Virtument User Manual

Contents

Starting Virtument in MatDeck

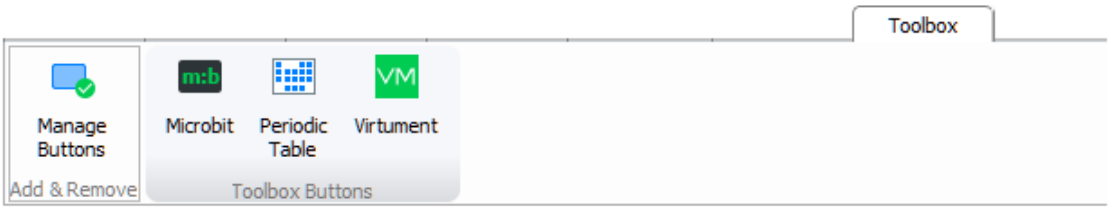
Please note: To use certain variable and values within MD documents in Virtument, they may need to be exported. Exporting and Importing values and variables is used in the example at the end.

There are multiple ways of starting and using in Virtument in MatDeck. This includes:

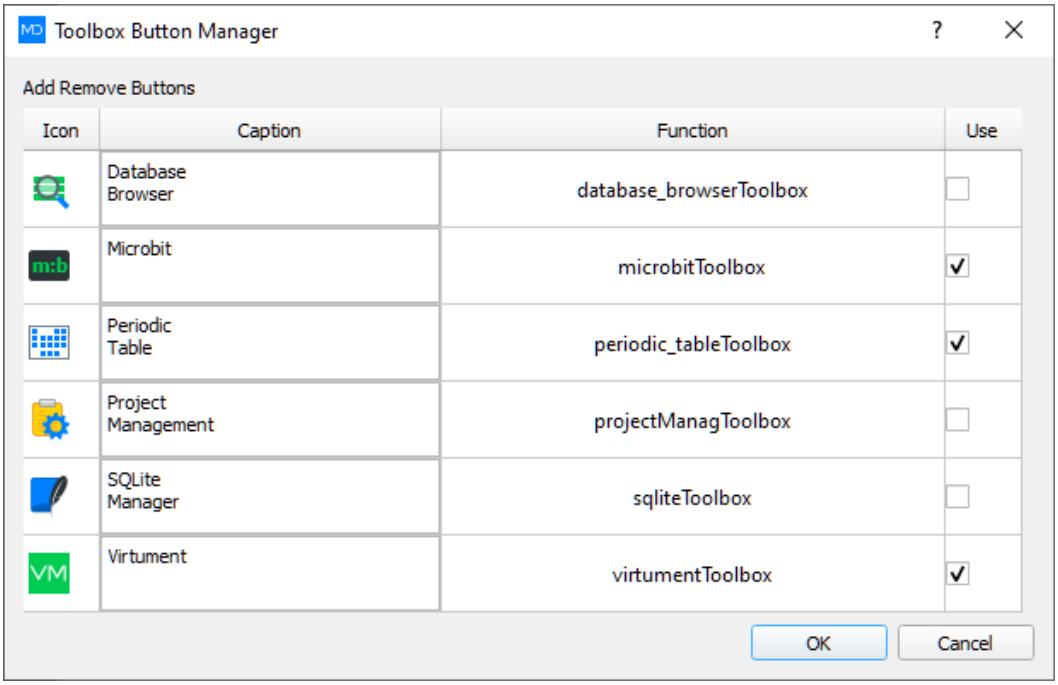
- **Opening Virtument in MatDeck via "Virtument Toolbox"**
- **Opening Virtument in MatDeck via "Virtument Form"**
- **Virtument Instruments/Widgets via Canvas**
- **Opening Virtument in MatDeck via Virtument functions**

Opening Virtument in MatDeck via "Virtument Toolbox"

Before being able to use Virtument in MatDeck, its toolbox must be added first. To do this, go to the 'Toolbox' toolbar at the top of the window and press on 'Manage Icons'.

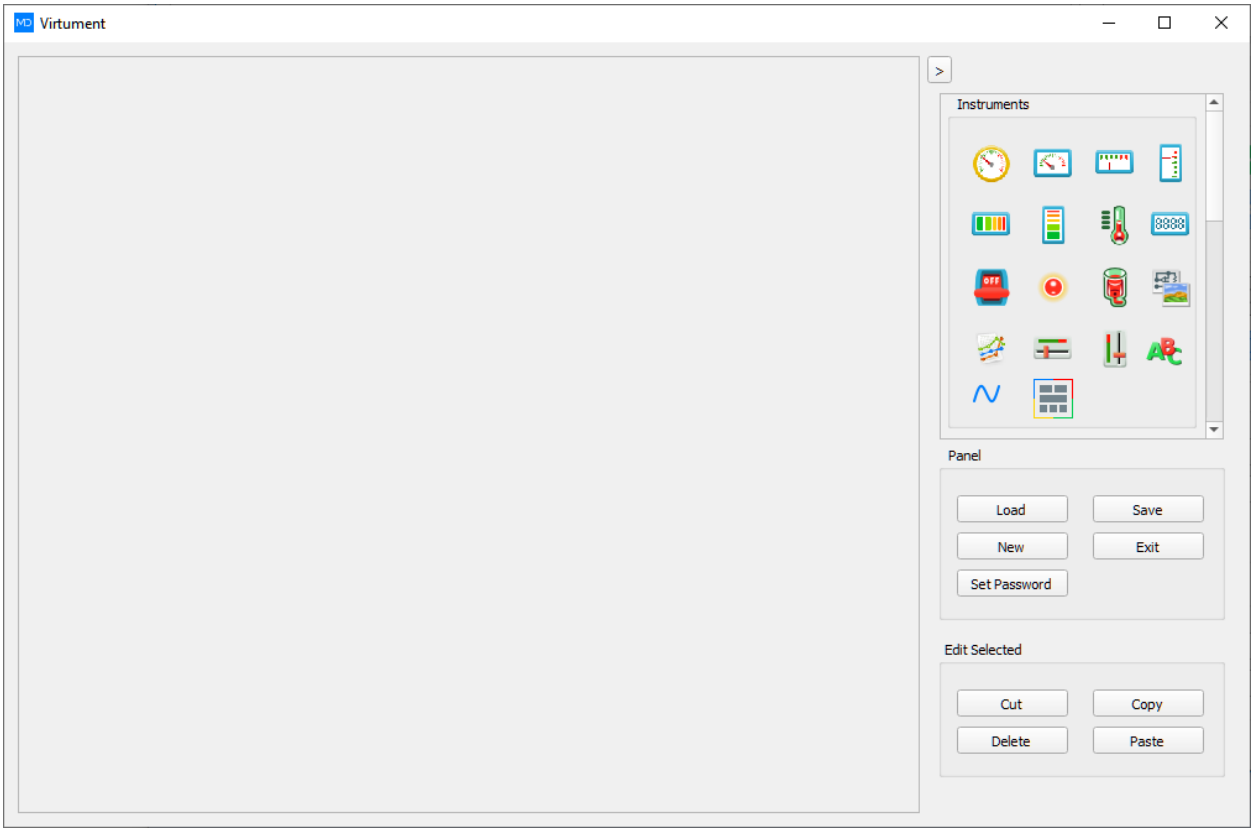


The window below will appear, with all the possible toolboxes that can be added. To add Virtument, tick the check box for it under "Use" and press "Ok" to confirm.



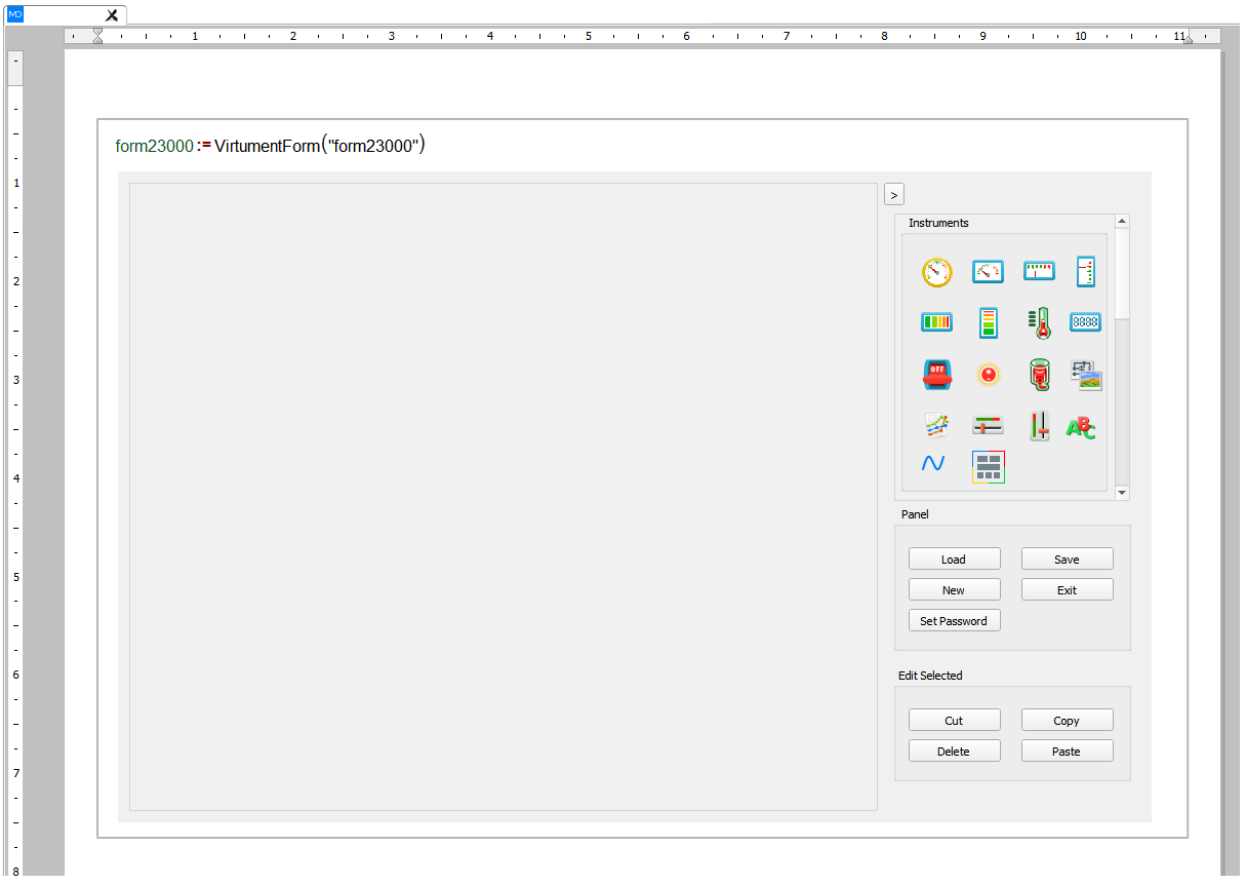
Opening Virtument in MatDeck: once a Virtument toolbox has been added to MatDeck, Virtument is ready to be used. Simply open Virtument by pressing on the new button you have created for the Virtument toolbox.

Once pressed, an empty Virtument instruments panel in a separate window will open such as the one below.



Opening Virtument in MatDeck via “Virtument Form”

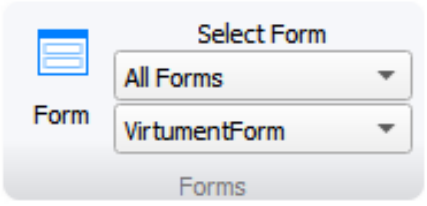
Virtument instrument panels can also be opened by inserting a Virtument form into a canvas. This has the added benefit that the instruments panel can be used and incorporated directly into the MatDeck document.



The Virtument panel will appear as so in the canvas.

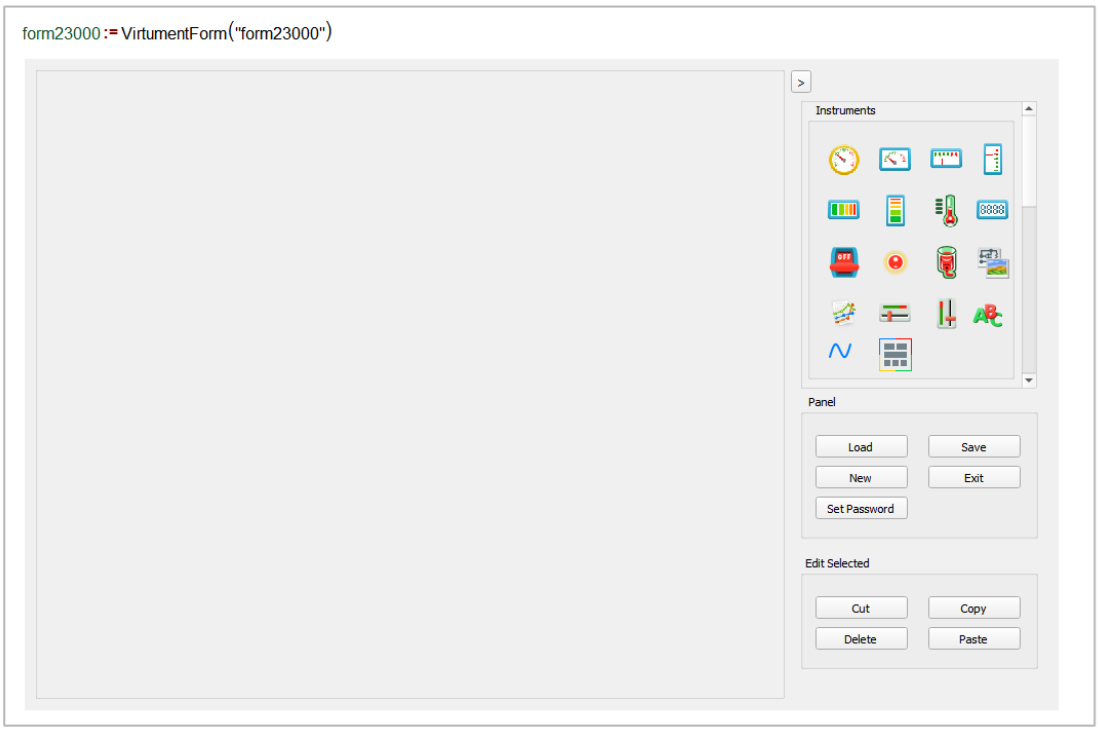
Please Note: To insert the Virtument panel, first make sure that your MD document is in A3 format. This can be done by going to the “Layout” tab, pressing on the “Paper Size” icon and selecting A3.

First, go to the “Insert” tab and move to the Form tab towards the right. Here, select the “VirtumentForm” option from the second drop down menu. The Form should look like this.



The form must be inserted into a canvas on the A3 document. To insert a canvas, simply go to the "Insert" tab and press on the Canvas icon. Now, press where on the document you wish to deploy the canvas. The Virtument instrument panel is larger than the default Canvas size so it is recommend to expand the canvas before adding the panel.

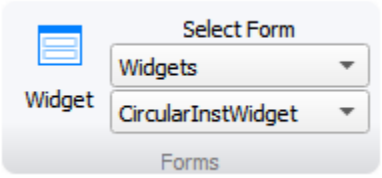
Once the Canvas is set and the form is configured, press on the form icon and select where in the canvas you wish to deploy the Virtument instruments panel. The panel will be deployed as such.



Virtument Widgets via Canvas

Specific Virtument instruments/widgets can be used outside the instruments panel and directly in the MatDeck document. Below is an example of an Analog Circular Gauge deployed in a MatDeck canvas.

Here, by selecting the “Widgets” option from the first drop down menu, users can select a widget from the second drop down menu to insert in the canvas.



By setting the “Select Form” tab as such, an Analog Circular Gauge has been selected. Press the “Widget” icon to initiate the widget and press where on the canvas you wish to deploy the widget.

The function used will be stored in an auto-created variable. In this case, the variable is called “wgt18523”.

Virtument widgets in MatDeck can be inserted two different ways. The example above was done by using the “Select Form”.

Virtument widgets can also be inserted by directly writing the widget functions in the canvas.

```
Widget := CircularInstWidget("ExampleWidget")
embed_widget(Widget)
```

Here, the function used for initiating an Analog Circular Gauge is stored in the variable, “Widget”, and the widget is named “ExampleWidget”. The function used only creates the widget but doesn’t deploy it into the canvas. This is where **embed_widget()** is used to deploy the widget instanlty in the canvas in its place.

```
Widget := CircularInstWidget("ExampleWidget")
```

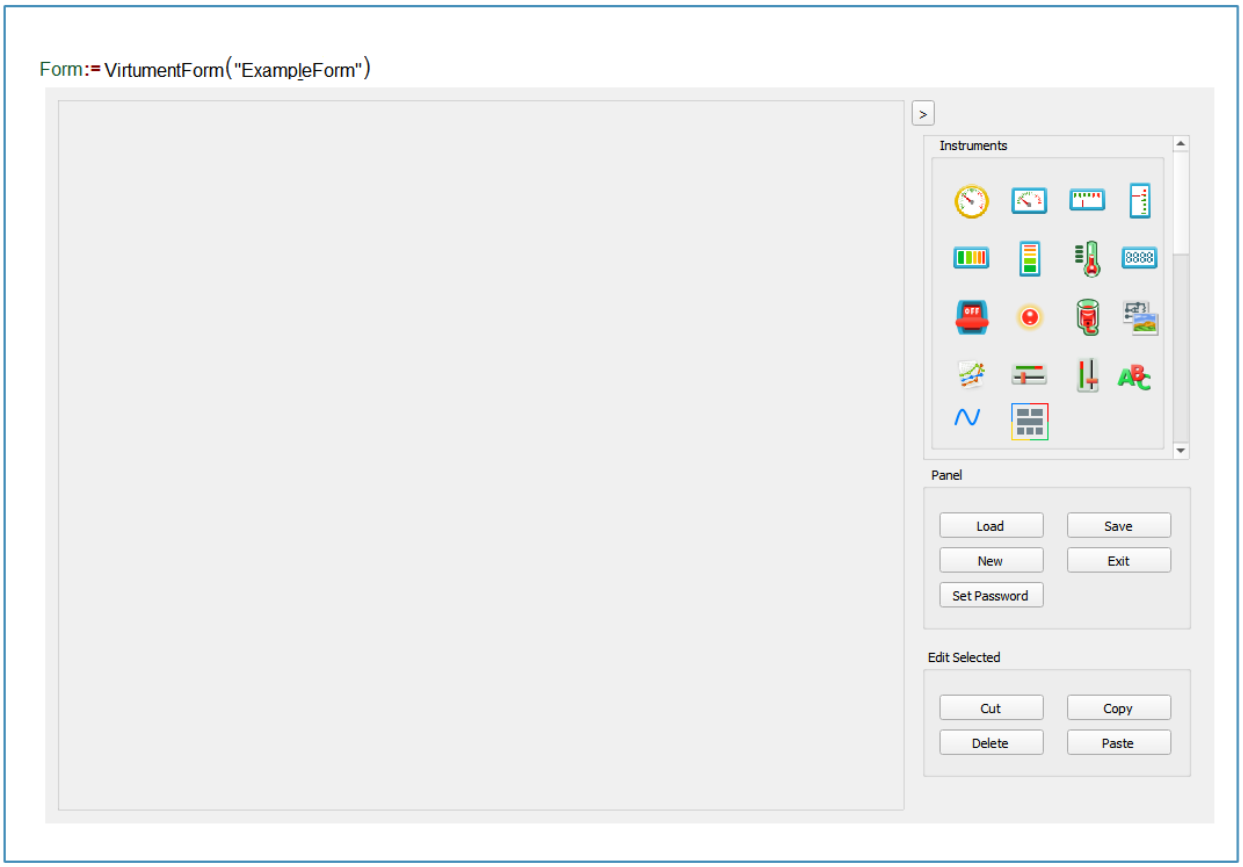
Opening Virtument in MatDeck via Virtument functions

Virtument can also be opened in MatDeck by using Virtument functions within canvases. Here, the Virtument panel will automatically open once the function has been written but can be embedded with the correct functions.

```
Form := VirtumentForm("ExampleForm")
embed_widget(Form)
```

In the example above, the function **VirtumentForm()** is used to initiate the Virtument instruments panel. Its only argument is the name of the Virtument instruments panel. In this case, “ExampleForm” is used.

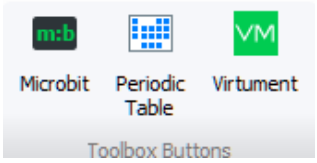
Similar to Virtument widgets, the function only creates the Virtument panel. The Virtument needs to be deployed by using another function. The panel can be either embedded in the canvas or deployed as an independent window. In this example, **embed_widget()** is used.

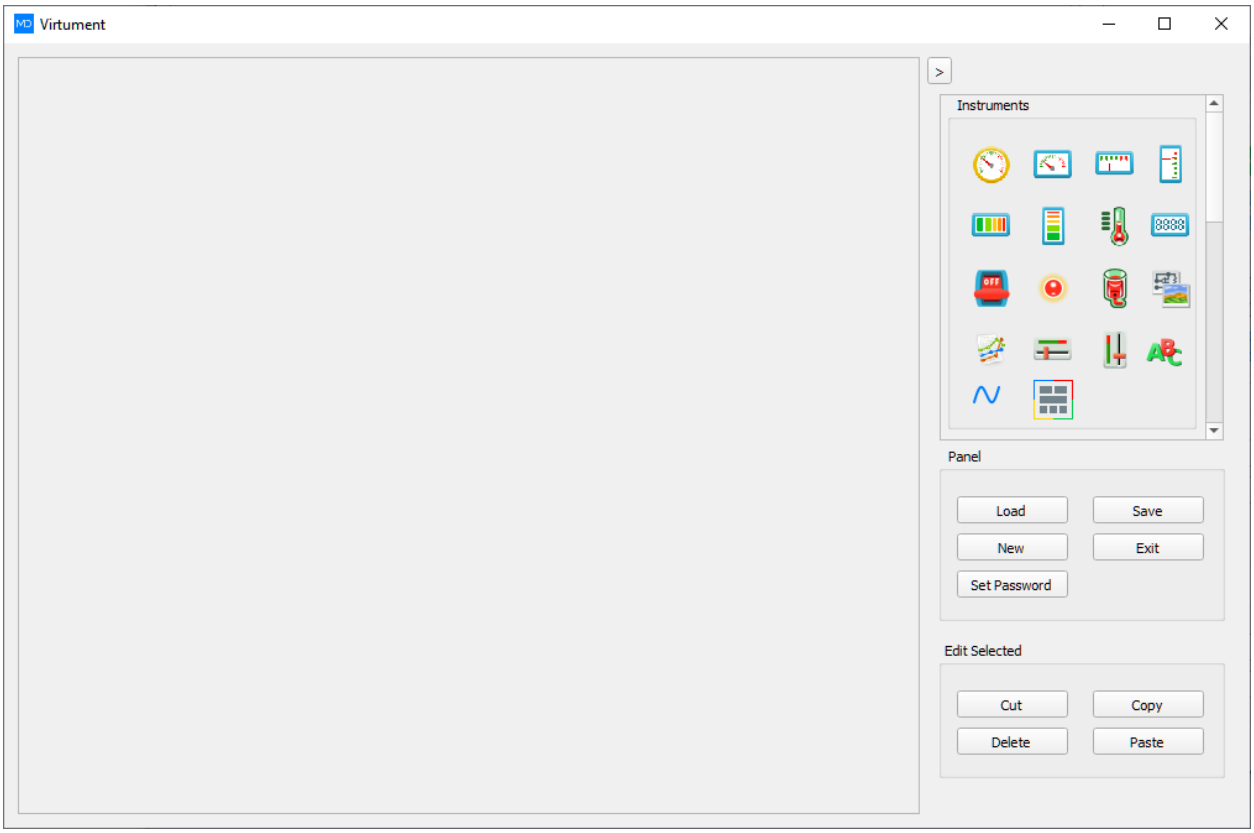


1 Instrument panel

This is the main working area in which you can insert new instruments.

Virtument can be accessed in multiple ways in MatDeck. The most common is through the Virtument toolbox but, Virtument can also be deployed directly into the document depending on the user's preference. Please read ***Starting Virtument in MatDeck*** to learn more.



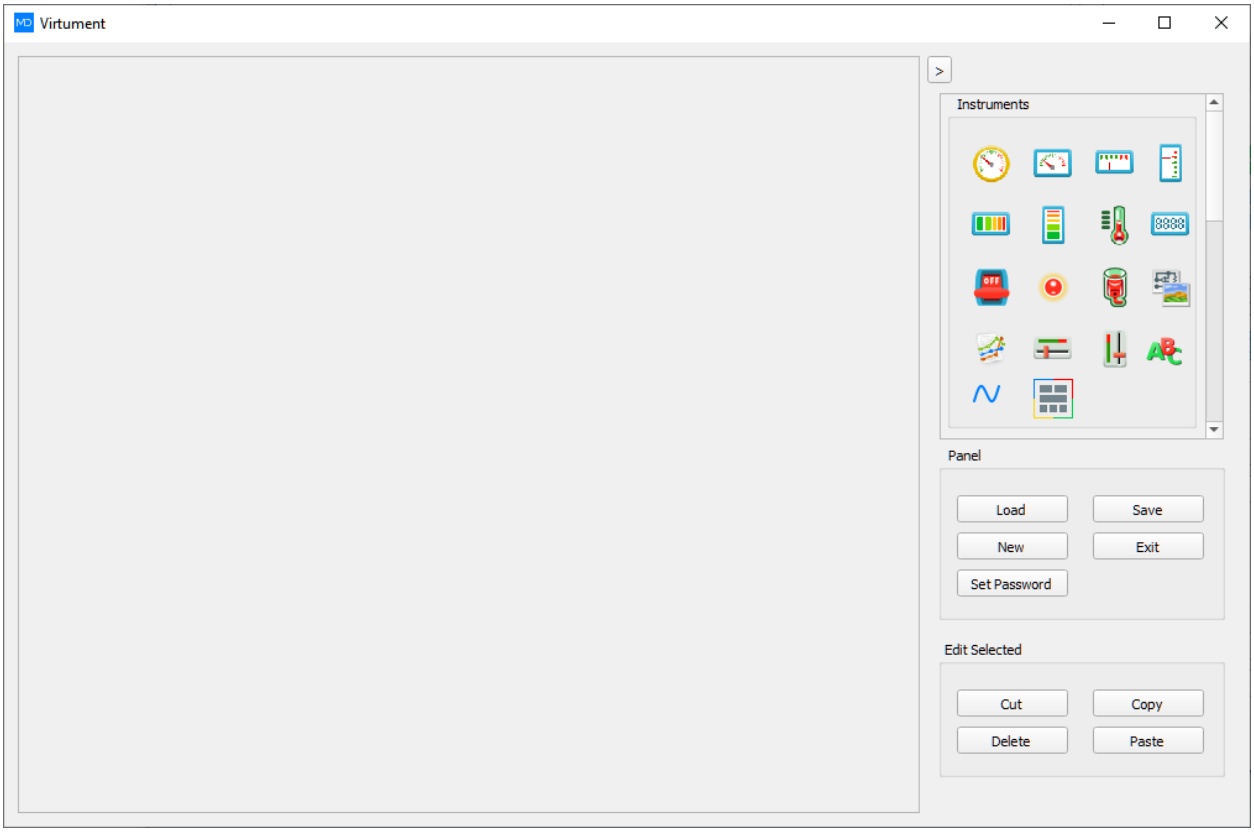


Picture 1: Virtument desktop

When Virtument is open, the window above will open. This is the default empty Virtument window.

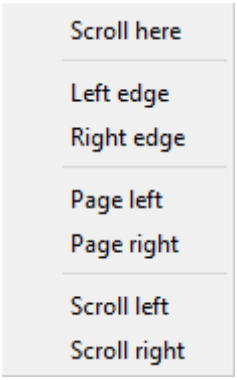
The desktop consist of the following features:

1. **Instrument panel**: main work area for adding new instruments and editing current instruments
2. **ToolBox**: the window located to the side which allows you to choose and insert new instruments to panels, save and open panels, edit instruments settings, lock and unlock panels …



Picture 2: Instrument panel

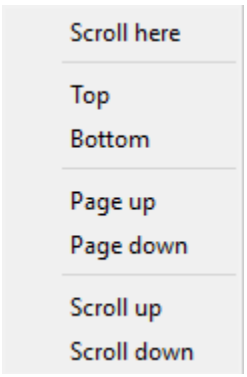
Scrolling and moving in the instrument panel: when first opened the Virtument window will be empty and the instrument panel will have no sliders for scrolling present. However, when new instruments are added and moved outside the starting area, vertical and horizontal sliders will appear which can be moved to transverse through the instrument panel.



Picture 3: Horizontal slider

By right clicking on the horizontal slider, it will open the content menu shown on Picture 3. From this menu, you can move the slider by choosing one of the available options.

For example, if you press the '*Scroll here*' option, the slider will position itself on the place where you have right clicked on. You can position the slider on the edges of the Instrument panel area with the '*Left edge*' and '*Right edge*' options. You can also move the slider one page to the left/right using *'Page left/right'* or move it one scroll to the left/right using *'Scroll left/right'*.



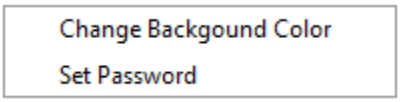
Similarly, pressing right click on the vertical slider will open the content menu shown on Picture 4.

In respect to the content menu above, the options in this menu are the same but are for moving the vertical slider.

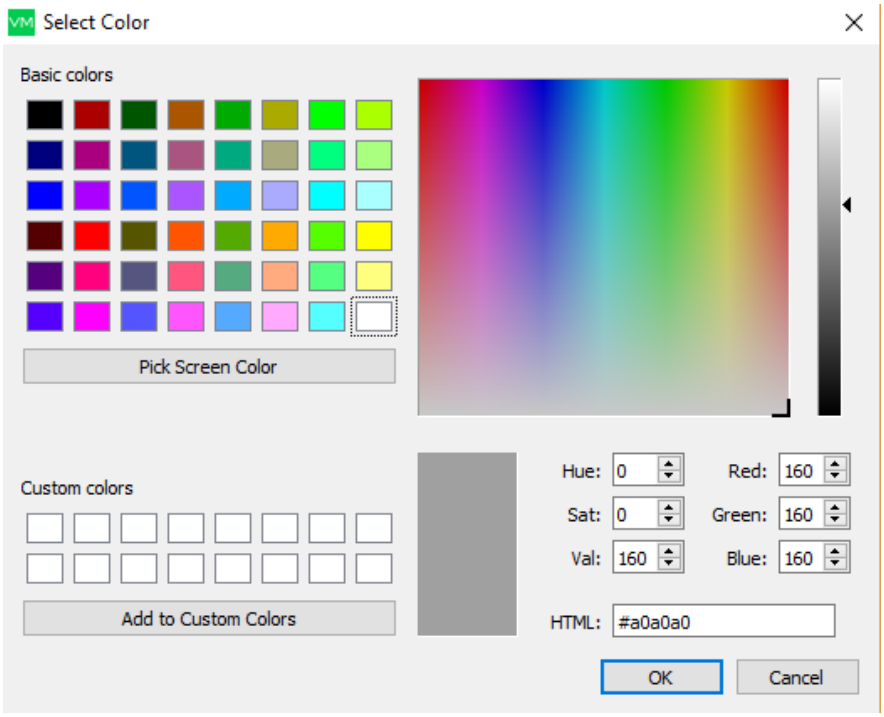
Picture 4: Vertical slider

Another feature present on the instrument panel is the collapse toolbar button  . This option allows you to hide the 'Instruments', 'Panel' and 'Edit Selected' features leaving only the main working area the instrument panel present. If you have hidden the toolbar and you wish to see it, simply press the button again to return to its original format.

Right clicking on the working area of the Instrument panel will open the options below.

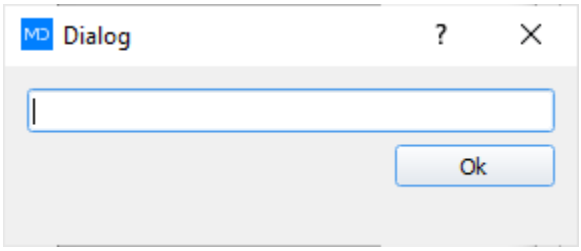


Change Background Color opens the window shown in Picture 5 from which you can set the Instruments panel area background color. Default background color is gray.



Picture 5: Background color

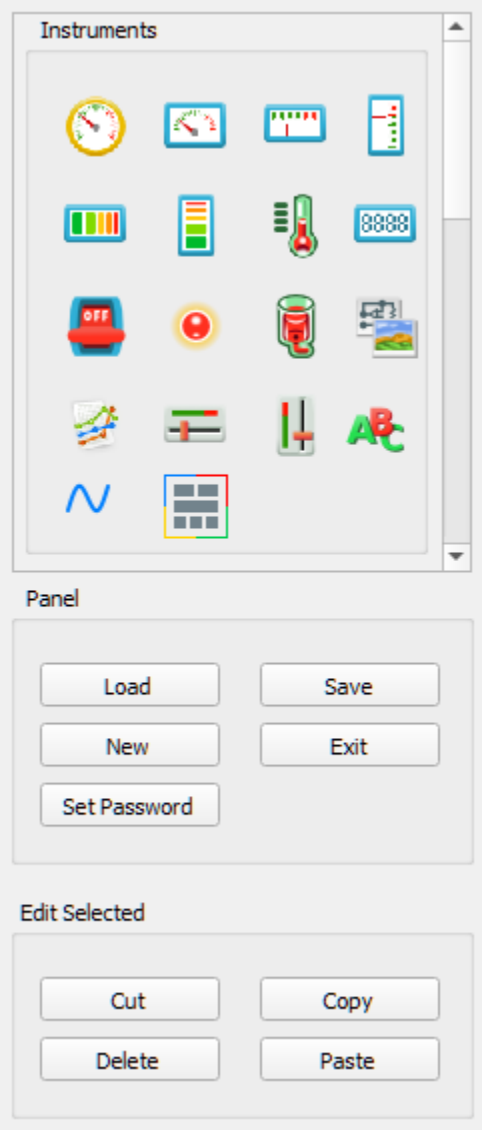
Set Password allows users to set a password of their choosing to be used on the instruments panel. By pressing “Set Password”, the following window will open where users can type in their password and confirm by pressing “Ok”. Once set, every time the instruments panel is opened, the password needs to be inputted to unlock the panel and allow for editing.



Inserting new instruments: to insert new instruments into the Instrument Panel, simply press on the instrument of your choice from the Toolbox and it will appear on the Instrument Panel in the upper left corner. From here, you can move and position the instrument to your preferred position by pressing and holding on the cursor on it.

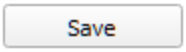
2 ToolBox

From this window, you can choose the preferred instruments that you want to place on the Instrument panel, save and open panels, edit and delete instruments, lock them, set a password for the editing and moving of instruments and delete all the instruments present in the Instrument panel.



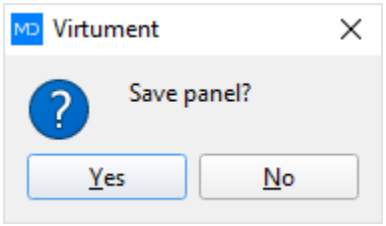
Picture 6: Settings ToolBox

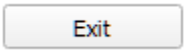
Load - When pressed will cause the opening of the Open content menu from which you can choose the destination folder and file you want to open.



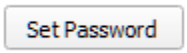
Save - When pressed will open the Save content menu from which you can choose the destination folder where the current Virtument panel can be saved. Like standard content menus, it will allow you to change and save the name of the panel. Virtument documents (panels) are saved in a .vir extension.

New – This can be used to open a new instruments panel in place of the current one. To retain your progress in the current instruments panel, a pop up window will appear asking if you wish to save your current panel.

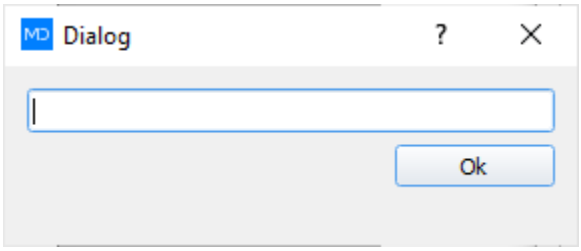




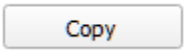
Exit – This can be used to close the current Virtument instruments tab that is open. If any instruments are present in the panel, a pop window will appear asking you whether you wish to save the panel before closing.



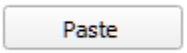
Set Password – Here, a custom password can be set which locks the instruments panel when it is next open. A pop window will appear where you can type in your password of choice and press “Ok” to confirm. Now, the next time this panel is opened a password will be required to access and edit it.



Cut – Similar to standard “Cut” options, it will remove your selected widget to the clipboard. By pressing “Paste”, the selected widget will be deployed in the top left corner of the instruments panel.

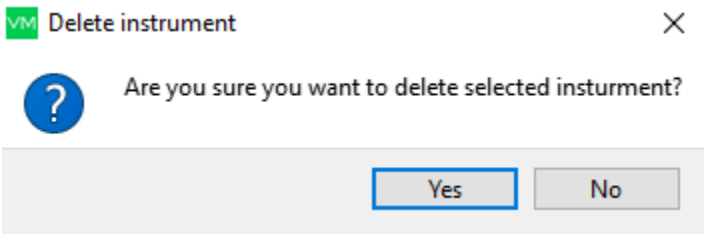


Copy – Similar to standard “Copy” options, it copies the selected widget to the clipboard without removing the original widget from the instruments panel. By pressing “Paste”, a copy of the selected widget will be deployed in the top left corner of the instruments panel.



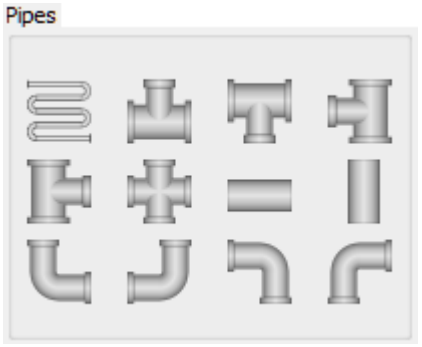
Paste – Similar to standard “Paste” options, it will output the clipboard’s contents to the top left corner of the instruments panel.

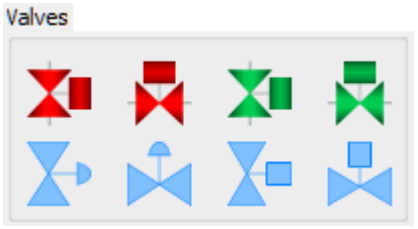
Delete - Pressing on it will delete the selected instrument(s) from the Instrument panel. Becomes active when one or more instruments are selected. Before an instrument is completely deleted, a message window shown in Picture 7 will open, asking you to confirm this action.

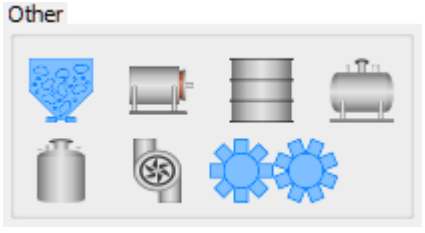


Picture 7: Delete confirm window

The first grouped tab on the right side of the instruments panel also includes additional widgets that can be added to the panel. By using the scroll tab, users can add in Pipes, Tanks, Valves, and Other widgets. These are especially useful for SCADA applications and allow users to represent and illustrate processes much more accurately and simpler.







Instruments

In Virtument, you have 16 instruments at your disposal and the number of instruments that you can place on the Instrument panel is unlimited. Every instrument has a distinctive set of settings unique to them. Additionally, a common set of settings are present in all instruments. We will go through them first.

List of instruments

 Analog Circular Gauge

 Analog Edge Gauge

 Analog Horizontal Linear Gauge

 Analog Vertical Linear Gauge

 Horizontal VUMeter Gauge

 Vertical VUMeter Gauge

 Thermometer Gauge

 Digit Meter

 Switch

 Indicator

 Graph

 Image

 Text

 Tank

 Horizontal Slider

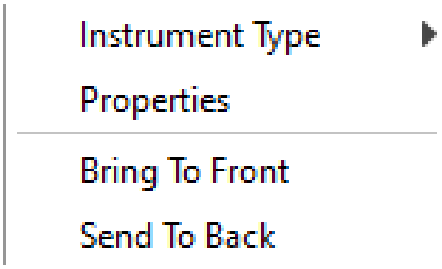
 Vertical Slider

 Instrument Frame

 Signal Generator

2.1 Context menu

The Context menu is the same for every instrument in Virtument. To open a Context menu, simply right click on the instrument of your choice. A menu of options like the one below will open.



Picture 8: Context menu

Instrument Type – This option when selected will open a drop down menu with all the instruments in Virtument (shown above). Here, you can change the current instrument you have selected to another of your choice by clicking on the instrument in the list you wish to use.

Properties – When pressed, it will show all the possible properties of your selected instrument. A window with tabs will house all of the settings which you can change. The tabs present are each designated for a certain aspect of the instrument. The number tabs and settings vary with the type of instrument you are using.

Please note: Editing and configuring a instrument's channels is done through the instrument's properties.

Bring to Front –This option will move the selected instrument in front of all other instruments on the panel. This option will prove useful when two or more instruments are overlapping.

Send to Back – This option will move the selected instrument behind all other instruments present on the panel. Like **Bring to Front**, this will be useful when two or more instruments are overlapping.

2.2 Instrument General Tab

General tab is the default tab present in every instrument's properties. It can be opened by selecting the option 'Properties' in the context menu that appears when you right click on an instrument.

Picture 9: General tab

Title group: From this group of settings you can edit all the properties related to the title of the selected instrument.

This includes:

- 'Show Title' – tick the checkbox to make the title of the instrument visible
- 'Title' – this field contains the title text itself (by default the title is 'Title')
- 'Font' – press on this for a drop down menu of fonts which you can choose from for your title
- 'Transparent Background' – checkbox for whether you would like a background for your title
- 'Background/Text colour' – colour options for the respective property

Scada Tag – If you have setup a SCADA system this option will allow you to enter a tag which can be used to refer this instrument to your SCADA.

Refresh Interval: This parameter is responsible for the time between instrument updates and is measured in milliseconds. For example, if the Refresh Interval is set to 2000, the instrument will have a delay of 2 seconds before it detects any changes in its source values.

2.3 Instrument Frame tab

The 'Frame' tab is present in the following instruments: Analog Circular Gauge, Analog Edge Gauge, Analog Horizontal Linear Gauge, Analog Vertical Linear Gauge, Horizontal VUMeter Gauge, Vertical VUMeter Gauge, Thermometer Gauge, Digit Meter, Graph, Image, Text and Tank.

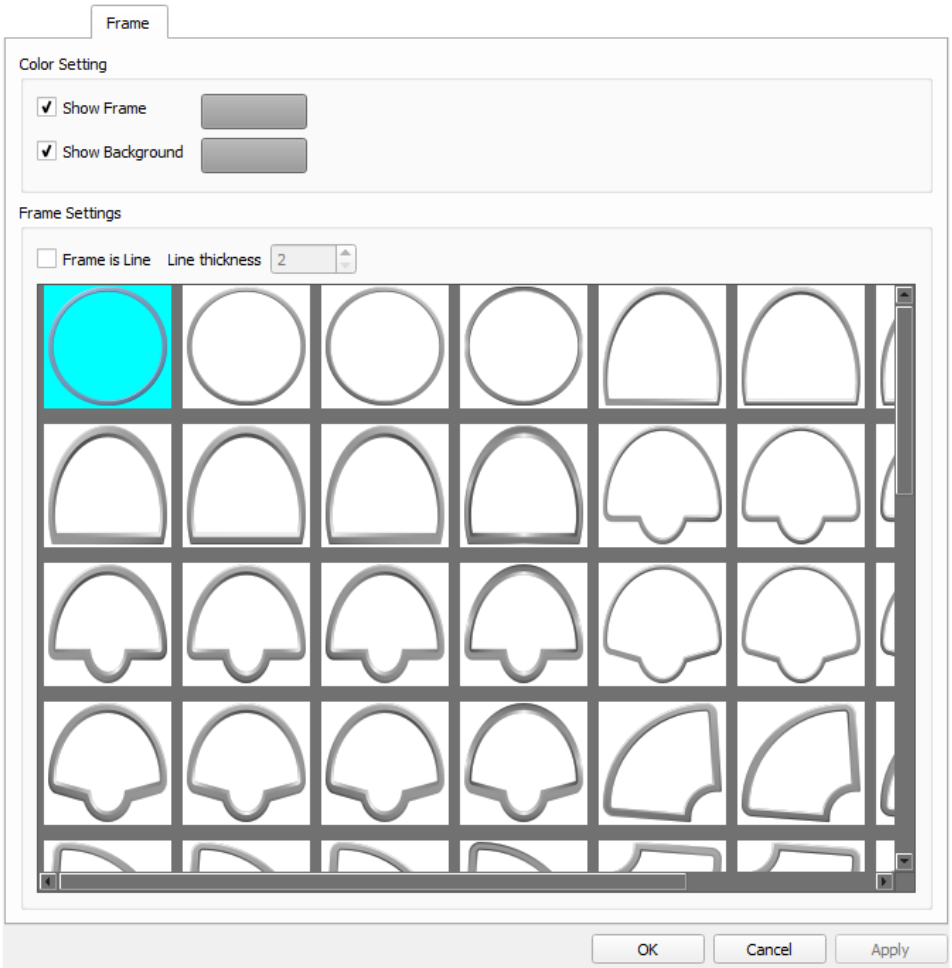
From the Frame tab you can:

Colour Setting – these settings concern all the colouring aspects of the instrument

Includes:

- 'Show Frame' – choose to show the instrument's frame and its colour
- 'Show Background' – choose to show the instrument background and its colour

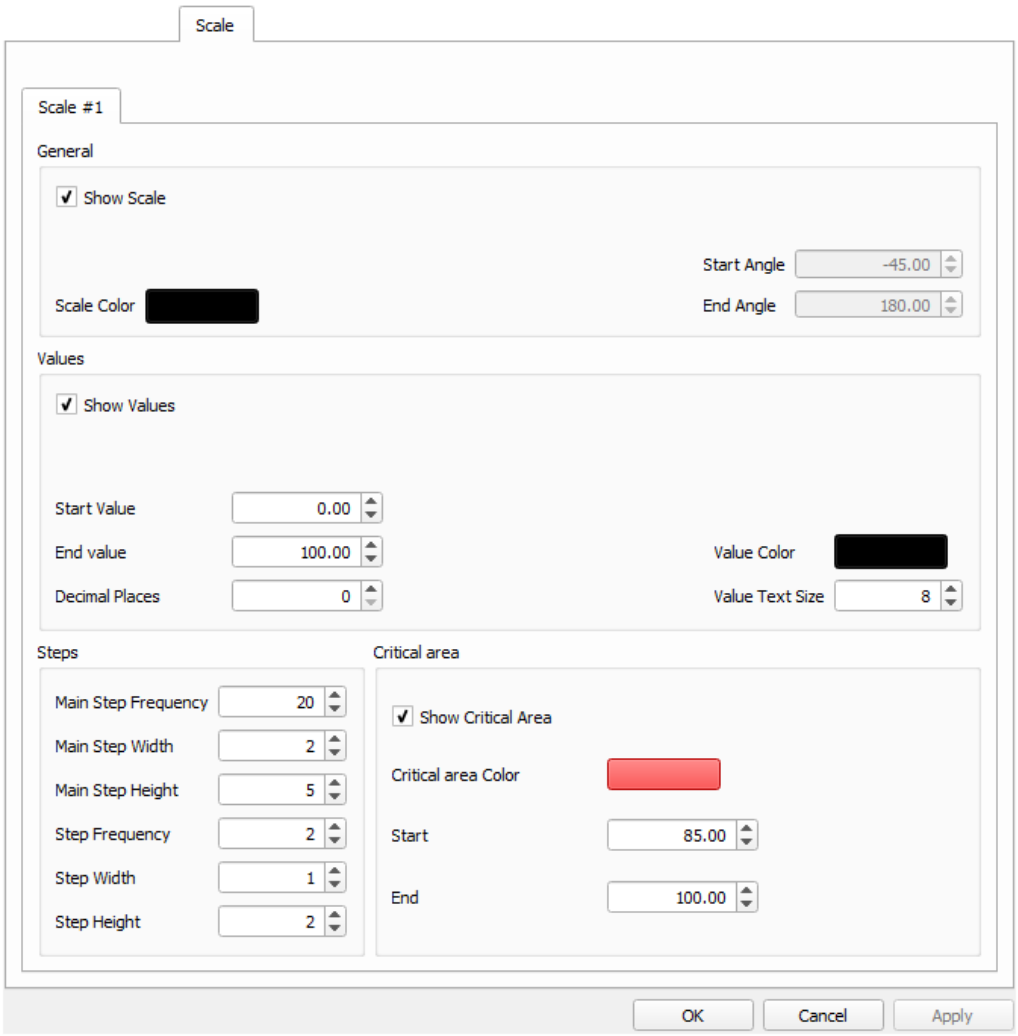
Frame Settings – settings that alter the thickness of the frame and the type of frame you wish to use. Frames available on instruments are unique and depend on the instrument you are editing.



Picture 10: Frame tab

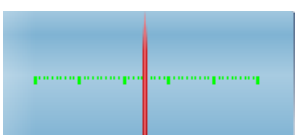
2.4 Instrument Scale tab

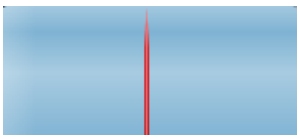
The Scale tab is present in the following instruments: Analog Circular Gauge, Analog Edge Gauge, Analog Horizontal Linear Gauge, Analog Vertical Linear Gauge, Thermometer Gauge, Tank, Horizontal Slider and Vertical Slider. Scale tab is shown in Picture 11.



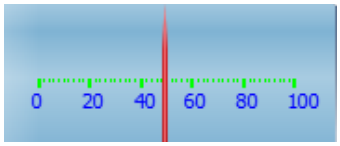
Picture 11: Scale tab

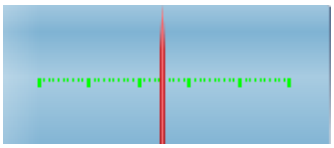
General group: From this group of settings you can choose if the scale will be shown, name the scale and set the scale colour.



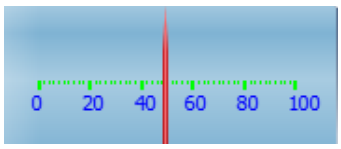


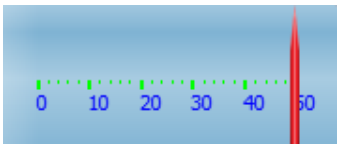
Values group: From this group of settings you can choose if the scale's values will be shown, set their start and end values, choose the number of decimal places for the values. The colour and size of the values shown below can also be changed.



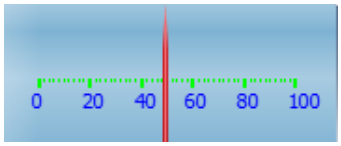


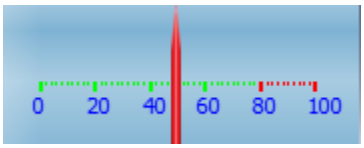
Steps group: From this group of settings you can choose the size of each step in your scale;





Critical area group: From this group of settings you can choose if the critical area is shown on the scale or not and set its values;



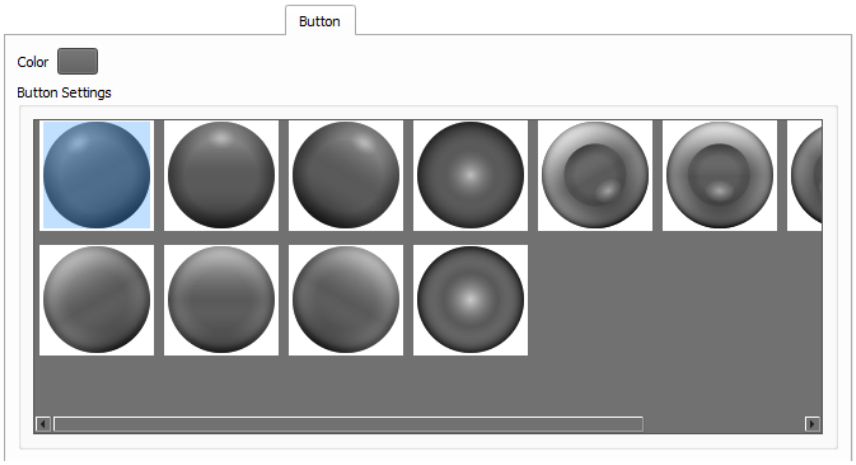


Please note: The examples and options shown in the scale tab above are for a slider instrument. Each scale tab will be unique and tailored more for the instrument you are editing. This means the scale tab will be the same for most instrument but slightly different for certain instruments.

Instrument specific tabs

The following segment will focus different properties which are specific and unique to a certain instrument. The tabs available in the properties of the following instrument only apply to a select group of instruments.

Button tab – Analog Circular Instrument



The Button tab is unique and only present in the properties of the Analog Circular Instrument. This tab allows you to choose what type of button/pin you want to use at the bottom of the needle. The colour of the button can also be edited at the top of the tab.

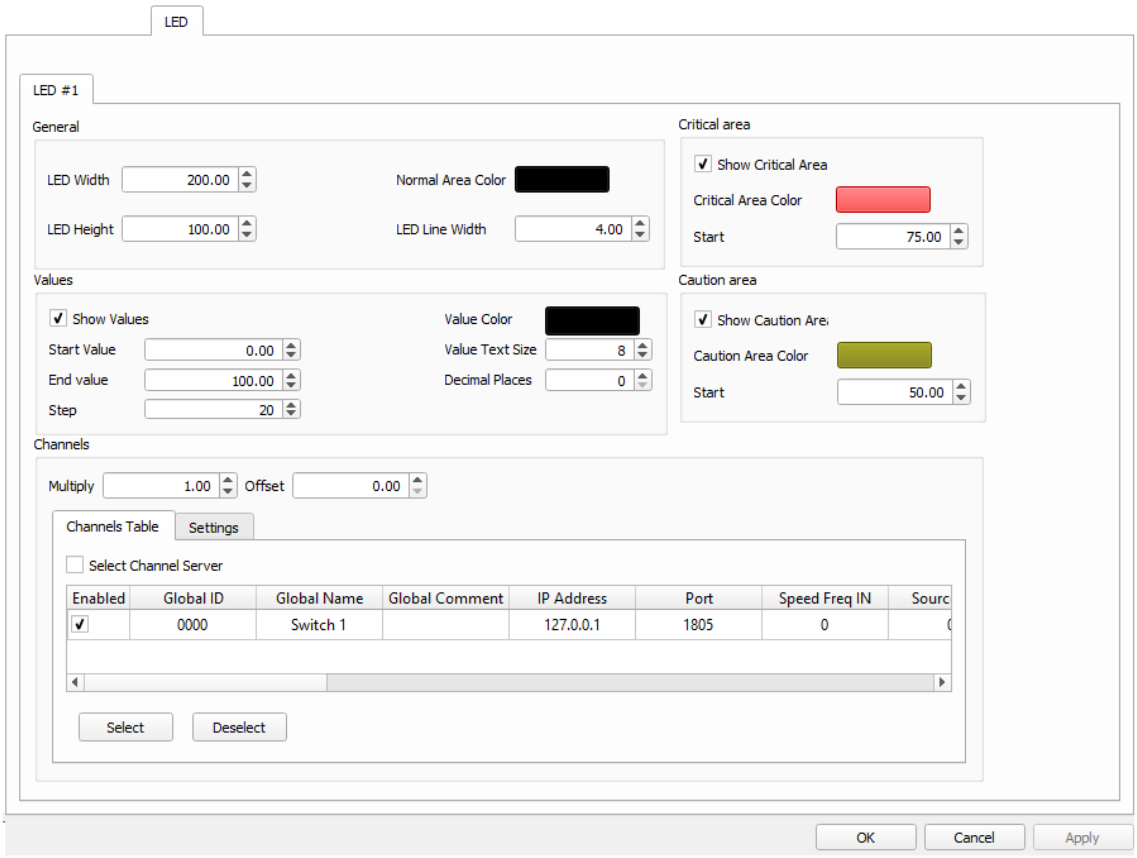
Note: Like the properties tabs explained above, to complete adding your changes press 'Apply' to add your changes in real time and 'Done' to finish.

LED – VU Meter Instrument

General – Here, you can change the width and height of the instrument itself as well as changing the colour of the 'Normal' area of the LED. 'Normal' means the group of values in the scale that is deemed safe. LED Line Width changes the actual width of each measurement mark/marking on the scale.

Critical area – This group of settings allow you to change the colour and the starting value for the critical area of the LED's scale. The start value of the critical area is the point at which any values above are critical and the critical area begins. Additionally, the checkbox 'Show Critical Area' allows you to choose whether or not you want your critical area to be visible.

Caution area – The settings present are the same as for the Critical area but apply to the Caution area of the LED's scale. This area is used to caution/warn the user that the value is approaching the Critical area.



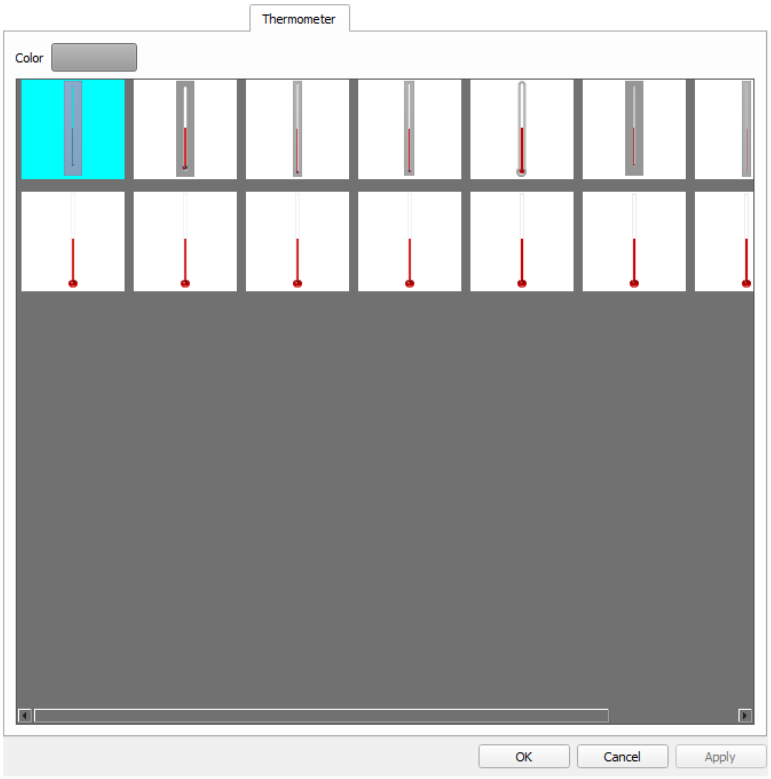
Values – These settings are used for properties of the values on the scale. This includes:

- Start/End Value – Changing the values of these parameters will change the starting and ending value on the scale of the instrument respectively
- Step – This will change how much the scale increases. The difference between different measurement markings on the instrument
- Value Colour – Change the colour of the values displayed on the instrument
- Value Text Size – The size of the values present
- Decimal Places – The number of decimal places present on the instrument's values
- Show Values – Check box for whether values on the instrument will be displayed

Channels – This channels window is the same as the channels tab explained earlier in this manual.

Thermometer/Tank/Slider tab

This tab applies to the Thermometer, Tank and Slider. This tab is unique to the mentioned instruments and coincidentally named after the instruments themselves. For each instrument, the tab is the same but contextualised to the selected instrument.



The image above is the Thermometer tab for the Thermometer instrument. The Tank and Slider instrument have the same layout but changed to apply to them.

Colour – This option remains the same for all of the instruments and is used to change the colour of the instrument's main body

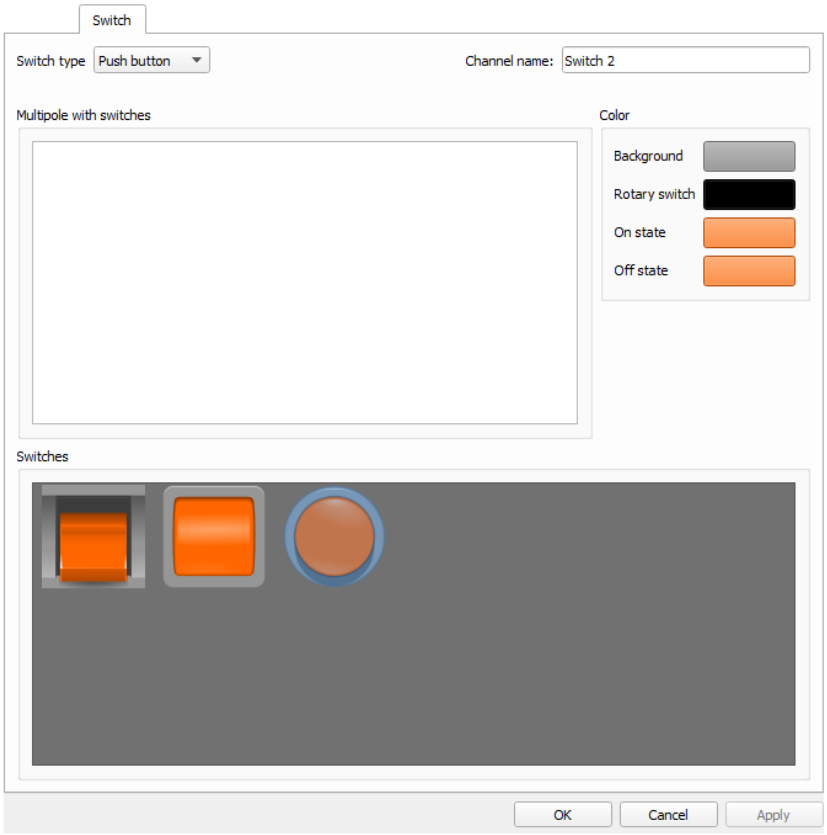
The window below has all the different bodies/frames which can be used on these instruments.

Switch tab – Switch Instrument

The Switch tab applies only to the Switch instrument and is unique.

Switch type – A drop down menu with all possible types of switches available in Virtument. All 4 options have the same settings except 'Rotary Switch' which has one additional settings unique to it.

Channel name – Switches produce their own channel automatically and this is used to name the channel it produces.



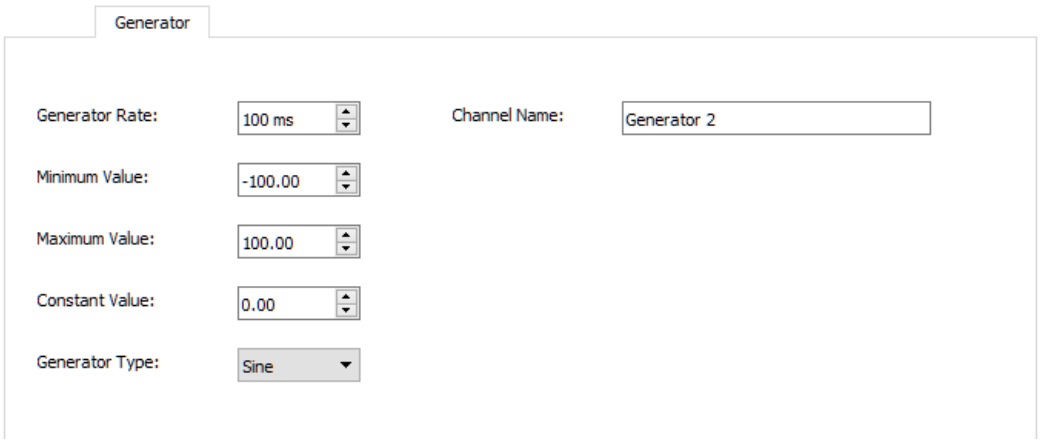
Colour – This group of settings includes:

Background – change the colour of the background (outer frame of the switch)
On state – the colour of the switch's toggle when it is on
Off state - the colour of the switch's toggle when it is of

Switches – Window located at the lower end of the tab that contains all previously used switches. Pressing on a switch in the window will change the current switch to the one pressed. Note, 'Apply' must be pressed to see the changes.

Generator tab - Signal Generator Instrument

The Signal Generator instrument has two tabs in its properties. The first is a General tab which we have already gone through earlier. However, the second tab is unique and only present in the Signal Generator's properties. Below is the Generator tab present in the Signal Generator's properties.



The Signal Generator instrument is used to produce signal automatically using the parameters that are set. It can produce the following types of signals: Constant, Sine, Sawtooth, Triangular and square.

Similar to the Switch instrument, this instrument produces its own channel automatically. You can name the channel by entering your preferred name in the 'Channel Name' field as shown above.

The settings on the left side are in regard to the features of the signal being produced. This includes:

Generator Rate – The frequency of the signal

Minimum Value – The trough/lowest point of the signal

Maximum Value – The peak/highest point of the signal

Constant Value – The offset of the signal

Generator Type – The type of signal which is to be used

Instrument Frame Properties

The Instrument Frame is a unique intractable instrument which can be placed and move like the rest of the instruments previously mentioned. However, the Instrument Frame differs in the fact that it doesn't have a 'Properties' tab in its context menu. Instead, Instrument Frame has 'Set Title Font' and 'Frame Thickness'.

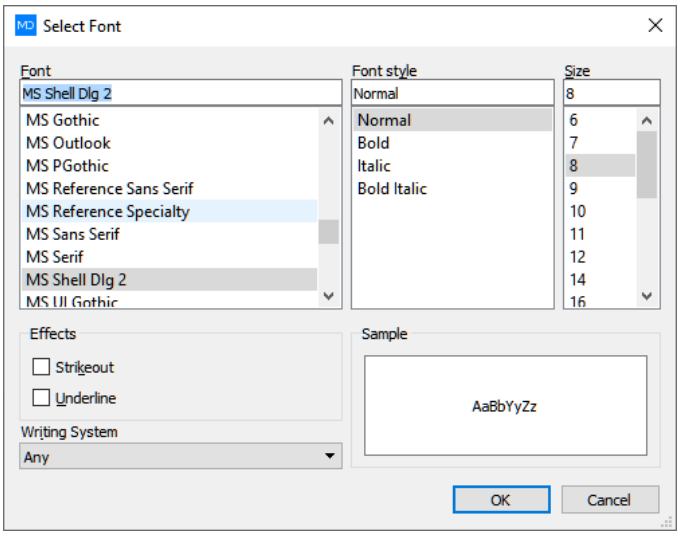
'Select Title Font' will open the window below. This group of settings will allow you to:

Change the font of the title text

Choose a font style – Normal/Bold/Italic/Bold Italic

Change the size of the text

Add effects to your text such as Strikeout and Underline



As you can see from the above image, the options also allow you to select a writing system of your choice. This will continue most writing systems in use today.

Additionally, the Sample box to the side will house an example of what your current text settings will make your text look like.

The other unique option present is 'Frame Thickness'. This is a self-explanatory setting which can be used to change the thickness of the outline of your frame.

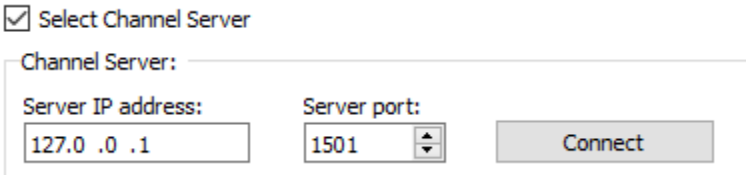
Please note: Instrument Frame is an aesthetic option that can be used to house and label certain instruments in your panel as shown below. It can prove useful as a way to separate different instruments which may be used for different purposes and organise your Instrument Panel better.

2.5 Instrument Channel group

This group of settings is common for all instruments that show or output values of any kind.

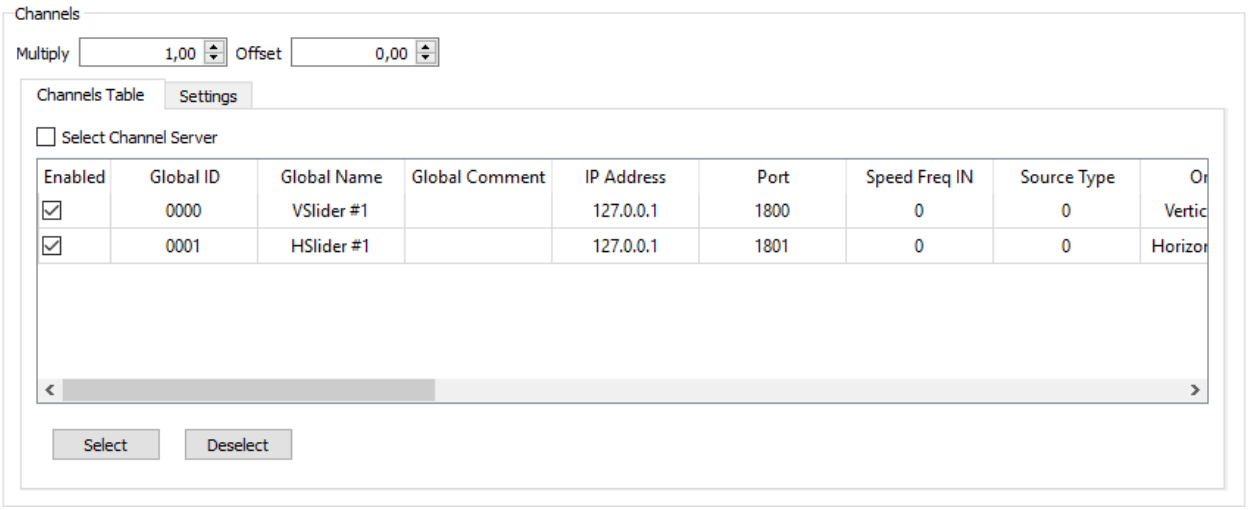
The Instrument channel group applies to the following instruments: Analog Circular Gauge (Needle tab), Analog Edge Gauge (Needle tab), Analog Horizontal Linear Gauge (Needle tab), Analog Vertical Linear Gauge (Needle tab), Horizontal VUMeter Gauge (LED tab), Vertical VUMeter Gauge (LED tab), Thermometer Gauge (Liquid tab), Digit Meter (Display tab), Graph (Graph tab) and Tank (Liquid tab).

From this group, you can select the server from which you are importing data from. If you want to connect your instrument to a channel created on the same computer (in MatDeck or Virtument on the same computer), leave the Select Channel Server checkbox empty (default state). If you are trying to connect the instrument to a channel that is created on another computer, tick the Select Channel Server and a new form will appear as shown below. Using this form, you should set the remote computer IP address (WAN address of router) and port to establish a connection and make the channel visible.



Picture 12: Select Channel Server

Horizontal and Vertical slider instruments export their values to the channel automatically. Their names are VSlider and HSlider as shown in Picture 13.

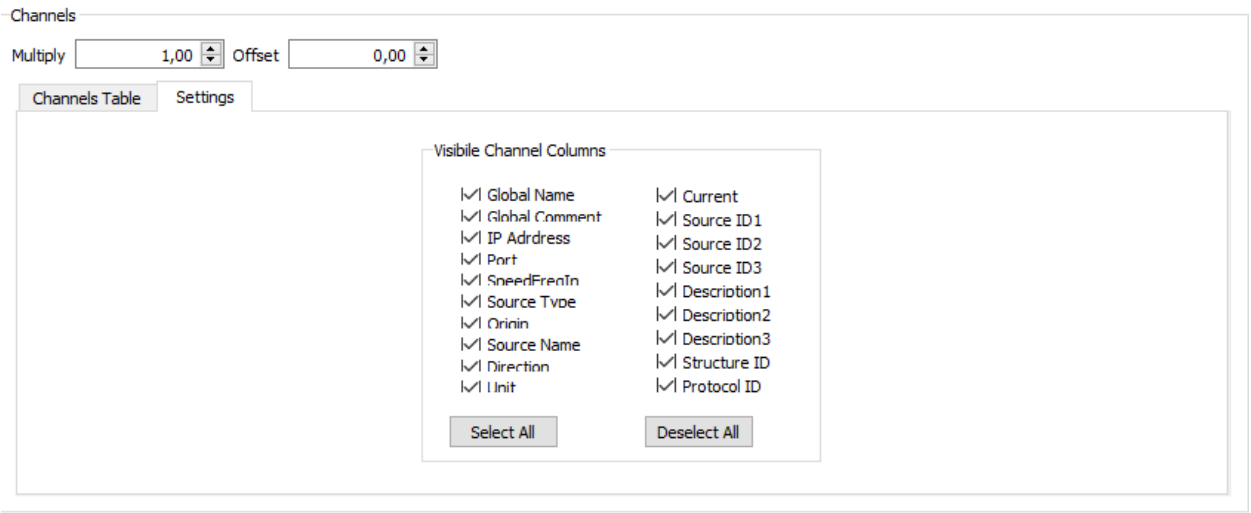


Picture 13: Channel table

To establish a connection, you have to select the channel in the table under the **Channels Table** tab from which you wish to insert data from. Once you have chosen a channel, press the Select button to finish.

If you want to break the connection press the Deselect button.

From the **Settings** tab of the Channel group you can choose which data will be shown in the Channel table (Picture 14). By default all the columns are set to be visible.



Picture 14: Channel settings

To connect instruments inside Virtument, output instruments such as progress bar will display data from input instruments such as Horizontal and Vertical sliders.

Alternatively, you can export the variable from MatDeck in the channel and connect the instrument in Virtument together.

We will demonstrate both ways of connecting in the following examples.

2.6 Connecting Virtument instruments

2.6.1 Connecting Virtument instruments using MatDeck script code

Virtument can be used as a separate window or embedded in MatDeck documents. Additionally, Virtument instruments can be interacted with and edited using custom MatDeck script functions instead of using channels and exporting variables. Using Virtument instruments through MatDeck script may be preffered as it makes integration with other MatDeck features simpler.

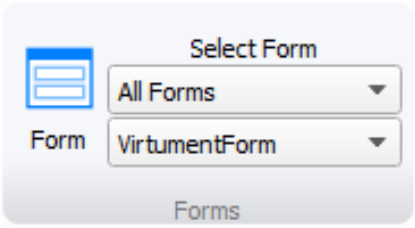
Virtument panels can be inserted in MatDeck documents in one of two ways.

- Embedded Virtument applications via 'Select Form'
- Embedded Virtument applications via custom Canvas Functions
-

Embedded Virtument applications via 'Select Form'

Embedded Virtument instruments will be displayed in the canvas you have selected and will be available to be used in the MatDeck document. To embed Virtument applications within MatDeck documents, the 'Select Form' function needs to be used.

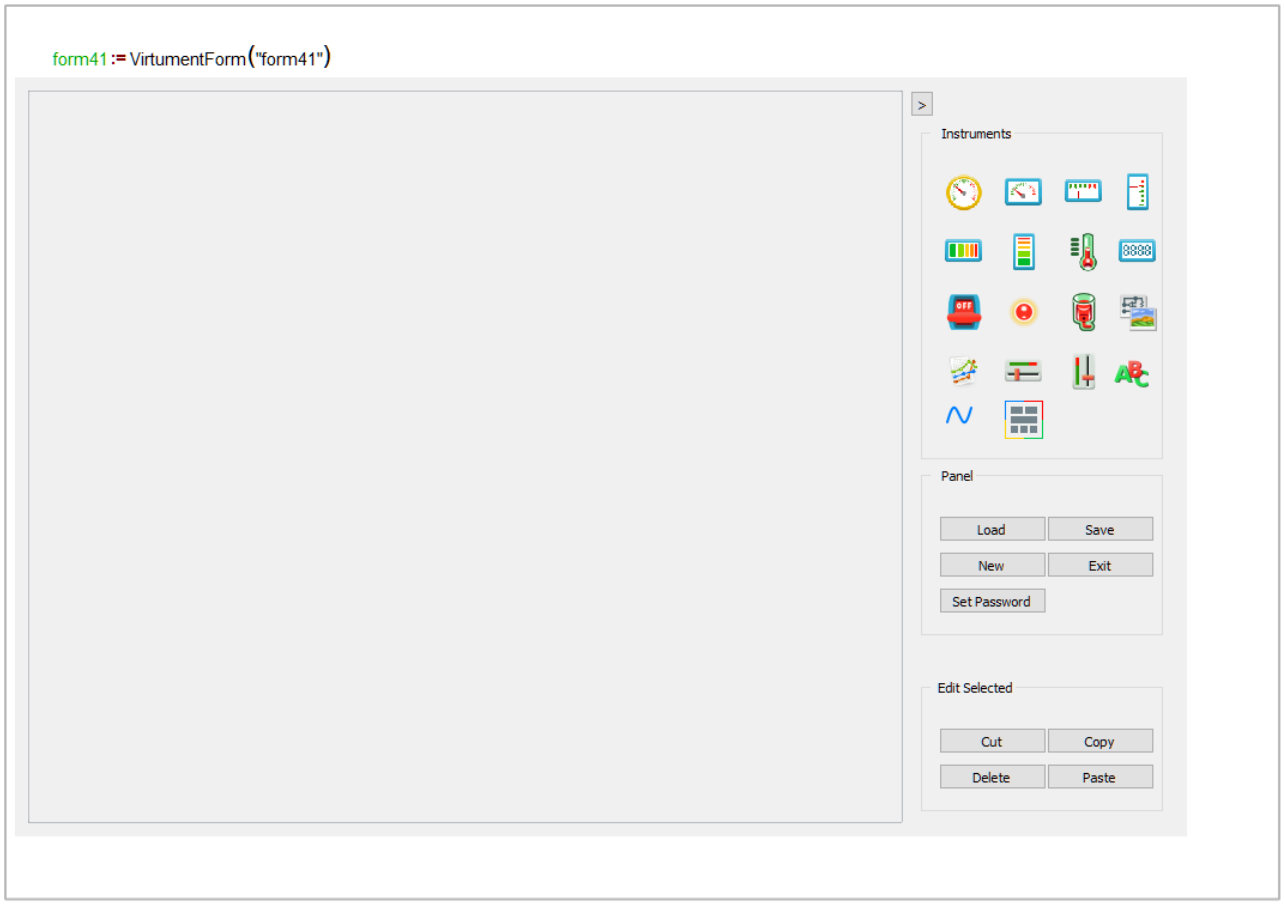
First, insert a new canvas inside your MatDeck document. Once inserted, configure the 'Select Form' function. To configure it so that you can insert Virtument panels, select 'All Forms' on the first drop down menu and 'Virtument form' on the second. Below is an example of this.



Once configured, press the 'Form' icon to initiate the selected form and press on the selected area of the canvas to place your form. Once done, an embedded Virtument form will appear.

```
form1 := VirtumentForm("form1")
```

The function **VirtumentForm()** will first appear followed by the Virtument panel itself.



A Virtument form such as the one above will appear in the canvas.

Embedded Virtument applications via Canvas Functions

Virtument panels can also be embedded by using the same Canvas functions. This method uses the same Canvas functions without the use of the 'Form Selector'. Instead, the user manually writes the function necessary for embedding the Virtument panel.

The user need to write the function **VirtumentForm()** which is used to start the form and has only one argument, the name of the panel in string form. The function needs to be stored in a variable which will be used later to embed the Virtument panel.

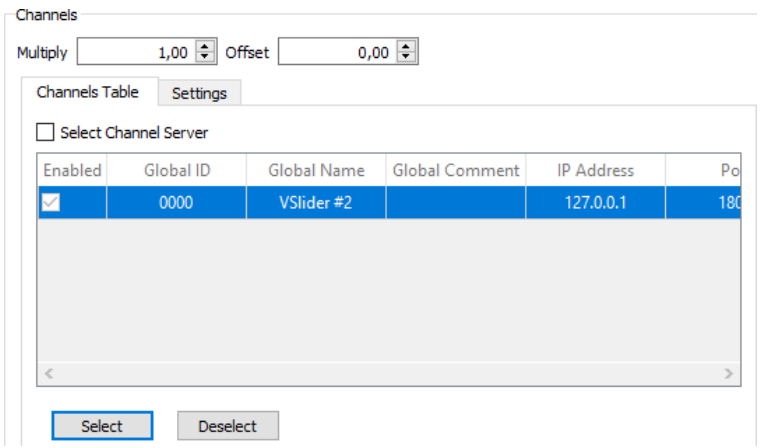
```
VirtumentExample := VirtumentForm("ExampleForm")
embed_widget(VirtumentExample)
```

In the example above, the function **embed_widget()** will place the Virtument panel in the MatDeck document. Once **embed_widget()** is written, the Virtument panel will automatically appear and replace the function .

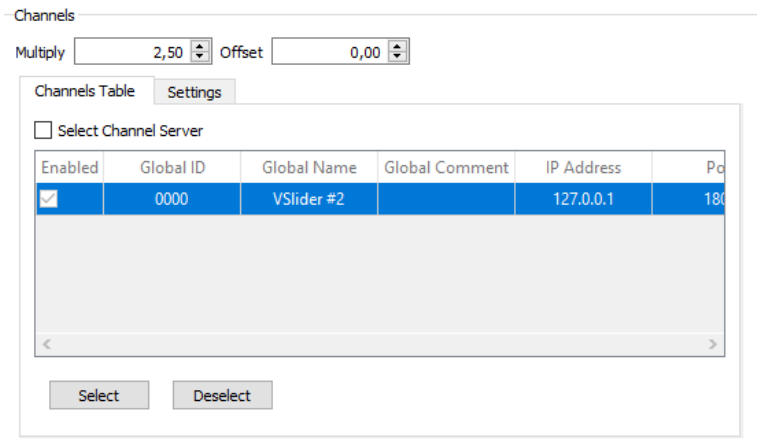
2.6.2 Example: Connecting Virtument instruments

Create two instruments and connect them to the Slider. Use the Multiply options for one of them, so displaying the instruments doesn't show the same values.

Method: Press the Analog Circular Gauge icon  and it will appear in the top left corner of the work area. Press the Digit Meter icon  and it will also appear in the top left corner of the work area. To move the instruments, float your cursor over the instrument. Then, press and hold on the instrument to move it. Once you are satisfied, press the Vertical Slider icon  and add it onto the instrument panel.



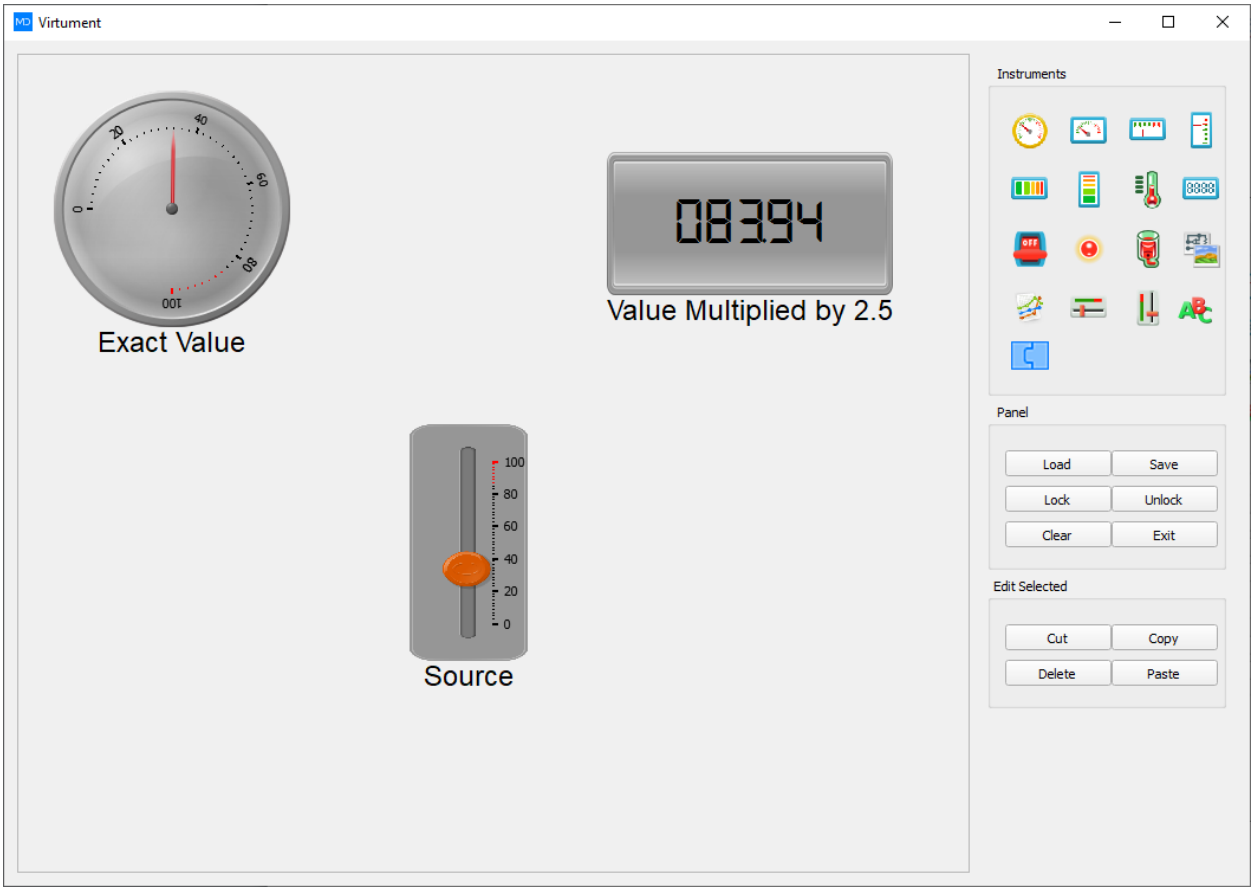
Right click on the Analog Circular Gauge and from the context menu choose Edit. Go to the Needle tab and in the Channels table select VSlider (the only channel in the table through which the values of the Vertical Slider will be sent) and press the Select button. At the end, press the 'OK' button to confirm the changes.



Now, repeat the procedure with the Digit Meter instrument. Right click on the Digit Meter and from the context menu choose Edit. Go to the Display tab and in the Channels table select VSlider (the only channel in the table through which the values of the Vertical Slider will be sent) and press the Select button. Set the 'Multiply' value to 2.5.

Make sure that you press ‘OK’ to confirm all the changes that have been made.

All you have to do now is to change the Vertical Slider’s value and watch the values of the other two instruments change.



Picture 15: Example 1

2.6.3 Example: Connecting Virtument instruments through MatDeck

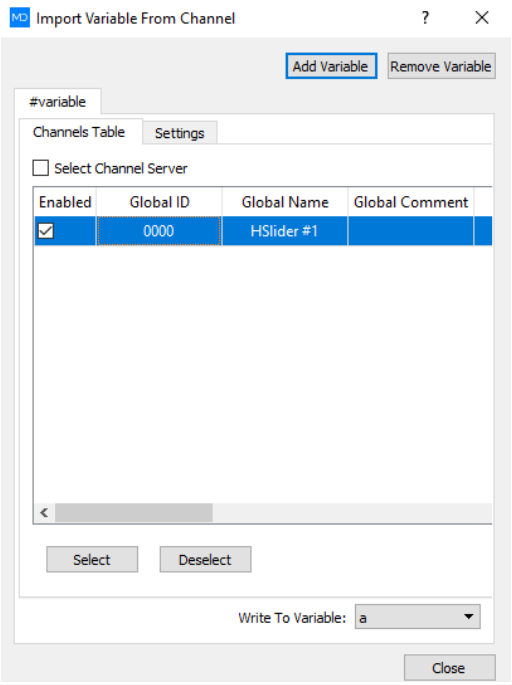
Create one Slider instrument and one other instrument to display the values. Send the data from Slider to MatDeck which process them and sends the data back to Virtument displaying instrument.

Method: Press the Analog Circular Gauge icon  . It will appear in the top left corner of the instrument panel. By pressing and holding on the instrument, you can move the instrument and position it. Next, press the Vertical Slider icon  . Like the Analog Circular Gauge, you can position it using the same method.

Once done, go to MatDeck and insert a Canvas 

. Canvas is located in the 'Insert' tab at the top of the window. Type **a:=0** to define the variable **a** with an initial value of 0. Next, add **a=** in a new line so you can check the value of the variable **a**, it should be 0. On a new line, type **b:=sin(a)** to define the variable **b** with a value of sin(a). Lastly, add **b=** on a new line to display the value of the variable **b**. It should be 0.

```
a:=0
a=0
b:=sin(a)
b=0
```

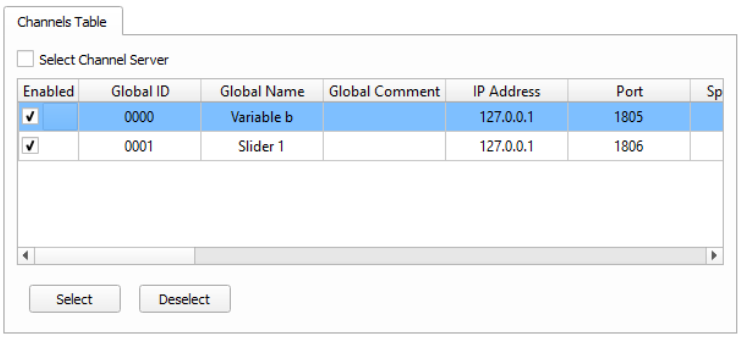


From the 'Data' tab at the top, press the Import icon 

and place it on the canvas. Right click on it and from the context menu that appears select 'Properties'. A new window will open. Press the 'Add Variable' button on the top and a new table with available channels will open. Click on the 'HSlider#1' row in the table and press select. Next, choose the variable **a** from the Write to Variable field. Once done press 'Close' to finish. We have now just imported the Horizontal Slider's values to the variable **a**.

Press the Export icon 

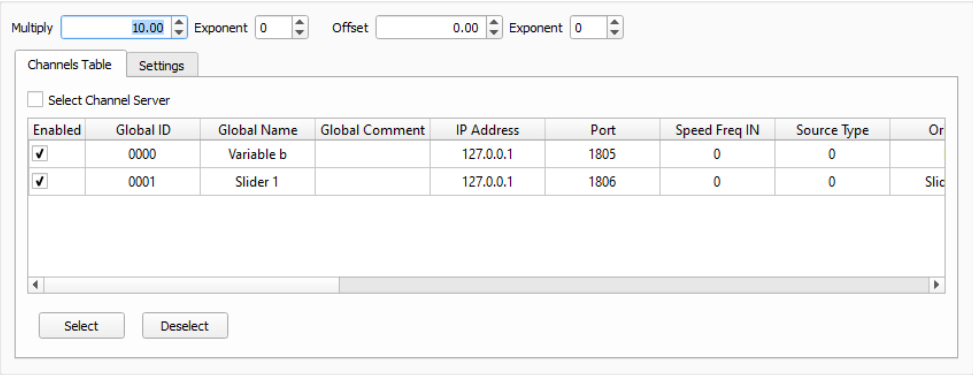
in the 'Data' tab and place it on the canvas. Right click on it and from the context menu select Properties. A new window will open. Select the variable **b** from the Document Variables field and press Add and then Close at the end. We have just exported the variable **b**'s values to the channel.



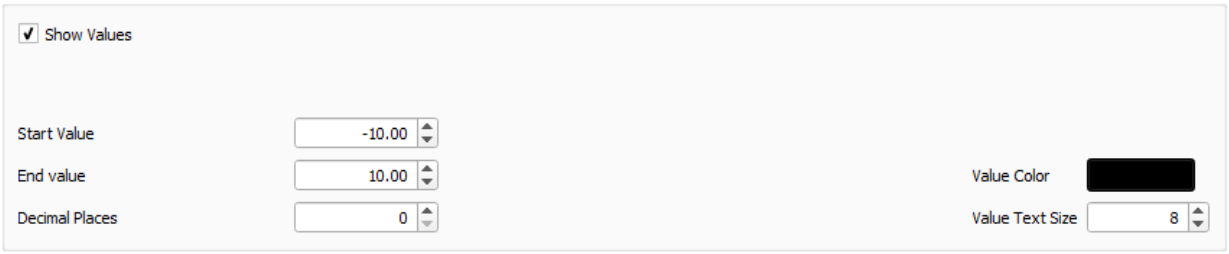
Return to Virtument and right click on the Analog Circular Gauge, from the context menu choose Properties. Go to the 'Needle' tab and in the Channels table select the Variable **b** (the variable we have sent to the channel from our MatDeck document) and press the Select button.

Now that we have connected the Analog Circular instrument to **b**'s channel it will display the variables values. As the variable **b** is the sin of **a** which is also connected to the Vertical Slider, the Analog Circular

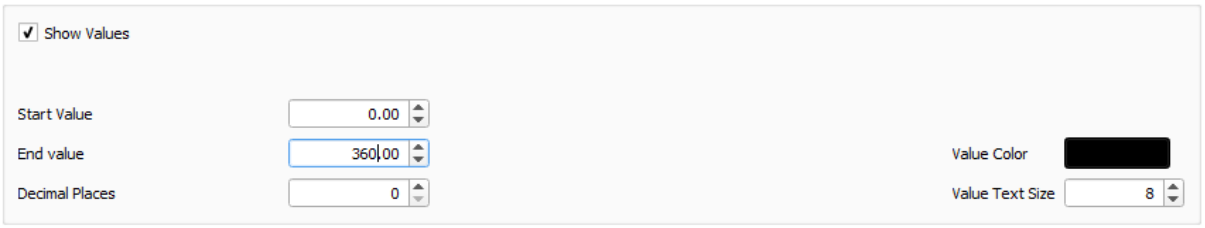
instrument will display the sine of the value on the slider. However, the sin of **a** only fluctuates between 1 and negative 1. To make the Analog Circular instrument's changes in value more noticeable we will multiply the values by 10. This means the min and max values of the Analog Circular instrument will no longer be -1 and 1 but -10 and 10. This will make the changes in the slider's values and their sin values more noticeable.

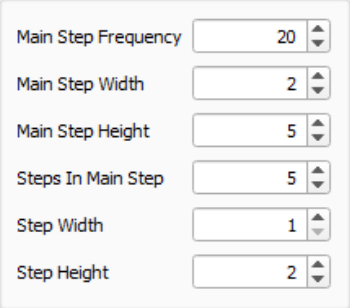


To do this, we will simply go to the channels settings group in the 'Needle' tab of the instrument's properties. The Multiply field of the settings will be set to 1.00. Change it by simply writing in 10.00 or pressing the upwards arrow. Now, all the values that the Analog Circular instrument receives will be multiplied by 10 and then displayed. In the Scale tab of the Analog Circular instrument and in the Values group, set the 'End value' to 10 (it will display the value of the variable **b** multiplied by 10. **b** is defined as sin (a) and its values will not go above 1 so, the instrument will not go above 10 and negative 10). To finish, press the 'OK' button to confirm the changes.



As the sin function is used for angles, we must set the slider to range from 0 to 360 degrees. This can be done by changing the end values in the value settings located in the Scale tab of the slider's properties. Once we have set the end value of the slider to 360, we need to change the markings on the slider.

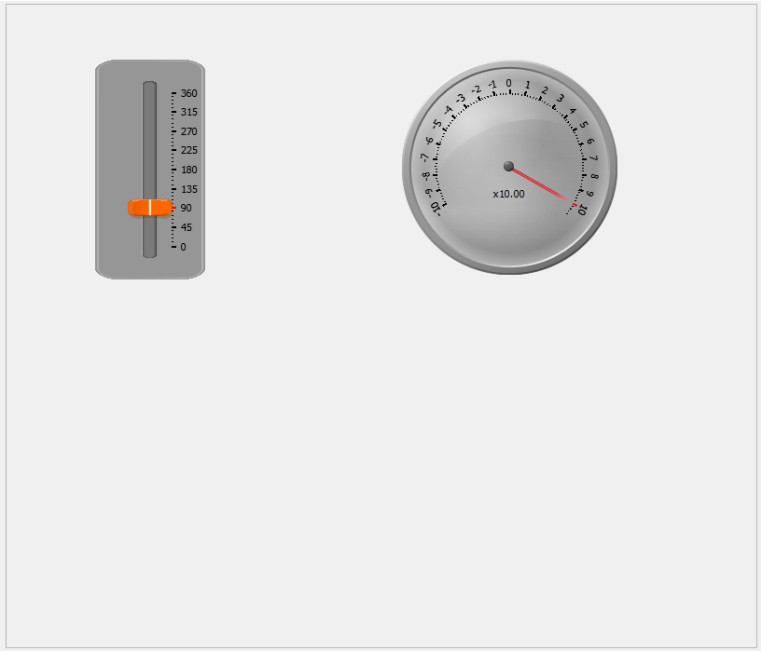




By default, the slider's markings will go up by 20 each time. As we have changed the slider's end values to 360, we must also change the amount its markings increase by. In the same scale tab as earlier, we will change the Main Step Frequency of the slider to 45 instead of 20. This now means that the measurement markings on the slide of the slider will go up in multiples of 45, not 20.

Finish adding the changes to Vertical Slider instrument by pressing the 'Done' button at the bottom of the Properties window.

Now, when you change the Horizontal Slider's value, the value on the Analog Circular Gauge instrument will display the sine value of the slider multiplied by 10.



Picture 16: Example 2