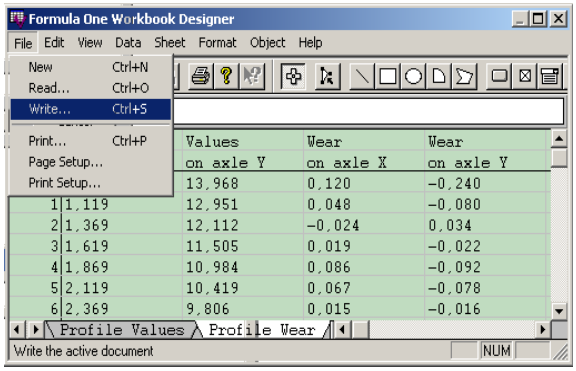
16.4. Wear calculation

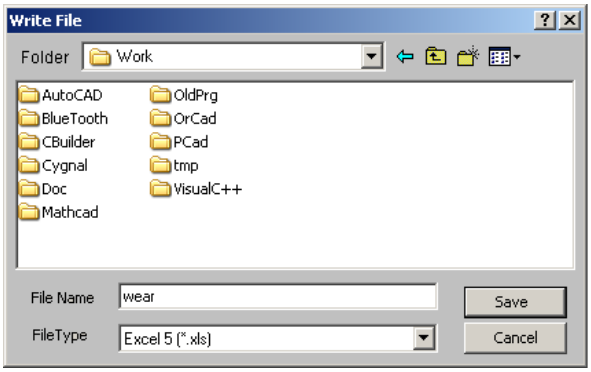
To calculate wear, select the **Parameters** and **Value** tabs, select reference profile and set the calculation step, if necessary. The table will show deviation of coordinates of the selected profile from those of the reference profile in two directions (X and Y).



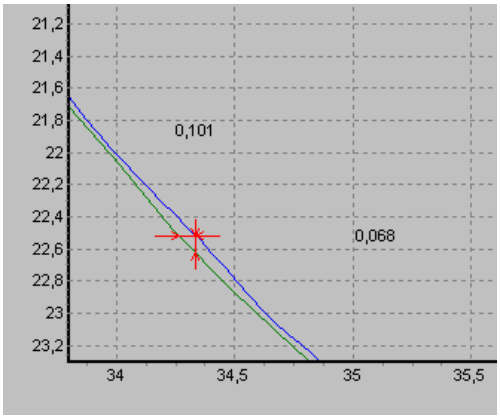
To save the table in the **Exel-format,** it is necessary to:

- click the right mouse key in the table values section;
- select **File > Write** in the emerging window;
- type the file name, select **Excel 5 (*.xls)** and save.



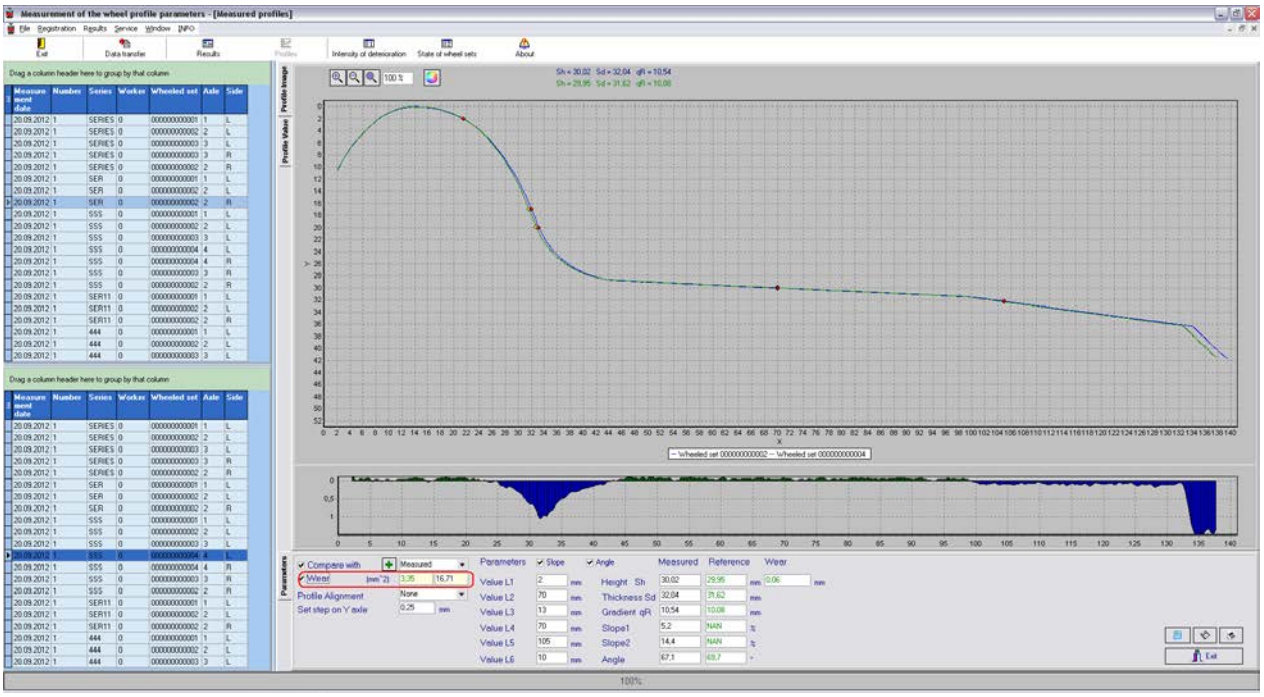


To obtain fast calculation of the profile wear at a certain point, put cursor bar to any of the profiles, and when a cross-like (+) mouse cursor appears press the left mouse key. The resulting screen will show the value of the co-ordinate difference between profiles taken along X- and Y-axes, as shown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

To obtain graphic presentation of wear, it is necessary to put a “tick” to the **Wear** field.



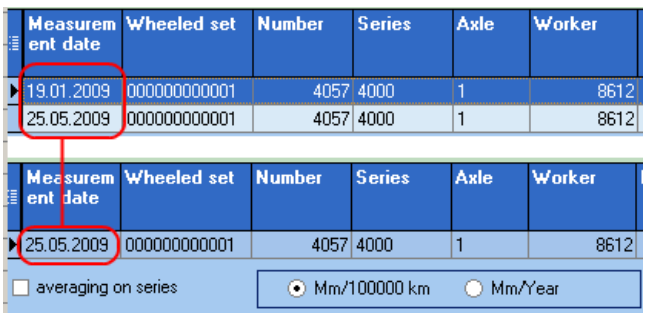
Value of the wear area is calculated in square millimeters with respect to selected reference profile:

16.5. Calculation of wear intensity

The program allows automatic formation of the table of wheel sets wear intensity values. Two calculation options are available:

- in millimeters for 100000 km of wheel sets running distance
- To perform calculation, the database must contain values of wheel pair running distance. Measurements made on the latest date and the closest date previous to it are automatically taken from the database. The wear value in millimeters is given for (reduced to) the 1000000 km running distance.
- in millimeters over 1 year of wheel sets use
- Measurements made on the latest date and the closest date previous to it are automatically taken from the database. The wear value in millimeters is given for (reduced to) the period of 1 year.
- To form the table, select **Service > Wear intensity** in the main menu of the program. Select options: **mm/100000 km** or **mm/year**

Starting and latest dates



Parameters

Thickness (left)	Thickness (right)	Height (left)	Height (right)	Gradient (left)	Gradient (right)	Diam (left)
31,90	31,93	30,00	30,04	10,30	10,32	
31,86	31,84	30,20	30,14	9,20	9,34	

Wear intensity

Thickness (left)	Thickness (right)	Height (left)	Height (right)	Gradient (left)	Gradient (right)
0,116	0,261	0,579	0,29	3,187	2,839

In calculation, it is possible to average wheel sets wear values over all locomotives of a given series. To achieve this, put a “tick” in the **Average over series** field.

Procedures of navigation over the table, filtration and sorting are described in par. 17. Procedures of generation and printing of reports are given in par. 18.

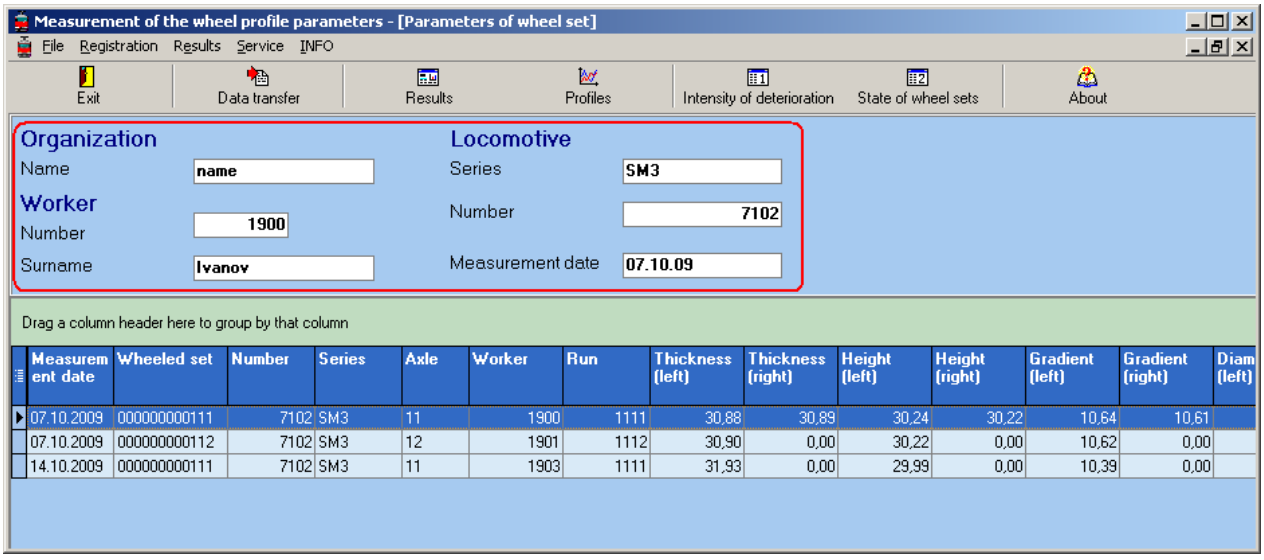
16.6. Calculation of percentage wear

The program allows automatic formation of tables showing percentage wear of wheel sets.

The percentage wear is calculated as follows:

Wear = (H - T)/(H – П)*100%, where **H** is the nominal parameter value (parameter value for reference profile), **T** is the current parameter value on the measurement date, **П** is the limiting parameter value (in accordance with the table of limiting wear values, see par. 13.5.).

To generate the table, select **Service > % wear** in the main program menu.

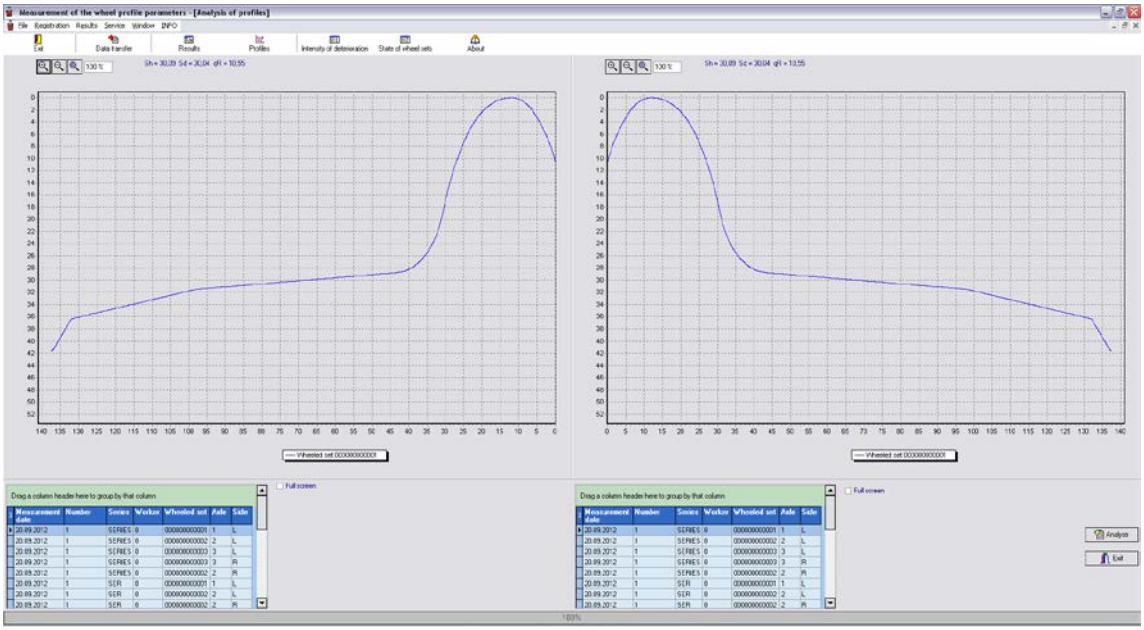


In calculation, it is possible to average wheel sets wear values over all locomotives of a given series. To achieve this, put a “tick” in the **Average over series** field.

Procedures of navigation over the table, filtration and sorting are described in par. 17. Procedures of generation and printing of reports are given in par. 18.

16.7. Implementation of minimum wheel truing function

The program allows automatic selection of that wheel profile from the reference profile base for which the total truing depth will be minimal. To choose the required profile, select **Service > Profiles analysis** in the main program menu.



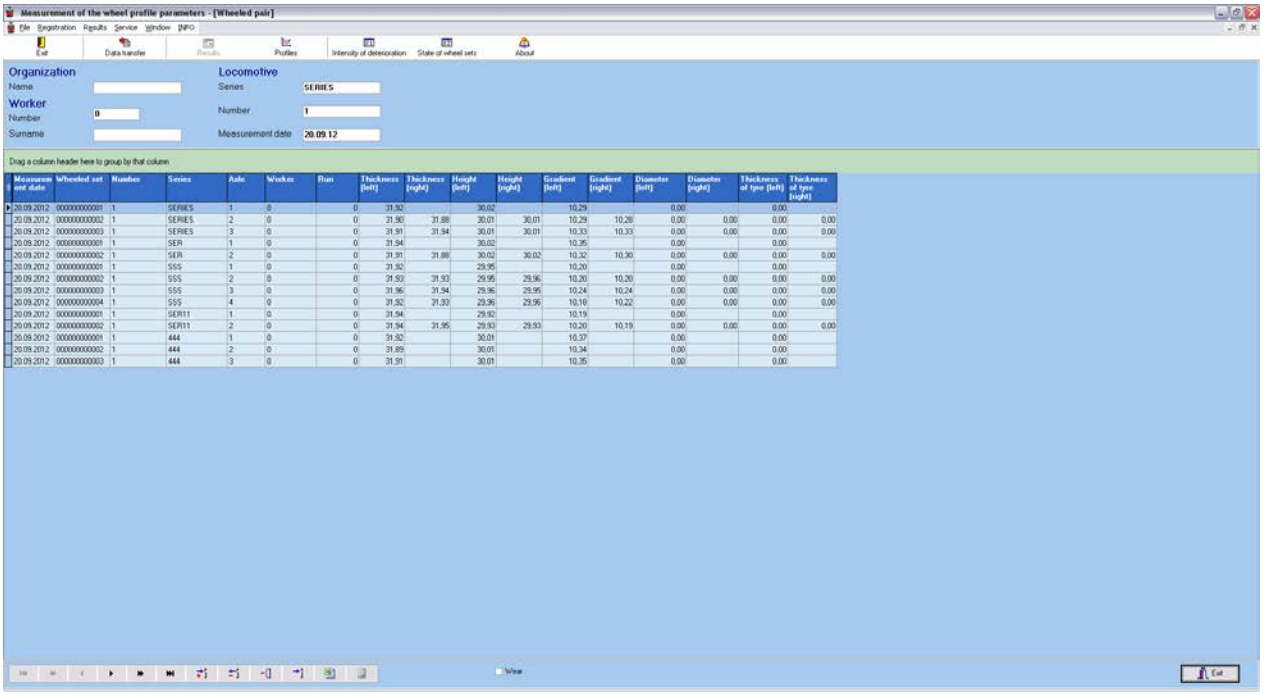
Select right and left wheel of wheel pair at the bottom part of the tables. The windows above the tables will offer optimal profile type.

To know the wheel cutting depth in a certain point, put the cursor to any profile, and when a cross-like (+) mouse cursor appears press the left mouse key. The resulting screen will show the value of difference between profiles along X- and Y-axes, as shown by arrows. To remove size indication from the screen, put cursor to any of the profiles and press the right mouse key.

17. Scanning and editing of data

17.1. Scanning and filtering of data

To scan data, select **Results > Wheel sets** in the menu or press the **Results** button. The form showing results will be as follows:



- ***Navigation over the table***

To navigate between the base entries, use “up/down” arrows or buttons of the navigation panel:

- - to the beginning of the database;
- - to the previous page of the database;
- - to the previous entry of the database;
- - to the next entry of the database;
- - to the next page of the database;
- - to the end of the database.

- ***Sorting of data***

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

Measurement date	Wheeled set	Number
01.01.2008	000000000001	2001
01.01.2008	000000000002	5
01.01.2008	000000000003	5
01.01.2008	000000000004	5
07.10.2009	0000SU000111	7102
07.10.2009	0000SU000112	7102
14.10.2009	0000SU000111	7102

Measurement date	Wheeled set	Number
01.01.2008	000000000001	2001
01.01.2008	000000000002	5
01.01.2008	000000000003	5
01.01.2008	000000000004	5
07.10.2009	0000SU000111	7102
14.10.2009	0000SU000111	7102
07.10.2009	0000SU000112	7102

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

- ***Filtering of data***

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

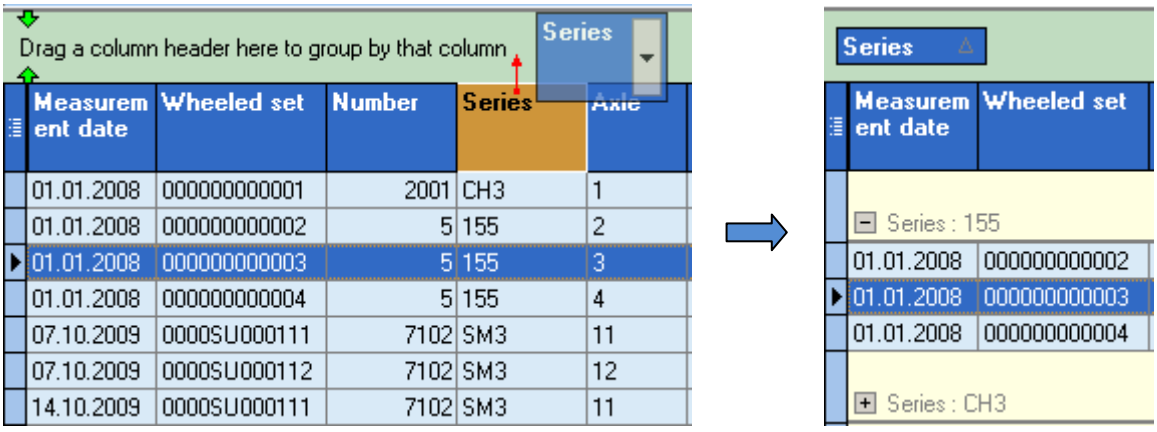
Measurement date	Series	Wheeled set
(All)	CH3	000000000001
(Custom...)	155	000000000002
01.01.2008	155	000000000003
07.10.2009	155	000000000004
14.10.2009	SM3	0000SU000111
07.10.2009	SM3	0000SU000112
14.10.2009	SM3	0000SU000111

Measurement date	Series	Wheeled set
07.10.2009	SM3	0000SU000111
07.10.2009	SM3	0000SU000112

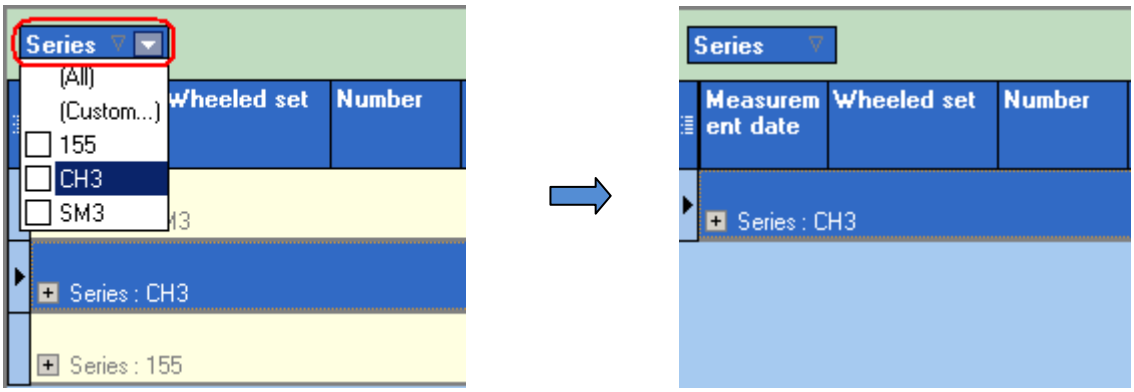
To cancel filtering, all steps should be taken in the reverse order.

- ***Data grouping***

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

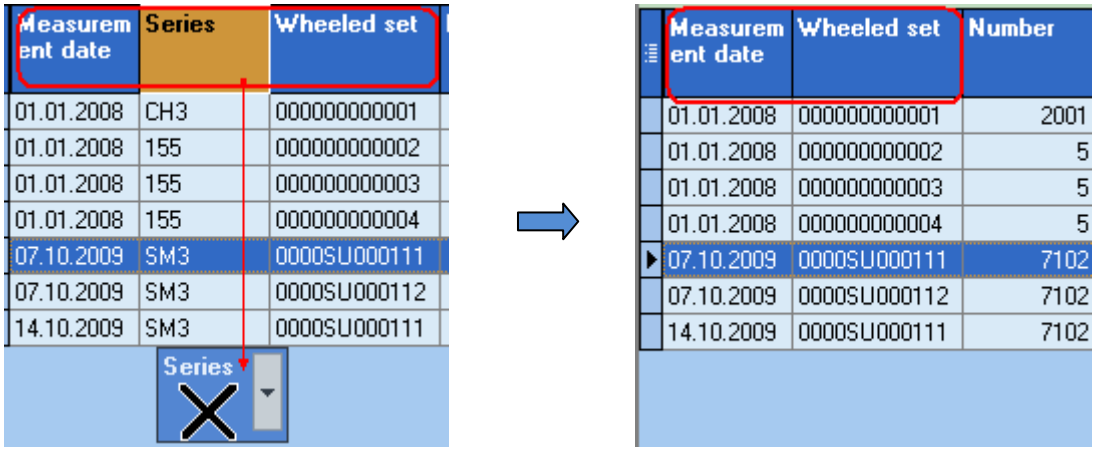


To filter data for a grouping field, click left mouse key on the header of the grouping field and select required value in the pullout list:

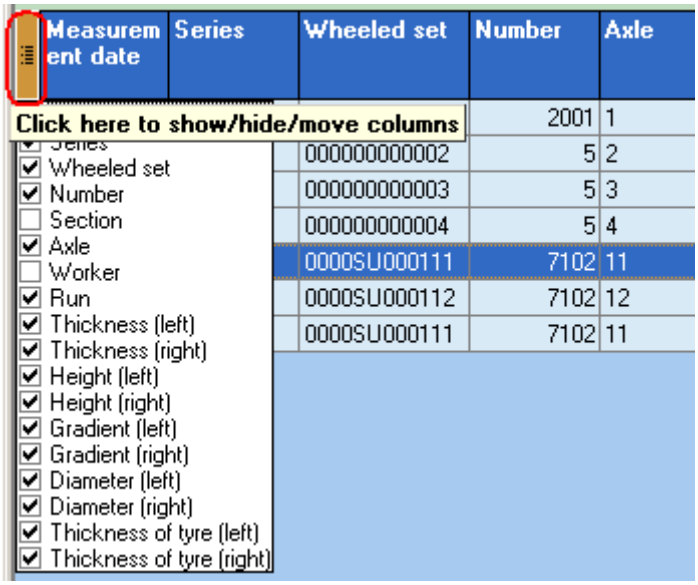


- ***Hide/show field***

To hide field, it is necessary to click left mouse key on the header of the field column, and, with the mouse key pressed, drag it outside of the with the mouse key pressed, drag it outside the table header:

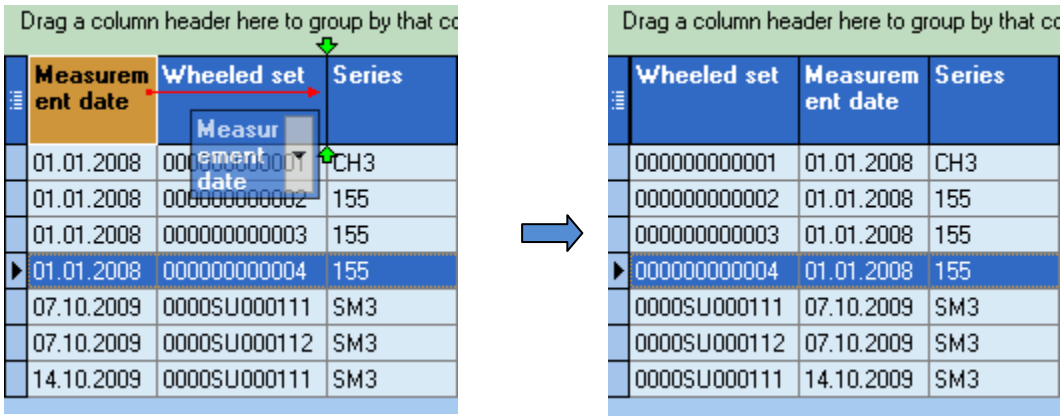


The second method: to hide/show the field, click left mouse key on the utmost left header, and remove mark from /mark required field in the table.



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

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

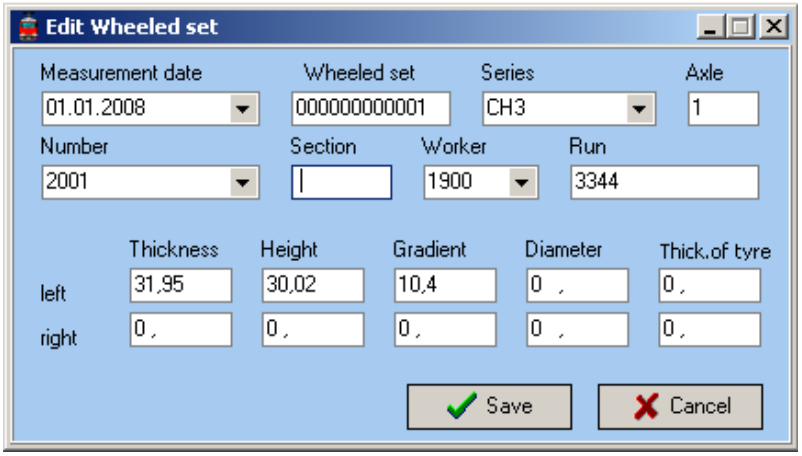


17.2. Editing data

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

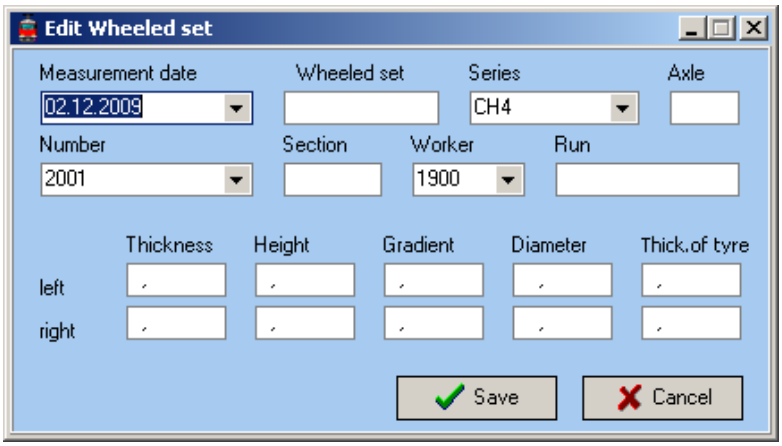
- ***Editing data***

To edit the current entry, press the button and input/change required parameter values, after the editing is complete press the **Save** button.



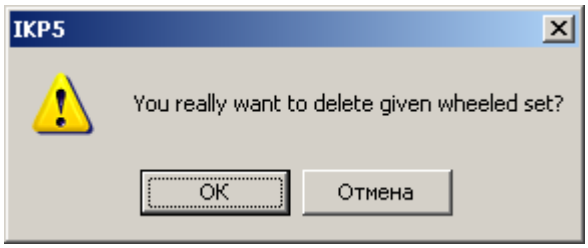
- ***Adding data***

To add a new data entry, press the button and type required parameter values, after the editing is complete press the **Save** button.



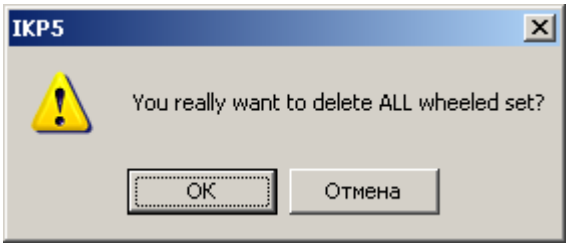
- ***Deleting data***;

To delete a current entry, press the button 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, press the button and confirm the deletion.



17.3. Creation of empty database

To create empty database, select **File > New DB** in the main menu.

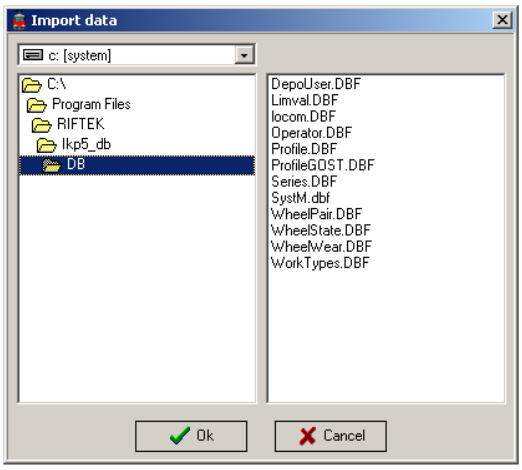
All data except for reference files will be deleted from the database. At the same time, catalog **DB(dd.mm.yy)** will be created in the installation directory whereto all deleted data (**dd.mm.yy** – current date) will be copied. Subsequently, these data can be restored (see par. 17.4.).

17.4. Import of database

To import data to data base,

- select **File > Data import** in the menu.

- select folder with DB files in the left-hand window. All files will appear in the right-hand window:

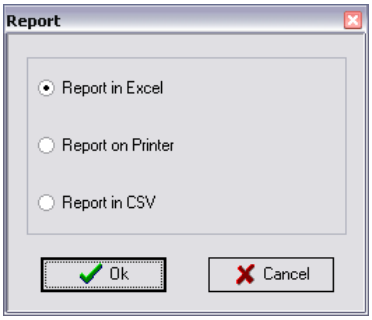


- press **OK** to import data.

18. Report preparation

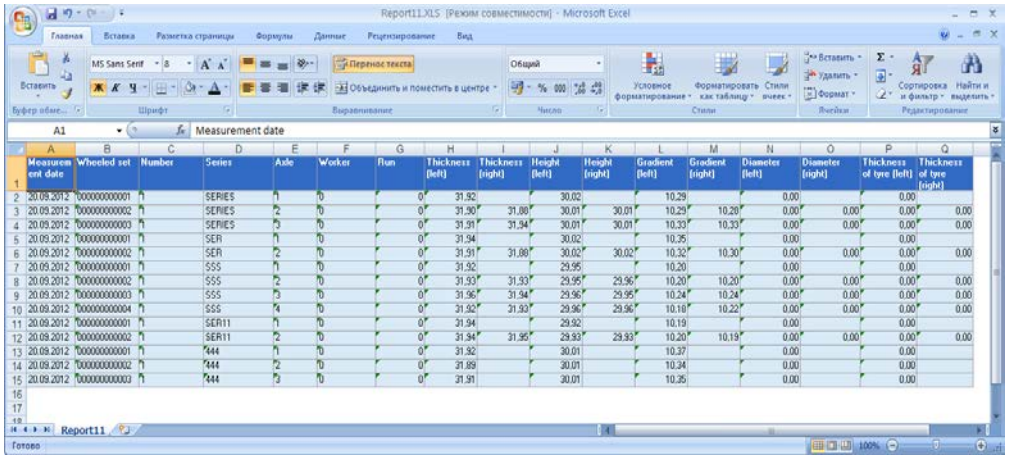
When staying in the scanning and editing of date mode according to par. 17, user can prepare reports in **Excel, RTF, TXT** formats or print out reports. In the formation of report sorting used at the moment is taken into account.

To generate a report, press the button, and the program will to select the following options:



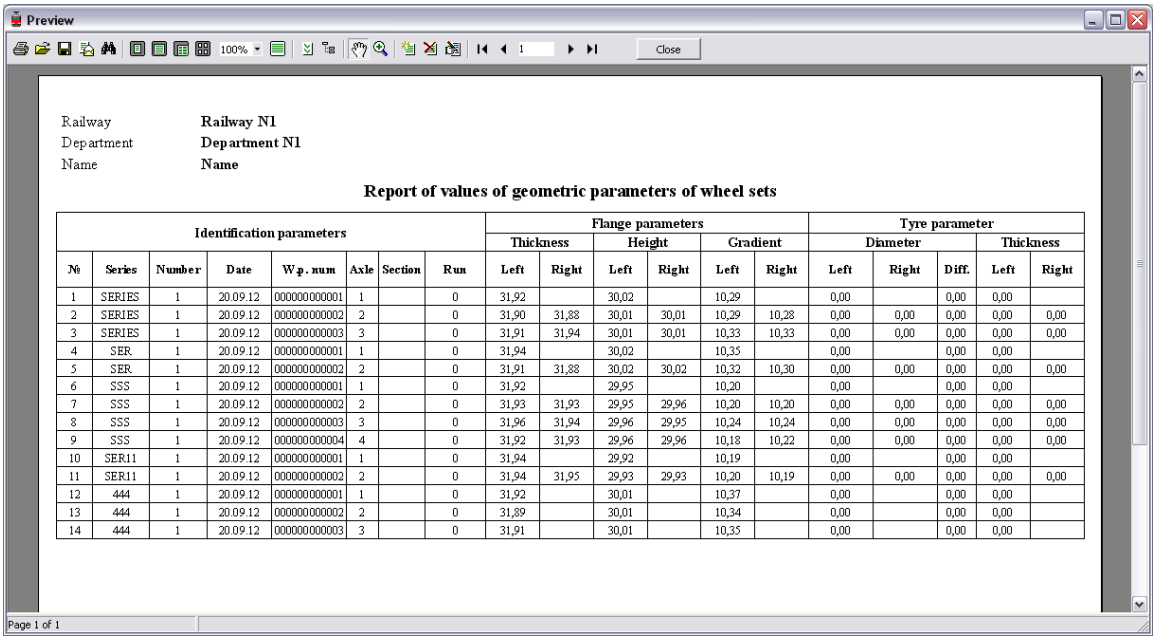
18.1. Exel-format report

To prepare a report in Excel format, select **Report in Excel** and press **OK.** The required data will be transferred to Excel-table:



18.2. Report for printout, Excel, RTF and text files

To prepare the report for printout, select **Report for printout** and press **OK**. Data will be presented in the form of report ready for printout. To start printing, press the **Printer** button.



Preview

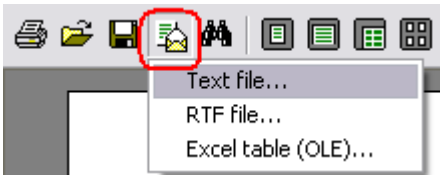
Railway Railway N1
Department Department N1
Name Name

Report of values of geometric parameters of wheel sets

Identification parameters								Flange parameters						Tyre parameter				
								Thickness		Height		Gradient		Dimeter			Thickness	
№	Series	Number	Date	Wp. num	Axle	Section	Run	Left	Right	Left	Right	Left	Right	Left	Right	Diff.	Left	Right
1	SERIES	1	20.09.12	000000000001	1		0	31,92		30,02		10,29		0,00		0,00	0,00	
2	SERIES	1	20.09.12	000000000002	2		0	31,90	31,88	30,01	30,01	10,29	10,28	0,00	0,00	0,00	0,00	0,00
3	SERIES	1	20.09.12	000000000003	3		0	31,91	31,94	30,01	30,01	10,33	10,33	0,00	0,00	0,00	0,00	0,00
4	SER	1	20.09.12	000000000001	1		0	31,94		30,02		10,35		0,00		0,00	0,00	
5	SER	1	20.09.12	000000000002	2		0	31,91	31,88	30,02	30,02	10,32	10,30	0,00	0,00	0,00	0,00	0,00
6	SSS	1	20.09.12	000000000001	1		0	31,92		29,95		10,20		0,00		0,00	0,00	
7	SSS	1	20.09.12	000000000002	2		0	31,93	31,93	29,95	29,96	10,20	10,20	0,00	0,00	0,00	0,00	0,00
8	SSS	1	20.09.12	000000000003	3		0	31,96	31,94	29,96	29,95	10,24	10,24	0,00	0,00	0,00	0,00	0,00
9	SSS	1	20.09.12	000000000004	4		0	31,92	31,93	29,96	29,96	10,18	10,22	0,00	0,00	0,00	0,00	0,00
10	SER11	1	20.09.12	000000000001	1		0	31,94		29,92		10,19		0,00		0,00	0,00	
11	SER11	1	20.09.12	000000000002	2		0	31,94	31,95	29,93	29,93	10,20	10,19	0,00	0,00	0,00	0,00	0,00
12	444	1	20.09.12	000000000001	1		0	31,92		30,01		10,37		0,00		0,00	0,00	
13	444	1	20.09.12	000000000002	2		0	31,89		30,01		10,34		0,00		0,00	0,00	
14	444	1	20.09.12	000000000003	3		0	31,91		30,01		10,35		0,00		0,00	0,00	

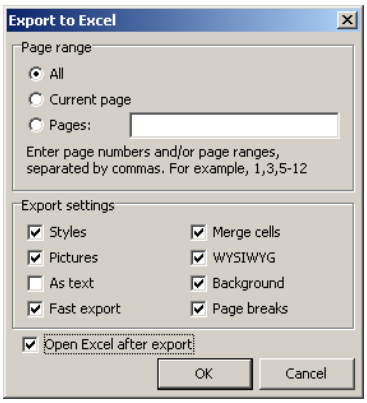
Page 1 of 1

When staying in this mode, it is possible to export data to **Excel, RTF** and **text** files. To export, press the button, and the pullout menu emerges:

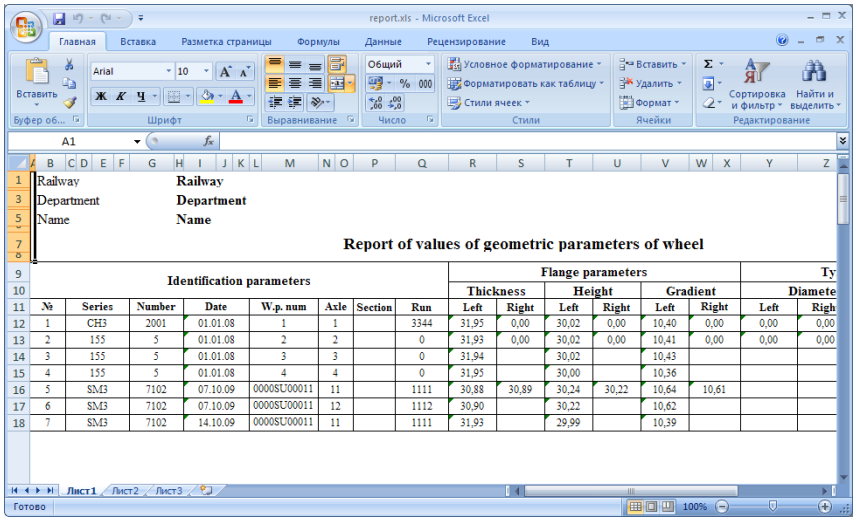


To export data to text file, select **Text file…**, to export to **RTF-**file select **RTF file…**, to export to Excel-file select **Excel table(OLE)**.

When exporting to **Excel**, make required settings in the emerging window and press OK.



Then, type the file name and press the **Save** button to export to **Exel.** As a result you will obtain:



report.xls - Microsoft Excel

1	Railway	Railway
3	Department	Department
5	Name	Name

Report of values of geometric parameters of wheel

	Identification parameters								Flange parameters						Ty	
									Thickness		Height		Gradient		Diamete	
№	Series	Number	Date	W.p. num	Axle	Section	Run	Left	Right	Left	Right	Left	Right	Left	Righ
1	CH3	2001	01.01.08	1	1		3344	31,95	0,00	30,02	0,00	10,40	0,00	0,00	0,00
2	155	5	01.01.08	2	2		0	31,93	0,00	30,02	0,00	10,41	0,00	0,00	0,00
3	155	5	01.01.08	3	3		0	31,94		30,02		10,43			
4	155	5	01.01.08	4	4		0	31,95		30,00		10,36			
5	SM3	7102	07.10.09	0000SU00011	11		1111	30,88	30,89	30,24	30,22	10,64	10,61		
6	SM3	7102	07.10.09	0000SU00011	12		1112	30,90		30,22		10,62			
7	SM3	7102	14.10.09	0000SU00011	11		1111	31,93		29,99		10,39			

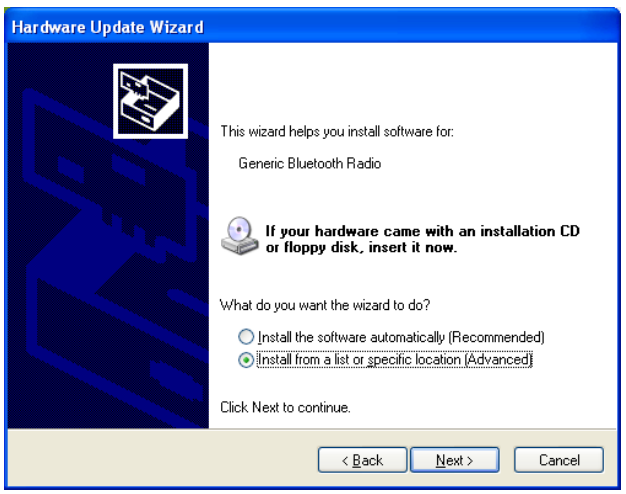
Лист1 Лист2 Лист3

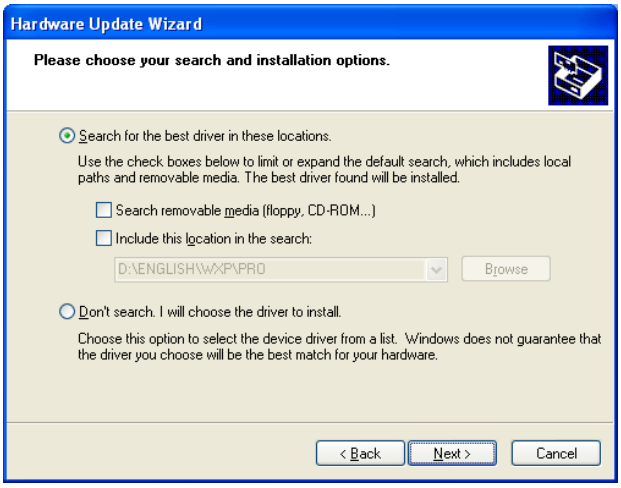
Готово 100%

19. Annex 1. Installation of Bluetooth connection between scanning module and PC

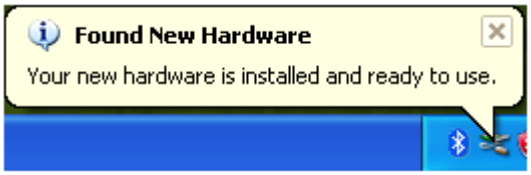
To install Bluetooth-connection between the laser scanning module and PC, it is necessary to:

- insert USB/Bluetooth-module to PC USB-port..
- continue installation of the equipment following instructions of the wizard by selecting successively:





- when drivers are installed, the corresponding message and Bluetooth icon will appear in the screen:

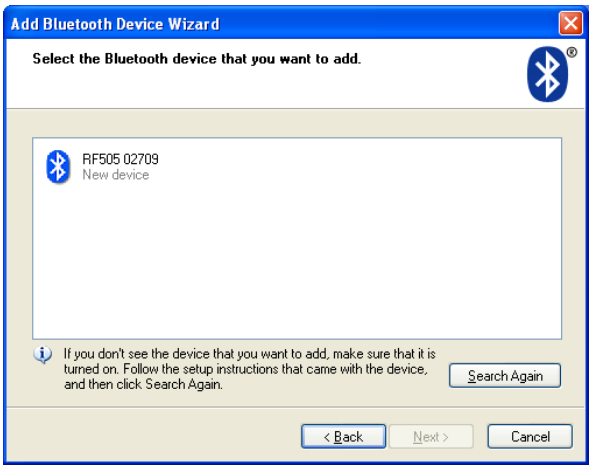


- activate **PDA**.
- click right mouse key on the Bluetooth icon and select **Add Bluetooth device**

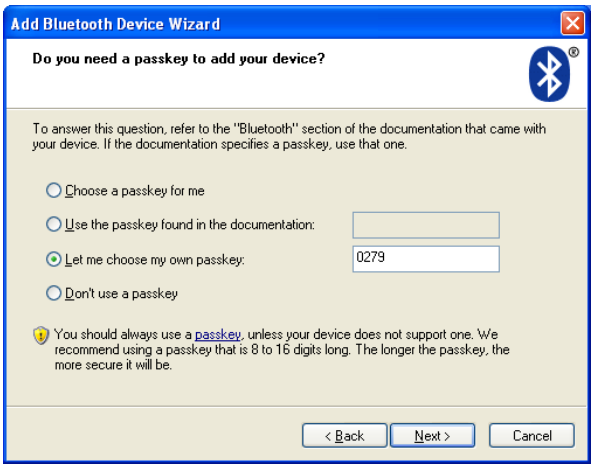
- Then Bluetooth installation wizard will start working:

- tick the **Device is installed and ready for connection**
- select **Further** for search

- when the search is competed, the wizard will show the devices found:



- select the required device (RF505), press **Further** and type access key (Pin). The key for each device consists of 4 symbols and is set based on the profilometer serial number. For example, if the profilometer number is 00810, then Pin=0080; 01309 - Pin=0139, etc.



- press **Further** and continue installation process.
- when required drivers are installed, the Bluetooth device will give a message with COM-port (outgoing) which should be opened for connection with profilometer during calibration or for controlling profilometer by PC (see par. 15.). In this case, the port is **COM20**:

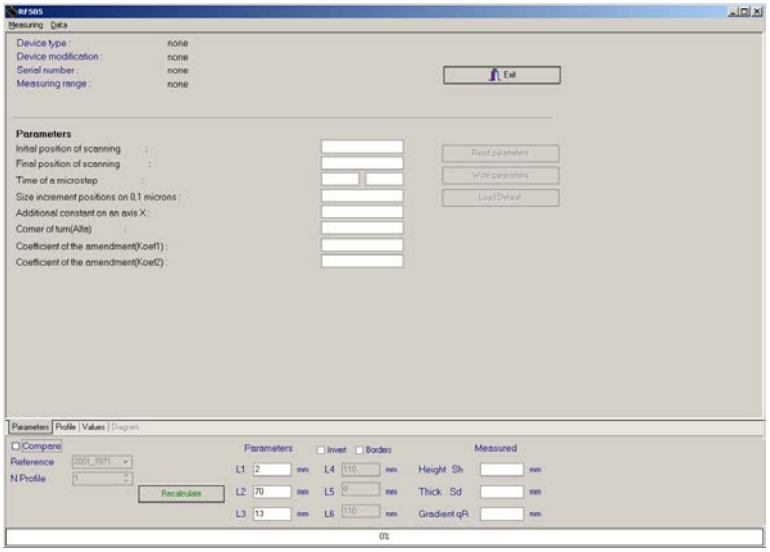
20. Annex 2. Testing and calibration

We can supply the profilometer complete with an RF432.10 (Figure 1A) calibration-wheel simulation unit and **F505Calibr** calibration program that are designed for periodic testing and self-calibration of the profilometer in case of unsatisfactory testing results

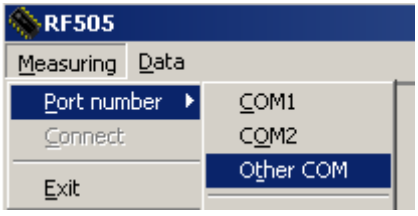
Instead of the calibration unit use can be made of the wheel with known profile entered to the database (see par. 13.6.).

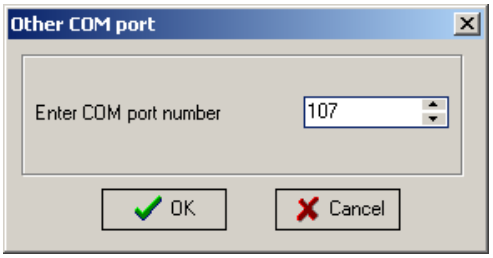
20.1. Preparation for testing/calibration

- install the **RF505Calibr** program.
- install Bluetooth-connection between the scanning module and PC as described in par. 19
- adjust the profilometer to the reference profile
- run **RF505Calibr** program

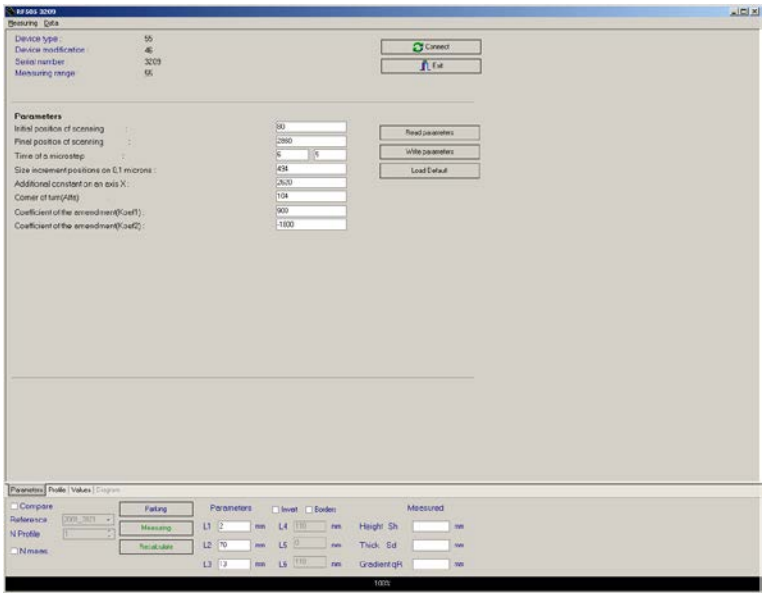


- select the required port

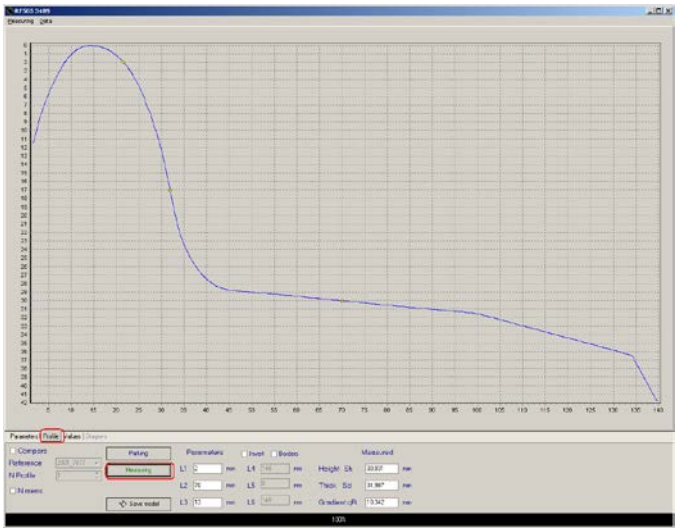




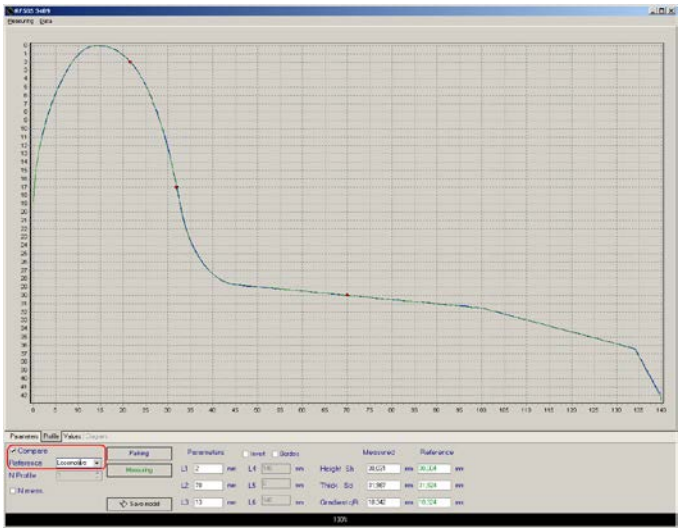
- press **Connect** to connection



- to measure the profile press **Measure** button. The display will show measured profile after measurement has been taken



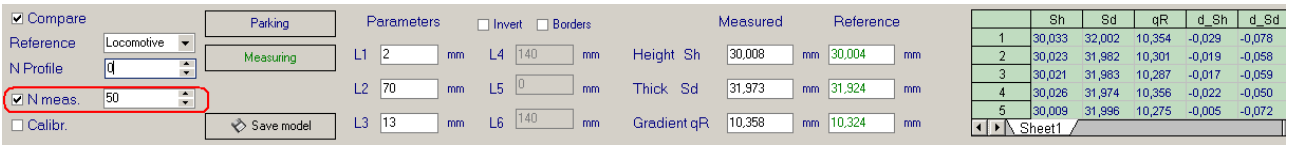
- to compare with the reference profile, tick the **Compare** checkbox and select the required reference profile in the drop-down **Reference** list.



20.2. Testing

To carry out automatic testing, do the following steps:

- tick the **N Meas** checkbox (number of measurements);
- specify the number of measurements (5-10);
- delete the **Calibr** checkbox, if it is not specified;
- press button **Measurement**

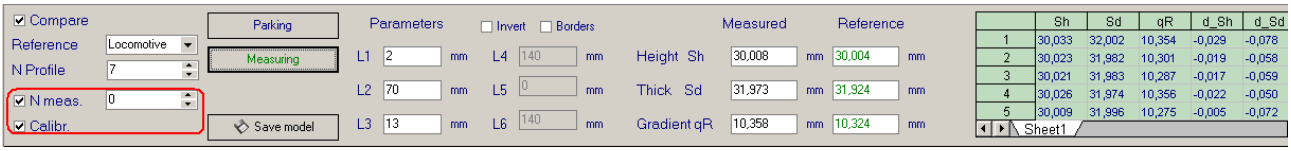


- The scanning module will make the specified number of measurements whose results will be entered to the table. The first three columns will present measured values of height (Sh), thickness (Sd), and flange slope (qR), while the other three columns will present deviations of the measured values from the reference values (d_Sh, d_Sd, d_qR). Deviation of the flange height and thickness from the reference values must not be more than 0.1 mm.
- If deviations exceed the permissible value, it is necessary to perform calibration of the scanning module.

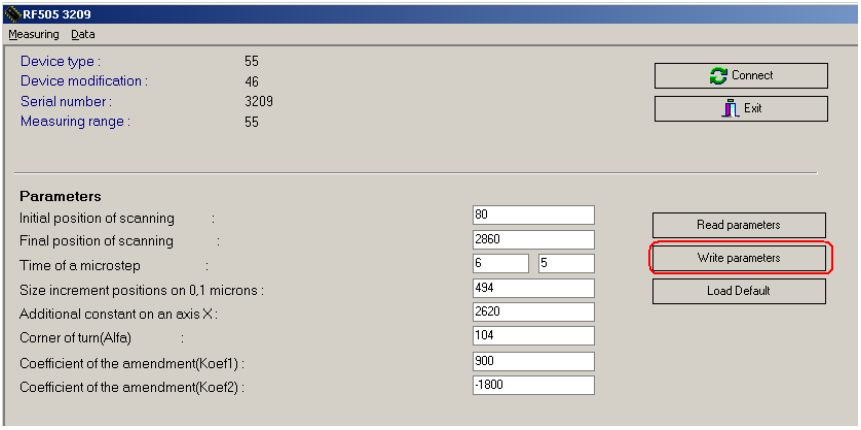
20.3. Calibration

To carry out automatic calibration, do the following steps:

- tick the **N Meas** checkbox (number of measurements)
- specify the number of measurements (5-10)
- tick the **Calibr** checkbox
- press button **Measurement**



- when scanning is completed, perform testing procedure in accordance with par. 20.2. In case of positive result, press the Write parameters (Write parameters) button to save the scanning module parameters.



- if parameters have incorrect values (negative or zero) for any reason, it is necessary to restore factory settings by pressing the Load Default. (restore parameters) button. After that, recalibrate the profilometer.

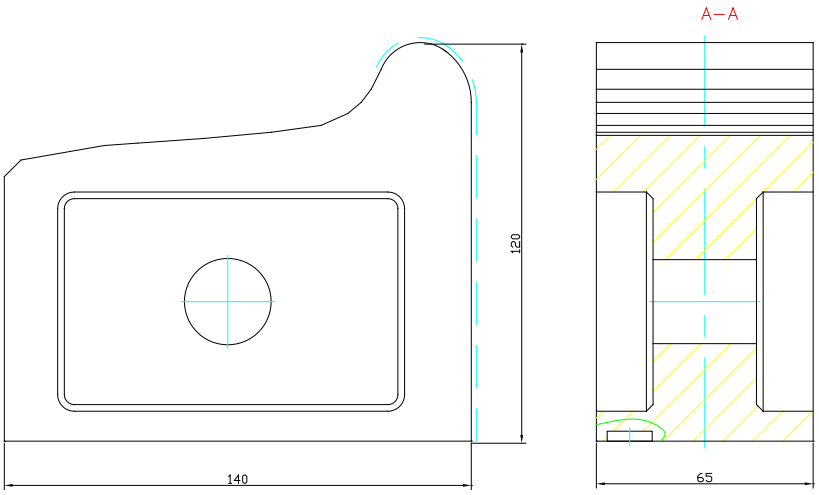
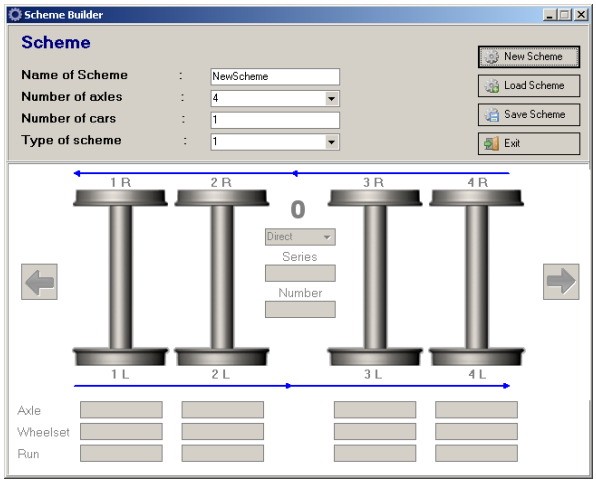


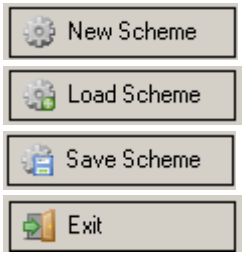
Figure 1A

21. Annex 3. Program for making measurement schemes

To make measurement schemes, use can be made of the special software **SchemeBuilder.exe**. When the program is started, the main window appears on the screen:



Buttons:

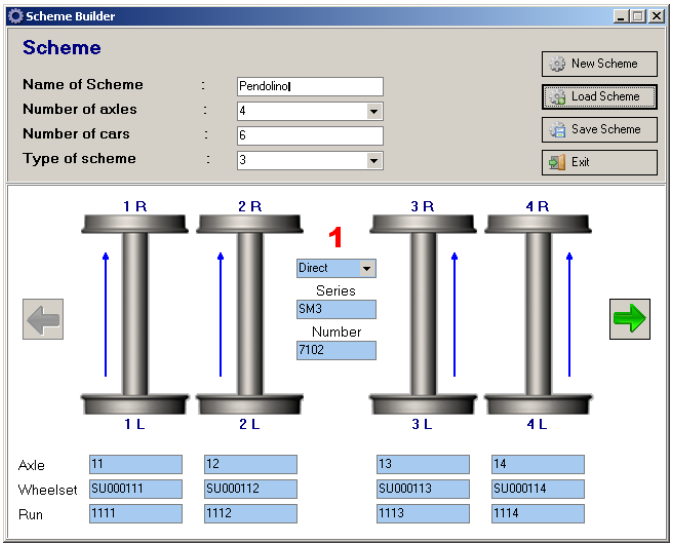


- create “empty” scheme;
- load the existing scheme;
- save the completed scheme;
- exit;
- next/previous coach in the train.

Enter the scheme name, number of cars, number of axles, type of scheme and press the **New Scheme** button to create a new “empty” scheme.

Advice: In addition to formation of the wheel processing scheme this program can be conveniently used for input of wheel pair numbers of a rolling stock and running

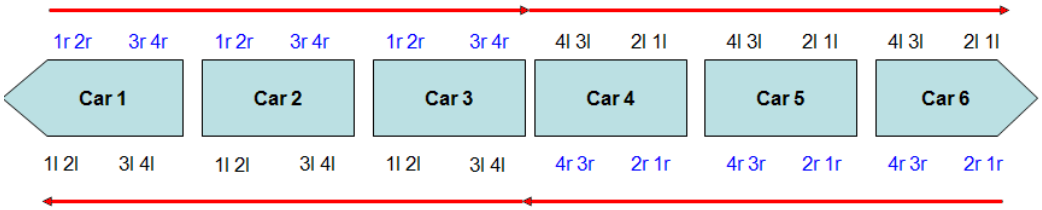
distance. If necessary, enter these data and press the **Save scheme** button.



To transfer the scheme file to PDA, use the procedure described in par. 14.1.5.

Clarification. The measurement scheme is a text file with extension **.sch**. User can create and edit such file by using any text processor.

Example:



Scheme_EXAMPLE
{
1d- |SM3|7102|1l|11|SU11|111|1r|11|SU11|111|2l|12|SU12|112|2r|12|SU12|112|3l|13|SU13|113|3r|13|SU13|113|4l|14|SU14|114|4r|14|SU14|114|;
2d-|SM3|7202|1l|21|SU21|211|1r|21|SU21|211|2l|22|SU22|212|2r|22|SU22|212|3l|23|SU23|213|3r|23|SU23|213|4l|24|SU24|214|4r|24|SU24|214|;
3d-|SM3|7302|1l|31|SU31|311|1r|31|SU31|311|2l|32|SU32|312|2r|32|SU32|312|3l|33|SU33|313|3r|33|SU33|313|4l|34|SU34|314|4r|34|SU34|314|;
4i-|SM3|7402|4r|44|SU044|414|4l|44|SU44|414|3r|43|SU43|413|3l|43|SU43|413|2r|42|SU42|412|2l|42|SU42|412|1r|41|SU41|411|1l|41|SU41|411|;
5i-|SM3|7502|4r|54|SU54|514|4l|54|SU54|514|3r|53|SU53|513|3l|53|SU53|513|2r|52|SU52|512|2l|52|SU52|512|1r|51|SU51|511|1l|51|SU51|511|;
6i-|SM3|7602|4r|64|SU064|614|4l|64|SU64|614|3r|63|SU63|613|3l|63|SU63|613|2r|62|SU62|612|2l|62|SU62|612|1r|61|SU61|611|1l|61|SU61|611|;
}

Where:
1d – coaches arranged in direct order (1 – sequence number)
1i – coached arranged in the reverse order (1 – sequence order)
SM3 – coach series
7102 -number
1l – sequence number of wheel pair and the side (l- left/r-right)
11 – axle number
SU11 – name of wheel set
111 – running distance of wheel set

22. Annex 4. Charging of built-in accumulator battery

- Switch off PDA (laser module).
- Connect charging device and PDA (laser module)
- Connect charging device and 220V.
- Time of charging–4 hours, until green LED is lit.

- Disconnect charging device and 220V
- Disconnect charging device and PDA (laser module)

ATTENTION: please follow the sequence of this points.

23. Annex 5. Reference profiles base

Reference profile file	Name of the profile	Description
Australia		
AUS_WPR 140mm.ref	WPR 140mm	
AUS_WPR 130mm.ref	WPR 130mm	
AUS_WPR 120mm.ref	WPR 120mm	
AUS_WPR7_8 140.ref	WPR7_8 140	
AUS_WPR7_8 130.ref	WPR7_8 130	
AUS_QR_LW3_140.ref	QR_LW3_140	
AUS_QR_LW3_127.ref	QR_LW3_127	
AUS_QR_LW3_120.ref	QR_LW3_120	
Belarus		
BLR_Car_29.ref	Car _29	
BLR_ DMeTILB _33.ref	DMeTILB_33	
BLR_DMeTILR_30.ref	DMeTILR_30	
BLR_Loco_29.ref	Locomotive_29	
BLR_Loco_33.ref	Locomotive _33	
China		
CHN_Tram.ref	Tram	
UK		
ENG_S1002.ref	S1002	
Finland		
FIN_PrflERRI.ref	UIC/ERRI	
FIN_PrflORE.ref	UIC/ORE	
FIN_Bombardier.ref	Bombardier	
FIN_Tram.ref	Tram	
FIN_NRV.ref	NRV	
France		
FRA_ NF_F_01_115.ref	NF_F_01_115	
Germany		
GER_2001_7871.ref	2001_7871	
GER_2001_7873.ref	2001_7873	
GER_2001_7874.ref	2001_7874	
GER_2001_7875.ref	2001_7875	
GER_2001_7876.ref	2001_7876	
GER_2001_7877.ref	2001_7877	
GER_2105.ref	2105	
GER_2107.ref	2107	
GER_9186.ref	9186	
GER_9187.ref	9187	
GER_9188.ref	9188	
Korea		

KOR.ref	Korea	
Russia		
RUS_Metro.ref	Metro	
New Zeeland		
NZL_B1.ref	Profile_B1	
NZL_B2.ref	Profile_B2	
NZL_3.ref	Profile_B3	
SAR		
SAR_908AB.ref	908AB	
SAR_N21.ref	N21	
SAR_N22.ref	N22	
SAR_N23.ref	N23	
SAR_Taiwan.ref	Taiwan	
Spain		
SPA_COMSA_1.ref	COMSA_1	
SPA_COMSA_2.ref	COMSA_2	
SPA_FGC.ref	FGC	
SPA_FSDR3_140.ref	FSDR3	
SPA_ 28.ref	Profile_28	
SPA_ 30.ref	Profile_30	
SPA__18610.ref	Profile_18610	
SPA_ Metro.ref	Metro	
SPA_Rodadura.ref	Rodadura	
Russia		
UKR_CarMINETEK.ref	CarMINETEK	
UKR_DMETILR.ref	DMETILR	
UKR_Elektrovoz.ref	Elektrovoz	
UKR_LocoMINETEK.ref	LocoMINETEK	
UKR_EtalCar.ref	Car	
UKR_EtalLoc.ref	Locomotive	
USA		
USA_Cylindrical.ref	Cylindrical Tread	
USA_Tapered.ref	Tapered Tread	
USA_AAR_1B.ref	AAR_1B	
USA_UICERRI.ref	UIC_ERRI	

24. Warranty policy

Warranty assurance for the laser profilometer - 24 months from the date of putting in operation; warranty shelf-life - 12 months.

25. Distributors

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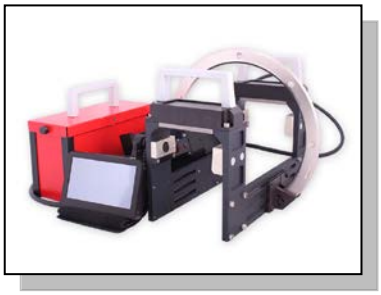
26. Annex 6. RIFTEK measurement instruments for railway transport

Back-to-back distance measuring gauge. IMR Series
The device is designed for:

- measuring 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.



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.

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.