

Section 4. Working With Graphs

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This section describes working with charts, instruments, and methods of technical analysis.

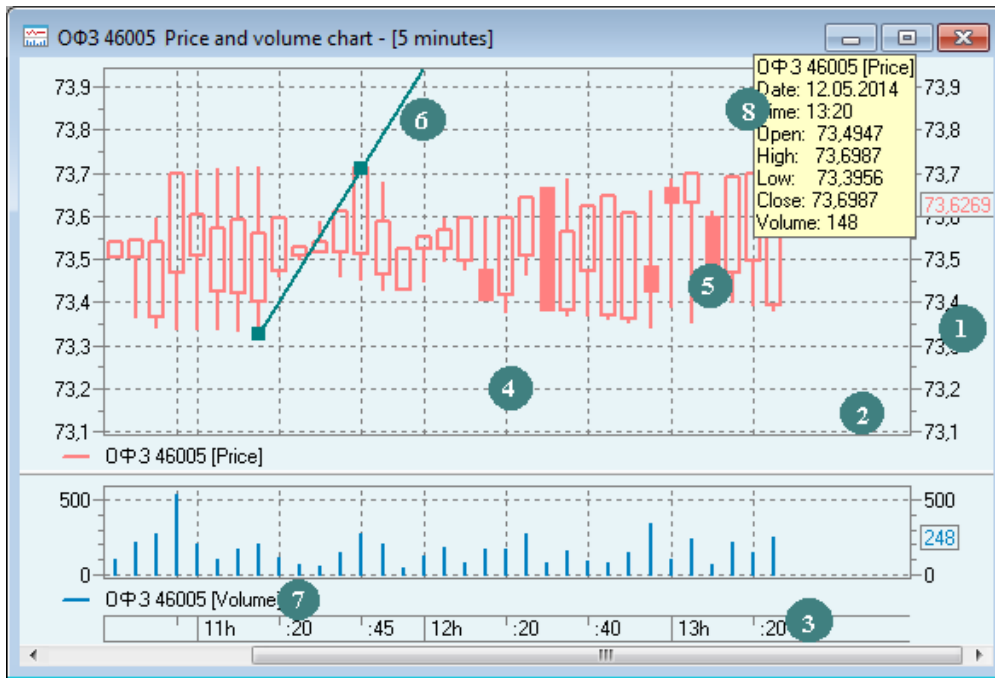
4.1 The Graphs Window

menu **Data export / Charts / New chart...** or button 

The Charts window is designed for graphical representation of changes in indices during a trading session.

4.1.1 Window Format

The program window in which graphs are drawn is named a chart and looks as follows:



The graph window allows for the application of the linked windows mode (for further details, see sub-section 2.7 of Section 2: Basic Operating Principles).

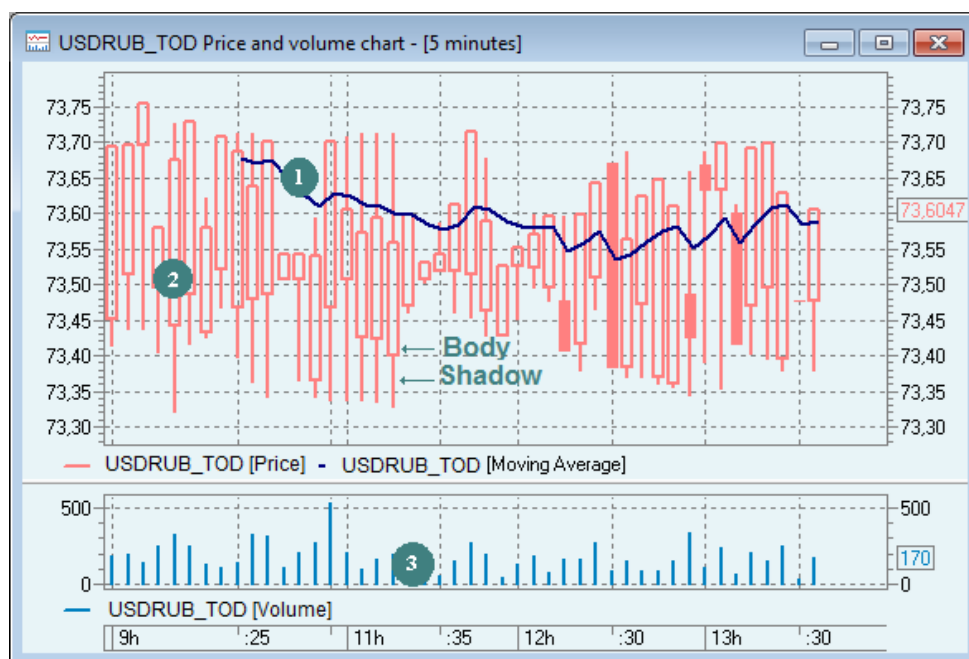
Diagram elements:

- 1. The chart window.** A chart can be separated vertically into several windows that have the same time scale. You can create graphs of different parameters in different windows (for example, display Last trade price changes in one window and Last traded volume changes in another window). The window's proportions can be changed by moving the separator between windows. A single chart can include up to 15 windows.
- 2. The plotting area.** The area within the window where graphs are displayed.
- 3. Scale.** The plotting area includes reference axes: the horizontal time scale and the vertical (left and right) scales that represent the range of values of the chart variables. The vertical scale of the left and right axes can be different for convenient display of graphs of different variables in one window.
- 4. Grid.** The grid divides the plotting area into equal intervals both horizontally and vertically. The grid step is equal to the step of the relevant scale.
- 5. Graph.** The graph displays the value of the parameter as function of time. There are different types of graphs provided for different parameters. One chart may include up to 15 charts.
- 6. Trend.** A line that indicates a general direction in which the parameter changes.
- 7. Legend.** The graph caption that defines the correspondence between lines in a chart and the parameters.
- 8. Tooltip.** The pop-up window with numerical data for a particular segment of a graph. Appears when the cursor hovers over a graph.

4.1.2 Chart types

Depending on time:

1. **Tick.** A new segment is drawn every time the parameter is changed. For example, for the Prices graph, every time a trade is completed.
2. **Interval.** A new segment of a graph is drawn at equal time intervals. Current variations of a parameter are displayed through changing of the graph's last segment appropriately.



Depending on line types:


1. A **Line chart** is a graph in the form of a broken line in which data points represent the parameter values at particular points in time or the last parameter value within the time interval (for interval graphs).
 2. A **Candlesticks chart** is a 'Japanese candlestick' chart. It is used to display trade prices. Each graph segment represents a special element (candlestick) with the following meaning:
 - **Body** of a candlestick is a rectangle that depicts price change between the beginning of a period (the opening price) and the end of that period (the closing price). If a candlestick is coloured, this means that the trade price has decreased, if not, the trade price has increased;
 - **Shadow** or **Candlewick** is a thin line that indicates the range of trade price fluctuations over a period of time. The upper end of the line shows the highest trade price, the lower end shows the lowest price.
1. **The edges of a candlestick's body and the shadow may coincide. For example, if a colored candlestick has no upper shadow, this means that the opening price matched the highest trade price within this time period.**

- 2. When several charts are displayed in the same plotting area, charts are shifted by 1-2 pixels horizontally relative to each other to avoid overlapping of 'candlewicks' of different graphs.**

- 3.** A Histogram is a graph consisting of columns. It is used to display trade volumes. The column's height indicates the trade volumes within a period of time.
- 4.** A Bar chart, also called a linear graph, is a graph consisting of bars. Each element of the graph is a vertical segment whose ends correspond to the maximum and minimum price values for a time period. Two short horizontal lines indicate the opening price (to the left of the vertical segment) and the closing price.

4.1.3 Methods of creating new charts

There are two ways to plot a chart:

- Quick – from the shortcut menu in any table;
- step by step – using the Graph plotting wizard, which can be opened by clicking  on the toolbar.

Click the Chart [parameter] item from the shortcut menu to quickly plot a graph for an instrument. The parameter and the instrument are determined by the table cell from which the shortcut menu was called. A chart window with settings from a template will open. These settings can be modified later.

The Graph wizard helps you to create a new chart with arbitrary settings (the default parameters are defined in a template).

To create a chart using the Graph wizard, follow these steps:

- 1.** Configure the chart parameters: set main parameters of the chart: the time period and interval length, scaling, grid display, legend, as well as color settings for the graphs' elements.
- 2.** Add a graph to the diagram: select an instrument and parameter for the graph and add technical analysis indicators.
- 3.** Configure the graph view: select the graph type, line color and thickness, and set the parameters of technical analysis indicators.

In addition, a new graph can be created through copying an existing graph by pressing Ctrl+N.

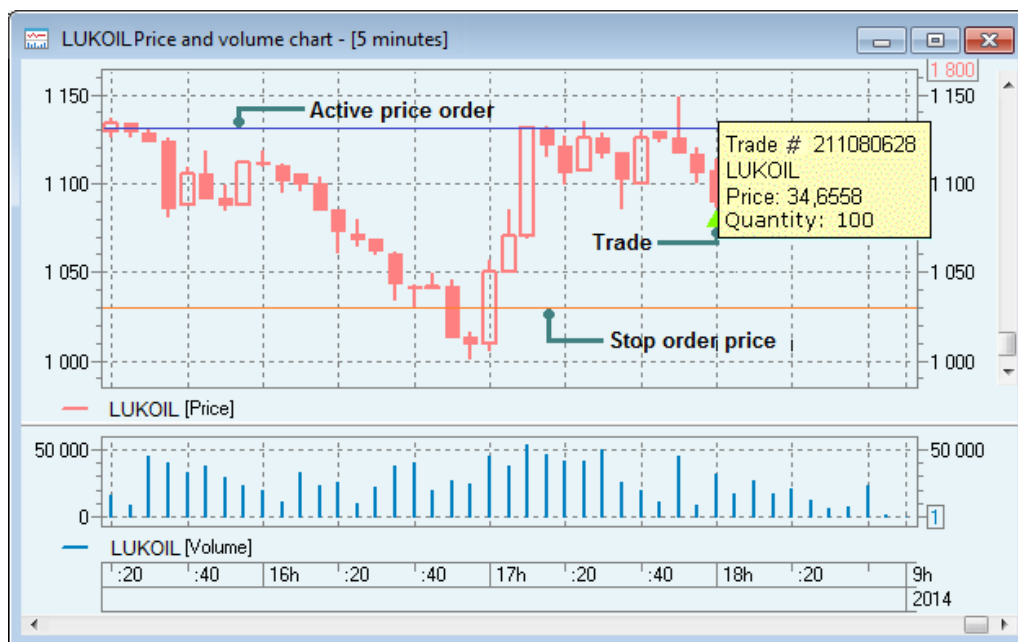
4.1.4 Displaying orders and trades in a graph

Active orders, stop orders, and trades of the user can be displayed in the graph window.

Orders and stop orders are displayed on a graph as colored horizontal lines that correspond to the price levels of orders.

Trades are displayed as triangles. Buy trades are marked with an upturned triangle, sell trades are marked with a downturned triangle. When the cursor hovers over an indicator, a tooltip window


with the following values will pop up: the trade number, instrument, type of trade (buying or selling), price and volume.

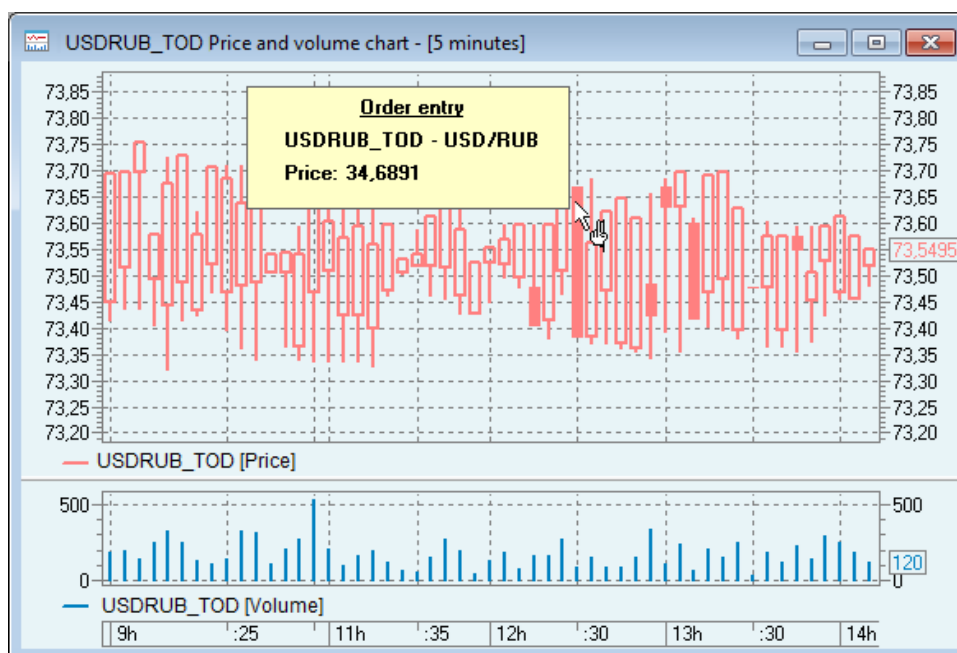


For more information about display settings for orders and trades, see sub-section [4.2.4](#).

4.1.5 Entering orders from the Charts window

You can enter orders from the **Charts** window using one of the following methods:

1. On a graph, hover the cursor over the candlestick's body and left-click on it while holding down the Ctrl key.
2. Enable the order entry mode from the chart window by clicking  on the **Charts** toolbar. In this case, the order entry window will open when you click on the chart.



Both methods require pressing and holding the left mouse button. This will display the **Order sending** tooltip showing the instrument name and the price that corresponds to the cursor position on the chart. You can select the desired order price by moving the cursor up or down.

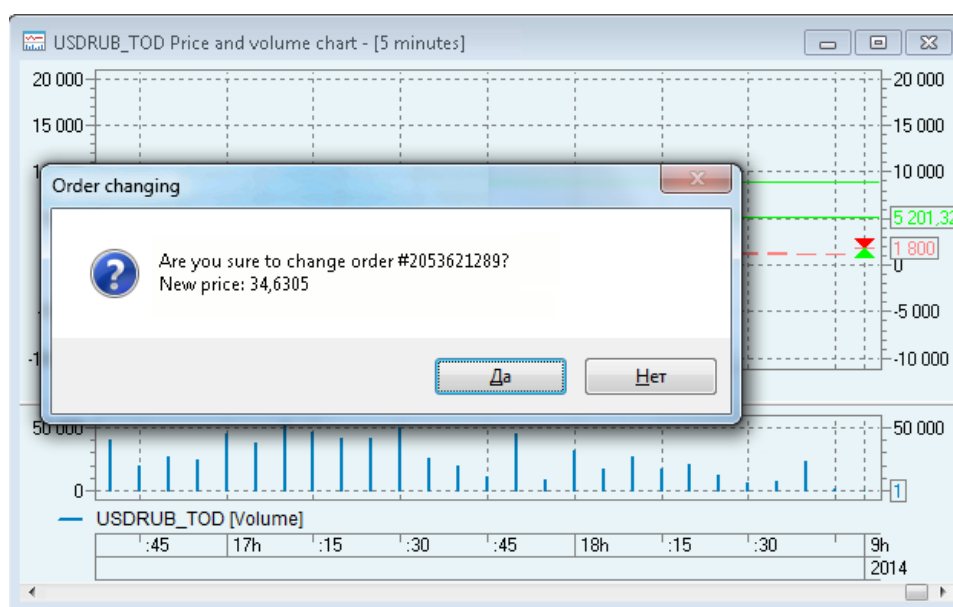
When you release the left mouse button, the order entry window with the selected price value will appear on the screen. The **Instrument** field will contain the name of the security that was displayed on the graph that you clicked on to open the order form. Other fields will contain the default settings.

To quit the order entry mode, just move the cursor outside of the **Charts** window and release the left mouse button once the cursor turns into the **Cancel** icon.

1. **Orders can be entered only when you are connected to the server.**
2. **The Client Code field can be automatically filled in with the value specified in the program settings (the Client code field in the Trading section under Settings / General...).**
3. **The Client Code field can be automatically filled in with the value specified in the 'global filter', if only one client code is selected in that filter and the Use global filter checkbox is selected in the chart settings.**

4.1.6 Managing orders with the mouse cursor

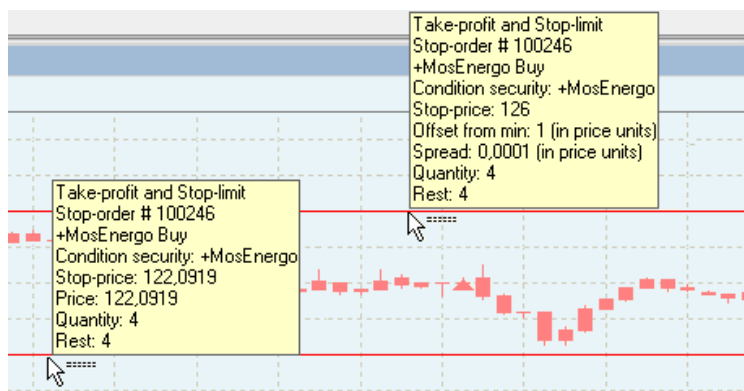
If display of the prices of active orders and stop orders as horizontal lines in the **Charts** window is enabled (see sub-section [4.2.5](#)), you can replace or remove an order by moving the corresponding line with the mouse cursor.



When the cursor hovers over the order line, the tooltip with the order parameters appears. The cursor will change its appearance as shown in the image. Lines of stop orders display the parameters of stop orders.

Order # 2053632395
USDRUB_TOD Buy
Price: 34,6305
Quantity: 100
Rest: 100

The **Take profit** and **stop limit** orders are displayed on graphs as two lines of the same color. When the cursor hovers over such a line, a tooltip pops up. For orders with the **Stop limit** condition, the tooltip displays **Stop limit** parameters. For orders with the **Take profit** condition, the tooltip displays **Take profit** parameters.



If the condition includes **At market price** parameter, the tooltip will display the **At market price** value instead of the **Price** and the **Protective spread** parameters. If the **Take profit** order activation price and the **Stop limit** condition price are the same, only one line is displayed on the graph, and the tooltip includes parameters of both order conditions.

Stop-limit
Stop-order # 100243
+MosEnergobuy
Condition security: +MosEnergobuy
Stop-price: 123
Price: 122,0919
Quantity: 32
Rest: 32
Take-profit
Stop-order # 100244
+MosEnergobuy
Condition security: +MosEnergobuy
Stop-price: 123
Offset from min: 1 (in price units)
Spread: 1 (in price units)
Quantity: 32
Rest: 32

Press and hold down the left mouse button and drag the line up and down the chart:

1. Moving the line up will replace the active order with a new one and increase its price to the specified level.
2. Moving the line down will replace the active order with a new one and decrease its price to the specified level.
3. Moving the cursor outside of the current graph plotting area will cancel the active order.

You can move the lines of **Stop limit** and **Stop price by another security** conditional orders, as well as the lines of orders with the 'If done' conditions while holding the Ctrl key down or without doing it. The following options are possible:

- If you move a line when the Ctrl key is pressed, both the stop price and the price of the limit order placed upon execution of the conditional order will change;
- In case of **Stop limit** conditional orders and 'If done' orders, both prices change by the same amount equal to the difference between the old and new stop prices. The prices change in the same way when you move a line of a conditional order of the **Stop price by another security** type if the stop price instrument and the stop order instrument are the same. Otherwise, when the instruments are different, the stop order price will change by the same percentage as the stop price;
- If you move a line when the Ctrl key is not pressed, only the stop price value changes, and the price of the limit order created upon execution of the conditional order will remain unchanged.

You can move the lines of conditional orders of the **Take profit and stop limit** and **Take profit and stop limit placed upon execution of an active order** types while holding the Ctrl key down or without doing it:

- When a take profit line is moved, the old stop order is cancelled and a new one with a new take profit stop price is created; the other conditions of the order remain unchanged. In this case, it does not matter whether you press the Ctrl key or not;
- When a stop limit line is moved, the old stop order is cancelled and a new one with a new stop price of the stop-limit is created. If the Ctrl key is held down, both the stop price and the order price change by the value equal to the difference between the old and the new stop price of the stop-limit.

Replacement or cancellation of an order must be confirmed by user.

If, after moving a stop order line, the new stop price value is not a multiple of the price step for this instrument class, a message prompting to select one of the acceptable values will appear: **Lower valid price value** and **Upper valid price value**.

If the instrument for the condition of a **Stop price by another security** order is different from the instrument of the stop order to be placed, when you move the line of that conditional order while holding the Ctrl key down, the stop order price is automatically rounded to the closest multiple according to the rules of arithmetic rounding.

If acceptable price ranges were set for the instrument specified in a conditional order (the **Trading / Security parameters...** menu), then, when the stop order line is moved, the new price value will be checked against the set price ranges. When the price goes outside the allowable range, an error message will appear and the order will not be moved. In this case, retry the operation but select a price within the allowable range.

When a partially filled stop order with a linked order type is replaced, the volume of the new stop order and of the limit order dependent on it will be equal to the unfilled volume of the contingent limit order that is being replaced.

Important points to be aware of when replacing orders “with a linked” type

Orders of this type are integrated orders that consist of two orders of the same direction: a stop order and a limit order (for more details, see sub-section 5.5 of Section 5: Client Operations). When such a stop order is replaced by moving its line on a graph, only the stop price of the conditional order is replaced; the price of the limit order dependent on it remains at the old level. If a limit order line is shifted, the linked stop order is cancelled. If the Ctrl key is pressed when you move a stop order line or limit order line, both linked orders will be replaced. In this case, the stop price, the price of the stop order and the price of the linked limit order will be changed by the same value equal to the difference between the values of the old and the new price of the order whose line was moved.

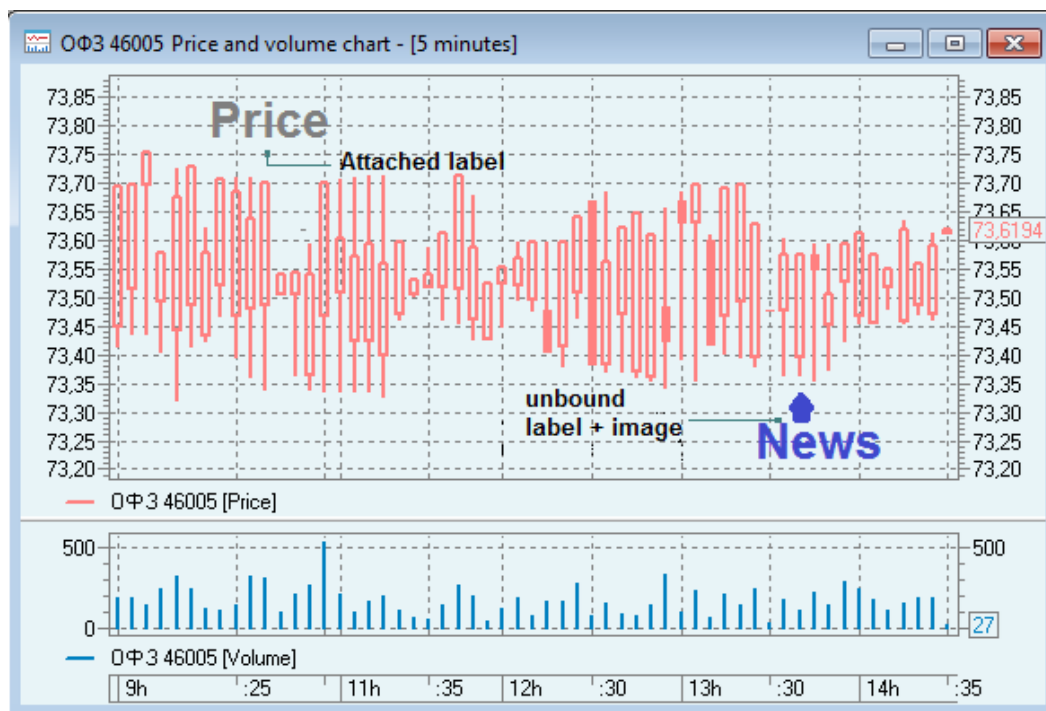
Important points to be aware of when replacing 'If done' conditional orders

When an active order is replaced, all conditional 'If done' orders that are contingent on the replaced order will be cancelled.

When a partially filled conditional 'If done' order is replaced, the volume of the new stop order will be equal to the unfilled amount of the limit primary order.

4.1.7 Displaying labels on a graph

The user can put labels on a graph. Labels can be both text and graphic. Text labels contain descriptions of the graph's contents. Graphic labels are images that can be loaded from a file and placed anywhere in the **Chart** window.



Labels can be attached to one of the graph elements; in this case, they will move with the chart. The labels that are not attached remain in their positions in the window when the instrument displayed in the graph window moves.

For detailed information about the settings, see sub-section [4.2.14](#).

The QPILE language supports working with labels; you can use it to set, change, and edit labels. For detailed information about the language functions, see sub-section 8.22 of Section 8: QPILE Language.

4.2 Graph Configuration

4.2.1 Configuring a chart

To create a new graph using the Graph plotting wizard, select **New chart...** under **Data export/Charts**. In an existing graph, this dialogue can be invoked by selecting **Current pane settings...** and **Chart parameters** from the shortcut menu.

Settings on the Chart tab:

1. **Title** makes it possible to set a custom heading to a chart.
2. **Interval** sets time intervals for plotting new segments on a chart. If the **Tick** value is selected, a tick graph will be created. The interval value is displayed in square brackets on the right of the chart window's heading and separated from the heading by symbol “-”.
3. Select **Automatically rescale the Y axis by visible candlesticks** to automatically adjust the vertical scale of the graph based the range of the maximum and minimum candlestick values in the visible area of the diagram. When this checkbox is unchecked, the vertical scale of the graph is selected based on the maximum/minimum values of all candlesticks on the chart.

4. Select **Consider levels of displayed operations during automatic scaling** to adjust the vertical scale of the graph with consideration for the order and trade prices represented by lines and labels. When this checkbox is unchecked, the vertical scale of a graph is determined based on the settings of the previous item.

Chart parameters setting

Chart | Format Chart Area | Current pane

Title: Charts

Interval: 5 minutes

☒ Automatically rescale the Y axis by visible candlesticks

☒ Consider levels of displayed operations during automatic scaling

Show graphs:

☒ all values

☐ from: 02.06.2014 10:00:00 to 02.06.2014 18:45:00

☐ last: 100 candlesticks

☐ Intra-day from: 10:00:00 to 18:45:00

☒ Show tooltip on a candlestick

☐ Use global filter

☒ Show horizontal axis

☒ Show vertical gridline

☐ Show future intervals

☐ Show empty intervals

Draw a line for an empty interval less than or equal to: 60 min.

Right edge (number of intervals): 0

Minimum number of intervals: 50

Layers order

Current instrument:

Change instrument

Save Cancel Help

5. Show graphs:

- Select **All values** to show the values for the entire time period available;
- Select **from ... to ...** allows the user to set the specified time interval for a chart;
- **The last ... candlesticks** shows the specified number of candlesticks on a graph. Data for earlier time periods is removed from the plotting area. This option is designed for monitoring short-term behaviour of parameter variation;
- **Intra-day from ... to ...** allows for creating a graph based only on the current day's data, without getting history of trade operation for an instrument.

Selecting the Daily, Weekly, or Monthly intervals for the Intraday graph makes no sense. The graph will be empty.

6. **Show tooltip on a candlestick** allows the user to select how the parameters of a selected candlestick will be displayed. If this checkbox is selected, when the cursor hovers over a candlestick, a tooltip will pop-up next to it. If this checkbox is cleared, the parameters will be displayed in the upper left corner of the diagram.
7. Select **Use global filter** to apply global filters to the orders and trades displayed on a graph. For more details about global filters, see sub-section 2.9 of Section 2: Basic Operating Principles.

- 8. Show horizontal axis** displays values on the time scale.
- 9. Show vertical grid** enables the display of vertical grid lines within the plotting area.
- 10. Show future intervals** enables the display of additional intervals to the right of the last candlestick. This checkbox is cleared by default. The number of future intervals is determined according to the following rules:
- For simple graphs (indicators), the number of future intervals is equal to the highest of the positive values of the **Number of intervals** parameter on the **Advanced** tab in the line parameters editing window;
 - For graphs with the Alligator indicator, the number of future intervals is equal to the sum of the positive value of the **Number of intervals** parameter and the Alligator indicator's own shift. Alligator indicator's own shift is determined by the highest value of the **Shift** parameter on the **Parameters** tab in the line parameters editing window;
 - For graphs with the Ichimoku indicator, the number of future intervals is equal to the sum of the positive value of the **Number of intervals** parameter and the Ichimoku indicator's own shift. Ichimoku indicator's own shift is determined by the highest value of the **Horizontal shift** parameter on the **Parameters** tab in the line parameters editing window.
- 1. Future intervals are visually separated by a triple vertical line in the style of the graph grid's vertical lines. This line lies the first future interval and is displayed if there is at least one future interval.**
 - 2. The values on the time scale in the area of future intervals represent numbers of the future intervals. The value of the first interval is marked with the '+' character.**
 - 3. When the cursor is hovering over the future intervals, the number of the future interval on the Cursor coordinates panel and that number shown when the cursor coordinates are displayed in the Crosshair mode (see sub-section [4.2.9](#)), is displayed with the '+' character.**
- 11. Show empty intervals** displays all time intervals on the time scale; if it is disabled, only the intervals that contain trades are displayed. This checkbox is unchecked by default.
- 12. If Draw a line for an empty interval less than or equal to ... min** is set, the intervals with empty values will be ignored during plotting a **Line** or **Dotted line** graph if the sequence of empty intervals is less than the specified value. This setting is enabled if the **Show empty intervals** checkbox is selected.
- 13. Right edge (number of intervals)** specifies the number of empty intervals added to the right end of the graph. It is used to extend trend lines into future periods.
- 14. Minimum number of intervals** specifies the minimum allowable number of intervals on a graph. This parameter matters at the beginning of the trading session to prevent the intervals from stretching across the entire plotting area.
- 15. Click Layers order** to define the order in which chart layers are displayed. To change the order of the displayed layers, use the Up and Down arrows. Note that the topmost layer in the list is the bottom layer on the chart.

16.Current instrument is an information field showing the name of the instrument that is graphed.

17.Change instrument allows the user to change the instrument to which the lines on the graph are related. Description of the instrument replacing dialogue see in sub-section 3.1.6 of Section 3: Viewing Information.

Settings on the Painting settings tab

Here you can specify colours of the diagram elements (background, axes, grid, fonts, colour and thickness of trend lines). For colour configuration settings, see sub-section 2.7.10 of Section 2: Basic Operating Principles.

Settings on the Current pane tab

To open this tab, select **Current pane settings...** from the graph's shortcut menu, or double-click on a free space in the plotting area.

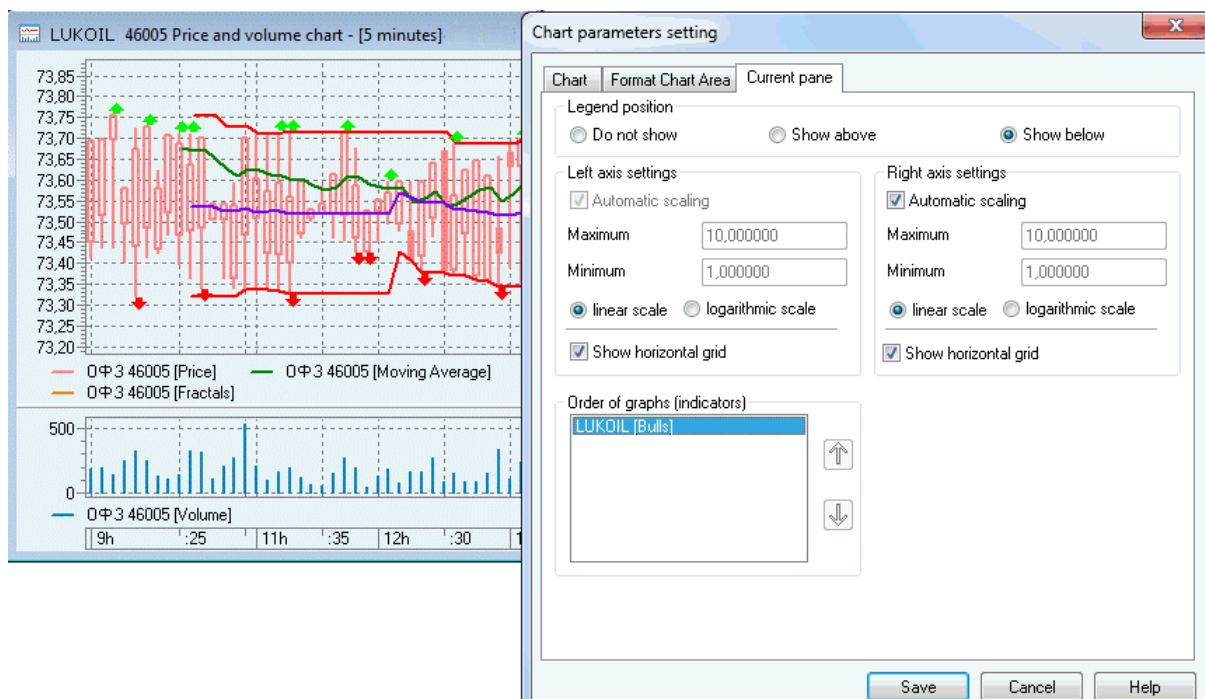
1. Legend position places the legend relative to the plotting area.

- _ **Do not show** removes the legend;
- _ **Show above** places the legend above the plotting area;
- _ **Show below** places the legend below the plotting area.

2. Settings of the right (left) axis:


- _ **Automatic scaling** enables automatic setting of the vertical scale (maximum and minimum value of parameters within the displayed time range). When automatic scaling is disabled, the upper and lower boundaries of the scale are set manually.
 - _ **Maximum** sets the maximum scale value;
 - _ **Minimum** sets the minimum scale value.
- _ **Linear scale / Logarithmic scale** – select the type of the graph scale;
- _ **Show horizontal grid** displays horizontal grid lines in the plotting area.

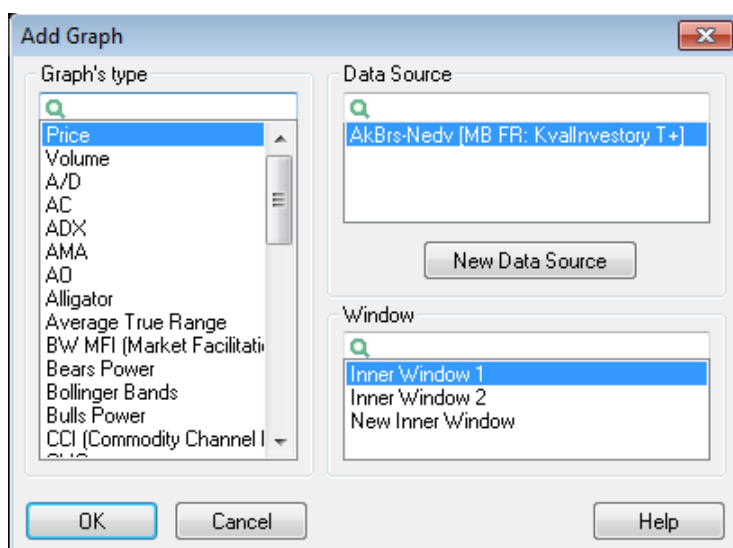
3. Order of graphs (indicators) sets the order of in which the graphs (indicators) are displayed in the current chart window. To change the order of graphs, use the Up and Down arrows. In this case, the graph in the first line of the **Order of graphs (indicators)** list will be the first in the legend list on the diagram (see the image).



When satisfied with the settings, click **Save**. A new window will open – **Add graph**.

4.2.2 Adding a graph to a chart

When you are creating a new chart, this window will automatically open upon completion of the previous setup step. To add a new graph to the existing diagram, you can open this window by clicking on the  button on the **Chart** toolbar or by selecting the **Add graph (indicator)** shortcut menu item.




This window contains the following settings:

1. Select the **Graph's type** from the list of available types. The **Price** value corresponds to the last trade price graph, and the **Volume** value to the last trade volume graph. Other types of graphs are various technical analysis indicators.

2. The **Data Source** field provides selection of an instrument and parameter to be plotted. This window shows all sources displayed on this graph. To add a new source, click the **New source** button. This window contains the following settings:

- **Available securities.** Select one of the instruments from the list. Classes are opened by clicking on the '+' character;
- Select **Sort by expiry date** to sort instruments in this class by the **Expiry date** parameter in ascending order. It can be used for instruments with limited period of circulation (bonds, futures contracts);
- Select a **Source type** for the graph. Select **Time and Sales table** to plot graphs for the trade price and volume (recommended). Select **Quotes History table** to plot graphs of a larger number of variables available from the list at the bottom part of the window;
- Select **Sort by name** to sort parameters in alphabetical order;
- Select **Short names** to replace full parameter names in the window with short names.

If a selected instrument is not found in the dictionary, a notification of the following view appears: 'Chart <...>: failed to create graph <...>, instrument <...> was not found'. The legend of such a graph is as follows: 

3. In the **Window** list, select the area where the chart will be plotted. Existing areas are named Pane1, Pane2, etc. To create a new area, select **New Pane**.

4. Having selected the desired parameters, click **OK**. The next window will open – **Settings [instrument (parameter)]**.

1. **The changes in parameters are saved in the Quotes history table at specified intervals; therefore, certain trades may be skipped. To plot a trade price and volume graph, use the Time and Sales Table source.**
2. **Data in the Quotes History table is accumulated during the connection to server and may have gaps for the periods when there was no connection to the server. To obtain continuous data, select Get missing data in the Program/Saving Data section under Settings/General....**
3. **Data from the Quotes History table is not archived and unavailable for plotting a graph for several days.**
4. **When a graph is plotted based on the Time and Sales table, the data is taken from this table if the user has created at least one table of this type. If there is no Time and Sales Table, then data is requested from the server. The data is divided into chunks of the specified length to minimise the traffic.**

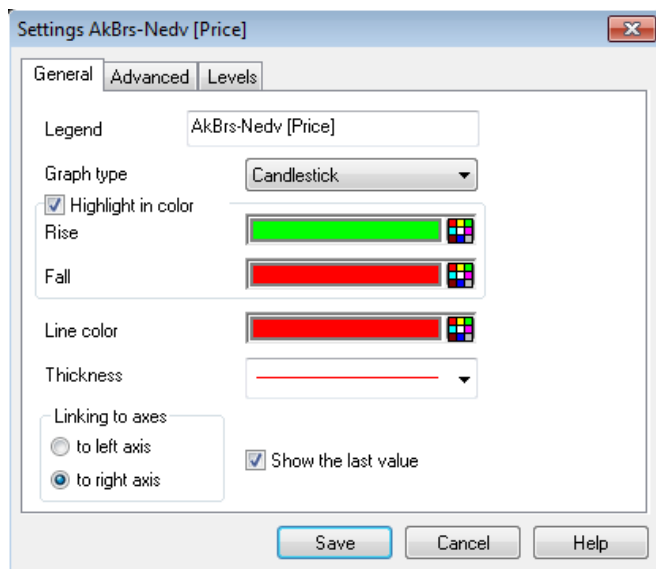
4.2.3 Configuring chart view

When configuring a new chart with the Graph plotting wizard, this window will automatically open once you have completed the previous step. To open this window to edit an existing graph, double-

clicking on the graph's line or its legend, or select **Graph settings/<chart name>** from the shortcut menu.

Settings on the **General...** tab:

1. **Legend** allows the user to edit the line caption on a graph, for example, to make the legend more compact.
2. Select the graph type in the **Graph type** field (**Line, Histograms, Candlestick, Bars, Dots, Dotted line**).



3. When **Highlight in colour** is selected, the graph's elements are highlighted with different colours depending on the direction in which the indicator is changing in the relevant interval. This setting is available for **Candlesticks, Bar, and Histograms**.

- **Rise** defines the colour that indicates increase in the value;
- **Fall** defines the colour that indicates decrease in the value.

The **Price** and **Volume** charts change their colour depending on the direction of price change in a given interval.

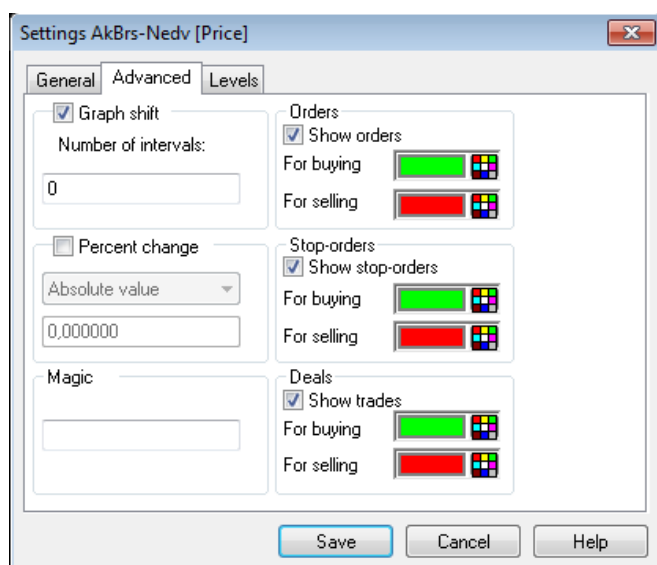
4. **Line colour** and **Thickness** define the line's colour and thickness.
5. In the **Linking to axes** group, select which axis (left or right) will be used for vertical scaling of the graph.
6. Select **Show the last value** to display the last value of price (or a configurable indicator) on the graph's axis.

When satisfied with the settings, click the **Save** button. The created chart will appear on the screen.

For technical analysis indicators, this window contains the additional Parameters tab for configuring these indicators.

4.2.4 Advanced settings

The **Advanced** tab of the line parameters editing window contains the following settings:



1. Select **Graph shift** to shift the graph alongside the time axis by a specified number of intervals. To shift forward (in the future), use positive values; to shift backward, use negative ones.
2. When **Percent change** is selected, the value axis (the axis of ordinates) of the graph will show the relative deviation of the parameter as a percentage of the initial value instead of the absolute value of the parameter. The initial value can be:
 - **Closing price** – the preceding day closing price;
 - **Absolute value** – the value specified in the lower field.
3. **Magic** is a unique string identifier of the graph. This identifier is used in QPILE language tools to get access to the specified graph.
4. **Show orders** shows horizontal lines on the chart representing the prices of the client's active orders. The user can set different line colours for buy and sell orders.
5. **Show stop orders** shows horizontal lines on the graph representing the prices of the user's active stop orders. The user can set different line colours for buy and sell orders.

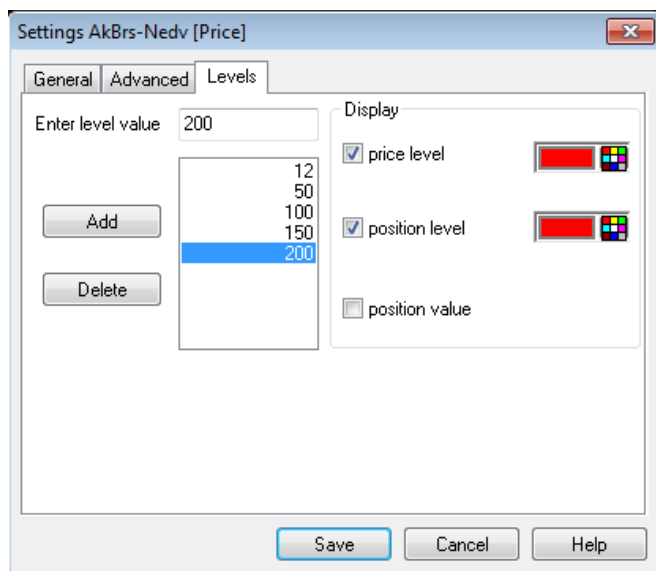
The lines representing conditional orders are displayed on different levels depending on the order's type:

- **Stop limit, With linked order** are displayed at the stop price level;
- **Stop price by another security** are displayed at the stop price level (the line is displayed on the graph of the instrument specified in the condition);
- **Take profit** and **Take profit and stop limit** are displayed at the level of the stop price the take-profit.

- 6. Show trades** displays the user's trades on the graph. Trades are represented by triangular markers that indicate the trade's direction (up for buying, down for selling). The user can choose different marker's colours for trades at bid price and ask price.

4.2.5 Horizontal levels

On the **Levels** tab of the line parameters editing window, you can set values for horizontal lines (levels) displayed on a graph. Levels are plotted up the axis that the graph is linked to.



To set a new level, specify its value in the **Enter level value** field and click **Add**. The value will be added to the list located below.

This value is specified in price units, except for the graphs for which the Percent change attribute is enabled (see sub-section [4.2.4](#)).

To delete a level, select it in the list and click the **Delete** button.

The checkboxes in the **Display** section allow the user to display the following levels on the graph and select their colours:

- **Price level** shows a line at the level of the last trade price. If a parameter graph is created instead of a price graph, the line will correspond to the parameter's last value;
- **Position level** shows a line at the level of acquisition price taken from the **Limits for securities** table for this client code and this security;
- **Position value** shows the position value on the vertical scale.


Configured price levels are saved in the graph template. When the graph window is copied with Ctrl+N, they will be copied to the new window as well.

4.2.6 Working with graphs in the drag-and-drop mode


Changing graphs display order in the current chart window

To change graphs' display order in the drag-and-drop mode, their legends must be displayed in the chart window.

Charts and indicators are displayed in the order in which their legends are located on the chart. Therefore, the graph whose legend is the last one is displayed above all other graphs and indicators.

If the cursor appears as  when the graph legend is moved, it means that this graph cannot be moved. In such cases, nothing will happen when you release the mouse button.

The sequence of actions:

1. Place the cursor on the selected legend and press the left mouse button (the cursor will appear as ).
2. Holding the left mouse button, move the cursor in the legend area (highlighted with the red rectangle on the image) of the graph before (after) which the selected graph will be placed. Release the mouse.

Example: 

Moving a graph

To move a graph between panels in a chart window or to move it into another chart window, position the cursor on the legend of this graph, press the left mouse button, and, holding the mouse, move the cursor with the legend to the desired location and then release the left mouse button. The legend of the moved graph will become the last legend in the chart panel.



When you move a graph, the following associated objects are moved with it:

- Orders;
- Stop orders;
- Trades;
- User levels;
- Price levels;
- Position levels;
- Trend lines.

If the **Ask for confirmation when moving and deleting items using Drag-and-Drop** checkbox is selected in the **Windows / Tables** section under **Settings/General...**, the system asks for confirmation before moving or deleting a graph when:


- the chart is moved to a window which has legend display disabled;
- the chart is moved to the window of another chart.

Deleting a graph

To delete a graph, position the cursor on the legend of the selected graph and press the left mouse button (the cursor will appear as ). Holding the mouse button, move the cursor with the legend beyond the chart window (the cursor will change to ) and release the mouse button.

If the **Ask for confirmation when moving and deleting objects using Drag-and-Drop** checkbox is selected in the **Windows / Tables** section under **Settings/General...**, the system asks for confirmation before deleting a graph.

4.2.7 Graph tips

1. Which of the two possible tables should be selected as data source for a graph?
 - For trade price and volume graphs, it is recommended that the **Time and Sales table** with full information on all trades entered, be used. For other parameters, use the **Quotes History table**.
2. How to rename a parameter caption in a legend?
 - Open **Graph settings/<chart name>** from the shortcut menu and change the name in the **Legend** field.
3. How to place graphs for different securities in the same plotting area?
 - Plot a standard graph;
 - Then select **Add graph (indicator)** from the shortcut menu;
 - Click the **New source** button and select the instrument to be added.
4. How to place price and volume graphs in the same plotting area?
 - Plot a standard graph;
 - Then select **Add graph (indicator)** from the shortcut menu;
 - Select the **Volume** graph type, the **Pane1** window and click **OK**;
 - In the **Graph settings** window that follows, select the left axis in **Linking to axes**;
 - Click **Save**. An order volume graph will be added to the price graph.
5. How to place several diagrams on the screen in an optimal way?
 - If many charts are configured, and they do not fit into the screen, place them on different tabs. The **QUIK** system has no limitations on the number of configured charts and screen tabs. The recommended number of charts on one tab on a 800x600 resolution display is from 2 to 4.
6. How to make all data on a chart fit on the display without scrolling?
 - Open a graph's shortcut menu and select **Scaling/Entire chart**, or click .

7. How to change an instrument in an existing graph?

- Double-click on the blank space of the graph to open the settings window. On the **Chart** tab click the **Change instrument** button and select a new security from the list to display the graph using the current settings. An instrument can also be changed through the Linked windows mode, see sub-section 2.8 of Section 2: Basic Operating Principles.

8. How to transfer graph settings to a new window?

- Create a copy of the window with the graph by pressing Ctrl+N. Then, if you need to change an instrument in the new window, follow the steps described in the previous paragraph.

4.2.8 Working with graph templates

A **Template** is the configuration of a **Graph** window saved under a specific name. Such a template can be applied to existing windows or used to quickly configure a new graph.

1. To view the template list, click **Templates...** from the graph window's shortcut menu.

- **To set up a default template**, select the required window configuration from the list of available templates and, then, click **Use as default**. The template name will be shown in the **Default template** area;
- **To rename a template**, select the required template and, then, click **Rename**. In the dialogue that opens, enter the new name and press **Enter**;
- **To delete a template**, click **Delete**;
- **To apply a template to several windows**, click the **Apply to all windows** button to apply the settings from the selected template to all charts; click **Apply to tab windows** to apply the settings to the windows on the current tab.

2. Create a template.

- Configure a new quotes graph window or select an existing graph to use as a template;
- Select **Save as template...** from the graph's shortcut menu;
- To edit a template, select its name in the window that appears and click **Save**;
- To create a template, click **Save as new**. In the dialogue that opens, enter the name and press **Enter**;
- Click **Exit**.

3. Template application. To configure a graph's settings using a template, select **Get chart settings from templates/<Template name>** from the shortcut menu.

4.2.9 Using the toolbars

We recommend the **Graph** and **Cursor coordinates** panels be enabled on the toolbar to facilitate working with charts.



Purpose of the buttons on the Graph panel:

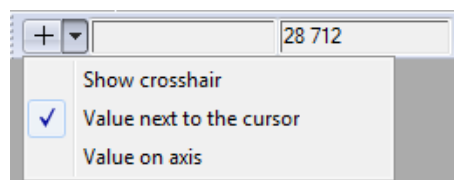
Button	Purpose
	Enable the order entry mode in the chart window. If this setting is disabled, orders cannot be transferred or placed from the chart window
	Add a graph to the current window (chart)
	Modify an interval
	Adjust the graph size to that of the window
	Increase the scale of the graph horizontally
	Decrease the scale of the graph horizontally
	Drag a graph using the mouse
	Draw a trend line
	Draw a horizontal line
	Draw a vertical line
	Draw the Fibonacci Arcs
	Draw the line speed
	Draw the Fibonacci Fan
	Draw the Fibonacci Retracement
	Draw the Fibonacci Time Zones
	Draw a channel
	Show Autochartist data (the details on using Autochartist data can be found in the 'Program interface of the Autochartist system' User's manual).

The **Cursor coordinates** panel includes the **Crosshair** button that enables the display of information about the cursor position in the graph plotting area. Enabling the **Crosshair** button will bring up a drop-down menu that will give you the option to select the way the cursor coordinates will be displayed. You can select one or several options. If none of the options is selected, the **Crosshair** button is inactive. The selection is saved when the **Crosshair** button is disabled. Possible display options of the cursor coordinates:

- **Show crosshair** displays the crosshair lines with axes **(1)**;

- **Value next to the cursor** displays information next to the cursor in a rectangle (2) in the following format:

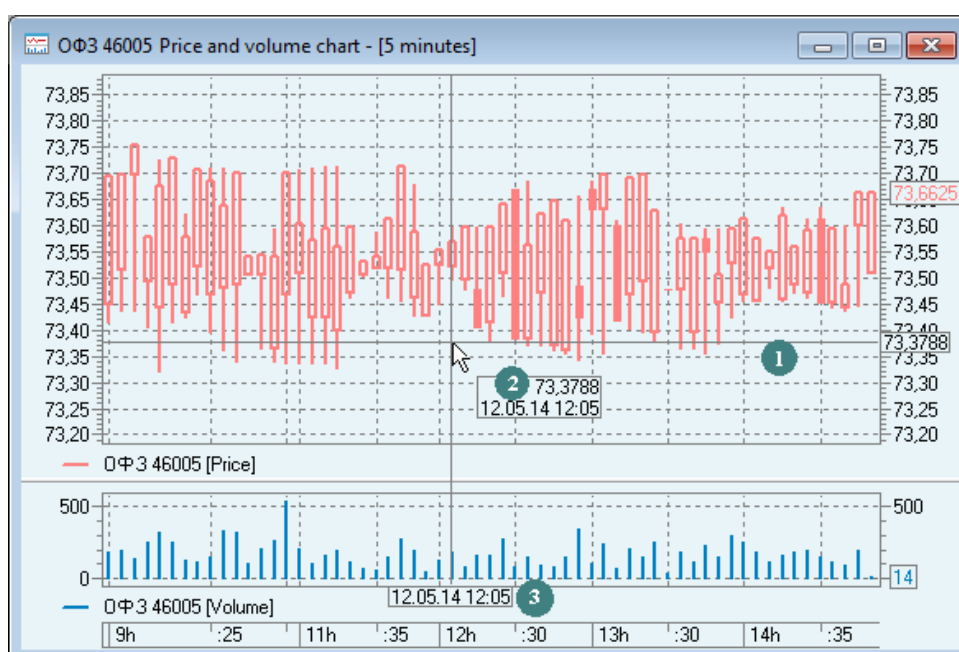
```
[axis value]
DD.MM.YY HH:MM
```



If the graph is linked to the left or right axis (when there are two graphs in one window), the value is displayed in the following format:

```
[left axis value] [right axis value]
DD.MM.YY HH:MM
```

- **Value on axis** displays information on axes as rectangular notes (3) that display the date and time (the abscissa) and values corresponding to them (the ordinate). The notes move along the axes as the cursor moves across a graph.



The **Cursor coordinates** panel also contains two fields to the right of the **Crosshair** button that show the date and time (the abscissa) and the corresponding values (the ordinate).

4.2.10 Editing graphs with the mouse

1. Viewing and editing:

- Hover the cursor over the graph to display the tooltip window with numerical values of the parameters for this graph segment;
- Double-click to edit the graph;
- Click and hold the mouse on the plotting area and drag it to the left or right to scroll the chart along the time axis;
- Click and hold the mouse on the plotting area and drag it up or down to scroll the graph vertically. The action is effective if the graph extends beyond the vertical bound of the plotting area, i.e., the graph has vertical scroll bar.

2. Chart scaling:

- Click and hold the mouse on the vertical scale and drag it to the left or right to adjust the width of the scale;
- Click and hold the mouse on the vertical scale and drag it up or down to adjust the vertical scale of the graph. Double click on the scale to resume automatic scaling;
- Click and hold the mouse on the horizontal scale and drag it to the left or right to change the scale of the graph along the time axis.

3. Control a graph by turning the mouse wheel:

- Over the plotting area: scroll the graph to the left/right;
- Over the plotting area if the graph extends beyond the vertical border of the plotting area: scroll the chart up/down;
- Over the vertical scroll bar: scroll the graph up/down.

4.2.11 The shortcut menu functions

- F5: refresh the content of the chart window. The function is available for charts created on the Quotes table data.

The general shortcut menu of the graph:

- **New chart:** create a new chart;
- **Add graph (indicator)...**: add a new graph to the current window of the chart;
- **Add pane...**: add a new pane to the chart;
- **Add label...**: add a user label to the graph (for details, see sub-section [4.2.14](#));
- **Current pane settings...**: configure scales, grid, and legend positions;
- **Chart parameters:** configure general chart parameters: heading, intervals, displayed trading period, and scaling;
- **Graph settings/<chart name>:** edit graph parameters: caption in the legend, type, thickness and colour of the line, linking to the left/right axis, and labels;

- **Link table:** enables the linked tables mode for this graph window;
- **Scaling:** quickly select the horizontal scale of the image:
 - _ **Zoom in** increases the graph horizontal scale;
 - _ **Zoom out** reduces the graph horizontal scale;
 - _ **Entire chart** displays the entire graph in the window.
- **Interval:** choose the interval size (tick, 1 minute, etc.);
- **Delete graph/<chart name>:** deletes the selected graph;
- **Delete current pane:** delete the pane from the chart;
- **Delete all trends in the current pane:** remove all overlaid trends, channels, lines, and Fibonacci levels from the current pane. The price/volume graph and indicators remain unchanged;
- **Delete all labels:** remove all labels from the graph;
- **Refresh:** refresh the contents of the graph window. Available for graphs created based on the Quotes table data;
- **Save to file...:** save the chart image to a file in Microsoft Bitmap (BMP) or Microsoft Enhanced Metafile (EMF) formats;
- **Save as template...:** save the window settings as a template;
- **Templates...:** open the graph templates window;
- **Get chart settings from templates:** select a template from the list and apply settings saved in the template to the chart;
- **Move to tab:** move a window to another tab.

The items in the graph shortcut menu correspond to the items in the Data export/Charts program menu.

The shortcut menu of a line (or a line legend) on the graph:

- **Graph settings:** edit the graph parameters: caption in the legend, type, thickness and colour of the line, and linking to the left/right axis;
- **Print graph:** print the visible part of the graph;
- **Save graph:** save the chart image into a text file *.txt;
- **Delete graph:** delete the current line of the graph;
- **Link to...:** select a vertical axis to display the graph values (left/right);
- **[<class>] <instrument>:** open the quotes window for the instrument;
- **Change instrument:** open the dialogue for replacing the instrument of the selected graph (indicator). Description of the instrument replacing dialogue see in sub-section 3.1.6 of Section 3: Viewing Information.

4.2.12 Saving graph image to file

A configured image of the chart window can be saved into a file in Microsoft Bitmap (BMP) or Microsoft Enhanced Metafile (EMF) formats. You can do this by selecting **Save to file** from the chart shortcut menu.

The chart will be saved exactly as it appears on the screen, with overlaid labels, indicators, and other elements. When a chart is saved to a file, not only its visible part but the entire chart is saved for all periods that can be viewed by scrolling image in the window.

It is possible to save the image of a size that does not exceed 1 Gb to a file without user confirmation. If the size is between 1 and 4 Gb, then the following notification appears: "The result image dimensions are too big. It is recommended to zoom out the chart to prevent possible problems with viewing. Continue anyway?".

Saving the image in EMF format reduces the file size and simplifies its processing in image editing programs.

4.2.13 Saving graph data to file

The numerical values on which the graph is based can be saved to a file. Both quotes and indicators can be saved. Price/volume values and indicators are saved to files of different formats. Information written into the file covers the time period as displayed on the graph.

How to do this:

1. Select the graph line you would like to save.
2. Select **Save graph** from the shortcut menu of the line.
3. In the window that will open, specify the file name and select a folder on the drive.

The format of a file of price and volume values is compatible with the Equis Metastock format:

<TICKER>	<PER>	<DATE>	<TIME>	<OPEN>	<HIGH>	<LOW>	<CLOSE>	<VOL>
* Ticker	Period	Date	Time	Opening price	Price maximum	Price minimum	Closing price	Volume

* **Ticker** – Instrument ID [Class code]

Example:

```
<TICKER>,<PER>,<DATE>,<TIME>,<OPEN>,<HIGH>,<LOW>,<CLOSE>,<VOL>
HYDR [TQBR],5,20100921,125500,2.072000,2.073500,.2068700,2.069000,29419.000000
HYDR [TQBR],5,20100921,130000,2.069000,2.071400,2.067000,2.071400,44473.000000
```

The file format for indicators:

<TICKER>	<PER>	<DATE>	<TIME>	Line 1	Line 2	Line 3	...	Line N
* Ticker	Period	Date	Time	Line #1	Line #2	Line #3	...	Line #N

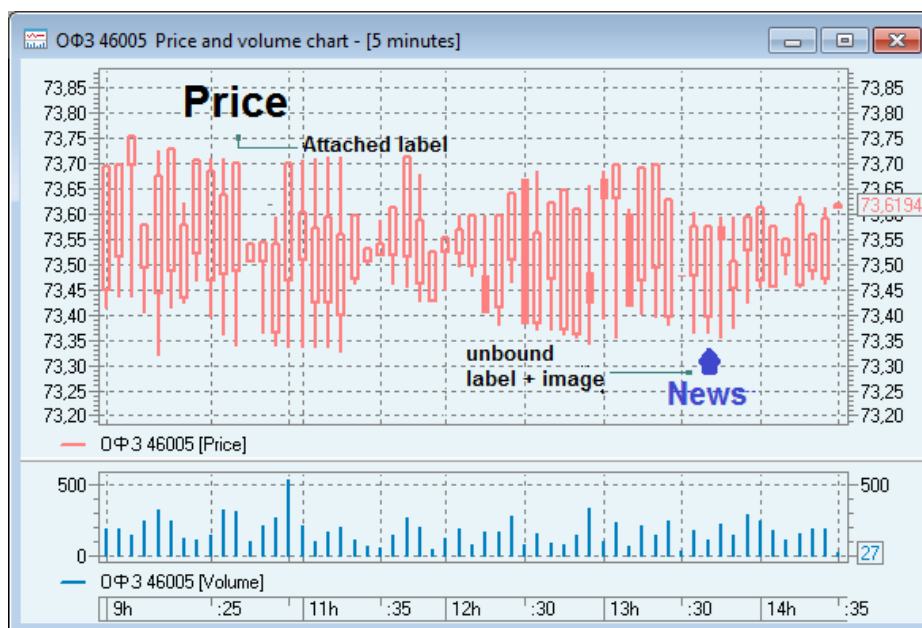
* **Ticker** – Instrument ID [Class code]

A sample file for the Alligator indicator:

```
<TICKER>,<PER>,<DATE>,<TIME>,<LINE_LIPS>,<LINE_JAW>,<LINE_TEETH>
HYDR [TQBR],5,20100921,133500,2.072900,2.072268,2.072268
HYDR [TQBR],5,20100921,134000,2.071000,2.072015,2.072015
```

4.2.14 User labels

Users can place labels on graphs: text or images from files.

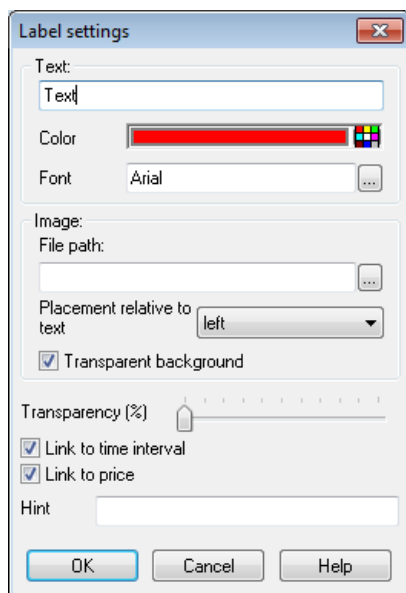


To add a label, select **Add label** from the graph shortcut menu. Purpose of the fields in the **Label settings** window:

Text settings:

- **Text:** label text displayed on the graph. For graphic labels, text can be skipped;
- **Color:** select the colour of the label text;
- **Font:** select the text font. Click the '...' button to open the font settings dialogue.

Image settings:



- **File path:** select an image file for a graphic label. The supported file formats are BMP and JPEG;
- **Placement relative to text:** select how the image will be placed relative to the label text;
- **Transparent background:** use background transparency property of BMP and JPEG files;
- **Transparency (%):** allow the user to change the level of label transparency by moving the slider to the left/right in cases where the label overlays other graph objects;
- **Link to time interval:** move the label along with the time scale;
- **Link to price:** move the label along with the price scale;

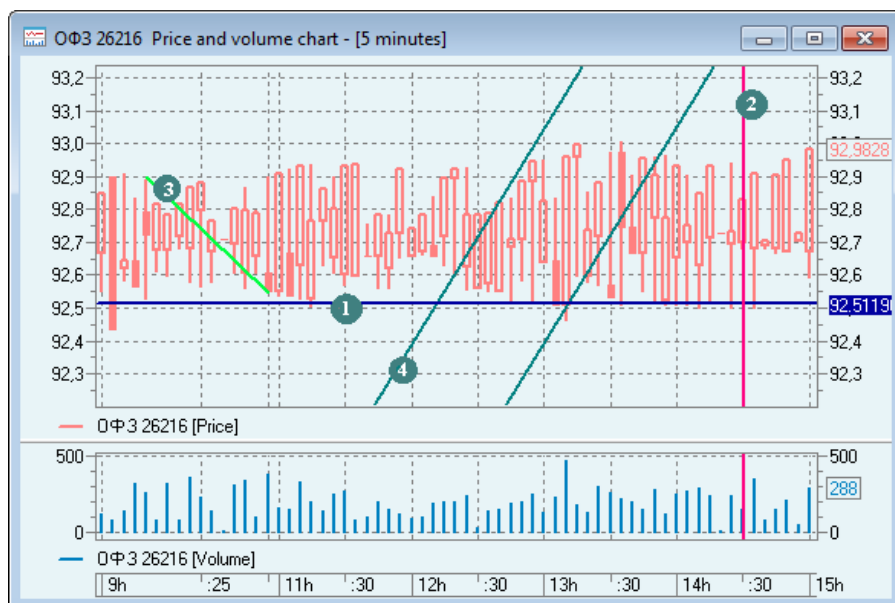
The label is always linked to the left price scale on a graph.

- **Hint:** enter the tooltip text displayed when the cursor hovers over the label.


4.3 Technical Analysis Instruments

To analyze trade prices behavior using graphs, QUIK allows you to draw lines and technical analysis indicators.


4.3.1 Drawing lines




1. To draw a horizontal line:

- Click  on the toolbar;
- Left-click on the graph window and drag the line that appears to the required level, then release the left mouse button.


2. To draw a vertical line:

- Click  on the toolbar;
- Left-click on the graph window and drag the line that appears to the required value, then release the left mouse button.

3. To draw trend lines:

- Press and hold the **Shift** key, then click on the line start point and drag in the required direction to draw a line;
- Alternatively, instead of pressing the **Shift** key you can click  on the toolbar.

4. To draw channels:

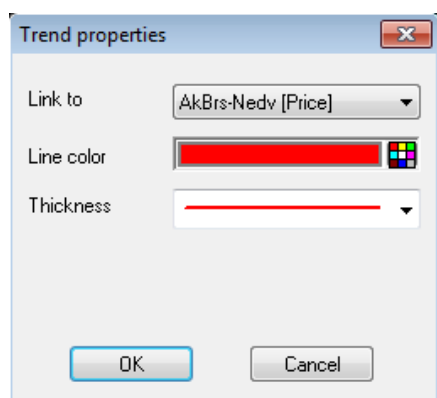
- Click  on the toolbar;
- Left-click on the line start point in the graph window and drag it in the required direction to draw a line. Once you release the left mouse button, the line will be fixed in this position;
- Generate the channel width by moving the cursor up and down, then left-click. The line will be fixed in this position.

Operations with lines:

1. Change line (for trends): left-click on the line end (a hand icon will appear next to the cursor) and drag it in the required direction to change the length and slope of the line.

To change slope and/or width of channel select the channel, then:

- To change slope of the channel's lines press left button of mouse in the hotspot of line which has two hotspots (image in form of hand will appear near the cursor) and drag in desired direction;
 - To change space between the channel's lines press right button of mouse in the hotspot of line which has one hotspot (image in form of hand will appear near the cursor) and drag the cursor up/down to form width of the channel.
2. Move line: left-click on the line middle (a crosshair icon will appear next to the cursor) and drag it in the required direction.
 3. Copy line: press and hold the Ctrl key, then left-click on the line (for parallel transfer) or on the line end (to create a new line that has a common vertex with the previous one).
 4. Select the line: select visually the hotspots of trend. It can be selected using one of the following ways:
 - Place the cursor on the trend line. To clear selection take away the cursor from the trend line;
 - Open the window Trend properties for the given trend. To clear selection close the window Trend properties;
 - Place the cursor on the trend line and press left button of mouse. Selection is cleared after clicking by left button of mouse on the graph area outside of the trend line.
 5. Delete line: delete trend line by one of the following ways:
 - Select the shortcut menu item **Delete trend** for trend line;
 - Select trend and press button Delete. The line will be deleted requiring confirmation.



Double-click to open the **Trend properties** window.

1. **Link to** allows the user to select the graph to which the trend line will be linked.

2. **Line color** and **Thickness** define the line's colour and thickness. This function is also available from the shortcut menu for a trend line.
3. **Continue to the right** and **Continue to the left** allow the user to change the trend line's length, turning the trend line into a beam.

Additional properties of trend lines:






1. When a chart is rescaled, trends change their appearance together with their graphs.
2. If a chart displays two graphs in the same plotting area, to scale a trend line correctly, you must specify the graph to which it belongs. This can be done from the **Link to...** item in the trend line's shortcut menu.
3. When you delete a graph to which a trend is linked, the trend lines are deleted as well.
4. A trend line cannot be drawn if there are no graphs in the plotting area.
5. Trend lines are not saved when you close the program.
6. Default colour and thickness of trend lines can be specified in the **Chart parameters settings / Format Chart Area** shortcut menu item.

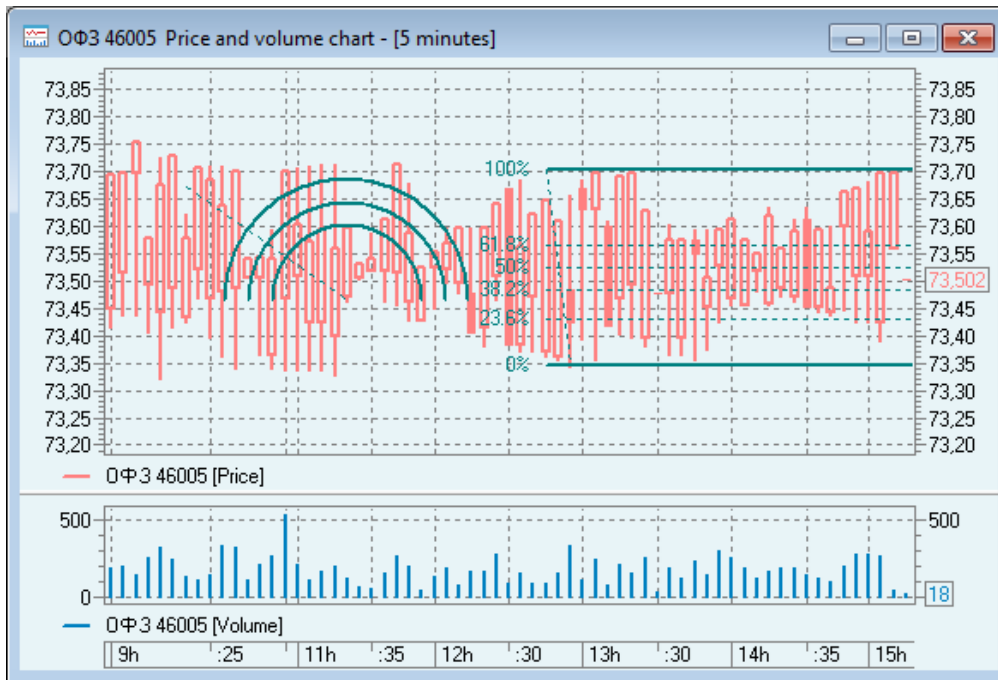
4.3.2 Linear instruments

Linear instruments are geometric figures placed on prices or indicators charts, for example Fibonacci lines.

Fibonacci numbers are the sequence in which every successive number is the sum of two preceding numbers. 1,1,2,3,5,8,13,21,34,55,89,144, etc. This sequence has some internal interdependencies. For example, every number in this sequence, except for the first three numbers, is approximately 1.618 time larger than the preceding number and 0.618 time smaller than the next number. Use of Fibonacci lines relies on the assumption that focal points of prices behaviour will be located near Fibonacci lines.

Available line types:

1.  – Fibonacci Arcs consist of three arcs with radii of 38.2%, 50.0%, and 61.8% of the price value differences at the start and the end of the line.
2.  – Fibonacci Fan consists of three inclined lines that cross a vertical line plotted from a later point at levels of 38.2%, 50.0%, and 61.8% of the price value difference at the start and the end of the line.
3.  – Fibonacci Retracement consists of nine horizontal lines at levels set by Fibonacci numbers 0.0, 23.6, 38.2, 50.0, 61.8, 100, 161.8, 261.8, and 423.6%.
4.  – Fibonacci Time Zones are a series of vertical lines running at intervals that correspond to numbers 1, 2, 3, 5, 8, 13, 21, 34 and so on.
5.  – Speed Resistance Lines are three inclined lines that cross the vertical line plotted from the later point at levels of 1/3, 2/3 and 1 of the price value difference at the start and the end of the line.



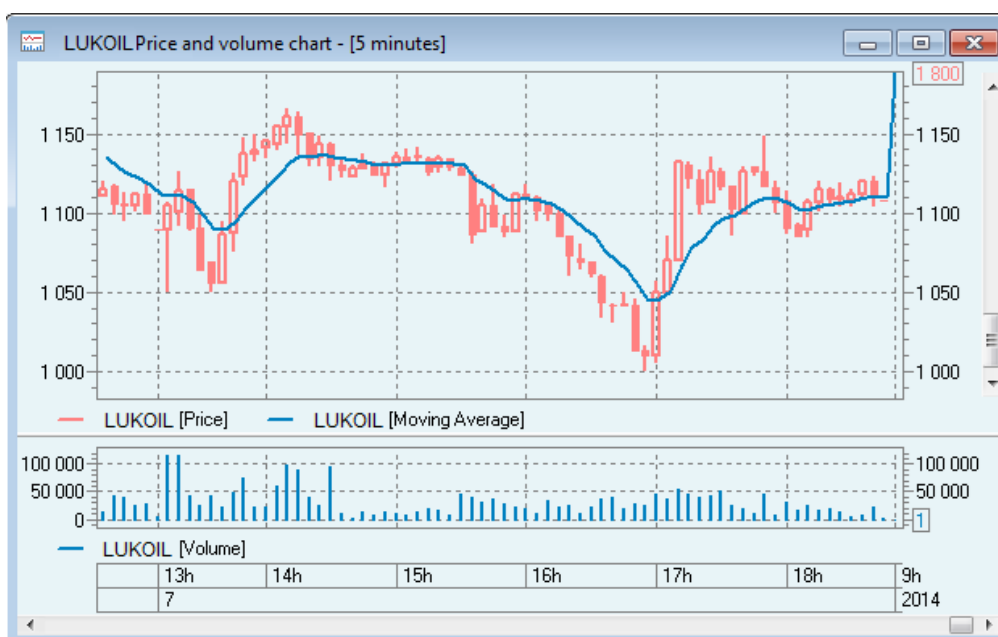
Use of linear instruments is similar to drawing lines. The line type is selected by clicking the buttons on the toolbar. Then draw a line on the chart to connect the extrema of the price (the maximum and the minimum).

4.3.3 Moving averages

The lines plotted using moving averages show an average price value for several preceding periods.

To add this technical analysis indicator to a chart, select **Add graph / <Instrument name>** from the shortcut menu and then select **Moving Average** from the list of available parameters.

The indicator settings are located on the **Parameters** tab of the next step of graph configuration.

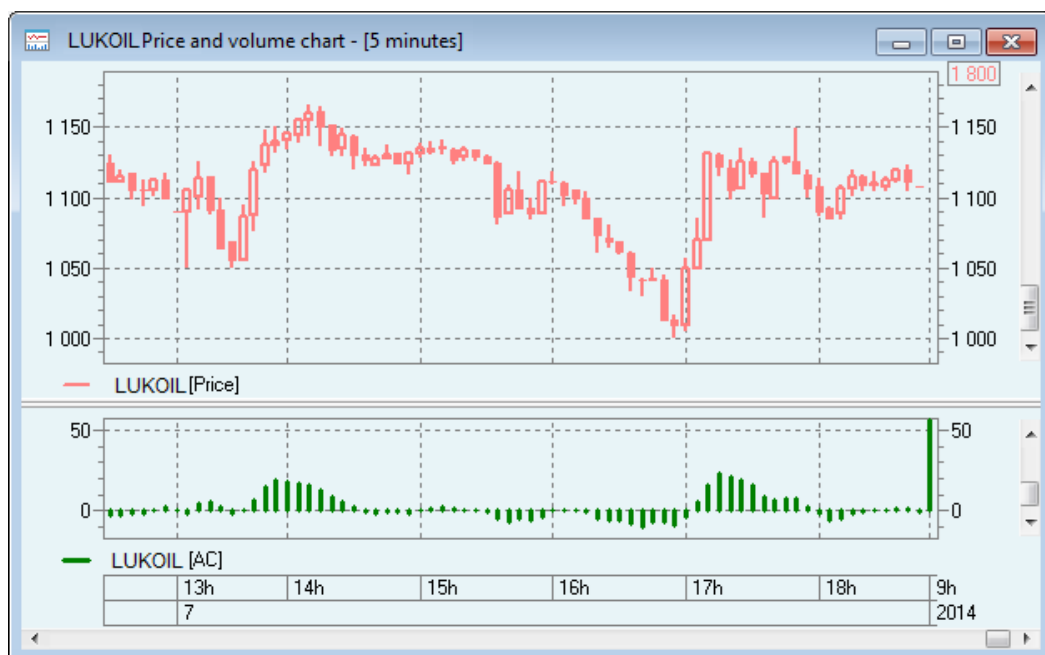


The following types of moving averages are available in QUIK:

Indicator name	Calculation	Settings
Simple moving average Simple Moving Average (SMA)	$SMA = \sum(P_i) / n$, Where P_i is the price value in the i th period	1. Number of periods: positive integer n . 2. Method: selecting the method of calculating the moving average (Simple, Exponential, Vol. Adjusted, Smoothed). 3. Price field: selection of the price value used in the formula. <ul style="list-style-type: none"> Open: the opening price (the first trade price) in a period; High: the maximum price; Low: the minimum price; Close: the closing price (the last trade price); Median = (High+Low)/2; Typical = (High+Low+Close)/3
Exponential moving average Exponential Moving Average (EMA)	$EMA_i = (EMA_{i-1} * (n-1) + 2 * P_i) / (n+1)$, where: <ul style="list-style-type: none"> P_i is the price value in the current period; EMA_i is the EMA value of the current period; EMA_{i-1} is the EMA value of the previous period; Initial value is equal to parameter by which the indicator is calculated: $EMA_0 = P_0$ – when calculating by price	
Volume adjusted moving average Volume Adjusted Moving Average (VMA)	$VMA = \sum(P_i * V_i) / \sum(V_i)$, where: <ul style="list-style-type: none"> P_i is the price value in the ith period; V_i is the volume value in the ith period 	
Smoothed moving average Smoothed Moving Average (SMMA)	$SMMA_i = (\sum(P_i) - SMMA_{i-1} + P_i) / n$, where P_i is the price value in the i th period. Initial value is equal to parameter by which the indicator is calculated: $SMMA_0 = P_0$ – when calculating by price.	

4.4 Methods of Technical Analysis

4.4.1 AC (Acceleration/Deceleration)



The AC indicator (Accelerator/Decelerator Oscillator) measures the acceleration and deceleration of the current market driving force. Market driving force changes before any changes in the price take place. Before the market driving force changes its direction, its acceleration must slow down to zero. After that, it will begin to accelerate in the opposite direction until the price begins to change its direction.

The AC indicator changes direction before any changes in the driving force, which, in its turn, changes its direction before the price. The AC indicator can be used as an early warning and can give you certain advantages.

Calculation:

$$AC = AO - SMA(AO, S),$$

where $AO = SMA(MEDIAN PRICE, S) - SMA(MEDIAN PRICE, L)$

S is the duration of the short period; the default value is 5;

L is duration of the long period; the default value is 34;

MEDIAN PRICE is the median price, $MEDIAN PRICE = (HIGH + LOW) / 2$

HIGH is the maximum bar price;

LOW is the minimum bar price;

SMA is simple moving average;

AO is the Awesome Oscillator indicator.

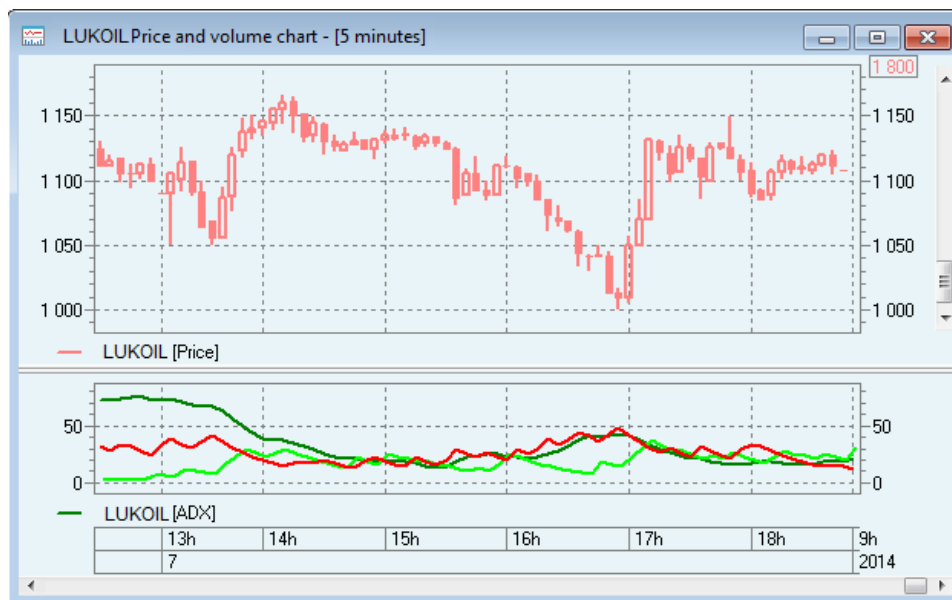
The AC column chart is the difference between the value of 5/34 of the driving force column chart and 5-period simple moving average taken from that column chart.

Settings:

1. **Short period** is the duration of the **S** short period for MA calculation.
2. **Long period** is the duration of the **L** long period for MA calculation.
3. **Method** is the **MA** calculation method (Simple, Exponential, Vol.Adjusted, Smoothed); the default value is 'Exponential'.

4.4.2 ADX (Average Directional Movement Index)

The ADX indicator (Average Directional Movement Index) serves to indicate the direction of the average price determined by comparing two directional indicators: the 14-period +DI (positive price change) and the 14-period -DI (negative price change). Welles Wilder, the author of the indicator, recommends buying when +DI is higher than -DI and selling when -DI is above +DI.



Calculation:

$$ADX_j = \text{Round} (\text{EMA} (DX_j, N)),$$

where DX_j is calculated as follows:

$$DX_j = |(+DI_j - -DI_j)| / (+DI_j + -DI_j) * 100$$

$$+DI_j = \text{Round} (\text{EMA} (+SDI_j, N))$$

$$-DI_j = \text{Round} (\text{EMA} (-SDI_j, N))$$

$$+SDI_j = +DM_j / TR_j * 100 \quad \text{if } TR_j < 0, \text{ otherwise } +SDI_j = 0$$

$$-SDI_j = -DM_j / TR_j * 100 \quad \text{if } TR_j < 0, \text{ otherwise } -SDI_j = 0$$

$$TR_j = \max(|HIGH_j - LOW_j|, |HIGH_j - CLOSE_{j-1}|, |LOW_j - CLOSE_{j-1}|)$$

$$+DM_j = |HIGH_j - HIGH_{j-1}| \quad \text{if } HIGH_j > HIGH_{j-1}, \text{ otherwise } +DM_j = 0$$

$$-DM_j = |LOW_{j-1} - LOW_j| \quad \text{if } LOW_j < LOW_{j-1}, \text{ otherwise } -DM_j = 0$$

$$\text{if } +DM_j > -DM_j, \text{ then } -DM_j = 0$$

$$\text{if } -DM_j > +DM_j, \text{ then } +DM_j = 0$$

$$\text{if } +DM_j = -DM_j, \text{ then } +DM_j = 0, -DM_j = 0$$

CLOSE is the closing price;

LOW is the minimum price of the interval;

HIGH is the maximum price of the interval.

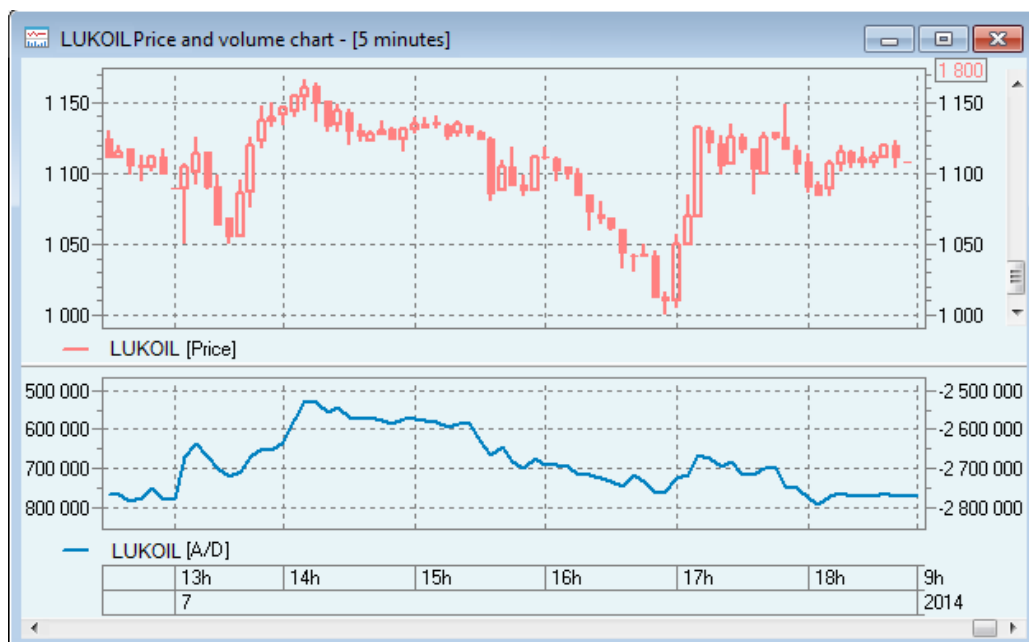
Settings:

1. **Number of periods** is the number **N** of periods for MA calculation.
2. **Method** is the MA calculation method (Simple, Exponential, Vol.Adjusted, Smoothed); the default value is 'Exponential'.
3. **Colour +DI**: line colour for the +DI.
4. **Colour -DI**: line colour for the -DI.

4.4.3 A/D (Accumulation/Distribution)

The Accumulation/Distribution indicator is determined by changes in the price and volume. Volume serves as a weighting factor for price: the larger the volume (the factor), the greater the contribution of the price change (within this time period) to the indicator value.

When the indicator grows, this means accumulation (buying) of a security, since the overwhelming share of trading volumes is related to a price uptrend. When the indicator drops, it means distribution (selling) of the security, since the overwhelming share of trading volumes is related to a price downtrend.



Calculation:

$$\text{CumAD} = \text{AD}_n + \text{CumAD}_{n-1},$$

where $\text{AD}_n = (2 * \text{CLOSE}_n - \text{LOW}_n - \text{HIGH}_n) * \text{VOLUME}_n / (\text{HIGH}_n - \text{LOW}_n),$

and $\text{CumAD}_0 = \text{AD}_1.$

CLOSE is the closing price;

LOW is the minimum price of the interval;

HIGH is the maximum price of the interval;

VOLUME is the volume.

There are no settings available.

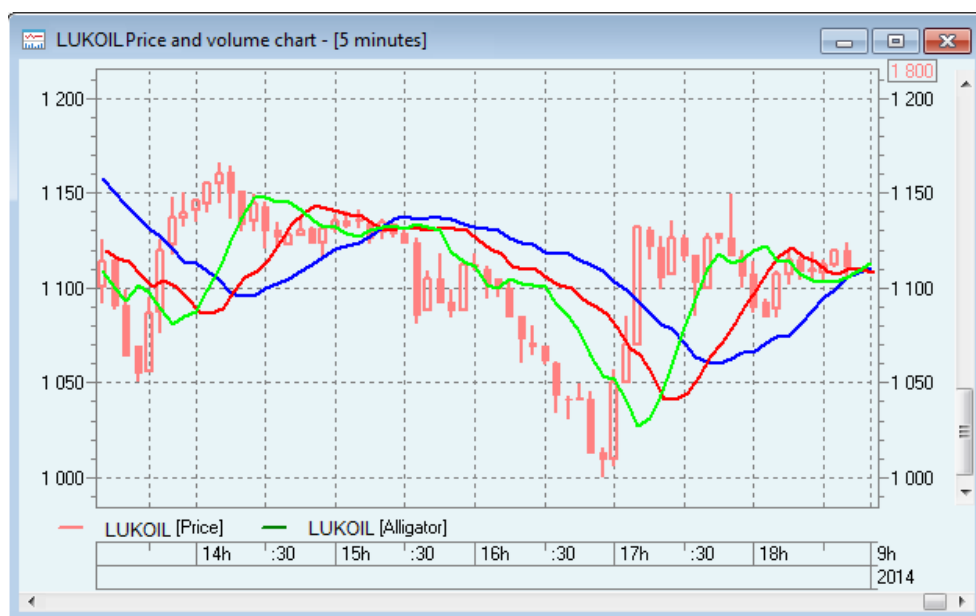
If the value of $\text{HIGH}_n - \text{LOW}_n$ in the denominator equals zero, the indicator value is calculated for the previous candlestick. If there is no previous candlestick, the indicator value equals zero.

4.4.4 Alligator

The Alligator indicator is a combination of balance lines (Moving Averages) that use fractal geometry and nonlinear dynamics.

- Blue line (Alligator's jaw) is the balance line for the period used to build the chart (13-period smoothed moving average shifted into the future by 8 intervals);
- Red line (Alligator's teeth) is the balance line for the period of one level lower (8-period smoothed moving average shifted into the future by 5 intervals);

- Green line (Alligator's lips) is the balance line for the period of one more level lower (5-period smoothed moving average shifted into the future by 3 intervals).



Calculation:

ALLIGATORS JAW = SMMA (MEDIAN PRICE, 13, 8)

ALLIGATORS TEETH = SMMA (MEDIAN PRICE, 8, 5)

ALLIGATORS LIPS = SMMA (MEDIAN PRICE, 5, 3)

where **MEDIAN PRICE** is the median price, **MEDIAN PRICE = (HIGH + LOW) / 2**

HIGH is the maximum price of the period;

LOW is the minimum price of the period;

SMMA (A, B, C) is smoothed moving average, where: **A** is the value being smoothed, **B** is the number of smoothing periods, **C** is the shift into the future;

ALLIGATORS JAW is the alligator's jaw;

ALLIGATORS TEETH is the alligator's teeth;

ALLIGATORS LIPS is the alligator's lips.

Settings:

1. Jaw: parameters for the **ALLIGATORS JAW**:

- **Number of periods** defines the number of smoothing periods, **B**;
- **Shift** defines the number of shift periods, **C**;

- **Line color:** line colour for the Blue line.

2. Teeth: parameters for the **ALLIGATORS TEETH**:

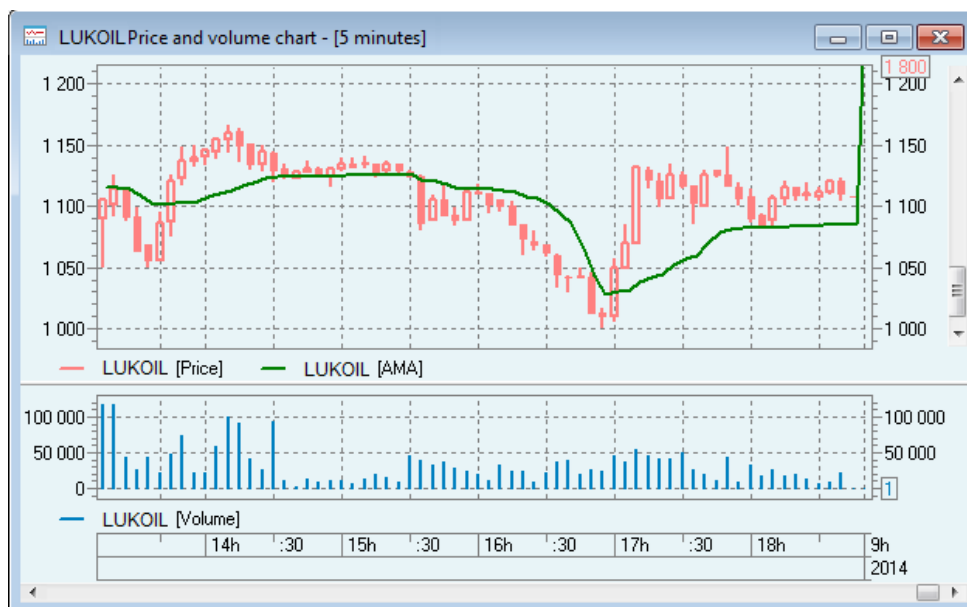
- **Number of periods** defines the number of smoothing periods, **B**;
- **Shift** defines the number of shift periods, **C**;
- **Line color:** line colour for the Red line;
- **Method** defines the **MA** calculation method (Simple, Exponential, Vol.Adjusted, Smoothed); the default value is 'Smoothed'.

3. Lips: are the parameters for the **ALLIGATORS LIPS**:

- **Number of periods** defines the number of smoothing periods, **B**;
- **Shift** defines the number of shift periods, **C**;
- **Line color:** line colour for the Green line.

4.4.5 AMA (Adaptive Moving Average)

The AMA indicator (Adaptive Moving Average) is used to plot a moving average with low sensitivity to noise in price series. It is characterized by the lowest delay for trend determination. One of the shortcomings of various algorithms for smoothing price time series lies in the fact that accidental price spikes can cause false signals of the emergence of a trend. On the other hand, smoothing causes inevitable delays in signaling that the trend has stopped or reversed. This indicator was developed by Perry Kaufman to overcome both of these shortcomings.



Calculation:

$$AMA_i = AMA_{i-1} + SSC_i^2 * (P_i - AMA_{i-1}), i > n \text{ is the current AMA value}$$

$$AMA_i = P_i, i = n$$

$SSC_i = ER_i * (fSC - sSC) + sSC$ is the variable smoothing constant

$ER_i = \text{Signal}_i / \text{Noise}_i$ is the efficiency ratio

$fSC = 2 / (fn + 1)$

$sSC = 2 / (sn + 1)$

$\text{Signal}_i = \text{abs}(P_i - P_{i-n})$ is the current signal value

$\text{Noise}_i = \sum_{j=i-n+1}^i \text{abs}(P_j - P_{j-1})$ is the current noise value

where **sn** is Slow EMA period,

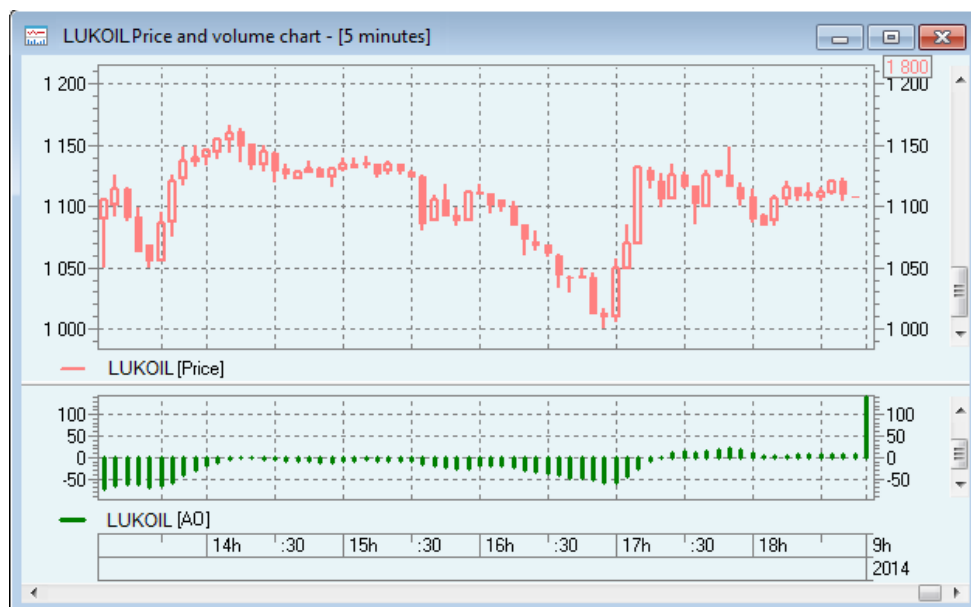
fn is Fast EMA period

Parameters:

1. **AMA periods** is the number of **n** periods for AMA calculation.
2. **Fast EMA periods** is the number of periods for Fast EMA calculation.
3. **Slow EMA periods** is the number of periods for Slow EMA calculation.
4. **Price Field** is the interval price value used for **P** (Open, High, Low, Close, Median, Typical); the default value is 'Close'.

4.4.6 AO (Awesome Oscillator)

Awesome Oscillator, developed by Bill Williams, helps to determine the current behaviour of the market driving force.



Calculation:

$AO = SMA(\text{MEDIAN PRICE}, S) - SMA(\text{MEDIAN PRICE}, L)$

where **S** is the duration of the short period; the default value is 5;

L is the duration of the long period; the default value is 34;

MEDIAN PRICE is the median price, $\text{MEDIAN PRICE} = (\text{HIGH} + \text{LOW}) / 2$

HIGH is the maximum bar price;

LOW is the minimum bar price;

SMA is the simple moving average.

Settings:

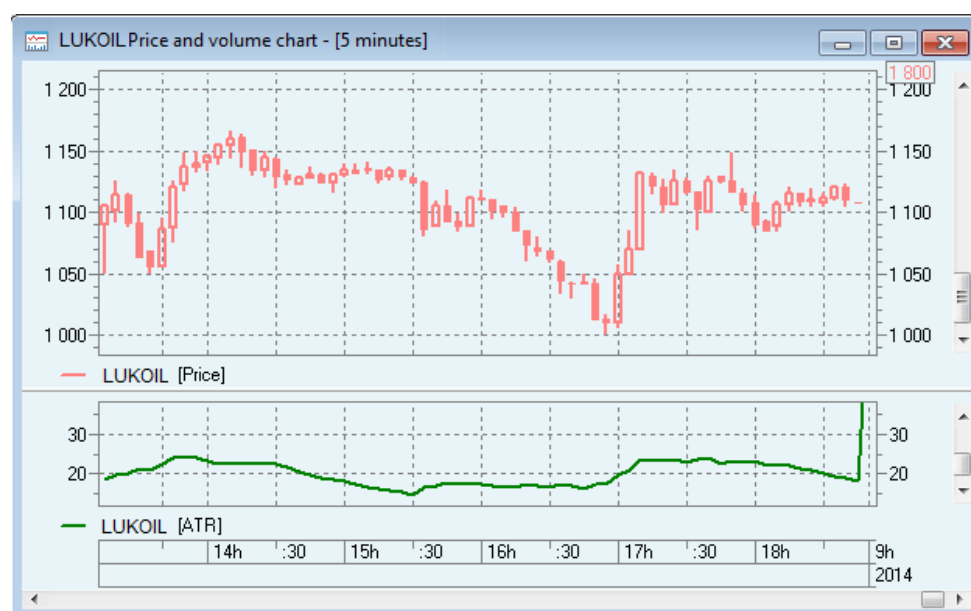
1. **Short period** is the duration of the **S** short period for MA calculation.
2. **Long period** is the duration of the **L** long period for MA calculation.
3. **Method** is the **MA** calculation method (Simple, Exponential, Vol.Adjusted, Smoothed); the default value is 'Exponential'.

4.4.7 ATR (Average True Range)

The ATR indicator is an oscillator that shows volatility of the market. The ATR indicator is required to determine the resistance and support levels. Since the ATR indicator is an oscillator, it can be analysed using the analysis techniques for classical oscillators.

- Low ATR indicates absence of trend and quiet trade operations within a narrow range.
- High ATR level shows a strongly pronounced trend and intensive trade operations.

The ATR indicator does not show the anticipated direction and duration of movement, it only shows the level of market activity.



Calculation:

$$ATR_i = \begin{cases} 0, & 0 < i < n \\ \left(\sum_{j=1}^n TR_j \right) / n, & i = n \\ \frac{ATR_{i-1} \cdot (n-1) + TR_i}{n}, & i > n \end{cases}$$

$$TR_1 = |H_1 - L_1|$$

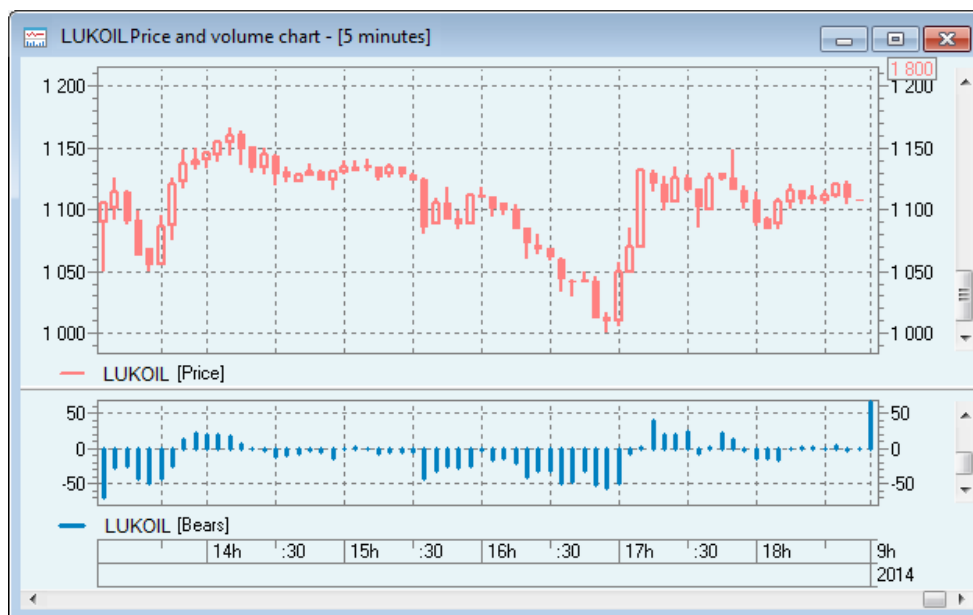
$$TR_i = \text{MAX}(|H_i - L_i|, |H_i - C_{i-1}|, |L_i - C_{i-1}|), i > 1$$

Settings:

- **Number of periods** is the number **n** of periods.

4.4.8 Bears Power

The Bears Power oscillator was developed by Alexander Elder to estimate 'bears power' balance and forecast possible change in the trend direction. This indicator is based on the difference between the minimum price and 13-period exponential moving average. In combination with 13-period EMA and the Bulls Power oscillator, this oscillator forms the Elder Ray technical indicator.



Calculation:

$$\text{Bears}_i = L_i - \text{EMA}_i$$

where **L** is the minimum price in the current period;

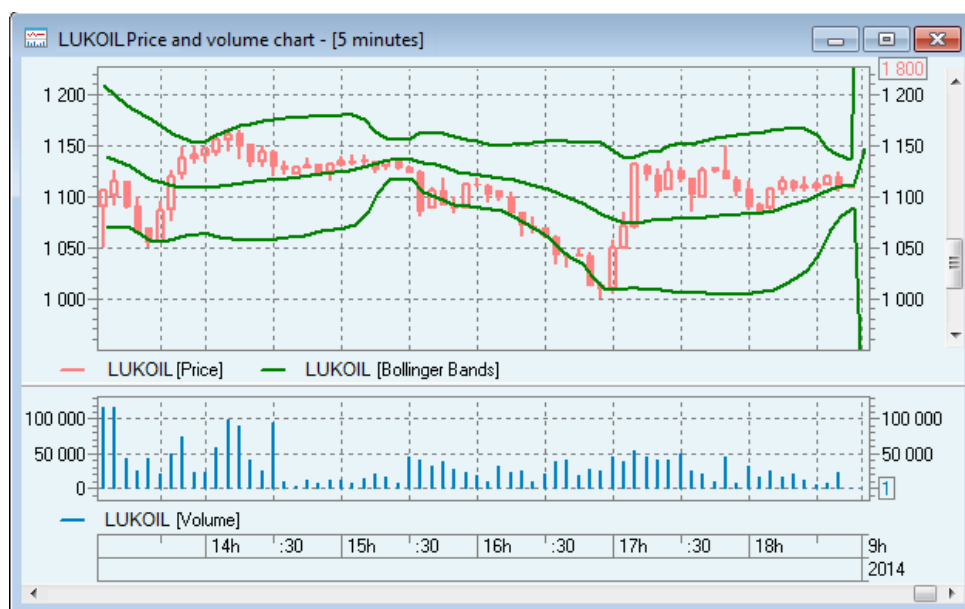
EMA is EMA of the current period.

Settings:

- **Number of periods** is the number **n** of periods for EMA calculation.

4.4.9 Bollinger Bands

Bollinger Bands are two bands plotted in the price graph area with the width proportional to the standard price deviation. The width of these bands shows market volatility: bands widen when the market becomes more volatile and narrow when the prices become less volatile.



Calculation:

BBLower = $MA(P,N) - k * StDev(P,N)$ is the lower band;

BBMiddle = $MA(P,N)$ is the moving average;

BBUpper = $MA(P,N) + k * StDev(P,N)$ is the upper band,

where **P** is the price;

N is the number of periods used for calculation of the moving average;

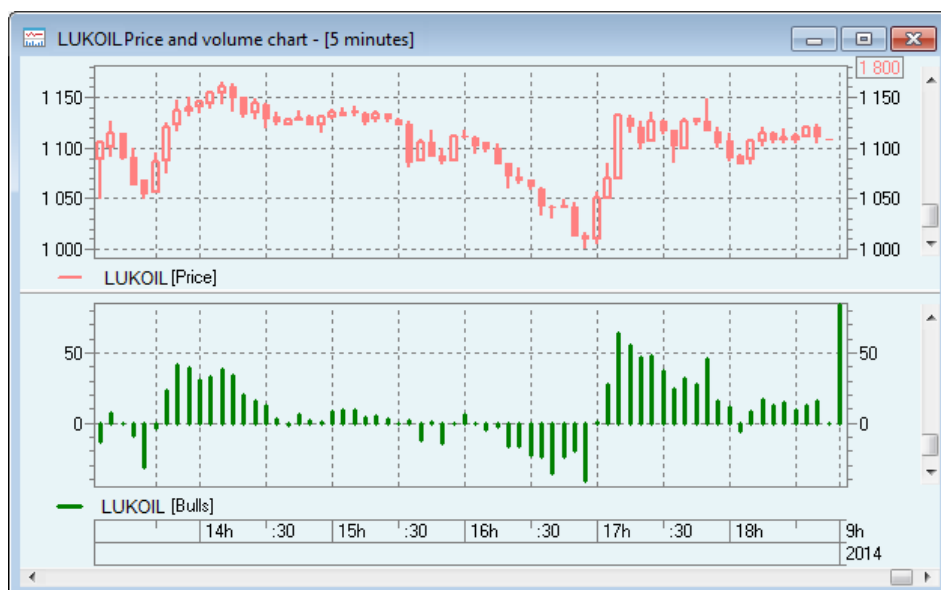
k is the number of standard deviations.

Settings:

1. **Number of periods** is the number **N** of periods for MA calculation.
2. **Deviations** is the number of standard deviations (**k**).
3. **Method** is the method used to calculate **MA** (Simple, Exponential, Vol.Adjusted, Smoothed); the default value is 'Simple'.
4. **Price Field** is the interval price (**P**) (Open, High, Low, Close, Median, Typical); the default value is 'Close'.

4.4.10 Bulls Power

The Bulls Power oscillator was developed by Alexander Elder to estimate the 'bulls power' balance and forecast possible change in the trend direction. This indicator is based on the difference between the maximum price and 13-period exponential moving average. In combination with 13-period EMA and the Bears Power oscillator, this oscillator forms the Elder Ray technical indicator.



Calculation:

$$\text{Bulls}_i = H_i - \text{EMA}_i$$

where **H** is the maximum price in the current period;

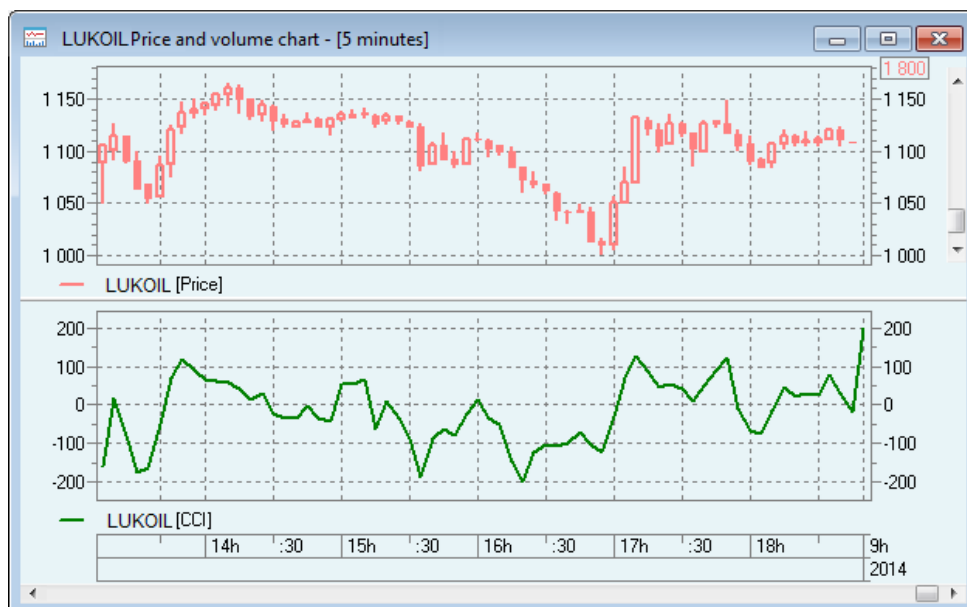
EMA is EMA in the current period.

Settings:

- **Number of periods** is the number **n** of periods for EMA calculation.

4.4.11 CCI (Commodity Channel Index)

Commodity Channel Index (CCI) measures the deviation of the instrument price from its statistical mean. High values of the index indicate that the price is unusually high as compared to the average price, and low values indicate that it is too low. Despite the name, this indicator is applicable to financial instruments, not only to commodities.



Calculation:

$$CCI = (TP - SMA(TP, N)) / (MD * 0.015)$$

where $MD = \text{SUM}(\text{ABS}(\text{MA}(TP, N) - TP_i)) / N$ is probable deviation;

$TP = (\text{HIGH} + \text{LOW} + \text{CLOSE}) / 3$ is a typical price;

MA is the moving average;

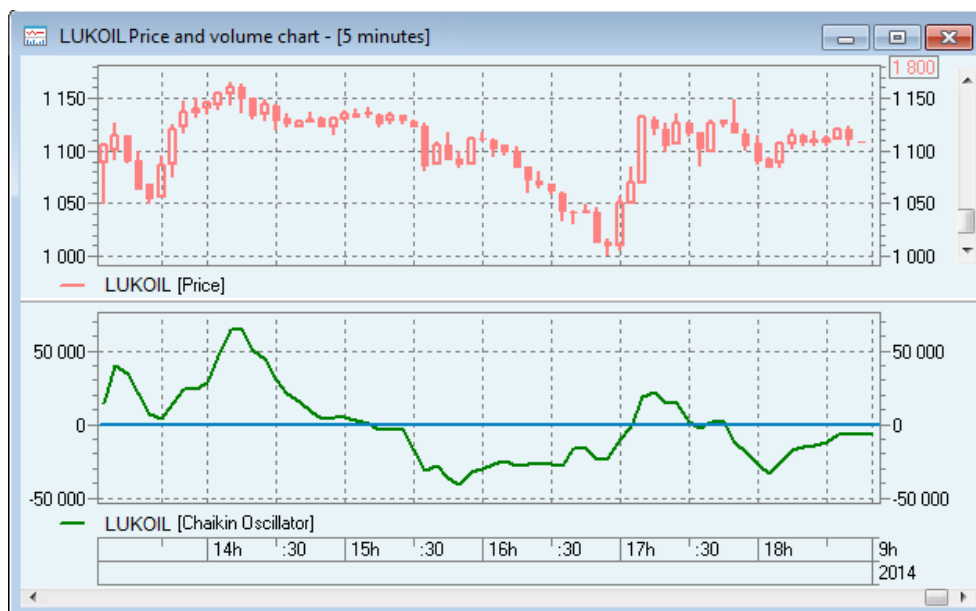
N is the number of periods.

Settings:

1. **Number of periods** is the number N of periods for MA calculation.
2. **Method** is the MA calculation method (Simple, Exponential, Vol.Adjusted, Smoothed); the default value is 'Exponential'.

4.4.12 Chaikin Oscillator

The Chaikin Oscillator is the difference between exponential moving averages of the Accumulation/Distribution indicator with averaging periods of 3 (short period) and 10 (long period) respectively.



Calculation:

$$CO = MA(N_{short}, CumAD) - MA(N_{long}, CumAD),$$

where **MA (N, CumAD)** is the moving average of **CumAD** for **N** periods;

CumAD is the value of the Accumulation/Distribution indicator;

Nshort is the number of intervals in the short period;

Nlong is the number of intervals in the long period.

Settings:

1. **Short period** sets the value of **Nshort**; the default value is 3.
2. **Long period** sets the value of **Nlong**; the default value is 10.
3. **Method** is the **MA** calculation method (Simple, Exponential, Vol.Adjusted, Smoothed); the default value is 'Exponential'.

4.4.13 Chaikin's Volatility

The Chaikin's Volatility indicator reacts to changes in the difference between the maximum and the minimum prices. It quantifies volatility as a widening of the range between these extreme values.

Calculation:

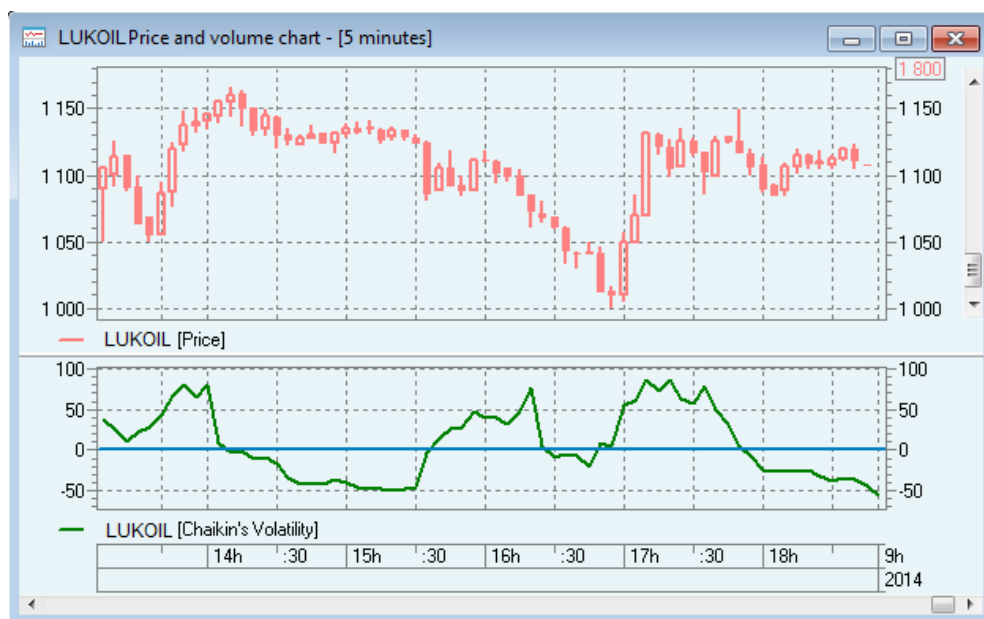
$$CV = (MA_n(i, SP_n) - MA_{n-i}(i, SP_n)) * 100 / MA_{n-i}(i, SP_n),$$

where $SP_n = HIGH_n - LOW_n$,

MA (i, SP) is the moving average of **SP** with period of **i**;

HIGH_n is the maximum trade price in the **n**th interval;

LOW_n is the minimum trade price in the n th interval.



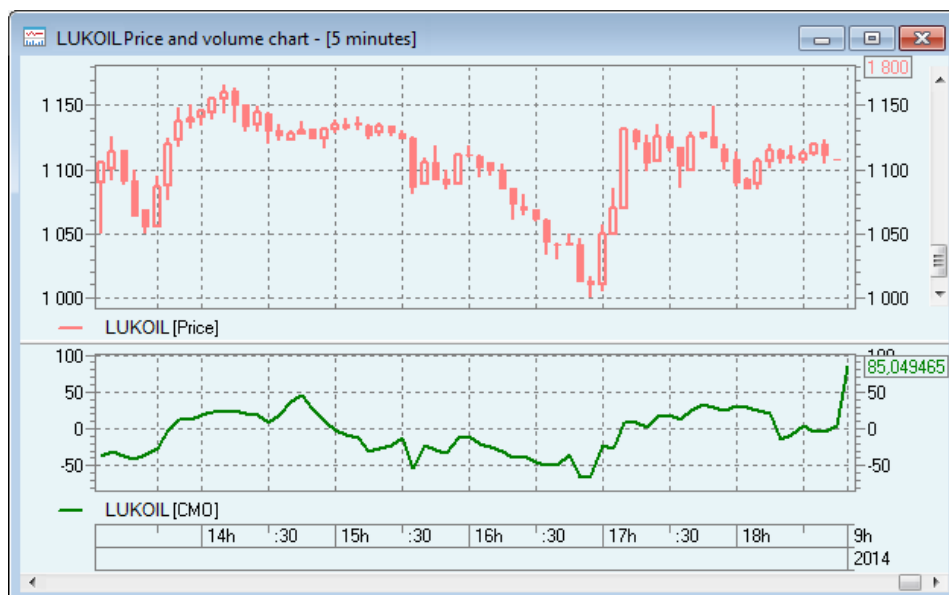
Settings:

1. **Number of periods** sets the number of periods i of **MA** averaging, the default value is 10.
2. **Method** is the **MA** calculation method (Simple, Exponential, Vol.Adjusted, Smoothed); the default value is 'Exponential'.

4.4.14 CMO (Chande Momentum Oscillator)

Main applications of the Chande Momentum Oscillator:

- Generally, CMO is interpreted to indicate that a security is overbought or oversold. A security is overbought when the oscillator is above +50 and oversold when below -50. These levels correspond to levels 70 and 30 of the RSI indicator;
- Trend indicator. When CMO of the long period crosses CMO of the short period, it means a buy signal and, conversely, when CMO of the short period crosses CMO of the long period, it means a sell signal.



Calculation:

$$\text{CMO} = (\text{SUM1} - \text{SUM2}) / (\text{SUM1} + \text{SUM2}) * 100$$

where **SUM1** = **SUM (CMO1, n)** is the total value of **CMO1** for n periods;

SUM2 = **SUM (CMO2, n)** is the total value of **CMO2** for n periods.

$$\text{diff} = P_i - P_{i-1},$$

If **diff** > 0, then **CMO1_i** = **diff**, **CMO2_i** = 0.

If **diff** < 0, then **CMO2_i** = **-diff**, **CMO1_i** = 0.

P_i is the price (usually the closing price) of the current period;

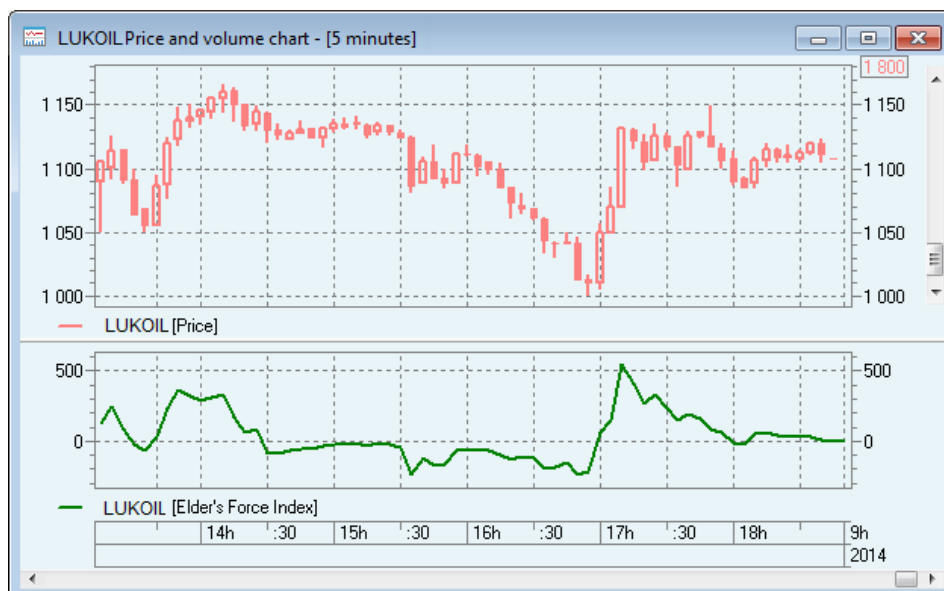
P_{i-1} is the price (usually the closing price) of the previous period.

Settings:

1. **Number of periods** is the change in the **n** number of periods; the default value is 14.
2. **Price Field** is the interval price (**PRICE**) (Open, High, Low, Close, Median, Typical); the default value is 'Close'.

4.4.15 Elder's Force Index

The Elder's Force Index (EFI), developed by Alexander Elder, measures strength of bulls after each increase and strength of bears after each decline. This indicator helps to find the best moment to open and close positions. It is better to buy when the indicator takes negative values and to sell when the value is positive.



Calculation:

$$EFI_N = MA(i, FI),$$

where $FI = (1 - PRICE_{n-1} / PRICE_n) * VOLUME_n$;

$MA(i, FI)$ is the moving average of FI with period of i ;

$PRICE_n$ is the price in the n th interval;

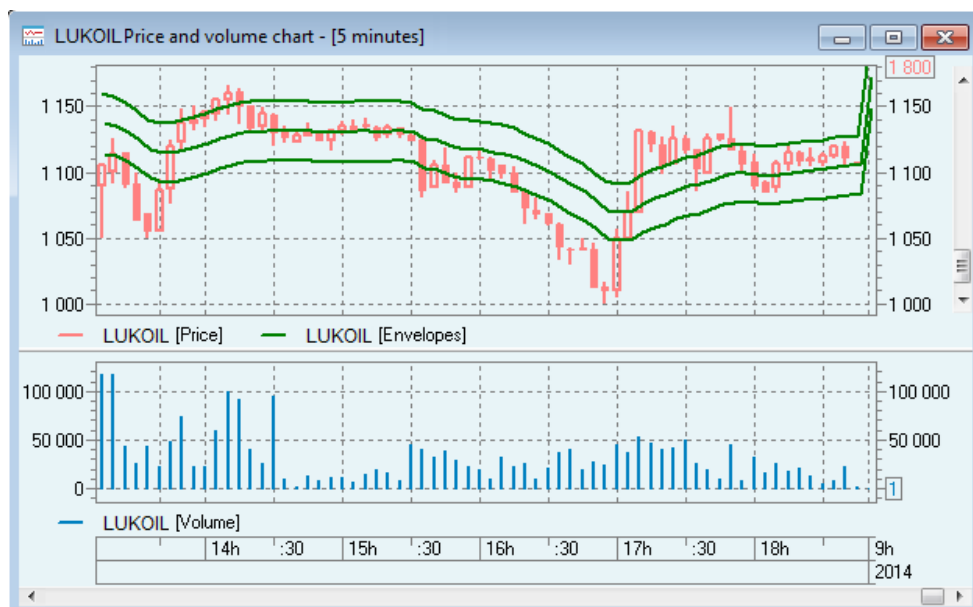
$VOLUME_n$ is the trade volume of the n th interval.

Settings:

1. **Number of periods** sets the number of periods i of **MA** averaging, the default value is 13.
2. **Method** is the **MA** calculation method (Simple, Exponential, Vol.Adjusted, Smoothed); the default value is 'Exponential'.
3. **Price Field** is the interval price (**PRICE**) (Open, High, Low, Close, Median, Typical); the default value is 'Close'.

4.4.16 Envelopes

The Envelopes indicator (Envelopes, Envelope lines) is formed with two moving averages (MA). One MA is shifted upward and another one is shifted downward. The envelope lines indicate the upper and the lower levels of the 'normal' trade range of a security. A sell signal is generated when the instrument price reaches the upper level, and a buy signal is generated when the price reaches the lower level. An optimal shift value (expressed as a percentage) depends on volatility of the instrument. Higher volatility means larger shift.



Calculation:

Lo = **MA(n, PRICE)** is the middle line;

Lup = **Lo * (1 + k/100)** is the upper line;

Ldown = **Lo * (1 - k/100)** is the lower line;

where **MA(n)** is the moving average of **PRICE** with a period of **i**,

k is the shift coefficient, %;

PRICE is the interval price.

Settings:

1. **Coefficient** is the shift value **k**; the default value is 2.
2. **Number of periods** sets the number of periods **n** of **MA** averaging, the default value is 20.
3. **Method** is the **MA** calculation method (Simple, Exponential, Vol.Adjusted, Smoothed); the default value is 'Exponential'.
4. **Price field** is the interval price value used for **PRICE** (Open, High, Low, Close, Median, Typical); the default value is 'Close'.

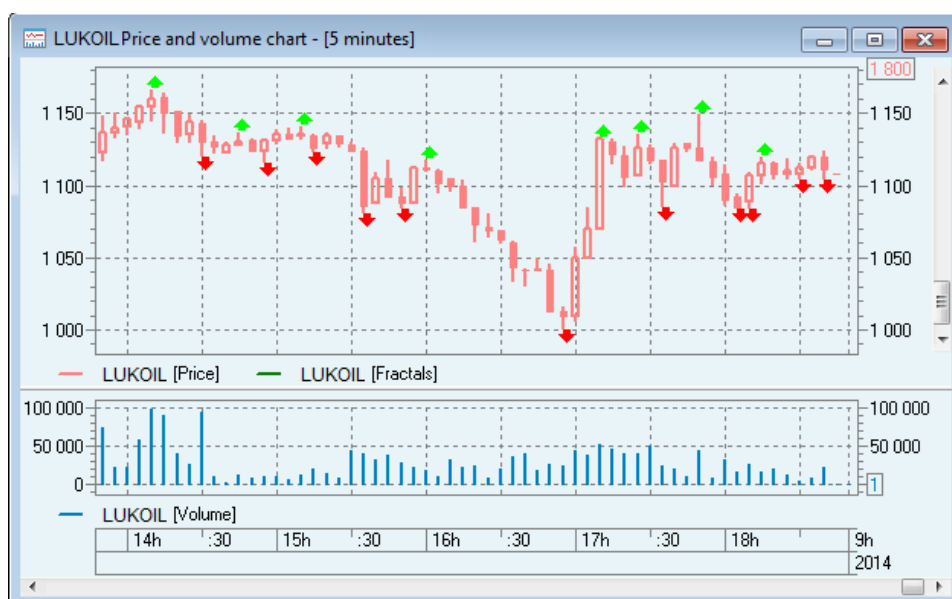
4.4.17 Fractals

The Fractals indicator consists of a series of successive candlesticks and may be of two types:

- An 'up fractal' is a series of at least five successive candlesticks with the maximum of the middle candlestick being higher than the maximums of the two preceding and two following candlesticks;

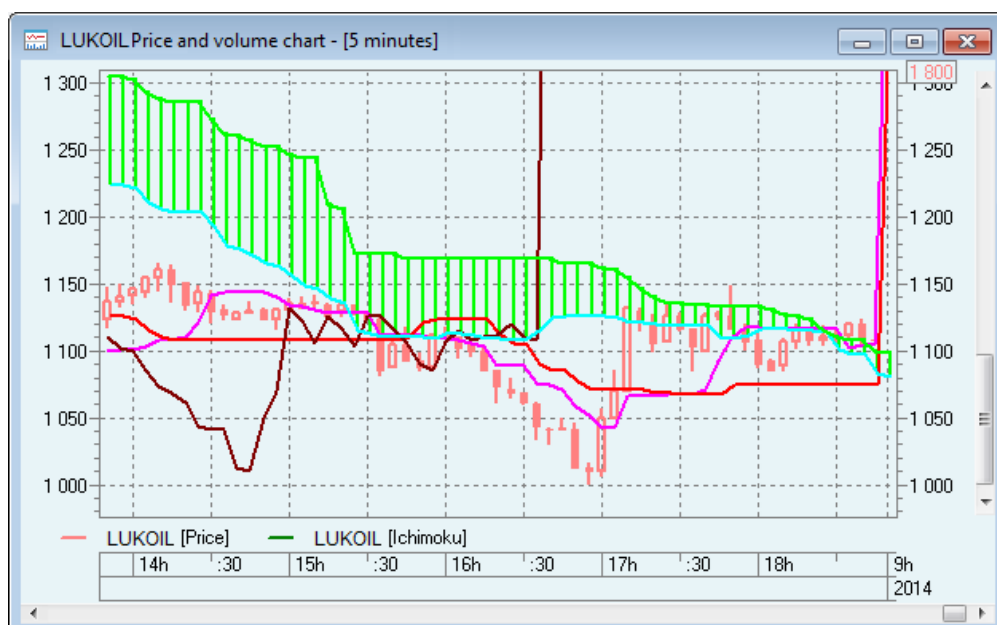
- A 'down fractal' is a series of at least five successive candlesticks with the minimum of the middle candlestick being lower than the minimums of the two preceding and two following candlesticks.

Fractals on a graph have **High** and **Low** values and are marked with up arrows and down arrows.



4.4.18 Ichimoku

The Ichimoku Kinko Hyo indicator is designed for determining a market trend, support and resistance levels, and for generating signals of buying and selling. This indicator works best at weekly and daily graphs.



The dimension of parameters are determined using four time intervals of different length. The values of individual lines that form this indicator are based on these intervals:

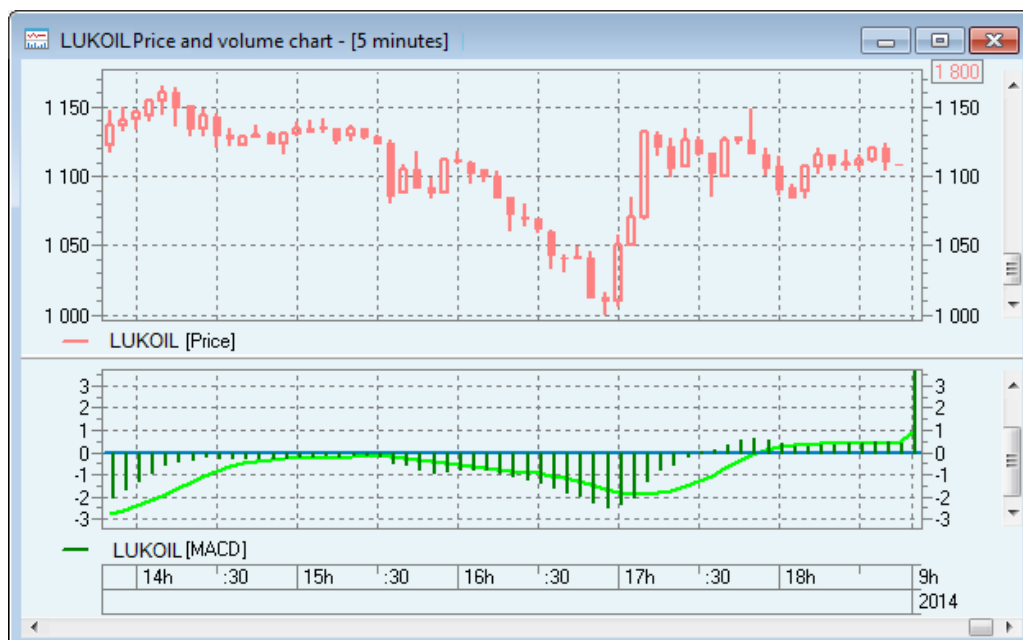
1. Tenkan-sen (the pink line) shows the average price during the first time interval. Tenkan-sen is used as an indicator of the market trend. If this line rises or falls, the trend exists. If it is horizontal, the market has come into a channel.
2. Kijun-sen (the red line) shows the average price during the second time interval and is used as an indicator of the market movement. If the price is higher than this indicator, the prices are likely to continue to increase. When the price crosses this line, changes in the trend are likely to occur. Kijun-sen can be also used to signal: a buy signal is generated when the Tenkan-sen crosses the Kijun-sen from below; a sell signal is generated when the Tenkan-sen crosses the Kijun-sen from above.
3. Senkou Span A (the blue line) shows the middle of the distance between two previous lines shifted forward by the value of the second time interval.
4. Senkou Span B (the green line) shows the average price during the third time interval shifted forward by the value of the second time interval. The distance between the Senkou lines is shaded with another colour and is called a 'cloud'.
5. Chinkou Span (the brown line) shows the closing price for the current candlestick shifted backward by the value of the second time interval. If the price is between the lines of the 'cloud', then the market is considered to be non-trending, and the edges of the 'cloud' form the support and resistance levels. If the price is above the 'cloud', then its upper line forms the first support level and its second line forms the second support level. If the price is below the 'cloud', then its lower line forms the first resistance level and its second line forms the second resistance level. If the Chinkou Span crosses the price chart from below, this is a signal to buy. If the Chinkou Span crosses the price graph from above, this is a signal to sell.

Settings:

1. **Tenkan** is the period length for the Tenkan-sen.
2. **Kijun** is the period length for the Kijun-sen.
3. **Senkou** is the period length for the Senkou Span A.
4. **Chinkou** is the period length for the Chinkou.
5. **Horizontal shift** is the shift length for the Senkou Span B.
6. **Line colors** defines the color of the lines.

4.4.19 MACD (Moving Averages Convergence/Divergence)

This indicator consists of two lines: MACD, the column chart that shows the difference between two exponential MAs, and MACD Signal, the 'signal' MA line based on the MACD value.



Calculation:

$$\text{MACD} = \text{MA}(\text{P}, \text{Nlong}) - \text{MA}(\text{P}, \text{Nshort}),$$

$$\text{MACD Signal} = \text{MA}(\text{MACD}, \text{N}),$$

where **MA(P, Nlong)** is the moving average of price (**P**) for **Nlong** periods (usually 26);

MA(P, Nshort) is the moving average of price (**P**) for **Nshort** periods (usually 12);

MA(MACD, N) is the moving average of **MACD** for **N** periods (usually 9).

Settings:

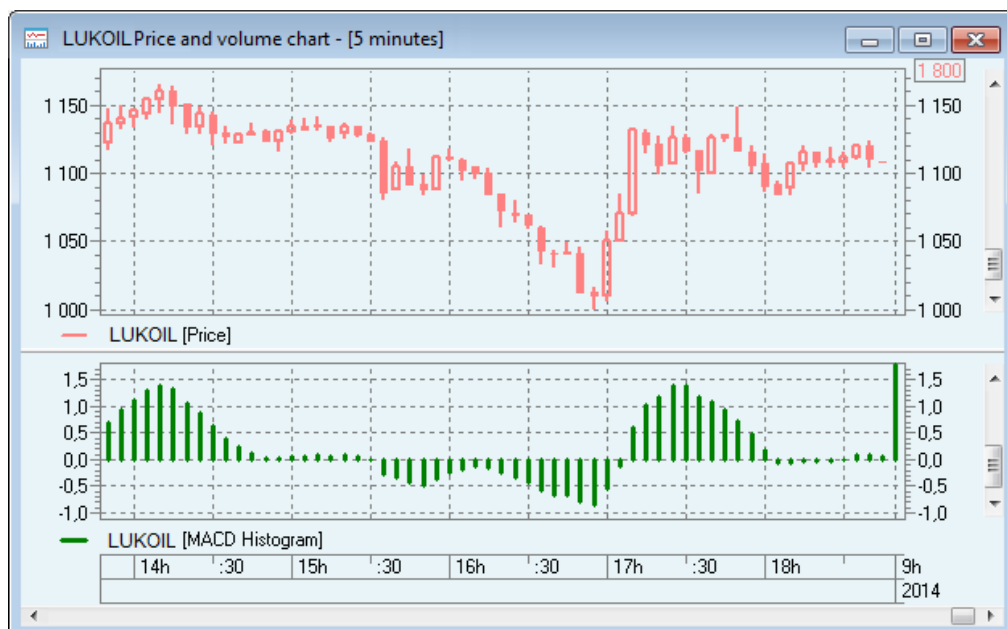
1. Settings **Moving averages**, **Method** are the same as for Price Oscillator.

2. **Signal moving average:**

- **Number of periods** is **N** number of periods for calculating **MA** of **MACD**;
- **Method** is the method used to calculate **MA** from **MACD** (Simple or Exponential); the default value is 'Simple';
- **Graph view** allows the user to select the graph view (lines, dots, or dashes);
- **Line color** allows the user to select the colour for the signal line.

4.4.20 MACD-Histogram

The MACD column chart is based on the difference between MACD and its signal line (by default, it is 9-period exponential MA).



Calculation:

$$\text{MACD Histogram} = \text{MACD} - \text{MACD Signal}$$

where $\text{MACD} = \text{MA}(\text{P}, \text{Nlong}) - \text{MA}(\text{P}, \text{Nshort})$,

$\text{MA}(\text{P}, \text{Nlong})$ is the moving average of price (**P**) for **Nlong** periods (usually 26);

$\text{MA}(\text{P}, \text{Nshort})$ is the moving average of price (**P**) for **Nshort** periods (usually 12);

$\text{MACD Signal} = \text{MA}(\text{MACD}, \text{N})$ is the 'signal line', the moving average of **MACD** for **N** periods (usually 9).

Settings:

1. **Moving averages** are the same as for the MACD and Price Oscillator.
2. Settings **Signal moving average, Method** are the same as for the MACD.

4.4.21 BW MFI (Bill Williams Market Facilitation Index)

Bill Williams Market Facilitation Index shows changes of price for one tick. Absolute values of this indicator are not indicative of anything, only relative changes have sense:

- Simultaneous growth of the MFI and the volume means that more and more players are entering the market (the volume increases) and new players open positions in the direction of bar development;
- Simultaneous decrease of the MFI and of the volume means that the participants are losing interest in advancing further;
- If the MFI increases, but the volume falls, the price movement is not supported by the market. The price movement is the result of speculation;

- If the MFI falls, but the volume increases, this means that 'bears' and 'bulls' are in a desperate struggle (the volume has increased), but their forces are roughly equal (the indicator has fallen). Williams called such a bar a 'squat bar'. In general, a breakthrough of such a bar is very important in terms of the future price behaviour.



Calculation:

$$\text{BW MFI} = (\text{HIGH} - \text{LOW}) / \text{VOLUME},$$

where **HIGH** is the maximum price of the current period;

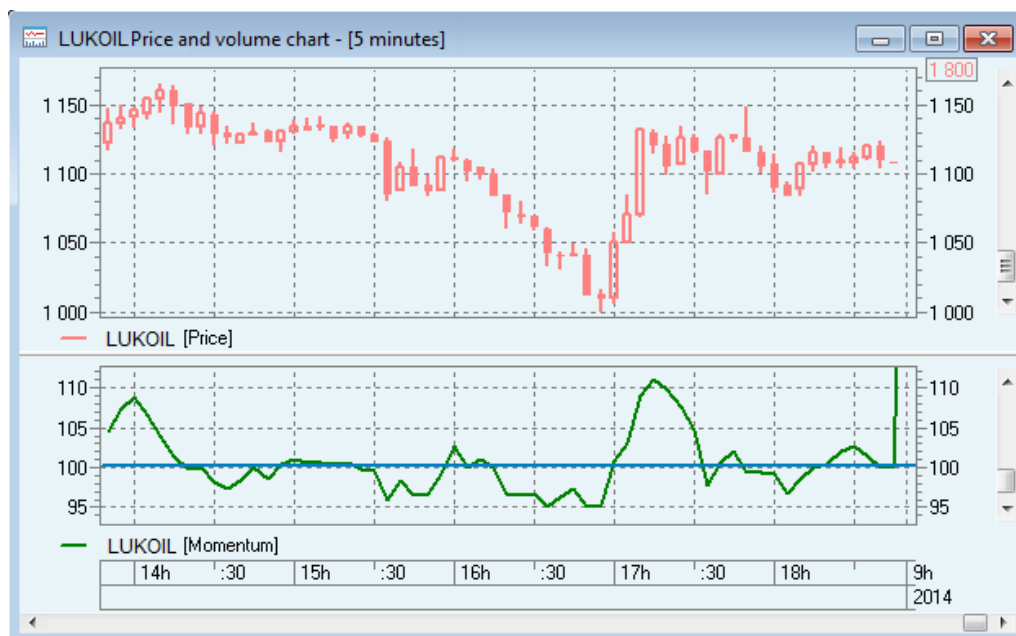
LOW is the minimum price of the current period;

VOLUME is the trade volume of the current period.

There are no settings available.

4.4.22 Momentum

The price 'momentum' is the ratio of the current price to the price *i* periods ago.



Calculation:

$$\text{MOM}_n = \text{PRICE}_n / \text{PRICE}_{n-i} * 100,$$

where **PRICE_n** is price in the **n**th period;

i is the number of preceding periods.

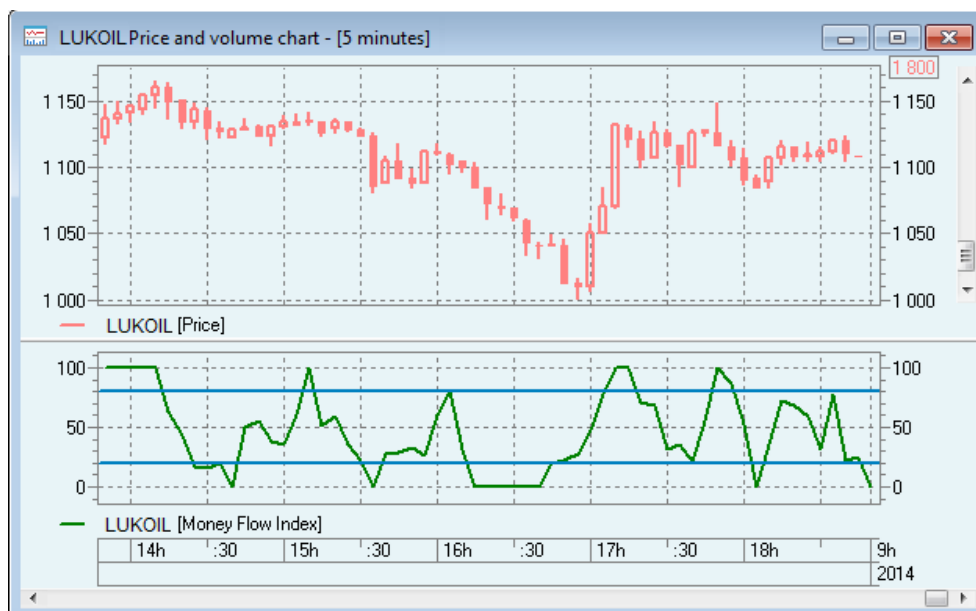
Settings:

1. **Number of periods** is the number of preceding periods (**i**); the default value is 5.
2. **Price Field** is the interval price (**PRICE**) (Open, High, Low, Close, Median, and Typical); the default value is 'Close'.

4.4.23 Money Flow Index

The Money Flow Index indicator (MFI) money flow (investment and withdrawal) for an instrument based on the comparison of positive and negative money flows.

Money flow is calculated by comparing the average price during the current period with the average price during the previous period.



Calculation:

$$\text{MFI} = 100 - 100 / (1 + \text{Ratio}),$$

where $\text{Ratio} = \text{Fp}_n / \text{Fn}_n$

$\text{Fp}_n = \text{Fp}_{n-1} + \text{TP}_n * \text{VOLUME}_n$, if $\text{TP}_n > \text{TP}_{n-1}$ is a positive money flow;

$\text{Fn}_n = \text{Fn}_{n-1} + \text{TP}_n * \text{VOLUME}_n$, if $\text{TP}_n < \text{TP}_{n-1}$ is a negative money flow;

$\text{TP}_n = (\text{HIGH}_n + \text{LOW}_n + \text{CLOSE}_n) / 3$ is a typical price;

n is the number of periods for calculation;

HIGH_n is the maximum trade price in the n th interval;

LOW_n is the minimum trade price in the n th interval;

CLOSE_n is the last trade price in the n th interval;

VOLUME_n is the volume of trades in the n th interval.

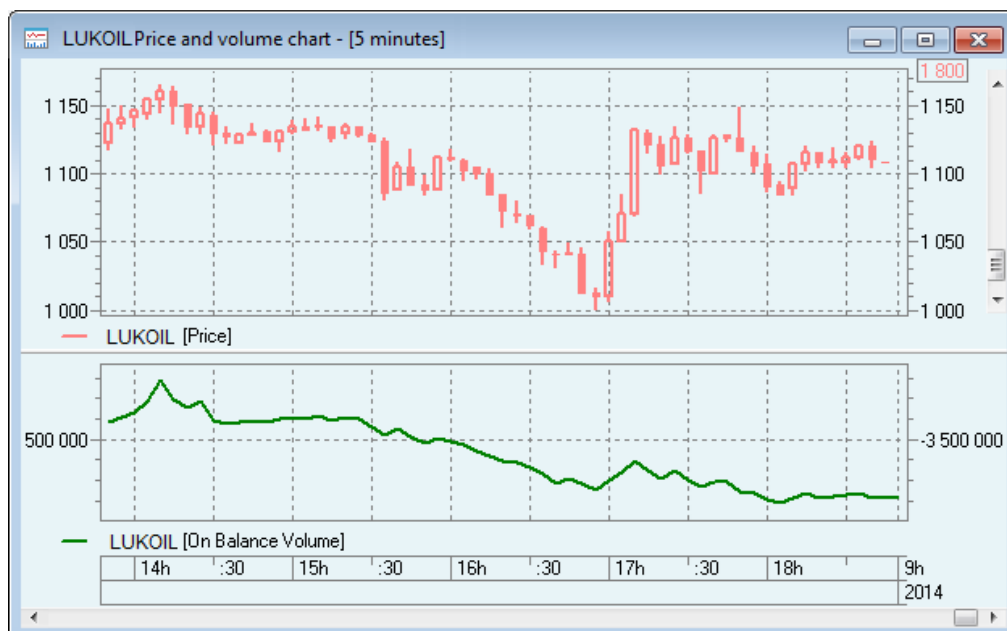
Settings:

- **Number of periods** is the number of periods (n); the default value is 3.

4.4.24 On Balance Volume

The On Balance Volume indicator shows the direction of the volume flow: in or out of the market.

If the closing price is higher than the previous closing price, the total volume of the period is considered positive. If the closing price is lower than the previous closing price, the total volume of the period is considered negative.



Calculation:

$$\text{OBV}_n = \text{OBV}_{n-1} + \text{VOLUME}_n, \text{ if } \text{PRICE}_n > \text{PRICE}_{n-1}$$

$$\text{OBV}_n = \text{OBV}_{n-1} - \text{VOLUME}_n, \text{ if } \text{PRICE}_n < \text{PRICE}_{n-1}$$

$$\text{OBV}_n = \text{OBV}_{n-1}, \text{ if } \text{PRICE}_n = \text{PRICE}_{n-1}$$

where **VOLUME_n** is the volume of trades in the **n**th period;

PRICE_n is the price for the **n**th period.

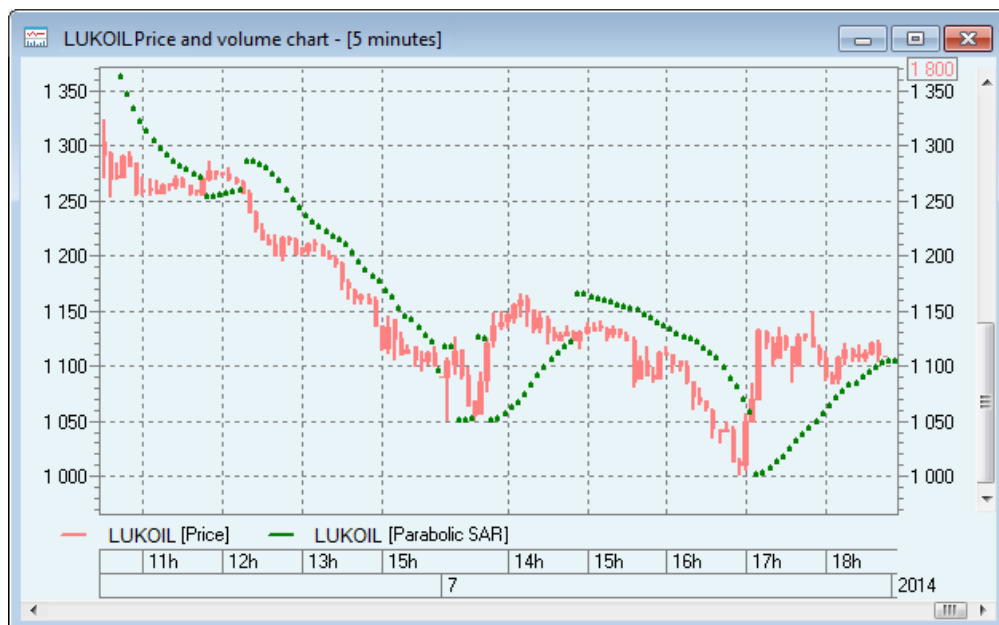
Settings:

- **Price Field** is the interval price value used for **PRICE** (Open, High, Low, Close, Median, Typical); the default value is 'Close'.

4.4.25 Parabolic SAR

Parabolic SAR ("Stop and Reverse") is the system used to identify potential reversals. This indicator is plotted on a price graph. Its meaning is similar to that of the moving average, the only difference is that the Parabolic SAR has a faster acceleration and can change its position relative to the price. If the price crosses the Parabolic SAR, the indicator reverses and its next values emerge on the other side of the price. Reversal of this indicator means that the trend has either ended or reversed.

The Parabolic SAR should be only used when there are trends. When there is no trend, it gives many false signals.



Calculation:

1. For long positions:

$$SAR_i = SAR_{i-1} + AF * (HIGH_{i-1} - SAR_{i-1})$$

2. For short positions:

$$SAR_i = SAR_{i-1} + AF * (LOW_{i-1} - SAR_{i-1}),$$

where $HIGH_{i-1}$ is the highest price of the previous period;

LOW_{i-1} is the lowest price of the previous period;

SAR_{i-1} is SAR in the previous period;

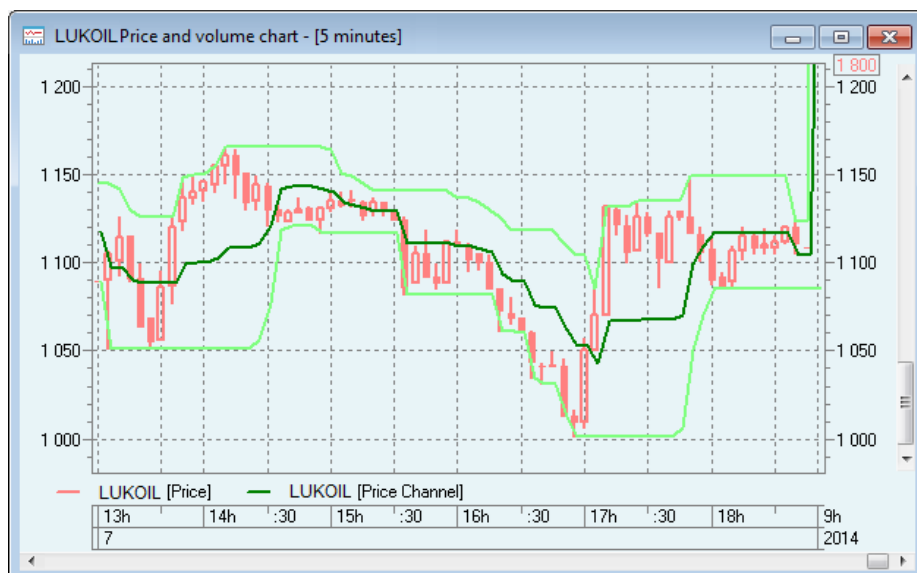
AF is the acceleration factor.

Settings:

1. **Step** is the increment of the closing price of a position (of the AF acceleration factor), the recommended value is 0.02.
2. **Max.step** is the maximum increment value, the recommended value is 0.2.

4.4.26 Price Channel

The Price Channel indicator consists of two boundary lines: the upper line is the price maximum during N periods, and the lower line is the price minimum during N periods. Channel lines can be interpreted as dynamic lines of support and resistance. The middle line is arithmetic mean of the two lines.



Calculation:

$PCh_i = \max([H_{i-n}; H_i])$ is the upper line (resistance),

$PL_i = \min([L_{i-n}; L_i])$ is the lower line (support);

$PCm_i = (PCh_i + PL_i) / 2$ is the middle line

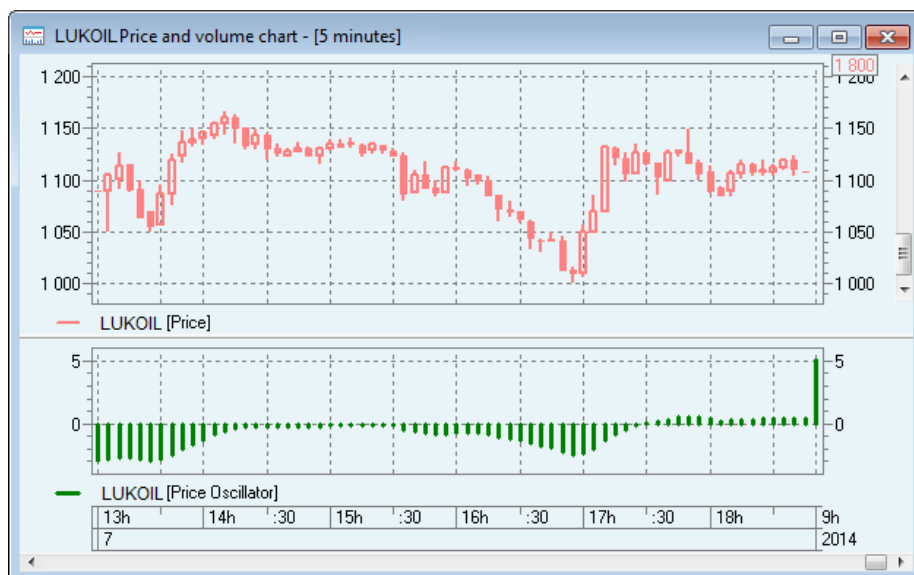
where $i \geq n$

Settings:

1. **Number of periods** is the number of periods (**n**); the default value is 10.
2. **Upper color** is the colour of the upper line.
3. **Lower color** is the colour of the lower line.

4.4.27 Price Oscillator

This indicator represents the difference of moving averages formed for two periods. This difference can be expressed both as a percentage and as absolute values.



Calculation:

$$PO = MA(P, Nshort) - MA(P, Nlong),$$

where **MA(P, Nshort)** is the moving average of the price **P** for **Nshort** periods;

MA(P, Nlong) is the moving average of the price **P** for **Nlong** periods.

Settings:

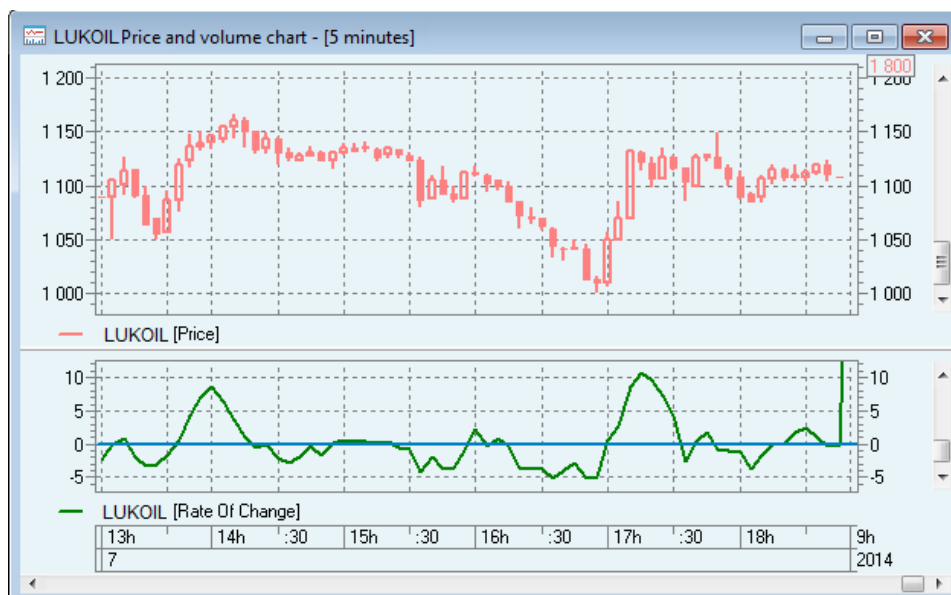
1. Moving averages:

- **Short period** is the **Nshort** period value for the first (short) **MA**;
- **Long period** is the **Nlong** period value for the second (long) **MA**;
- **Method** is the method used to calculate **MA** (Simple, Exponential, Vol.Adjusted, and Smoothed); the default value is 'Exponential';
- **Price Field** is the interval price value used for **P** (Open, High, Low, Close, Median, and Typical); the default value is Close.

2. Method is used to select the method for **MA** comparison (Percentage, Dots).

4.4.28 Rate Of Change

The Rate Of Change indicator (Price Rate-Of-Change — ROC) is calculated as the ratio of the closing price for a certain period to the closing price at the beginning of that period. The result shows the percent change in price during a given number of periods.



Calculation:

$$ROC = (PRICE_n - PRICE_{n-i}) / PRICE_{n-i} * 100,$$

where **PRICE_n** is the price for the **n**th period;

i is the number of periods.

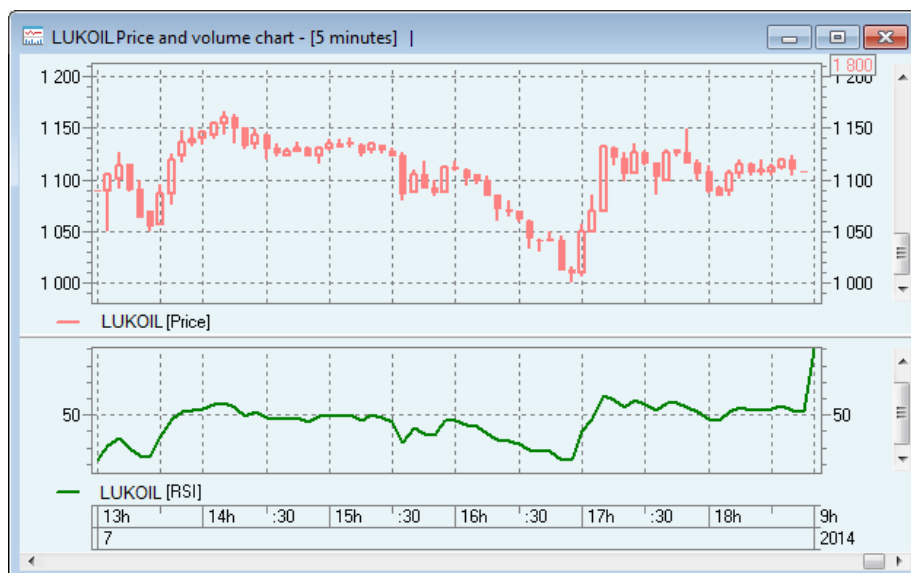
Settings:

1. **Number of periods** defines the number **i** of periods; the default value is 5.
2. **Price Field** defines the interval price (**PRICE**) (Open, High, Low, Close, Median, and Typical); the default value is 'Close'.

4.4.29 Relative Strength Index

Relative Strength Index (RSI) is a price-following oscillator that ranges between 0 and 100.

A popular method of analysing the RSI is to look for a divergence between prices and the indicator value at which the price forms a new maximum, and RSI cannot exceed its previous maximum. This divergence indicates the possibility of a reversal.



This indicator has two control levels (30 and 70 by default) on a graph represented by two horizontal lines. When the RSI goes above the upper control level, the indicator is considered to be in overbought territory. When the RSI goes below the lower control level, the indicator is considered to be in oversold territory.

Calculation:

$$RSI = 100 / (1 + D(P,N) / U(P,N)),$$

where $U(P,N)$ is the moving average of P price growth for N periods;

$D(P,N)$ is the moving average of the decrease in price P during N periods.

Settings:

1. **Number of periods** is the number N of periods for calculation of moving averages.
2. **Price Field** defines the interval price value used for P (Open, High, Low, Close, Median, and Typical).

4.4.30 Relative Vigour Index

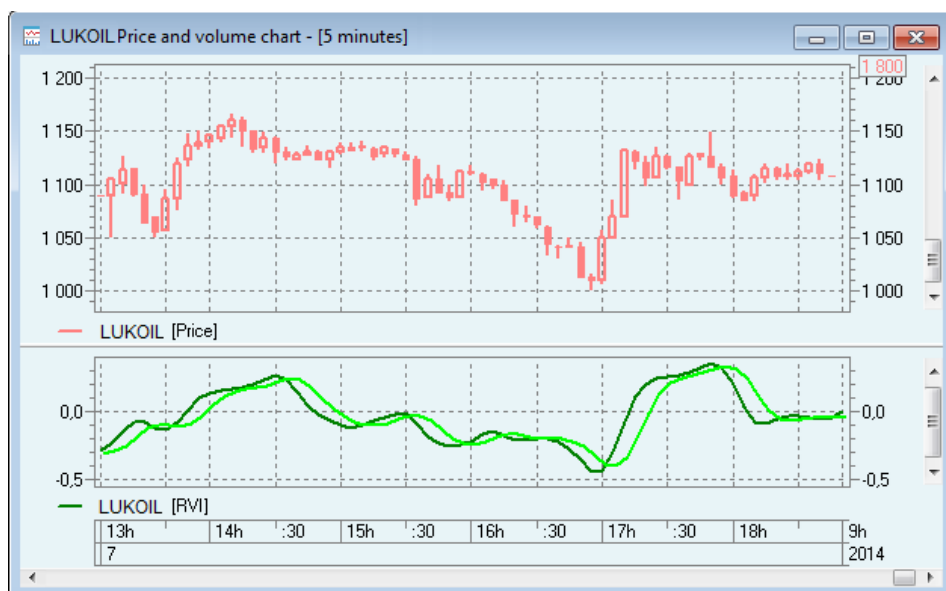
The Relative Vigour Index measures the certainty of the current price movement and the likelihood that it will continue.

The RVI compares the position of the closing price relative to the price range, and the result is smoothed by calculating a moving average of the values. The moving average, in turn, reflects the average equilibrium value for a particular period. In this case, a 4-period moving average of the Relative Vigour Index value, which is meant to reduce uncertainty, serves as a signal line.

The fast RVI line (blue) indicates the energy of marked movement, which is based on the fact that the closing prices are higher than the opening prices, and reflects the equilibrium of the market crowd during a short time period. The slower **signal line** reflects equilibrium of the market crowd

during a longer time period. The combination of the two lines provides crossing signals typical of oscillators.

When the fast RVI line crosses the slow signal line from below, this signals that buyers are currently strong on the market and it is better to open buy positions. When the fast RVI line crosses the slow signal line from above, this signals that sellers are currently stronger on the market and it is better to open only sell positions.



Calculation:

$$RVI_i = \frac{\sum_{j=i-n+1}^i MoveAverage_j}{\sum_{j=i-n+1}^i RangeAverage_j}, i \leq n + 3$$

$$MoveAverage_i = (C_i - O_i) + 2 (C_{i-1} - O_{i-1}) + 2 (C_{i-2} - O_{i-2}) + (C_{i-3} - O_{i-3}), i > 3$$

$$RangeAverage_i = (H_i - L_i) + 2 (H_{i-1} - L_{i-1}) + 2 (H_{i-2} - L_{i-2}) + (H_{i-3} - L_{i-3}), i > 3$$

$$RVI_Signal_i = (RVI_i + 2RVI_{i-1} + 2RVI_{i-2} + RVI_{i-3})/6, i \geq (n + 3) + 3$$

where C_i is the closing price of the i th period;

H_i is the maximum price of the i th period;

L_i is the minimum price of the i th period;

O_i is the opening price of the i th period.

Settings:

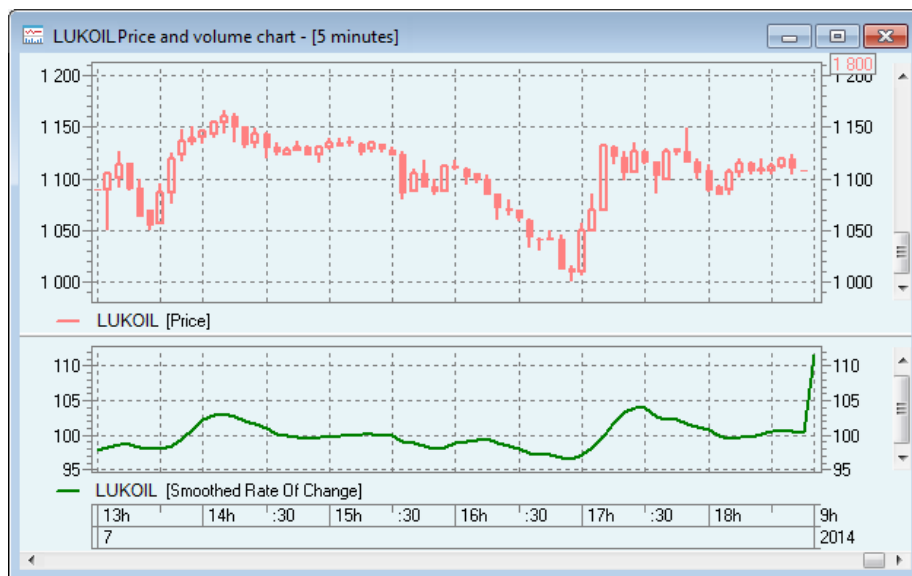
1. Number of periods is the number n of periods for calculation of moving averages.

2. The **Signal parameters** group contains the settings for the display of the signal line:

- **Graph view** defines the way the signal line is displayed. The default value is 'Dashes';
- **Line color** defines the line color.

4.4.31 Smoothed Rate Of Change

The Smoothed Rate Of Change indicator (S-RoC) compares values of exponential moving averages instead of price values at two moments of time. Therefore, contrary to the Rate Of Change indicator, it reacts to each data element once rather than twice. This oscillator produces fewer but more reliable signals.



Calculation:

$$\text{SROC} = \text{MA}(n) / \text{MA}(n-k) * 100,$$

where **MA(n)** is the moving average of the **PRICE**;

n is the number of periods for **MA** averaging;

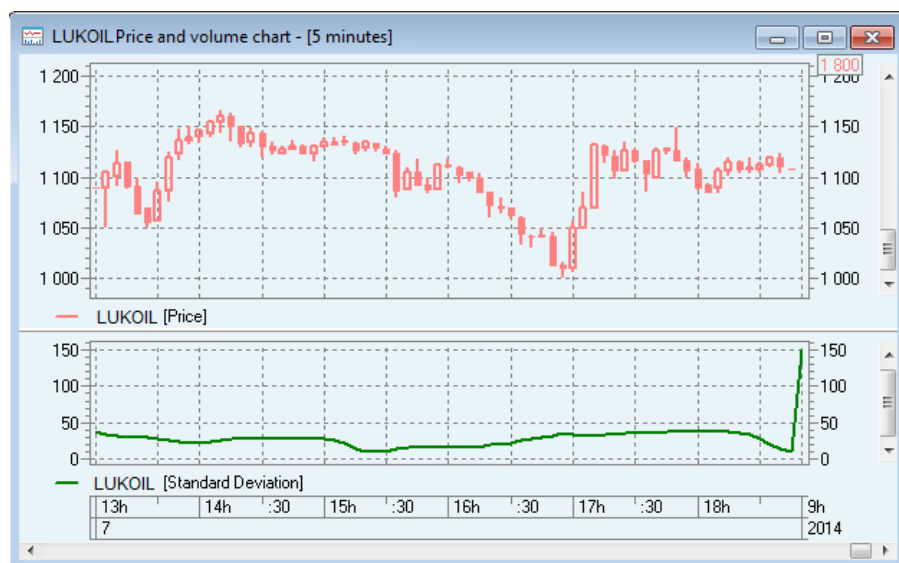
k is the smoothing coefficient.

Settings:

1. **Coefficient** defines the value of the **k** smoothing coefficient; the default value is 5.
2. **Number of periods** sets the number of periods **n** of **MA** averaging, the default value is 10.
3. **Method** is the **MA** calculation method (Simple, Exponential, Vol.Adjusted, and Smoothed); the default value is 'Exponential'.
4. **Price field** is the interval price value used for **PRICE** (Open, High, Low, Close, Median, Typical); the default value is 'Close'.

4.4.32 Standard Deviation

The standard deviation is a statistical method for measuring market volatility. This indicator is rarely used by itself. Most often, it is used as a part of another indicator. For example, standard deviation is used to calculate the Bollinger Bands.



Calculation:

$$\text{StDev} = \text{SQRT}(\text{SUM}((P_i - \text{SMA}(P, N))^2 / N),$$

where **SMA** is the simple moving average of price **P** during **N** periods;

N is the number of periods;

SQRT () is the square root.

Settings:

1. **Number of periods** is the number **N** of periods for **MA** calculation.
2. **Price Field** is the interval price (**P**) (Open, High, Low, Close, Median, and Typical); the default value is 'Close'.

4.4.33 Stochastic Oscillator

The Stochastic Oscillator shows moments when the price comes close to its price range over a given time period. This indicator consists of two lines: the fast line (%K) and the slow line (%D).

Calculation:

$$\%K(m) = 100 * \text{SMA} (C - \text{LLV}_n, m) / \text{SMA} (\text{HHV}_n - \text{LLV}_n, m),$$

$$\%D = \text{MA} (\%K, s),$$

where **SMA** is the Simple Moving Average;

C is the closing price of the current period;

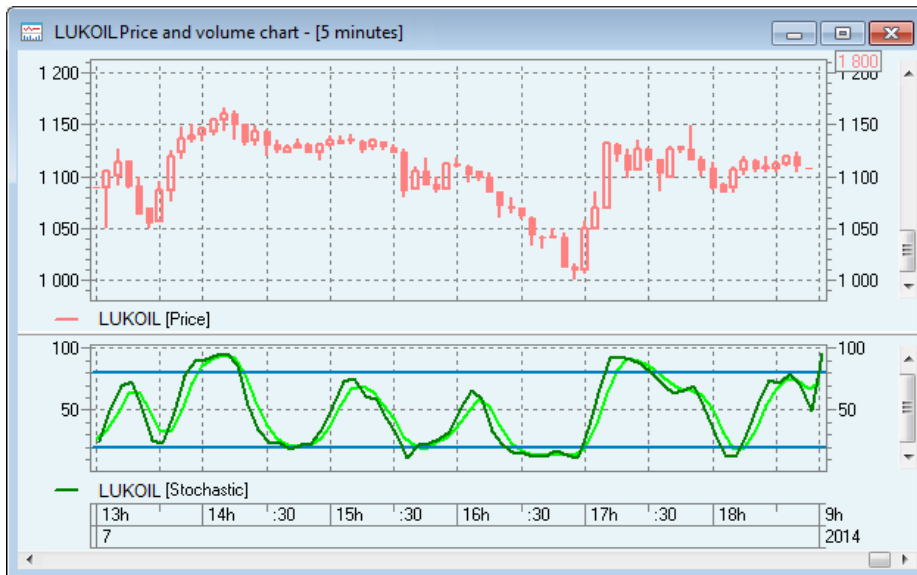
LLV_n is the minimum price for the last **n** periods;

HHV_n is the maximum price for the last **n** periods;

m is the number of smoothing periods;

n is the number of periods (usually from 5 to 21);

s is the number of periods used for calculation of the moving average.



Settings:

1. Parameters of %K:

- **Number of periods** is the number **n** of periods;
- **Smoothing** is the period used for internal smoothing of values **%K**. A value of 1 is considered a strong (fast) stochastic. A value of 3, which is the default value, is considered a slow stochastic.

2. Parameters of %D:

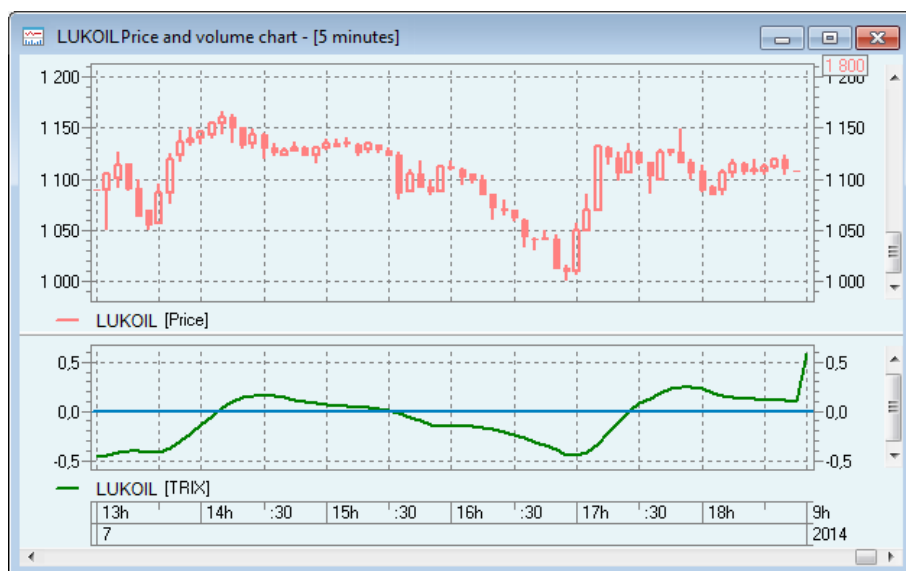
- **Number of periods** defines the number of periods for **MA** calculation;
- **Method** is the method used to calculate **MA** (Simple or Exponential); the default value is 'Simple';
- **Graph view** allows the user to select the graph view (lines, dots, or dashes);
- **Line colour** defines the line colour.

4.4.34 TRIX (Triple Exponential Moving Average)

The TRIX indicator is a dynamic indicator that displays the percent rate of change of a triple exponentially smoothed moving average of the instrument's closing price. The TRIX indicator oscillates around zero and is used to filter out the instrument's movements that are insignificant relative to a larger trend of the instrument.

The TRIX is calculated as follows:

1. Obtain the exponential MA.
2. Obtain the exponential MA of EMA obtained at step 2.
3. Obtain the exponential MA of EMA obtained at step 3.
4. Calculate the 1-period difference between the results of triple smoothing: the value of step 4 of the current period is subtracted from the value of step 4 of the previous period.
5. The value obtained at step 5 is divided by the value of step 4 of the previous period and multiplied by 100 for convenient display on a graph.



Calculation:

$$\text{TRIX}_i = (3\text{MA}_i - 3\text{MA}_{i-1}) / 3\text{MA}_{i-1} * 100$$

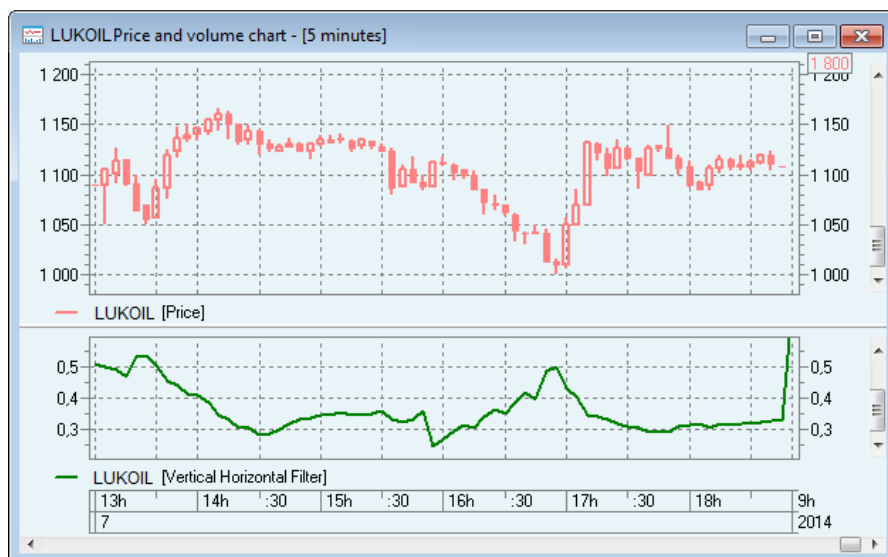
where $3\text{MA} = \text{MA}(\text{MA}(\text{MA}(\text{H} / \text{L} / \text{O} / \text{C})))$

MA is the moving average with parameters set by the user;

H / L / O / C is the price field selected by the user.

4.4.35 Vertical Horizontal Filter

The Vertical Horizontal Filter indicator (VHF) is used to determine if market is trending and identifies whether the prices are in a trending phase or a congestion phase. The VHF compares the sum of ROC indices for a particular period to the difference between the maximum and the minimum price in the same period.



Calculation:

$$\text{VHF} = A / B,$$

where $A = HH - LL$;

HH is the maximum price in the selected period;

LL is the minimum price in the selected period;

$B = \text{SUM} (\text{ABS}(\text{PRICE}_n - \text{PRICE}_{n-1}))$ in the selected period.

Settings:

1. **Number of periods** defines the number **n** of periods; the default value is 28.
2. **Price Field** defines the interval price value used for **PRICE** (Open, High, Low, Close, Median, and Typical); the default value is 'Close'.

4.4.36 Volume Oscillator

The Volume Oscillator is the difference between two MAs of trade volume for an instrument expressed as a percentage.

The difference between two MAs of the volume with different period lengths can be used to determine a general trend in the volume movement (increase or decrease). If the Volume Oscillator rises above zero, this means that the short-term MA of the volume is above the long-term MA, i.e., that the short-term volume trend is higher than the long-term trend.

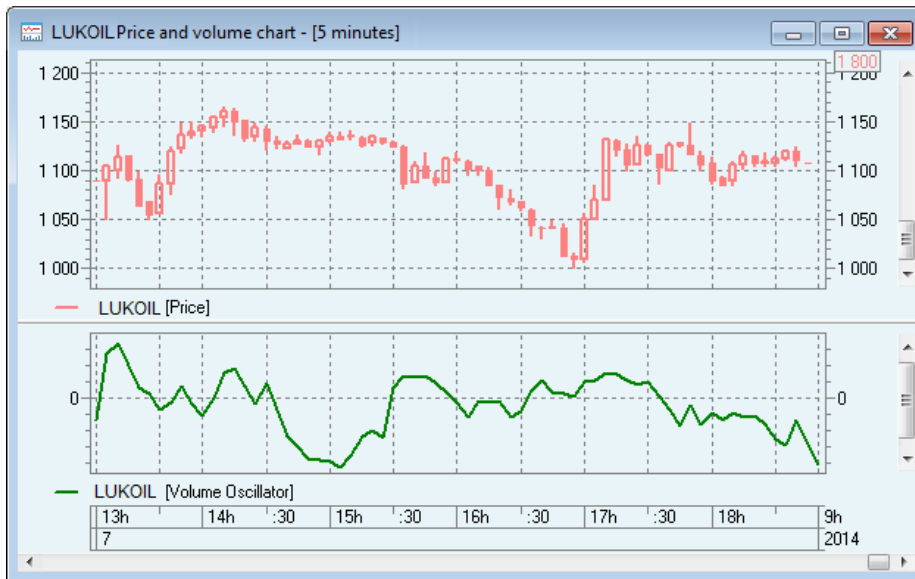
Calculation:

$$\text{VO} = (\text{MA}(\text{Nshort}, \text{VOLUME}) - \text{MA}(\text{Nlong}, \text{VOLUME})) / \text{MA}(\text{Nlong}, \text{VOLUME}) * 100,$$

where $\text{MA}(\text{N}, \text{VOLUME})$ is the moving average of the volume (**VOLUME**) for **N** periods;

Nshort is the length of the short period;

Nlong is the length of the long period.



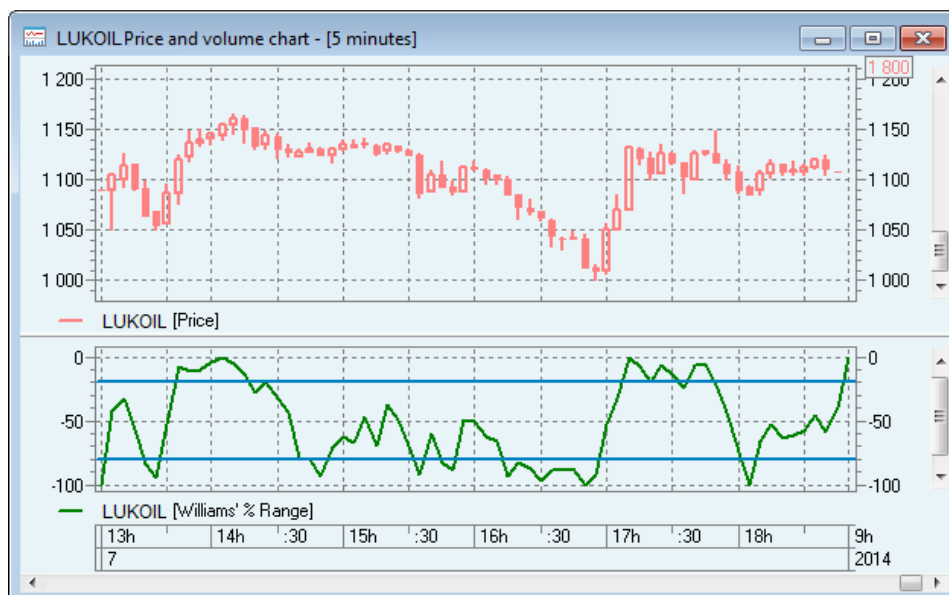
Settings:

1. **Short period** defines the value of **Nshort** for the first (short) **MA**; the default value is 5.
2. **Long period** defines the value of **Nlong** for the second (long) **MA**; the default value is 10.
3. **Method** is the method used to calculate **MA** (Simple, Exponential, Vol.Adjusted, Smoothed); the default value is 'Exponential'.

4.4.37 Williams' % Range

The Williams' Percent Range Indicator (%R) is a dynamic indicator that measures overbought and oversold market conditions.

This indicator is formed on the reversed scale where 0 is in the upper part and 100 is in the lower part of the scale; therefore, to show this indicator, a minus symbol is placed before each value.



Calculation:

$$\%R = -100 * (H - C) / (H - L),$$

where **C** is current closing price;

L is the minimum price in the last **n** periods;

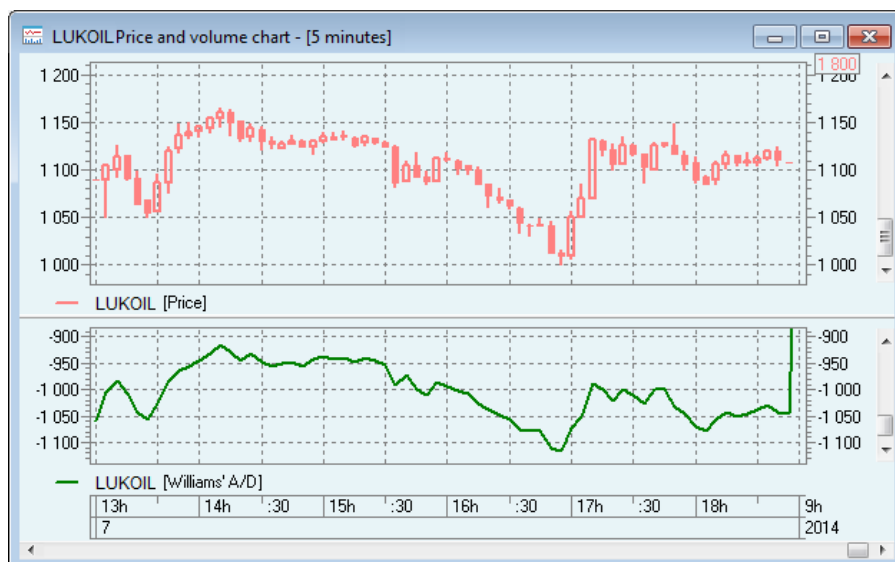
H is the maximum price in the last **n** periods.

Settings:

- **Number of periods** defines the number **n** of periods.

4.4.38 Williams' Accumulation / Distribution

The Williams' Accumulation/Distribution indicator (Williams' A/D) shows the distribution of securities if the prices of trades for an instrument form new maximums, but the indicator's values cannot form a new maximum. The indicator shows accumulation of securities when prices of trades reach new minimums, but the indicator cannot reach a new minimum.



Calculation:

$$\text{CumWAD}_n = \text{CumWad}_{n-1} + \text{WAD}_n,$$

where $\text{WAD}_n = \text{PRICE}_n - \text{TL}$, for $\text{PRICE}_n > \text{PRICE}_{n-1}$,

$\text{WAD}_n = \text{PRICE}_n - \text{TH}$, for $\text{PRICE}_n < \text{PRICE}_{n-1}$,

$\text{WAD}_n = 0$, for $\text{PRICE}_n = \text{PRICE}_{n-1}$,

$\text{TH} = \max(\text{PRICE}_{n-1}, \text{HIGH}_n)$ is True Range High;

$\text{TL} = \min(\text{PRICE}_{n-1}, \text{LOW}_n)$ is True Range Low;

PRICE_n is the closing price in the n th interval;

HIGH is the maximum price in the n th interval;

LOW is the minimum price in the n th interval.

There are no settings available.

4.5 Bonds Yield Graph

The **Data export / Charts / New bonds yield chart** menu or the  button

The bonds yield graph displays yield for the selected set of bonds depending on their expiry date (or the offer).

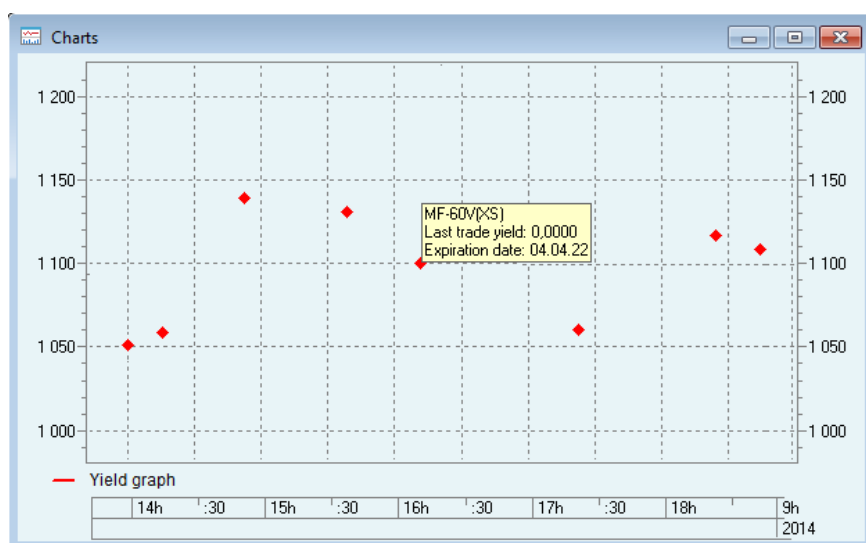
4.5.1 Window Format

The graph consists of multiple points each of which corresponds to a single bond. The positions of the points on the graph are determined by two parameters:


- Along the time axis: the closest of the two dates: the expiry date or the offer date;

- Along the vertical axis: the **Last trade yield** value or the **AWP yield** value. Configure plotting yield labels in the program settings (see sub-section [4.5.2](#)).

The names of the parameters selected for a label on the graph, as well as their values, are displayed on the graph when the cursor hovers over the point.



4.5.2 Configuring chart parameters

To create a new graph, select **Data export / Charts / New bonds yield chart** from the menu or click  on the toolbar. To change the graph settings, use the shortcut menu (see sub-section [4.5.4](#)).

The Bonds yield chart tab contains the following settings:

- Title** allows the user to specify the heading of the graph window.
- Available securities, Selected securities** allow the user to configure the list of bonds displayed on the graph. The list of selected bonds is configured separately for each window on the graph. To do so, select the window name in the **Window** field and, then, configure the list of bonds.

3. **Window** is the list of the graph windows; by default, all data is displayed in **Pane1**. If you need to add a new window, click the **Add** button. Click **Remove** to delete the selected window in the list.

Each window has its own associated list of bonds. Therefore, several charts for different instruments can be plotted in the common window of the bonds yield graph.

4. In the **Show values** list, select parameters to be displayed on the graph:
- **Last trade yield** shows yield values calculated according to the last trade price;
 - **AWP yield** shows yield values calculated according to the WAP;
 - **All** shows labels for both parameters. The values are displayed in the same plotting area but have different colors.
5. Select **Show tooltip on the label** to display the bond parameters when the cursor hovers over a point on the graph. If this checkbox is selected, parameters are displayed as a tooltip next to the selected point. If this checkbox is cleared, parameters are displayed in the upper left corner of the chart.
6. Select **Show horizontal axis** to display the values on the time scale.
7. Select **Show vertical gridline** to display the vertical grid lines on the graph.
8. If **Show empty intervals** is selected, all time intervals are displayed on the time scale; if it is cleared, only the intervals that contain values are displayed. This checkbox is selected by default.

The Format Chart Area tab contains the following settings:

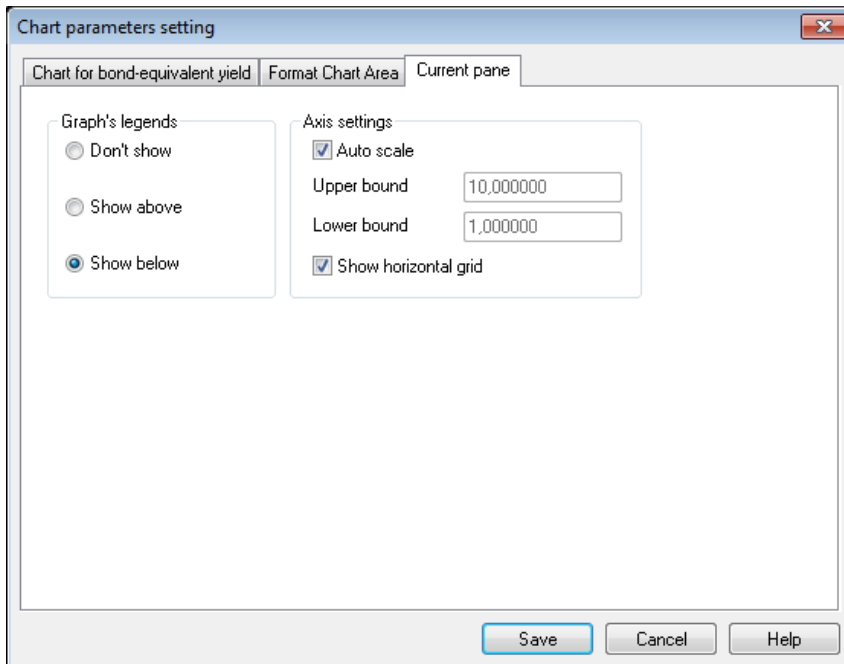
1. The **Font** option allows the user to select the type, size and colour of the font of text legends on the graph.
2. The **Color settings** block allows the user to select the colours for the background, axes, and the grid.

The Current pane tab contains the following settings:

This tab is displayed when **Current pane settings...** is selected from the graph's shortcut menu, or upon double-clicking on the free space in the plotting area.

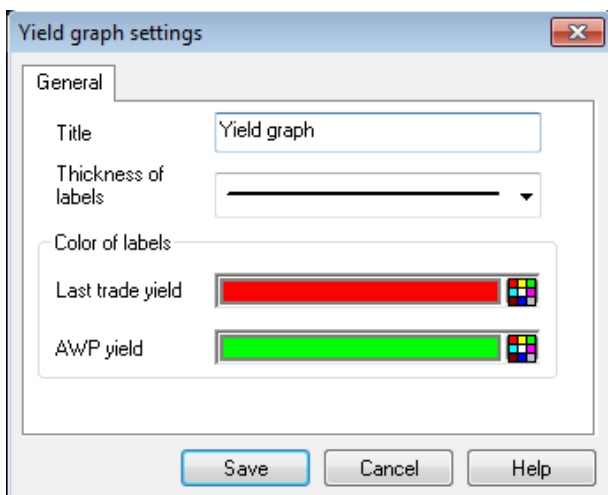
1. The **Legend position** options define how the legend will be placed relative to the plotting area:
 - **Do not show** hides the legend;
 - **Show above** places the legend above the plotting area;
 - **Show below** places the legend below the plotting area.
2. Settings of the right (the left) axis:

- Select **Automatic scaling** to automatically adjust the vertical scale (the maximum and the minimum values of parameters within the displayed time range). When automatic scaling is disabled, values of the upper and the lower boundaries of the scale are set manually;
- **Maximum** refers to the maximum scale value;
- **Minimum** refers to the minimum scale value;
- **Show horizontal grid** displays horizontal grid lines on the plotting area.



4.5.3 Yield graph view settings

The following settings are available in the configuration dialogue:



1. **Title** allows the user to edit the legend in the current window of the graph.
2. **Thickness of labels** allows the user to select the labels' size.
3. **Color of labels** allows the user to select the labels' colour depending on the method used to calculate the yield:

- Last trade yield;
- AWP yield.

4.5.4 Available actions

Actions performed from the shortcut menu on the plotting area

1. **New chart...** creates a chart for the desired securities and parameters; for further details, see sub-section [4.2.1](#).
2. **New bonds yield chart...** creates a new bonds yield chart.
3. **Add label...** adds a user's label to the graph (for further details, see sub-section [4.2.14](#)).
4. **Delete all labels** removes all labels from this graph.
5. **Current pane settings...** opens the graph settings window on the **Current chart window** tab. For further details, see sub-section [4.5.2](#).
6. **Chart parameters...** opens the graph settings window on the **Bonds yield chart** tab. For further details, see sub-section [4.5.2](#).
7. **Graph settings** opens the graph view configuration window. For further details, see sub-section [4.5.3](#).
8. **Delete graph** deletes the selected graph.
9. **Delete current pane** deletes the current pane from the chart.
10. **Save to file** saves the chart image to a BMP or EMF file.
11. **Move to tab** moves the graph window to another tab.

Actions performed from the graph's point's shortcut menu

1. **Settings Yield graph** opens the graph view configuration window. For further details, see sub-section [4.5.3](#).
2. **Print graph** prints the current graph.
3. **Save graph** saves the data of the current graph as a text file; the file format is described in sub-section [4.5.5](#).
4. **Delete graph** deletes the current graph.

4.5.5 Saving graph data to a file

The numeric values of a graph can be saved to a file. The data on all securities displayed in the selected graph window is saved to the file.

To do this, follow these steps:

1. Select a point in the graph window that you want to save.
2. From the shortcut menu of that point, select **Save graph**.
3. In the window that opens, specify the file name and select a folder on your drive.

The file format is as follows:

The first line contains names of the parameters in angle brackets separated by commas. The subsequent lines contain the data on bonds in the ascending order of their expiry dates. The yield

parameter saved to the file are those parameters that were configured for display on the graph (see sub-section [4.5.2](#), “Show values” option).

Example of a file:

```
<Instrument>,<Expiration>,<Last trade yield>,<WAP yield>  
Ust-Luga1,11.02.10,18.520000,0.000000  
Rusfinans4,12.02.10,24.140000,0.000000
```