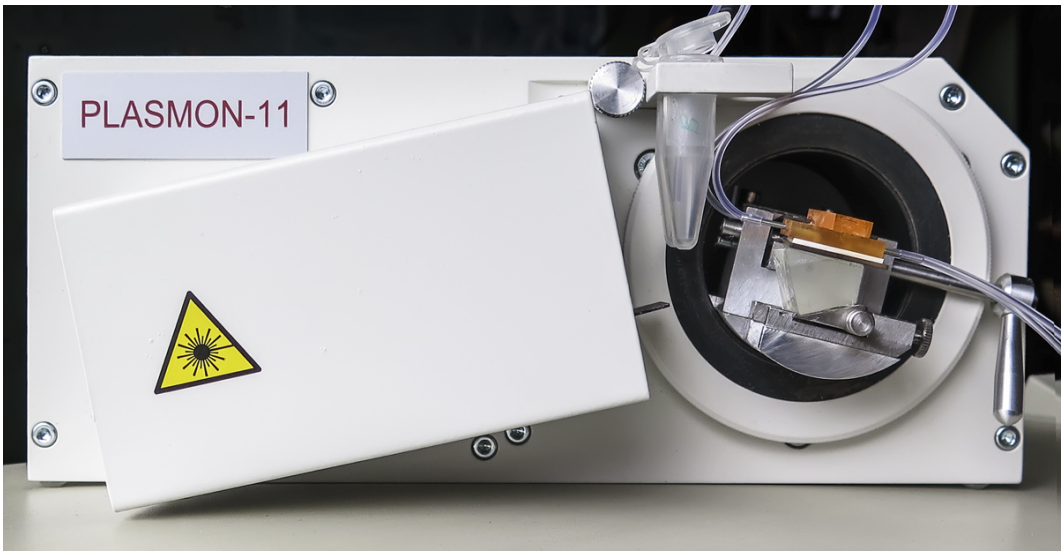
Plasmon-11

Plasmon-11 Help V1



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Click on the **highlighted** text for more information about each item.

2 System requirements

System requirements

Operating systems supported by the program: Windows 7 - 10.

PC configuration for normal device and program operation:

CPU frequency – no less than 2500 MHz.
Standard USB-2 (depends on device modification).
150 MB of free disk space.
Mouse.

Note: Device will work at lower CPU frequencies but its operation stability decreases. If it is necessary to work on low-power PC, you can follow these instructions to reduce CPU load:

- Increase curve drawing speed by adjusting the **Drawing acceleration** element (highest possible

value – 5) on the **Single** page in the **Options** window of the program.
- Increase measurements **Period, s** during measurements in **Multiple** mode.
- Increase **Delay, s** between measurements during measurements in **Slope** mode.

3 Working with program

Working with program

- Measurement modes
- Main window
- Set options
- Monitoring and stabilization of the temperature
- Restart
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3.1 Measurement modes

Measurement modes

Single measurement – single-stage measurement.

Multiple mode Kinetic measurements – kinetic measurements.

- Multiple measurement – reiterated measurement.
- Slope – measurement of signal intensity on the slope of the curve.
- Amplification_set

Calibration - start calibration of absolute angles measurement.

Adjustment – adjustment of the instrument.

Subsidiary channel – subsidiary channel for the external signal measurement.

Stop – measurement termination.

Pause – measurement pause/resumption.

Kinetics Restart – start of the kinetics measurement.

3.1.1 Single measurement

Single measurement

Single measurement of the SPR curves within the angular range specified by the **Max angle, degree** option and in the angular coordinates specified by the **Absolute angle-Angle in air-Angle in glass** options. The results are processed (see Data processing) and displayed in the window

entitled **SPR1**, which is opened automatically if necessary (see Data presentation). Positions of the curves minima are also marked with vertical markers and displayed in the top right corner of the window. If the curve minimum is not found, the corresponding message is displayed instead of the angular value.

The results can be saved to file in text or graphic format (see Save file), copied to clipboard (Copy Clipboard) or printed (Print graphics).

Measurements are started with the Button  from the main menu or from the keyboard using shortcut "Ctrl"+"N".

3.1.2 Kinetic

Kinetic measurements

2 kinetic measurement modes are provided in the device:

- Reiterated full SPR curve measurements mode – Multiple measurement.
- Mode of measurements without mechanical rotation of the prism (measurements on the slope) – Slope.

In first mode the SPR curve (or its part) is measured periodically, the angular position of the minimum of this curve is found and its value is plotted on the kinetic curve versus time.

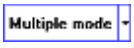
During measurements in the Slope mode the scanning part of the device is fixed at the specified position corresponding to the specified point on the SPR curve slope and the dependence of, for example, reflected radiation intensity level in mV on time is displayed on the kinetic curve.

The main (left) field of the button turns on kinetic measurements in the specified mode.

It is possible to specify the measurements mode and set up options corresponding to the selected mode in two ways:

- press the right field of the toolbar (with down arrow) or
- invoke the pop-up menu using the left mouse button.

In both cases the menu consisting of 3 items will drop down. First 2 of them are intended for selection of the kinetic measurement mode, and the fourth is intended for calling the set options window for the selected mode.

Kinetic measurements are started with the 

(with mode selection), from the main menu or from the keyboard using shortcut "Ctrl" + "K" or "Space".

3.1.2.1 Managing Channel

Managing Channel

Concept of the managing channel makes sense only for the multi-channel instrument. Selection of the managing channel implies the selection of the channel in which the signal of which the system is positioned for the measurement in the Slope mode. It is possible to select the managing channel in the **Managing Channel** window, which is automatically opened after the initial measurement of the whole SPR curve in the modes indicated above.

The **Managing Channel** window is opened if more than one channel is enabled.

The managing channel selection is performed through the left panel of the window. In the right panel any measurement channel can be switched on/off.

3.1.2.2 Multiple measurement

Multiple measurements

 Periodic measurement of the SPR curves (in the same way as in the Single measurement mode). Data obtained in each measurement are processed and displayed similarly to the Single measurement mode, then for every enabled measurement channel the angular position of the minimum is found (see Data processing). If the minimum is found, its position is displayed on the plot in the window entitled **SPR2** (see Data presentation). If the minimum is not found, a corresponding message is displayed in the **SPR1** window, and a corresponding point is omitted in the **SPR2** window.

If the prescribed value of the **Period, s** element is less than the time required for the single measurement, then the measurements will be performed continuously.

Kinetic data displayed in the **SPR2** window can be processed mathematically (see Data processing).

The results can be saved to file in text or graphic format (see Save file), copied to clipboard (Copy Clipboard) or printed (Print graphics).

Additionally, the SPR curves can be saved in text files directly in the course of the measurement in the Automatic data saving mode.

The measurement process can be interrupted by sending the Pause command or terminated by pressing the Stop button. In the latter case, the last measured point data may be lost.

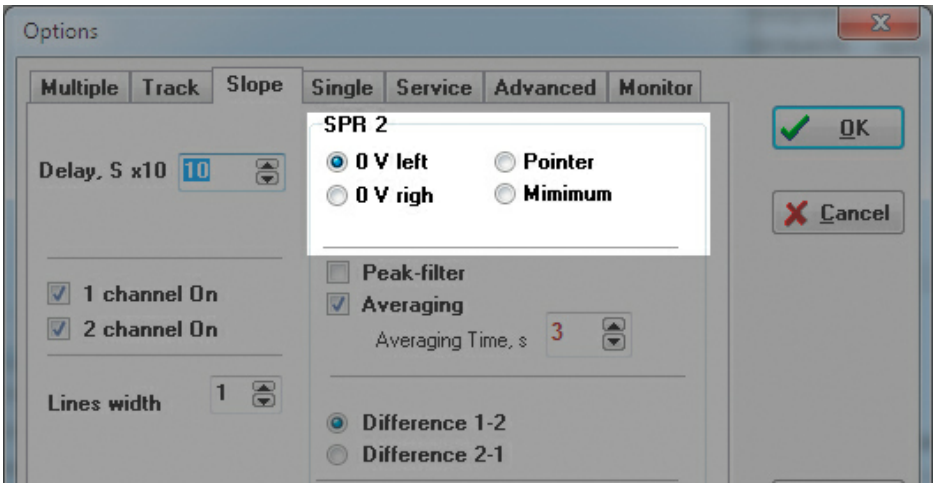
Maximal continuous measurement time depends on several parameters; first of all, it depends on the angular scan range (**Max angle, degree**). With increase of the angular scan range the measurement time increases. The maximum continuous measurement time for the angular scan range of 5 degrees is 8 hours.

3.1.2.3 Slope

Slope mode

 In this mode measurements are carried out without mechanical rotation of the measurement prism and are characterized by high speed of operation, low noise level and high sensitivity

First, one measurement is performed, as in Single measurement mode, and the Managing Channel control channel selection window is displayed. Next the angular position of the prism with the sample is set to a certain position, depending on the measurement method chosen in the options.



If **0 V left** is selected, the angle is set to the position where the signal is close to zero at the point located on the left shoulder of the SPR curve. If **0 V right** is selected, the angle is set to the position where the signal is close to zero at the point located on the right shoulder of the SPR curve. If Minimum is selected, an angle is set corresponding to the position of the extremum. Pointer mode allows you to select an arbitrary angle by dragging the marker along the curve in the SPR 1 window.

To increase the sensitivity, it is possible to increase the amplification of signals by 10 and 100 times. This is done in the Amplification window, which is invoked by the button , from the menu or the shortcut Ctrl + M from the keyboard. Increasing the sensitivity is especially useful if the options **0 V left** or **0 V right** are selected. After setting the desired angle, pressing the button ◄ ► can reduce / increase the angle by one step.

The measurement consists in reading the signals in the enabled channels, processing these signals and displaying them in the window entitled **SPR2** (see Data presentation) when the prism position is fixed. Then the instrument waits for the time specified by the **Delay, s** element and the process is repeated.

The results can be saved to file in text or graphic format (see Save file), copied to clipboard (Copy Clipboard) or printed (Print graphics).

The measurement process can be interrupted by sending the Pause command or terminated by pressing the Stop button. In this case, the last measured point data may be lost.

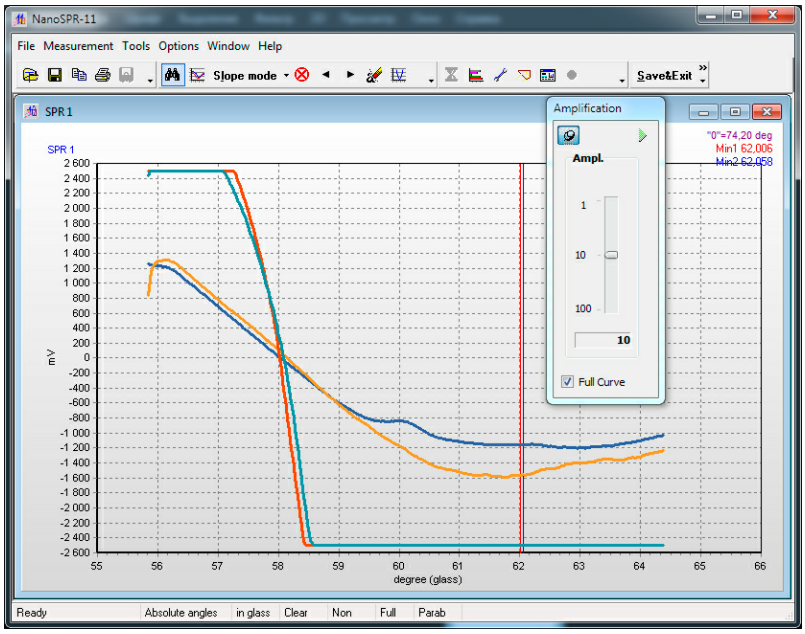
Maximal continuous measurement time depends on the **Delay, s** option and for delay of 0.1 s it equals 2 hours, and for delay of 10 s – 200 hours. Maximal continuous measurement time is calculated and indicated before the beginning of the measurement in the **Reminder** window.

3.1.2.4 Amplification set

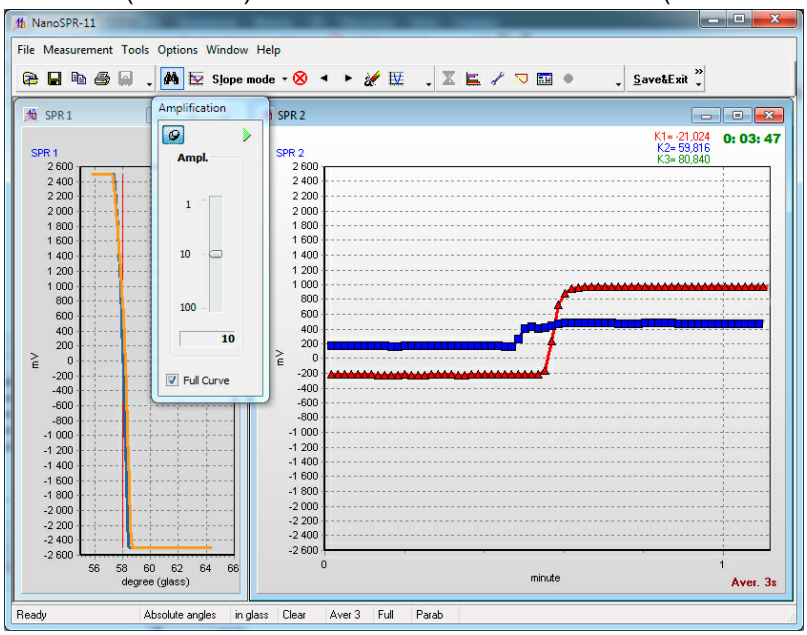
Amplification set

Click the Amplification button and select the desired gain. In Fig. shows the SPR curves obtained with the gain of 1, 2, 5, 10.

Obviously, increasing the gain increases the sensitivity of the device.



Increasing an amplification value is especially useful in the Slope mode (when the options **0 V left** or **0 V right** are selected), because this allows you to increase the sensitivity of the device multiple times. In Fig. is shown kinetics at amplification k = 10 for distilled water (n = 1.333) that was changed with saline (n = 1.337) in channel 1 and for diluted saline (n=1.334...1.335) in the channel 2.



3.1.3 Calibration

Calibration

It is necessary to know absolute values of the angle of incidence of light for some calculations. There is a built-in reference point in the instrument for the determination of the absolute angles.

Angular position of the reference point is near to the position of normal incidence of light on the prism and it is precisely determined as an instrumental calibration correction during the device adjustment made by the manufacturer.

The system calibration consists in associating the rotation system with the built-in reference point. This operation is to be repeated after each prism replacing or changing its position (for instance, by turning the preset ring).

The calibration mode can be switched on by selecting the **Measurement/Calibration** menu item or by pressing the **Device calibration** button in the main window, if this button has been added into the main window.

During the calibration, the special mode of the reference signal measurement is turned on and the system position is defined when the reference signal is maximal. The reference signal and the calculated position of its maximum in the form of the vertical line and in the form of the inscription are displayed in the **SPR1** window. Here, correction for the real angular position of the reference point (instrumental calibration correction) is taken into account automatically.

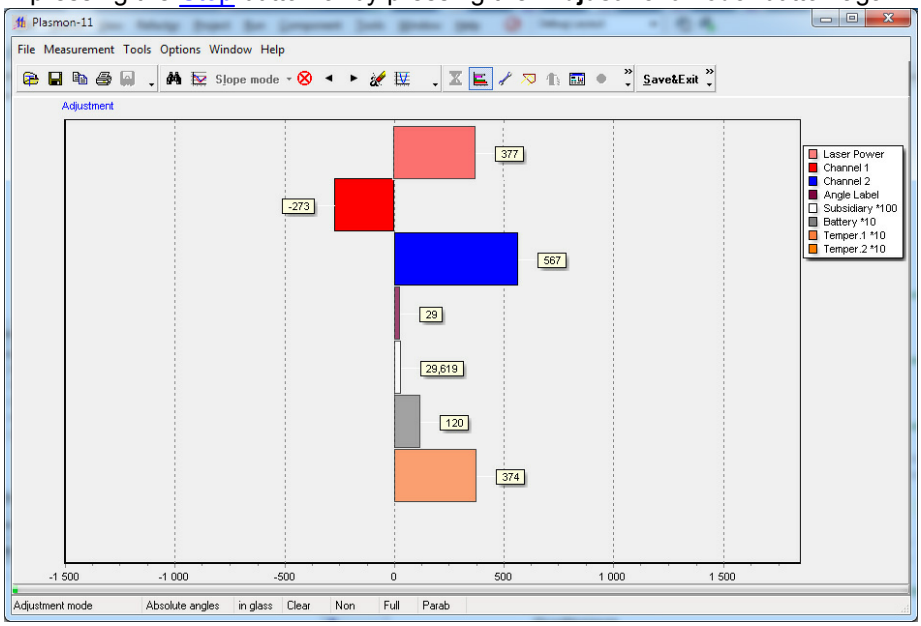
Note: An instrumental calibration correction is stored in the “Device11Dat.dat” file, which the instrument is supplied with.

3.1.4 Adjustment mode

Adjustment mode

The adjustment mode can be switched on from the **Tools/Adjustment mode** menu or by pressing the “**Adjustment**” button. In this mode the signal intensities in all measurement channels are monitored periodically and their values are displayed as a horizontal color bar chart diagram in the main window.

This process lasts for several minutes and then switches off automatically. It can be also terminated by pressing the Stop button or by pressing the “**Adjustment mode**” button again.



Note: The indication is carried out for all channels, even for those that are not used in the current device model.

The signals table can be shown to the right of the plot if the **Legend** element is checked in the pop-up menu of the window.

This mode is convenient for the device adjustment and testing purposes.

3.1.5 Subsidiary channel

Subsidiary channel

 Subsidiary channel is intended for measurement and representation of the user's external signal voltage. The measured range is -5V…+5V.

The subsidiary channel can be operated in two different modes: in the independent mode and in the synchronous mode. During operation in the first mode, the measurement is performed periodically after a period of time specified by the timer. In this mode the measurement starts immediately after the window is opened. In the second mode the measurement in the subsidiary channel is performed simultaneously with the SPR kinetics measurement. It means that the measurement is performed when the next kinetics point is determined (the minimum position in the Multiple measurement and the signal measurement in the Slope mode).

Note: The independent measurement mode is available only during the stand-alone operation of the subsidiary channel. If any mode of kinetics measurement is switched on, the synchronous mode will be automatically switched on.

Attention! If the 5 channel is turned off, the external signal measurement mode is unavailable.

It is possible to control the window and the Subsidiary mode via the Pop-up_menu and from the **Advanced** panel of the **Options** window.

These panels contain the following elements:

- **Averaging** – switches on/off the averaging mode.
- **Number of points** – defines the number of points that are used for averaging.
- **Independence Period, sx10** – specifies the measurement period.

Note: Inaccuracy of the measurement of the internal signal can be reduced by executing the accurate Subsidiary channel calibration.

3.1.5.1 Subsidiary Calibration

Subsidiary channel calibration

 Calibration of the subsidiary channel consists in determination of precise values of amplification factor and position of the zero line of the channel.

To perform the calibration, proceed as follows:

1. Switch the channel on in the independent mode by pressing the  button in the main window.

2. Short-circuit the wires corresponding to the input signal of the subsidiary channel and wait for some time while the zero line is drawn.

3. Connect the constant-current source with known voltage to the channel input and wait for some time while the line corresponding to this voltage is drawn.

4. Interrupt the measurement by selecting the **Independence** item in the pop-up menu. Changing the

curve scale, determine the applied voltage value as a difference between the signal and zero line levels. Divide the real applied voltage by this value and obtain the **k1** coefficient.

5. Open the **Options** window on the **Advanced** page, read the amplification coefficient value **k** from the **Amplification** window and replace it with a new value calculated as the **k*k1**.

6. Short-circuit the wires corresponding to the input signal of the subsidiary channel and wait for some time while the zero line is drawn.

7. Determine the precise **p1** value, which corresponds to the “0” input voltage.

8. Open the **Options** window on the **Advanced** page, read the pedestal value **p** from the **Pedestal, V** window and replace it with a new value calculated as **p-p1**.

3.1.6 Pause

Pause

The pause is switched on/off by pressing the **Pause** button or the “Ctrl” + **“P”** keys in the keyboard. This mode is intended for the temporary measurement interruption. It is useful when the examination of the data already obtained is desired, to switch to another application and so on.

Switching on the Pause mode is indicated by change of the button image color.

It is recommended to use this mode also when making some commutations, changing options etc.

Note: If the Pause mode is switched on during the kinetics measurement, then program operation interrupts but the measurement time count continues.

3.1.7 Stop

Stop

Kinetics measurements can be stopped automatically or by user depending on the selected options. They can be interrupted at any time by pressing the button or by sending the **Stop** command from the main menu or "Ctrl"+"S" or "Escape". After pressing the button, the interruption may not occur immediately because the system may need some time to stop the operation correctly.

Information corresponding to the last measured point may be lost when the **Stop** command is used.

3.1.8 Kinetics Restart

Kinetics Restart

– press this button to start kinetics measurement. This button is active only when the kinetics measurement mode is switched on (Multiple measurement or Slope modes). This button is intended to begin the kinetics measurement after some preparatory stage.

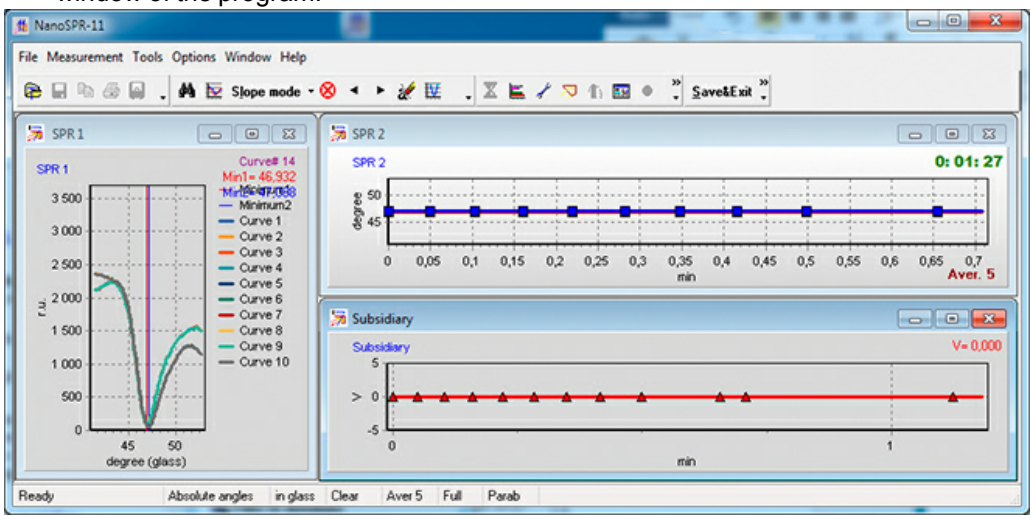
If this button is pressed, the kinetics measurement timer is zeroed and the SPR2 and Subsidiary windows are cleared. The previously measured kinetics data will be lost.

Pressing this button is equivalent to switching off and then switching on the kinetics measurement mode.

3.2 Main window

Main window

When the program starts, it detects and initializes the instrument and after that opens up the Main window of the program.



The Main window contains main **Menu**, toolbars with Control buttons below the menu and **Status bar** at the bottom of the window.

Middle part of the window is empty just after start of the program. Windows with plots of the measurement results will be located here (see Data presentation).

Menu has standard appearance, structure and functioning.

Position and structure of toolbars that contain Control buttons can be adjusted by user. Structure of toolbars set up by user is stored automatically.

Status bar as well as Menu and Buttons serves as active control element. Most of its functions are duplicated by menu items, buttons and control options.

Note: The main window current size and position are stored by the system. You can resize or drag the main window to any desirable position, and this size and position will be reproduced when you run the program next time.

3.2.1 Control buttons

Control buttons

Control buttons are normally located in 4 customizable toolbars which are situated in the top part of the main window.

Initially, buttons are located in the following order:
Toolbar 1 contains:

- Open file – read text files.
- Save file – save data in a file.
- Copy Clipboard – copy data into system Clipboard.

Print graphics – copy plot to the printer.

AutoSave – enable automatic data saving in a text file.

Toolbar 2 contains:

Amplification_set - control the signal gain value.

Single measurement – start single-stage measurement.

Kinetics measurement – start kinetics measurement.

Multiple measurement – start reiterated measurement (hidden).

Slope – start measurement of signal intensity on the slope of the SPR curve (hidden).

Stop – terminate the measurement.

Step left, Step right - shift the angle left / right by 1 step.

Restart – set up initial position (hidden).

ClearSPR1 – clear the SPR1 window.

Subsidiary channel – subsidiary channel.

Toolbar 3 contains:

Pause – pause/resume the measurement.

Adjustment – enter the instrument adjustment mode.

Set options – set up parameters.

Calibration – start calibration of absolute angles measurement.

open/close the Monitor window intended for the monitoring of temperatures and device power supply voltage.

Kinetics Start – start the kinetics measurement.

Toolbar 4 contains:

- Save&Exit – finish device operation.

3.2.2 Menu

Menu

Almost all menu functions are duplicated by the main window buttons or by the Pop-up_menu commands; these functions are described in their descriptions, with the exception of the following ones:

File/Print setup – Opens the system printer selection and settings dialog window.

Tools/Set device – Opens the initial device setup window and writes the instrument's factory settings from the **Device11dat.dat** file into the system registry.

Customize – adjustment of toolbars.

Window/SPR1 in New Windows – if this element is selected, each measured SPR curve is plotted in a separate window.

Window/Notes – calls and opens/closes the Notes window.

Window/View – calls and opens the View review window.

Window/Align – windows arrangement control.

Window/Style –adjustment of main menu and control buttons menu style.

Help/Help - connects this HELP-file (it is connected by default).

Help/ Hardware - connects the instrument HELP-file.

Help/ About - information about the program and device controller.

3.2.3 Toolbars setup

Toolbars setup

Control buttons are normally located in 4 customizable toolbars in the top part of the main window. Toolbars adjustment is carried out in the **Customize** dialog window, which is opened from the **Tools/Customize** menu of the main window. Furthermore, it is possible to hide or show buttons that appear in each panel. To do this, click on the right field of the toolbar (down arrow) and check or uncheck the flag opposite to the button of interest in the drop-down window. **Customize** dialog window contains the following pages: **Toolbars, Actions, Options**.

The **Toolbars** page contains the **Toolbars** panel, which elements for turning on/off the **atbFile, atbMeasurement, atbTools, atbExit, atbAdjustment** toolbars in the main window of the program are located on. To turn on/off either toolbar it is necessary to check or uncheck the corresponding flag. This page also contains the **ToolbarOptions** panel which allows turning on captions of correspondent buttons for the selected toolbar or all toolbars if the **Apply caption options to all toolbars** flag is checked.

The **Actions** page contains the **Categories** and **Actions** panels. These panels allow every user of the program to adjust toolbars. Namely, user can pick only the buttons that he needs in the toolbar. To do this, select the category of interest from the **Categories** panel, and elements related to this category will be shown in the **Actions** panel at that. Then choose the element from the **Actions** panel by clicking it with left mouse button and drag it to the desired toolbar of the main window while holding the mouse button.

The **Options** page contains the **Personalized Menus and Toolbars** and **Other** panels. If the **Menu show recently used items first** flag in the **Personalized Menus and Toolbars** panel is checked, then the first button in the toolbar will be the one that was used last in the latter operation session. The **Other** panel allows switching to large toolbar button icons when the **Large icons** flag is checked, and controlling switching on/off the pop-up prompts that appear when the mouse pointer is pointed at the button symbol in the toolbar.

3.2.4 Status bar

Status bar

The Status bar is an active control element. It is intended not only to inform about the operation modes that are currently turned on, but also to set up and modify some of them. That partially duplicates controls in the Set options window.

The Status bar consists of 8 fields, first and eighth of which are intended for indication only, while the rest of them are used for both indication and modification of corresponding modes. To switch between the different modes, click on corresponding field in the status bar. At that, the inscription in the string field will change, and the appearance of the field may change. Status bar fields and their destinations are listed below.

1. This field indicates the current operation mode.

2. Indicates and modifies the light angle-of-incidence calculation and presentation method:
Relative angles – angle displayed corresponds to the turning angle of the prism table with reference to its initial position;
Absolute angles – angle displayed corresponds to the absolute angle of incidence of light. In order for this mode to operate correctly, the Angle calibration is to be carried out first.
See also Data processing.

3. Specifies absolute angles calculation method:
in glass – angles indicated in the data plots correspond to the angles of incidence of light on the top prism face (in glass);
in air – angles indicated in the data plots correspond to the angles of incidence of light on the input face of the prism. When the beam reflected from the input prism face appears to lie above the incident beam, the angles are considered negative; in the opposite case they are considered positive.
See also Data processing.

4. Enables/disables automatic erasing of the SPR curves in the SPR1 plot. Available only when the **SPR1 in New Windows** mode is turned off:
n_Clear – all measured SPR curves are displayed;
Clear – on plotting every sixteenth SPR curve the window is cleared, and then the next 16 curves are plotted, the window is cleared and so on.
The window can be also cleared at any time by pressing the **Clear SPR1** button.

5. Indicates and controls processing of kinetics curve data (SPR2) for the Multiple measurement and Slope operation modes. Options for data processing modes can be adjusted in the Set options**Data processing** window.
None – data processing is switched off;
Peak – single spike filter (peak-filter) mode is switched on;
Peak+Aver – peak-filter and data averaging modes are switched on;
Aver x. – data averaging mode is switched on, averaging is executed by **x** points.

6. Indicates and controls the plot scale of the OY axis for kinetic plot in the SPR2 window:
Full – full window in initially preset scale is shown;
Link – OY axis scale in the SPR2 window is dependent on the SPR1 window scale so that with changing of the plot scale in the SPR1 window the OY axis scale in the SPR2 window is changed automatically;
Fix – previously adjusted OY axis scale (e.g. in the **Link** mode) is kept.

7. Indicates and controls the method of determination of the SPR curve minimum:
Abs – determination of the absolute minimum of the SPR curve.
Parab – method of approximating the SPR curve by the parabola; minimum position is then calculated for this approximate function.
See also Data processing.

8. This field is used by the automatic data saving to the files. It displays the name of the last data file saved.

3.3 Pop-up menu

Pop-up menus

The **SPR1**, **SPR2**, **View**, **Subsidiary** and **Adjustment** windows possess the pop-up menus. The pop-up menu is called by the mouse click on the correspondent window using the right mouse button.

For the most of windows the pop-up menu contains the following items:

Align – in its turn, contains embedded menu that controls the window arrangement. All submenu items have standard meaning except the **Normalized** item. When this item is selected, the SPR1 window is placed in the left third part of the screen and has the full screen height, and the SPR2 window is placed on the right from the SPR1 window. If the Subsidiary window is opened, the SPR2 window height is halved and the Subsidiary window is placed underneath the SPR2 window.

Copy Clipboard – copies the contents of the window, which the pop-up menu was called from, to the system Clipboard.

Save Graphic – saves the information contained in the window, which the pop-up menu was called from, to the file (see Save file).

Print – prints out the plot contained in the window, which the pop-up menu was called from, using the system printer (see Print).

Delete Window – deletes the window, which the pop-up menu was called from.

Note: This is the only method to delete the already open windows instances.

Pop-up menu in each window contains specific items in addition to the common items. They are listed below.

Pop-up menu in the **SPR1** window contains the following specific items:

Minimum Search – allows finding and displaying the minimum of the last SPR curve measured or opened from the file.

Clear SPR1 – clears the window by deleting all previously plotted curves. This menu item is duplicated by the similar button.

Auto Clear SPR1 – turns on the mode, during which not more than 16 curves are plotted in the window. After that the window is cleared, and the next 16 curves are plotted etc. This mode can be also controlled via the Status bar.

SPR1 in New Windows – when this item is selected, each measured SPR curve is plotted in a separate window. Otherwise, all curves are displayed in the same window. This menu item is duplicated in the main menu.

Legend – controls the representation of the curves marking table that is to the right of the plots.

Pop-up menu in the **SPR2** window contains the following specific items:

Difference – when this item is selected, the curve that presents the arithmetic difference of the curves correspondent to the 1 and the 2 channels is plotted in the **SPR2** window. Otherwise, kinetic curves are plotted for each channel. This element is available for two-channel instrument only.

Tools – submenu which contains elements for turning on the service possibilities for processing of the data represented in the window.

Coordinate – turns on the mode of mouse pointer coordinates determination while it moves over the plot.

Distance – turns on the mode of determination of the distance between two sequentially specified plot points. The distances along the X and Y coordinates are determined separately.

Delta Y Line – turns on the mode of determination of the distance between two sequentially specified levels along the Y coordinate.

Delta Y Region – turns on the mode of determination of the distance (along the Y coordinate) between the average values of points which are included in two selected regions.

Gradient – turns on the mode of determination of the curve gradient between two selected points.

It is also possible to turn on service possibilities from the Status bar.

Link mode – submenu which contains elements for scaling of the vertical axis of the plot displayed in the SPR2 window.

Full Graphic – the full window with the initially set scale.

Link mode – when the plot scale in the SPR1 window is changed, the OY axis scale of the plot in the SPR2 window changes automatically.

Fix Left Axis – breaks the link between the SPR1 and SPR2 windows and stores the OY axis scale previously specified in the **Link Graphics** mode.

SPR2 marks – when this item is selected, the points on the curves displayed in the **SPR2** window are marked with markers.

Legend – controls the representation of the curves marking table that is to the right of the plots.

Show Const - controls the appearance of constants showing the sign and magnitude of the change in kinetics.

Pop-up menu in the **Subsidiary** window contains the following specific items:

Independence – when this item is selected, the independent operation mode is switched on. In this mode the measurement starts immediately after the window is opened and it is performed periodically after a period of time specified by the timer. Otherwise, the measurement is performed simultaneously with the SPR kinetics measurement. It means that the measurement is performed when the next kinetics point is determined (the minimum position in the Multiple measurement and modes or the signal measurement in the Slope mode).

Tools – submenu which contains elements for turning on the service possibilities for processing of the data represented in the window.

Coordinate – turns on the mode of mouse pointer coordinates determination while it moves over the plot.

Gradient – turns on the mode of determination of the curve gradient between two selected points.

Subsidiary marks – when this item is selected, the points on the curves displayed in the **Subsidiary** window are marked with markers.

Legend – controls the representation of the curves marking table that is to the right of the plots.

Axis Auto – if this option is set, the scale is selected automatically in such a way that all displayed information is visible.

Averaging – turns on/off the averaging mode. Number of points which are averaged is defined in the **Subsidiary** panel on the Advanced page in the **Options** dialog window.

Pop-up menu in the **View** window contains the following specific items:

Add File – adds kinetic from the new file to the window.

Clear – clears the window.

Axis Auto – if this option is set, the scale is selected automatically in such a way that all displayed information is visible. Otherwise, the maximal value is set equal to the maximal OY axis value of all kinetic curves loaded, and minimal value is set equal to the minimal OY axis value.

Legend – controls the representation of the curves marking table which is to the right of the plots.

Pop-up menu in the **Adjustment** window contains 2 items:

Legend – controls the representation of the signals table which is to the right of the plots.
Stop – interrupts the measurements.

3.4 Set options

Set options

Setting of the options is executed in the “Options” dialog window. This window is activated by the **“Set Options”** button or the **“Options/Set Options”** menu item.

It is possible to set up options related to kinetic measurements by pressing the right field (down arrow) of the **Kinetic measurements** button in the second toolbar. At that, a menu will drop down; select the **Options Kinetic** menu item and the **Options** dialog window which contains pages related to kinetic measurements will open.

The “**Options**” window elements are located on seven pages:

- The **Multiple** page contains device adjustment elements for operation in the multiple SPR-curve measurement Multiple measurement mode.
- The **Slope** page contains device adjustment elements for operation in the Slope mode without mechanical rotation of the measurement prism.
- The **Single** page contains device adjustment elements for operation in the single curve measurement Single measurement mode.
- The **Service** page contains control elements for data representation windows color appearance and control elements for sound accompaniment of the measurements.
- The **Advanced** page contains elements that assign parameters of the device optical part and subsidiary channel control elements.
- The **Monitor** page contains elements for control and management of the temperature and device power supply.

Most of the changes made take effect after pressing the **“OK”** button. Changes of some options are immediately sent to program; control elements of these options are highlighted with green color.

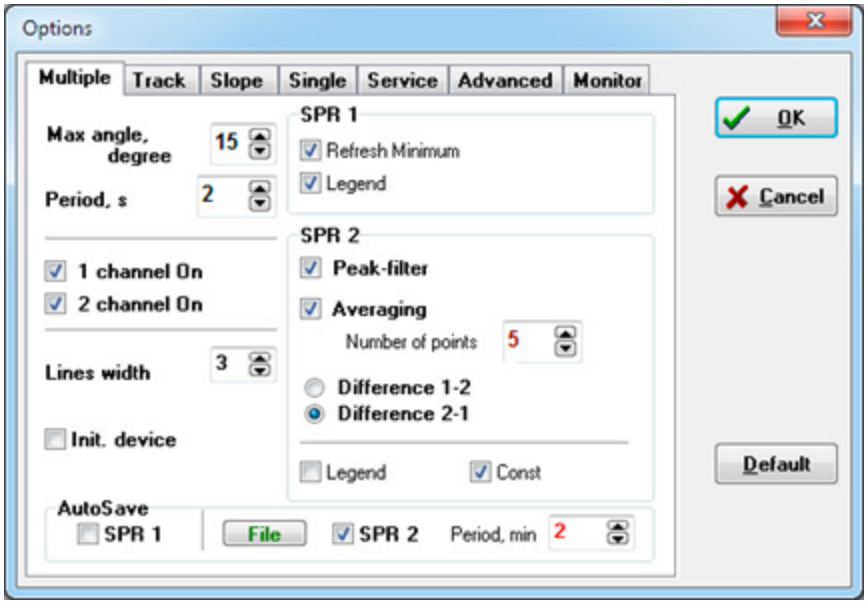
The **“Default”** button is intended for recovery of the default options values.

It is recommended to change options before beginning of the measurement. Options change during the measurement may lead to unpredictable results. Options which can be changed during the

measurement can be managed using the Status bar or Pop-up_menu.

3.4.1 MultipleOptions

Multiple



The **Multiple** page in the **Options** window is intended for **Multiple** mode options setup and contains the following control elements:

Max angle, degree – specifies the prism angular rotation range when operating in the Single measurement and Multiple measurement modes and when searching for the operating point before measurement in the Slope mode.

Period, s – specifies the measurement period duration in the Multiple measurement mode. If the period specified is less than the time required for the measurement of one point, the measurements will be executed continuously.

The **Channel On** elements allow switching on (when the flag is set) or off (when the flag is not set) device measurement channels.

The **Line width** element specifies the thickness of the lines used for drawing the plots.

The **SPR1** panel contains the following elements:

Refresh Minimum – if this flag is set, the last values of the minima will be marked on the plots in the SPR1 window and the previous ones will be cleared. If this flag is not set, all old values will remain.

Legend – controls the representation of the curves marking table of the SPR1 window that is to the right of the plots.

The **SPR2** panel contains the following elements:

Peak-filter – switches on/off the single peak filtration mode for the kinetics curve.

Averaging – switches on/off the data averaging mode. Number of points that are used for averaging is defined by the **Number of points** element.

Difference 1-2 - in Difference mode, the kinetic curve will be constructed as the difference

channel 1 minus channel 2.
Difference 2-1 - in the Difference mode, the kinetic curve will be constructed as the difference channel 2 minus channel 1.

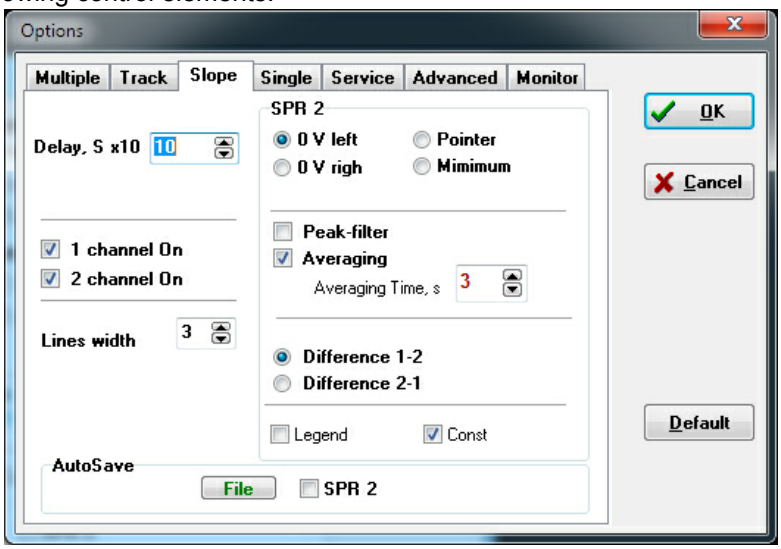
Legend – controls the representation of the curves marking table of the SPR2 window that is to the right of the plots.
Const - controls the appearance of constants showing the sign and magnitude of the change in kinetics.

The **AutoSave** panel is intended for managing automatic saving of experimental data during the operation. The **SPR1** element switches on/off the Automatic data saving mode for the SPR1 window, and the **SPR2** element switches on/off kinetics autosaving (for the SPR2 window). On default the kinetics (the SPR2 window) is saved to the "SPR2.sp21" file. The file name can be modified after pressing the **File** button.

3.4.2 SlopeOptions

Slope

The **Slope** in the **Options** window is intended for the **Slope** mode options setup and contains the following control elements:



Delay, Sx10 – specifies the interval between the measurements.

The **Channel On** elements allow switching on (when the flag is set) or off (when the flag is not set) device measurement channels.

The **Line width** element specifies the thickness of the lines used for drawing the plots.

The **SPR2** panel contains the following control elements:
0 V left, if selected, sets the angular position where the signal is close to zero at the point located on the left shoulder of the SPR curve.
0 V right, if selected, sets the angular position where the signal is close to zero at the point located on the right shoulder of the SPR curve.
Minimum, If selected, set the angle corresponding to the position of the extremum.

Pointer mode allows you to select an arbitrary angular position by dragging the marker over the curve in the SPR 1 window..

Peak-filter – switches on/off the single peak filtration mode for the kinetics curve;

Averaging – switches on/off the data averaging mode. Number of seconds which the averaging is made over is defined by the **Averaging Time, s** elements.

Difference 1-2 - in Difference mode, the kinetic curve will be constructed as the difference channel 1 minus channel 2.

Difference 2-1 - in the Difference mode, the kinetic curve will be constructed as the difference channel 2 minus channel 1.

Legend – controls the representation of the data table that is to the right of the plots.

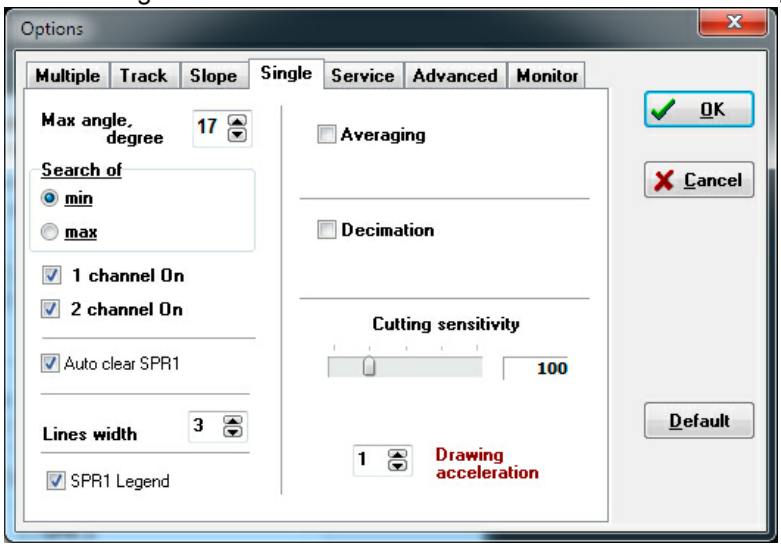
Const - controls the appearance of constants showing the sign and magnitude of the change in kinetics.

The **AutoSave** panel is intended for managing automatic saving of experimental data during the operation. The **SPR2** element switches on/off the kinetics autosaving (for SPR2 window). On default the kinetics (the SPR2 window) is saved to the "SPR2.sp21" file. The file name can be modified after pressing the **File** button.

3.4.3 SingleOptions

Single

The **Single** page in the **Options** window is intended for SPR1 window operation mode options setup for both single and kinetic measurements and contains the following control elements:



Max angle, degree – specifies the angular prism rotation range when operating in the Single measurement and Multiple measurement modes and when searching for the operating point before measurement in the Slope modes.

Search of min/max - Search of min / max - determines the extreme type of the SPR curve.

Cutting sensitivity - adjusts the trimming sensitivity of the "wings" of the SPR curves.

The **Channel On** elements allow switching measurement channels of the instrument on (the flag is set) or off (the flag is not set).

Auto Clear SPR1 – allows/forbids automatic curves clearing in the SPR1 window. It works only if

the **SPR1 in New Windows** mode is turned off. Not more than 16 curves will be output into the plot if the **Auto Clear SPR1** mode is turned on.

It is also possible to switch this mode on/off via the Status bar.

The **Line width** element specifies the width of the lines which are used for plotting.

SPR1 legend – controls the representation of the curves marking table that is to the right of the plots.

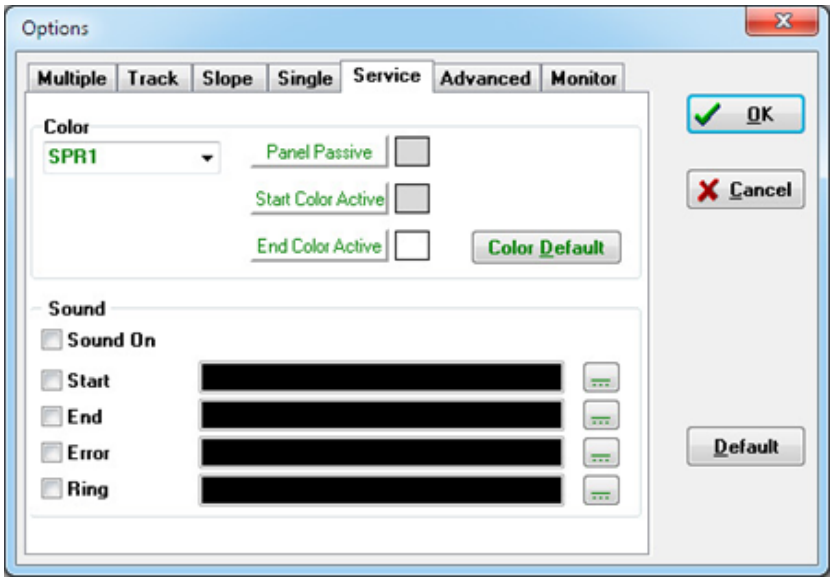
Averaging – switches on/off the SPR curve averaging mode; if the averaging is switched on, then **n** measured points of the SPR curve are averaged into one point (**n** is the value that is specified in the **Number of points** window which is activated only if the **Averaging** element is marked). The averaging is made immediately during the measurement and all subsequent operations (such as minimum search, saving data to file etc.) are executed with averaged values. Thus number of points of the SPR curve is reduced by a factor of **n**. This mode is available during the single-channel instrument operation only.

Decimation – switches on/off the mode of the SPR curve "decimation"; if this mode is switched on and a value of **n** is set in the **Number of points** window, then saving SPR curve to file results in saving only **n** points that are uniformly picked from the measured array of points.

The **Drawing acceleration** element allows controlling the speed of the SPR1 curve representation. Increase in speed is achieved by plotting not all of the measured points (but all of the measured points are taken into account during the data processing and saving the data to a file).

3.4.4 ServiceOptions

Service



The **Service** page in the **Options** window contains the following control elements:

The **Color** panel allows specifying color appearance of the SPR1, SPR2, Subsidiary and View windows.

The window, which colors are being specified for, is selected by the left element.

It is possible to specify the following options for the first three windows:

- The color of the passive window.
- The color of the top part of the active window (Start Color).
- The color of the bottom part of the active window (End Color).

The window will have a gradient color if Start Color and End Color do not coincide.

All changes made are sent to the program immediately.

It is possible to select the color of the passive window only for the **View** window. This window will always have the selected color.

The **Sound** panel contains control elements for managing sound signals that accompany the program operation.

The **Sound On** element switches on/off all sound signals.

The **Start** string contains the following elements:

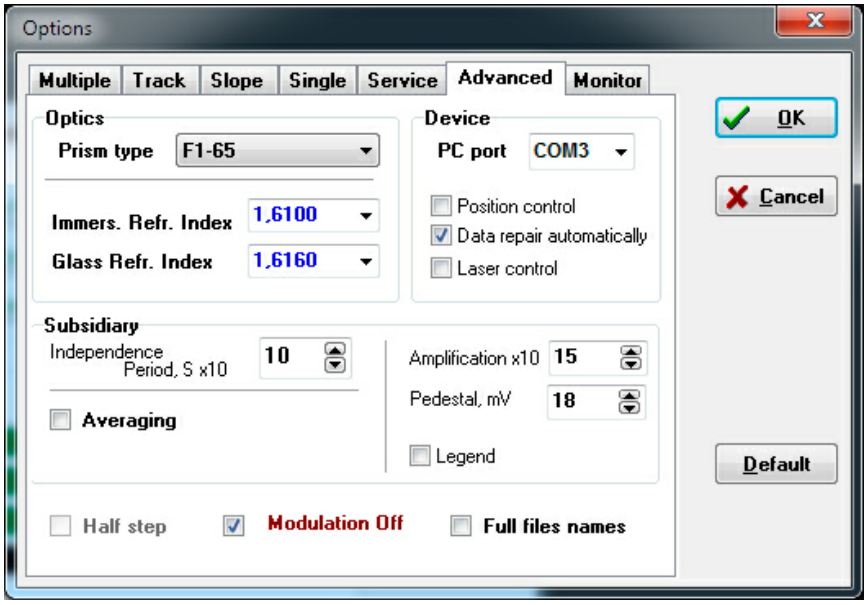
Control element for switching on/off the sound that accompanies the measurement beginning. If this element is selected, then the button is activated. A sound file can be selected if one clicks on this button. The name of the selected file is displayed in the text field which is located in the middle of the string.

End of point, **End** and **Error** strings are similar and correspond to the end of the measurement of one kinetics point, the end of the measurement and the measurement error, respectively.

The sound that is defined by the **Ring** string is used upon the pumps control.

3.4.5 AdvancedOptions

Advanced



The **Advanced** page in the **Options** window contains the following control elements:

The **Optics** panel is intended for instrument optical part options setup and contains the following elements:

Prism type – specifies the type of the used prism.

Immers. Refr. Index – specifies the refractive index of the immersion.

Glass Refr. Index – specifies the refractive index of the material of the glass of the sensitive chip with a gold layer.

The program contains the database which contains the following preset parameters:

- four prism types with correspondent refractive indices and working angles,
- two refractive indices of immersion,
- two refractive indices of glass.

If user introduces new values of refractive indices of the immersion or the glass material, these values are added to the database. It is possible to add 3 values of each parameter in such a way. The

prism types are predefined and cannot be changed by user.

If user has changed some parameters in this page, then on closing the window by pressing the **"Ok"** button the program calculates and displays the utmost attainable angle of incidence of light from glass onto the active layer.

The **Subsidiary** panel contains control elements for subsidiary channel:

Independence Period, s – allows specifying the measurement period for subsidiary channel.

Averaging – switches on/off the measurements averaging mode.

Number of points – specifies the number of points that are averaged when the **Averaging** is turned on.

Pedestal, V and **Amplification** control elements are intended for setup of amplification factor and position of the base line for the subsidiary channel (see Subsidiary channel calibration).

Legend – controls the representation of the kinetic curve series marking table that is to the right of the plots.

The **Device** panel contains the following elements:

PC port – specifies PC COM port which the instrument is connected to. If this option is set to **Auto**, then the program will try to determine the port automatically.

Position control – switches on/off the mode of programmatic tracking of allowable position of mechanical system of the instrument. It is not recommended to turn on this option.

Data repair automatically – activates (when the flag *is set*) or deactivates (when the flag *is not set*) the procedure of automatic repair of the data that program receives from the instrument. It is not recommended to turn off this option.

Laser control – activates/deactivates the automatic accounting of laser radiation instability.

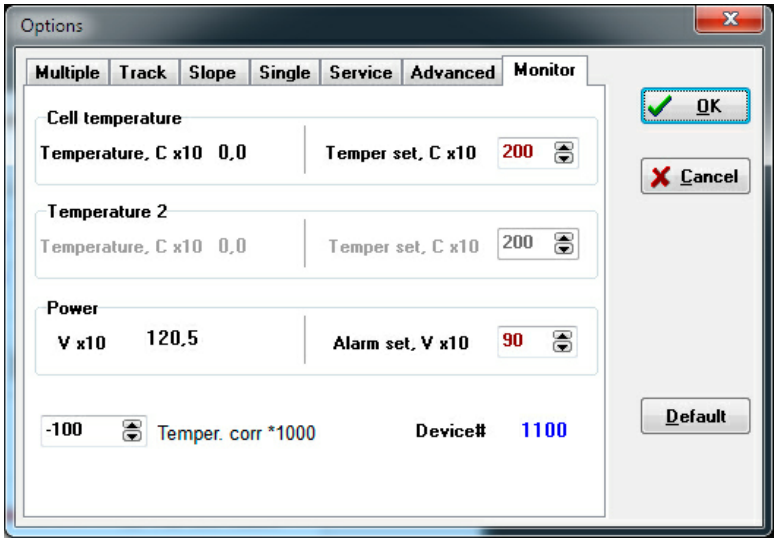
Half step - the mode is used in some device modifications to increase the accuracy of measurements.

Modulation Off - must be selected!

Full files names – when this element is selected, full name (including path) of the file, which data were loaded from, will be displayed in the windows captions.

3.4.6 MonitorOptions

Monitor options



The **Monitor** page in the **Options** window contains 3 panels with control elements:

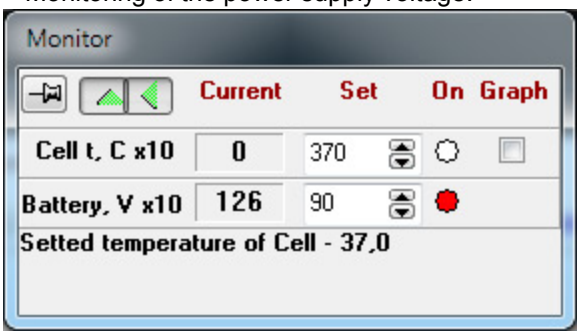
The **Cell temperature, C x10** panel contains elements for indication of the measured temperature (at the left) and for specifying the cell temperature (at the right).
The **Temperature, C x10** panel contains elements for indication of the measured temperature (at the left) and for specifying the laser temperature (at the right). This panel is not used in the current device model.
The **Power** panel contains elements for indication of the power supply voltage (at the left) and for specifying the limiting power supply voltage **Alarm set** at which the power supply emergency warning is displayed (at the right).

The **Temper.corr.*1000** element, which allows inputting the cell temperature measurement system correction, is located in the bottom left part.
The instrument serial number is displayed in the bottom right part for reference.

3.5 Monitoring

Monitoring and stabilization of the temperature

The following additional possibilities can be provided in the device:
- Monitoring and stabilization of the cell temperature.
- Additional monitoring channel and stabilization of the laser temperature.
- Monitoring of the power supply voltage.



Switching of the monitoring mode on is indicated by periodical red coloring of buttons/indicators in the "On" column of the window.
When you select the **Graph** element, an additional window will open, in which the graph of

temperature changes will be displayed.

The monitoring mode is switched on upon calling the Monitor window that can be called from the main menu: **Tools/Monitor** or by pressing the corresponding button in the main window. At this the **Monitor** window is called.
When the monitoring mode is on, the periodical measurements of the power supply voltage and the temperature of the cell and the additional temperature channel are carried out and the measured values are displayed in the **Monitor** window. A power supply emergency warning window is displayed upon the power voltage decrease to the previously specified value.

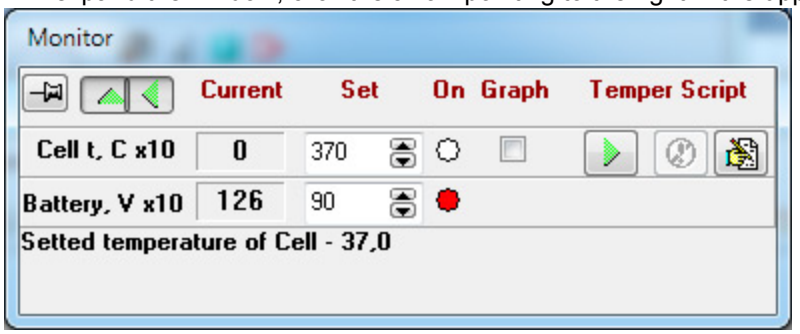
The cell temperature stabilization is possible only if the special cell with built-in heater and thermometer is used. Temperature stabilization occurs by means of cell warming so the stabilizable temperature cannot be lower than the ambient temperature.
It is possible to switch the temperature stabilization of the cell and/or additional temperature channel on/off from the **Monitor** window by clicking on the corresponding button/indicator located in the "On" column. If the button has red color, then the stabilization mode is turned on.

It is possible to specify the stabilization temperatures and power monitoring actuation level using elements located in the “Set” column only when the device is not engaged in SPR measurements.

3.5.1 Temper programming

Temper programming

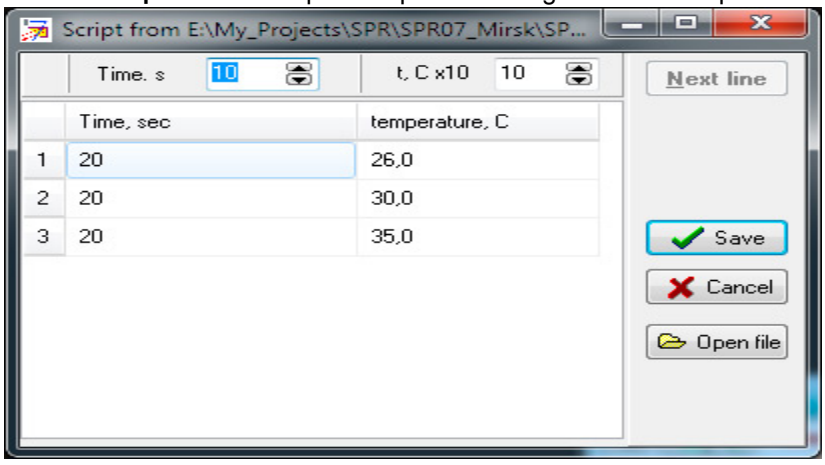
The sample temperature can be controlled according to the script specified in the Monitor window. To expand the window, click the arrow pointing to the right in the upper left corner of the window..



There is a button that opens the pumps programming panels in the top right corner of this window. These panels contain 3 buttons each:

- “**Run script”** – switches on the operation according to the program.
- **“Stop script”** – stops the operation according to the program.
- **“New/Edit script”** – allows developing or editing the program.

The **Edit script** window is opened upon switching on the development/editing mode.



3.6 Restart

Restart

Sets the instrument mechanical system to its initial position. This operation is performed automatically each time on starting the program and before the beginning of the measurements in

any mode. It can be repeated using the **Restart** command at any time when the instrument is not carrying out the measurement. It is recommended to execute this operation if the fault in the mechanical system of the instrument is suspected.

Note: In some versions the Restart operation is available and can be executed in the Multiple measurement and Track modes also.

3.7 Device information

Device information

It is possible to receive information about the available prisms and the device number from the **Options/Set Options/Advanced** Menu.

Upon this the **Advanced** page in the **Options** window allows:

- choosing the working prism from the suggested list and, if necessary, introducing corrections for its parameters,
- choosing (or introducing) information about the immersion liquid and the substrate glass.

The **Monitor** page in the **Options** window allows finding out your device number.

If there is a theoretical limitation on the maximum angle of incidence of light on the active layer with the introduced parameters, you will receive its value on closing the **Options** window.

3.8 ComandLine

Command line

- One parameter can be specified in the command line of the program call.

The program accepts two types of the parameter:

1. If the command line parameter represents a file name that has the **.SP11** or **.SP21** extension, then the program will open this file in the same way as in the Open file mode.
2. On starting the program, it detects the instrument and checks some instrument parameters. If the instrument is not detected, the error messages are displayed. If the “debug” command line parameter is stated, the program will be executed in a special mode, which allows operation without the instrument with some limitations.

3.9 Close

Close

To finish the work with the instrument, press the **Save&Exit** button, select the main menu **File/ Save&Exit** item or press the **F4** key in the keyboard.

The system will request:

- “Save SPR2?” if the SPR2 window was opened but was not saved;
- “Delete AutoConserved files?” if the Automatic data saving mode was switched on;
- “Save SPR1?” and then close the program.

The program can be also closed by pressing the system close button in the top right corner of the window; in this case no data saving request will be displayed and certain option settings which were defined during the operation will not be stored.

4 Working with experimental data

Working with experimental data

- Data processing
- Data presentation
- Data saving
- Data files format
- Open File
- Viewing the automatically saved files

4.1 Data processing

Data processing

This instrument is constructed according to the Kretschmann's configuration with measurement of intensity of light reflected from the sample. Angular distribution of intensity of the reflected light is determined during the mechanical rotation of the measuring prism. Precision mechanical system and built-in fine position determining system allow determining absolute angles of incidence of light.

The following information is used during the calculation of absolute angles of incidence:

- The results of angular positioning of the system with respect to the inner reference point (**Zero position**), which is carried out on the Calibration command.
- Prism parameters specified by user in the **Advanced** page of the **Options** window (see Device information).
- Correction of absolute angular position of the inner reference point definition defined by the instrument manufacturer and stored in the Devicedat.dat file.

The angles are recalculated directly in the course of measurements and used for plotting the curves. The following information is used depending on the options setting:
turning angles of the prism table, if the **Relative angle** mode is set;
angles of incidence of light on the front prism face in the **Absolute Angle in Air** mode;
angles of incidence of light on the top prism face in the **Absolute Angle in Glass** mode.

The same angles will be saved in the data file created on Save file command or during the files autosave.

Data processing is executed both immediately during the device operation and when processing obtained results.

During the device operation the following information processing is executed.

The kinetics is determined as the change in the angular position of the minimum of the SPR curve during the kinetics measurements in the Multiple measurement mode. Several methods are used to determine the angular position of the minimum:

Absolute minimum – position of the minimum is calculated as the angular position of the absolute minimum of the SPR curve. This method is the most reliable and stable, but not very precise.

Parabolic approximation – the SPR curve is approximated to the second-order polynomial and the minimum of this polynomial is calculated. This is the most advanced method; it is characterized by the lowest noise of the kinetics curve. This method is defined as default.

Average value – position of the minimum is calculated as the mean value of the centres of several line segments which connect two points that are located at grade on different slopes of the

SPR curve. These points are chosen in the vicinity of the minimum.

Cubical approximation – the SPR curve is approximated to the third-order polynomial and the minimum of this polynomial is calculated. Unfortunately, calculation errors may be sometimes observed when using this method of the minimum determination.

Some versions of the program also use such a method for the determination of the SPR curve minimum as **Center of Mass**. Stability of this method is also lower than of Parabolic approximation method.

Note: The latter 2 methods are implemented in some program versions only.

Angular position of the SPR curve minimum can be converted to the equivalent value of refractive index of the medium under investigation during the measurement of absolute angles. Virtually, this is simply another kinetics representation mode. Representation modes can be controlled via the Pop-up_menu of the SPR2 window.

During the kinetics measurement in the Slope mode the kinetics is determined as a change of a signal due to the SPR curve shift when the device mechanical system is fixed. The kinetic curve can be plotted either as a direct signals change (with or without taking into account the SPR curve steepness in the measurement point) or as a result of conversion of a signals value to the equivalent value of the SPR curve minimum shift. Kinetics representation modes, which are described in the previous paragraph, are available in the latter case. The kinetics presentation method can be controlled via thePop-up_menu of the SPR2 window and by the elements on the **Slope** panel in the Options window.

One method of the SPR curve processing is provided.

Averaging – the SPR curve averaging. After switching this mode on, it is possible to define the number of averaged points **n**. The averaging is made immediately during the measurement and all subsequent operations (such as minimum search, saving data to file etc.) are executed with the averaged values. Thus number of points of the SPR curve is reduced by a factor of **n**. This mode is available during the single-channel instrument operation only.

Two methods of the kinetics curve processing are provided.

Peak-filter – allows filtrating sizeable single-point peaks on the kinetics curve.

Averaging – switches on/off the data averaging mode.

Averaging Time, s – defines the time interval of the measurement during which the obtained points are averaged. In any case the averaging is executed using the “running window” method.

Switching of the modes on is indicated in the Status bar in the main window and it can be changed via the Status bar.

The subsequent information processing includes the following possibilities.

Service possibilities, which are provided for the data in the **SPR2** window, are described below. These possibilities can be turned on by selecting the corresponding **Tools** submenu item in the Pop-up_menu of the **SPR2** window. Only one possibility can be turned on at the same time. The results are depicted in two panels located in the bottom left corner of the window. All results are presented in the same units the plot is represented in.

1) If the **Coordinate** element is selected, the mouse pointer coordinates determination takes place while the mouse pointer moves over the plot.
2) If the **Distance** element is selected, the distance between two sequentially specified plot points is determined. The distances along the X and Y coordinates are determined separately.
3) If the **Delta Y Line** element is selected, an **Assign first point.** prompt appears in the top left corner of the main window. Following the prompt, it is neccesary to press the left mouse button and place the arisen dotted horizontal line at the selected level on the plot. An **Assign second point.**

prompt will appear. Following this prompt, it is neccesary to specify the second level in the same way as the first. The result will contain the distance between the marked levels along the Y coordinate.

4) If the **Delta Y Region** element is selected, the distance between the average values of the points which are included in two selected regions is determined. Each region is defined by two outermost points which are specified by user following the **Assign first point.**, **Assign second point.**, **Assign third point.** and **Assign fourth point.** prompts correspondingly.
5) If the **Gradient** element is selected, the curve gradient between two points, which are specified following the **Assign first point.** and **Assign second point.** prompts correspondingly, is determined.

Three service possibilities are provided for the data in the **Subsidiary** window. These possibilities can be turned on by selecting the corresponding **Tools** submenu item in the of the **Subsidiary** window.

1) If the **Coordinate** element is selected, the Pop-up_menu mouse pointer coordinates determination takes place while the mouse pointer moves over the plot.
2) If the **Distance** element is selected, the distance between two sequentially specified plot points is determined. The distances along the X and Y coordinates are determined separately.
3) If the **Gradient** element is selected, the curve gradient between two points, which are specified following the **Assign first point.** and **Assign second point.** prompts correspondingly, is determined.

4.2 Data presentation

Data presentation

Presentation of the data measured or opened from the files takes place in five types of **windows**, entitled as ***SPR1***, ***SPR2***, ***Subsidiary***, ***Notes*** and ***View***. Many windows of the ***SPR1***, ***SPR2*** and ***Subsidiary*** type can be opened simultaneously, but only one window of each type contains data which can be processed. Window arrangement can be controlled via the main menu or via the pop-up menus of these windows themselves. Only one instance of the ***Notes*** and ***View*** windows can exist.

The SPR1 window opens in all measurement modes except the stand-alone operation with the subsidiary channel. It is intended for direct display of the SPR curves being measured.

The SPR2 window opens in all measurement modes except the Single measurement mode and stand-alone operation with the subsidiary channel. It is intended for presentation of kinetics of the processes.

The Subsidiary window opens when the Subsidiary mode is switched on. It is intended for displaying the signal in the subsidiary measurement channel.

The Notes window is intended for the text user's comments to the measurement process.

The View window is intended for simultaneous representation of several previously obtained kinetic curves.

The Monitor window is intended for representation of measured cell and laser temperatures and source voltage.

The **Timer window** is opened as a separate window if one makes a mouse double-click on the timer indication in the top right corner of the **SPR2** window. If one makes a mouse double-click on the timer window field, the window will disappear and timer indication will return to the **SPR2** window.

Information displayed in the ***SPR1***, ***SPR2*** and ***Subsidiary*** windows can be saved to file in text and graphic formats (see Data saving). Additionally, the window can be copied to clipboard (Copy Clipboard) or printed (Print graphics).
Information contained in the ***Subsidiary*** and ***Notes*** windows is saved automatically when saving information displayed in the *SPR2* window in any text format.
Information displayed in the ***View*** windows can be saved to file in graphic format ***.bmp** or ***.wmf**, copied to clipboard or printed.

The ***SPR1***, ***SPR2***, ***Subsidiary***, ***View*** and ***Notes*** windows can display the information previously saved in the text format (see Open file and Command Line).

4.2.1 SPR1 window

SPR1 window

Windows of this type open automatically when it is necessary.

The **SPR1 window** is used in all measurement modes except the stand-alone operation with the subsidiary channel. It is intended for presentation of directly measured SPR curves. If the **SPR1 in New Windows** mode is selected (this mode can be selected via the Pop-up_menu or main menu), then each new curve is plotted in a separate window. The curve number is displayed in the window title. Otherwise, all curves are plotted in the same window. In this case the **Auto Clear SPR1** mode can be switched on, then not more than 16 last curves will be shown simultaneously in the window.
Data plots read from the file are always displayed in a separate window.

On the OX axis the angle, degrees is laid off:
with the **Absolute angle** mode off – the prism turning angle,
with the **Absolute angle** mode on – the angle of incidence of light on the front face of the prism when the **in Air** mode is selected, or the angle of incidence of light on the top face of the prism when the **in Glass** mode is selected. These modes can be set via the Status bar, in the dialog box brought up by pressing the “Set Options” button or from the menu (see Data processing).
Signal magnitudes measured in the enabled channels are laid off along the OY axis in arbitrary units.

In this window the measured SPR curves are plotted and positions of their minima are displayed if they have been found successfully. The minimum of the curve that corresponds to the first channel is displayed in red color, and the minimum of the curve that corresponds to the second channel is displayed in blue color.
If the flag of the **SPR1 legend** element in the Pop-up_menu is set, then the table with curves marks is displayed to the right of the plots.
The initially specified plot scale can be changed:
- Mark the rectangle with the left mouse button pressed and then release the mouse button. If the rectangle is marked starting from its top left corner, then its contents will “stretch out” into the whole window. This operation can be repeated for many times. If the rectangle is marked starting from any other corner, then the plot will restore its initially specified scale.
- With the right mouse button pressed, the plot can be “dragged” in the window to represent different segments of the curves.

With the cursor positioned within the window, the Pop-up_menu can be brought up by pressing the right mouse button. This menu contains control elements for the main functions of the window.
The window can be also controlled via the main menu and the Set options window.

In the right top corner of the window the following information is displayed:
- The value of the last angle calibration;
- The last value that corresponds to the minimum of the curve measured in the first channel. It is displayed in red color;
- The last value that corresponds to the minimum of the curve measured in the second channel (for a two-channel device) and the number of the measured point (when the kinetics measurement is carried out). It is displayed in blue color.

The contents of the **SPR1** windows can be saved to file in both text and graphic formats (see Data saving). Additionally, the window can be copied to clipboard (Copy Clipboard) or printed (Print graphics).

4.2.1.1 ClearSPR1

Clearing the SPR1 window

The SPR1 window can operate in two modes: 1) all measured curves are plotted in the same window or 2) a new window is opened for every curve. Representation mode can be switched via the Pop-up_menu (**SPR1 in New Window**) or via the main menu (**Window/SPR1 in New Window**). Window clearing is intended for removing the old curves when operating in the 1 mode.

If the **Auto Clear SPR1** mode is switched off when operating in the 1 mode, then all measured curves are plotted in the SPR1 window. If the clearing mode is switched on, then not more than 16 lately measured curves will be displayed in the window.

4.2.2 SPR2 window

SPR2 window

Windows of this type open automatically when it is necessary.

The **SPR2 window** is used in all measurement modes except the Single measurement mode and stand-alone operation with the subsidiary channel. It is intended for presentation of kinetic plots of the process under study.

Plots displayed in this window represent the kinetics of the angular position of the SPR curves minima (in the Multiple measurement modes) or the signal magnitudes measured in the enabled channels (in the Slope mode). For the two-channel instrument all information related to the first and to the second channel is displayed in red and blue color, respectively.

It is possible to operate in the mode when the difference of the signals measured in the first and the second channels is displayed. Switching of the presentation modes can be made from the Pop-up_menu.

With the cursor positioned within the window, the Pop-up_menu can be brought up by pressing the right mouse button. This menu contains control elements for the main functions of the window.

The window can be also controlled via the main menu and the Set options window.

The horizontal scale (time scale) is set automatically.

The vertical scale is initially set equal to the horizontal scale of the SPR1 window (in the Multiple and Track modes) and the vertical scale of the SPR1 window in the Slope mode. In the course of the measurements vertical scale of the window can be changed in the following way:
- Switch the **Full Graphic** mode to the **Link Graphics** mode. This can be done via the Pop-up_menu or via the status bar.

- Change the SPR1 window scale to zoom into the region of interest. The SPR2 window scale will be changed automatically.
- Switch the set **Link Graphics** mode to the **Fix Left Axis** mode. The chosen vertical scale will be fixed.

The specified plot scale can be changed for the convenience of the work with plot:
- Mark the rectangle with the left mouse button pressed and then release the mouse button. If the rectangle is marked starting from its top left corner, then its contents will “stretch out” into the whole window. This operation can be repeated for many times. If the rectangle is marked starting from any other corner, then the plot will restore its initial scale.
- With the right mouse button pressed, the plot can be “dragged” in the window to represent different segments of the curves.

The scaling operations can be performed directly in the course of measurements. Nevertheless, it is more correct to make them after the measurements are completed or interrupted by the Pause mode.

In the right top corner of the window the following information is displayed:
- Current timer value. Clicking on the timer twice brings up a separate timer window, which can be dragged to any desirable position in the screen. To hide this window, click on it twice.
- The measurement time for the last data point.
- The slope constant of the curve measured in the first channel.
- The slope constant of the curve measured in the second channel (for a two-channel instrument).

It is possible to switch the curve points markers and the curve marking table (legend) on/off from the Pop-up_menu.

The following determination service possibilities are provided for processing of the data that are represented in the window:
- Mouse pointer coordinates determination.
- Determination of the distance between two points along the X and Y coordinates.
- Determination of the distances along the Y coordinates.
- Curve gradient determination.

These service possibilities are available from the Pop-up_menu. Operation results are displayed in two panels located in the bottom left corner of the window.
Service possibilities are more fully described in the Data processing section.

The contents of the **SPR2** windows can be saved to file in both text and graphic formats (see Data saving). Additionally, the window can be copied to clipboard (Copy Clipboard) or printed (Print graphics).

4.2.3 Subsidiary window

Subsidiary window

Windows of this type can be opened by pressing the **Subsidiary Channel** button in the main window.

The **Subsidiary window** is intended for displaying the signal measured in the subsidiary measurement channel.
It is possible to work with subsidiary channel only if this channel is enabled. Information displayed in this window can be saved to file in graphic format and is always saved automatically when saving information displayed in the **SPR2** window to file in text format (see Data saving). The window can be also copied to clipboard (Copy Clipboard) or printed (Print graphics).

The initially specified plot scale can be changed:
- Mark the rectangle with the left mouse button pressed and then release the mouse button. If the rectangle is marked starting from its top left corner, then its contents will “stretch out” into the whole window. This operation can be repeated for many times. If the rectangle is marked starting from any other corner, then the plot will restore its initially specified scale.
- With the right mouse button pressed, the plot can be “dragged” in the window to represent different segments of the curves.

All scaling operations can be performed directly in the course of measurements. Nevertheless, it is more correct to make them after the measurements are completed or interrupted by the Pause mode.

It is possible to switch the curve points markers and the curve marking table (legend) on/off from the Pop-up_menu.

The following determination service possibilities are provided for processing of the data that are represented in the window:
- Mouse pointer coordinates determination.
- Curve gradient determination.

These service possibilities are available from the Pop-up_menu. Operation results are displayed in two panels located in the bottom left corner of the window.
Service possibilities are more fully described in the Data processing section.

For more detailed information about this window and the subsidiary channel see Subsidiary Channel section.

Information displayed in this window is saved automatically when saving information displayed in the **SPR2** window to file in text format (see Data saving).
The **Subsidiary** windows can display the information previously saved in the text format (see Open file and Command Line).

4.2.4 Notes window

Notes window

Windows of this type can be opened from the main menu: **Window/Notes.**

The **Notes window** is intended for typing any user’s text comments to the measurement process.
Additionally, the following information is put into the window as a separate line:
- Current date and time upon the mouse click on the date or time representation fields in the **Notes** window;
- Results of service measurements (distance between two points, distance along the Y coordinates, curve gradient) in the SPR2 window upon the mouse click on this results representation fields in the **SPR2** window;
- Current experiment time upon the mouse click on the current time timer.

Information displayed in this window is saved automatically when saving information displayed in the **SPR2** window to file (see Data saving).
The **Notes** windows can display the information previously saved in text format (see Open file and Command Line).

4.2.5 View window

View window

 This window can be opened from the main menu: **Window/View**.

The **View window** is intended for simultaneous representation of many previously obtained results. This window can represent either SPR curves or kinetic curves. Type of the curves represented is defined by the type of the curve which was loaded first in the window.
The curves for representation can be read from previously saved ***.sp11 and *.sp21** files.

The time axis scale of the image is selected automatically according to the most long-duration kinetic curve loaded when representing kinetic curves. The OY axis scale is selected depending on the **Axis Auto** option, which can be set upon clicking the right mouse button in the pop-up menu of the **View** window. If this option is set, the scale is selected automatically in such a way that all displayed information is visible. Otherwise, the maximal value is set equal to the maximal OY scale value of all kinetic curves loaded, and minimal value is set equal to the minimal OY scale value of all kinetic curves loaded.

The initially specified curves scale can be changed:
- Mark the rectangle with the left mouse button pressed and then release the mouse button. If the rectangle is marked starting from its top left corner, then its contents will “stretch out” into the whole window. This operation can be repeated for many times. If the rectangle is marked starting from any other corner, then the plot will restore its initially specified scale.
- With the right mouse button pressed, the plot can be “dragged” in the window to represent different segments of the curves.

The contents of this window can be saved to file in graphic format ***.bmp, *.emf** or ***.wmf**, copied to clipboard or printed. To do this, select **Save file**, **Copy clipboard** or **Print** items in the pop-up menu of the window, correspondingly.

It is possible to close the **View** window using the pop-up menu only by selecting the **Delete Window** item.

4.2.6 Monitor window

Monitor window

 This window can be opened from the main menu: **Tools/Monitor.**

The **Monitor window** is intended for:
- displaying and specifying the cell temperature.
- displaying and specifying the temperature of the additional channel of the laser temperature stabilization.
- displaying the current and specifying the limiting power supply voltage.

Note: If the power voltage decreases to the limiting value, device operation will be blocked and the window with corresponding warning will be displayed.

The page contains 3 strings:
The **Cell t, C x10** string contains elements corresponding to the cell temperature: elements that indicate measured (at the left) and specified (at the right) temperature and an indicator button for switching the temperature stabilization mode on/off.
The **Temp2, C** x10 string is similar to the previous string but it corresponds to the laser temperature.

This string is not used in the current device model.

The **Battery, V x10** string contains elements for displaying the power supply voltage (at the left) and specifying the power supply voltage at which the power supply emergency warning window is displayed (at the right).

4.3 Data saving

Data saving

- Save file – save data to a file of prescribed type.
- Automatic data saving in the Multiple measurement mode.
- Copy to Clipboard.
- Print graphics.
- Data files format – text files format.

4.3.1 Save as

Save File

Data saving to a file.

To save data, press the **Save** button in the main window or select the **Save** command from the main menu or from the pop-up menu of any window.

If this command is sent from the main menu or using the button in the main window, then the program will suggest to save data in the currently active window (the active window is indicated by color); if this command is sent from the Pop-up_menu, then the program will save data contained in that window which pop-up menu the command has been sent from.

After sending the command the program requests the file name and opens it for writing. The file format is determined by the file name extension the user has defined in response on the system request.

Information from the **SPR1**, **SPR2** and **Subsidiary** windows can be saved in text (***.sp11** or ***.sp21**) or graphic format (*.bmp, ***.emf** or ***.wmf**). Information from the **View** window can be saved in graphic format only (*.bmp, ***.emf** or ***.wmf**).

Note: Data stored in the **SPR2** and **Subsidiary** windows are saved simultaneously in the same file. Information contained in the **Notes** window is stored in a separate file, which is saved simultaneously with the **SPR2** window.

It is recommended to keep all data files in the “Data” folder, which is created automatically during installation of the program.

Data saved in the text format can be read using the Open file command or on starting the application using the Command line. Previously saved files can be also loaded into the View review window.

For more detailed information about ***.SP11** and ***.SP21** file formats see Data files format.

Note: If some files were not saved, then the program will suggest saving them on exit.

4.3.2 Auto Save

Automatic data saving

Automatic data saving mode is intended for automatic saving of SPR and kinetic curves to text files in the ***.sp11** and ***.sp21** formats, correspondingly. Automatic data saving of SPR curves is available only in the Multiple measurement mode while automatic saving of kinetic curves is available in any kinetics measurement mode.

To switch the automatic data saving mode on/off, select the options setting mode (Set Options) from the **Options** menu and select the **Multiple** or **Slope** page.

For automatic saving of SPR curves, mark the **SPR1** element. If this mode is set, then after beginning of the measurement in the Multiple measurement mode a dialog window **AutoSave data as text** is opened. It is possible to select or introduce the base file name in this window. After the measurement of each SPR curve, the program will save data to the file with a name, received by addition of the file number to the base name.

If the automatic data saving mode is enabled, the AutoSave button  in the main window becomes available. This button can be used for on the fly switching this mode on/off in the course of the measurements.

After each file is saved, its name appears in the rightmost field of the Status bar.

By default this mode is disabled, and can be enabled as described above or by opening the ***.SP2** file previously saved with the enabled automatic data saving mode.

Note: Up to 999 files can be saved in this way. In case of need to save more data files, switch the automatic data saving mode off, switch it on again and introduce another base file name.

For automatic saving of kinetic curves mark the **SPR2** element. Switching on this mode activates the **Period, min** element that allows specifying the period of autosaving for SPR2 and Subsidiary windows data. Default file name for saving the kinetics data is **"SPR2.sp21"**. To change the file name, press the **File** button and introduce a new name.

After each file is saved, its name appears in the rightmost field of the Status bar.

The state of the SPR2 autosaving mode is stored when you exit the program and is used as a default setting at the next program starting.

4.3.3 Copy Clipboard

Copy Clipboard

Copying the data from the **SPR1**, **SPR2**, **View** or **Subsidiary** window into the system Clipboard for further use in other applications.

If this command is sent using the Button or from the main Menu, the data displayed in the currently active window will be copied to Clipboard. The active window is indicated by the change of its color.

If this command is sent from the Pop-up_menu, the data displayed in the window, which pop-up menu the command has been sent from, will be copied to Clipboard.

4.3.4 Print graphic

Print graphics

Copying the plot displayed in the **SPR1**, **SPR2**, **View** or **Subsidiary** window to the printer.

If this command is sent using the Button or from the main Menu, the data displayed in the currently active window will be printed out. The active window is indicated by the change of its color.

If this command is sent from the Pop-up_menu, the data displayed in the window, which pop-up menu the command has been sent from, will be printed out.

4.4 Data files format

Data files format

Experimental data can be saved to files in the ***.sp11**, ***.sp21**, ***.bmp, *.emf** and ***.wmf** formats.

The ***.sp11** and ***.sp21** files are text files. Data, corresponding to the **SPR1** window, are saved to ***.sp11** files, and data, corresponding to the **SPR2** window, are saved to ***.sp21** files.

The ***.SP11** file has the following format:

The first string contains the following service information: window name (spr11), number of the points, initial and final OX axis values (in angular minutes), initial and final OY axis values (in mV), information about the coordinates, which the data and correction value (in angular minutes) are recorded in.

Information about the coordinates, which the data is recorded in, can have the following values: **degree** or **a.m.** – information is recorded in the relative angles; **deg.(air)** or **a.m.(air)** – absolute values of angles of incidence of light on the prism; **deg.(glass)** or **a.m.(glass)** – absolute values of angles of departure of light from the prism.

The second string consists of the headers of data columns located below.

In the first data column angle values are recorded in tens of angular seconds (e.g. 120 means 1200 angular seconds or 20 angular minutes), in the rest of the columns signal values in the enabled channels are recorded in relative units. If the column is filled with zeros, the channel corresponding to this column is disabled.

The ***.SP21** file has the following format:

The first string contains the following service information: window name (spr21 or spr31), number of the points, initial and final OX axis values, initial and final OY axis values, information about the coordinates, which the information is recorded in.

Information about the coordinates, which the information is recorded in, can have the same values as for the ***SPR1*** window (see above).

The second string consists of the headers of data columns located below.

In the Multiple measurement mode time in seconds is recorded in the first column, angle corresponding to the minimum of the 1 channel in tens of angular seconds is recorded in the second column, angle corresponding to the minimum of the 2 channel in tens of angular seconds is recorded in the third column, subsidiary external channel data is recorded in the fourth column.

In the Slope mode in the first column time is recorded in seconds, if the measurement delay exceeds 1

second (**Period, s** exceeds 1); otherwise, time is recorded in 0.1 s. Signal values in the 1 and 2 channels are recorded in the second and third columns, respectively, and subsidiary channel data is recorded in the fourth column.

The ***Subsidiary*** window data are saved simultaneously with data contained in the **SPR2** window in the same file.

The ***Notes*** window data are saved simultaneously with data contained in the **SPR2** window in a separate file, which has the same name as the **SPR2** data file but with the ***.txt** extension.

4.5 Open files

Open File

Reading data files, previously saved (see Save file) in the text format (***.SP11** or ***.SP21**).

When this command is sent, the program requests a file name, opens corresponding windows for the selected file and loads the data from the file in these windows. Working with these data has no difference from working with the experimentally obtained data (see Data presentation).

It is possible to load data files in different ways. If the View window is opened, then the files are loaded into this window. If this window is not opened, then the file is loaded into the SPR1 or the SPR2 window depending on the file type.

The following actions are carried out additionally when loading the SPR2 data file:

- search for the **Subsidiary** window information in the file. When such information is found, then this window is opened.
- search for the file with **Notes** window information. When such file is found, then this window is opened.

If the Multiple measurement mode has been operated with the Automatic data saving mode switched on, then autosaved SPR curve files can be also viewed (see Viewing the automatically saved files).

4.6 Open automatically saved files

Viewing the automatically saved files

Reading data files, previously saved automatically in the Automatic data saving mode.

If the Multiple measurement mode has been operated with the **Automatic data saving** mode switched on, then autosaved SPR curve files can be also viewed. To do this, proceed as follows:

- Use the Open file command to open the file containing the kinetics data (SPR2). The SPR2 window that contains the kinetics plot will be opened.
- Switch on the **SPR2 Marks** mode from the pop-up menu of the SPR2 window if it has not been set.
- With the CTRL keyboard key pressed, click on the point of interest on the kinetics curve with

the left mouse button. If the SPR curve file that corresponds to this point is found, the SPR1 window will open and this file will be loaded in this window. If the file is not found, the program will display a corresponding warning message.

Alternatively, the automatically saved SPR curve files can be viewed as usual files.

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