USB OSCILLOSCOPE USER GUIDE

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1 PURPOSE

The main purpose of the "UsbOscilloscope.exe" program (hereinafter referred to as Program) is monitoring, storage and analysis of input analog and digital signals.

The Program operates in combination with the USB-oscilloscope device (hereinafter referred to as Device).

At work with the Device please read the safety requirements paragraph (see. §7).

2 COMMON DESCRIPTION OF THE USB OSCILLOSCOPE

The Device operates in two modes:

1 – is the mode of 1-, 2-, 4-, 8- channeled analog oscilloscope;

2 – is the mode of 4 or 8 - channeled digital analyzer.

Both modes are used to perform monitoring, measuring and recording of the investigated signal in the real time mode.

2.1 Analog oscilloscope mode

- The number of the input channels is 8.
- The channeling of the oscilloscope is 1, 2, 4, 8 (at the user's choice).
- ADC resolution: 12 bits.
- Range of the input signal:
  +/- 15 V with 7.3 mV resolution.
- Maximal sampling frequency:
  hadware version 1.x:
  250 kHz - single channel sub-mode;
  125 kHz - double channeled sub-mode;
  50 kHz - 4 channeled sub-mode;
  25 kHz - 8 channeled sub-mode;
  hadware version 2.0:
  500 kHz - single channel sub-mode;
  250 kHz - double channeled sub-mode;
  125 kHz - 4 channeled sub-mode;
  50 kHz - 8 channeled sub-mode.
- Sampling mode: uninterrupted streaming (frameless).
- Input resistance: 1 MOhm.

Additional possibilities: a free switching of oscilloscope inputs (the possibility of connection of the analog input to any channel of the oscilloscope "on fly").

2.2 Digital analyzer mode

- The Number of digital inputs is 4 or 8.
- Sub-modes: 4, 8 channels.
- Maximal sampling frequency:

hadware version 1.x:

500 kHz - 4 channeled sub-mode;

250 kHz - 8 channeled sub-mode;

hadware version 2.0:

500 kHz - 4 and 8 channeled sub-modes.

- Sampling mode: uninterrupted streaming (frameless).
- Input resistance: 10 kOhm.

PC and measuring circuits has galvanic isolation in hardware version of oscilloscope 2.0. Parameters of isolation:

- isolation is tested with condition of 2500 Vrms during 1 min.;
- isolation capacitance less then 10 pF;
- isolation resistance more then $1x10^{14}$ ohm.

2.3 Short description of the oscilloscope Program

- Supported operation systems (OS): Windows 98/Me, Windows 2000/XP.
- Main functions: monitoring + recording + measuring of input signal(s) in the real time simultaneously.
- Range of a time scale:

hadware version 1.x:

analog oscilloscope mode - 100 us/div. – 1 s/div.;

digital analyzer mode - 50 us/div. – 1 s/div.;

hadware version 2.0:

analog oscilloscope mode - 50 us/div. – 1 s/div.;

digital analyzer mode - 50 us/div. – 1 s/div.;

- Range of a voltage scale (just for analog oscilloscope mode):

input divider 1:1 - 50 mV/div. - 5 V/div;

external input divider 1:10 - 0.5 V/div. - 50 V/div;

external input divider 1:100 - 5 V/div. - 500 V/div;

external input divider 1:1000 - 50 V/div. - 5 kV/div;

external input divider 1:10000 - 500 V/div. - 50 kV/div.

- Synchronization: any of the oscilloscope channels are used for it and it is performed by the forward or backward front of the signal threshold level.

- Recording time (on conditions that the correspondent disc space exists): for maximal sampling frequencies

OS	Mode	Maximal sampling frequency, kHz	Minimal recording time, minutes
Windows 2000/XP	Analog oscilloscope	250	47*
		500	23*
	Digital analyzer	500	71*
Windows 98	Analog oscilloscope	250	23*
		500	12*
	Digital analyzer	500	35*

(*) – recording time increased in proportion to decreasing of sampling frequency.

- Maximal size of the recorded file:

OS - Windows 2000/XP - 1 Gbyte;

OS - Windows 98 - 512 Mbytes.

- Measurement tools: max/min/average voltage, difference of voltages, time and frequency.

- Average or peak-to-peak sub-modes of the signal viewing are available for low sampling frequency modes.

- Output formats: a binary file, JPEG, getting of the signal hard copy by using the printing function.
- Possibility of compression or decompression “on fly” during binary files saving or loading.

- The Program supports simple edition functions for the recorded oscillogram.

- The automatic signal analyzing is realized on the basis of **VBScript** or **JScript** analyzer files, with the receipt of the report, marking and comments of characteristic points of the oscillogram with the help of bookmarks.

2.4 Hardware and OS limitations

The Program operates under the next operation systems: Windows 98 SE, Windows Me, Windows 2000 and Windows XP.

Minimal hardware configuration:

Pentium II, 500 MHz, 128 Mb of RAM, UDMA HDD 3 Gb, existence of USB 1.1 (USB 2.0) port, SVGA.

Attention! Be sure that the Device is connected to the USB-port of your PC before starting the real time signal monitoring. Please check that the Device driver was properly installed.

3 HOW TO USE THE PROGRAM

3.1 The main window of the Program

The main window of the Program (fig.1) appears on the desktop right after "UsbOscilloscope.exe" – the Program has been run.

The main window has the menu -1, the toolbar -2 and the status bar -3.

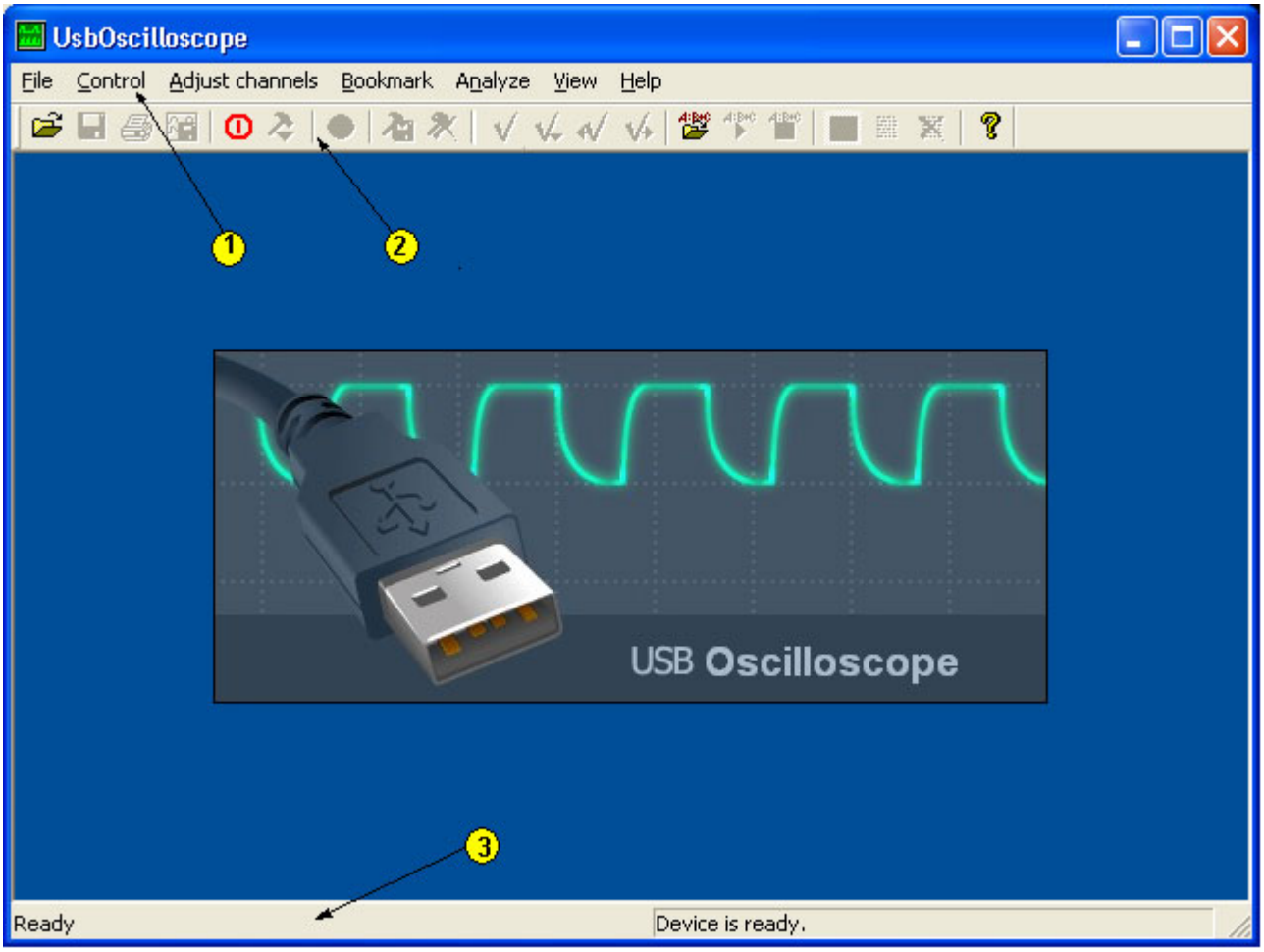


fig.1. The main window of the Program

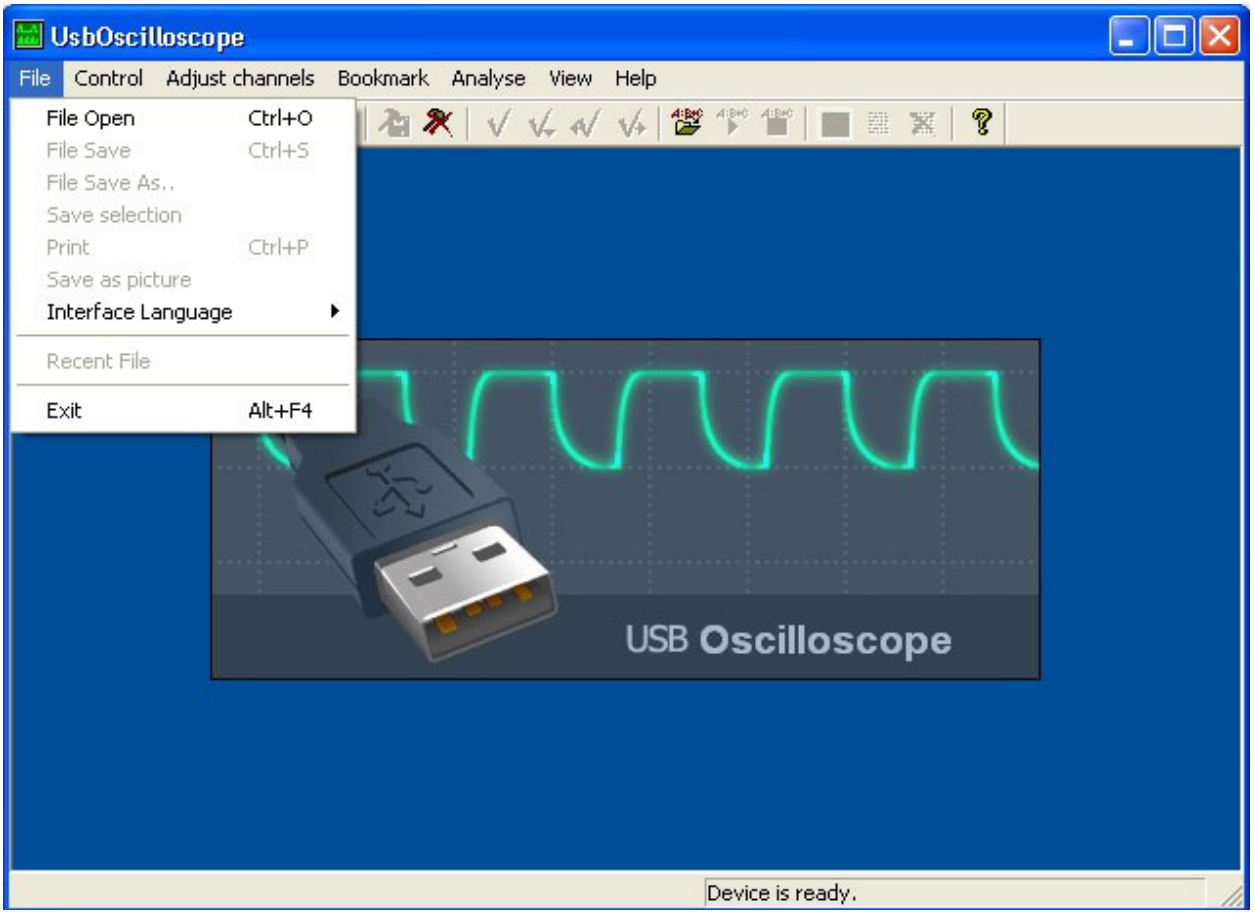


fig. 2. "File" popup menu

Next tables describe general functions, which are performed by the Program menu and the toolbar.

Menu "File" (fig.2):

Menu item name	Related button of the toolbar	Performed Function
File Open		Loads the binary file of the oscillogram
File Save		Saves the binary file of the oscillogram
File Save As..	-	Saves the binary file of the oscillogram with a new file name
Save File Compressed	-	Compress and overwrite current file
Save selection	-	Saves the selected fragment of the oscillogram as a binary file
Print		Prints out the oscillogram
Save as picture		Saves the oscillogram as a JPEG-picture
Interface Language	-	Helps to choose one of the installed Program languages
Resent file	-	Loads one of the resent file

Menu "Control":

Menu item name	Related button of the toolbar	Performed Function
Start/Stop		Starts or stops the signal monitoring mode
Record		Starts or stops the oscillogram recording
Load user preset		Loads one of the user preset files
Save user preset		Saves current oscilloscope settings into the user's preset file
Delete user preset		Deletes one of the user's preset files
Circle record	-	Enables the circle record option
Use SW sampling divider	-	Enables the software sampling divider option

Menu "Adjust channels":

Submenu item name	Related button of the toolbar	Performed Function
Analog input 1 . Analog input 8	- - -	Latches the analog input adjusting dialog for the current input (1..8)
Load default values	-	Loads calibration constants from device

Menu "Bookmark":

Submenu item name	Related button of the toolbar	Performed Function
Set/Remove		Sets or removes a bookmark to or from the current position
Show all		Shows a bookmarks list
Move to previous		Moves a viewing area to the location of the previous marker
Move to next		Moves a viewing area to the location of the next marker
Delete all	.	Clears a bookmarks list

Menu "Analyze":

Submenu item name	Related button of the toolbar	Performed Function
Open script		Loads a script file, which will be used by the oscillogram analyzing function
Execute script		Executes a current script file
Abort script		Abort a current script execution
Delete report		Deletes a report with the results of the script execution

Menu "View":

Submenu item name	Related button of the toolbar	Performed Function
Toolbar	-	Shows/hides a toolbar panel (fig.1 pointer [2])
Status Bar	-	Shows/hides a status bar panel (fig.1 pointer [3])
Measure bar	-	Shows/hides a measure bar
Switch to oscillogram view		Shows the current oscillogram
Switch to report view		Shows the analyzer report
Auto zoom selected area		Performs auto zooming of the selected area

Menu "Help":

Submenu item name	Related button of the toolbar	Performed Function
Oscilloscope User Guide	-	Loads and shows the user guide documentation
About UsbOscilloscope..		Shows the about dialog with the software and hardware information

3.2 Operation mode selection (oscilloscope/analyzer)

Latching or stopping of the oscilloscope is performed by the **"start/stop"** menu item or the button of the toolbar (there is an alternative possibility to start the oscilloscope: by using the user preset file functionality, see § 3.6).

Program shows the operation mode selection dialog (fig.3), which serves for the selection of one of two basic modes: 1,2,4,8 – channel(ed) *analog oscilloscope* or 4-, 8- channeled *digital analyzer*. Choose one of two modes and the necessary number of channels, using this dialog. Press **"OK"** button to run the selected mode.

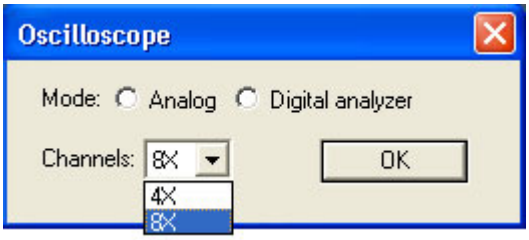


fig.3. Operation mode selection dialog

3.3 Analog oscilloscope mode

3.3.1 Oscilloscope control panel

The oscilloscope control panel is placed vertically in the left side of the Program main window. The current panel contains channels, synchronization and time scale control elements (fig.4 pointer [1]).

3.3.2 Channel control panel

Channel control panel allows controlling of oscilloscope *channel(s) parameters*. The current panel is shown on fig.4 pointer [2].

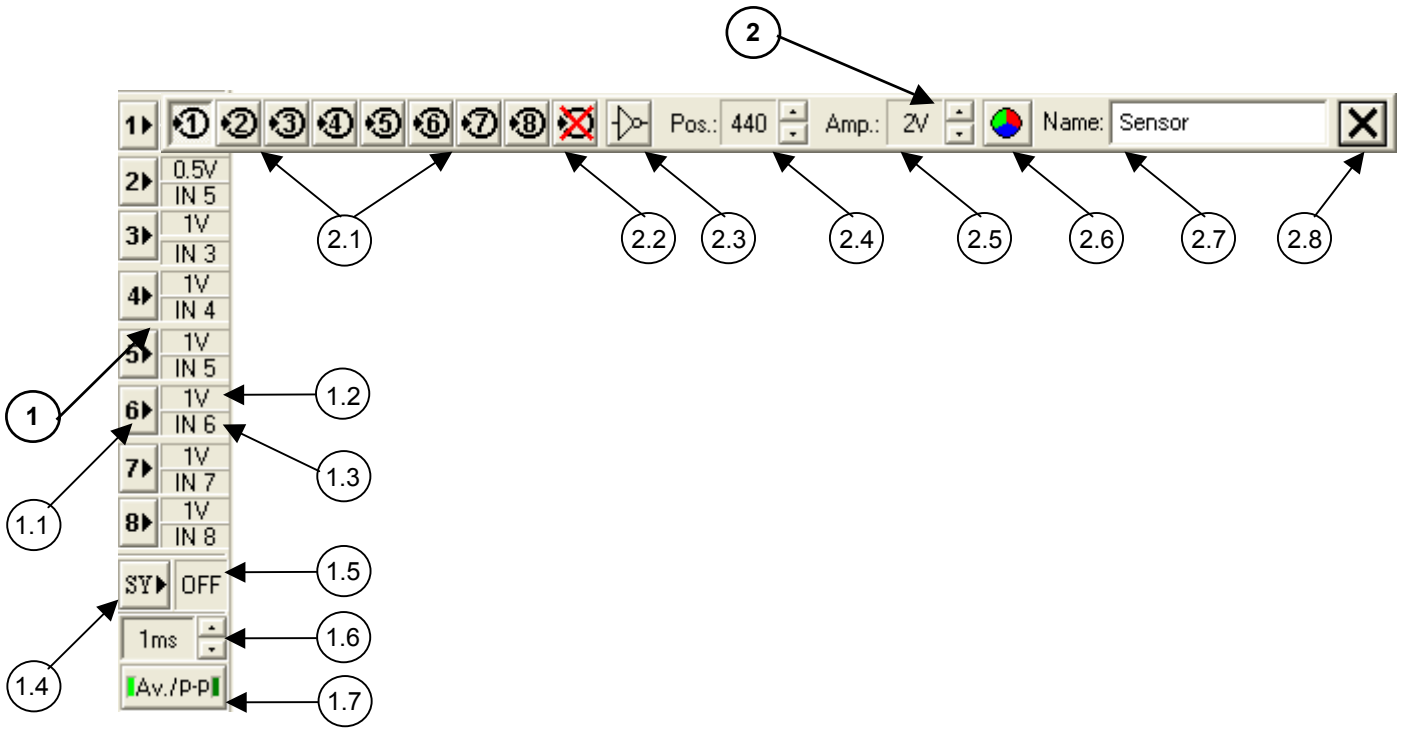


fig.4

1- Oscilloscope control panel:

1.1 - channel control panel activation button,
1.2 - current channel amplification (Volts / division),
1.3 - current Device input, chosen as a channel input,
1.4 - synchronization control panel activation button,
1.5 - synchronization channel (№ of the scope channel, chosen for the synchronization, or "OFF", when synchronization is not used),
1.6 - current value of the time scale,
1.7 - current view sub-mode.

2- Channel control panel:

2.1 - input selection buttons (1-8),
2.2 - disable button,
2.3 - inversion button,
2.4 - base line position control element,
2.5 - amplification control element,
2.6 - color selection button,
2.7 - name of the window,
2.8 - close button.

The panel gives the possibility to select one of the Device inputs for viewing on the current oscilloscope channel, or temporary to disable the channel. It has control elements, which enable the signal inversion; it is possible to change the vertical position of the channel base line, to setup the channel amplification. Some additional functions help to change the channel color and define its name. Last function can be helpful for signal source identification.

The arrow and the figure with the channel number in the left side of the oscillogram window (see fig.6) define the current vertical position of the channel base line. They are colored in the selected channel color. Zero value of the base line is at the topmost line of the oscillogram screen. The amplification value is defined in Volts per cell of the measurement grid.

3.3.3 Synchronization mode

Control panel of synchronization services to define the *synchronization mode*. This panel is shown on fig.5 (pointer [1]).

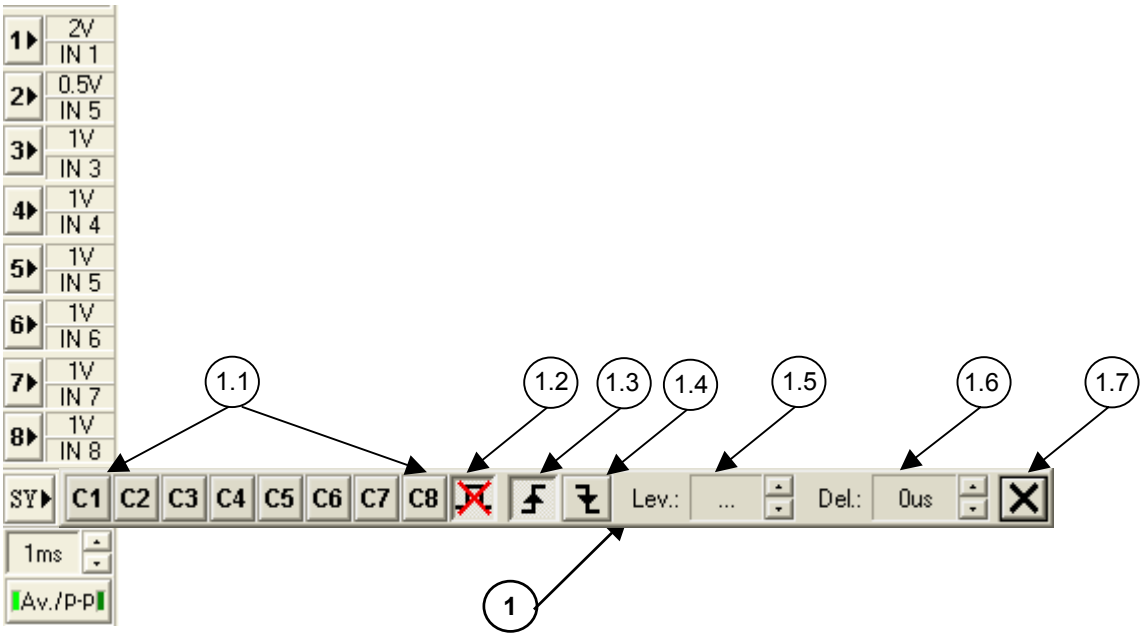


fig.5. Control panel of synchronization

1.1 - synchronization channel buttons (C1-C8),

1.2 - disable button

1.3 - select rising-edge button

1.4 - select falling-edge button

1.5 - synchronization threshold level control element

1.6 - synchronization delay control element

1.7 - close button.

One of the used oscilloscope channels can be defined for synchronization. There is a possibility to disable synchronization. The type of the synchronization front is defined by  buttons (fig.5 pointers [1.3], [1.4]). Synchronization threshold level is controlled by **"Lev."** - element (fig.5 pointer [1.5]).

The time shift position point of synchronization is defined by the control element **"Del."** (fig.5 pointer [1.6]).

If the input signal does not correspond to the defined synchronization parameters, the real time monitoring of input signal will be stopped. In this case the oscillogram screen will show the static frame. If the current condition will continue longer than the synchronization timeout, the Program will show the  icon in the top left corner of the screen (fig.6 pointer [1]). The icon will blink until the signal does not reach the condition of synchronization again.

When the Program operates with big values of time scale, it needs more time to collect the required number of samples in a view buffer. That creates a delay with synchronization.

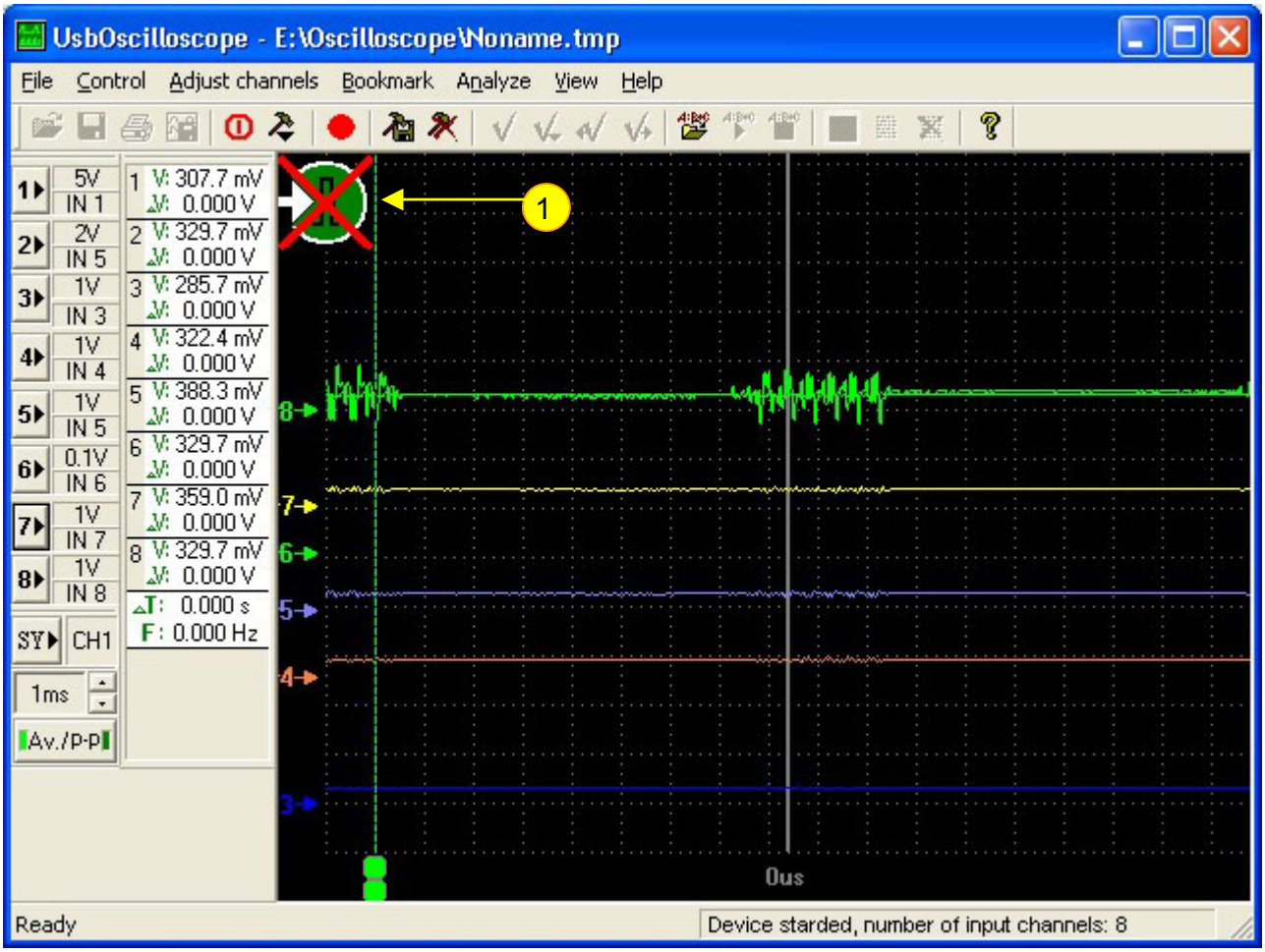


fig.6

3.3.4 Time scale

Time scale value is managed by the control element shown on fig.4 pointer [1.6]. It defines the time interval for a single cell of the measurement grid.

The minimal value of time scale depends on the number of oscilloscope channels and corresponds to the following values:

hadware version 1.x:

0.1 ms – single channel oscilloscope;

0.2 ms – double channeled oscilloscope;

0.5 ms – 4 channeled oscilloscope;

1 ms – 8 channeled oscilloscope;

hadware version 2.0:

50 us – single channel oscilloscope;

0.1 ms – double channeled oscilloscope;

0.2 ms – 4 channeled oscilloscope;

0.5 ms – 8 channeled oscilloscope.

Maximal value does not depend on the mode and number of channels and is equal to 1 second.

When the oscilloscope operates with time scale values equal or less than 20 ms/div there is an additional possibility to select one of the signal viewing sub-modes. This option is controlled by the element, shown on fig. 4 pointer [1.7], and has two modes of operation:

- average signal viewing - **"Av."**;
- peak-to-peak signal viewing - **"P-P"**.

Currently selected sub-mode is highlighted. When **"Av."** viewing sub-mode was selected, each point on the screen corresponds to the average level of the signal. When **"P-P"** sub-mode is used, the screen displays minimal and maximal levels of the signal for each point.

3.4 Digital analyzer mode

Control elements of this mode in general have the same functionality and viewing as in the analog mode. Therefore current paragraph will describe only differences in these elements.

Same as in analog oscilloscope mode, the main control element of this mode is oscilloscope control panel. It's view and functions are the same as described above for the analog oscilloscope mode (see § 3.3.1).

Channel control panel in general has the same functionality as described above (see §3.3.2). The only difference for this mode is the dimension of amplification. For this mode amplification is defined in the cells of the measurement grid.

Synchronization mode is controlled the same way (see § 3.3.3), except that this mode doesn't have the element that controls the threshold level of synchronization.

Time scale management is organized the same way as described above (see § 3.3.4). The difference of time scale control for this mode is its minimal values see table bellow.

Device version	1.x	2.0
4 channeled sub-mode	50 us	50 us
4 channeled sub-mode	0,1 us	50 us

3.5 Oscillogram recording

To provide the opportunity of oscillogram storage, with the purpose of future analyzing, the recording option is added to the Program. This option is accessible in both operation modes (analog oscilloscope and digital analyzer).

This option can be switched on or off with the help of **"Control/Record"** menu item or the related toolbar button -  . The maximal recording file size as well as its duration depends on the available disc space and current mode settings (value of time scale and number of channels).

When the recording process has been started, the total available recording time and the duration of the already recorded fragment will be displayed in the right side of the status bar. When the circle record option is switched off and the maximal file size is reached, the Program will automatically stop the recording and will switch to the oscillogram view mode. In other case when the circle record option is active, the Program will continue recording from the very beginning of the file, it will happen each time when the maximal available file size is reached. In this case all previously recorded data will be overwritten (lost). During the recording process the Program continues the real time monitoring of the input signal, but the time scale management becomes unavailable.

3.6 Viewing of oscillogram binary files

The main control element of this mode is a *viewing control panel;* its view and functionality in general is the same as the oscilloscope control panel (fig.4 pointer [1]). The view of this panel is shown on fig.7 pointer [1].

The *channel control panel* is used to manage the *channel parameters*. This panel is shown on fig.7 pointer [2].

The Panel helps:

- To enable/disable the signal viewing (pointers [2.1] and [2.2]);
- To invert a signal (pointer [2.3]);
- To setup a vertical position of the signal base line (pointer [2.4]);
- To change the signal amplification (pointer [2.5]);
- To select a signal's displaying color (pointer [2.6]);
- To define/change a signal name (pointer [2.7]).

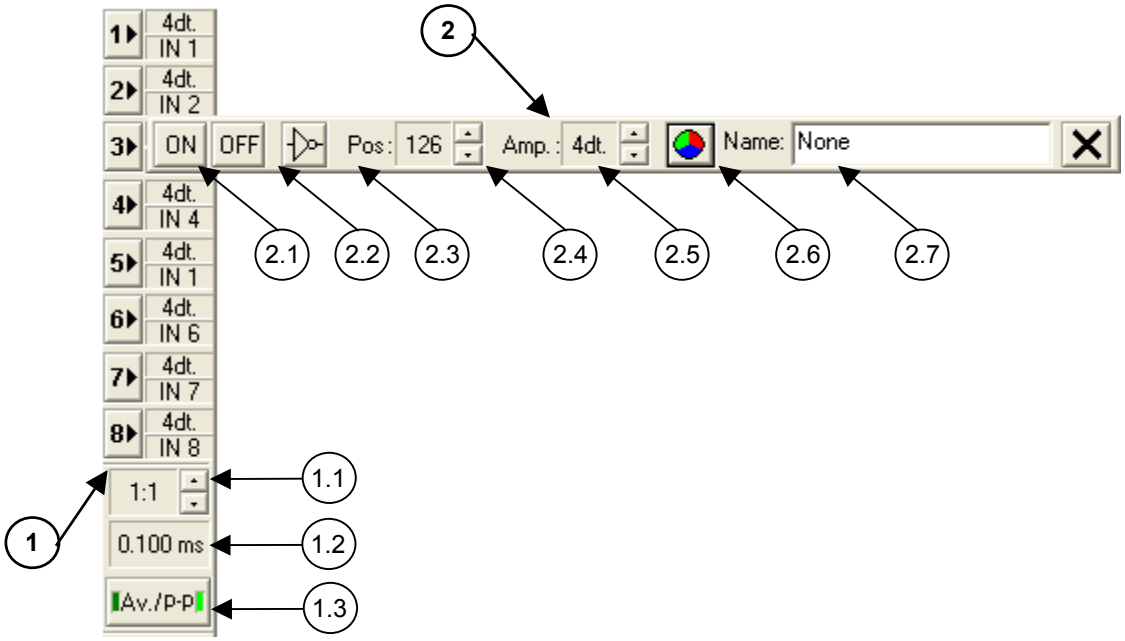


fig.7. The Viewing control panel [1] and the channel control panel [2] in the oscillogram files view mode

For the purpose of better visualization of low frequency signal components, the panel has a time scale zoom control element. This element helps to “gripe” or “stretch” a signal in the time scale dimension. This element is named **"Current zoom"** (fig.7 pointer [1.1]). When the current zoom is bigger than 1:1, a user can select one of the signal viewing sub-modes, see the element on fig.7 pointer [1.3]. This element has the same functionality as in the oscilloscope mode (see § 3.3.4).

The current value of the time scale for measurement grid is displayed on the element, shown on fig.7 pointer [1.2].

All viewer settings, which were made, can be stored in the oscillogram file. If some of these settings were changed and a user decided to close the file the Program will show the message **"Do you want to save changes you have made?".** When this suggestion is accepted, the Program stores the current viewer setting into the oscillogram file.

The scrolling of the view area of the oscillogram screen is performed with the help of the horizontal (time scale) and vertical scroll bars or left, right and up down arrows keys. “Page UP” or “Page Down” keys help to move the signal screen one page back or forward. “Home”, “End” keys service to move the view area to the beginning or to the end of the oscillogram binary file.

The total time of the oscillogram file and the time of the current view area position are displayed in the right side of the status bar.

There is the possibility *to select some part of the signal* in the term of the time interval. This function is performed with the help of the mouse. Put a mouse pointer to the beginning (end) of the selected area, press the left button of the mouse and move it’s pointer to the end (beginning) of this area. Release the mouse button to finish selection. When the selected area is bigger than one screen and the mouse pointer has reached the left or right side of the oscillogram screen, the Program will scroll the screen to the left or right direction. The part of the signal, which was selected such a way, can be saved as a new file, printed or saved as an JPEG-picture file. More detailed information about the print and picture save functions see § 3.10, § 3.11.

3.7 How to use the user preset files

This Program option helps to create preset files for typical (frequently used) measurements.

The user-preset file keeps all information about the oscilloscope mode, sub-modes, the channel, time scale and synchronization settings.

To create a new user preset file run the oscilloscope and make all settings you need, then save them by the **“Control/Save user preset”** menu item or the  button of the toolbar into the preset file. Each time when the current preset file is loaded, the Program will configure the oscilloscope for the current type of measurements. To load the user preset file use the **“Control/Load user preset”** menu item or  button of the toolbar.

The **“Control/Delete user preset”** menu item or the button of the toolbar delete the user preset file.

3.8 Measurements of signal parameters

Measurements of the signal parameters can be performed in real time with the signal monitoring and recording file viewing modes. The Program helps to determine the following parameters of the signal: averaged and peak voltages, delta voltages, the time interval and frequency. All of these measurements are performed with the help of the measurement panel (see fig.8) and markers (see fig.9).

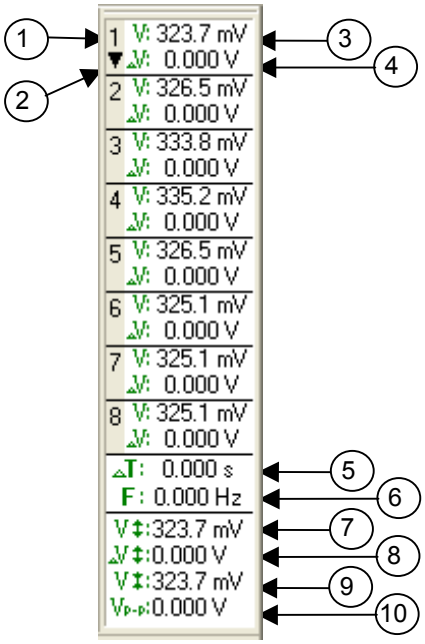


fig.8. Measurement panel:

1 - the number of a channel;

2 - an indicator that defines the number of a channel, the addition information of which is displayed in the bottom window (pointers [7], [8], [9], [10]);

3 - the current (average) voltage for channel 1 in the point of the signal, which is defined by marker 1 (see fig.9);

4 - the current (average) difference of voltages for channel 1 in points of the signal, which are defined by markers 1 and 2 (see fig.9);

5 - the time interval (T) that corresponds to the distance between markers 1 and 2 (see fig.9);

6 - frequency value that equals to the value of 1/T for the current time interval;

7 - maximal value of the voltage in the point of the signal, which is defined by marker 1, for the channel, pointed by the additional information indicator (see. fig.10);

8 - the maximal difference of voltages in the points of the signal, which are defined by markers 1 and 2, for the channel, pointed by the additional information indicator (see. fig.10);

9 - the minimal value of the voltage in the point of the signal, which is defined by marker 1, for the channel, pointed by the additional information indicator (see. fig.10);

10 - the peak-to-peak value of the voltage in the point of the signal, which is defined by marker 1, for the channel, pointed by the additional information indicator (see. fig.10).

There are elements on the measurement panel that display current or average values of voltages and the difference of voltages for the analog oscilloscope mode or logical levels and changes of logical levels for the digital analyzer mode. These values are displayed for each of active channels for the signal points, which are defined by positions of markers 1 and 2.

Next elements of the measurement panel display the time interval (T) and frequency (F) that equals to 1/T, what corresponds to the distance between markers 1 and 2 (see fig.9 pointers [5], [6]).

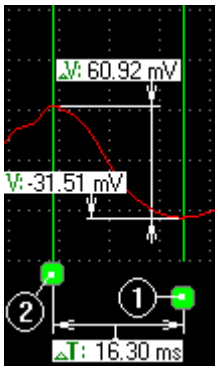


fig.9

As it is shown on fig.9, marker 1 defines the point where the Program evaluates the signal voltage and the difference of the signal voltages is calculated in points, which are defined by markers 1 and 2.

The following elements in the bottom of the measurement panel (pointers [7], [8], [9], [10] fig.8) are activated in the analog oscilloscope mode for the time scale values equal to or bellow 20 ms/div., and for the current zoom values above 1:1 (see fig.7 pointer [1.1]) in the oscillogram file view mode. These elements display information for one channel that is pointed by the additional information indicator (arrow down in the left part of the channel rectangle below the channel number, see fig.8 pointer [2]).

The explanation of the additional information values is shown on fig.10 (for better clearness thickness of the marker line was specially increased).

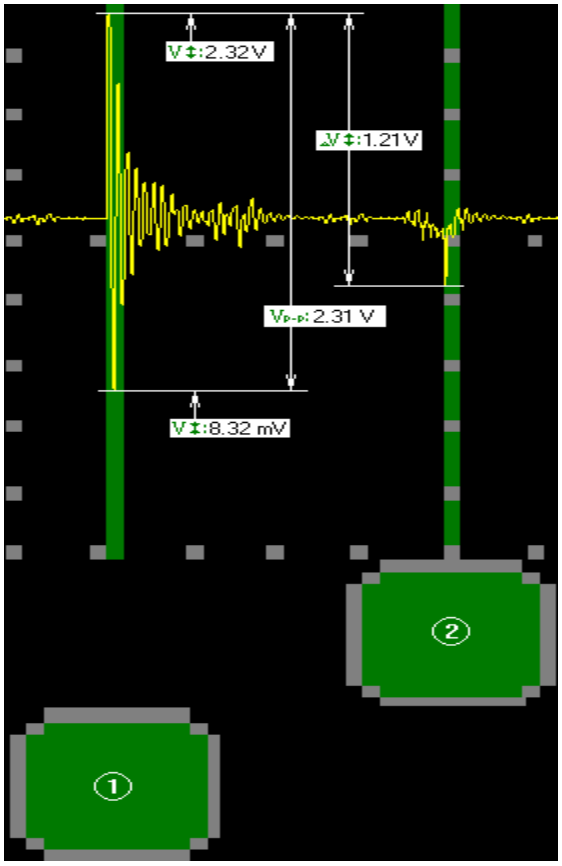


fig.10

To perform measurements of phase and duty-circle of the signal, phase and duty-circle window has been added to the measurement panel fig. 11. Current window is displayed when additional time information mode has activated. Window is displayed instead of voltage parameters pointers [7], [8], [9], [10] see fig.8.

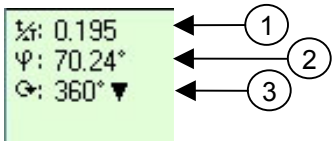


fig.11. Phase and duty-circle window of measurement panel:

1 – the duty-circle value at the position pointed by mouse cursor, on the period defined by markers 1 and 2,

2 – the phase value at the position pointed by mouse cursor, on the period defined by markers 1 and 2 and the current value of the degree scale;

3 - the current value of degree scale 360 or 720.

To define the additional information channel move the mouse pointer to the left part of the channel number rectangle and press the left button of the mouse. The measurement panel can be shown or hidden with the help of the menu option **"View/Measurement panel"**. *To activate or deactivate phase and duty-circle window* move mouse cursor on the time parameters window (window with pointers 5, 6 fig.8) and press the left button of the mouse. *To change current value of degree scale* move mouse cursor on the arrow down in the right side of current value (see fig.11 pointer 3) and press the left button of the mouse. Then choose new value from the list has dropped. *To move markers* use the mouse or a keyboard. With the help of the mouse this operation is performed in the following way:

- Move the mouse pointer to the marker handle (square area in the bottom of the screen under the marker line),
- Press the left button of the mouse and move the marker to a new position,
- Release the mouse button.

To change the marker position with the keyboard use left and right arrow keys in the combination with “Shift” key to move marker 1 and “Ctrl” key to move marker 2.

The specific character of marker’ dislocation is different; it depends on the current Program mode. In real time in the signal monitoring mode (analog oscilloscope or digital analyzer modes) the position of both markers is limited by the left and right sides of the oscillogram screen.

In the oscillogram file view mode the position of marker 2 defines the time moment in the oscillogram file. Therefore it moves together with the oscillogram, while scrolling operation is being performed. If the current position of marker 2 is out of the signal view area, marker 2 becomes invisible. In this case if necessary move marker 2 within the current view area, press and hold "Ctrl" key and then press the left button of the mouse in order to capture marker 2. When the left button of the mouse is released, a new position of marker 2 will be defined by the current position of the mouse pointer.

3.9 Calibration of analog inputs

Calibration operation is to compensate the inaccuracy of input circuits. Calibration is performed with the help of the adjusting of two parameters. One of them is the value of micro Volts per ADC step. Another one is a zero level offset. Initially these values are read from the Device for all its channels. Both of these values in combination with the value of the input divider are used for the calculation of the signal voltage. Calibration operation can be performed only in the analog oscilloscope mode with the help of **"Adjust channel/Analog input №"** menu item, where № - is a channel number 1 .. 8. This operation is available only for active analog inputs (active inputs are inputs that have been currently selected for any of the oscilloscope channels).

Adjusting is performed with the use of the etalon voltage source with the help of **"Adjusting of analog input №"** dialog (fig.12). The value of the etalon voltage source is compared with the value that the measurement panel displays for the channel, where the adjusted analog input is used.

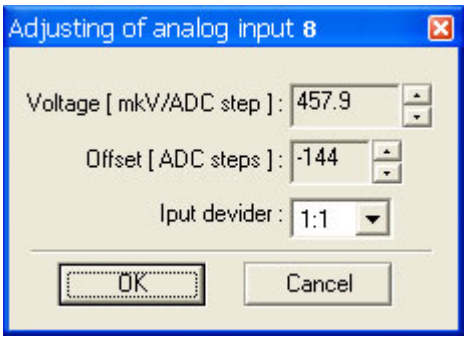


fig.12. "Adjusting of the analog input" dialog

Use **"Adjust channel/Load default values"** menu item to load default values. This operation loads calibration constants from the Device.

3.10 Oscillogram printing

This function is available in the oscillogram file view mode and services to print out the recorded oscillogram. This function can print the whole oscillogram file or the area, which is currently selected (see § 3.6 to find out the information how to perform selection*)*. The function is activated by the **"File/Print"** menu item, or by the  button of the toolbar. Printing is controlled with the help of the **“Print”** dialog, see fig.13.

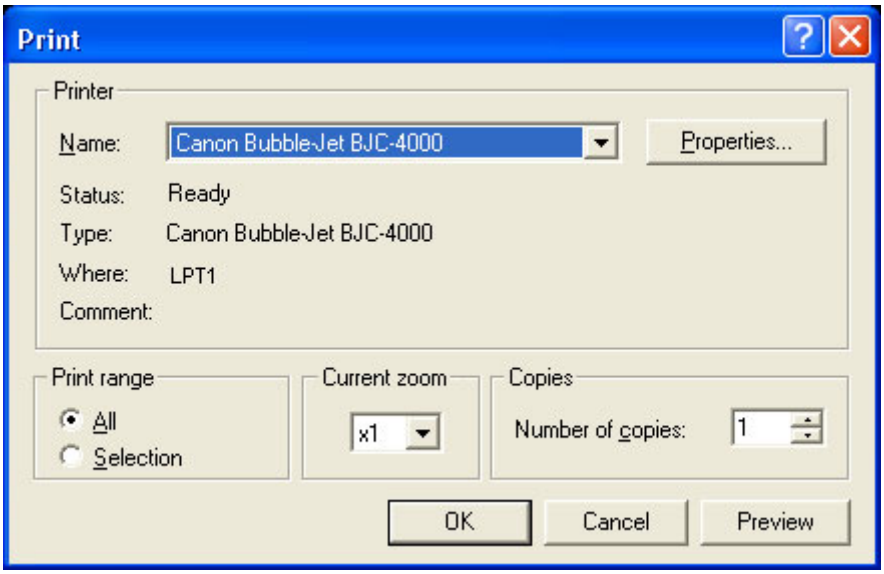


fig.13. “Print” dialog

The **“Name:”** control element helps to select the printer that will be used for printing. The **"Properties.."** button latches the printer properties dialog.

The **"All"**, **"Selection"** elements are grouped into the **“Print range”** frame, they allow to manage what portion of the oscillogram will be printed. If the **"All"** item is selected, the whole oscillogram file will be printed, in other case the function will print only its selected part.

The **“Current zoom”** control element can define the printing zoom factor.

The **"Preview"** button latches the print preview frame, which helps to see and adjust the layout of the image before printing will be executed. The view of preview frame is shown on fig.14.

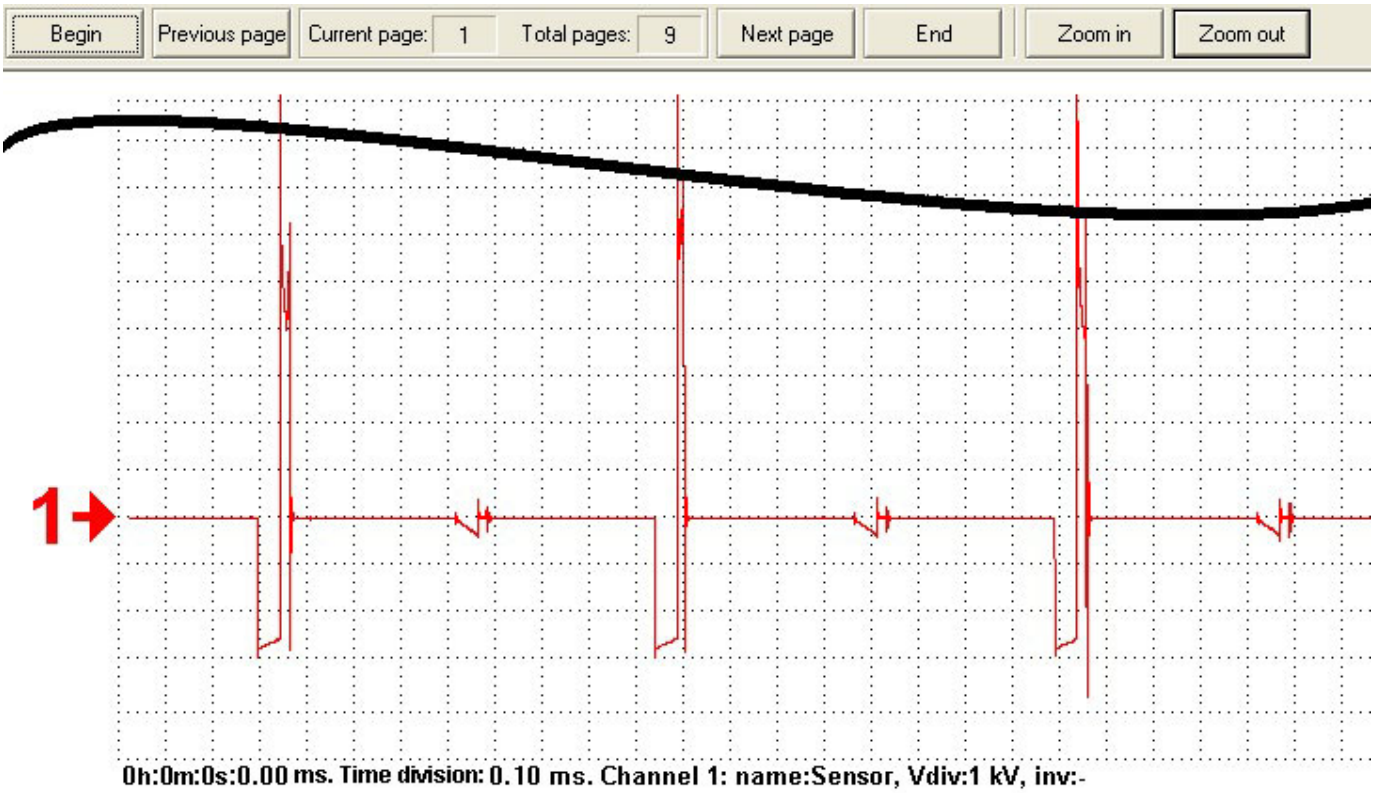


fig.14. Preview frame

The preview control panel is placed on the top of the preview frame; it services to control the preview option. The **"Begin"**, **"End"**, **"Previous page"** and **"Next page"** buttons help to change the active page. The **"Current page"** and **"Total pages"** elements display the information about the order number of the currently displayed page and the total number of pages. The **"Zoom in"** and **"Zoom out"** buttons increase and decrease a zoom factor of the preview screen. The oscillogram information is placed in the bottom left side of each page. This information contains the next parameters (left to right order): the time offset for a zero coordinate of the current page, time division of the measurement grid, a list of parameters for each channel (number of a channel, the channel name and the current channel voltage scale). To start printing press **"OK"** button of “Print” dialog. Print the condition dialog, which is shown on fig.15, it displays the condition of the printing process. Use the **"Cancel"** button to abort printing.

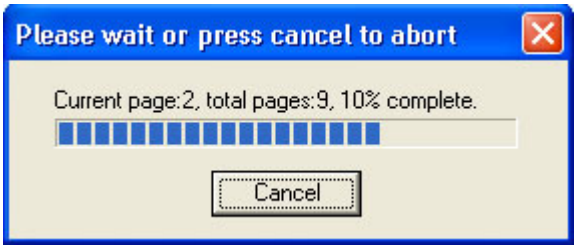


рис.15. Print condition dialog

3.11 Save oscillogram in JPEG file

This option is identical to the print option; it has almost the same functionality and a set of control elements. This option creates one file or a set of image files, which contain the view of the oscillogram file. The option can be helpful for the creation of a signal graphical copy that can be used in some kind of electronic documents. The “Picture” dialog is shown on fig.16.

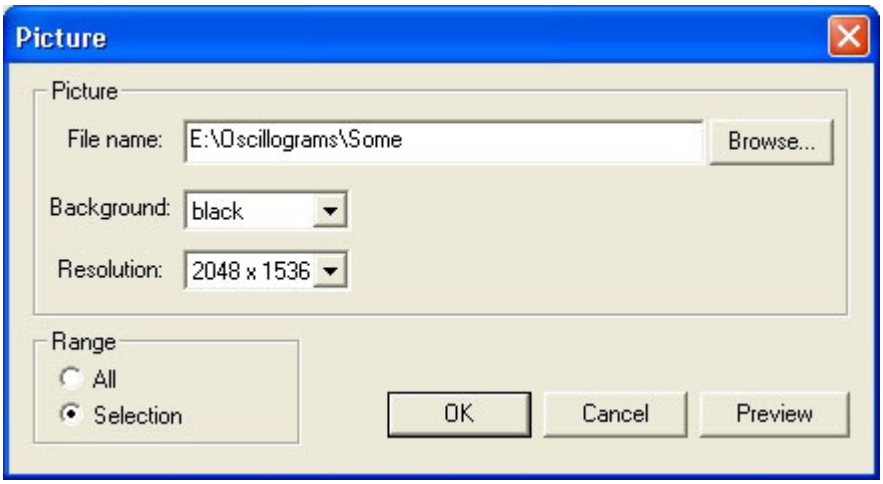


fig.16. “Picture” dialog

The **"File name"** item displays the path and the prefix part of the name for the image sequence. A new name can be entered with the keyboard or selected with the help of the **"Browse.."** button. Next two elements service to define the **“Background”** color and change the image **"Resolution"** ([number of image points horizontally] x [number of image points vertically]). The rest elements of this dialog work identically to the analogous elements of the print dialog.

3.12 How to use bookmarkers

In order to improve the navigation functionality and additional possibilities for description of the signal characteristic points, the Program is added with bookmarks options. Each marker corresponds to some position in the oscillogram file and has an additional comment property. The information about the installed bookmarks is stored in the oscillogram file and can be used each time, when the current file is loaded. The **"Bookmark/Set/Remove"** menu item or button of the toolbar or “Ctrl+F2” hot key combination services to set or remove the bookmark to or from the position, which is pointed by marker 1 (see fig.9). Move marker 1 to the required position and set or remove the bookmark. The bookmark list window (fig. 17) is used to see the whole list of bookmarks. The **"Bookmark/Show all"** menu item or button activates the bookmark list window. More detailed information about the bookmark list functions see below.

"Bookmark/Move to previous”, **"Bookmark/Move to next"** menu items or , toolbar buttons or “Shift+F2”, “F2” hot keys combinations are used to have the

possibility to navigate between the installed bookmarks. The **"Bookmark/Delete all"** menu item helps to remove all installed bookmarks.

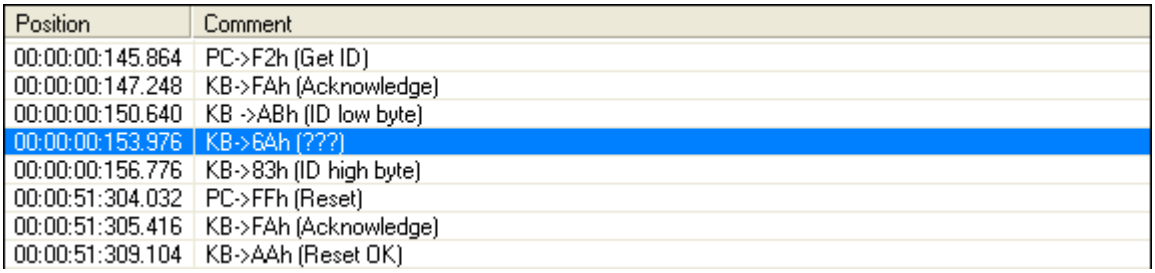


fig.17. Bookmark list window

The bookmark list window displays the information about the marker's **position** (in the terms of time [hours]:[minutes]:[seconds]:[ms].[us]) and its **comments**. The Bookmark list window helps to perform some additional functions. The popup menu, a mouse and a hotkey combination are used to activate these functions. The right button of the mouse is used to activate the bookmark list popup menu. The bookmark list item should be activated before performing any of these functions. Left or right buttons of the mouse can activate the list item. For the function execution use the left button of the mouse in combination with the hotkey or right one in case of using the popup menu.

The following table describes the list of popup menu items, related hotkeys and functions, which they perform.

Popup menu item	Hotkey	Function description
Delete	Delete	Deletes the selected marker
Change comments	-	Adds/changes comments for the selected marker
Move to ..	Enter	Moves the oscillogram view area to the point, which is defined by the selected marker position
Delete all	-	Clears the bookmark list

The "*change comment*" and "*move to..*" functions have the alternative mechanism of execution. To execute the first function make a double click with the left button of the mouse on the crossing of the ***"Comment"*** column and the current bookmark item. The second function is executed by the double click of the left button of the mouse on the crossing of the **"Position"** column and the bookmark item.

3.13 Usage of analyzer scripts

This Program option creates the possibility for an automatic (algorithmic) signal analysis with proper visualization of its results. This option is based on the usage of MS **JScript** and **VBScript**, with embedded in script engine functions, constants and objects, which are supported by the Program. That helps to access and analyze signal parameters and perform some additional tasks such as the result visualization and user interfacing. In other words the user script file can access data of the oscillogram file, analyze it and return results of this analysis back to the Program. The results of this analysis are displayed in the report window of the Program. Moreover the analyzer script algorithm can install bookmarks, mark and give comments on characteristic points of the signal.

Analyzer script files are simple text files with **"*.ajs"** extension for a Jscript file type, or **"*.abs"** extension for VBScript one. The **"Analyze/Open script"** menu item or the  button of the toolbar services to load a script file. To run the script file, which has been currently loaded, use the **"Analyze/Execute script"** menu item or  button of the toolbar. To abort script, which was executed, use the **"Analyze/Abort script"** menu item or  button of the toolbar. The switching between windows of the oscillogram view and report view is done with the help of **"View/Switch to oscillogram view"** and **" View/Switch to report view"** menu items or  and  buttons of the toolbar. Use the **"Analyze/Delete report"** menu item or  button of the toolbar to delete the current analyzer report. The current document does not include any description of the scripts. The table below contains the description of embedded in script functions and constants from the Program side.

Constants

Name	Description
DataType	Type of data values: "DIG" – digital analyzer data; "ANA" – analog data.
Channels	Number of channels in the current file
Frequency	Sampling frequency for the current file
NumberOfSamples	Single channel data array size for the current file

Functions

Name	Description
GetChannelName(iChannel)	Get the name of the channel - iChannel, where: 1 <= iChannel <= Channels (see constants)
HasChannelInversion(iChannel)	Detect if the channel – iChannel had an inversion, where: 1 <= iChannel <= Channels (see constants)
GetFullScale(iChannel)	Get a full scale voltage for the channel - iChannel, where: 1 <= iChannel <= Channels (see constants)
ValueAt(iChannel, iPos)	Get a signal level at the position - iPos for the channel – iChannel, Where: 0 <= iPos <= NumberOfSamples; 1 <= iChannel <= Channels (see constants) For analog data type (“ANA”) values return in Volts (value of the input divider is included). For the digital data type (“DIG”) values are 0.0 and 1.0.
SynchBy(iChannel, iType, Level, iFromPos, cSamples)	Search forward for the iType – front of the signal, crossing the threshold Level on the channel – iChannel in the range from iFromPos within cSamples length, where: iType: “1” - rising-edge; “-1” - falling-edge; Level is a voltage value for the analog type of data or 0.0 and 1.0 values for digital one. When CSamples = 0 the search interval is unlimited. This function returns the position into the data array, where a signal satisfies the condition, defined by arguments. If the search function is unable to find such a condition of the signal, it returns to “-1”
ReportOut(strText)	Prints the strText message in the report window
SetMarker(iPos, strComment)	Sets or modifies (when exists) the bookmark in the position iPos, with the strComment - comment
CreateConfigure(strName)	Creates and returns the configuration object with the strName – name.

Functions of the configuration object

Name	Description
AddItem(strName, DefValue)	Adds the configuration variable strName with the default value, which is equal to DefValue. When DefValue is defined as a string that contains the list of elements divided with the help of the “\n” character, then only one of the defined values can be selected in the configuration dialog. The GetValue function in this case will return the ordinal index of the selected list item. The Index of the first element is zero.
GetValue(strName)	Get the value of the strName variable
Configure()	Show the configuration dialog. The function returns TRUE, when the configuration was accepted by the “OK” button of the configuration dialog

4 EXAMPLE OF THE ANALYZATOR SCRIPT USAGE BASED ON JSCRIPT

```
// This algorithm searches for low level impulses and calculates their width
If (DataType == "DIG") // Data should have a digital type
{// Creates configuration to let the user select the number of channel
var MyCong = CreateConfigure("Impulse width");

 MyCong. AddItem("Channel", 1); // use 1 as a default value
 MyCong. Configure(); // show the configuration dialog
 DataChannel = GetValue("Channel");// get the № of the channel, which Is defined by
the conf. dialog
// validate the value of the channel number
 If (DataChannel > 0 && DataChannel <= Channels) {
  cFound = 0;
  ReportOut( "====== Run ========" );

  for( Position = 0; Position < NumberOfSamples;)
  { // get the position of the next falling-edge of the signal
   StartPos = SynchBy(DataChannel , -1, 0, Position, 0);

   If (StartPos >= 0) { // Falling-edge has been found, the search of the following
rising-edge
    Position = SynchBy(DataChannel , 1, 1, StartPos, 0);

    If (Position >= 0) {// Rising-edge has been found, the calculation of the impulse
width in ms.
     ImpulseWidth = 1000 * (Position – StartPos)/ Frequency;
     cFound++;
     // Printing of  the impulse number and its width.
                  ReportOut( "Impuls N:" + cFound.toString(10) + " width:" +
                                 ImpulseWidth.toString(10) + " ms \n");
  /* installation of the bookmark at the beginning of the current impulse, and adding of
                       the comment with the value of the impulse width */
     SetMarker( StartPos, "Impulse width:" +  ImpulseWidth.toString(10) + " ms");
    }
    else break; // Rising-edge has not been found, stopping of the execution
   }
   else  break; // Falling-edge has not been found, stopping of the execution
  }
 ReportOut( "====== Has done ========" );
 }
else ReportOut( "Invalid channel number" );
}
else
  ReportOut( "Data should be recorded in the digital analyzer mode");
```

5 DESCRIPTION OF PROGRAM ERROR MESSAGES

№	Error message	Possible cause	Solution
1	There is not enough free space on the drive - *disc name* - for the creation of the temporary file	The disk, where the Program was installed, does not have enough space for the Program's temporary file, its minimal size should be 16 Mb	Try to free the disc space with the help of windows or manually on the disc where the Program is installed, or reinstall the Program on another disk of your PC
2	Wrong file format!	The loading file has a wrong format. Possibly the file is damaged	Try to run windows disc check system utility
3	The Device is removed or does not work	The Program cannot access the oscilloscope Device. It is possible that this access was interrupted by the system or the Device can be damaged	Check the Device USB-cable connection to one of the USB ports of your PC. Check if the oscilloscope Device driver is installed and properly operated. There is the possibility of the Device or data stream "hanging". To remove the source of this problem close the Program, stop the Device with the help of "Unplug or Eject hardware" dialog and disconnect the Device USB-cable from PS. Put the cable back after 2-3 seconds delay. If the described above operations do not help, reboot your PC
4	Can not create the object	System is unable to create the object	Try to close other applications or reboot Windows
5	Device does not respond	The Device does not respond to the control requests. There is no connection with the Device	Check the Device USB-cable connection or perform operations described above see item 3
6	Cannot open the	It is the same as described	Close the previous copy of

	Device. It can be disconnected or used by another process	in item 3 of the current table, the only exception is the case when the Device is already used by the before executed copy of the Program	the Program
7	USB transfer error. The Device is stopped	The Critical error of the USB traffic occurs. The reason can be noise, disappearance of the contact in the USB-connector or the lack of processor resources of your PC	Rerun the oscilloscope. Reconnect the Device, if it still does not work (see item 3 of this table)
8	Cannot create the temporary file	The Program is unable to create the temporary file on the current location. The Current disk can have read-only properties or partly damaged ones	Check maybe you run the Program from CD. Test the disk with the system disk tools. It is possible that your PC has a lack of resources, see item 4 of the current table
9	Invalid user preset file format	The loading file has a wrong format. Maybe the file is damaged	Try to run the windows disc check system utility
10	Failure to overwrite the file	The Program is unable to overwrite the existing file. It can be that the file has a read-only attribute or is used by another application	Check and change file attributes. It can happen that the “busy” attribute of the file is not removed because of the abnormal Program termination, which used this file. Restart your PC in this case
11	Failure to save the file	The Program is unable to save the file. It can be that the file with the same name already exits and has a read-only attribute or is used by another application	Try to save the file with another file name
12	Failure to print the document	The System is unable to print the document to the currently selected printer	Check if the printer was correctly chosen, if it is connected and ready for printing
13	Failure to print the page	An error occurs while printing the page of the	Try to free the system disc space, and close

		current document. Possibly the system does not have enough resources to print out your document	other unused applications or reduce the number of printing pages
14	There are not enough resources to complete the operation	Your PC does not have enough system resources to perform the requested operation	Try to close unused applications or change the image resolution
15	Failure to save the image	The Program is unable to store the image file in the defined name or location	Change the file name or location, try to free the disk space
16	There are not enough system resources to create the preview surface	The Program is unable to create the image surface that equals in size to the printer surface. It is possible that printer DPI settings are too high and OS Windows 98 or Me, used on your PC, have some physical limitations	Try to reduce printer DPI settings with the help of the printer properties dialog

6 TROUBLESHOOTINGS AND POSSIBLE SOLUTIONS

№	Troubleshooting	Case	Solution
1	Program stops the real time signal monitoring	a) Error in USB tract. b) Device is “hanging” because of ESD	a) Disconnect and connect the Device again in few seconds. б) Check if there is the connection between the Device zero clamp and PC cover ground
2	The shape of the signal becomes chaotic at the real time signal monitoring	USB data tract on your PC does not provide the Device with the flow capacity. Such problem can be the corollary of the performed LAN transmission and is caused by the specific work of the driver or the motherboard chipset of your PC	Close all unused applications and stop background tasks

7 SAFETY REQUIREMENTS FOR THE USAGE OF THE CURRENT DEVICE

To provide the protection of the Device and connected PC it is necessary to equalize their potential and the potential of the measurements object. This requirement can be done by the way of connection of the Device zero measurement clamp with a cover or a ground of the PC. Current conditions are required only for devices with HW versions 1.x.

When measurements are performed in conditions of a high risk of the electric shock and the PC is connected to the power supply network, then it must be necessarily grounded. Connection rules for the Device and object of measurements are shown on fig.18.

To avoid damaging of the Device, the zero measurement clamp must be always connected in the first place!

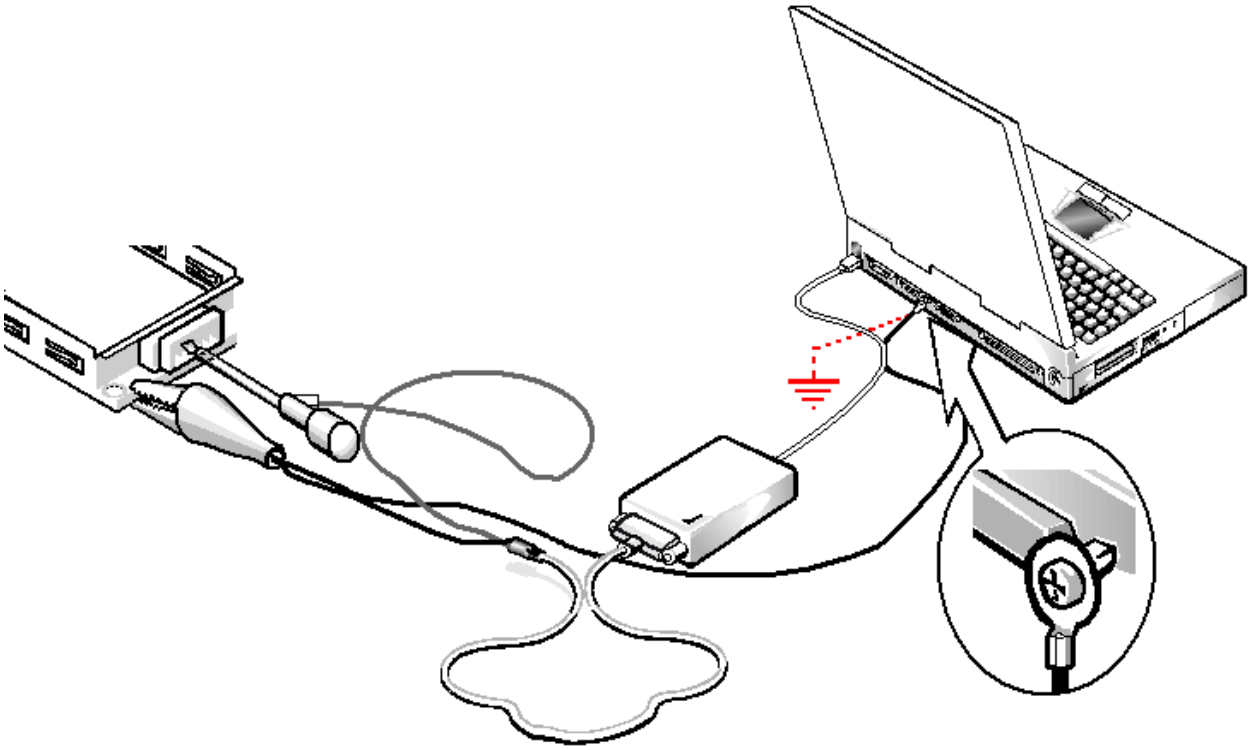
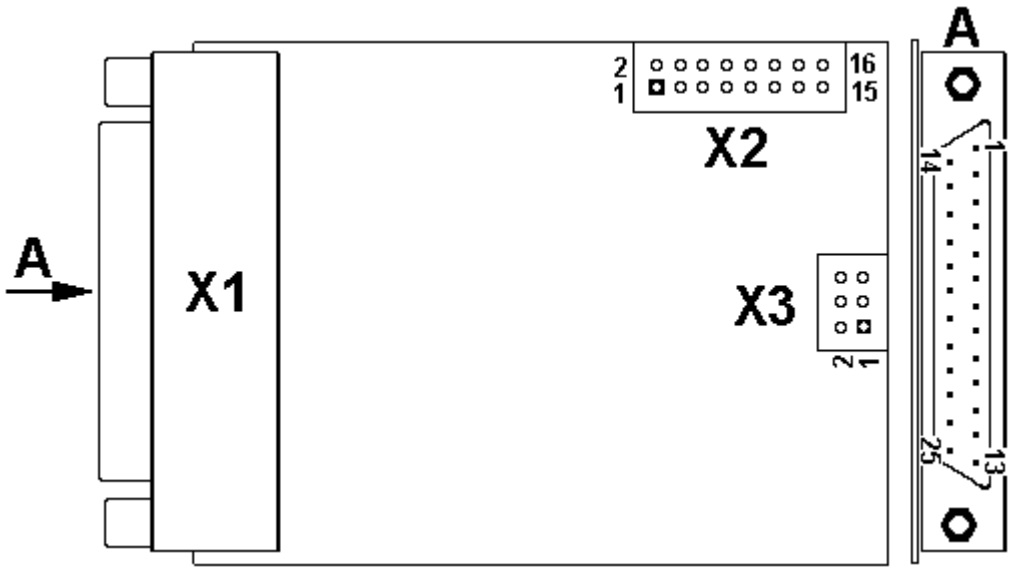


fig.18. The connection of the Device and the object of measurements

8 APPENDIX

Layout of the Device connectors for hardware versions 1.x



Analog input connector - X1 (DB25)

Signal name	Pin number	Comment
AIN1	12	Analog input number 1
AIN2	23	Analog input number 2
AIN3	9	Analog input number 3
AIN4	20	Analog input number 4
AIN5	6	Analog input number 5
AIN6	17	Analog input number 6
AIN7	3	Analog input number 7
AIN8	14	Analog input number 8
AGND	1, 2, 4, 5, 7, 8, 10, 11, 13, 15, 16, 18, 19, 21, 22, 24, 25	Analog ground

Digital in/out connector – X2 (PLD16)

Signal name	Pin number	Comment
DIO1	1	Digital in/out port 1
DIO2	3	Digital in/out port 2
DIO3	5	Digital in/out port 3
DIO4	7	Digital in/out port 4
DIO5	9	Digital in/out port 5
DIO6	11	Digital in/out port 6
DIO7	13	Digital in/out port 7
DIO8	15	Digital in/out port 8
DGND	2, 4, 6, 8, 10, 12, 14, 16	Digital ground

The Device internal connector – X3 (PLD6)

Signal name	Pin number	Comment
+ 5V	1	Weak power supply +5V
RES	2	Device reset
LED	4	LED indicator output
GND	5, 6	Digital ground