

# User Guide

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# 1 Introduction

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## 1.1 Overview (What is Apaix?)

Apaix is a data visualization program working with many different sources. It comes together with a video player to allow synchronizing data and video.

The current version of Apaix contains two different types of plots, a docking System to customize your layout, which can also be shared with other people. Also, there are multiple Layers of data that can import quite a lot of different data formats and is also able to export them or build virtual channels from them.

The native format for Apaix are \*.TKS files and will be also the type of the export.

## 1.2 System Requirements

- Windows 7/10 64 Bit
- DirectX 9.0c or higher
- Microsoft Visual C++ Redistributable 2013
- Microsoft .Net Framework v4.6.1

## 1.3 License Agreement

Except where otherwise noted, all of the data, documentation and software included in the APAIX Setup package is copyrighted by TeKshift GmbH.

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## 1.4 Installation

Any older versions of Apaix should be uninstalled properly before installing a newer version.

Step 1:

Start the Setup.exe to start the installation.

Step 2:

Select the language for the installer.

(Apaix itself will remain English only)

Step 3:

Follow the default steps of the installation and read the License agreement.

Step 4:

If you have a demo version, you need to copy your demo license file into the installation folder of Apaix. Otherwise, for users with a valid dongle, just make sure the dongle is inserted and start Apaix.

Depending on the license type a USB-Stick containing the license will be needed to run.

To uninstall Apaix, use the uninstall.exe in Apaix main directory.

## 1.5 Known Problems / Limitations

The following things about the current version of Apaix should to be taken into consideration:

- Signals can only be plotted once for each window.
- The concatenation of files is not working for now.

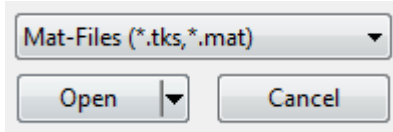


## 2 Quick Start

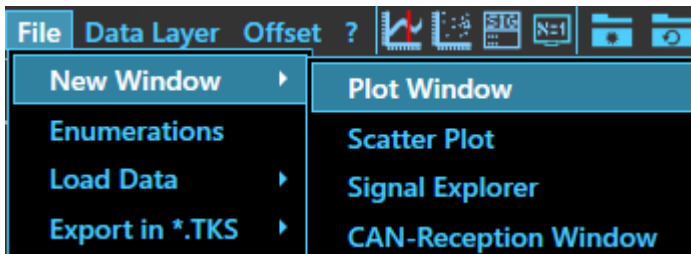
1. Start Apaix.
2. Double click the first layer label on the top left of the screen.



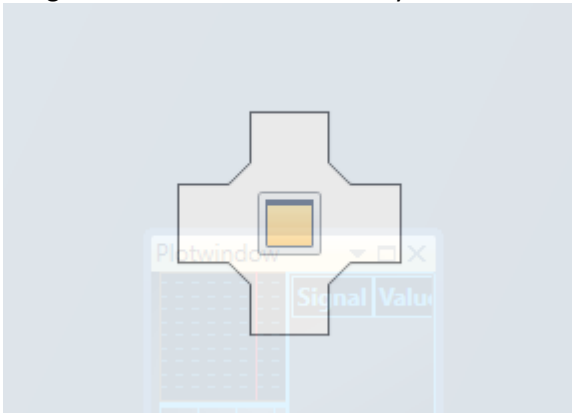
3. Select the file type and load the file you want to load.



4. Click on File -> New Window -> Plotwindow



5. Drag the window to the middle symbol on the screen.



6. Click the plot area and then press 'P'
7. Select a signal you want to plot, and press submit.

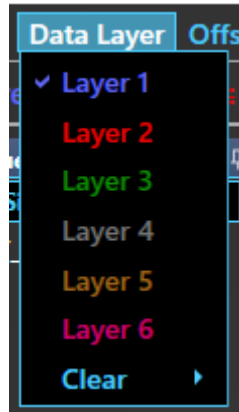




## 3 Layers

A layer is basically an individual container for the data you want to load.

There are a total of 6 layers that can be switched on or off by selecting them in the DataLayer dropdown menu.



Each Layer has its own color for overlaying different layers and if wanted, you can change the color in the options window.

On default the first Layer is always activated, and it is necessary to have at least one layer activated to be able to see some information.

Also, Layers shown on the main page can be de/activated by right clicking the text of those labels.

If you want to clear a Layer, just go into the “Clear” menu item and select the Layer you want to clear.



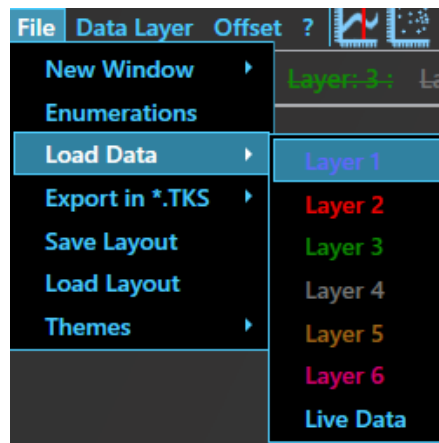
Cleared Layers will directly be deactivated. Also loading a file into a Layer will automatically activate it.



## 4 Data

### 4.1 Loading

Click on the “File” dropdown and hover above “Load File” to see a selection of all layers available.



Click on one of those Layers to load a file into this layer. Alternatively, you can double click one of the Layer labels and you will directly get to the load dialog.

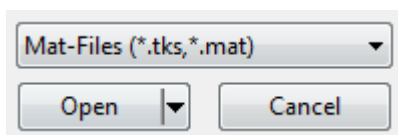
Note: The last folder location you load your data from, as well as the file type, will be memorized and stored into your layout. And loading into a deactivated Layer will activate it automatically.

If loaded successfully, the file will be displayed directly in the layer information bar.



### 4.2 Import data from other tools

To import nonnative Apaix files you will need to set the filter in the loading dialog. On default it is set to \*.TKS files.



The supported types you can load are:

- Mat-Files (\*.tks,\*.mat, \*.h5)
- Ascii (\*.txt)
- Wintax (\*.prn)
- Motec (\*.csv)
- DSpace (\*.csv)
- TDMS (\*.tdms)
- Session Info (\*.apxs)



Ascii, Wintax and Motec are a bit different to import than the rest. That is, because they are saved in text format and the files must be parsed. So, a file converter will pop up.

The window below is the parser that puts the lines of the \*.txt file to data:

Format:

Signals Name Line :

Signal Value first Line :

Signal Value Last Line :

☐ Tab ☐ Comma ☐ Semicolon ☐ Space ☐ other

Up to 32 lines of preview :

line	Time	Ax_BandPass05[G]	Ay_BandPass05[G]	Brake_Press_F[bar]	Brake_Bias[%]	Corner_radius[user defined]	Damper_F[mm]	Damper_RL[mm]
line 16								
line 17	451754699.3050000	0.034599	-0.018741	0.000000	0.000000	0.000000	-0.388885	-9.73733
line 18	451754699.3250000	0.034599	-0.018741	0.000000	0.000000	0.000000	-0.407195	-9.73333
line 19	451754699.3450000	0.034385	-0.011729	0.000000	0.000000	0.000000	-0.407195	-9.72934
line 20	451754699.3650000	0.028515	-0.010567	0.000000	0.000000	0.000000	-0.370574	-9.71744
line 21	451754699.3850000	0.023574	-0.020439	0.000000	0.000000	0.000000	-0.407195	-9.72934
line 22	451754699.4050000	0.031397	-0.007500	0.000000	0.000000	0.000000	-0.407195	-9.72934
line 23	451754699.4250000	0.030234	-0.001436	0.000000	0.000000	0.000000	-0.370574	-9.74921
line 24	451754699.4450000	0.020635	-0.017256	0.000000	0.000000	0.000000	-0.407195	-9.74521
line 25	451754699.4650000	0.022676	-0.024307	0.000000	0.000000	0.000000	-0.370574	-9.73333
line 26	451754699.4850000	0.027969	-0.008769	0.000000	0.000000	0.000000	-0.407195	-9.73733
line 27	451754699.5050000	0.022314	-0.014365	0.000000	0.000000	0.000000	-0.407195	-9.72534
line 28	451754699.5250000	0.021338	-0.024492	0.000000	0.000000	0.000000	-0.388885	-9.70144
line 29	451754699.5450000	0.029336	-0.007754	0.000000	0.000000	0.000000	-0.398040	-9.69744

OK Cancel

Let's zoom on it:

Format:

Signals Name Line :

Signal Value first Line :

Signal Value Last Line :

☐ Tab ☐ Comma ☐ Semicolon ☐ Space ☐ other

- Name Line: The line in which the signals names are listed.
- Value first Line: The line in which the first values are listed
- Value last Line: The last value that will be imported from the file.  
(INF reads to the end of the file)

Set the matching delimiter and the file converter will parse it into the preview window.

If everything is alright, it should look like the parsed values in the screenshot.

If something is wrong, like if you have less signals than data vectors or no present time vector, it will render the ok button red and it won't accept the file.

So, make sure the first entry of the signals names is always "Time".

### 4.3 Quick Loading

Double click one of the Layer Labels and the loading dialog will directly pop up. The selected file will be loaded into the clicked layer.

### 4.4 Multi-rate data

Apaix can handle different rates, as every Signal gets its own Timevector. Depending on the import type.



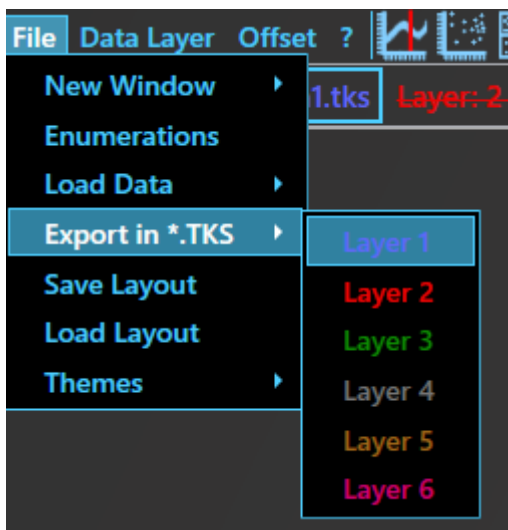
## 4.5 File-Concatenation

Concatenating files is currently not working.

## 4.6 Export

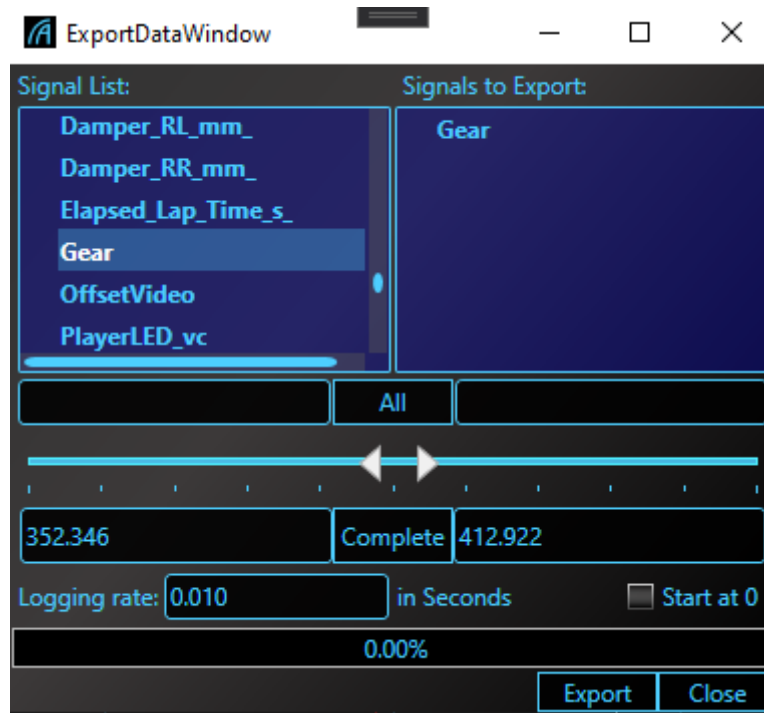
Exports will currently always create a \*.tkts file, which can also be opened with Matlab. The file will contain a unified Timevector created by the user defined logging rate and the time range of what should be exported.

To export a file, just go to the File dropdown and select the layer which you want to export inside the Export dropdown.





The following dialog will then appear:



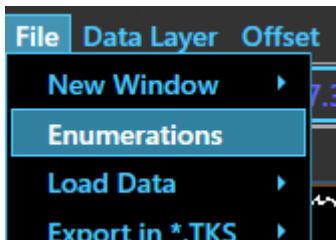
- The Signals that shall get exported are predefined as the Signals plotted in the active Plotwindow and can be altered if wanted (only available signals will be there)
- The boxes underneath the Signals are text-filters
- The “All” button will put all Signals to the Export
- The slider sets the range of the Timevector of the Signals to be exported
- The left box under the slider is for the starting time of the Timevector and the right box for the end time, while the “Complete” button sets both values to the maximum
- The box underneath the “Complete” button is for the logging rate to decide how big the steps should be and is entered in seconds
- On the right of it, there is the “Start at 0” box which lets the export begin at a zero-based time
- Then there is the progress bar that indicates the progress of the export.
- Even virtual channels can be exported as real signals this way, they appear at the bottom of the signal List in green as usual, but only if they can be used



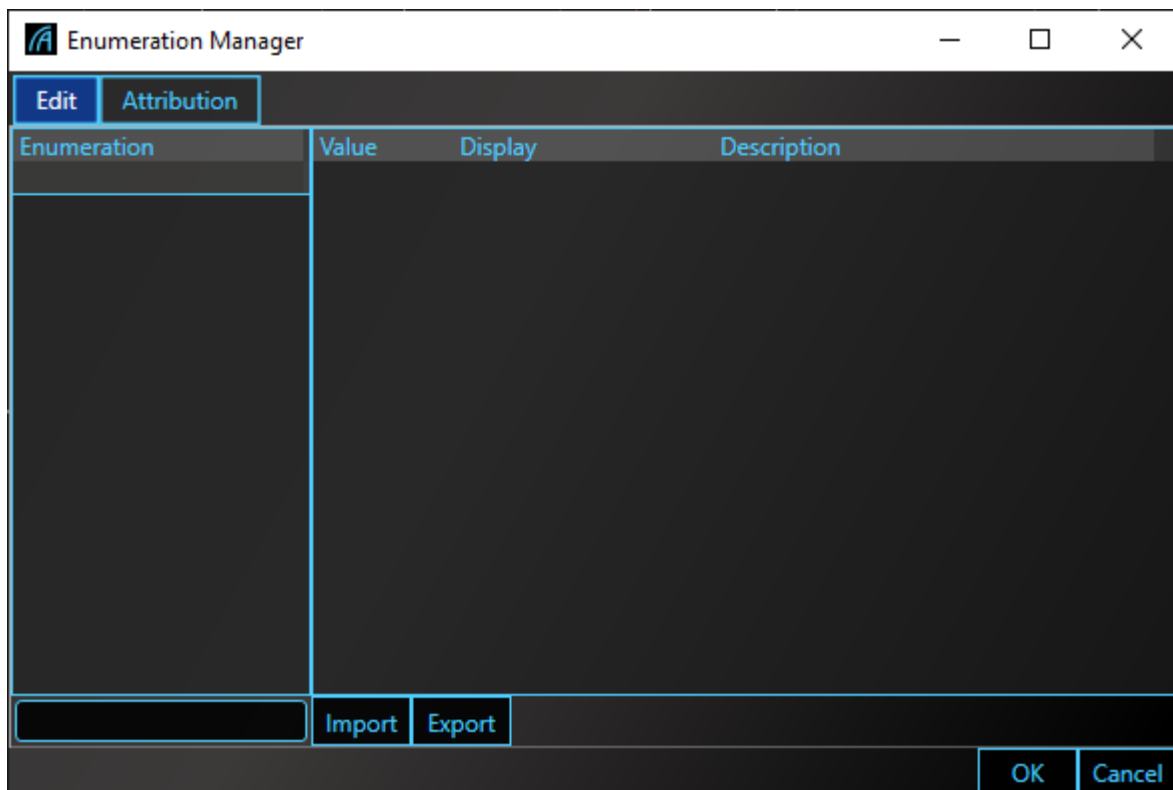
## 5 Enumerations

### 5.1 Creating Enumerations

First go to the Enumeration Manager, which will open if you click on “File” then “Enumerations”.



The resulting window will look like this:



1. Double Click into the first empty field of the Enumerations
2. Enter a name

Enumeration	Value	Display	Description
MyEnumeration			

3. Double Click into the filed Value, Display, Description to enter their values.
4. If the last wanted field is Edited, hit “Enter” and the field will be added to the List.

Enumeration	Value	Display	Description
MyEnumeration	0	The First Value	Displays the first value



Note that there is always an empty Line at the bottom if it is a table where you can create new items. Also, there is some error check, which will render the fields red, if something is wrong, Like multiple occurrences of the same Enumeration - Name or Value in the Enumerations Value – Column.

Enumeration	Value	Display	Description
MyEnumeration	-1	Default	
2ndEnum	-1	Default	
2ndEnum			

You can delete them by selecting the column that should get deleted and press the delete key “Del”

## 5.2 Using Enumerations

Now that the Enumerations are created, they will need to be assigned to signals to be used.

So, go to the Attribution page of the Enumerations Manager:

(In this example we have an Enumeration called Gears)

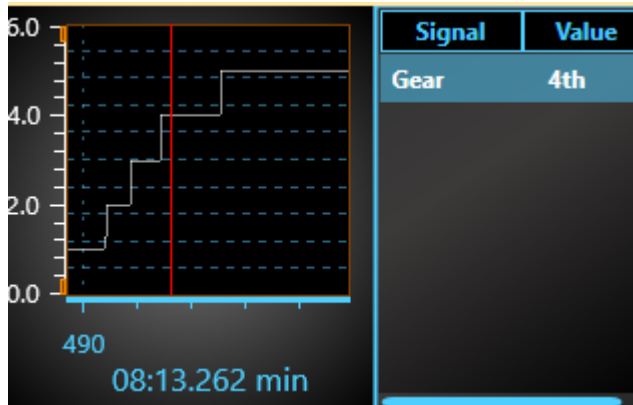
Edit	Attribution	
Enumeration	Assigned Signals:	Source Signals:
Gears	Gear	Damper_RR_mm_ Elapsed_Lap_Time_s_ Gear OffsetVideo PlayerLED_vc RPM_rpm_ Roll F m

- If an Enumeration is selected, the Selected Signals List will display which signals are selected for the Enumeration. The “Signals from Source” List will show all currently available Signals and Virtual Channels.
- Removing is again the “Del” Key
- Not Existing signals can be entered by double clicking the empty cell in the “Selected Signals” List and confirm with “Enter”
- Already Existing ones can be entered by double clicking a signal from the list. (For example, Gear)
- Also, you can filter with the filter fields on the bottom.

Enumeration	Selected Signals
Gears	Gear



Now that the signals have been assigned to the Enumeration “Gears”, both will display the corresponding Values that have been entered in the Enumeration, should the value be found. Otherwise the displayed value will be “NaN”.

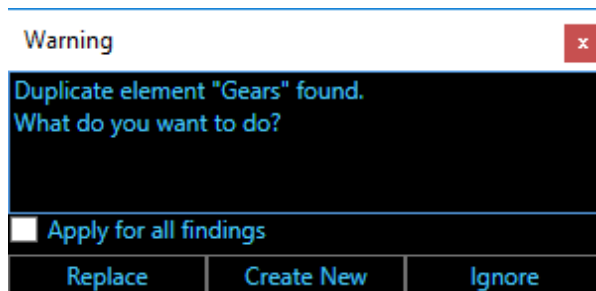


## 5.3 Import & Export

First of all, exporting will only work for the file type “\*.enum” and will export as text in an xml structure.

So, to export, just click the “Export” button and select a destination.

For importing there will be box that can appear if duplicates were found before merging your actual list and the Enumerations found in the file.



- Replace: The Enumeration will get its values replaced by the ones found in the file
- Create New: The Enumeration will be given an extension with “\_NUMBER” which is incrementing, if the actual number is found already and be added to the list.
- Ignore: The found duplicate will just be left out of the import.



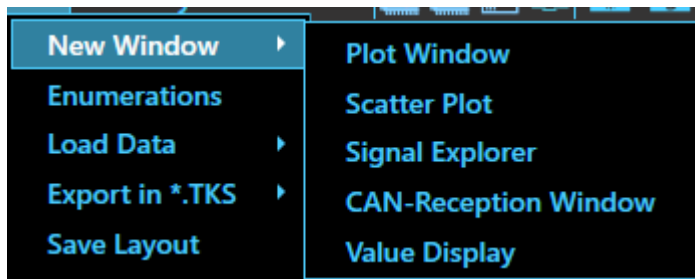
## 6 Plotwindows

Currently there are two different types of plots and a data visualization and a CAN-Reception window. The normal X-Y-Axis plot and a Scatterplot where different signals can be plotted and the visualization window that can hold signals and just display their values like the legend in the other windows. Also, there is the Signal Explorer, which is a tool to plot signals easily.

These windows can be docked like the user wants to freely customize the layout over several pages and save it for later use. Also, the save structure of Apaix allows for an easy option to share whole layouts or just single pages you created with someone.

### 6.1 Creation and docking

The File dropdown contains in the “New Window -> Plot Window” option.

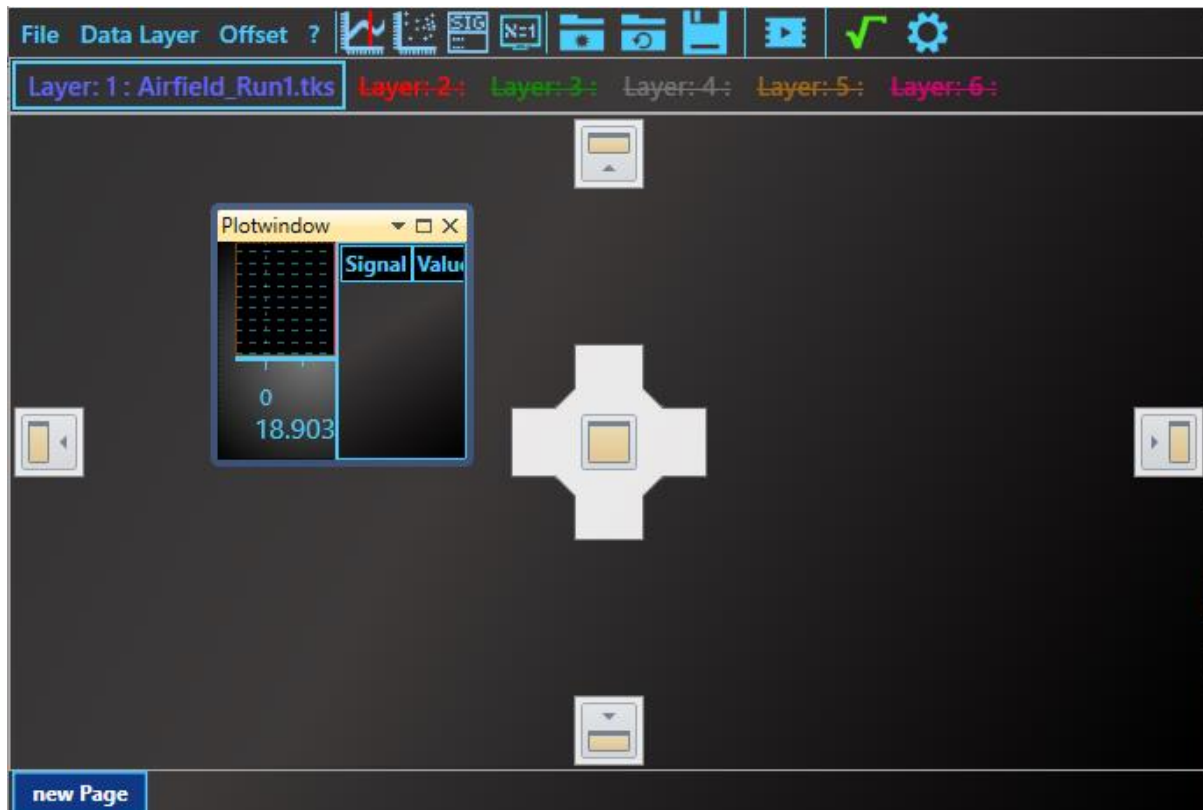


The Plot Window will be created in the upper left area of the screen.





After creation you need to dock it in your working area. Just drag and drop the window where you want to have it



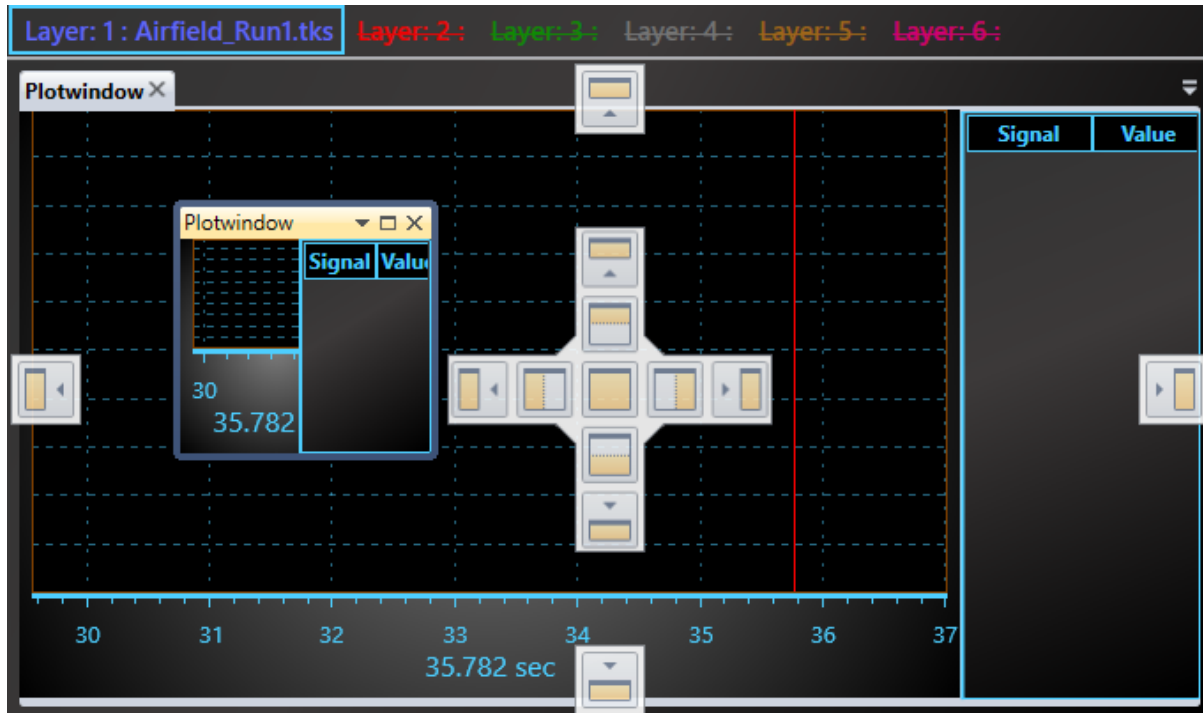
- Middle: insert as a main document
- Sides: insert a window as a side document

Drop the Plotwindow on the symbol in the middle to make it automatically take all the space.

Drop on the sides will fix it to that side, with not taking all the space.



If there are already Plotwindows present:



- Middle: put it into the existing plot window. (It will get a second tab)
- Halved: divide the available space, so that each window gets the same size
- Edge: puts the Plotwindow far to the relative edge, taking a minimum of space.



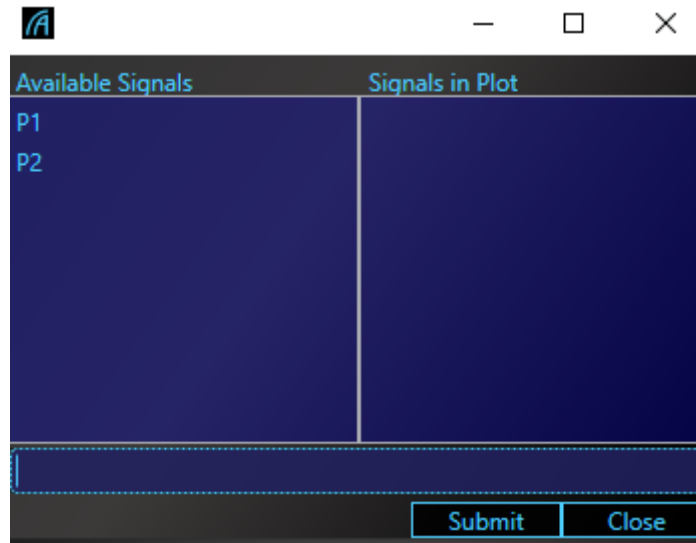
## 6.2 Using the Plotwindow

This step assumes Data loaded and windows in place.

### ❖ Plot data in the window

Right clicking the legend on the right side of the plot will open a context menu displaying three options. Select signals, Show and Background.

Select Signals opens the signal selection window.



### ❖ Add a signal in the list

Clicking once on an available signal is enough to add it in the list for signals in plot. The line with the cursor focus is a filter used for full text search in your signals list. Also, the filter is capable to use wildcards like "\*" or "?".

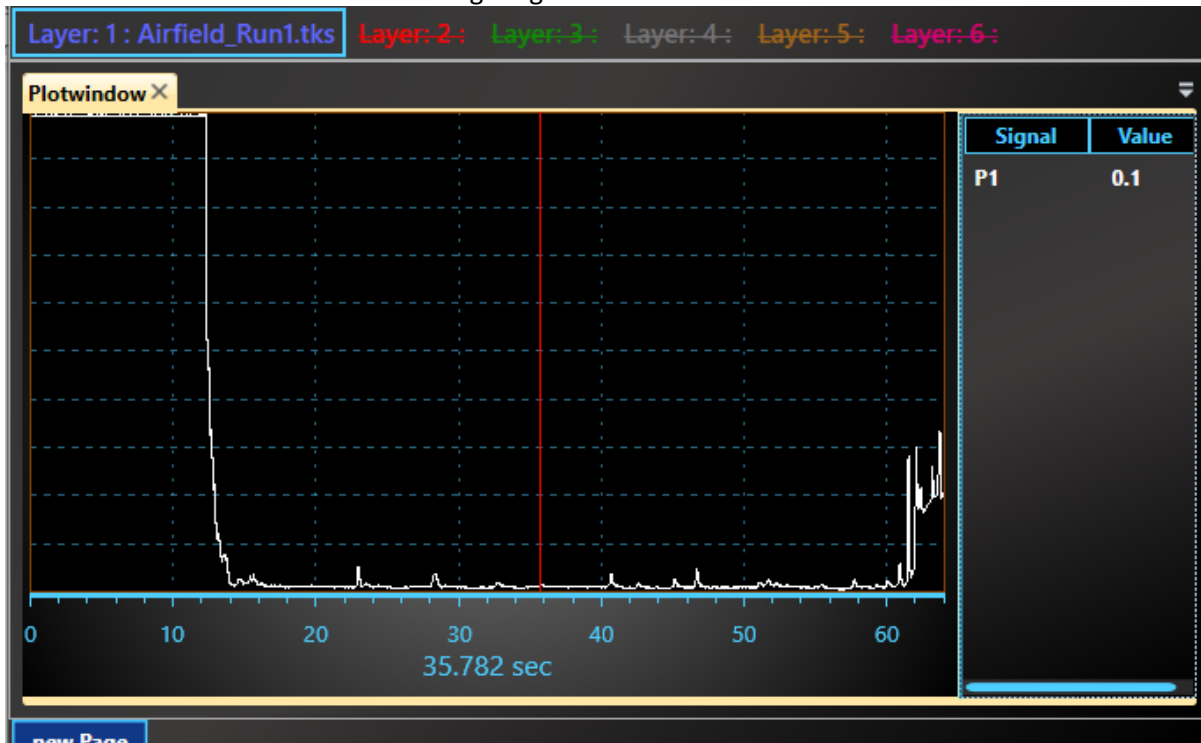
- "\*": Star counts for 0 or any number of any character
- "?": Question mark is used for just one random character

### ❖ Remove a signal from the plot

Either double left Click on the "Signals in Plot" section or select them and press delete on your keyboard to remove them.



Plotting a signal would look like this:



The value is for the current cursor position. (Solid red line)

## ❖ Cursor tool

The cursor is the dashed red line in the plot and can be moved by either clicking/dragging somewhere in the plot with the left mouse button or using shift plus the left or right arrow keys. To activate an auto scroll like function, like in documents, just use either s, or press the left mouse button and while pressing click the right mouse button once and release the left mouse button. Then just move the mouse to the right or the left, to scroll into that direction. If the cursor gets moved, the scatterplot will also show which point is currently relevant.

## ❖ Zooming

### Normal zoom:

You can zoom in/out with either the mouse wheel, or the plus/minus buttons, or the page up/down buttons on the keyboard.

### Default X or Y- direction:

Use the middle mouse to drag an area that will be zoomed in or use ctrl and right click to do the same. If done normally the zoom will take the x-direction. However, if you hover with the mouse over a Y-axis it will apply the zoom for the said Y-axis.

### Axis reset:

Press A to reset the x axis or press shift and A to reset x and y axes for the selected Plotwindow.



### Set distribution:

If you have moved your Y-Axis manually like you want and it should always stay like this on resetting the axes, press the “right mouse button” while hovering with the mouse over the certain y-axis.

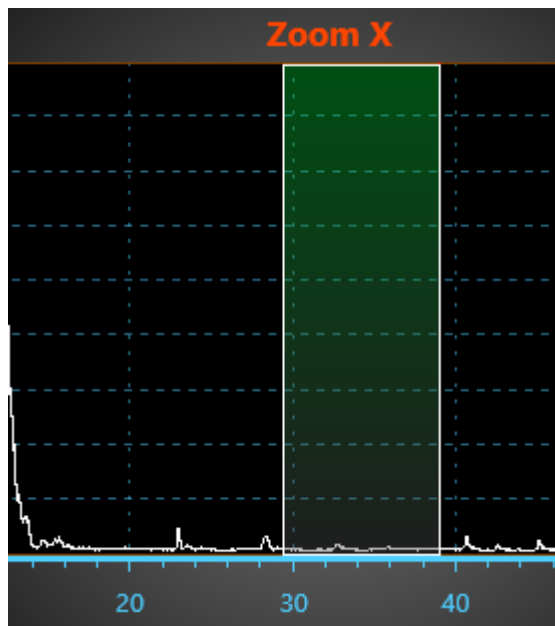
The Signals will then automatically set their distribution value.

### Zoom Box:

You can enter it by pressing “Z”, “X” or “Y” while the plot is being focused and you can switch between the modes by just pushing the other buttons. If you are in any mode and press the same key again you will end the Zoom Box Mode.

When using the zoom mode, it will replace the panning function of the right mouse button in the plot by instead creating a zoom box, depending on the mode. If the right mouse button will be released, the plot will apply the zoom. And the mode is depicted on top of the plot.

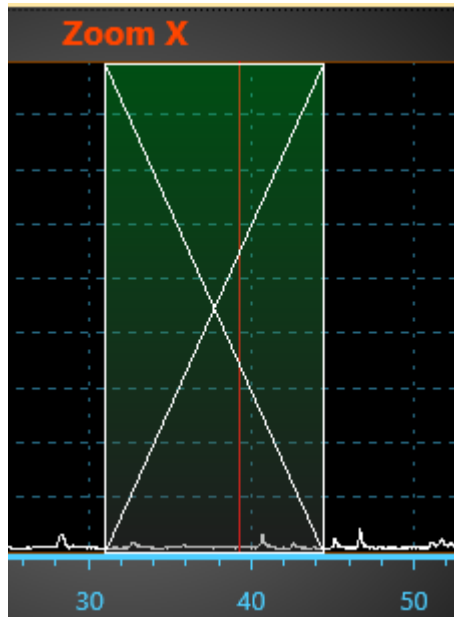
Zoom in



Zooming in will always take the area that is being selected, depending on the mode. To zoom in you must move the mouse to the right, compared to where the initial click happened, regardless if x, y or xy-mode.



Zoom out



Zooming out will always zoom out by a set margin and will only zoom out the direction that reflects the current mode. To zoom out, do the opposite than to zoom in. Move the mouse to the left, relative to the initial right click. Also, if executed properly, there should be the X appearing inside of the area.

#### ❖ Move the axis

Axes can also be moved with drag and drop with the left mouse button. This applies to both, x and y axes.



## ❖ Parameter Window

Double click in the legend area to open the signals parameter page.

The parameter page is divided into the Signals and the Segments Page.

Signals:

The top screenshot shows the 'Signals' tab. It has a table with columns: Display Name, Source Name, Format, Units, YAxis-Lock, Min, Max, Distribution, Color, and Show Y-Axis. The first row is 'Gear', 'Gear', '0.0', empty, a checkbox, '0.0', '6.0', '0 to 100', a color swatch, and a checkbox. Below the table is a horizontal scrollbar and 'Submit' and 'Cancel' buttons.

The bottom screenshot shows the 'Segments' tab. It has a table with columns: Segment, Filter, Cut-Off Frequency, Show Warning, Min.Warning, Max.Warning, Series Type, and Show Points. The first row is '1', a dropdown, a checkbox, '0', a checkbox, '0', '6', 'DEFAULT', a dropdown, and 'DEFAULT'. Below the table is a horizontal scrollbar and 'Submit' and 'Cancel' buttons.

The formula for the first order filter is:

$$y_k = y_{k-1} + (1 - e^{-2\pi f t}) \cdot (x_k - y_{k-1})$$

The sample time period will be automatically detected in the software.

A left click on the parallel modes column header will align everything to fit into parallel mode.

Switching the Auto-Distribution off, allows to set the absolute min and max of the axis range, which prevents zooming out going too far.

## ❖ Segments

The screenshot shows the 'Segments' tab. It has a table with columns: Segment, Segment Height, Segment Height Divisor, and Percentage. The first row is '1', '1', '1', and '100.0'. To the right of the table are 'Add' and 'Remove' buttons. Below the table is a horizontal scrollbar and 'Submit' and 'Cancel' buttons.

Segments are a new introduced feature that allows to have a clear division in the same graph.



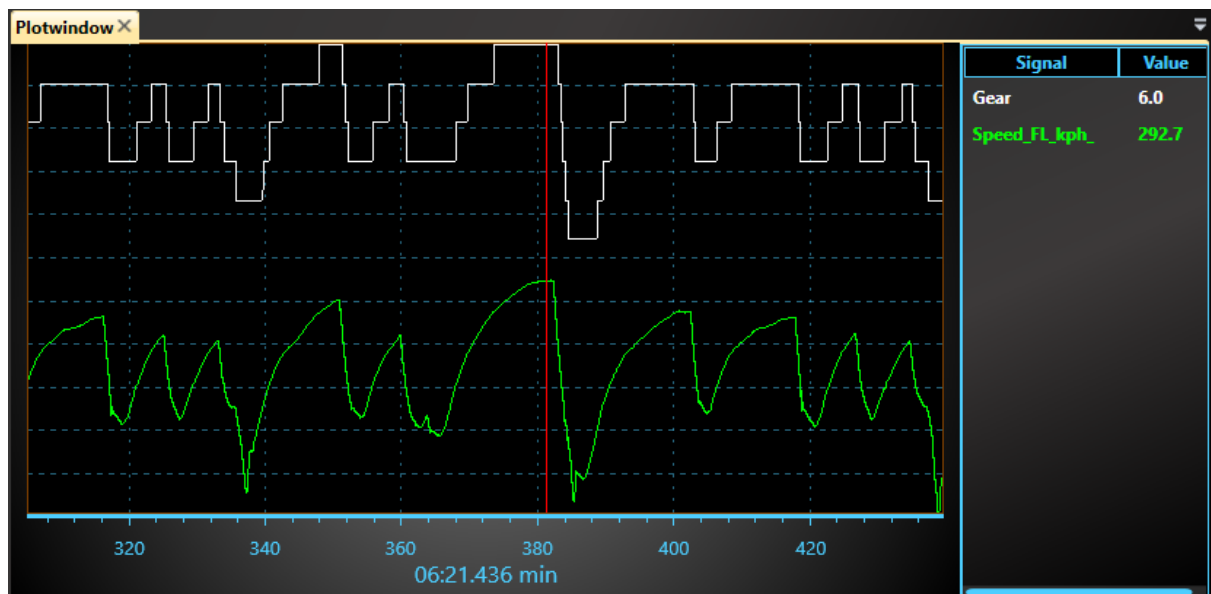
By adding a segment, it will automatically be added with a segment height of 1. The percentual usage of the screen of the segment will change for both to 50 % because now there is 2 segments with each having a height of 1.

Segment	Segment Height	Segment Height Divisor	Percentage
1	1	2	50.0
2	1	2	50.0

The segment height divisor depicts the total height of all segments together, which means if there are 5 segments with a height of 1 the divisor will be 5. And each segment takes 20 % of the screens space.

Segment	Segment Height	Segment Height Divisor	Percentage
1	1	5	20.0
2	1	5	20.0
3	1	5	20.0
4	1	5	20.0
5	1	5	20.0

Example of 2 segments with the same height:



Note that a new Signal will always on default end up in segment 1, so you have to manually set them in the Signals Property Page.

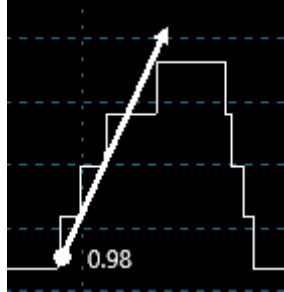
## ❖ Min, max, delta & average

Right click the legend to open the context menu, then select min, max, delta or average of the signals, which get automatically calculated depending on the focused area, to show them.



### ❖ Gradient cursor

Select signals in the legend and press the “G” key to toggle it. The gradient cursor can be dragged if you click in its middle. If you pick the outer parts you will move the tips of it.

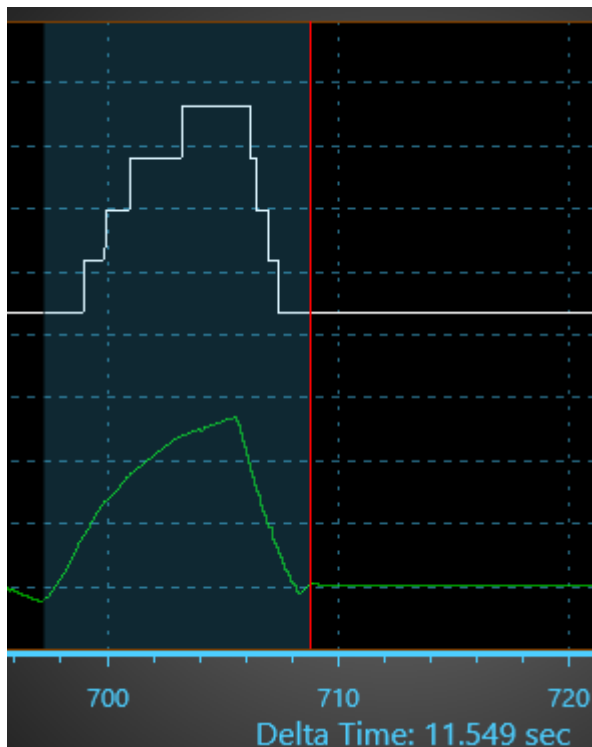


The plot can have one gradient cursor per signal and have them all active at the same time.

### ❖ Reference Cursor

Pressing “R” will activate it at the position where the cursor was at the last time and it will create an area between itself and the normal cursor. The area affects:

- Min, Max, Delta, Average (calculated only in this area if active)
- Scatterplot renders points outside of this area transparent to show selected data, if active



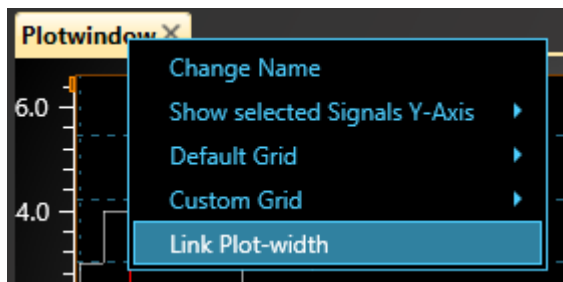


## ❖ Set Legend Width

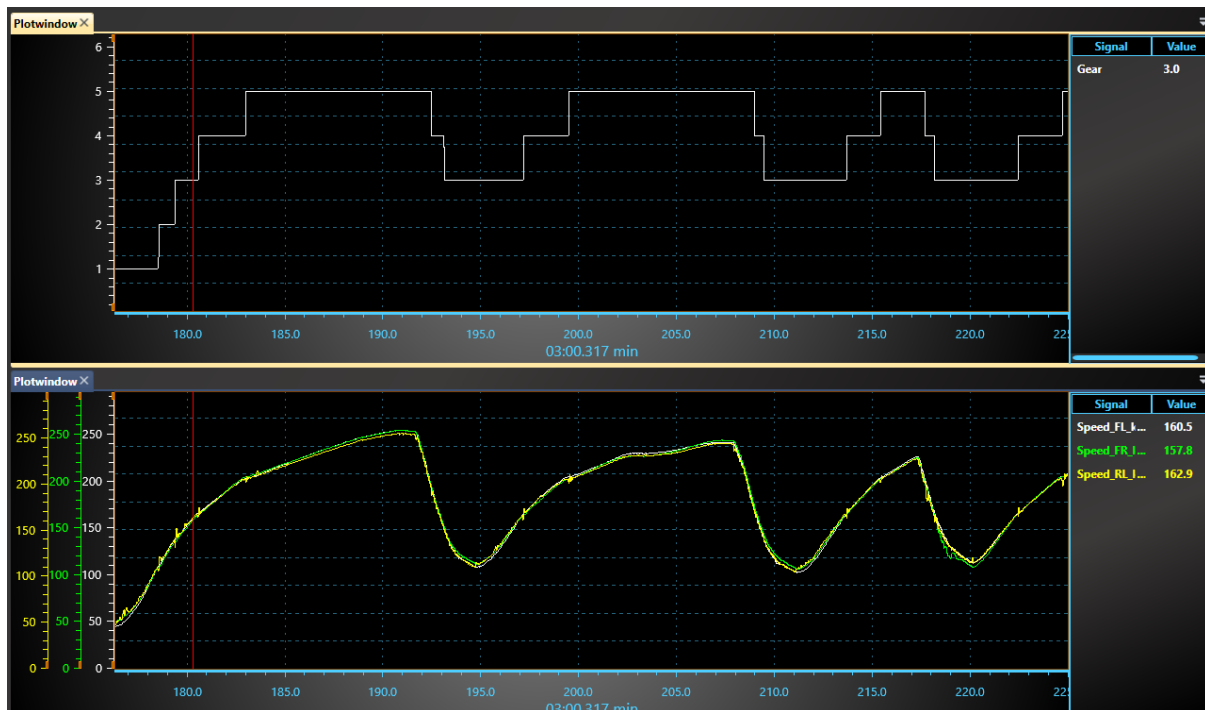
To change the legends width just move the line between plot and legend per mouse drag. But for the normal plotwindows there is an automatic alignment for the legend to autofit the information displayed. This does however not apply if the Plot width is being synched with other plots.

## ❖ Synch Plot Width

Synching the width of the plot is done by right clicking the windows title and selecting “Link Plot-width”.



The Link will keep the width of the legend, as well as the space the visible y-axes take linked between all currently visible Plotwindows. So, if an axis gets added, the space will be adjusted.

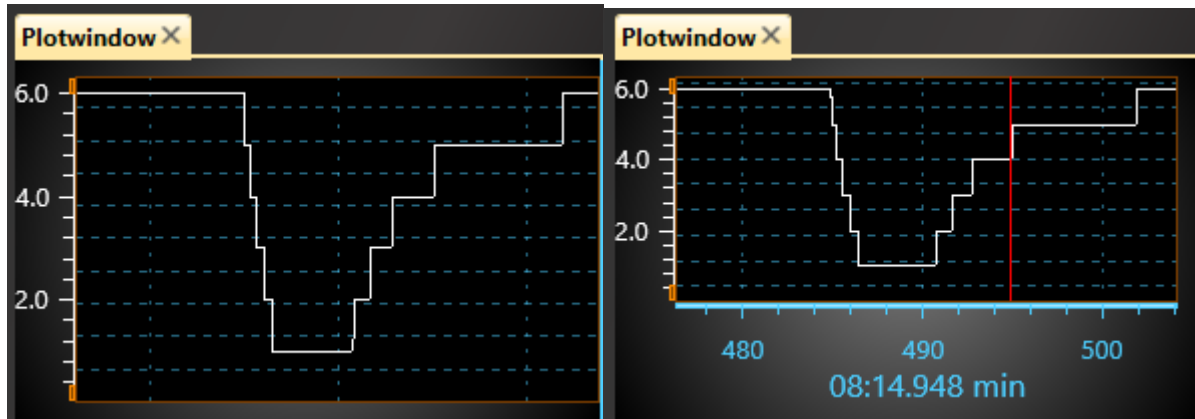


Note: This functionality is not available for Scatterplots.



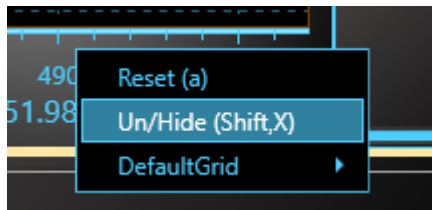
## ❖ Hiding the X-Axis

If the X-Axis takes too much space or like in the above example for linked windows is disturbing to have multiple times, press “Shift” and “X” simultaneously to toggle the visibility of the X-Axis.



Here you can see the difference in height if the X-Axis is set to be invisible.

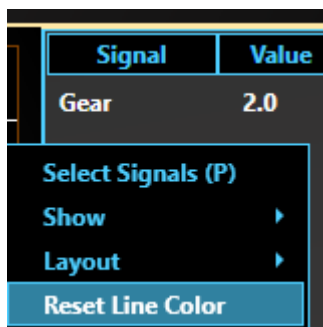
You can also Rightclick the Axis, even when hidden, to open a small context menu that has the possibility to hide, or unhide the X-Axis.



Note: This functionality is also Plotwindow only.

## ❖ Reset Line Color

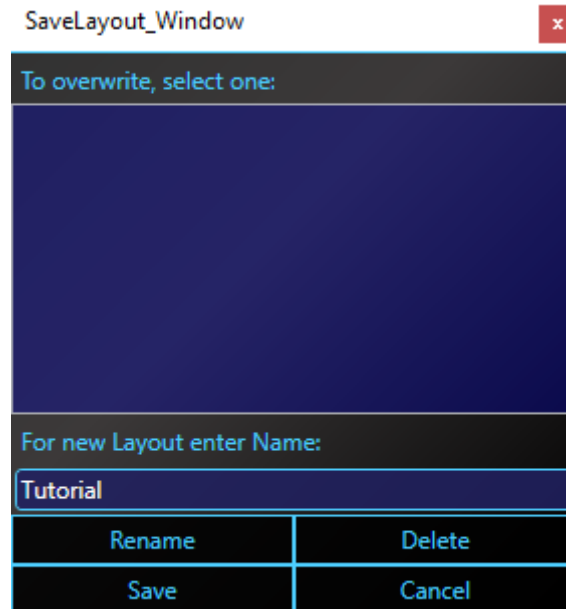
This function will apply the default colors (depending on the background color) from top to bottom of your legend area. Can be used to make a window printable, by setting the background to white and then reset the lines colours to fit the white background.





## 7 Layouts

Click “Save Layout” in the “File” dropdown.



### 7.1 Saving with custom name

Type the layout name and press save. It will save your layout and close the layout save window.

### 7.2 Overwrite, rename and delete

If the layout is already present, just double click in the list to save it. To rename or delete, select a layout in the list clicking once and click on either “Delete”, or type the new name and press “Rename”.

### 7.3 Load a Layout

Select the Load Layout option in the File dropdown and double click the wanted layout.

You can also set the check in the options menu to always load the last used layout on startup.

### 7.4 What happens on saving?

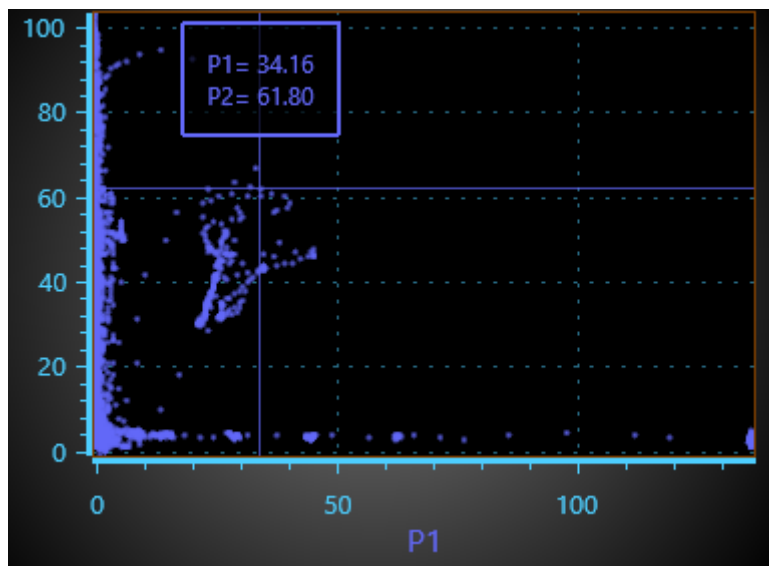
If the folder is not present, Apaix will create a “Layouts” folder inside its main directory and put a folder inside that labels the name of the layout. Inside pages and one workbook are stored. For sharing either share the whole folder or give single pages that will be put into a new layout folder.

**Note:** Pages can be created/deleted/renamed by right clicking on the page in the lower left area of the screen. However, the last one remaining can’t be removed. Also the Workbook contains Enums, Virtual Channels and the information about last used data types and paths.



## 8 Scatterplot

It will be created and docked just like the normal Plotwindows. It can only show one combination of signals at the same time, but for each layer that is active. The first layer as shown in the picture uses this blue color, as for the other layers, they use their own color.

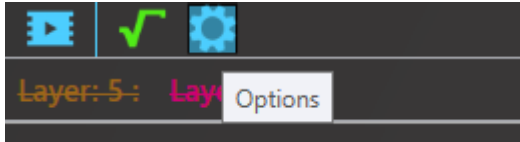


- ❖ Uses the Layers main color to display values
- ❖ Display is linked to Plotwindows range and will automatically alter the displayed data depending on the relevant area.
- ❖ The legends context menu has a setting to always use the full range, if the reduction is not wanted.
- ❖ The reference cursor link will change the relevant range to the selected area, rendering points outside of the selected area a bit more transparent.
- ❖ Tracker that allows to read each point's exact data by just holding down the left mouse button on a designated point.
- ❖ Settings in the legend's dropdown menu allows to use always the full range of values if preferred.
- ❖ Tracker will automatically display the selected point, when the cursor of Plotwindows is moved.



## 9 Options

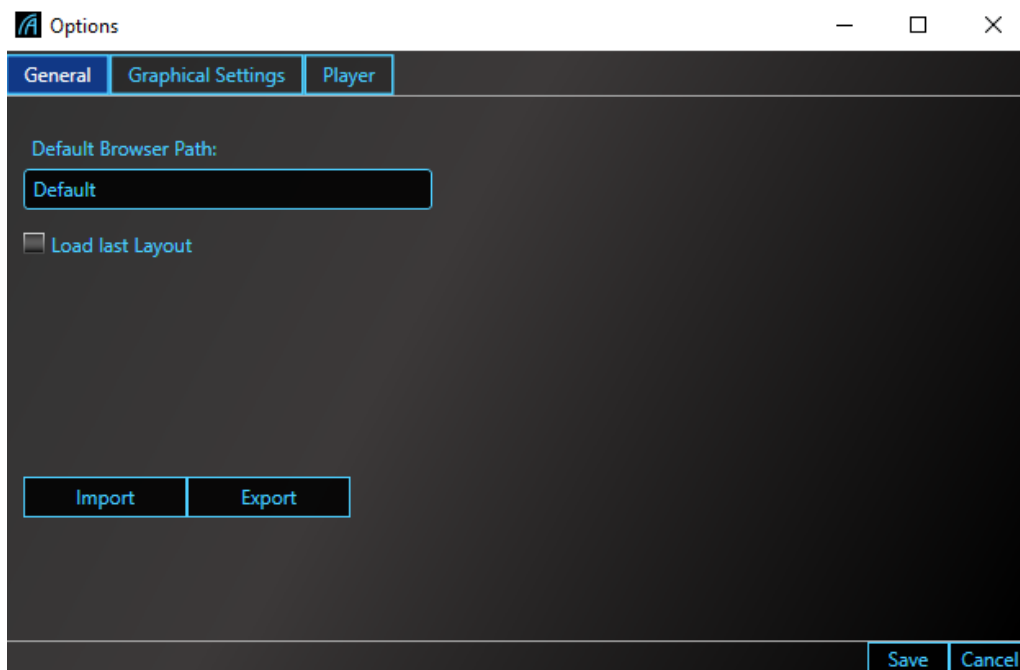
The Options window can be reached by clicking the gear symbol in the menu bar.



This Menu contains Three categories:

- General
- Graphical Settings
- Player

### 9.1 General



General contains the default browser path for Data to load, if the last data path from the layout is not available.

The the import and export functions for the settings.

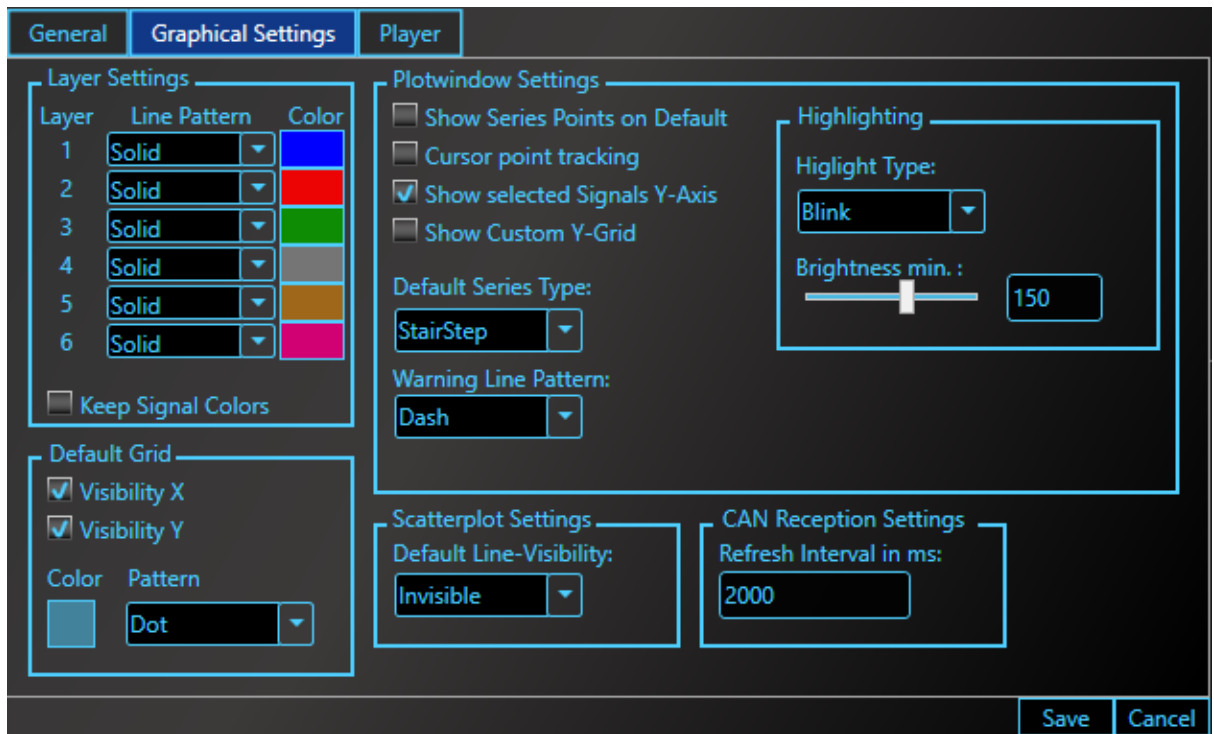
And the option to open the last used Layout.

The files exported will be \*.cfg files and loading them will apply to all the options in the General and Graphical Settings tabs.

The Player Tab will be referenced in the video player related section of this guide.



## 9.2 Graphical Settings



The Graphical Settings are divided into several parts as well:

- Layer Settings
- Plotwindow Settings
- Default Grid
- Scatterplot Settings
- CAN Reception Settings

### ❖ Layer Settings

Here you can select individual colors or line pattern for each layer and define if the layers should keep their color when using multiple Layers at the same time.



### ❖ **Plotwindow Settings**

Here you can define if you want to see the points of the series, activate the point tracking which will draw a little X where the cursor hits the series line, activate showing the y-axis of selected signals or set the Custom Y-Grids Visibility. The latter will display a grid corresponding to each visible y-axis. Also, you can decide on the default Warning Line Pattern, the Series Type and the Highlighting.

The Highlighting lets you choose from a normal highlight, blinking and pulsing. The Brightness min. defines the transparency applied to the selected signals. If blinking with a brightness min of 0, then the signal will completely disappear and reappear shortly after that. However, if it is at like 150, it will swap between less visible and fully visible. And finally, with pulse it will gradually fade until it reaches the minimum and then gradually get more visibility until fully visible again.

### ❖ **Default Grid**

You can adjust the visibility of the default x and y axes grid visibility and also pick a color and a pattern for them.

### ❖ **Scatterplot Settings**

You can define whether you want to have the dots connected by a line on default.

### ❖ **CAN Reception Settings**

This sets the Refreshinterval for the UI of the CAN Reception controls.



# 10 Video Player

## 10.1 Starting the player

To open, click the small player symbol in menu bar, but remember that it is important to have the correct layer selected.

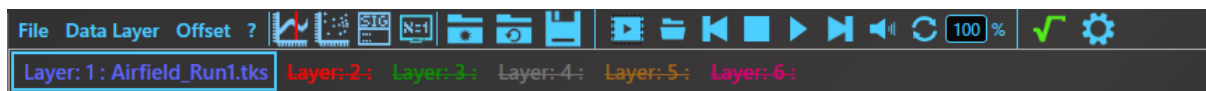


The right layers would be layer 1 and layer 2. Layer 1 is hereby always needed, because layer one points to the video one of player 1 and video 2 points to player 2.

That means  $\Rightarrow$  Layer 1 = video 1 = player 1

Layer 2 = video 2 = player 2

So left click the Layer you wish to select when loading a video. (Before loading a video in layer 2, layer 1 must have a video present)



\*note that the symbols to control the player appear after the player is visible.

Click the blue folder button to open a video file for the player, depending on the layer you selected. The play, stop, pause and frame by frame buttons count for both players simultaneously.

## 10.2 Settings and synchronizing

To synchronize the video with the data, the video to data offset needs to be set for the depending layer. After pressing "Shift" + "O" in the Plotwindow and the video to data offset can be changed like the normal offset. While doing this the cursor can be moved to see the point in the video, then move the axis to select a part where video and data look matching. Then just press "O" again and it will be set.

If known the numerical value for the offset can be entered manually in the Offset tab next to the data layers.

The gauges are a visualization of signal data. They can be set in the options menu in the tab Player and then Signals. The User has to select signals that fit the display.

On the second tab in the Player settings there are max engine speed, limiter speed etc.

Some can be set for both players and others are for each individual player.



### 10.3 Gauge Explanation

1. RPM = the Curved line that starts yellow and turns into red the further it reaches the limit
2. Lateral and Longitudinal Acceleration = the box in the top right in the picture
3. G – Sensor = The part in the very middle calculated by Lateral and Longitudinal Acceleration
4. Gear and LED = the box with the value 2 is the gear and the LED is the one right next to it
5. Speed = the box with the 102 kph
6. Throttle = the box with 0%
7. Brake = the box with 51.0 bar



## 10.4 Session Info

The Session Info is a file that gets created when loading a new data-file, as long as it does not already exist.

It is named after the file, but with a different ending. It is: \*.apxs

It stores information on the Video to Data Offset and the signals that were to be displayed for the file.

To save those settings into the \*.apxs-file you will need to check the box corresponding to the layer and save to overwrite the previous/default settings. If you don't check the checkbox you can still have a look at your signals without saving them into the Session Info.

General

Graphical Settings

Player

Signals

Config

Player 1:

Gear

Speed\_FL\_kph

RPM\_rpm

Throttle Pedal\_perc

Brake\_Bias\_perc

Ax\_BandPass05\_G

Ay\_BandPass05\_G

Elapsed\_Lap\_Time\_s

PlayerLED\_vc

Player 2:

Gear

Vehicle speed

Engine speed

Throttle pedal

Brake pressure

Longitudinal Acceleration

Lateral Acceleration

Lap time

LED

☐ Save Signals for Layer 1

☒ Match Signals

☐ Save Signals for Layer 2



To save the Layout just go to your Offsets and click the last option.

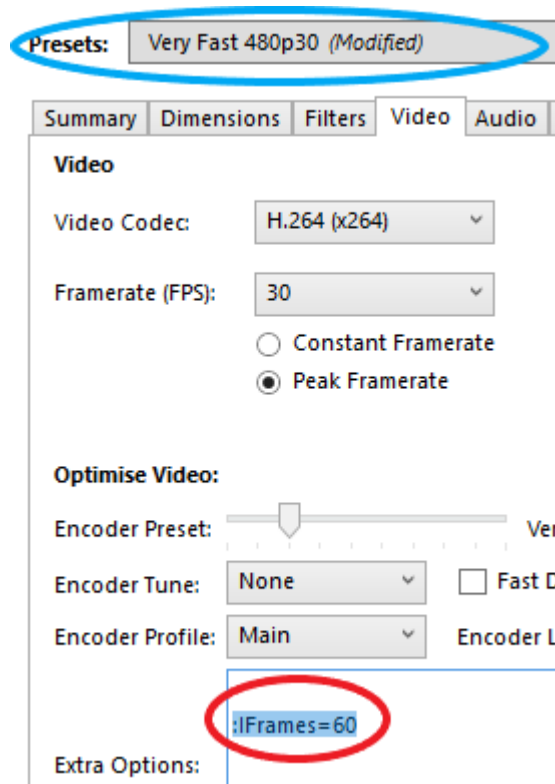
If you reset the Video to Data-Offset, it will be reset to the value saved in the Session Info for the selected layer.

## 10.5 Fluid Videos

In order to get the optimal speed when skipping through the video, there can be done two things to improve a slow video.

1. Reduce the resolution of the video
2. Reduce the range of I-Frames of the video

This can be done with any video converting software, but we focus on the free tool Handbrake for now.



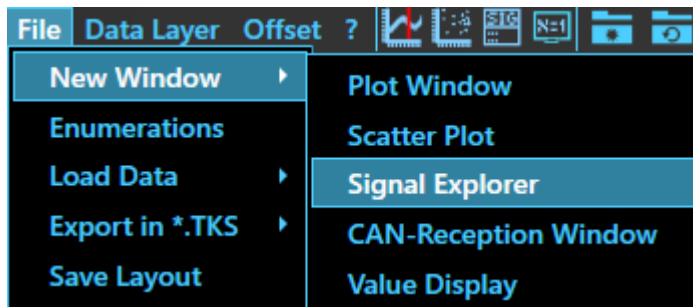
The picture above shows a really good setup for videos, if the quality is not too important.

- Reducing the Resolution will make the video faster and smaller.
- Reducing the range of the I-Frames will make the video faster as well, but the size will be increased.

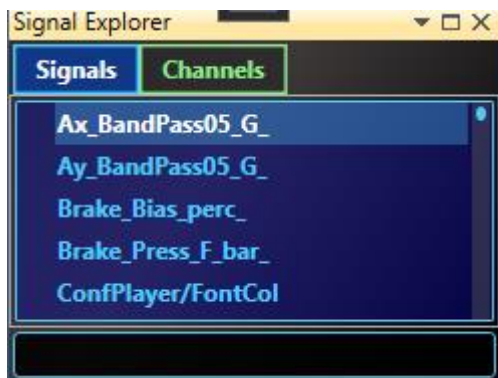


# 11 Signal Explorer

In the menu “File” there is in “New Window” also the option to open the “Signal Explorer” window. This window allows the user to easily plot signals just by drag and drop.



The Signal Explorer will have all signals that are available with data listed in the “Signals” tab and all virtual channels in the “Channels” tab. Also, the Explorer has a filter at the very bottom to alleviate the work of finding the signals in huge files.



1. Load data
2. Open the Signal Explorer
3. Drag and drop the Signal into the desired Plotwindow or Scatterplot axis

Also, if the little pin symbol with the tooltip “Auto Hide” is clicked when docked, the window will hide itself and be a little box at the border of the window. If you click it, it will enlarge and be normally usable and on focus loss it will go back to the hidden state.

Note: Remember to always dock Floating windows, as it can make problems with loading and saving layouts.



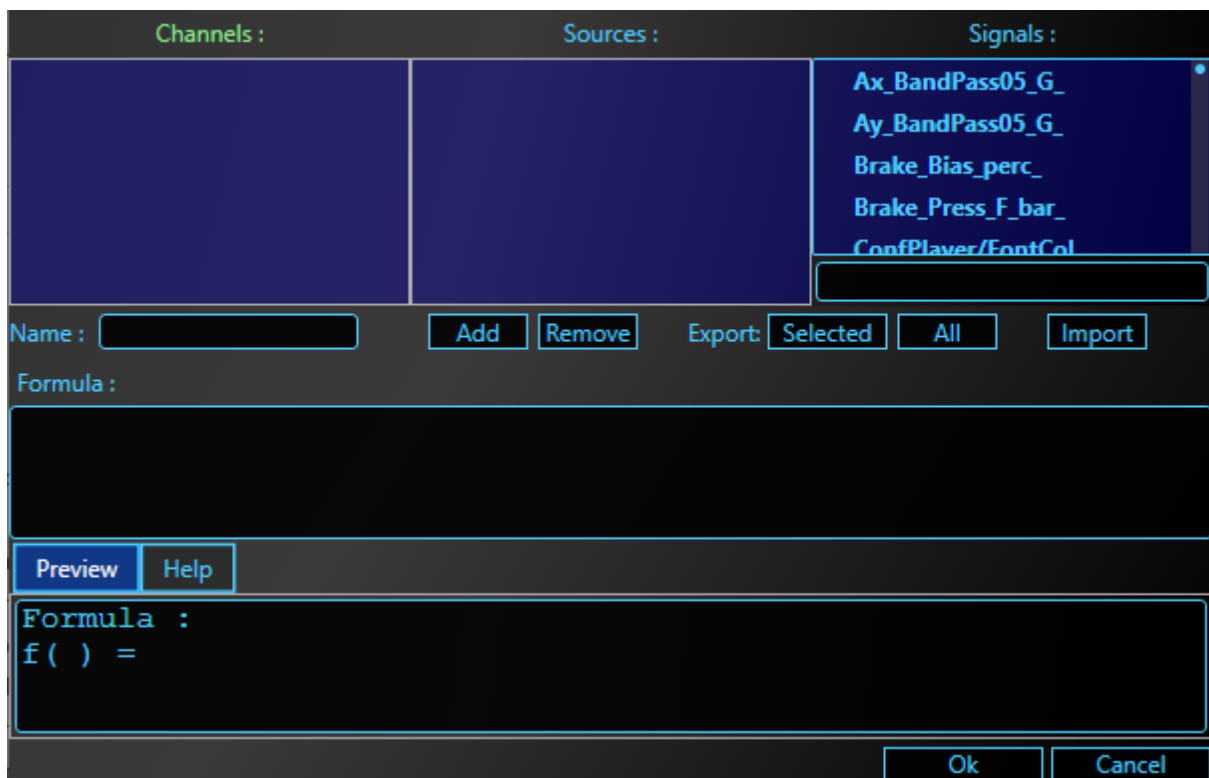
## 12 Virtual Channels

Virtual channels in Apaix are a way to create Signals that are processed with custom math formulas to apply any calculation that is wanted by the user.

To access them just click on the green Square root symbol in the menu bar.



And the resulting window will look like this:

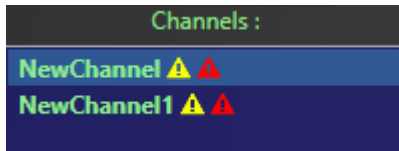


1. Add a channel
2. Select the channel and then click the sources you want to have in the Signals Box on the left
3. Enter the formula
4. Use it in plots or the video player or even export it into a new data file.
  - Export / import channels or removing them from the list is also possible.



## 12.1 Adding / Removing a Channel

When adding a new Channel it will appear with 2 indication triangles, a yellow and a red one.



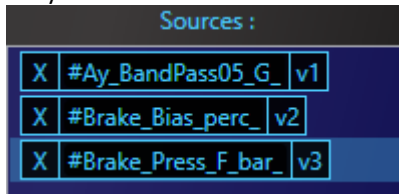
- Yellow: One or more Layers have no sources available
- Red: The formula for this Channel is wrong

Also note that the Name is given automatically and can be changed in the “Name” field after selecting the desired channel. Also, if the “NewChannel” is already present, the next channels will have an increasing number. If there is no “NewChannel” but a “NewChannel1” the tool will create the next channel with the name “NewChannel2” so the channel can always be found looking for the biggest number.

When removing only select the desired channel and click the remove button.

## 12.2 Selecting and removing Sources

At first you select the channel and then click the desired sources in the Signals List. They will then be filled in as sources.



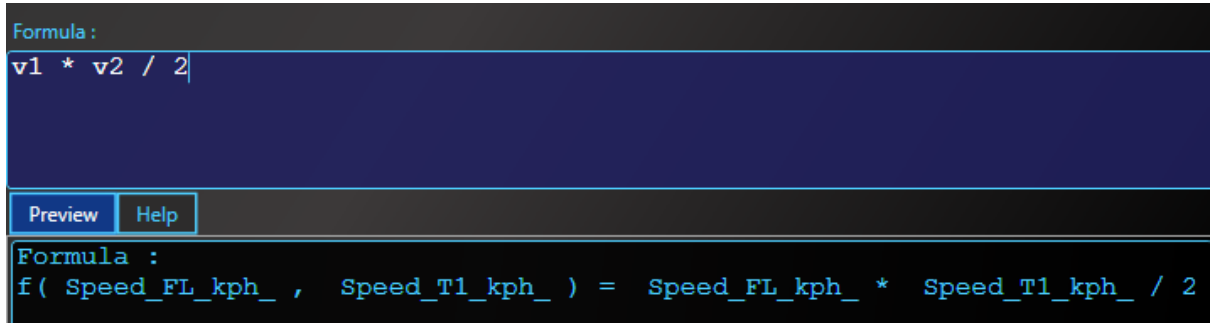
- The “X” is the button to remove not wanted sources.
- The Name is in a Textbox that allows renaming for more flexibility in terms of name convention changes
- And the last Button is the variable name of the source (important for the formula). Clicking it will insert the variable into the formula at its cursor position.

Note: Removing sources in between will cause the variables of the later ones to change its number. This means removing the “v3” will cause “v4” to become “v3” and “v5” will become “v4”.



## 12.3 Formula and Preview

For this example, we take just two speed values and create an average



- The “v1”, “v2” .... “vn” represent the sources covered in the last topic and clicking the button of the source will automatically place the variable at the cursor position of the formula box
- “v1” is basically the actual value for the first source for each value iteration as well as “v2” is the same for the second source
- Brackets and mathematical operators can be used like in any formula, like here where the 2 values get added and then divided by 2
- The Preview writes the variables names out, so it is easier to have a good overview on the real names

### ❖ Indexing

The indexing allows to reach different values of the source than the actual one.

- “v1( number )” will give out the value of the sources array at the position of “number”. So, this means “v1(0)” will always give out the very first value of the source
- “i1” stands for the actual index. Which means if you only put “i1” in a formula, the result will be a count from 0 up to the sources length – 1
- “i1( number )” will give the actual index, but shifted by the “number” this means “i1(-1)” would be the previous index
- “v1( i1(-1) )” Would then be the previous value of the first source the brackets after i1 can even be omitted and written as v1(i1-1) which is a bit shorter

Also, the actual Timevector can be indexed as well.

- “t1” which is basically the same as “t1(i1)” so the Time of the first source at the current index.
- “t1(number)” which is the time of the first source at the chosen index

The number that represents the source can also be put to 0, this stands for the channels output.

- “v0” would then be the actual output value
- “t0” is the actual time of the outputted channel
- “i0” will then be the actual index of it

Note: keep in mind that as the output signal is not already calculated there will be only NaN values which will require “if-statements” to be used along with these indexes. For “if-statements” read the next chapter.



## ❖ “If” statements

In some cases, it might be needed to have some logic for formulas for example to have some kind of error detection. Here in this example we have set a range from -1 to 1 where the signal would be ok, in any other cases we will give out the value [NaN]. This will then be easy to note in the graph if there are breaks in the line.

Formula :  
`if( v1 > 1 || v1 < -1 , [NaN], v1 )`

- The structure looks like this “if( condition, if true, if false)” , so if the condition is true the part after the first comma will be the output and else the last part will be the output
- Like here “v1>1” checks if the actual value is bigger than 1 “||” is the logical “or” and “v1 < -1” checks if the actual value is smaller than -1. If not, it will put out the actual value of the first source “v1” and otherwise the formula will put out a [NaN] value.
- The preview will have the name of the Channel for the output.

## 12.4 Import / Export

The export is depending on which channels are selected. Only the selected channels get exported for cases, where only a certain set of channels should be exported.

1. Select all the channels that should get exported (“CTRL + Click” or “Shift + Click” are needed for the selection)
2. Click the export button
3. Save the file

When importing keep in mind that only channels with different names than the actual existing channels get imported, to avoid losing your channels if the file has already channels that have the same name.

The channels are saved as XML and can be altered with default text editors in cases they should be altered in any way before importing.



## 12.5 Integrate / Derivate

**To integrate** we will use an if statement to exclude the very first value and set it to 0 and also be sure that the parser will not try to access the value before the first one, as this would lead to everything being NaN values because the first value does not exist already.

Formula :

```
if( i0>0 ,v0(i0-1) + v1 * ( t1(i1)-t1(i1-1) ) , 0)
```

Formula to copy and paste: `if( i0>0, v0(i0-1) + v1*( t1(i1)-t1(i1-1) ),0)`

The part of “( t1(i1)-t1(i1-1))” here is the difference between the actual and the last time value. If you do not want to have it starting with 0 , you can always set the first value of the source or anything else as the starting value, like “v1(0)”.

**To derivate** we use basically the same things except we do not need the if statement.

Formula :

```
(v1 - v1( i1 - 1 )) / (t1( i1 ) - t1( i1 - 1 ) )
```

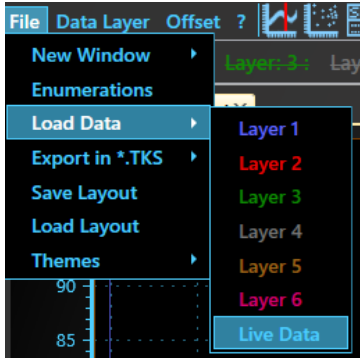
Formula to copy and paste: `(v1 -v1(i1-1))/(t1(i1)-t1(i1-1))`

“v1 – v1(i1-1)” is the difference between the actual and the previous value and this will be divided by “( t1(i1)-t1(i1-1))” which is the time difference between both values.

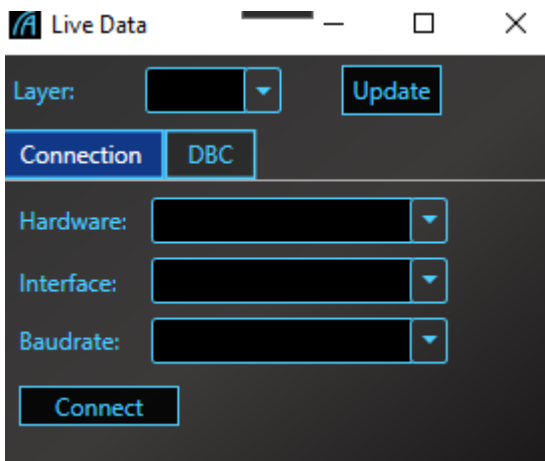


## 13 Live Data(WIP)

For loading Live Data go to:



Then you will be able to select the Protocol and the Layer you want to read into:



Currently Apaix is only supporting CAN data as protocols.

The supported Hardwares are :

- PEAK
- KVASER (WIP)

**Note that this feature is currently work in progress and also not available in the Demo Mode.**



The CAN can be connected directly and DBC Files can be added later on.

Layer:

▼

Update

Connection

DBC

DBC - Files:

File Name	Path
-----------	------

Add

Remove

Clear

Apply

A list of several DBCs can be added to the layer and with “Apply” it will be set.

### 13.1 CAN Reception Window

CAN-Reception Window															
Layer: 1															
Send	CAN ID	TYPE	LENGTH	DATA								CYCLE TIME (MS)	COUNT	TRIGGER	COMMENT
	AF		4	10	AF	21	11	00	00	00	00	<input checked="" type="checkbox"/> 1000	6		
												<input type="checkbox"/>			
Receive	CAN ID	TYPE	LENGTH	DATA								CYCLE TIME	COUNT		
	100	PCAN_MESSAGE_STANDI	8	50	01	02	03	04	05	06	00	2000	23		
	01	PCAN_MESSAGE_STATUS	4	00	00	00	08	00	00	00	00	2000	45		

Select the Layer in the top left Corner and the Reception Window will update the read messages in the rate put in the Options.

Sending can be done with either the Cycle Time, or selecting the Message and send it Via the Send Button individually.



# 14 Demo Mode

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## 1.1 What is Demo Mode?

It allows Apaix to be used without a license. However, it has some restrictions on features that can not be used.

## 1.2 When is Demo Mode active?

Demo Mode is running, if Apaix does not find a valid license on startup. If you want to have for example, a license dongle and start Apaix without plugging it in, you will need to restart Apaix and plug it in, in order to start Apaix in Licensed Mode.

## 1.3 What restrictions are there?

The Demo Mode restricts Loading, Saving, Renaming and Deleting of Layouts. Other than that, also the functionality to use Live CAN Data is restricted. Every other feature can freely be used.



## 15 Glossary

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### ❖ A:

**Auto-scroll mode:** Depending where the mouse is relative to the cursor position, the cursor will scroll to the left or right. With increasing distance the scrolling will be faster. To cancel it, just press the |right mouse| or again |S| on the keyboard.

### ❖ D:

**Default Background color:** This setting will change the initial background color of the Plotwindows that get created to the corresponding color. If desired, the Plotwindows current background color can be changed in the context menu of the legend.

### ❖ L:

**Layer:** Apaix has a total of 6 layers. That means it can have up to 6 sets of data loaded simultaneously. The Layers are directly depicted on the main screen and they show which file is stored into them. They also show if they are active or not by being strikethrough if not active.

**Layer to Layer offset:** This is the offset that can be set between the layers. It has no impact on the video synchronization.

### ❖ F:

**Focus:** Apaix has multiple windows and controls. Clicking on those will also give the focus to the designated element. For example clicking the plot will give the focus to the plot of that Plotwindow.

### ❖ S:

**Signal:** Basically rather a set of all possible signals for its name, depending on the amount of active layers. A signal contains everything that is needed to visualize it along with data up to 6 different datasets.

### ❖ T:

**Twin video mode:** The twin video mode is used to compare two sets of data, which have videos, with each other. It will be activated if Layers 1 and 2 are both active, video 1 has already been assigned to layer 1 and video 2 gets assigned to layer 2.

### ❖ V:

**Video to data Offset:** This offset is mainly used for the video synchronization but has currently also an effect on the offset between the layers. The way to use it would be to first align the videos with this offset and then if the layers are in synch with their corresponding videos, use the layer to layer offset to align the data, if more than one set of data will be used. This is subject to change in the future to not have an impact on the normal offset anymore. Start the change of this offset by pressing “Shift” + “O” inside of a Plotwindow and drag the Plot with the “Right Mouse Button”. If the offset looks good, apply it by again pressing “O”.



# 16 Key-bindings

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These bindings depend sometimes on which UI-element has the focus. As an example, in a Plotwindow you have the legend on the right side, and the plot on the left. If the binding is now only for the use inside the plot, you must click the plot before using the binding.

## 16.1 Selection

Select the nearest Signal to mouse position	"Shift" + "Left Mouse Button"
Select from Legend	"Up" or "Down"
	➤ Use "Shift" or "Ctrl" as modifiers for multi selection

## 16.2 Signal alteration

These commands work when the Plotwindow has the focus and signals are selected.

Gradient Cursor	"G"
Hide Signal	"H"
Reference Cursor	"R"
Show Y-Axis	"Shift" + "Y"
Remove Signal	"Del"
Warning Lines	"W"

## 16.3 Additional Menus:

Legend context menu	"Right Click" in the legend
Plot context menu	"Right Click" the plots name
Warning line context menu	"Shift" "Right Click" while the mouse is over a warning line
Axis context menu	"Right Click" while the mouse is over an Axis (plotwindow only)
Signal Selection Menu	<ul style="list-style-type: none"> <li>• "p"</li> <li>• open the context Menu and select it there</li> </ul>
Parameter Page	"Double Click" in the legends area



## 16.4 Plot Movement

Auto scrolling	<ul style="list-style-type: none"> <li>• “s”</li> <li>• Hold “Left Mouse Button” down, then “Right Click” and release the buttons</li> </ul>
Move axes	<ul style="list-style-type: none"> <li>• X-axis: “Left” or “Right”</li> <li>• All Y-axes: “Up” or “Down”</li> <li>➤ “Control” as modifier to do smaller steps</li> </ul>
Pan X Axis	hold “Mouse Right” in the plot and move the mouse
Jump to Min / Max	Activate min or max in the context menu and click the value of the signals min or max

## 16.5 Zooming

Normal Zoom	<p>Works either on the plot itself or any axis</p> <ul style="list-style-type: none"> <li>• “Mouse Wheel”</li> <li>• “Plus” or “Minus”</li> <li>• “Page Up” or “Page Down”</li> <li>➤ “Control” as modifier to do smaller steps for keys</li> </ul> <p>Select a Range to be zoomed</p> <ul style="list-style-type: none"> <li>• “Middle Mouse”</li> <li>• “Alt” + hold “Right Mouse”</li> </ul>
Zoom XY-Mode	<p>If the plot has the focus:</p> <p>“Z”: Changes the right mouse button to create a Zoom Box. Switched off if pushed again</p>
Zoom X-Mode	<p>If the plot has the focus:</p> <p>“X”: Changes the right mouse button to zoom the X-Axis. Switched off if pushed again.</p>
Zoom Y-Mode	<p>If the plot has the focus:</p> <p>“Y”: Changes the right mouse button to zoom the Y-Axes. Switched off if pushed again.</p>
Zoom out	If in any of the above three modes, dragging the rectangle from right to left will let the user zoom out.
Autozoom Y-Axis	“F”: Changes the scale of the axes automatically, depending on the visible graph.
Reset Axes	<ul style="list-style-type: none"> <li>• Only X: “A”</li> <li>• All: “Shift” + “A”</li> </ul>



## 16.6 Misc.:

Copy plot to clipboard

"C" when the plot is focused

Save Layout

"Ctrl" + "S"

Open Help

"F1"

Offset Mode

"O"

Video to Data Offset Mode

"Shift" + "O"

Set the Cursor position

"Left Mouse Button" while in the plot

Show/hide X-Axis

"Shift" + "X"



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