«Inva (Portable)»

User Manual
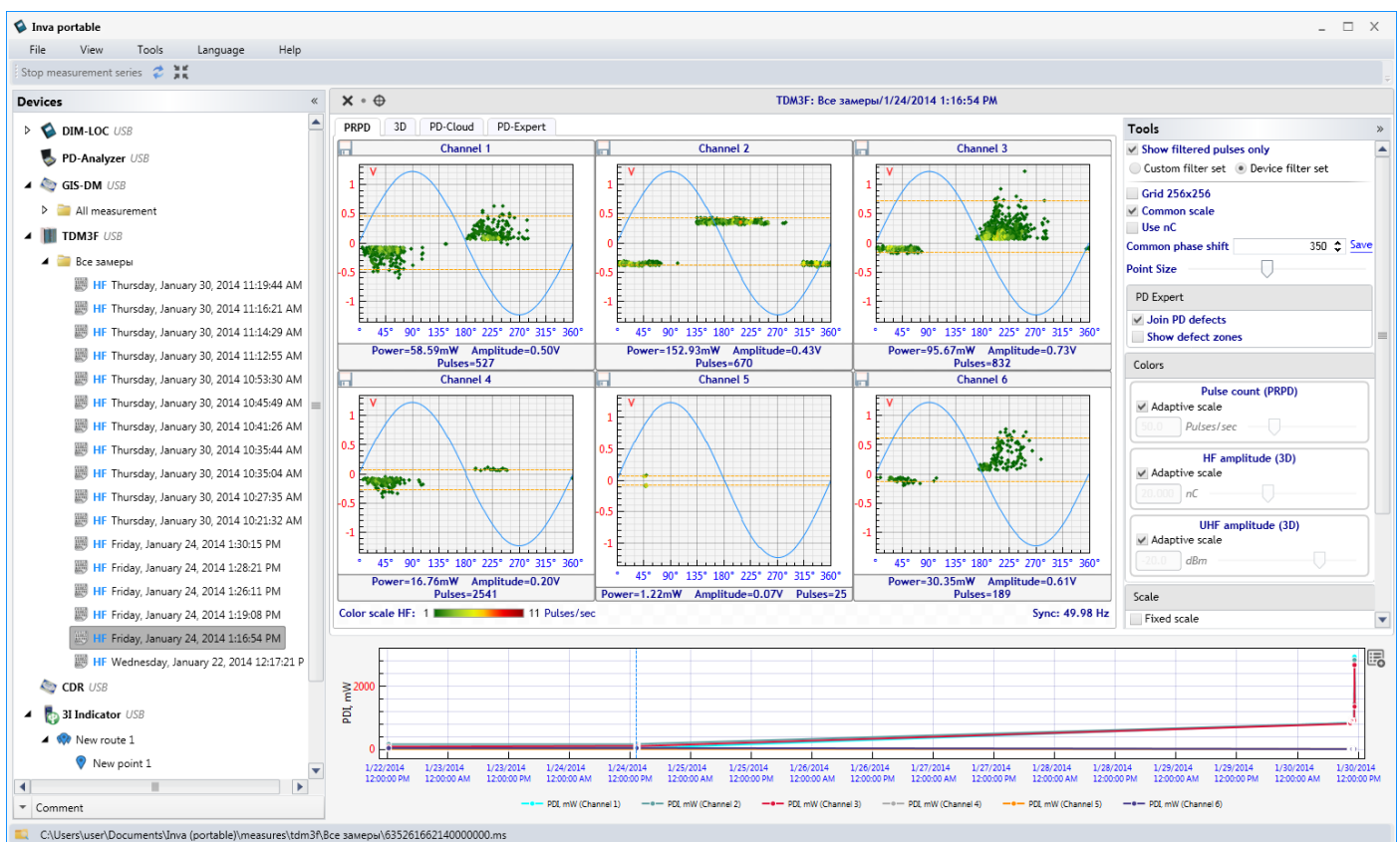
Contents

1. Purposes of «Inva (Portable)» software

Software «Inva (Portable)» is designed to work with devices of «Dimrus» such as: «DIM-LOC 1», «PD Analyzer», «GIS-GM», «CDR», «TDM-3F», «3I-Indicator »and others.

«Inva (Portable)» is used for collecting, storage and processing of data obtained from the above-mentioned devices.

1.1. Required components

To work with the program, the following components are required:

- Microsoft.net Framework 4.5 or higher. If you are using Microsoft Windows XP, install Microsoft.net Framework 4.0.3.
- Microsoft Visual C ++ 2010 Redistributable.
- USB drivers set from Dimrus.

«iNVA Portable» Software requires the following computer system:

1. Operating system:
    - Windows XP SP3
    - Windows Server 2003 SP2
    - Windows Server 2008 (except Server Core)
    - Windows 7
    - Windows Server 2008 R2 (except Server Core)
    - Windows 7 SP1
    - Windows Server 2008 R2 SP1
2. Hardware (minimum):
    - System: Celeron G530 (2.4 GHz), 2GB RAM, 250GB HDD
    - Display 14"
    - Keyboard, mouse
3. Hardware (recommended):
    - System: Core i5-2500 (3.3 GHz), 4GB RAM, 1TB HDD
    - Display 23"
    - Keyboard, mouse
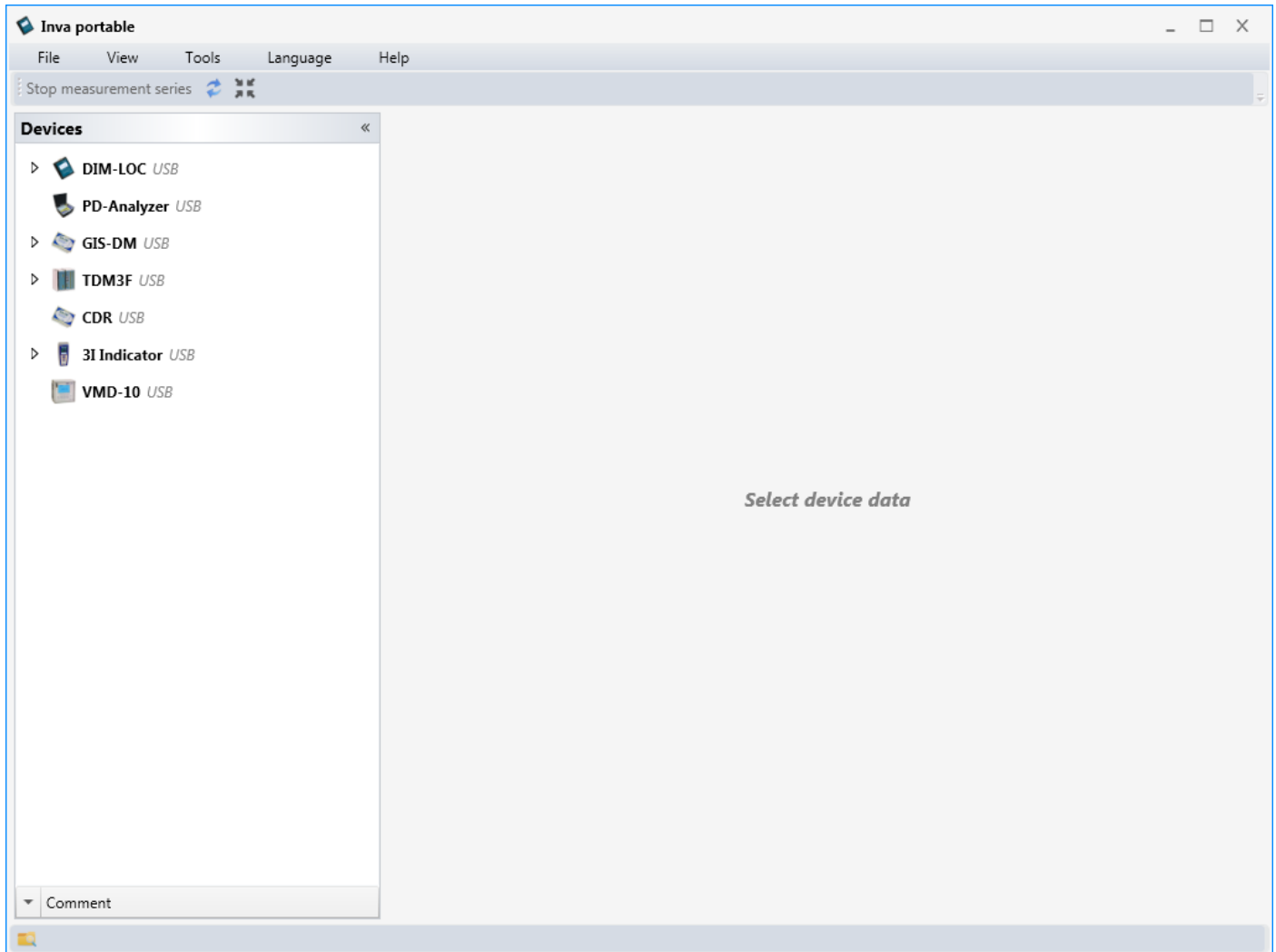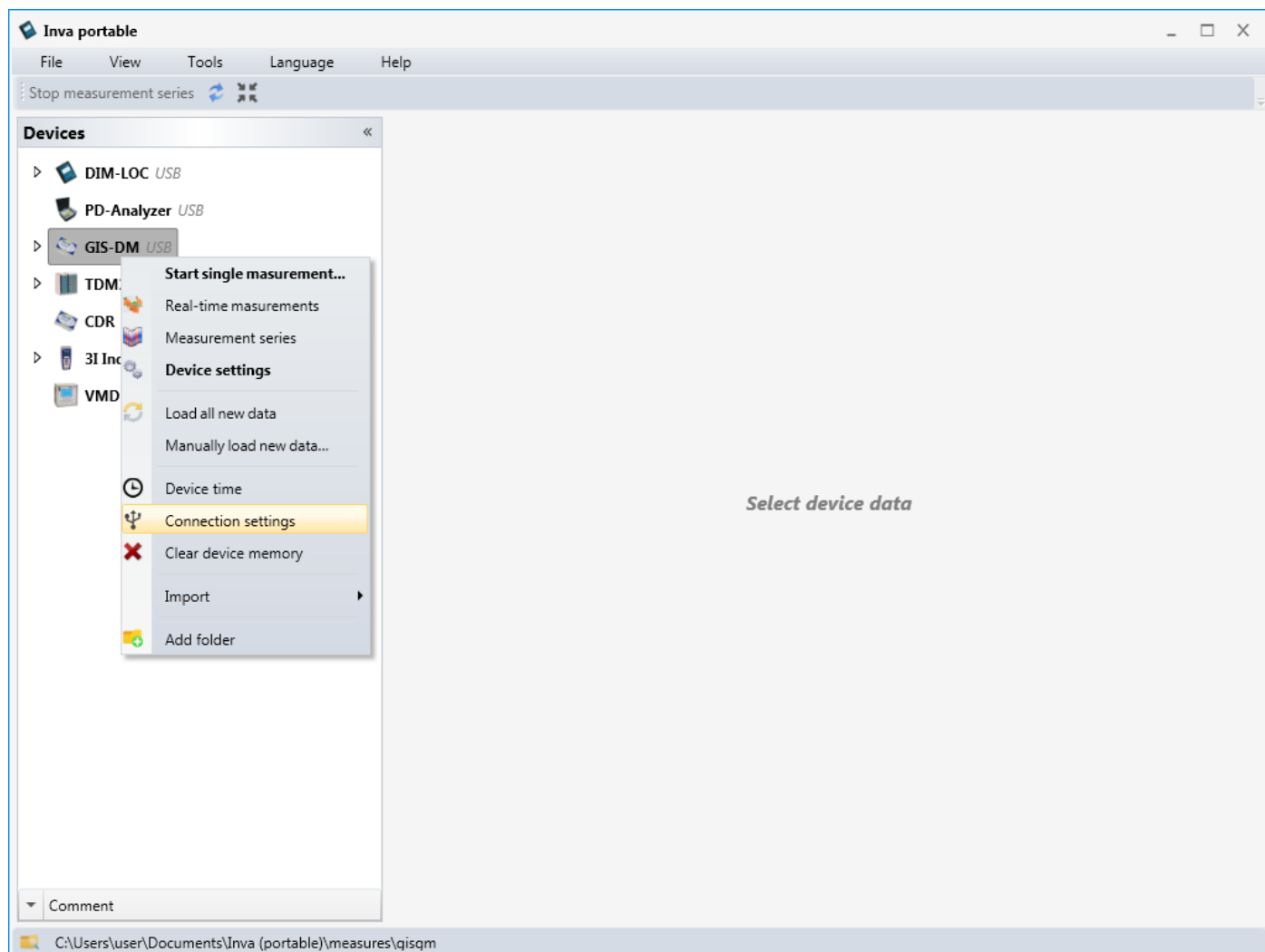
Fig. 2. Context menu «Device»

Next in the «Connection settings», specify the required type of communication / MODBUS address / IP address / port.
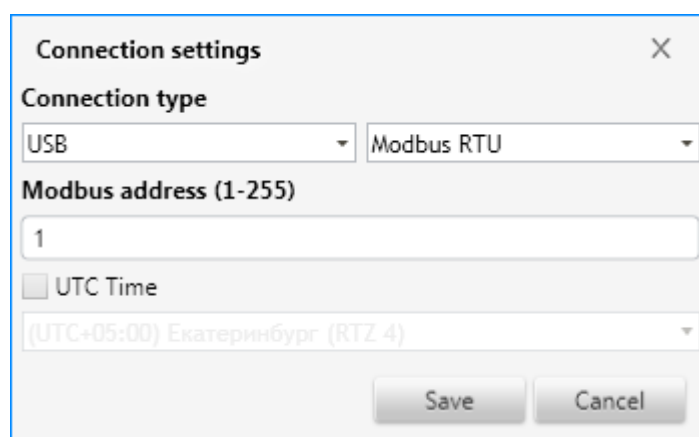
Fig. 3. Connection settings

NOTE: The connection parameters may also be assigned to any subfolder. Thus the appointed parameters

are valid for all the subfolders till new parameters are assigned to one of the subfolders of the lower level.

2.2. Setting the device time

To set the current time in the device, choose the menu item «Device time» (fig. 4).
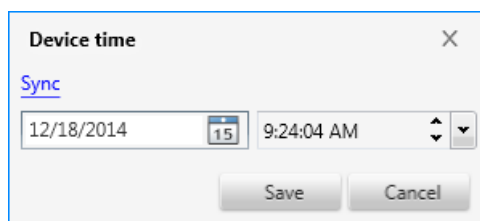
Fig. 4. Set device time

If you click the link «Sync» – the current system time will be set.

2.3. Create the folder structure of the device

The folder structure may reflect the actual structure of the enterprise (fig. 5). Folders store measurements.
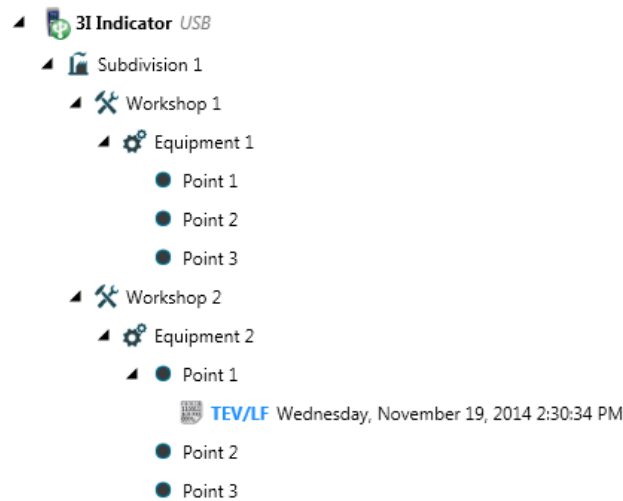
Fig. 5. Example folder structure for the enterprise

For the folders the following context menu is also available (fig. 6).
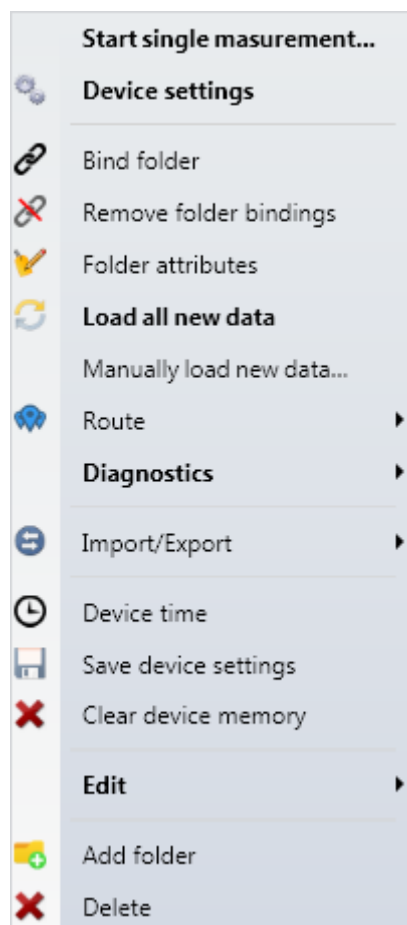
Fig. 6. The context menu of a folder

Here, the following points are added. Select «Bind folder» and «Remove folder bindings» are used to link multiple folders of the same type of devices interconnected to view measurements and diagnostics. For example, two of the three-channel devices can form one six-channel device.

By selecting «Folder attributes» the folder attributes can be set (fig. 7).
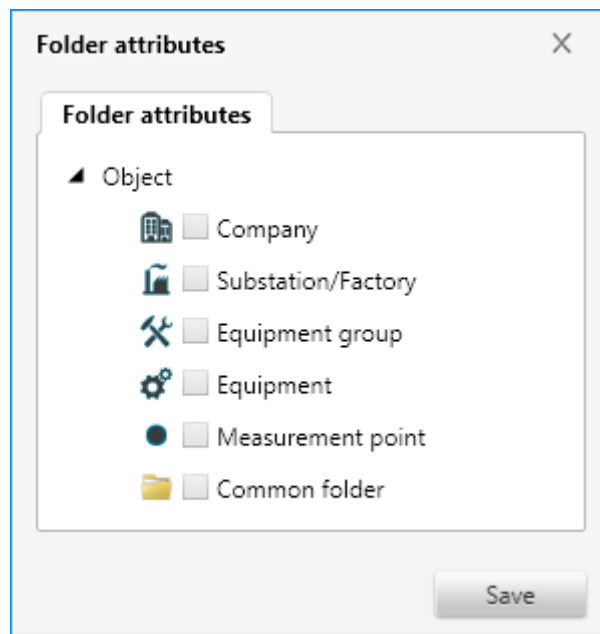
Fig. 7. Folder attributes

Also, when adding subfolders into the folder containing the attributes, the same window will be offered for selecting attributes.

Setting the attributes of folders is necessary for generating a report for the company, which is activated by the item «Tools/Report on the technical state of the equipment» (see chapter «Reports»).

The menu item «Edit» opens the submenu (fig. 8).
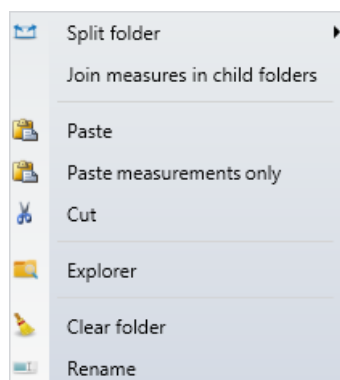
Fig. 8. «Edit» submenu

Items in this submenu:
- «Split Folder» – brings up the following submenu: «by day», «by weeks», «by month». Allows

you to group measurements by time;
- «Join measures in child folders» – allows to collect all the measurements in one folder;
- «Paste» – allows you to paste a folder with measurements;
- «Paste measurements only» – allows you to paste measurements only;
- «Cut» – allows you to cut a folder with measurements;
- « Explorer» – opens a folder with the measurements in the Windows Explorer;
- «Clear folder» – deletes all the data in the folder;
- «Rename» – allows to rename a folder.

2.4. Creating routes

When operating a portable device it is convenient to use routes. The route is a set of measurement points with unique identifier names.

Not all devices support the routing technology.

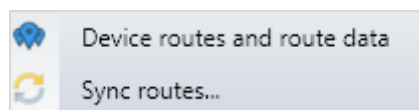Routes can be created for the current directory, in accordance with the structure of the enterprise. In order to work with routes, there must be at least a folder with the attribute «Company». For such files context menu item «Route » is available (fig. 10). This item contains two subitems "Device routes and route data" and "Sync routes…".

Fig. 9. Subitems of «Route» item

If you select «Sync routes» the route will be formed for the current folder structure and loaded into the device. The item "Device routes and route data" is used for creating an arbitrary route (fig. 10).
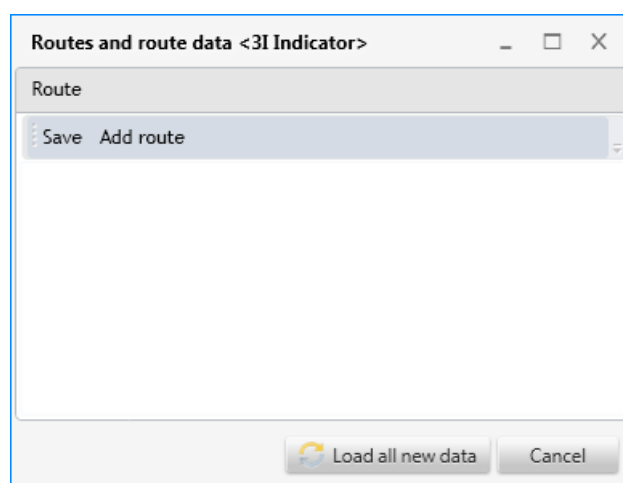
Fig. 10. Window for route creating

Here is the list of routes found in the device. You can add a new route by pressing the button «Add route» (fig. 11). Also you can add a new route point (fig. 12).
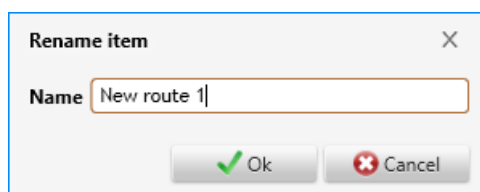
Fig. 11. Adding a new element of the route
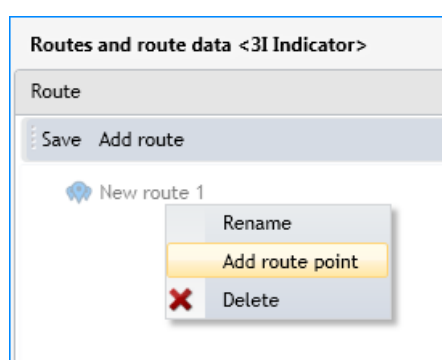
Fig. 12. Adding route points

After adding all the required points in the route, it can be saved in the device by pressing «Save» (fig. 13).
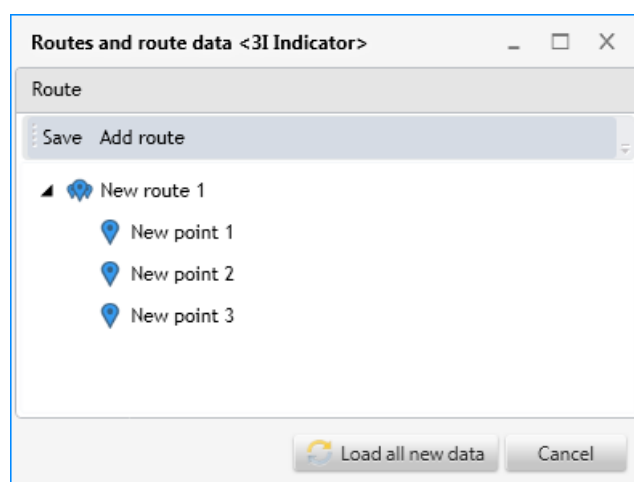
Fig. 13. Created route

For each point of the route, you can set parameters – warning and alarm settings, and choose the type of channel. The units corresponds to the units specified for the instrument channel (fig. 14).
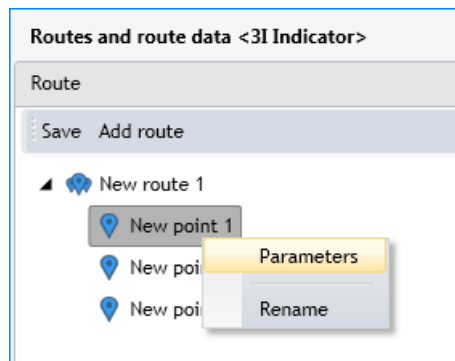
Fig. 14. Change the settings for route points
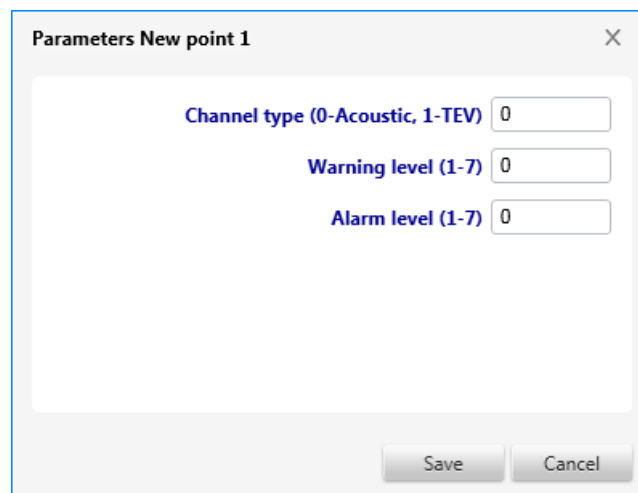
Fig. 15. Route point parameter window (for example, the device 3i)

To download all the data on the routes, press the «Load all new data», all the measurements will be put into the appropriate folders of the route points (fig. 16).
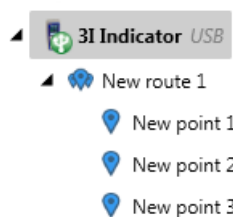
Fig. 16. Route structure in the folder tree

The route can be deleted by «Delete» context menu of the route. All the measurements of the route will also be deleted.

2.5. Measurement load

To download measurements from the device memory, select point «Load all new data» or «Manually load new data…» from the context menu of the device or folder (fig. 6).

If «Load all new data» is selected from the menu of the device, a new child folder will be created inside the directory (if is does not exists yet), and all the new measurements will be added into the child folder.

If «Load all new data» is selected from in the directory menu, then is a child folder will be created in the directory, and all measurements made later than that stored in the directory will be saved.

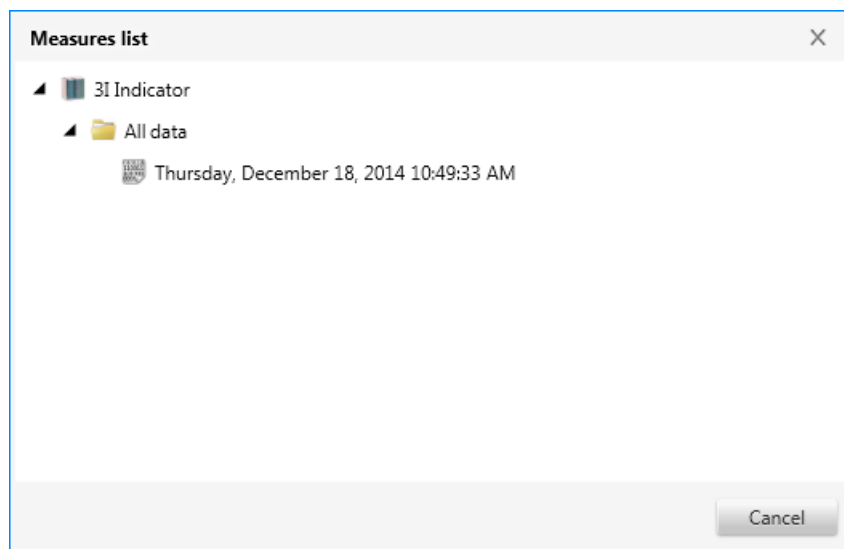If «Manually load new data…» is selected, then the operator can choose which measurement or directories must be loaded from memory. In order to download the measurements, select a measurement or directory in the «Measures list» (fig. 17) and drag and drop it into any directory of the selected device.

Fig. 17. Selecting a measurement for download

2.6. Measurement start

Depending on the device type, the following functions are available:

- Start a single measurement;
- Real-time measurements;
- A series of measurements.

To start the measurement, select the appropriate option in the menu of the device or directory (some types of devices may not support one or more of the above functions).
NOTE: Some types of devices do not support the launch of measurements (e.g., DIMLOC-4, VMD-10)

2.7. Start a single measurement

When this option is selected, the device sends a command to start the measurement. After the measurement is done, the measurement results is loaded from the device memory. If the menu item has been activated from the menu of the device, then a dialog box appears «Measures list» (fig. 17), and the user can select a directory to save the measurement. If the menu item has been called from the directory menu, the measurement will be stored in the appropriate directory.

2.8. A series of measurements

When this option is selected, the device is measuring continuously, saving and displaying the results after each measurement. If a menu item has been called from the menu of the device, in the device catalog directory a new folder will be created for this series of measurements. If a menu item has been called from the directory menu, the directory will be created inside the selected directory.

2.9. Real-time measurements

Certain types of devices (e.g. «GIS-DM», «CDR» or «TDM-3F») allow partial discharge parameters measurement in real time. This mode provides the ability to record measurements.

If the menu item «Measurement in real time» has been called from the menu of the device, then «Data Online» folder will be created in the device directory and all the new measurements will be saved in it. If the menu item has been called from the directory menu, the measurements will be stored in it. The recorded data is saved with the label «Rec». Play it by double-clicking.

2.10. Viewing the results of PD measurements in the range of HF/UHF

When selecting a measurement indicated by the labels «HF», «UHF» or «HF/UHF», on default «PRPD» representation opens. «PRPD» is an amplitude-phase distribution of partial discharges for a period of sinusoid graph (fig. 18). The color of areas or points indicates the number of pulses in the zone.
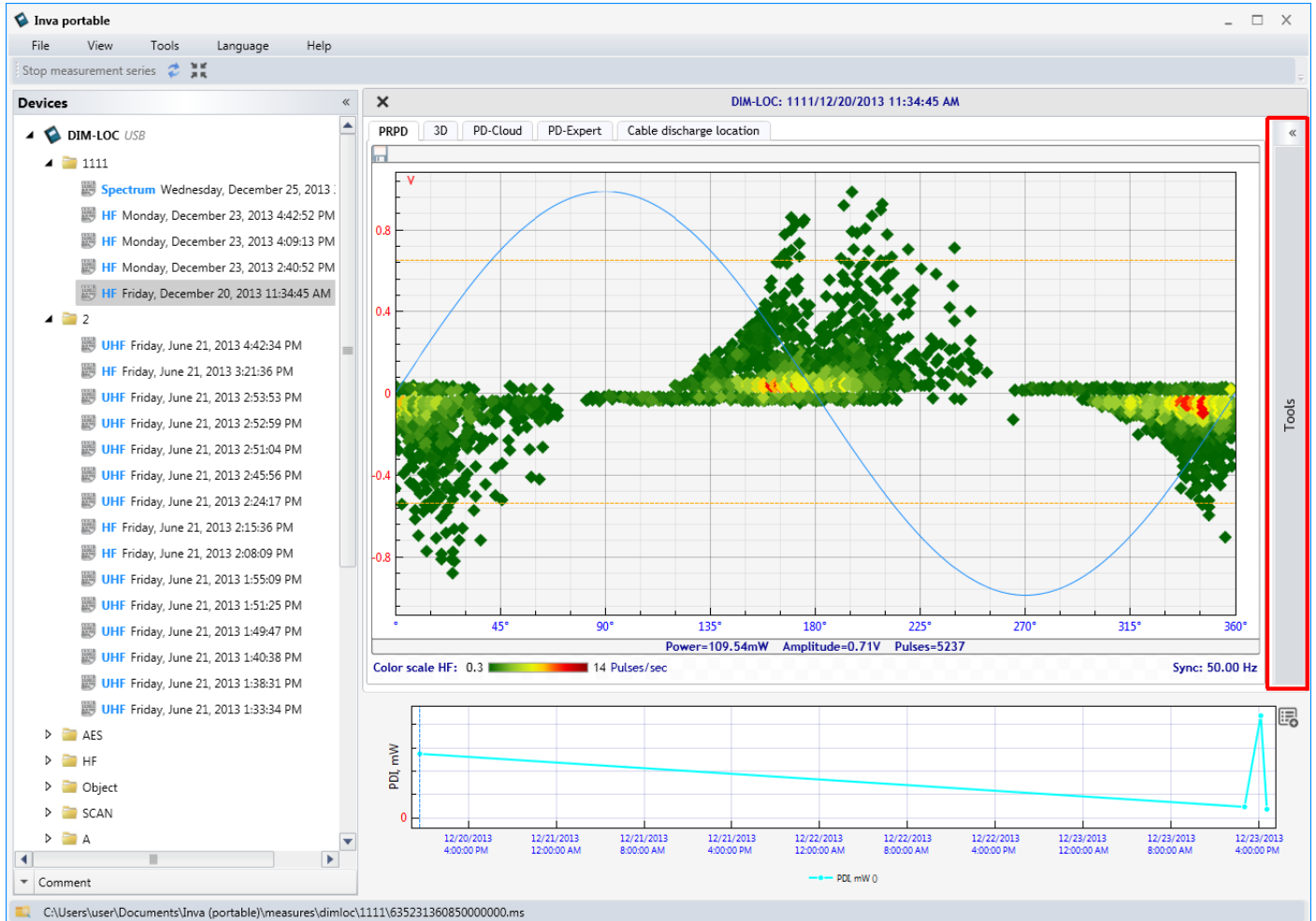
Fig. 18. Sample measure from device DIMLOC-4 in the range of HF (PRPD)

To view the shape of the initial pulse hold the left mouse button «Ctrl» and point at «PRPD» pulse for viewing, using the left mouse button. After that «Initial Pulse» window will open (fig. 19).
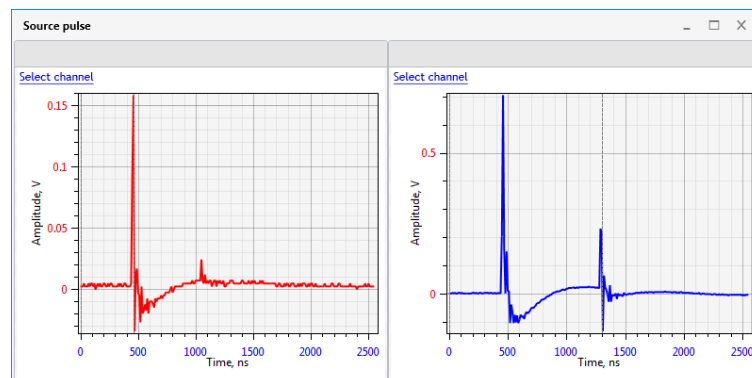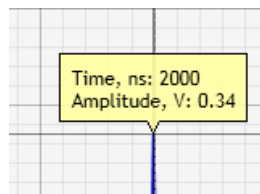

Fig. 19. The shape of the initial pulse

For operating with graphics signals use the mouse. The mouse button assignments:
- left button – for zoom area indication (fig. 20);

- middle button – for showing the value of a point (fig. 21);
- right button – for moving the signal graph; double click returns the scale to its original value.

Fig. 20. Zoom area

Fig. 21. Displays the value of a point

To change the display settings, you can use the panel «Options» (panel is red color framed on fig. 18). The sidebar is shown on fig. 22. Using the sidebar «Options» you can do the following:

- Show or hide the filtered device impulses;
- Show or hide the impulses filtered using custom filters;
- Choose pulses mapping: dots or a 256x256-cell matrix;
- Set or disable the overall scale of the graphs;
- Select the unit of the amplitude measurement (volts or nC);
- Install an additional phase shift;
- Adjust the size of the point on the graph;
- Set the borders of color scale.

Fig. 22. Sidebar «Options»

«3D» (fig. 23) is a three dimensional graph where X axes is for pulse amplitude, Y axis is for impulse phase and Z axis is for the sine period number. For example, at mains frequency of 50 Hz and measurement time of 1 second, the Z axis maximum is 50.
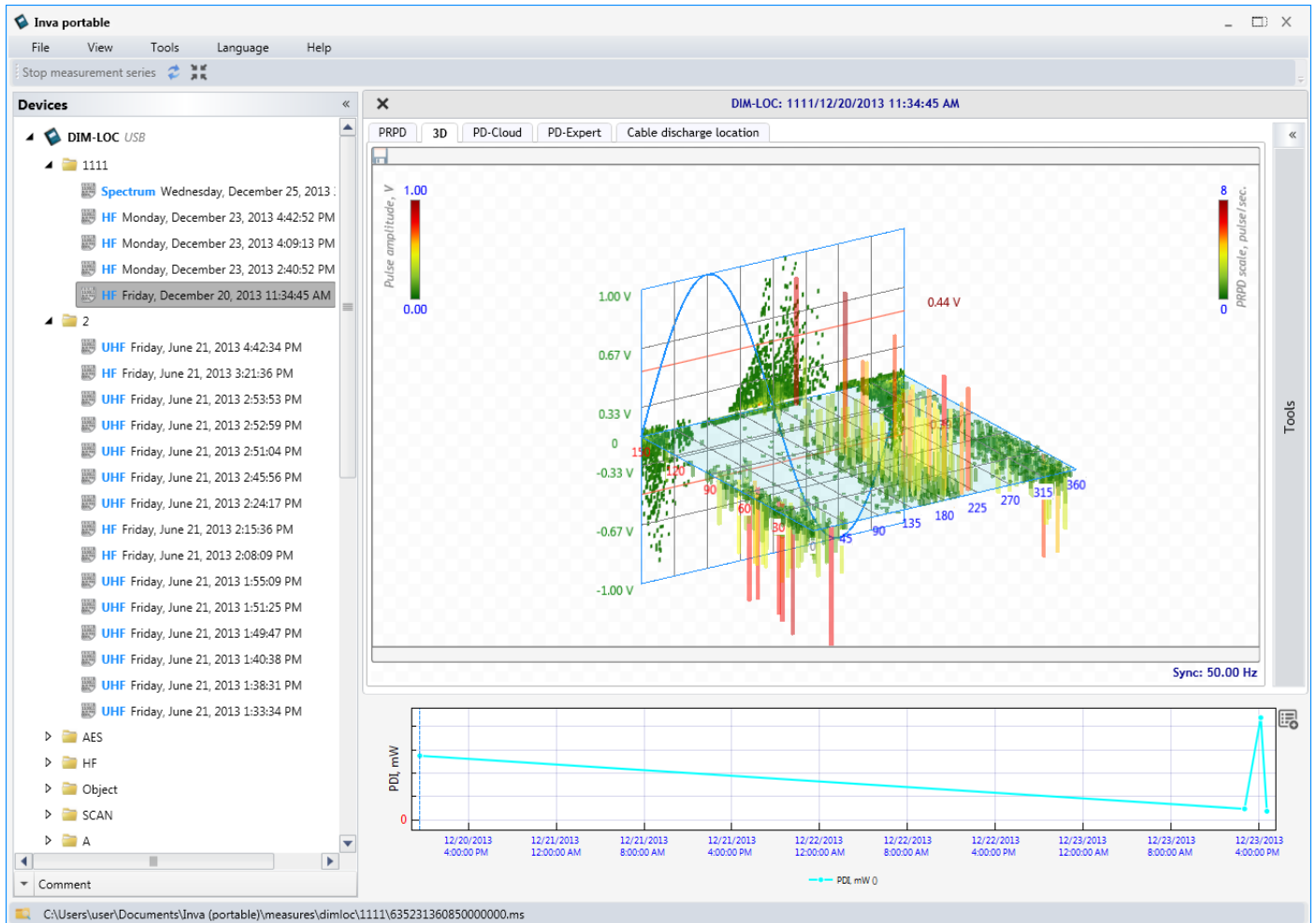
Fig. 23. Measure from device DIMLOC-4 in the range of HF (3D)

«PD Cloud» (fig. 24) is a three-dimensional graph, on X (T1) axis the value of the first half-cycle pulse duration is plotted, on Y (T2) axis the pulse duration value is plotted, on Z axis the value of the pulse phase is plotted.
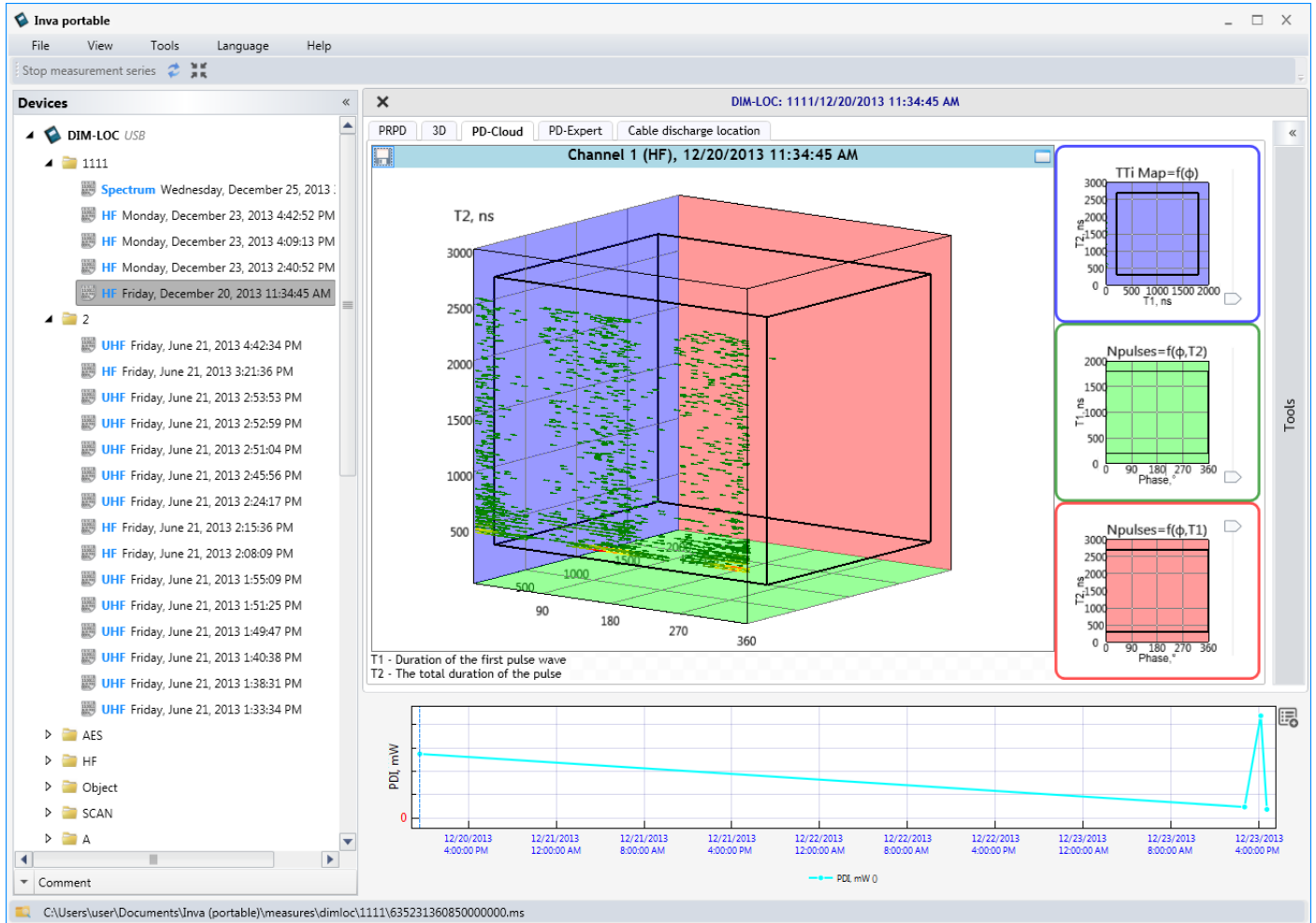
Fig. 24. Measure from device DIMLOC-4 in the range of HF (PD-Cloud)

This presentation may be useful when two pulses of different sources are measured by one channel (for example, the sources are two different defect in the insulation). Typically, the pulses from different sources have different duration and frequency of the first half-wave, whereby there are a kind of "groups" in the T1-T2 graphics plane, each of which represents a particular pulse source. Later each group of pulses may be selected and analyzed by «PD Expert» an expert system.

«PD Expert» is an expert system for determining the type of insulation defect by analyzing the amplitude-phase distribution of pulses. The user may obtain the opinion of an expert system in two ways. First method: «Automatic analysis». When using this method, the expert system automatically selects groups for analysis (selection is done by the pulse duration and the pulse first half-wave analysis). The second way: «Analysis of the area selected in the «PD Cloud»». When using this method, the user must manually select a group of pulses for subsequent analysis in the «PD Cloud» (fig. 23).
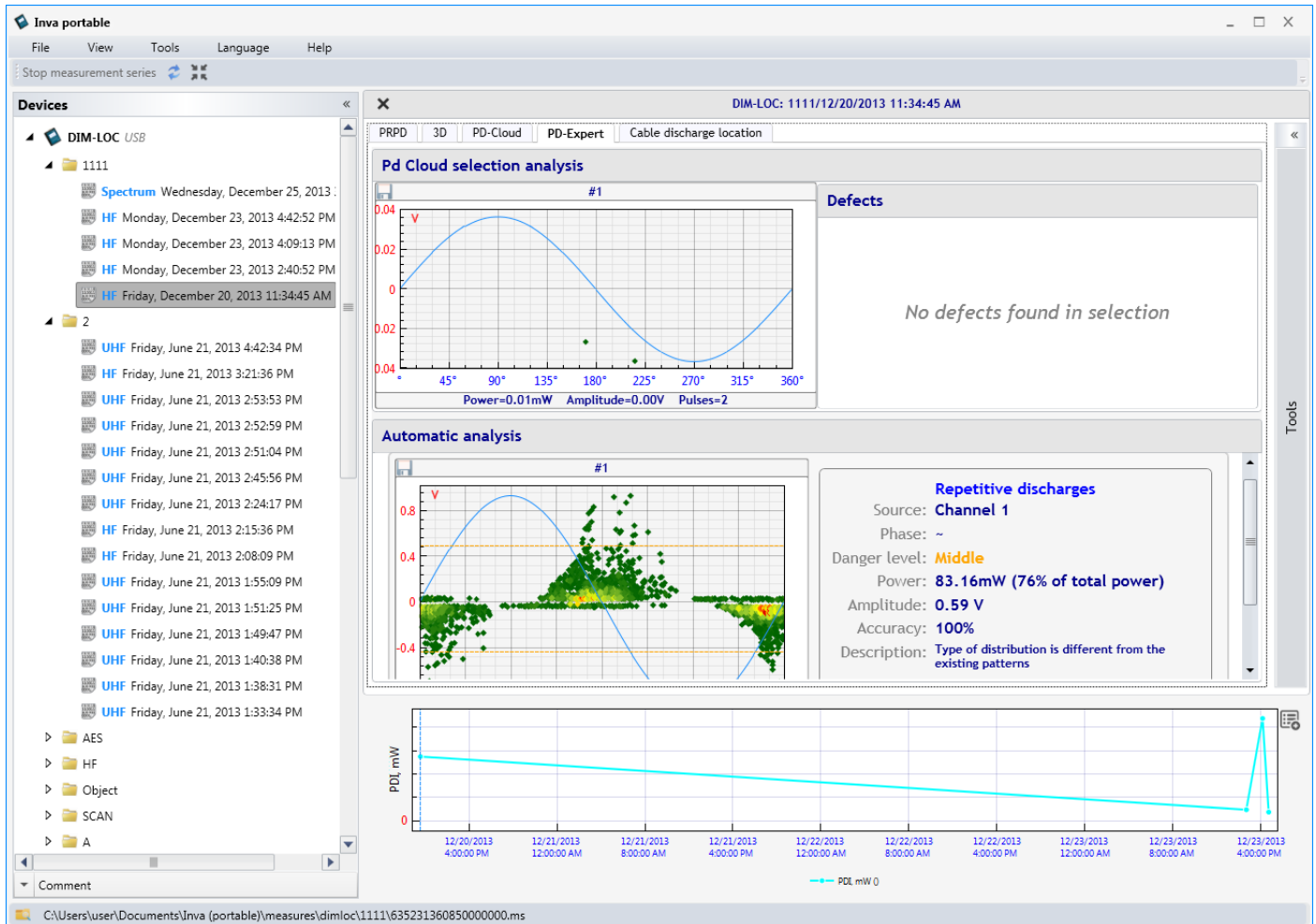
Fig. 25. Measure from device DIMLOC-4 in the range of HF (PD-Expert)

2.11. Viewing the results of measurements in the acoustic range

When selecting measurement, tagged as «LF» window «Acoustic signal» window opens on-default, which shows the oscillogram of the acoustic signal measured by the device (fig. 26).
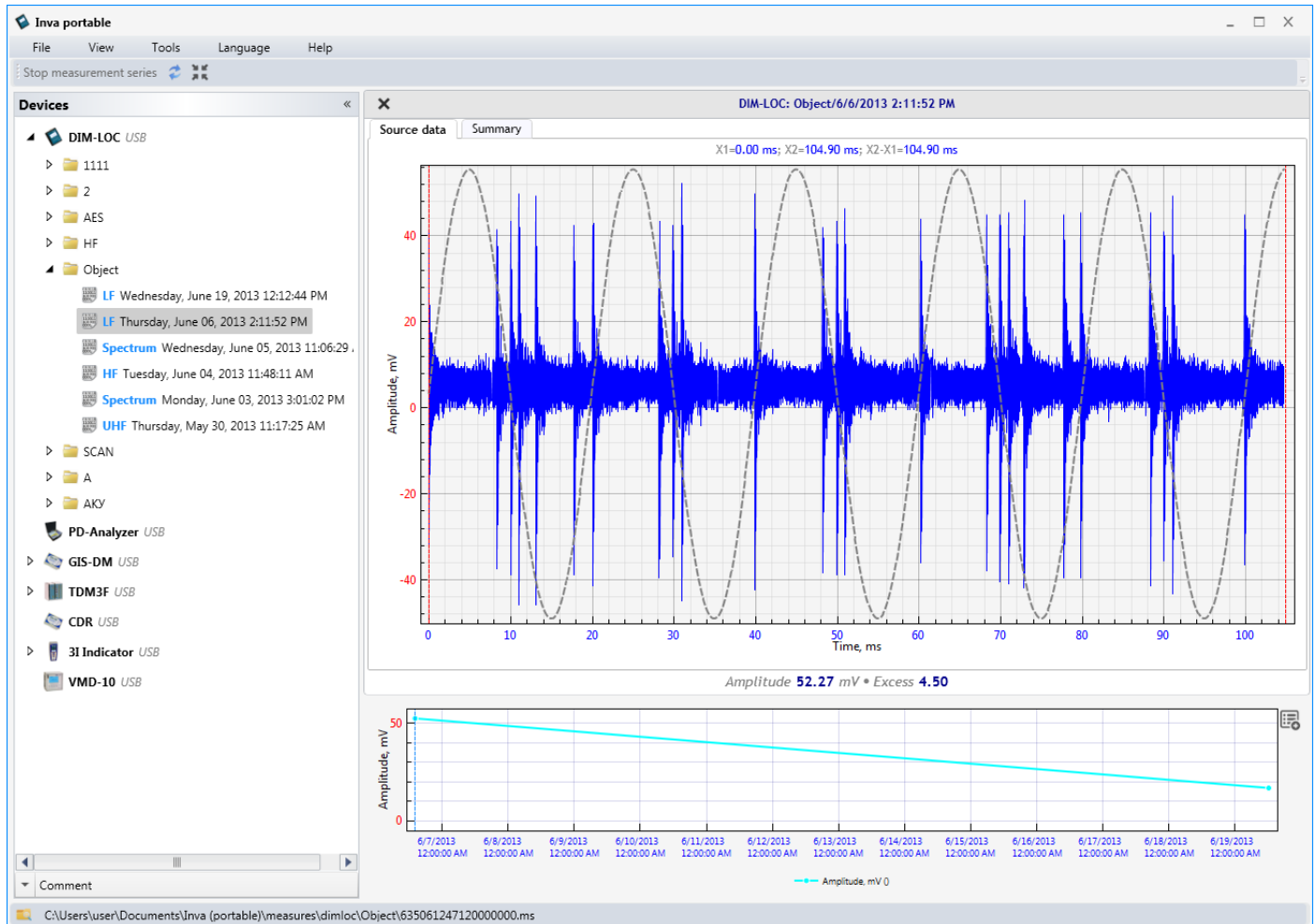
Fig. 26. Measurements from device DIMLOC-4 in the range LF

Also, the acoustic signal can be represented as a histogram (fig. 27). The histogram entire signal is superimposed on one period of a sine graph. For convenience, the columns of the histogram have different color (dark-red color corresponds to 100% amplitude, dark blue - to 0%, etc.).
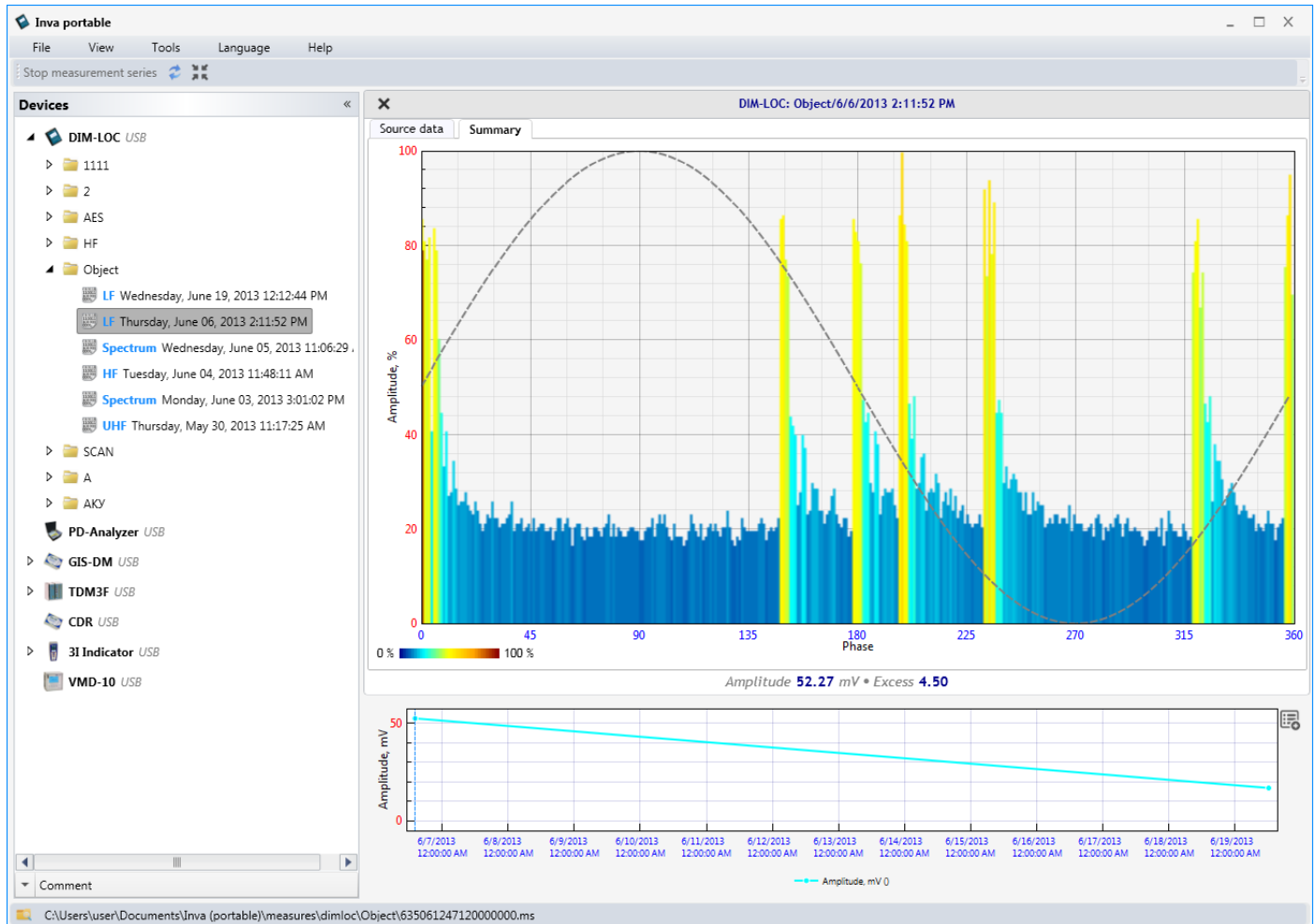
«Inva (Portable)»

Fig. 27. Measurements from device DIMLOC-4 in the range LF. Amplitude-phase distribution

2.12. Changing the program settings and saving measurements

The «Tools» menu consists of the item «Settings», when clicked, opens a window with the program settings (fig. 28).
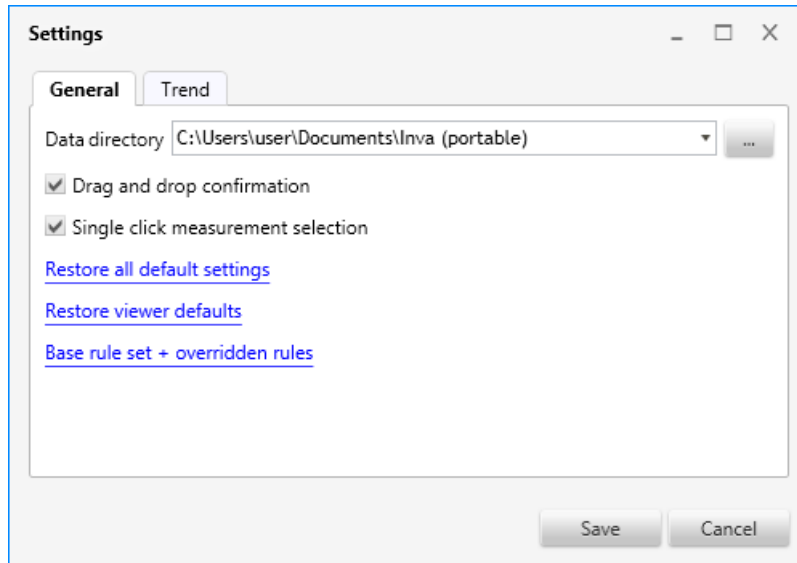
Fig. 28. Base settings

On the «General» tab the storage path for measurements is selected, and you can customize the behavior of the program when viewing measurements:

- «Drag and drop confirmation» – confirmation when you drag a folder or measurements;
- «Single click measurement selection» – display graphic information on measurements in a single click;
- «Base rule set + overridden rules» – used in together with visualization program iNVA.
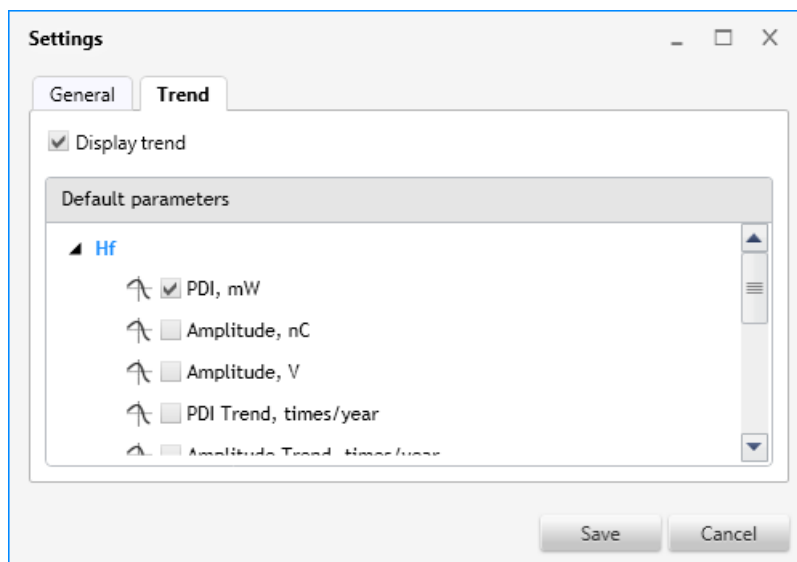

Fig. 29. Trend settings

«Trend» tab indicates whether the trend graph should be displayed and what parameters need to be displayed it. The point of the chart is also duplicated in the menu «View/Display trend».

Save measurements by using the «File» menu of the program, it consists of a sub-menu:

- «Open simulator template» – open a file for data simulation (used in together with visualization system iNVA);

- «Import data archive...» – import zip-archive for all the measurements of all devices;
- «Create data archive...» – create a zip-file with all the measurements of all devices;
- «Exit» – close the program.

In addition, the «Language» menu allows you to change the language: Russian, English or Chinese. «Help» menu displays information about the program and allows checking for updates (fig. 30).
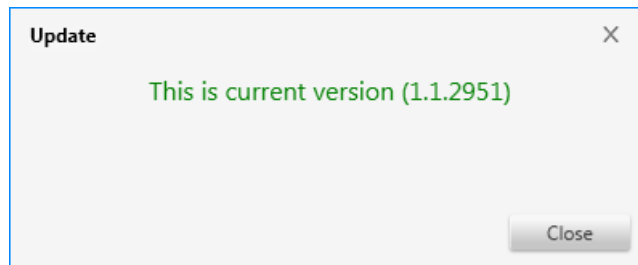
*Fig. 30. Window to check for new versions of the program*

2.13. Data import/export from the monitoring system INVA

If stationary monitoring system is installed in the local substation network, then it is possible to import data from «INVA» to «INVA Portable» and back. To do this, select the necessary or newly created folder of the device and call the context menu, right-click (fig. 31).
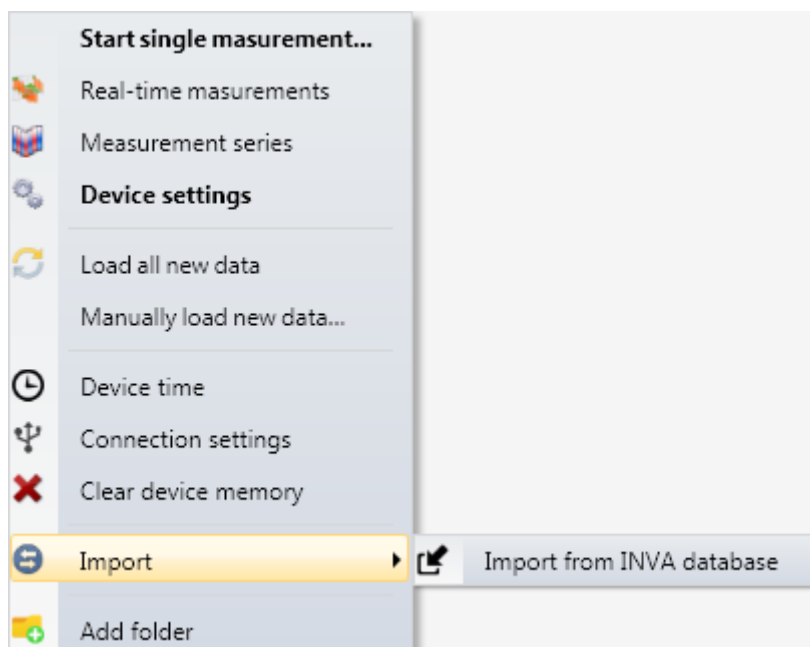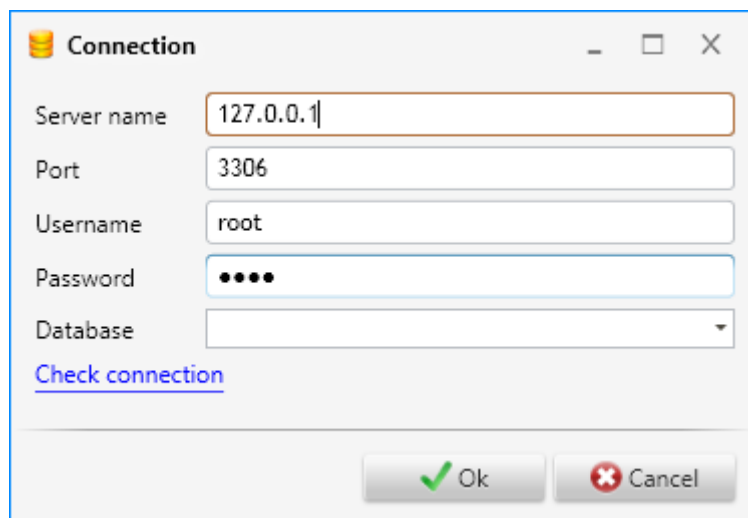

Fig. 31. Context menu Import/Export

At selecting import operation the database connection window is displayed (fig. 32).
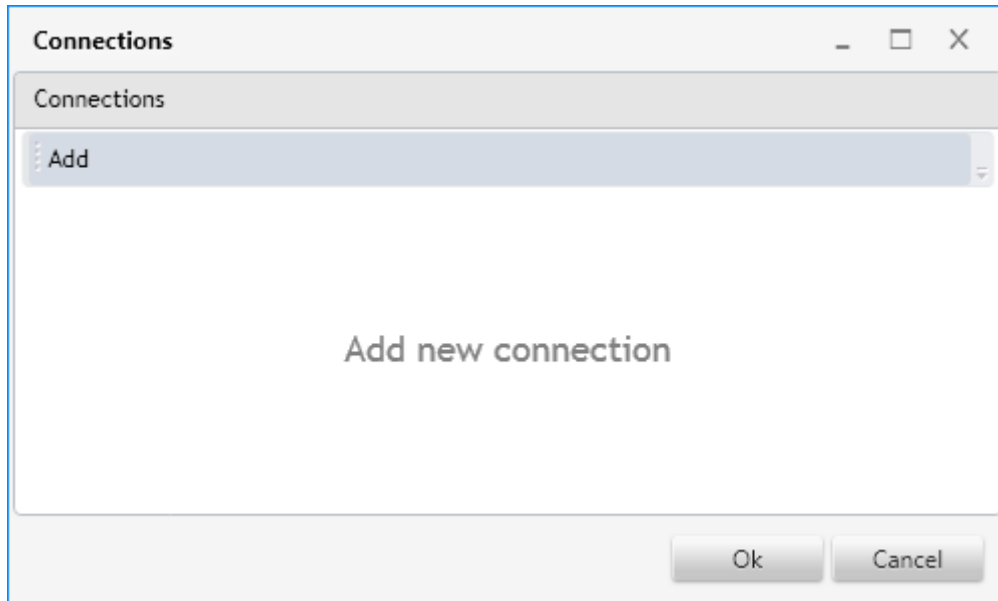
Fig. 32. Window of the database connections

If the connection list is empty, create a new connection, with IP address of the monitoring system server, the user «root», the password "5421" and select the necessary database from the list (fig. 33).

Fig. 33. Setting up the database connection

If you install INVA Portable on the same computer where INVA database is, use «127.0.0.1» as IP-address. The name of the INVA software database on-default is «invadb».

If there is already the data for the selected type of device in the database, the following window is displayed (fig. 34). Here set the import time cycle, then click on the highlighted in blue line with the required device name and the measurement data will be imported into «INVA Portable» (fig. 35).
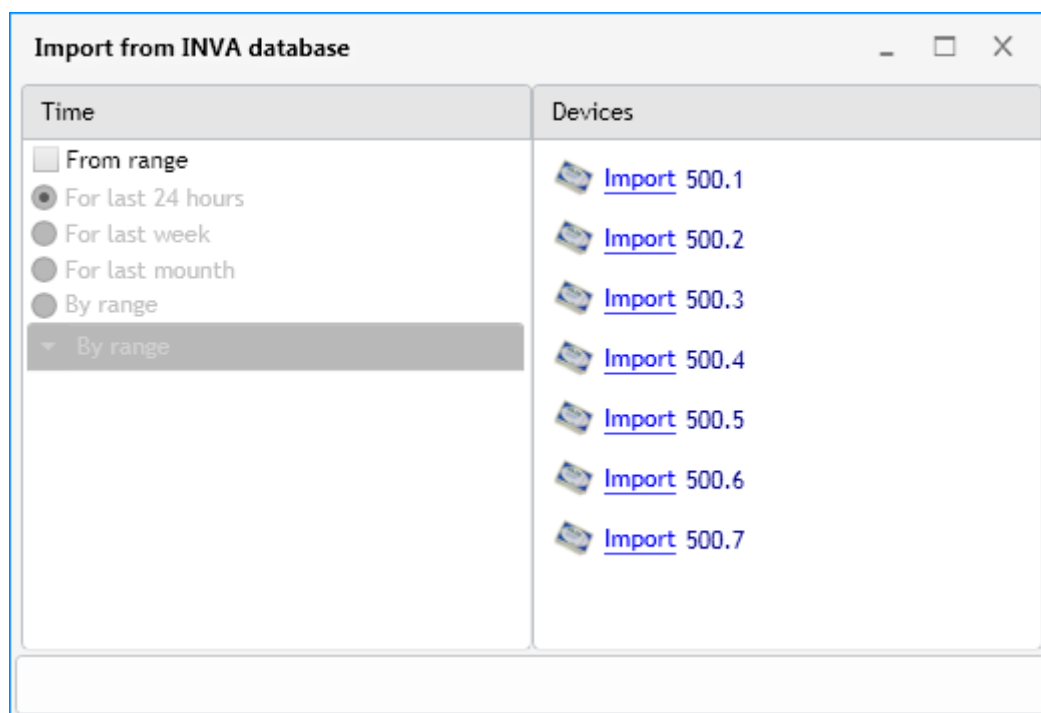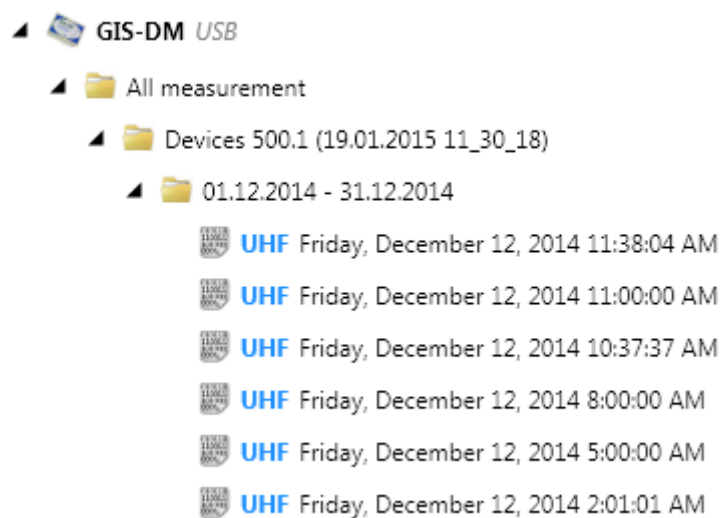
Fig. 34. Import data window

Fig. 35. The result of the measurement import

2.14. Import/Export data from INVA Portable, installed on another computer using Windows Explorer

All data from one program can be stored on external media by opening the folder in Windows Explorer (fig. 36). Then, in another program, you can also open a folder and paste the data from the storage medium, using standard Windows.
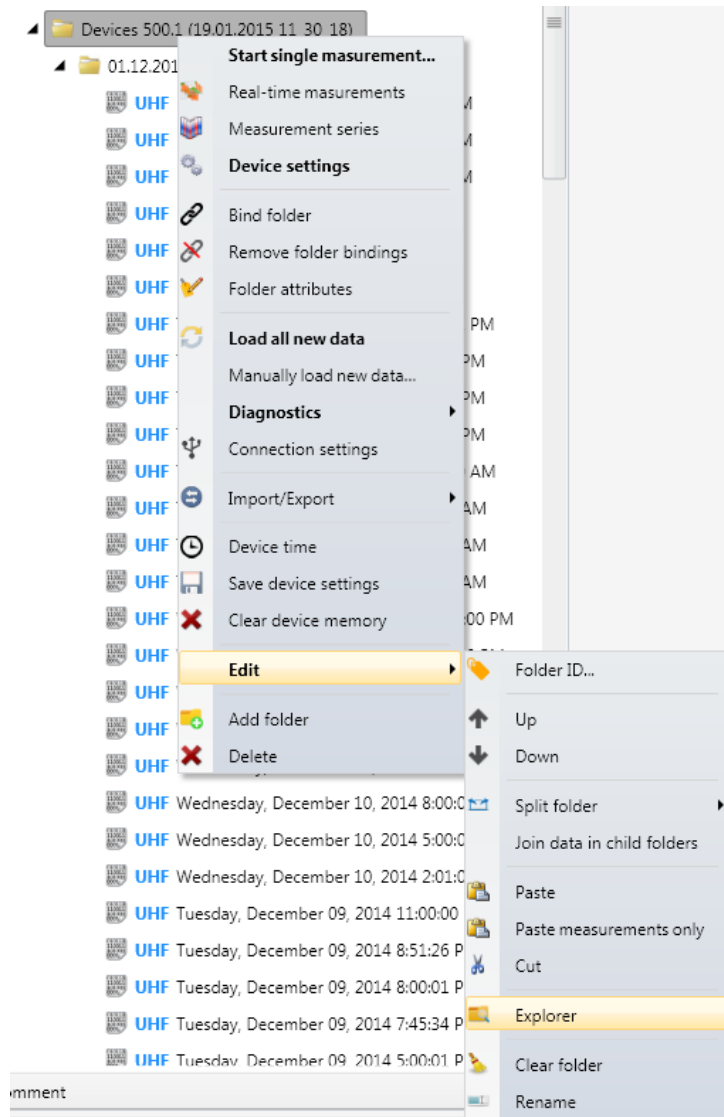
Fig. 36. Open the folder in Windows Explorer

After pasting the data, you must restart the program to update the data structure.

3. Report on the insulation condition
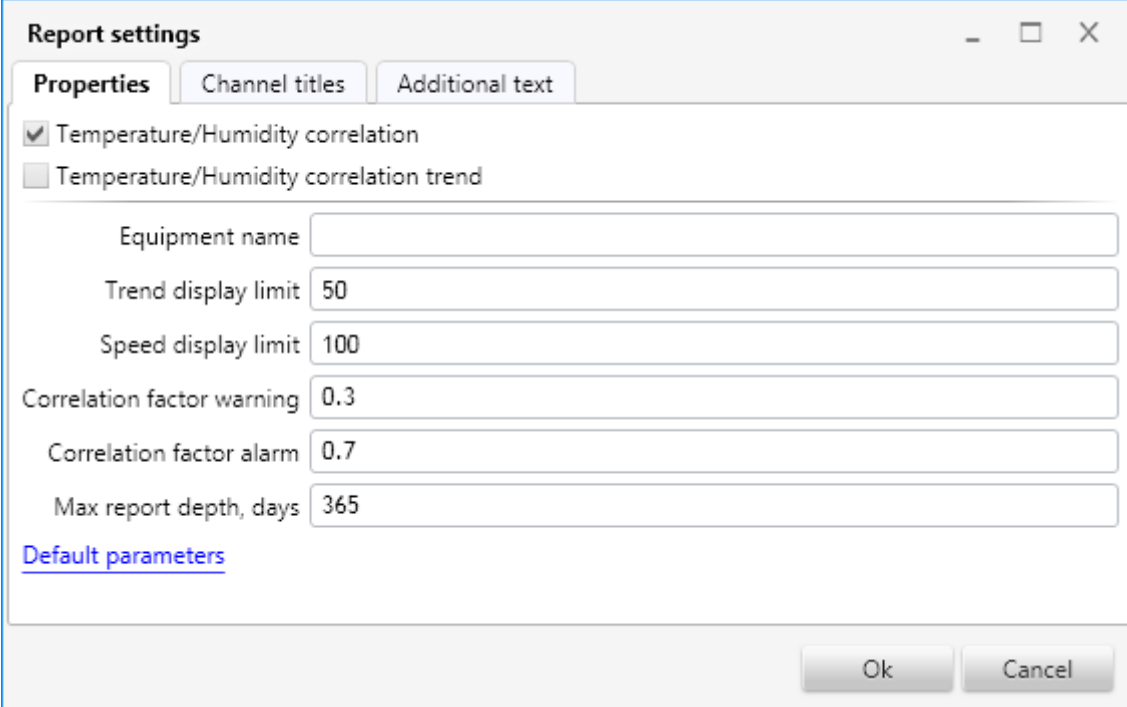
3.1. Report types

For each type of equipment different types of reports are available. The reports called from the context menu "Diagnostics" for the selected folder or loaded signal.

The types of reports are the following:

1. Report (partial discharges in the insulation) - report on the defects presence in the insulation and their type;
2. Report on the equipment condition – warning/alarm level exceeding;
3. Report on the timing of repairs - report on the timing of repairs for the selected equipment;
4. Report on the timing of measurements - a report on the time of the next measurements;
5. Report on the residual service life - a report on the residual service life in % for the selected equipment.

3.2. Report parameters

Report parameters can be viewed and changed by calling the menu item «Diagnostics/Report Settings» (fig. 37).


Fig. 37. Setting report parameters

Here you can set the parameters to be displayed in the report:

1. Temperature/Humidity correlation – adds the data on the relation between ambient temperature, humidity and pulse power;

2. Temperature/Humidity correlation trend – adds the trend graph on the relation between ambient temperature, humidity and pulse power (if there is the relation);
3. Trend display limit – if PD level growth exceeds the specified value (% / year), the note will be added into the report;
4. Speed display limit – if PD level growth exceeds the specified value (% / month), the note will be added into the report;
5. Correlation factor warning – on the basis of a predetermined value, it is determined whether there is a link between technological parameters and pulse intensity;
6. Correlation factor alarm – if the correlation coefficient is above a predetermined value in the report will be added to the record of a strong relationship between technological parameters and intensity pulses;
7. Max reports depth, days – to generate a report for a certain number of days before the selected measurement;
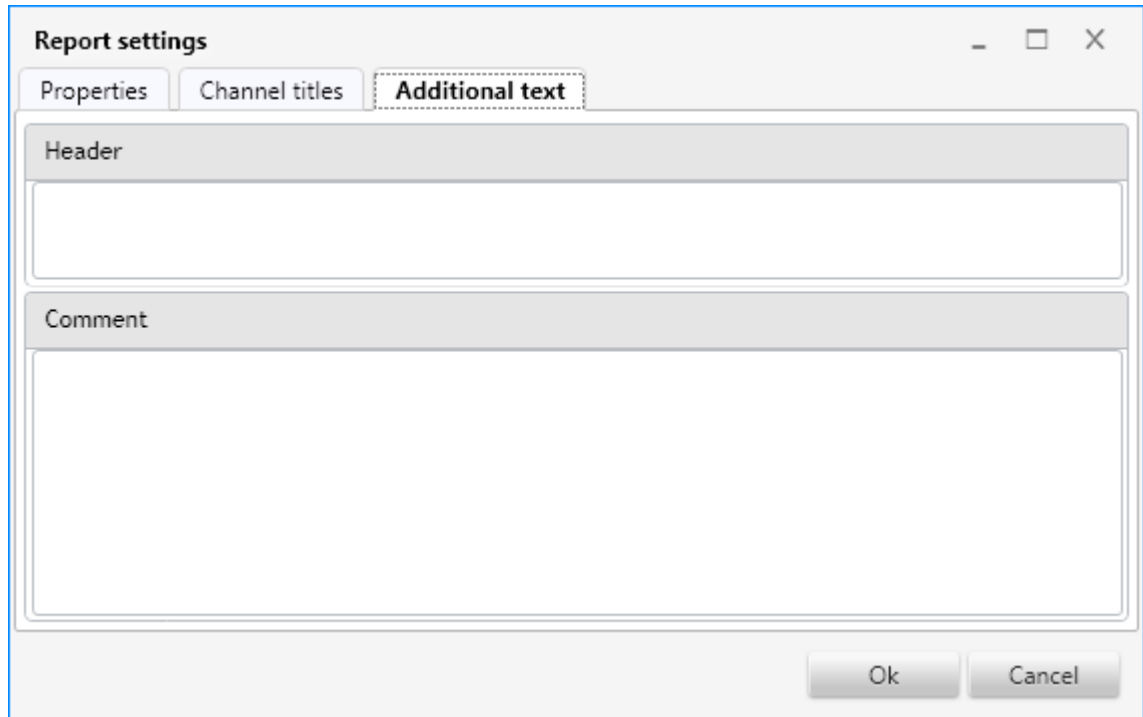
If necessary, specify the names for measurement channels of the device (fig. 38).
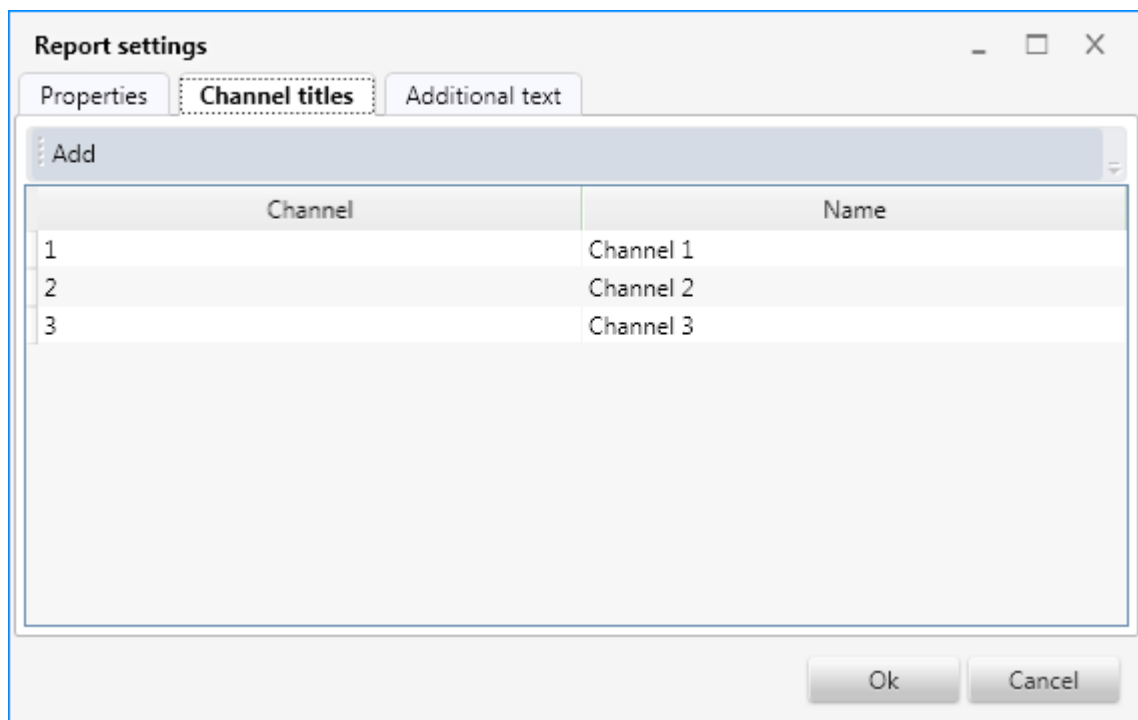
Fig. 38. Names for channels

Additionally, you can add the text to display in the header, as well as a comment to the report (fig. 39).

The set parameters also apply to all the subfolders.

*Fig. 39*. Specifying additional parameters

3.3. Report window

Report of exceeding the threshold settings (fig. 40) can be generated by calling the item «Tools/Report on the technical state of the equipment».

The report can be generated for any level of the hierarchy of the folder that has the attribute set.

To work with the report there is the top row of buttons, they are (from left to right):

- save the report in the format docx;
- open the report in Microsoft Word version 2007 and above;
- open the report in Adobe Acrobat Reader;
- update the report;
- print the report;
- copy the report to the clipboard;
- group zoom buttons;
- a group of buttons positioning layout;
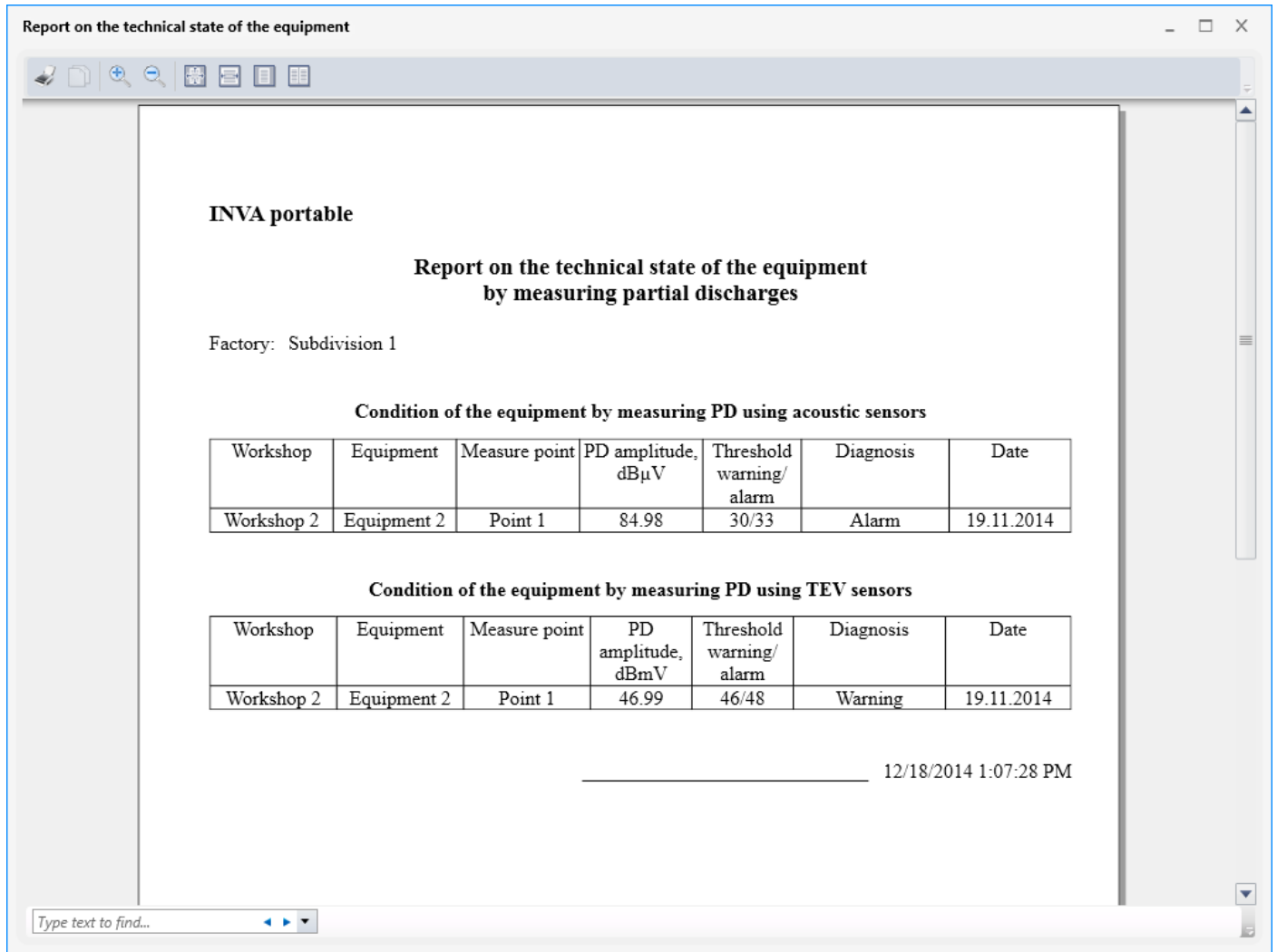
Fig. 40. Report on the equipment condition

3.4. Report generation

To create a report on measurements performed in a certain period, select the point of the last measurement on the graph, then, holding down «Ctrl», select the point of the first measurement in the range you need (fig. 41).

To create a report on measurements performed during several days before the current measurement, click on the icon «Report», select «Create report (current and previous measures)». The number of days for which the report will be generated, can be specified in the report parameters

To make a report for a certain number of days before the current measurement, clicking on the icon «Report», select «Create report (selected range)». The number of days for which the report will be generated, can be specified in the report parameters (fig. 37).
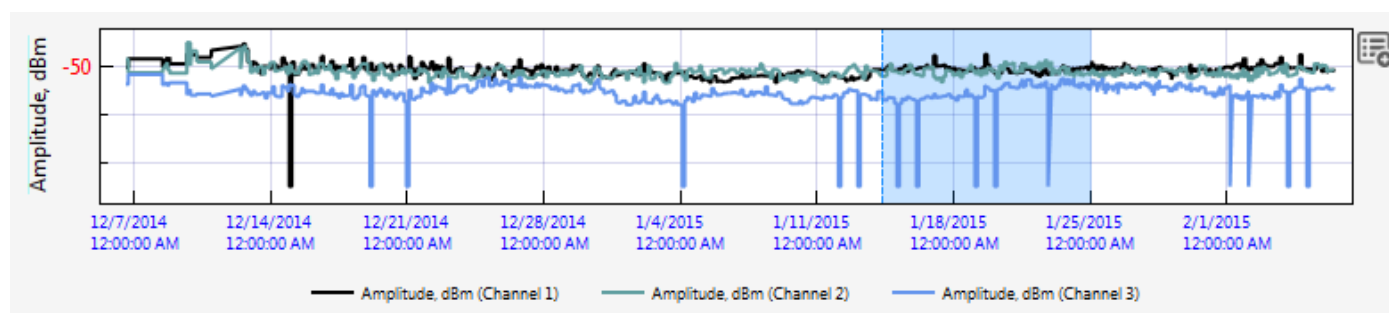
Fig. 41. Selecting a time range on the graph for creating a measurement report

To generate a report only for the currently selected measurement, click on the icon «Report» and select «Create report (current measure)».
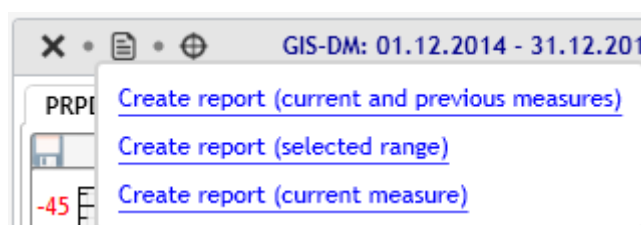

Fig. 42. Create report menu

It is also possible to generate a report on all of the data in the selected folder (including the data in the subfolders), by the menu item «Diagnostics/Report (partial discharges in insulation)».

4. Location of partial discharges in cable lines and switchgear

4.1. Location in the switchgear according to one device

To locate the source of the discharge activity on the data from the two sensors connected to a single device, right-click on the relevant measurement in the pop-up menu, select «PD location» (fig. 43).
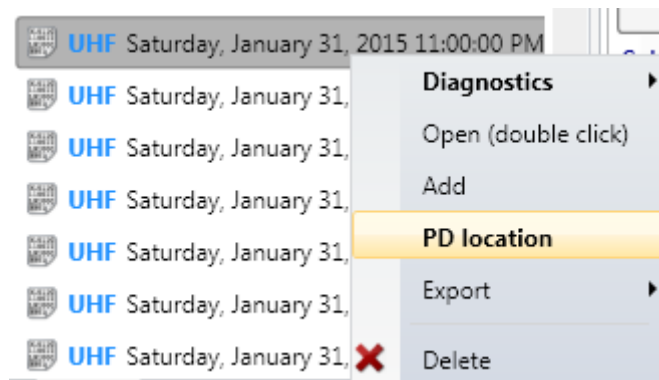

Fig. 43. Location of PD

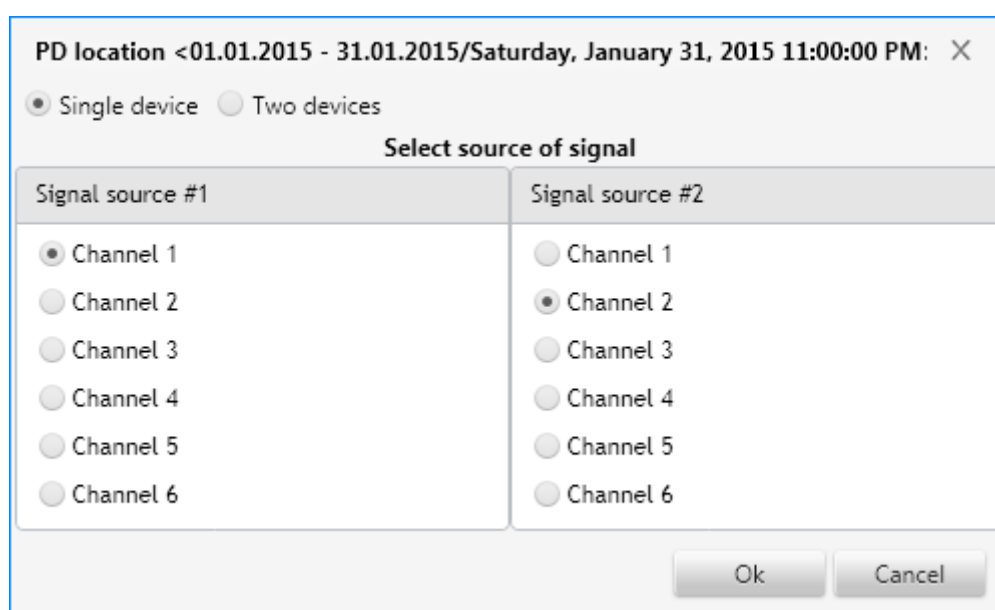Specify the pair of the device channels for PD location (fig. 44).

Fig. 44. Channel selection for location

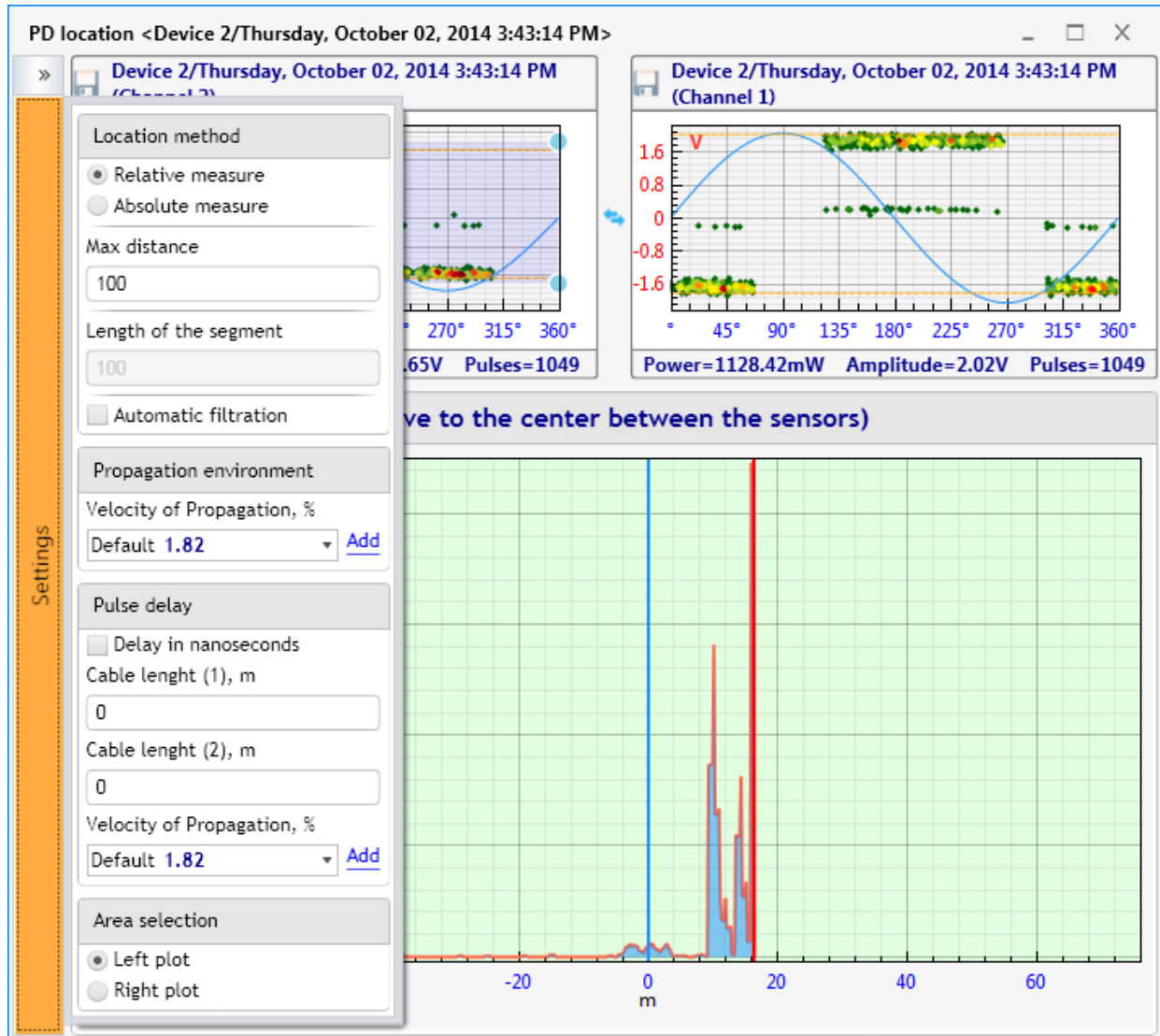In the window that opens, select the PD location settings (fig. 445).

Fig. 45. Location settings

In the location settings you have to specify the following:
- A method of locations - relative or absolute measurement;
- Parameters of the location object - velocity factor for the environment in which the location is conducted;
- Signal delay in measuring chains - cable length and velocity factor for this type of cable, or specify a delay in nanoseconds;
- Signal Group - a group of signals for location;

On the chart «PRPD» (left or right depending on the schedule settings, see fig. 45), you can select a group of signals for location (fig. 46).
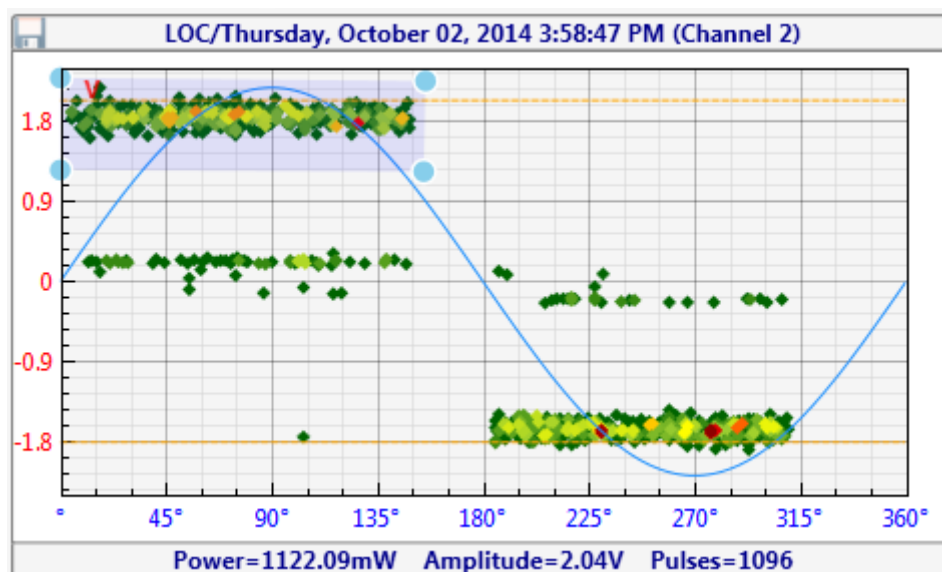
Fig. 46. Selecting signal groups for location

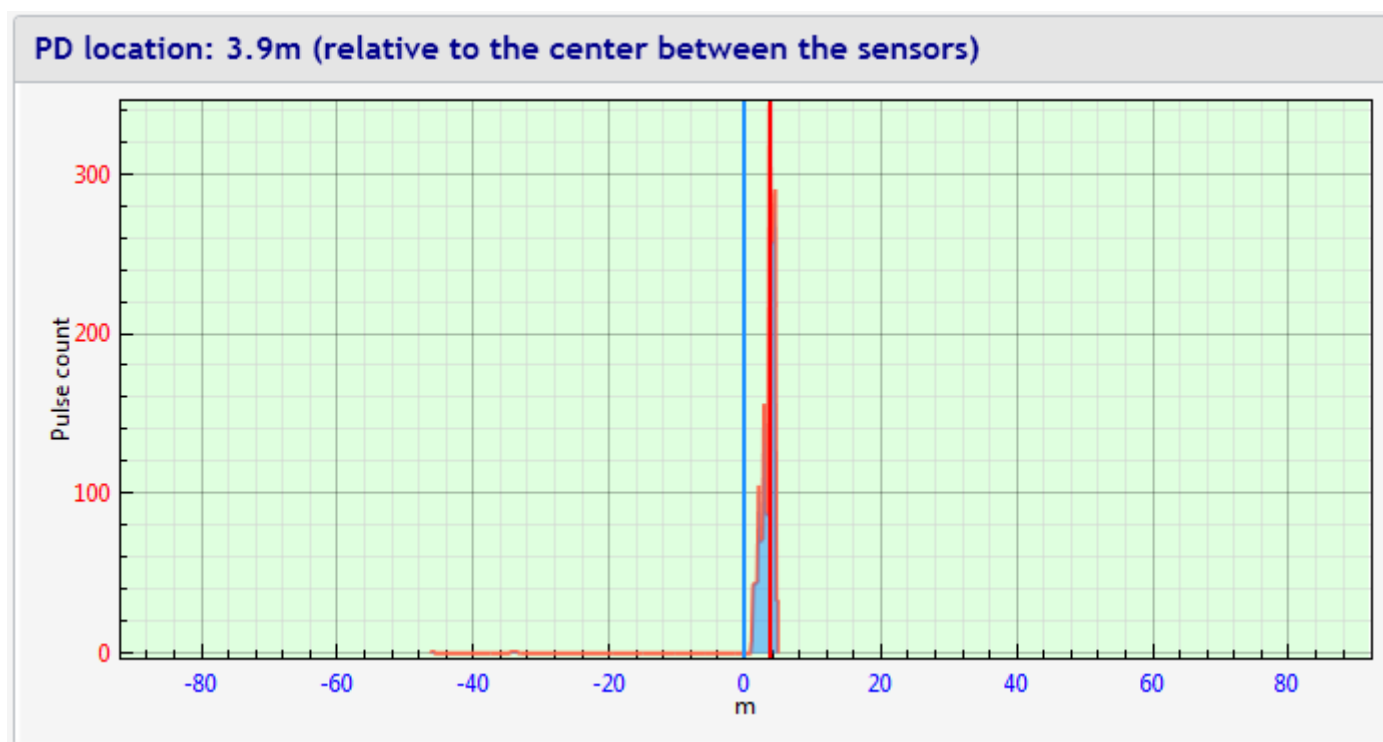The result of location is represented in the graph below (fig. 47).

Fig. 47. The number of pulses along the cable and PD source location
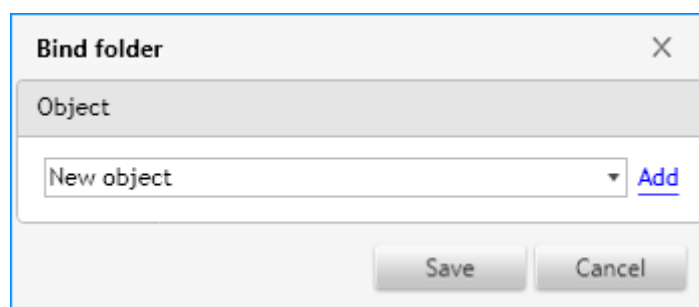
4.2. Location according to two devices

To see the measurements obtained with the two devices select the menu item «Bind folder» (fig. 48), select a folder to bind, select «Bind folder» again and specify a name for the connection (fig. 49).

Further actions are similar to those of chapter 4.1.
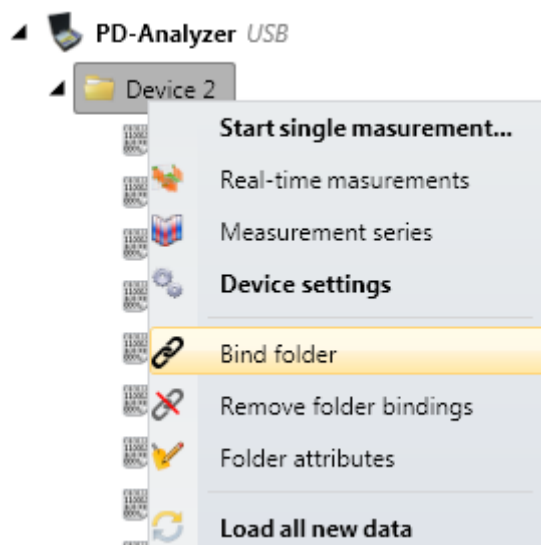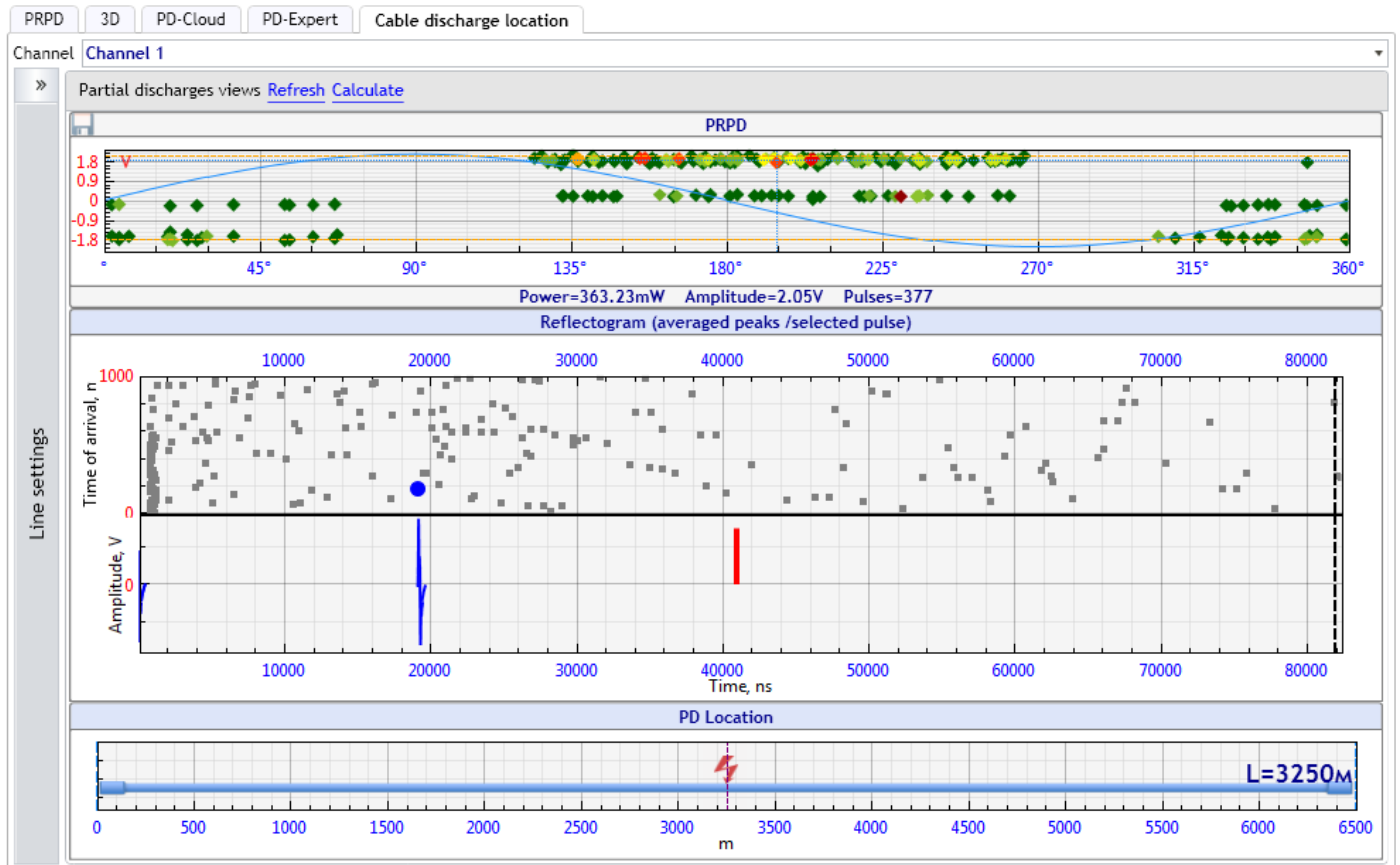

Fig. 48. Selecting a folder for binding

Fig. 49. Name the connection

4.3. Location discharges in the cable line

Open the measurement on which location should be done, and switch to the tab «Cable discharge location».

Fig. 50. Location in the cable line

In the left part of the window there is the «passport» of cable line – its length, velocity factor, the distance between the couplings.

In the top right part of the window there is the amplitude-phase distribution constructed by the pulses with reflection. Just below there is averaged trace. Selecting any pulse on the amplitude-phase plane or on a averaged trace plane you can see a single trace «synthesized» from a variety of pulses, it is shown in blue.

Moving the element indicating the location of the defect labeled «lightning» in the image of the cable line, we will see all the possible reflections from the coupling of the cable line. They will be shown in the graph of the selected trace in red. Comparing the selected and calculated trace, we can locate the pulse source.

The location of the greatest number of pulses is considered the most likely location of the defect in the isolation.