



# HANDHELD INNER DIAMETER MEASURING GAUGE

**RF096-100/250-87-HH Series**

User's manual

since 1976

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## Contents

1.	Safety precautions and measurement conditions.....	3
2.	CE compliance.....	3
3.	Laser safety.....	3
4.	General information.....	3
5.	Basic technical data.....	4
6.	Example of designation when ordering.....	4
7.	Complete set to be supplied.....	4
8.	Device structure.....	5
8.1.	Basic components.....	5
8.2.	Laser scanning module.....	6
8.3.	Calibration ring.....	7
9.	Operating principle.....	7
10.	Turning on and the main program window.....	8
11.	Basic settings.....	8
11.1.	Date/time settings.....	9
11.2.	Program language selection.....	9
11.3.	Synchronization with PC.....	9
11.4.	Database settings.....	10
12.	Calibration and measurement settings.....	11
13.	Calibration.....	12
14.	Measurement.....	13
15.	Viewing the database.....	16
15.1.	Pipe profile visualization.....	16
16.	Software for PC: installation and starting up.....	17
16.1.	PC and gauge synchronization.....	17
16.2.	Starting up the software.....	17
17.	User settings.....	18
17.1.	Parameters.....	18
17.1.1.	Pipe parameters.....	18
17.1.2.	Calculated parameters.....	19
17.2.	Database settings.....	19
17.2.1.	Specifying a path to the database.....	19
17.2.2.	Creating an empty database.....	20
17.2.3.	Database import.....	20
17.2.4.	Program language selection.....	20
18.	Data exchange between the gauge and the PC.....	21
18.1.	ActiveSync synchronization.....	21
18.2.	Mass Storage synchronization.....	21
19.	Viewing data.....	22
20.	Annex 1. Battery charging procedure.....	24
21.	Technical support.....	24
22.	Warranty policy.....	24
23.	List of changes.....	24
24.	Distributors.....	25

## 1. Safety precautions and measurement conditions

- Before installing the gauge, the pipe end must be cleaned of dirt.
- When installing the gauge on the pipe, do not allow strong shocks.
- It is necessary to periodically inspect the windows of the laser sensors and the base supports of the gauge and clean them of dirt.

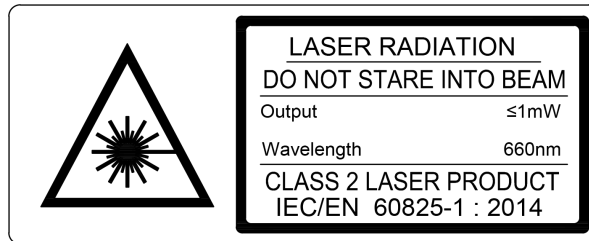
## 2. CE compliance

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

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

## 3. Laser safety

The gauge makes use of an c.w. 660 nm wavelength semiconductor laser. The maximum output power is 1 mW. The gauge belongs to the 2 laser safety class according IEC/EN 60825-1:2014. The following warning label is placed on the body:



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

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

## 4. General information

The device is designed for non-contact scanning and measuring the inner diameter of pipes.

## 5. Basic technical data

Parameter	Value
Diameter measurement range, mm	100...250
Diameter measurement error, mm	±0.05
Discreteness of indication, mm	0.01
Space resolution, points/turnover	700
Measurement depth from the pipe end, mm	87
Measurement time, not greater, s	2
Measured parameters	diameter (min., max., average), ovality, roundness
Dimensions	see Figure 4
Power supply, V	3.7 V, Li-ion battery, 6400 mAh
Number of measurements that can be taken before recharging the battery, not less	1500
Operating ambient temperature, °	-10...+50
Enclosure rating	IP42
Laser sensor output power, mW	1
Laser safety class	2 (IEC60825-1)
Weight, kg	1.2

**NOTE:** Gauge parameters can be changed for a specific task.

## 6. Example of designation when ordering

RF096-Dmin/Dmax-L-HH

Symbol	Description
Dmin/Dmax	Diameter measurement range, mm
L	Measurement depth from the pipe end, mm
HH	Hand-held gauge.

## 7. Complete set to be supplied

Designation	Name	Quantity	Weight, kg
RF096-100/250-87-HH	Laser scanning module	1	1.2
RF401.00.012_13	Removable supports, set	2	0.15
RF096.40	Charger	1	0.2
RF096.42	Data cable	1	
	User's manual	1	
RF096.30	Case	1	2.7
RF596.11	Calibration ring 106/146 mm	1	0.6

The gauge comes in the special case that protects the device against any possible damage during transportation.



Figure 1

## 8. Device structure

### 8.1. Basic components

Figure 2 shows the main components of the gauge:



Figure 2

Designations:

- (1) Laser scanning module
- (2) Base
- (3) Removable support
- (4) Data cable
- (5) Charger
- (6) Calibration ring

## 8.2. Laser scanning module

Figure 3 shows the main components of the laser scanning module:

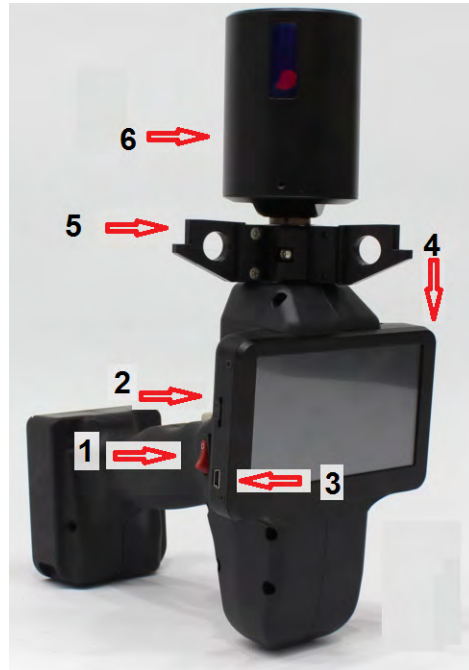


Figure 3

Designations:

- (1) Power button
- (2) Measurement button
- (3) Charger connector
- (4) Display
- (5) Mounting support
- (6) Rotating laser head

Overall dimensions of the laser scanning module are shown in Figure 4:

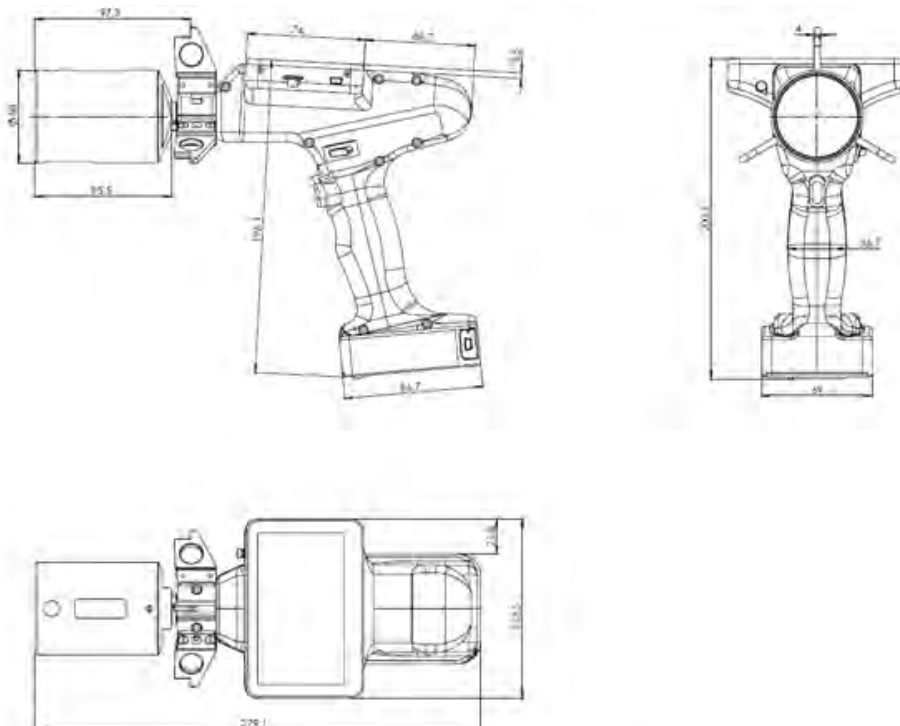


Figure 4

### 8.3. Calibration ring

The calibration ring is designed to calibrate the device, check its performance. Overall dimensions of the calibration ring are shown in Figure 5:

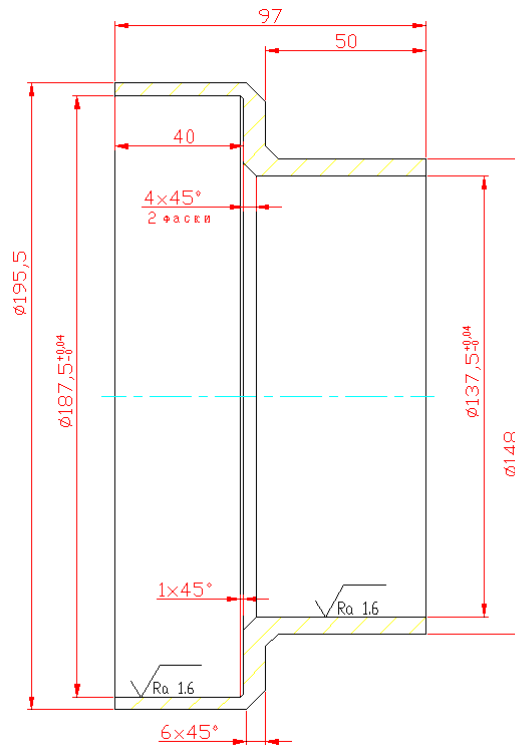


Figure 5

## 9. Operating principle

The operation of the gauge is based on the principle of laser scanning of the inner surface of the pipe by a rotating laser head.

To achieve the required accuracy, the range of controlled diameters is divided into two sub-ranges controlled by independent laser triangulation sensors installed in a rotating head. The gauge also contains removable supports (two sets) designed to install the gauge on the end of pipes of different diameters. The rotation of the laser head is carried out by a built-in motor. The gauge is equipped with a display to show the results.

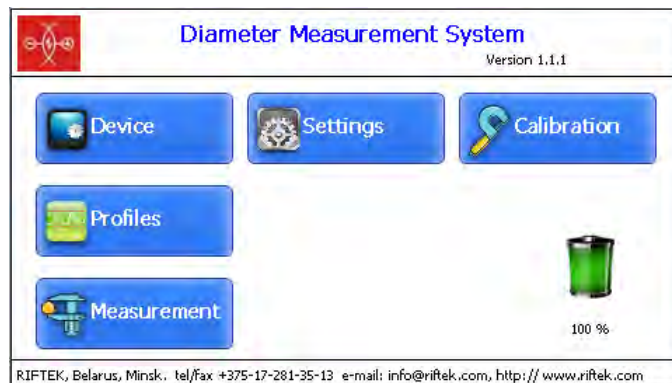
The gauge operates as follows: the operator inserts the head into the pipe and places the supports of the gauge at the pipe end. After pressing the **Measurement** button, the laser head begins rotating, the laser sensor scans the inner surface of the pipe, and the built-in controller receives the polar coordinates of the surface (the distance from the axis of rotation measured by the laser sensor and the corresponding rotation angle measured by the encoder). The controller calculates the required parameters (minimum, maximum and average diameters, roundness), displays them and shows the result OK / NOK in accordance with the specified tolerances. Measurement data can be accumulated in the gauge memory and transferred to the database on the PC.

Video presentation:

<https://www.youtube.com/watch?v=vGm17wVITqU&feature=youtu.be>

## 10. Turning on and the main program window

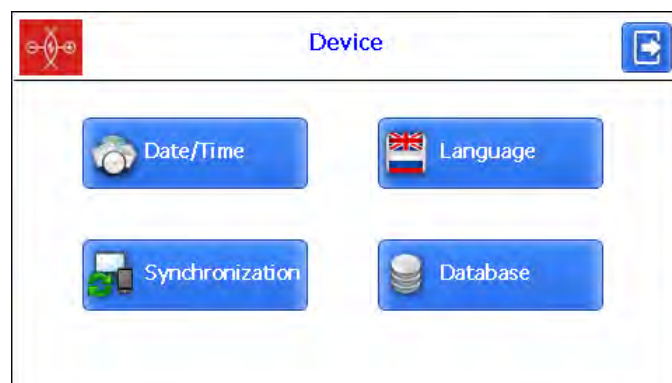
Charge the batteries of the gauge. The charging procedure is described in Annex 1. Turn on the gauge by pressing the power button (1), see Figure 3. The main program window will appear on the screen. In this window, you will see the main menu and the battery charge indicator.



Button	Assignment
Device	Basic parameters of the gauge (p. 11).
Settings	Calibration and measurement settings (p. 12).
Calibration	Starting the calibration / verification (p. 13).
Profiles	Database of saved measurements (p. 15).
Measurement	Starting the measurement process (p. 14).

## 11. Basic settings

Before you start working with the device, it is necessary to configure its basic parameters. In the main program window (see p. 10), tap the **Device** button:

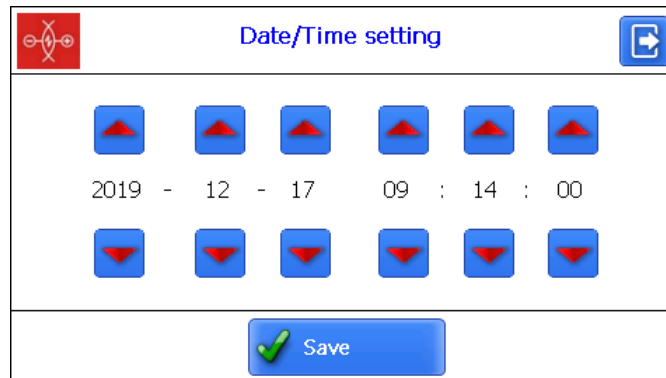


Button	Assignment
Date/Time	Date/time settings.
Language	Program language selection.
Synchronization	Synchronization with PC.
Database	Database settings.



## 11.1. Date/time settings

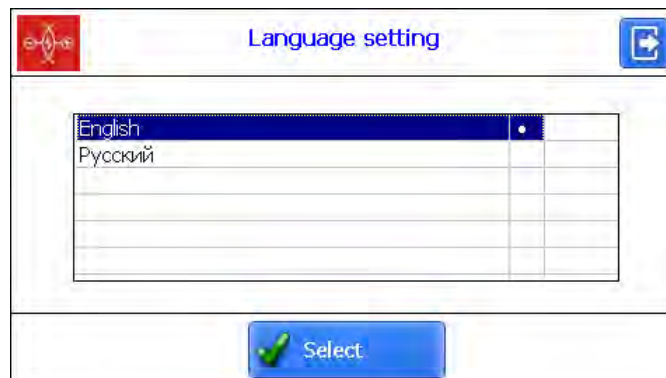
To set the date and time, tap the **Date/Time** button. Then use the buttons   to set the date and time, and tap the **Save** button.



## 11.2. Program language selection

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

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



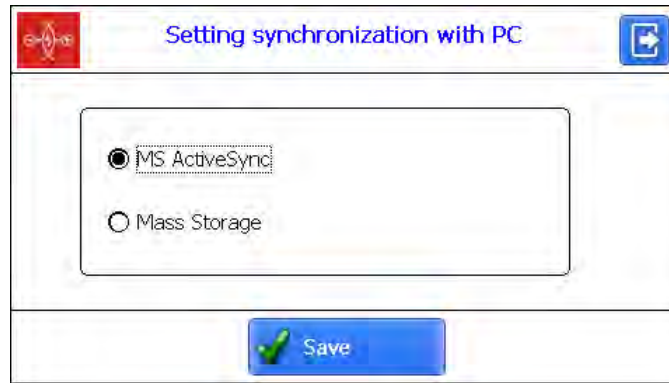
## 11.3. Synchronization with PC

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

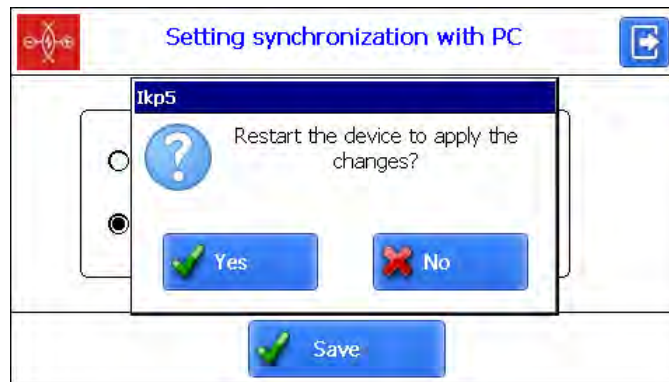
When you select **MS ActiveSync**, synchronization with PC is performed via the **ActiveSync** software (Windows XP), or via **Windows Mobile Device Center** (Windows 7).

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

To select the type of synchronization, tap the **Synchronization** button in the **Device** window. Then select the required type and tap **Save**.



For the changes to take effect, the device will prompt you to restart. If you do not need to sync the PDA with the PC at the moment, you can restart the PDA later.

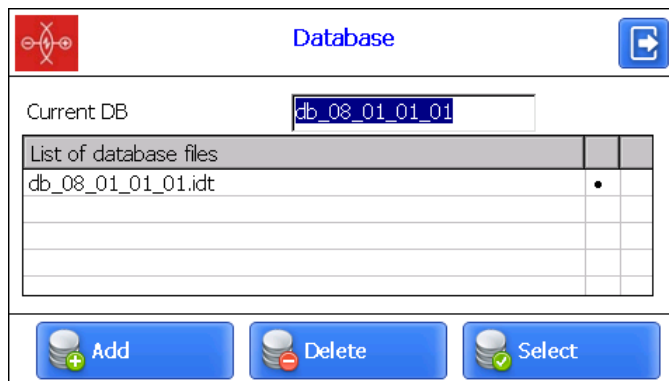


10

#### 11.4. Database settings

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

To select the database file, tap the **Database** button.



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

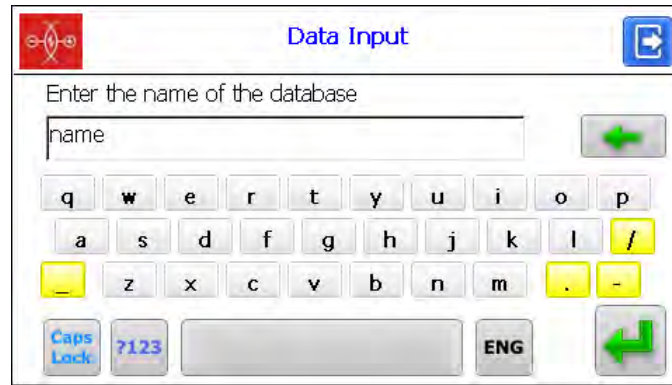
By default, it will be prompted to form the database file with the name **db\_yy\_mm\_dd.idt**, where yy\_mm\_dd is the current date:


**yy** – the last two digits of the year;

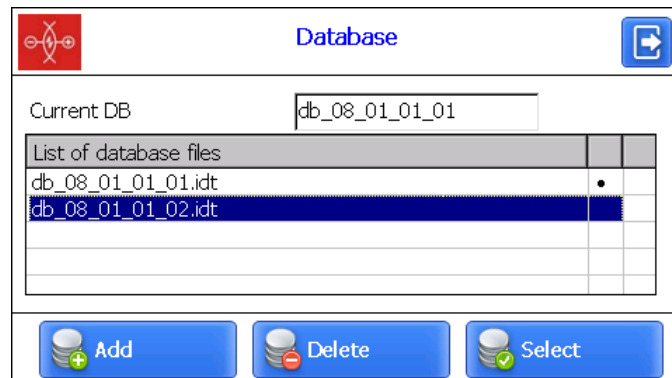
**mm** – month;

**dd** – day.

You can agree with this name, or enter another:



After typing the name, tap the **Enter** button - .

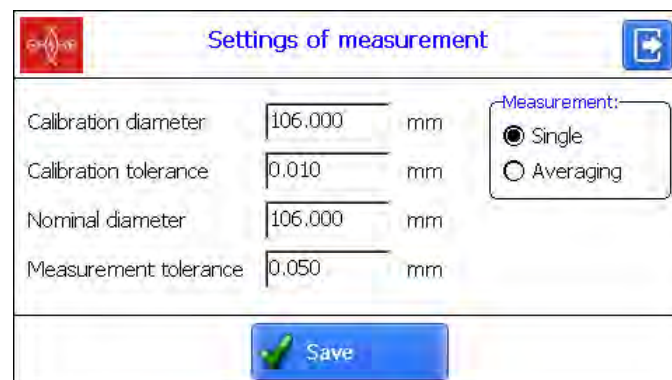



To select the database from a list, tap on the line and then tap **Select**. The selected file will be marked with a "dot" symbol.

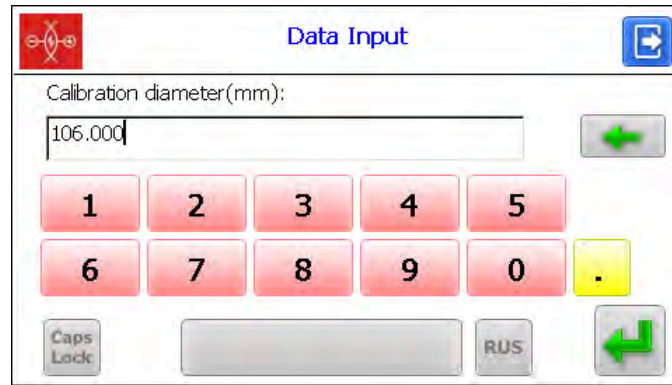
To delete the database file, tap on the line and then tap **Delete**. If you delete the current database, the error message will appear.

## 12. Calibration and measurement settings

To configure calibration and measurement settings, tap the **Settings** button in the main program window.



To make changes, you need to select the required parameter and enter the new value in the **Data Input** window. Then tap the **Enter** button - .



To save the changes, tap the **Save** button.

Description of parameters is given in the table below:

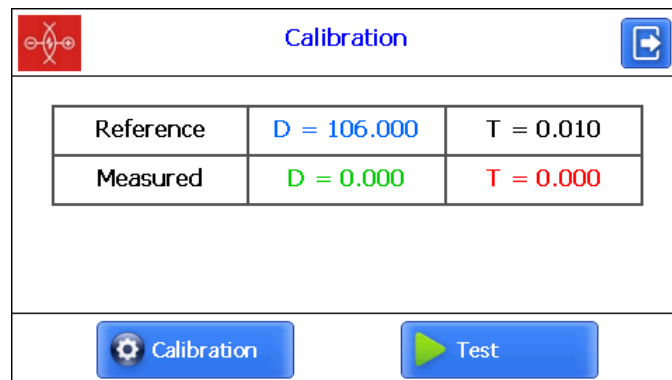
Parameter	Default value	Description
Calibration diameter	137.5 mm	Calibration ring diameter.
Calibration tolerance	0.01 mm	Tolerance for calibration and testing.
Nominal diameter	137.5 mm	Measured diameter.
Measurement tolerance	0.05 mm	Measurement tolerance.

12

## 13. Calibration

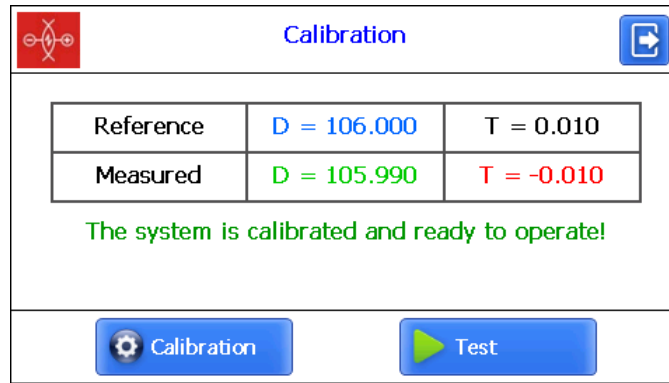
Before making measurements, the gauge must be calibrated. The calibration procedure:

- Install the gauge on the calibration ring using supports and make sure that it is installed correctly, and there are no gaps between the supports and the face of the ring.
- In the main program window, tap the **Calibration** button.
- After tapping the **Calibration** button, the gauge will check the status of the sensors and, if successful, the calibration mode will become available:



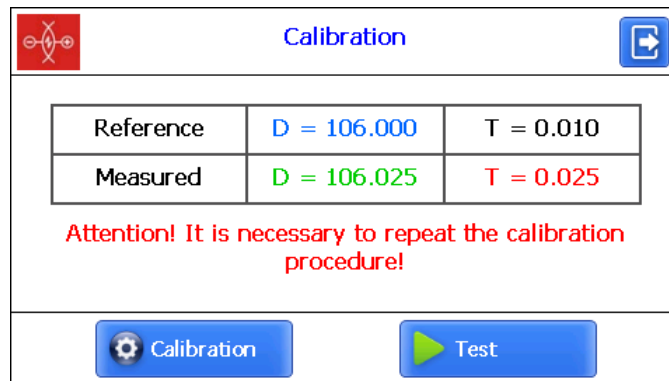
Parameter	Description
Reference D	Calibration ring diameter.
Reference T	Tolerance for calibration and testing.
Measured D	Measured diameter.
Measured T	Deviation from the reference value.

- Tap the **Calibration** button. The gauge will scan the calibration ring and perform an automatic calibration. Then the gauge will scan the calibration ring again in order to perform the testing procedure. If successful, you will see the following message:



13

The **Measured T** column shows the difference between the actual value of the ring diameter and the measurement result. The calibration-verification is considered successful if this difference does not exceed the value of the set tolerance (**Calibration tolerance** parameter), which by default is 0.01 mm. In case of a negative result, the window shown below appears. The calibration is considered unsuccessful and must be repeated with the specified or new tolerance.



The calibration procedure must be performed for two sensors installed in the scanning head.

## 14. Measurement

To make a single measurement, follow these steps:

- Fix the gauge on the pipe edge using the supports (4).



Figure 6

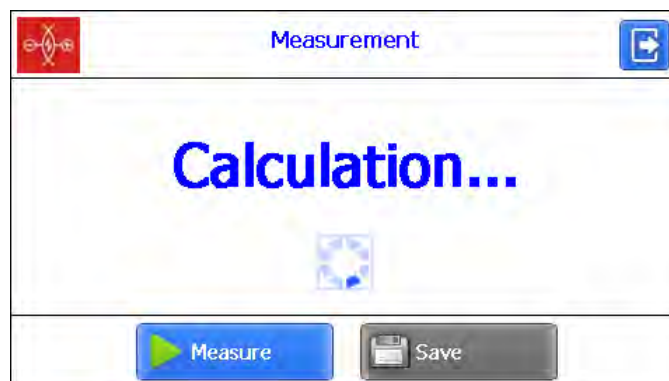
- Make sure that the gauge is installed correctly and that there are no distortions or gaps.
- Tap the **Measurement** button in the main program window, or press the measurement button on the gauge.
- After pressing the measurement button, the gauge will check the status of the sensors and, if successful, the measurement mode will become available.



- To make a measurement, tap the **Measure** button or press the measurement button on the gauge.
- Screen view during the scanning process:



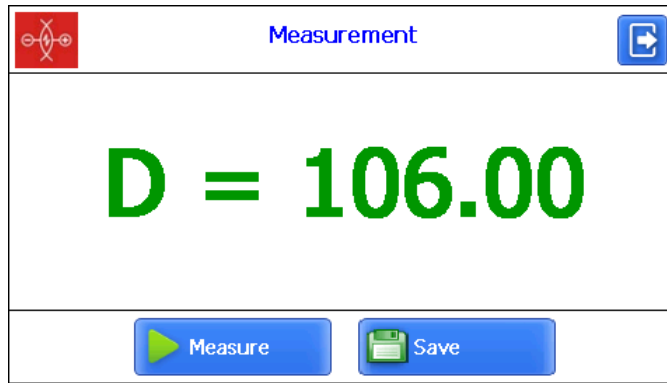
- After the scanning process is completed, the gauge can be removed from supports. Screen view:



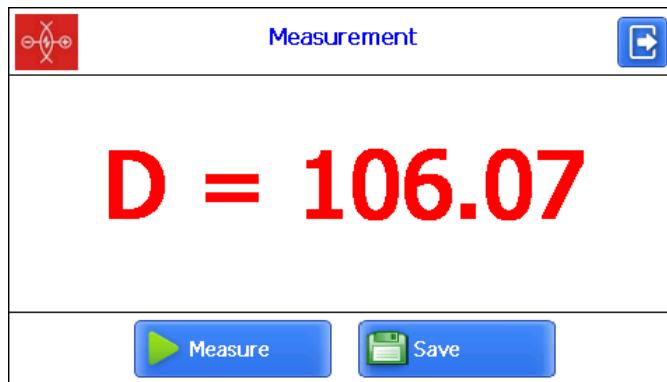
- After completing the calculations, the display will show the measured value of the diameter.

If the **Averaging** option is selected, the subsequent measurements will be made with averaging.

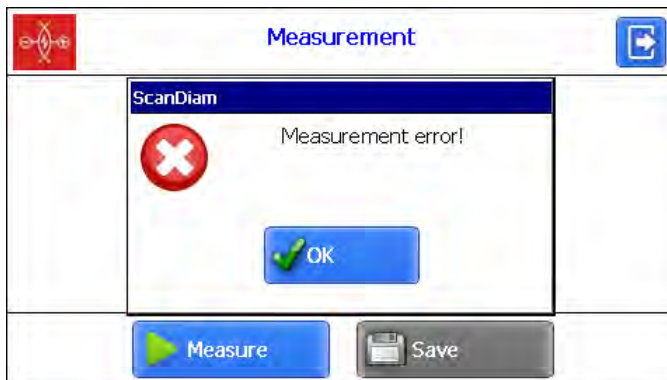
15



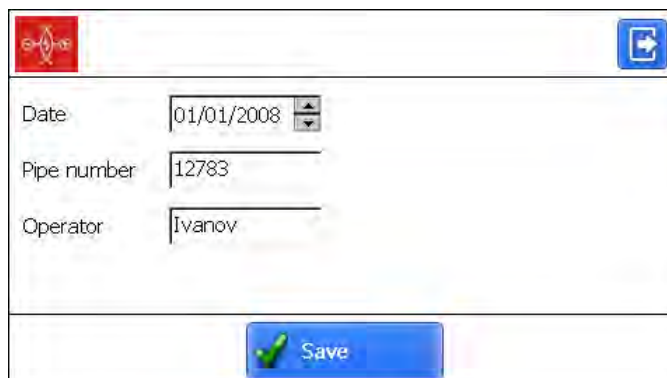
If the measured value of the diameter exceeds the specified tolerance, the value will be shown in red:



If the measurement is incorrect or the diameter is outside the working range of the gauge, the message about the measurement error will be displayed on the screen:



- To save the measurement, tap the **Save** button and, if necessary, enter the pipe parameters:





## 15. Viewing the database


To view the saved data, tap the **Profiles** button in the main window. You will see information about the current database, the number of saved values, a table with saved pipe profiles and measured diameters.

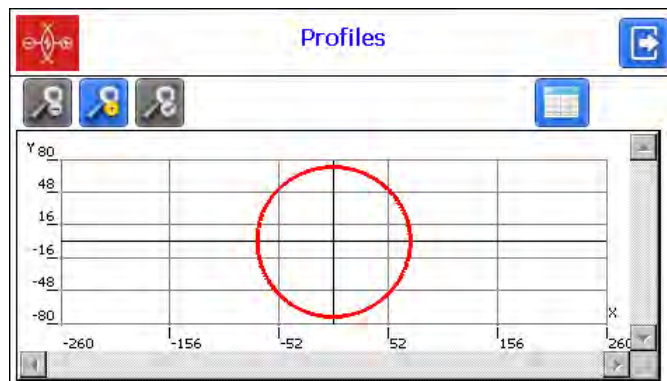
Profiles					
Database		:db_08_01_01_01			
Number of profiles		:5			
Date	Pipe No	Operator	Diameter	Wear	
01/01/08	77	sd	106.003	0.003	
01/01/08	678	fff	146.027	40.027	
01/01/08	222	ddd	106.004	-0.017	
01/01/08	33	ddd	106.005	0.005	
01/01/08	44		106.029	0.029	

Buttons:



	View the profile of the selected pipe.
	Delete the selected measurement.

### 15.1. Pipe profile visualization

To view the pipe profile, tap the **Profile** button - . The program will display the scanned profile of the pipe.



Buttons:

	Zoom in.
	Zoom out.
	Standard image scale.



## 16. Software for PC: installation and starting up

The **pipe\_DB** software is intended for maintaining a database of measured pipes on a personal computer.

To install the software, insert the CD into the PC drive, open the **Software** folder and run **Install\_pipe.exe**. Follow the instructions of the installation wizard. By default, the program is installed in **C:\Program Files (x86)\Riftek, LLC\pipe\_db\**.

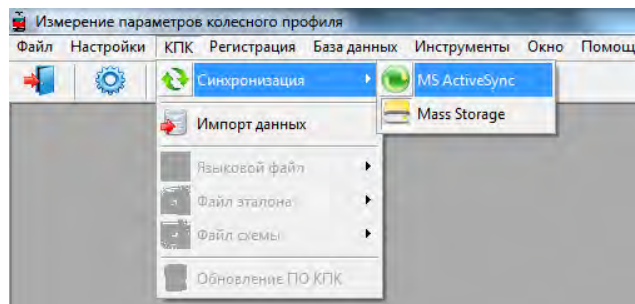
### 16.1. PC and gauge synchronization

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

- 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. You can find the installation files on the supplied CD.

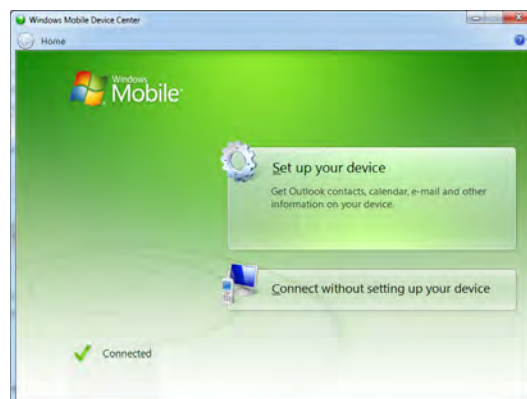
It is necessary to select **MS ActiveSync** as the synchronization type (see par. [11.3](#)).



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

It is necessary to select **Mass Storage** as the synchronization type (see par. [11.3](#)).

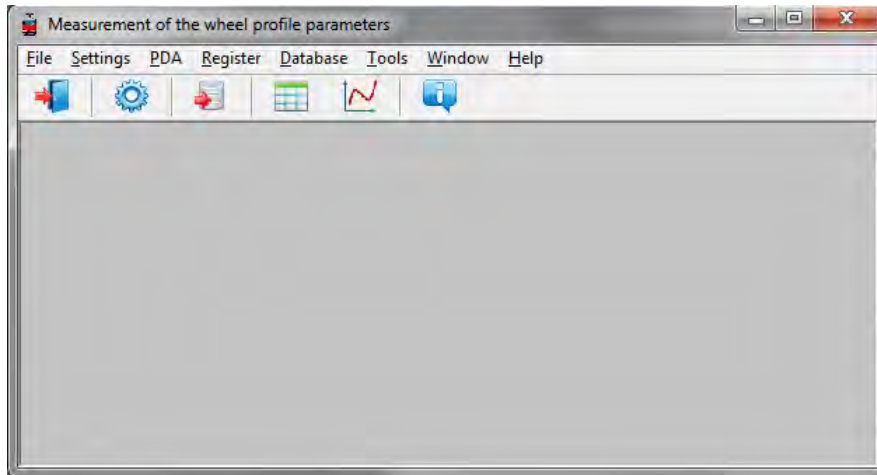
To check if the **MS ActiveSync** synchronization is correct, switch on the gauge and connect it to the USB port of the PC by the supplied cable. If the connection is successful, a message about it will appear on the screen:



### 16.2. Starting up the software


To start the software, select **Start > All programs > Riftek, LLC > pipe\_DB > pipe\_DB.exe**.

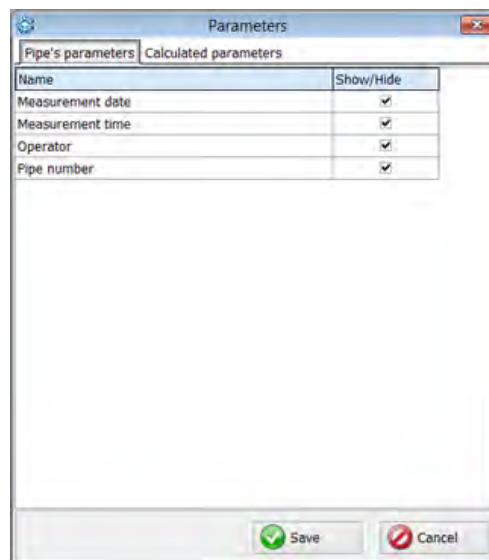
The main program window:



## 17. User settings

### 17.1. Parameters

To open the **Parameters** window, select **Settings > Parameters** or click on the icon .



The **Parameters** window contains two tabs: **Pipe's parameters** and **Calculated parameters**.

#### 17.1.1. Pipe parameters

In this tab, the user can select the parameters that will be displayed when viewing the database.

Name	Show/Hide
Measurement date	<input checked="" type="checkbox"/>
Measurement time	<input checked="" type="checkbox"/>
Operator	<input checked="" type="checkbox"/>
Pipe number	<input checked="" type="checkbox"/>

If a parameter is selected, then its value will be shown in the table of measurement results.

## 17.1.2. Calculated parameters

In this tab, the user can select the geometric parameters of the pipe, which will be calculated and displayed on the screen when viewing the database.

Pipe's parameters		Calculated parameters
Name	Show/Hide	
Diameter (D)	<input checked="" type="checkbox"/>	
Diameter (Dmin)	<input checked="" type="checkbox"/>	
Diameter (Dmax)	<input checked="" type="checkbox"/>	
Wear (Wear)	<input checked="" type="checkbox"/>	

## 17.2. Database settings

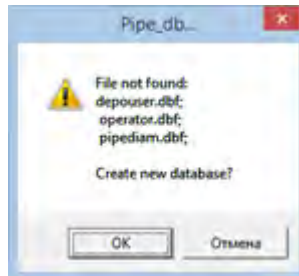
### 17.2.1. Specifying a path to the database

It is possible for the user to change the drive and the database storage directory. In the main window, select **File > Path to DB...**

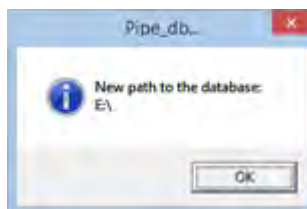


Next:

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

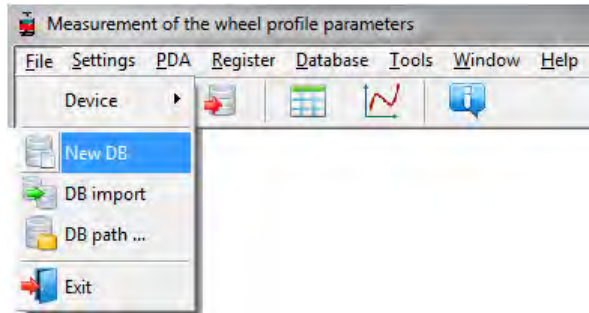


All database files will be copied to the specified path.



## 17.2.2. Creating an empty database

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

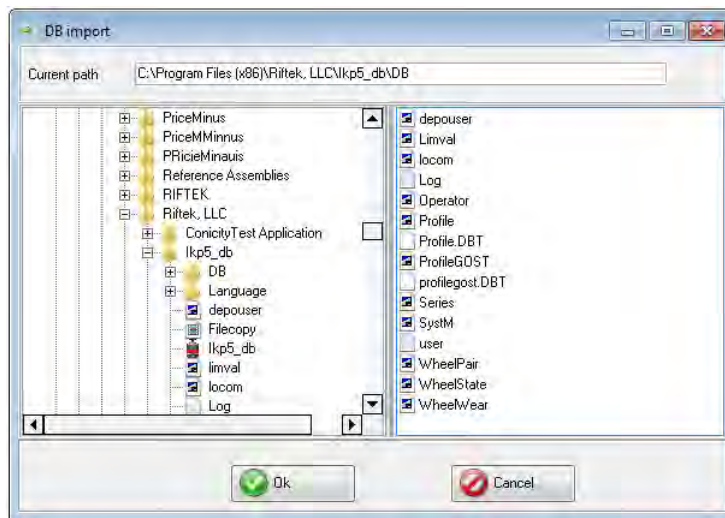


All data will be deleted from the database. At the same time, the **DB(dd.mm.yy)** directory will be created in the installation directory where to all the deleted data will be copied (dd.mm.yy – current date). If necessary, these data can be restored.

## 17.2.3. Database import

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

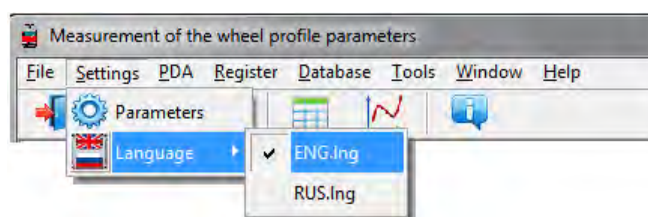
- Select **File > Import Data**.
- Select the directory with DB files in the left window. All files will appear in the right window:



- Click **Ok** to import data.

## 17.2.4. Program language selection

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



## 18. Data exchange between the gauge and the PC

Data exchange between the PC and the gauge is carried out by connecting the gauge to the USB port of the PC via the supplied cable (RF096.42).

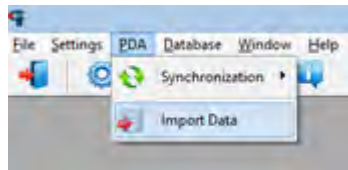
There are two ways of synchronization via the USB cable:

- ActiveSync
- Mass Storage

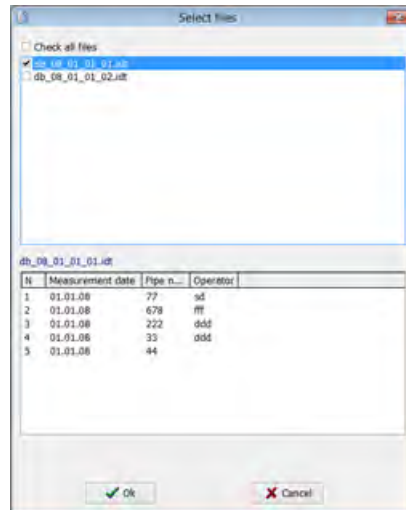
### 18.1. ActiveSync synchronization

To transfer the database file from the gauge to the PC, you must:

- Select **PDA > Import data**.

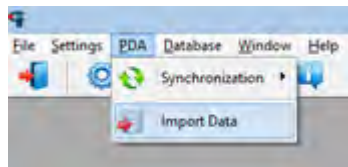


- Select the required files and click **Ok**.



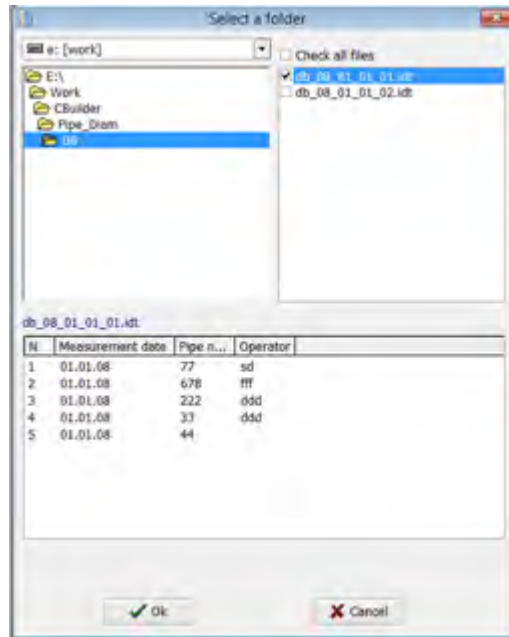
### 18.2. Mass Storage synchronization

When you select this type of synchronization, the gauge is detected as an external storage device. Therefore, the only **Import Data** item is active. Transferring files from the gauge to the PC can be done by simple copying.



To transfer database files from the gauge to the PC, it is necessary to:

- Select **PDA > Import Data**.
- Specify a path to the database (by default, **SDMMC\Autorun\DB**).



- Mark the required files in the emerged window and click **Ok**.

## 19. Viewing data

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

Measurement time	Measurement date	Pipe number	Operator	Diameter (D)	Diameter (Dmin)	Diameter (Dmax)	Wear (Wear)
01:36:59	01.01.2008	77	sd	106,00	105,98	106,03	0,00
01:43:26	01.01.2008	678	fff	146,03	145,96	146,09	40,03
02:43:29	01.01.2008	222	ddd	106,00	105,92	106,08	-0,02
02:45:50	02.01.2008	33	ddd	106,01	105,95	106,05	0,01
02:47:23	03.01.2008	44		106,03	105,96	106,10	0,03

- **Hide/show the field**

The table displays the identification and geometric parameters of the pipes, which are selected for displaying in the settings (see p. [17.1.1](#) and p. [17.1.2](#)).

- **Sorting of data**

To sort data by any of the fields, left-click on the column header of the field:

Measurement date	Measurement time	Pipe number
01.01.2008	01:36:59	77
01.01.2008	01:43:26	678
01.01.2008	02:43:29	222
02.01.2008	02:45:50	33
03.01.2008	02:47:23	44

➔


Measurement date	Measurement time	Pipe number
01.01.2008	02:43:29	222
02.01.2008	02:45:50	33
03.01.2008	02:47:23	44
01.01.2008	01:43:26	678
01.01.2008	01:36:59	77

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

• **Filtering of data**

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

Measurement date	Measurement time	Pipe number
01.01.2008	02:43:29	222
02.01.2008	02:45:50	33
03.01.2008	02:47:23	44
01.01.2008	01:43:26	678
01.01.2008	01:36:59	77




Measurement date	Measurement time	Pipe number
01.01.2008	02:43:29	222
01.01.2008	01:43:26	678
01.01.2008	01:36:59	77

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

• **Data grouping**

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

Measurement date	Pipe number	Measurement time
01.01.2008	222	02:43:29
02.01.2008	33	02:45:50
03.01.2008	44	02:47:23
01.01.2008	678	01:43:26
01.01.2008	77	01:36:59




Measurement date		
Measurement date	Pipe number	Measurement time
- Measurement date : 01.01.2008		
01.01.2008	222	02:43:29
01.01.2008	678	01:43:26
01.01.2008	77	01:36:59
+ Measurement date : 02.01.2008		
+ Measurement date : 03.01.2008		

• **Changing of the field position order**

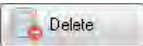
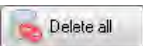

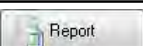
To change the field position, left-click on the header of the field column and, with the mouse key pressed, drag it to the required position:

Measurement date	Measurement time	Pipe number
01.01.2008	01:36:59	77
01.01.2008	01:43:26	678
01.01.2008	02:43:29	222
02.01.2008	02:45:50	33
03.01.2008	02:47:23	44



Measurement time	Measurement date	Pipe number
01:36:59	01.01.2008	77
01:43:26	01.01.2008	678
02:43:29	01.01.2008	222
02:45:50	02.01.2008	33
02:47:23	03.01.2008	44

**Buttons:**


	Delete the selected pipe.
	Delete all pipes.
	Export the coordinates of the pipe surface to Excel.
	Export the table of pipes to Excel.

• **Deleting data**

To delete the current entry, click  and confirm the deletion.



- **Deleting all selected data**

If it is necessary to delete not only one entry but several entries combined by some condition, filter the data according to the corresponding attribute, click  and confirm the deletion.



## 20. Annex 1. Battery charging procedure

- Turn off the gauge.
- Connect the gauge to the charging device.
- Connect the charging device to 220 V AC.
- Time of charging - 8 hours (full charge indication - green LED).
- Disconnect the charging device from 220 V AC.
- Disconnect the charging device from the gauge.

## 21. Technical support

Technical assistance related to incorrect work of the gauge and to problems with settings is free. Requests for technical assistance should be addressed at [support@riftek.com](mailto:support@riftek.com), or by phone +375-17-3573657.

## 22. Warranty policy

Warranty assurance for the Handheld Inner Diameter Measuring Gauge RF096-100/250-87-HH – 24 months from the date of putting in operation; warranty shelf-life – 12 months.

## 23. List of changes

Date	Revision	Description
10.04.2020	1.0.0	Starting document.



## 24. Distributors

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25

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