IPEmotion_Software_Manual_Release_2017_R1_2

June 28, 2017

Table of Contents

1 Important and general information

1.1 Important information

Please follow these instructions before and during the use and application on any IPETRONIK product!

1.1.1 Safety and Warning instructions

Please follow the instructions **and** information as contained in the user manual!

1. The user can **influence an electronic system by applying the IPETRONIK product**. This might cause risk of personal injury or property damages.
2. The **use and application of the IPETRONIK product is permitted only to qualified professional staff**, as well as, only in appropriate manner and in the designated use.
3. **Before using an IPETRONIK measurement system** in the vehicle it **has to be verified** that **no function of the vehicle, which is relevant for secure operation, might be influenced**:
   - by the installation of the IPETRONIK measurement system in the vehicle,
   - by an potential malfunction of the IPETRONIK system during the test drive.

   In order to avoid possible danger or personal injury and property damages, appropriate actions are to be taken; such actions have to bring the entire system into a secured condition (e.g. by using a system for emergency stop, an emergency operation, monitoring of critical values).

   Please check the following points to avoid errors:

   - Adaption of sensors to components of the electrical system / electronics, brake system, engine and transmission control, chassis, body.
   - Tap of one or several bus systems (CAN, LIN, ETHERNET) including the required electrical connection(s) for data acquisition.
   - Communication with the vehicle's control units (ECUs), especially with such of the brake system and/or of the engine and transmission control (power train control system).
   - Installation of components for remote data transmission (mobiles, GSM/GPRS modems, WiFi and Bluetooth components).

The products can be operated in extended temperature ranges greater $70\,^{\circ}\mathrm{C}$ and therefore the operator has to take safety measures to avoid any skin burnings on hot surfaces while touching the products.

4. **Before** directly or indirectly using **the data acquired by an IPETRONIK measurement system to calibrate control units, please review the data regarding to plausibility**.
5. With regard to the application of IPETRONIK products in vehicles during use on public roads the manufacturer and/or registered user of the vehicle **has to ensure that all changes/modifications have no influence concerning the license of the vehicle or its license of operation.**
6. **User does agree to the instructions and regulations as mentioned above.** In case the user does not agree with the instructions and regulations as mentioned above, he has to notify this expressly and immediately in writing to IPETRONIK before confirming the sales contract.

1.2 Terms and conditions

See IPETRONIK website for details: https://www.ipetronik.com/en/terms-conditions

1.2.1 Legend of used icons

Tip	*This icon indicates a useful tip that facilitates the application of the software.*
Information	*This icon indicates additional information for a better understanding.*
Attention!	*This icon indicates important information to avoid potential error messages.*

1.2.2 Support

Headquarter:

IPETRONIK GmbH & Co. KG
Im Rollfeld 28
76532 Baden-Baden, Germany
Phone +49 7221 9922 0
Fax +49 7221 9922 100
info@ipetronik.com
www.ipetronik.com
Limited commercial partnership with its head office in Baden-Baden, registry court HRA No. 201313
IPETRONIK Verwaltungs-GmbH Baden-Baden is an individually liable society, registry court Mannheim HRB No. 202089
CEOs: A. Wocke, C. Buchholz

Technical support and product information
www.ipetronik.com e-mail: support@ipetronik.com

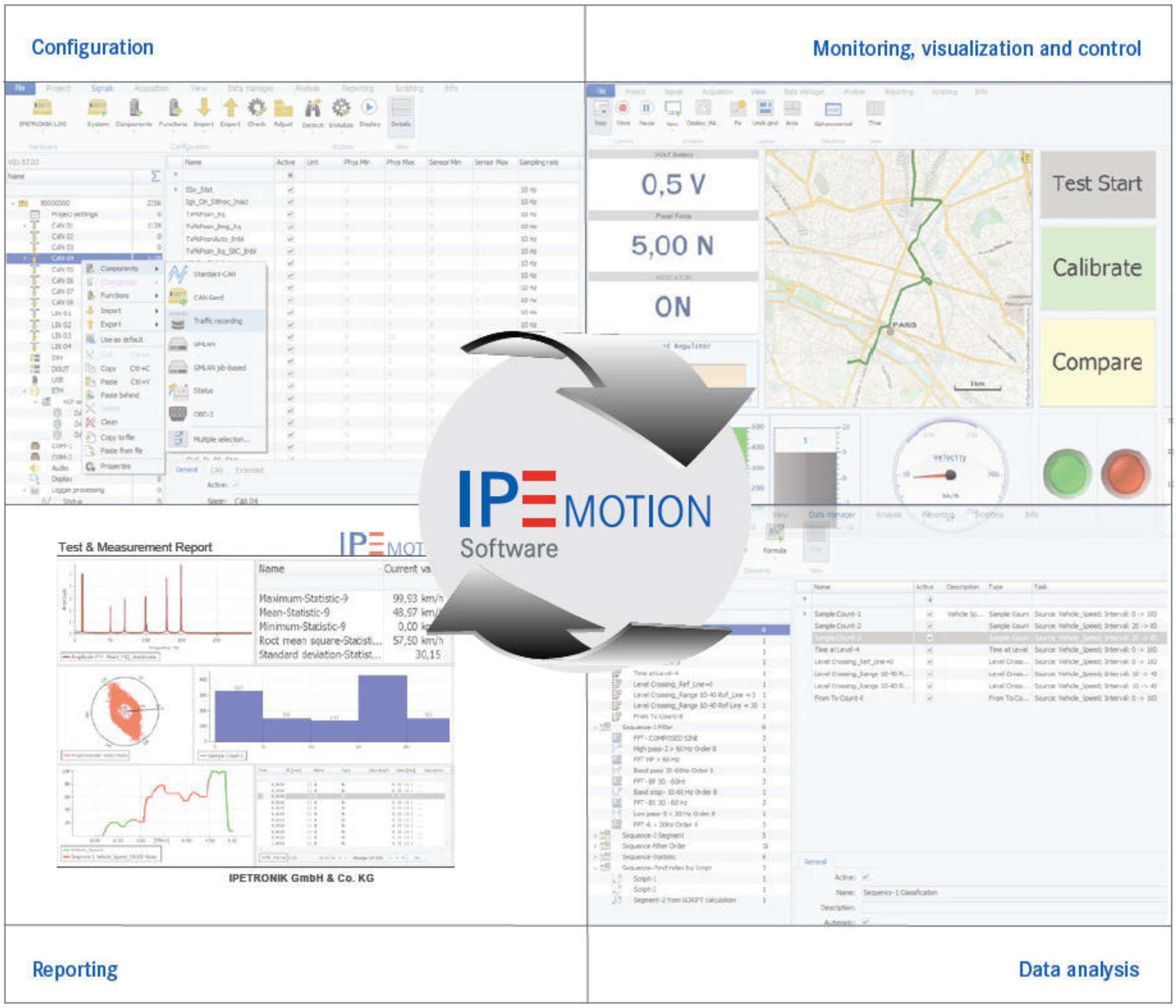
2 Introduction to IPEmotion

2.1 YouTube resources

If you like to discover more functions refer to the IPEmotion YouTube channel which has a growing number of video tutorials about the software and many different PlugIns.
IPEmotion YouTube channel: http://www.youtube.com/user/IPEmotion/videos

2.2 The next-generation data acquisition software

IPEmotion was invented in 2009 and is the latest data acquisition software on the market. Compared to other leading DAQ software applications, the IPEmotion software follows a unique approach. Most DAQ software programs are designed to support one vendor-specific data acquisition hardware only.
However, IPEmotion was designed in a way that it is an hardware-independent software the use of which is not restricted to one specific data acquisition hardware. In fact, the software is based on open interfaces so that any hardware vendor can interface his hardware to this software. IPETRONIK data acquisition modules and data loggers are integrated to IPEmotion by the same PlugIn interface standard as any other hardware system.
With IPEmotion, you can cover the complete data acquisition process from configuring your data sources / instruments, to show live data on different instruments and mimics, to automate your test bench applications and finally to analyze your stored data and generate a report output.



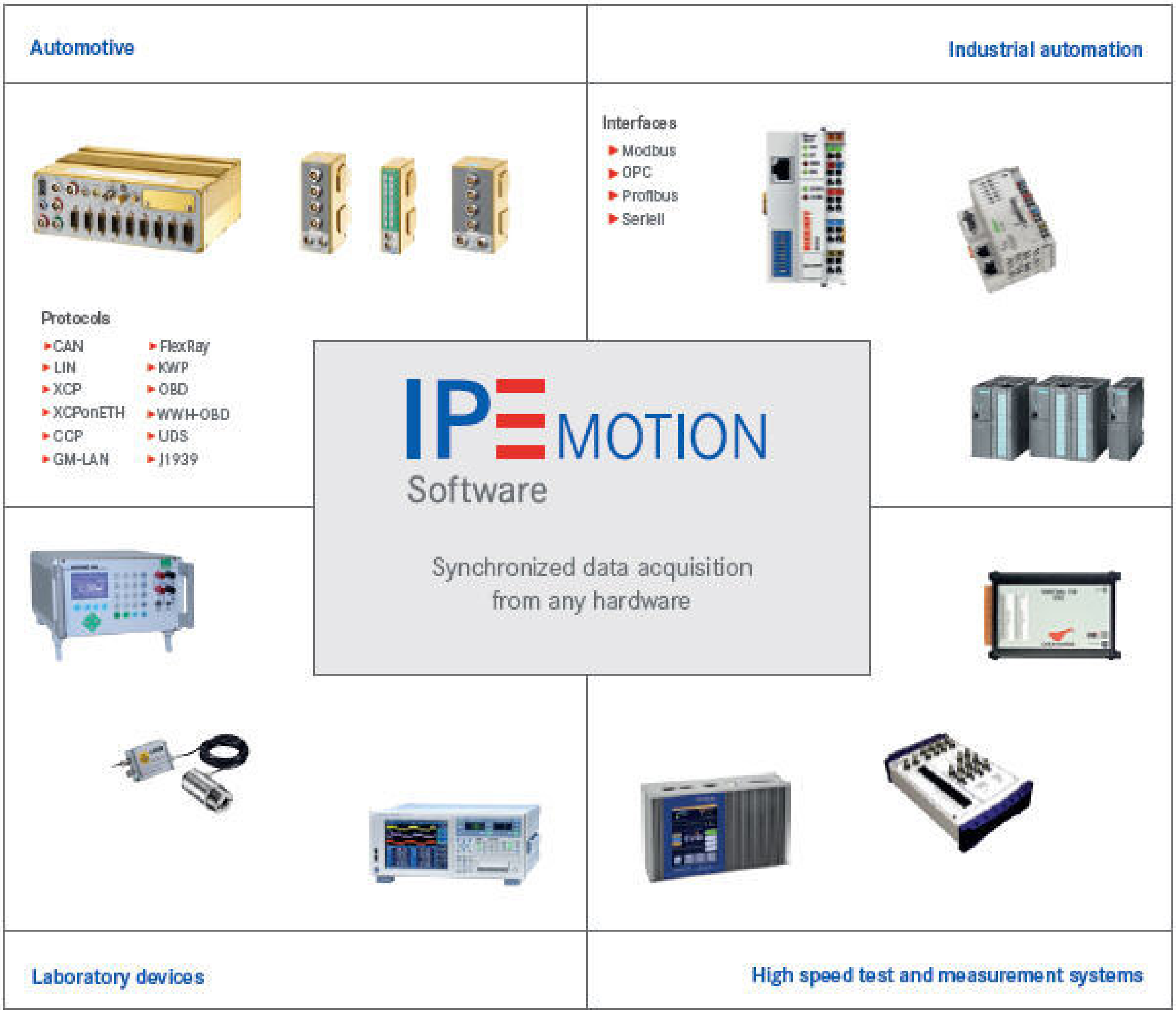
2.3 The key features of IPEmotion

2.3.1 YouTube resources

What is IPEmotion? http://youtu.be/U0WE5TP-d_E

2.3.2 Vendor independent PlugIn concept

Anybody can interface his hardware to IPEmotion by developing a PlugIn. Documentation, development tools and support are provided by IPETRONIK. Many hardware systems are already supported and the list of supported hardware is growing continuously. The PlugIns are usually developed by the hardware vendors. Currently, there are over 30 PlugIns listed on the IPEmotion website. If the hardware you like to use is not listed on the IPETRONIK website please get in touch with the IPEmotion support team (support@ipetronik.com) to send your enquiry and we will check the availability.



- ▶ A PlugIn is an interface between any data acquisition hardware and IPEmotion.
- ▶ The PlugIn interface provides two functions. One function is dedicated to device configuration and the other function is dedicated to read measurement data from devices.
- ▶ A PlugIn can also be an interface to the manufacturer API (Application Programming Interface) to integrate the devices.
- ▶ With the PlugIn designer development tool, the graphical interface is developed to configure the hardware in IPEmotion.
- ▶ The PlugIn Designer exports a VisualStudio project with a C#-Framework for configuration and a C++-framework for measurement.

2.3.3 Configuration – based GUI

The graphical user interface of IPEmotion is designed in a unique way so that the main task of any test and measurement engineer - which is to measure data- can be accomplished easily. The entire user interface is based on configuration dialogs. There is no need for programming to bring data on the computer screen.

2.3.4 COM interface – open programming interface

However, IPEmotion can also be regarded as development system for all customers who like to solve complex DAQ and test bench applications. The COM and VBS / Python scripting interfaces are a very efficient way to integrate specific functions to the program.
Details about the PlugIn development is available on the IPETRONIK website Academic:
https://www.ipetronik.com/en/academic/plugin-development

2.3.5 Data API to access IPEmotion IAD data files 32 and 64 bit

An API is available for developers to write import filters for IPEmotion (.IAD) for other programs. This API was originally developed for (.IAD) file import into NI DIAdem software. The data API is posted on IPETRONIK Website in the following link.
https://www.ipetronik.com/en/academic/plugin-development
If you require IPEmotion (.IAD) file import for National Instruments software applications see the following link:
http://search.ni.com/nisearch/app/main/p/bot/no/ap/tech/lang/de/pg/1/sn/ssnav:dpl/q/ipemotion/

2.3.6 OEM and customer-specific setups

Worldwide, IPEmotion is a unique product allowing customers to get their own customer-specific setup. IPEmotion is based on a technology which makes it easy to tailor and customize the software perfectly to client needs. Compared to most off-the-shelf data acquisition software packages, the IPEmotion setup package can be perfectly tailored to corporate standards to increase productivity in test and measurement labs.

3 A guided tour through the main software functions

As an introduction to this manual a high level overview of the main functions is provided.

3.1 YouTube resources

IPEmotion DAQ Software - Functional Overview: http://youtu.be/fXpAjCM4aRw

3.2 Installing IPEmotion and PlugIns

The latest version of the IPEmotion software is hosted on www.IPETRONIK.com. After downloading the setup you can run the installation. The software and PlugIns are installed on the following directory:

WIN 7: C:\Program Files (x86)\IPETRONIK

The software works on following operating systems:

- Microsoft Windows 10 (32 Bit and 64 Bit operating systems)
- Microsoft Windows 8.1 (32 Bit and 64 Bit operating systems)
- Microsoft Windows 8 (32 Bit and 64 Bit operating systems)
- Microsoft Windows 7 (32 Bit and 64 Bit operating systems)

Attention! *IPEmotion 2016 R1 and higher releases require **.Net framework 4.5.1.** When this software is missing the installation will not be possible.*

3.2.1 Option: IPEmotion as x64 bit application

The software is now optionally available as a x64 bit application. The main advantages of x64 bit application are:

- Handling larger data file size over 1 GB
- Higher RAM memory allocation for large data files beyond 1 GB.

The x64 bit application is installed parallel to the 32 bit application in its own directory:

- Win 7 C:\Program Files\IPETRONIK\IPEmotion 2016 R3

Separate desktop icon for the **x64** application.

[IN_3]

The “About” dialog is indicating the x64 bit application, too.
During the installation process you can chose between different installation options. The main differences are:

3.2.2 Full

- All language packages are installed if not deselected.
- PlugIn designer development tool is installed.
- All standard IPETRONIK PlugIns will be installed if not deselected.

3.2.3 Typical

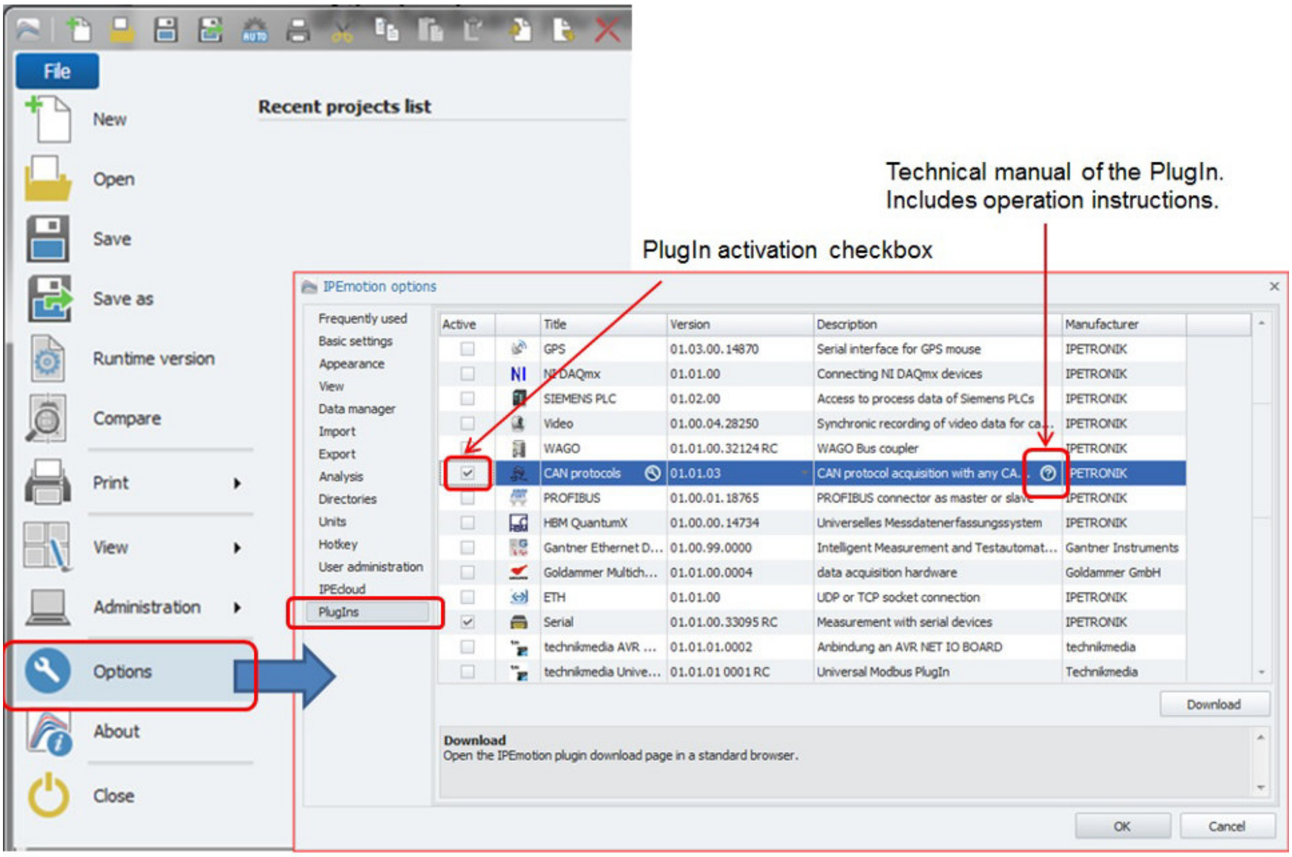
- Only the English and local language package related to the computer operating system is installed when supported by IPEmotion.
- PlugIn designer development tool is NOT installed.
- All standard IPETRONIK PlugIns will be installed if not deselected.

3.2.4 User defined

- Define your own installation settings.

3.3 Activating PlugIns in the OPTIONS

After installing IPEmotion and the PlugIn, start IPEmotion again and activate the PlugIn in the Options. You can access the options through the application menu or directly through the ribbon. PlugIns are activated through the check box. Most of the PlugIns include technical documentations explaining the functions supported by the PlugIns. See chapter OPTIONS >PlugIn for more details about the PlugIn activation 22.16.



[IN_4]

3.4 SIGNALS – Configuring your acquisition system

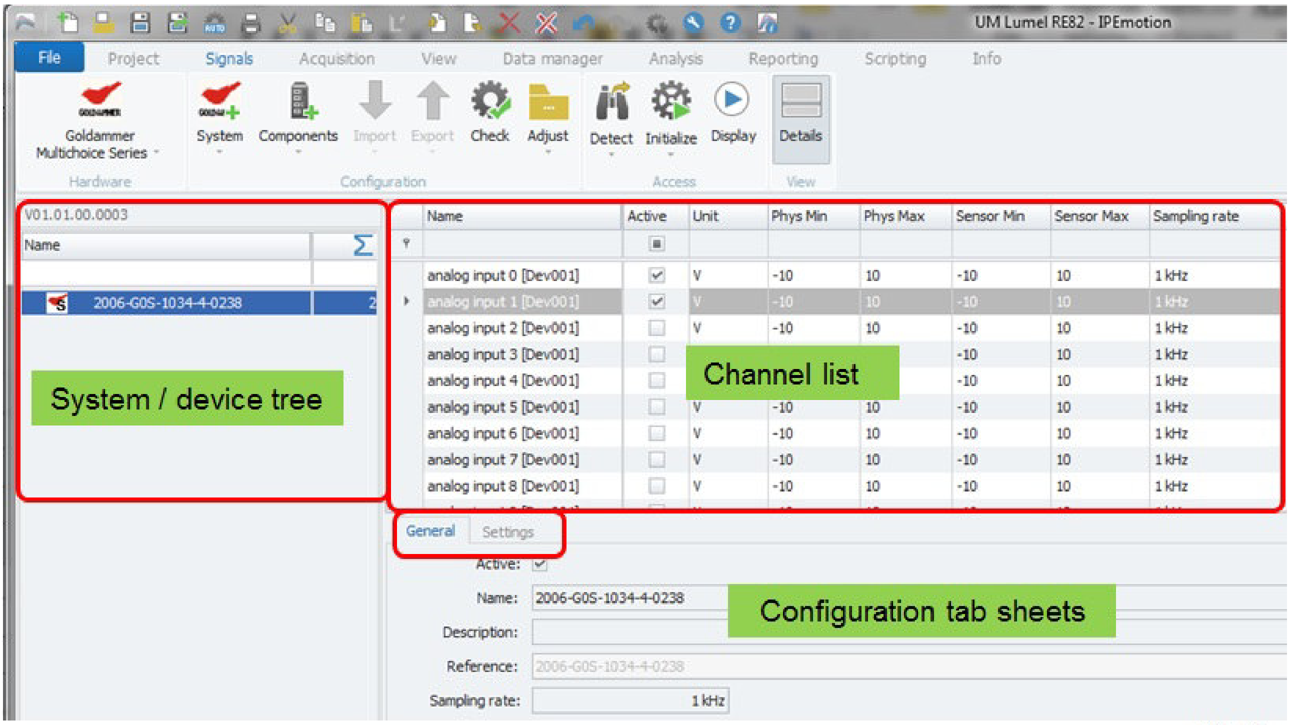
3.4.1 YouTube resources

Overview of PlugIn configuration videos.

- Dataforth MAQ 20 and IPEmotion – http://youtu.be/4EbKQTRSg-8
- IPEmotion YOKOGAWA PlugIn – http://youtu.be/YSTu41c1QwU
- IPEmotion DAQmx PlugIn – http://youtu.be/eToyjNb2OZI
- IPEmotion Advantech ADAM PlugIn – http://youtu.be/cQ7Rrti-Wpw
- IPEmotion Serial PlugIn – http://youtu.be/v7XH4CW6d9Q
- IPEmotion Goldammer MultiChoice – http://youtu.be/clLQCkuqNZg
- IPEmotion Pollin AVR-NET-IO PlugIn – http://youtu.be/-GQH05aw3UU
- IPEmotion ATMEL Processor – http://youtu.be/3EUPfAoKOiU
- IPEmotion SIEMENS PLC PlugIn – http://youtu.be/HZ68IJP0l4A
- IPEmotion SIEMENS SPS PlugIn – http://youtu.be/ytdOCrwB5bE
- IPEmotion and Gantner Instruments – http://youtu.be/uj7xduTDswc
- IPEmotion IOtech DAQBook – http://youtu.be/HBjl-f3ByWI
- IPEmotion Advantech APAX-5070 – http://youtu.be/jhspWDGyorE
- IPEmotion Velleman K8055 – http://youtu.be/3oU6-5UNBfo

After PlugIn activation, we can move to the SIGNALS work space. This work space is dedicated to the PlugIn configuration. The SIGNALS work space is structured for all PlugIns in three main elements:

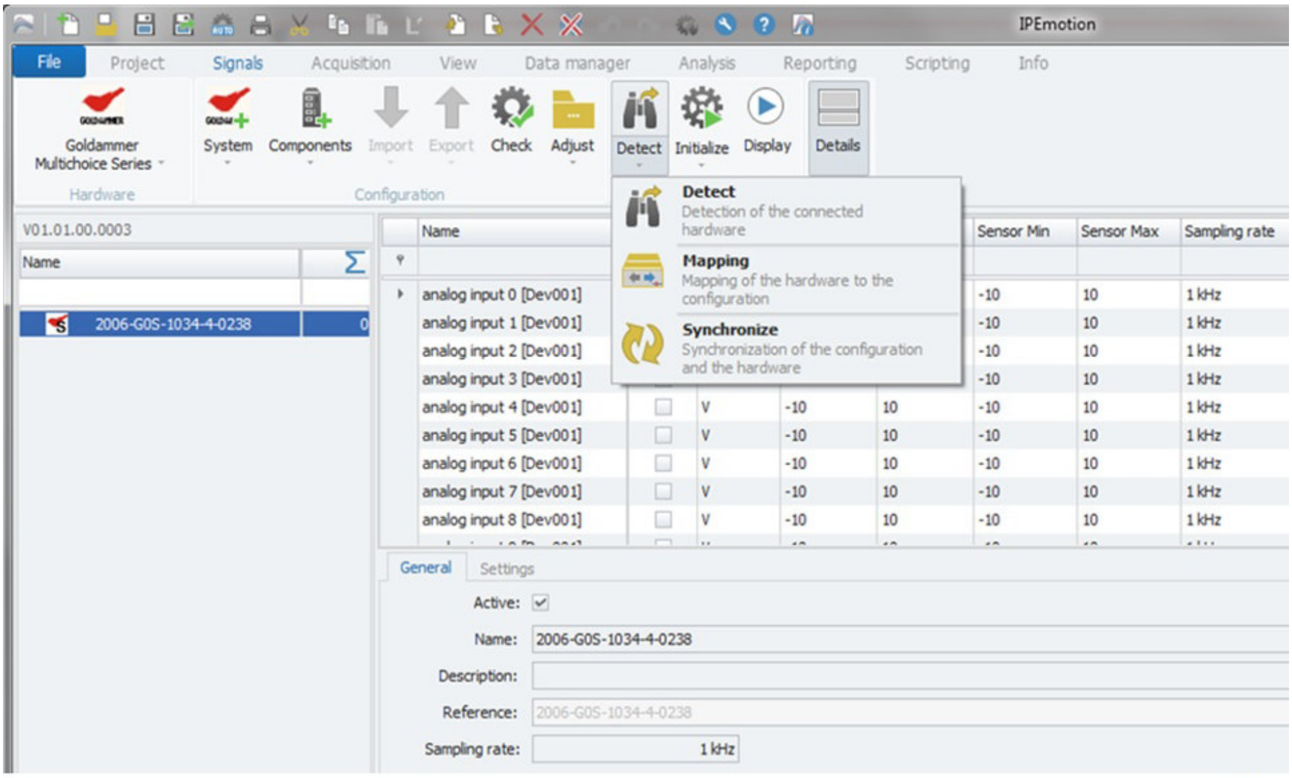
- System Tree – list of devices
- Channel List
- Configuration tab sheets / or head up displays for device and channel configuration. The configuration tab sheets are related to the item selected. The available tab sheets can vary a lot from PlugIn to PlugIn. See chapter SIGNALS for more details 11.5.



[IN_5]

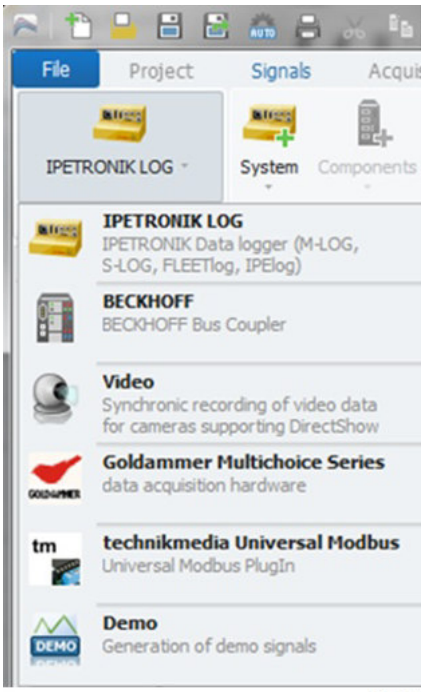
3.4.2 Hardware detection

The most important button in the SIGNAL work space is the DETECT button. This button runs a scan function and searches all activated PlugIns for the devices connected to the computer. This DETECT button with the automatic hardware detection is not supported in all PlugIns.



[IN_6]

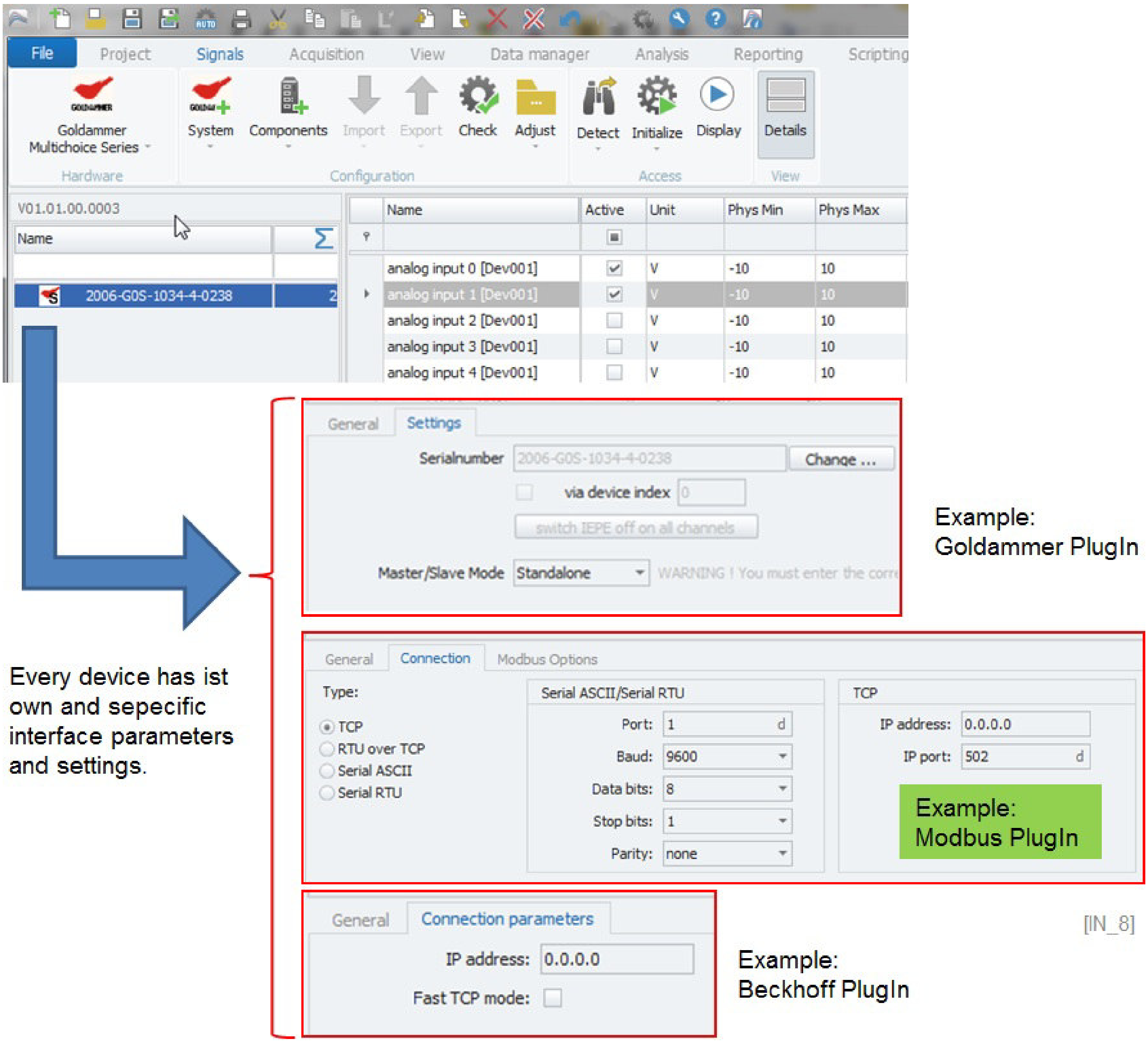
Several PlugIns can be activated in the OPTIONS at the same time and you can switch between PlugIns by selecting different systems from the drop down list.



[IN_7]

3.4.3 Hardware configuration (manually)

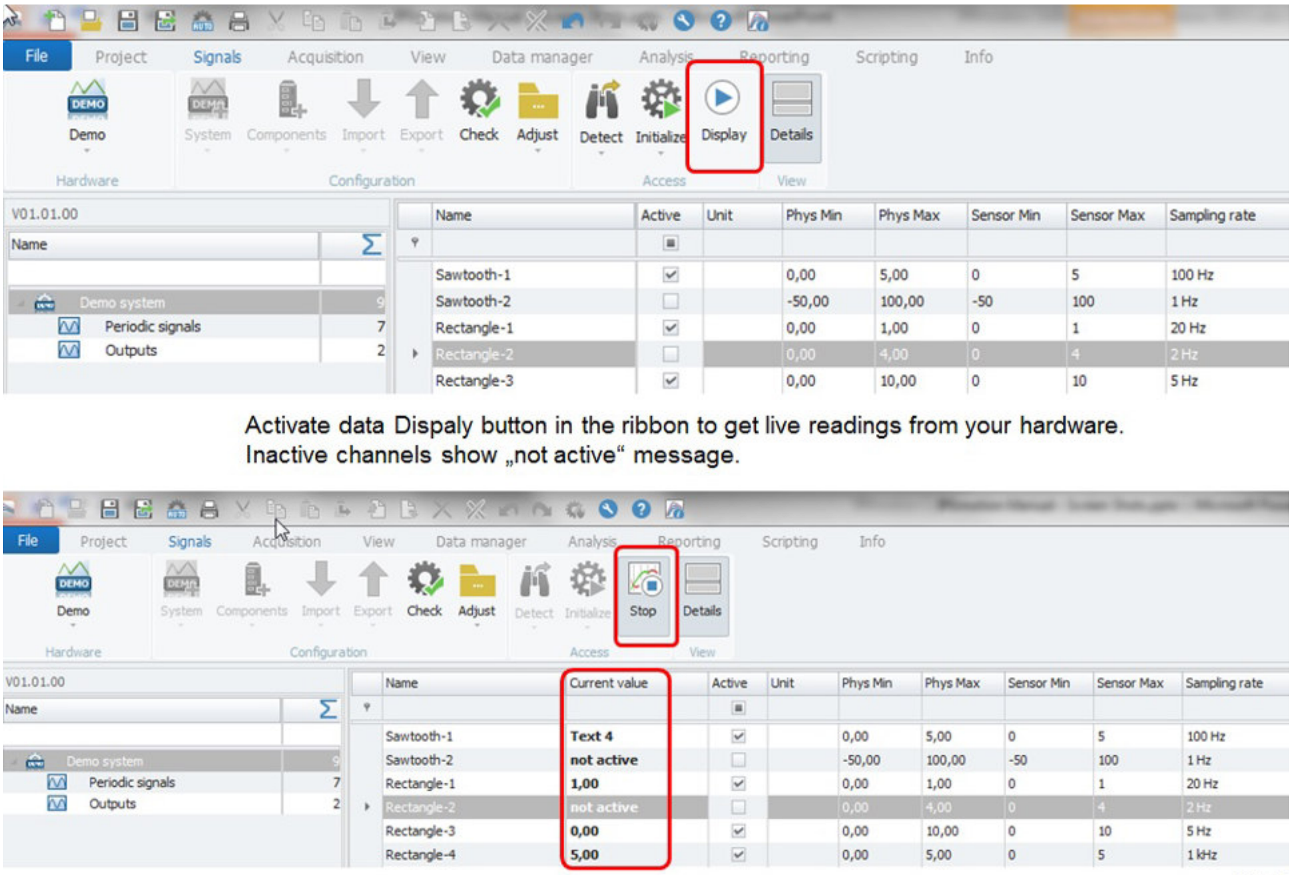
When the automatic HW detection is not supported by the PlugIn a manual interface configuration is required. Every device has its own interface settings and parameters. This can be a COM port, an IP address or Serial Number. Details on how to setup communication to the device are included in the vendor PlugIn manual. Some examples for different interface settings are listed below.



[IN_8]

3.4.4 Testing data communication

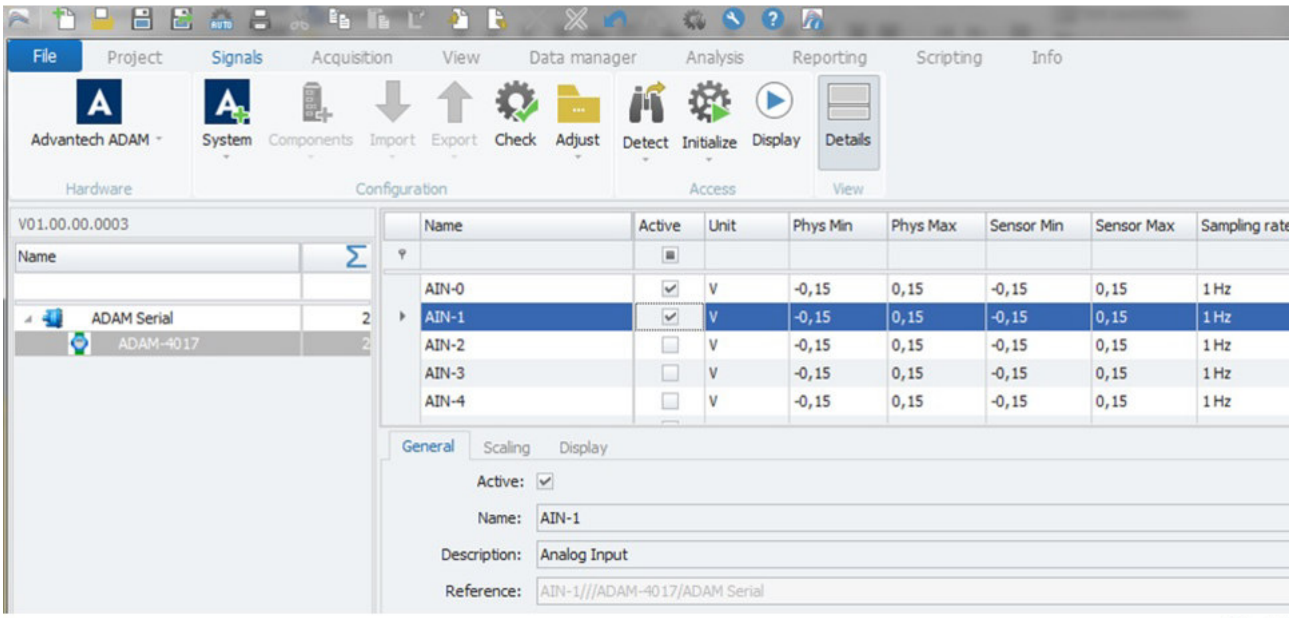
After setting up the hardware system, the communication can directly be tested by running the display function.



[IN_9]

3.4.5 Channel configuration and scaling

Now we need to look into the channel scaling options. This is an important configuration to read your engineering units in IPEmotion. Each channel has the following 3 standard tab sheets.



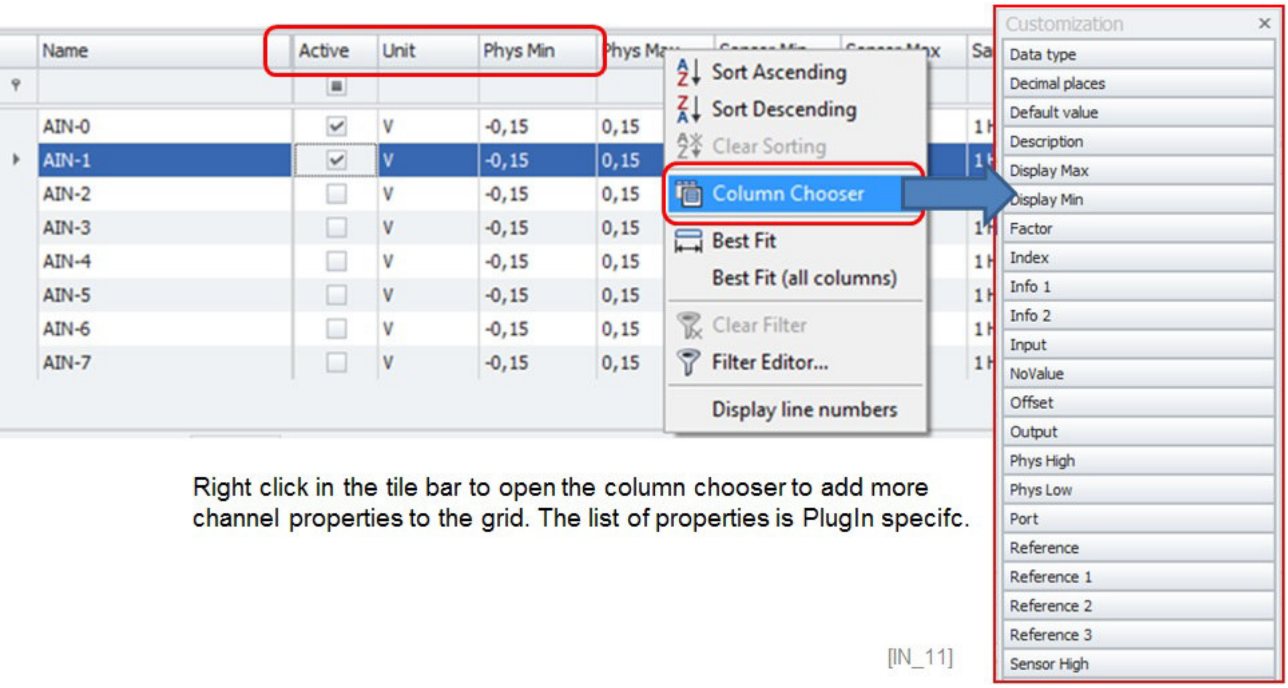
[IN_10]

- General >for defining channel name & description
- Scaling >for scaling sensor input (MIN / MAX) to engineering units
- Display >decimal places on the display instruments and axis on charts

The default channel grid consists of columns for:

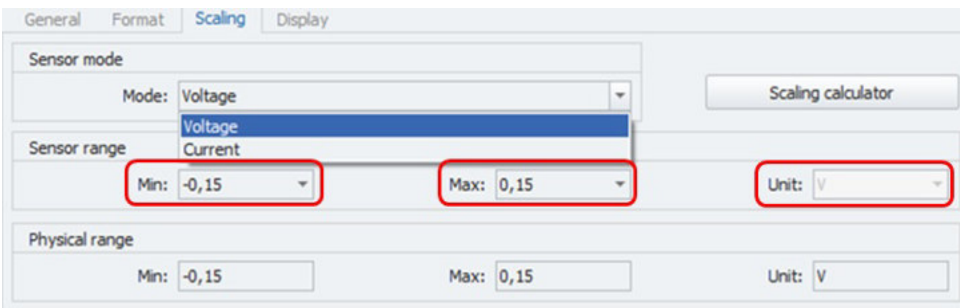
- Active check box
- Units (engineering units: V mA, A, bar, PSI, Ohm, etc. . . . . .)
- Physical MIN / MAX (engineering units)
- Sensor MIN / MAX (electrical signal to the input)
- Sample rate (measurements per second in Hz)

With the column chooser more channel properties can be added to the channel grid.



[IN_11]

The scaling calculator offers a large range of functions. Basic scaling operations to convert analog measurement in engineering units can be performed in the scaling tab sheet. Select the sensor mode from the list box and define the sensor range to the expected electrical signal. In the physical range you can define the engineering unit (bar, rpm, PSI, mm, etc. . .).



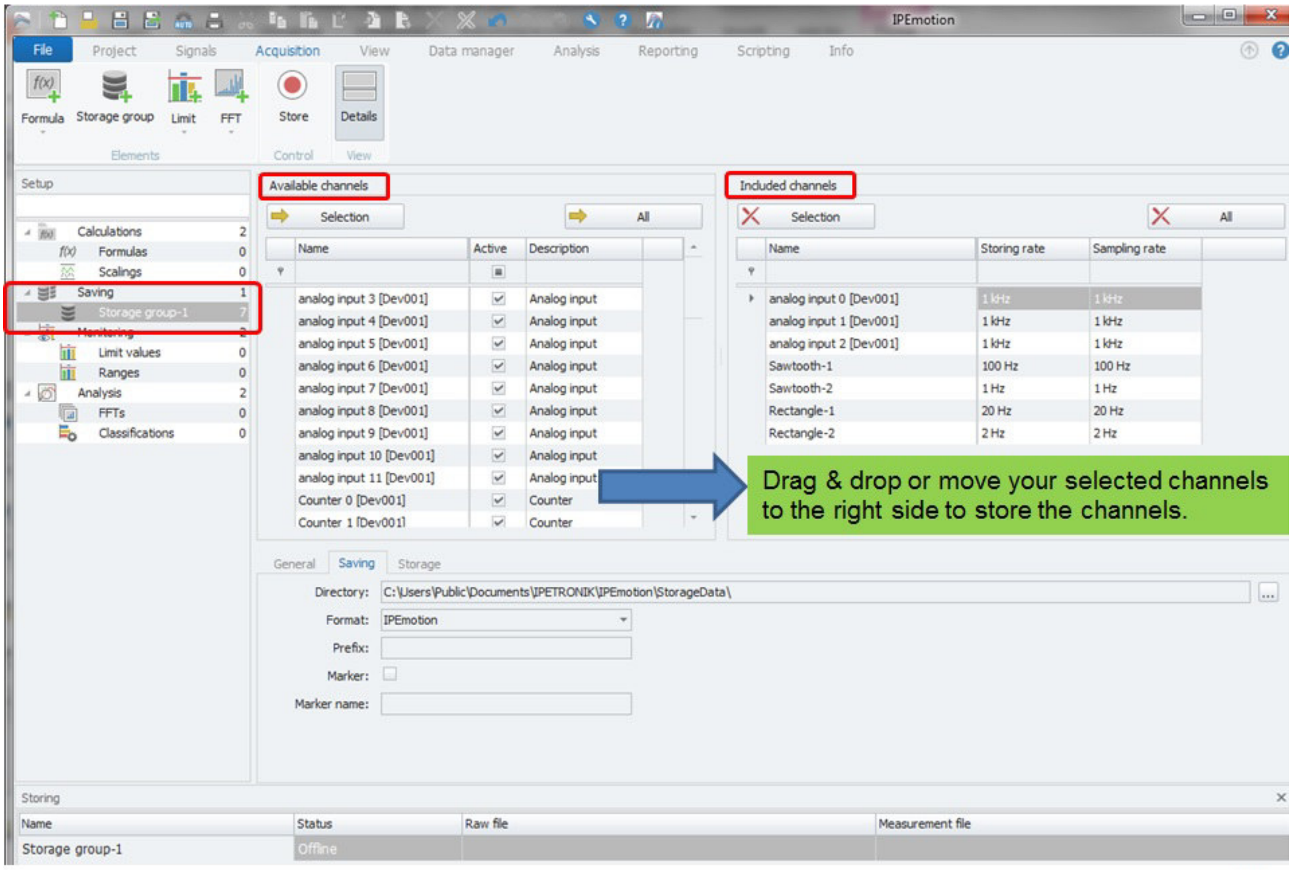
[IN_12]

In this example, the ADAM PlugIn supports the analog inputs of the 4017 module VOLT and CURRENT measurement in different predefined ranges.
IPEmotion offers a sophisticated scaling interface for each PlugIn. The different scaling options will be explained in the SIGNALS chapter 11.8.

Information *Sensor mode is PlugIn-specific. Not all modules and inputs support all types of sensor modes like voltage, current, strain or temperature measurement. The supported functions depend on the hardware. Some hardware systems only support one mode with one static measurement range e.g. +-10 Volt.*

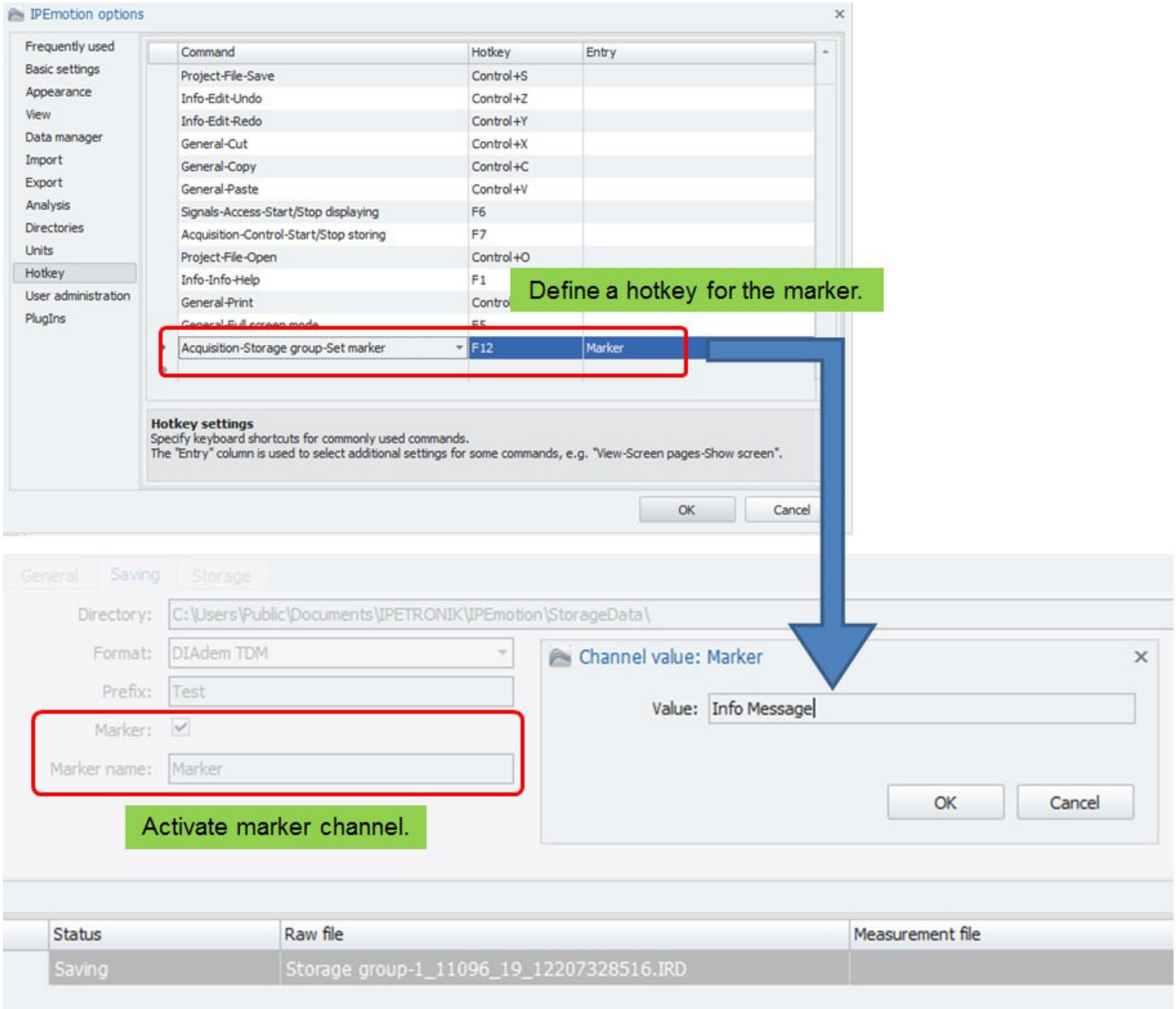
3.5 ACQUISITION – Setting up data storage

Data storage is very important and therefore IPEmotion is very easy to use in this aspect. You just need to add the available channel (left side) to the right window to include them in the storage group.



[IN_13]

- Format: When you hit the store button data storage is enabled and IPEmotion stores data in the selected file format. An overview of the formats you find in OPTIONS 3.7
- Prefix: The prefix is a static name which is put in front of the data file name. After the prefix, an index increments from 0 to n to differentiate the storage files. The number increments by one for each file generated.
- Marker & marker name operated with a hotkey: For adding text information to the data file, you can define a marker channel. The marker can then be operated using a keyboard combination (hotkey) defined in the OPTIONS. When you hit the defined hotkey, a pop up window appears and the comment can be added during recording process.



[IN_14]

3.5.1 Defining storage trigger conditions

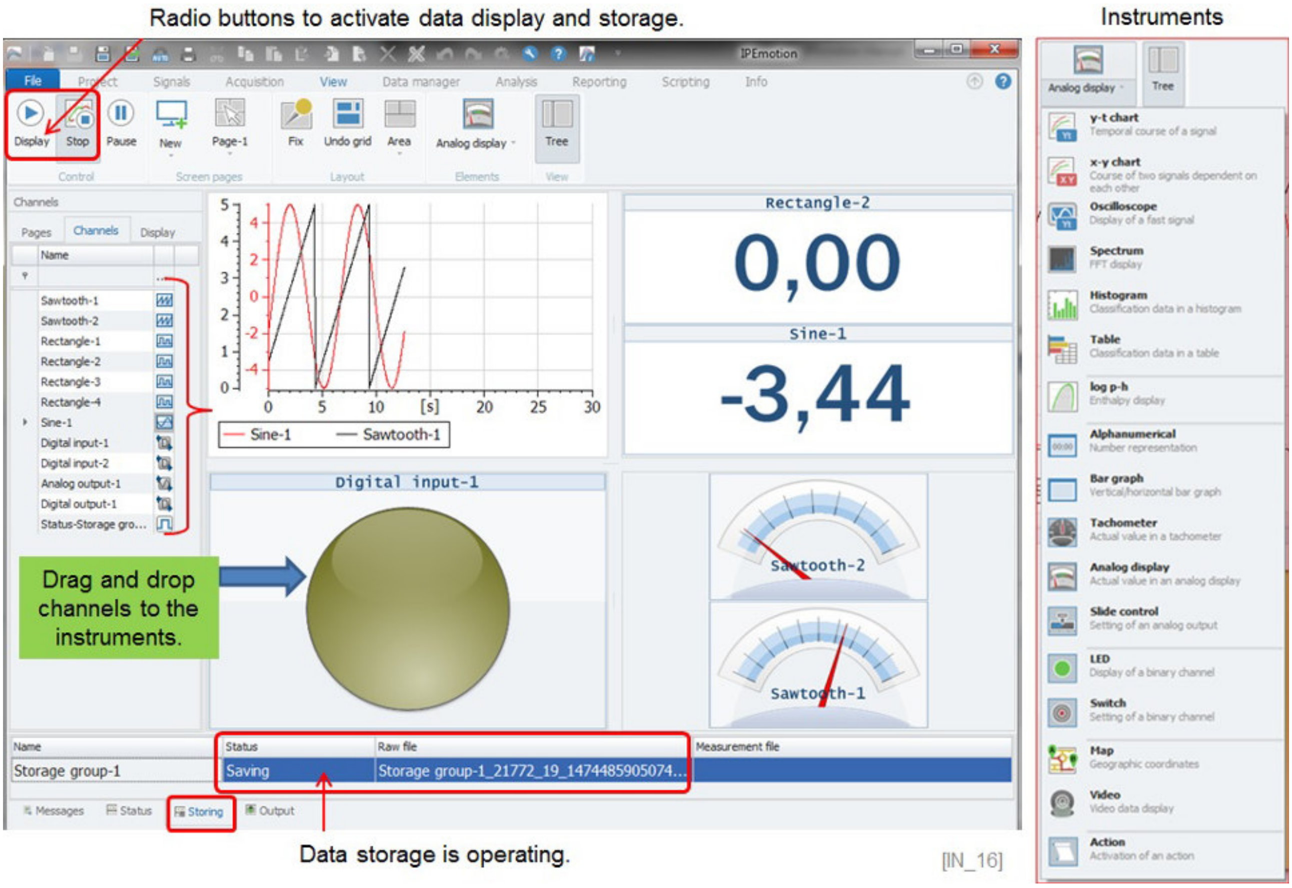
Three different storage modes are supported:

- One file per acquisition: In the default storage mode, data is recorded when the store button is activated.
- Cyclical storage: In this mode, a new data file is automatically generated after a period of time has elapsed. The cycle can be defined in second [s], minutes [m] or hours [h].
- Triggered data storage: However, in many cases data storage should be started based on trigger events. Triggered data storage with static pre-trigger, post trigger time and the start & stop trigger conditions can be defined through the formula parser which will be explained in chapter ACQUISITION in more detail.

[IN_15]

3.6 VIEW – Displaying live data in instruments

There is a large list of instruments available to build your graphical user interface to show live data in different analog and digital instruments. You can also add action buttons and operate switches to trigger functions or to set output channels. You can modify the mimics during display and data storage which is a very comfortable function. There is no need to stop the acquisition process if you like to modify the screen design. The configuration options of each instrument will be explained in detail, later on.

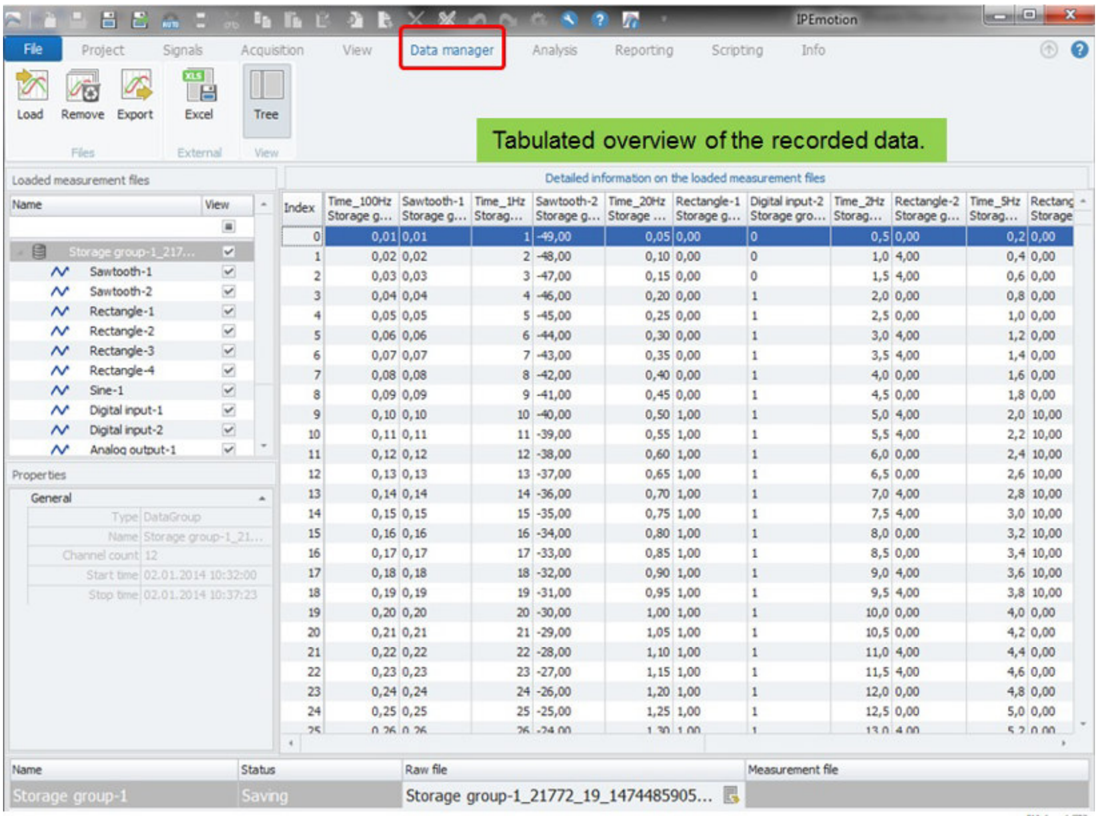


[IN_16]

After activating data storage you will see the storage file in the bottom line. You can access this storage file during recording and get access to the already recorded data to perform data analysis functions. This topic will be discussed in the next chapter.

3.7 DATA MANAGER

If you access the raw data file during recording process the software will take you directly to the data manager providing a tabulated overview of the recorded data.



[IN_17]

The DATA MANAGER offers many exports and import formats as indicated in the table below.

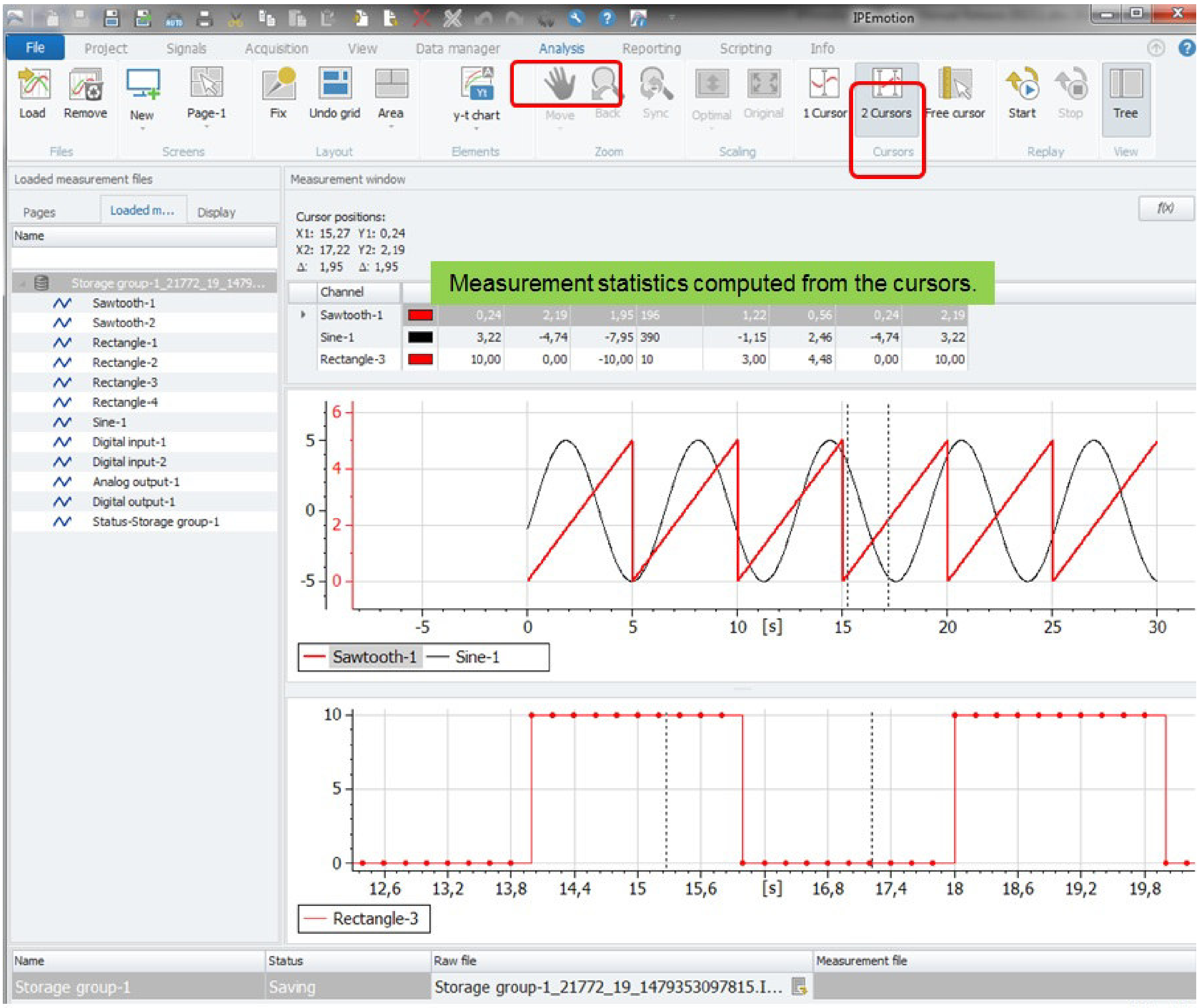
Format	File Type	Storage	Data Export	Data Import
IPEmotion	.iad & .ird	yes (iad)	yes	yes
CSV	.csv & .txt & .asc	yes (csv)	yes	yes
DIADEM	.dat & .tdm	yes	yes	yes
Drupal Metadata	.XML	yes	yes	
Excel 2003 XML	.xls & .xml	yes	yes	
Excel 2013 XLSX	.xlsx	yes	yes	
ASAM ATF/XML	.atfx	yes	yes	
PAK ASAM ATF/XML *	.atfx	yes	yes	
FAMOS	.dat	yes	yes	
MATLAB	.mat	yes	yes	
MDF 3	.mdf & .dat	yes (mdf)	yes	
MDF 4	.mf4	yes	yes	yes
PD5	.pd5	yes	yes	
RPCIII	.rsp	yes	yes	
Video	.avi	yes	yes	yes
AUDIO	.wav	yes	yes	yes
GPX	.gpx		yes	yes
G.I.N. audio	.wav		yes	
Graphtec	.gbd			yes
KML	.kml		yes	
TRAFFIC ASCII	.asc		yes	yes
TRAFFIC BLF	.blf		yes	
TRAFFIC MDF	.log. & .mdf		yes	
TESTdrive AUDIO	.dat & .wav		yes (atfx)	yes
TESTdrive Data Format	.zip			yes
TESTdrive Video Format	.dat			yes
TESTdrive Traffic	.bin			yes
Data export & online display e.g. in Yt graph: restricted to the channel count of the Edition:				
Basic = 10 / Lite = 64 / Standard = 256 / Professional, Developer, Analysis = no limit				

[IN_18]

3.8 ANALYSIS – Analyzing recorded data

3.8.1 YouTube resources

IPEmotion - Data Analysis-Processing - Reporting: http://youtu.be/0ELZLvmrxO4
IPEmotion - Althen Graphtec Data Analysis: http://youtu.be/kDKKfy23d5o
If you like to perform data analysis functions you need to navigate the ribbon to the tab sheet ANALYSIS. In the analysis work area you can display recorded data in different instruments like Yt, YX, Maps and Video displays. The main features are applying zoom, stretching and moving functions to the charts. With cursor lines you can add a table with measurement statistics. The mimics you define in the analysis section are converted to a report as you will see in the next chapter.

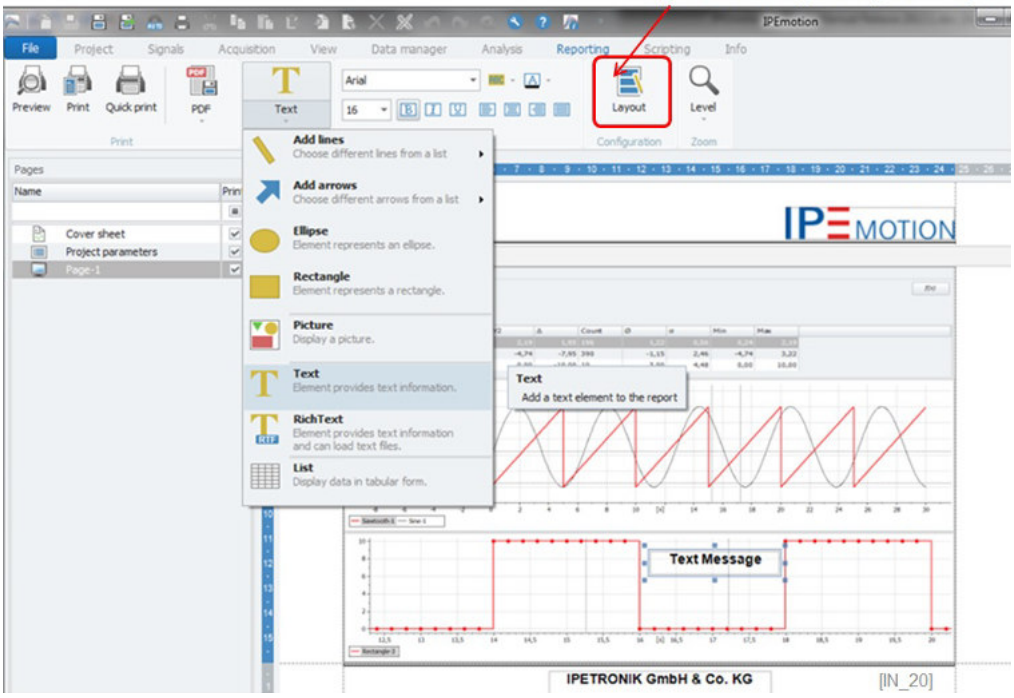


[IN_19]

3.9 REPORTING – Generating a report file

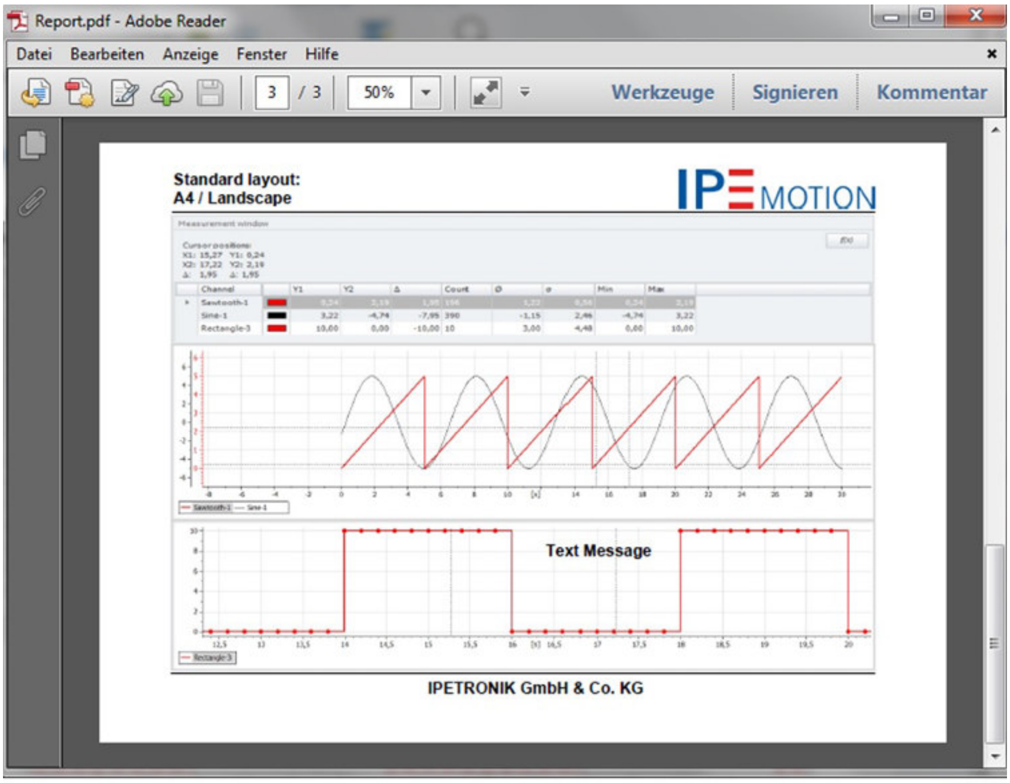
In the REPORTING work space you can launch a layout designer to customize your standard report layout in regard to the header and footer sections. You can add text, tables, pictures and graphical elements directly to report without starting the layout designer. These changes are not saved to the standard template. When you restart the application the manual entries are removed. However, if you add graphical elements using the layout designer and if you save these changes to your default template they will be available any time you open up the report again.

Report customizing with layout designer.



[IN_20]

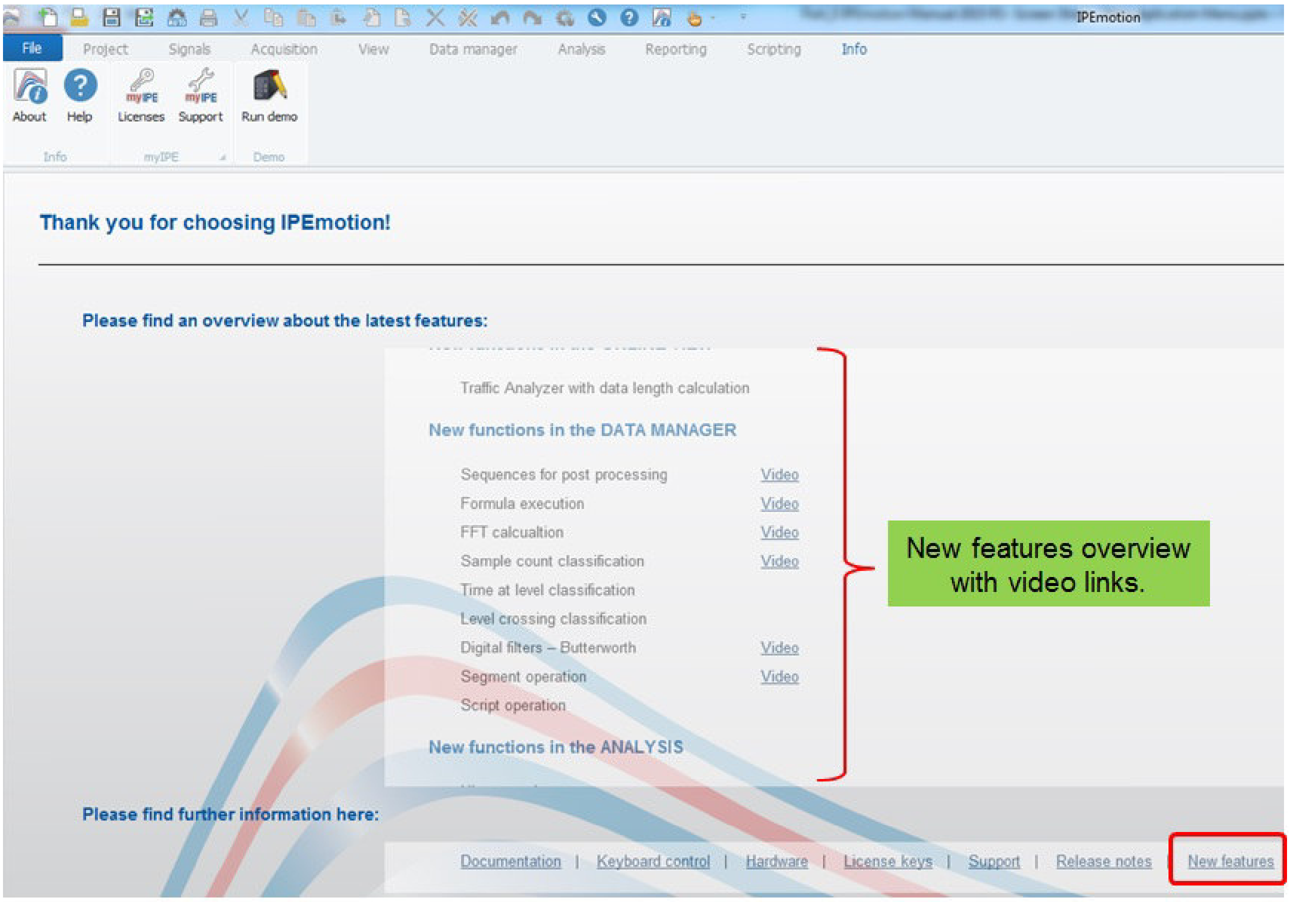
The results of the report can be converted directly to a PDF file, as well. Find more details concerning the Layout Designer in chapter: 20.



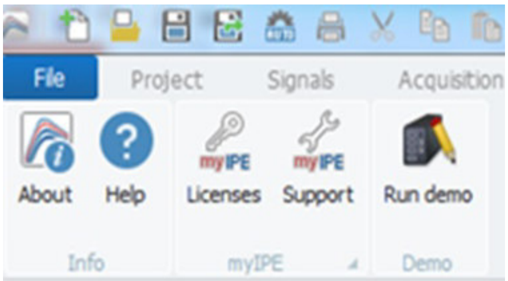
[IN_21]

3.10 INFO – New feature overview, link to online resources

Starting IPEmotion the first time you will directly be guided to the INFO tab sheet. Here you will see a comprehensive summary of new functions and you will find a couple of web links which take you through additional online resources.



[IN_22]



[IN_23]

Functions in the ribbon:

- About: Access to IPEmotion license dialog.
- Help: Access to pdf help manual.
- License: Access to myIPE website to see all your IPEmotion licenses (login is required).
- Support: Access to myIPE website to see all your support cases (login is required).

The available links and resources are the following:

▶ Documentation:	Link to this software manual.
▶ Keyboard control:	List of all hotkey functions to operate IPEmotion using the keyboard.
▶ Hardware:	This link takes you to the IPEmotion website and a list of all PlugIns.
▶ License keys:	This link takes you to the IPETRONIK website to access your license keys.
▶ Support:	This link takes you to the IPETRONIK website to access the support forum.
▶ Release Notes:	List of all changes and program enhancements for each release.
▶ New features:	Detailed overview of all new functions includes in this release version.

3.10.1 YouTube videos – Overview of new Features

▶ Release 2013.01.x	http://youtu.be/Cxc18SONMRA
▶ Release 2013.02.x	http://youtu.be/S9cywf8yoT8
▶ Release 2014 R1.x	http://youtu.be/f8hg-ongfyw
▶ Release 2014 R2.x	http://youtu.be/qCcTjzdAZzQ
▶ Release 2014 R3.x	http://youtu.be/BhwtG-T-7bI
▶ Release 2015 R1.x	http://youtu.be/r7qp6-F5jtQ
▶ Release 2015 R2.x	http://youtu.be/sC1_tydXf-8
▶ Release 2015 R3.x	https://youtu.be/0RohIWQzQiY
▶ Release 2016 R1.x	https://youtu.be/dn6KgL5N2qY
▶ Release 2016 R2.x	https://youtu.be/5dWuShbVhSI
▶ Release 2016 R3.x	no video available
▶ Release 2017 R1.x	https://youtu.be/XitWhXakzQA

3.11 Conclusion

In this chapter we have covered the complete DAQ process supported by this software. You got an overview of how the program is structured to accomplish your data acquisition tasks quickly. In the next chapters we will have a look at many detailed aspects of the product.

4 Software Editions

4.1 Overview table

IPEmotion is available in different editions. Every edition supports a specific set of functions and you can pick the best edition in terms of cost and functions for your application.

Overview Editions

Features	Demo / Student	Basic	Lite	Standard	Professional	Developer	Analysis (offline)
License	free	free	■	■	■	■	■
Supported PlugIns	■	■	1	■	■	■	
Number of channels for live data	■	250	64	256	■	■	
Number of storage groups (online)	■	0	1	2	■	■	
Number of display pages for online data	■	20	5	20	■	■	
Number of display pages for offline analysis	■	1	5	5	■	■	■
Number of channels for offline analysis	■	10	64	256	■	■	■
Additional online tools: traffic analyzer, traffic simulator, map	■				■	■	
Additional offline tools: traffic analyzer, 3D Model, map	■				■	■	■
Macro recorder - VBS & IronPython scripting	■				■	■	■
COM interface - external access	■		■	■	■	■	■
Create runtime editions						■	
Module: control - test sequencing	■				■	■	
Module: climate - thermodynamics	■				■	■	■
Module: acoustic - noise & vibration	■				■	■	■
Software maintenance			■	■	■	■	■

4.1.1 Demo Edition

This is a 30 days trial edition supporting all features of the Profession edition including the Control module. Anybody can request a Demo Edition license key from the IPETRONIK website. You just need to register an account on the IPETRONIK website and then you can generate your own Demo license key. There is no limitation about the number of Demo keys you can request. However you can activate only one time a Demo key on one computer.

4.1.2 Student Edition

This edition is provided to all enrolled students for free. It covers the functions of the Professional Edition including the Control module and Acoustic Module. This license is valid for 12 months. After that, the Student Edition expires and turns into a Basic Edition. On demand you can also request a Student license supporting the Climate module.

4.1.3 Basic Edition

Free of charge edition to configure all IPETRONIK systems and data loggers. The import of description files like CANdb or A2L is supported. Data can be displayed from several PlugIn at the same time. It is not possible to store data in this edition. The COM programming interfaces for external applications access is blocked. The online data display in instruments is limited to 250 channels on 20 pages which is corresponding to the display capacity of the IPEmotion App. With the Basic Edition the App can be completely configured. The offline data analysis is restricted to 10 channels and 1 display screen.

4.1.4 Lite Edition

The Lite Edition allows data display of 64 channels on up to 5 pages and data storage in 1 storing group. Only one PlugIn of your choice can be activated. The import function for description files like CANdb or A2L is supported. Data export into other formats is limited to the number of channels (64).

4.1.5 Standard Edition

The Standard Edition provides online data display of 256 channels on up to 20 pages and data storage in up to 2 storing groups. Data from several PlugIns can be recorded at the same time. Data export into other formats is limited to the number of channels (256). The offline data analysis pages are restricted to 5 pages.

4.1.6 Professional Edition

No limit on the number of channels, data display pages and storing groups. Data from all PlugIns can be recorded at the same time. Also, the A2L and CANdb (.DBC) files can be imported for measurements on the CAN bus. This edition also includes a module to record and run VBS or Python scripts. The Map, Traffic Analyzer Instrument, Traffic Generator and 3D Instrument are supported in this Edition as well. For more details about these instruments see chapters: Map 17.27, Traffic Analyzer 17.25, Message Generator 17.26 and 3D-View 19.18.

4.1.7 Analysis Edition

Suitable for offline data analysis, post processing, import, export in all data file formats and to generate reports. This edition supports the scripting tab sheet for macro recording and COM programming interface to automate the report generation. On the instrument tool box the log-ph instrument is only available on request because the REFPROP fluid data base hast to be installed and purchased additionally.

4.1.8 Developer Edition

No limit on the number of channels, data display pages and storing groups. Data from all PlugIns can be recorded at the same time. Also, the A2L and CANdb (.DBC) files can be imported for measurements on the CAN bus. This edition also includes a module to record and run VBS or Python scripts and to create an unlimited amount of RUNTIME applications. The Map, Traffic Analyzer, Traffic Generator and 3D Instrument are supported in this edition including the Runtime Editions as well. For more details see chapters: Map 17.27, Traffic Analyzer 17.25, Message Generator 17.26 and 3D-View 19.18.

4.1.9 Runtime Edition

The Runtime Edition is a locked application. The Runtime project [IRD] file is created by the Developer Edition only in the Application menu. For more details how to generate a Runtime project see chapter 6.4.

4.2 Software Options

4.2.1 Control Module

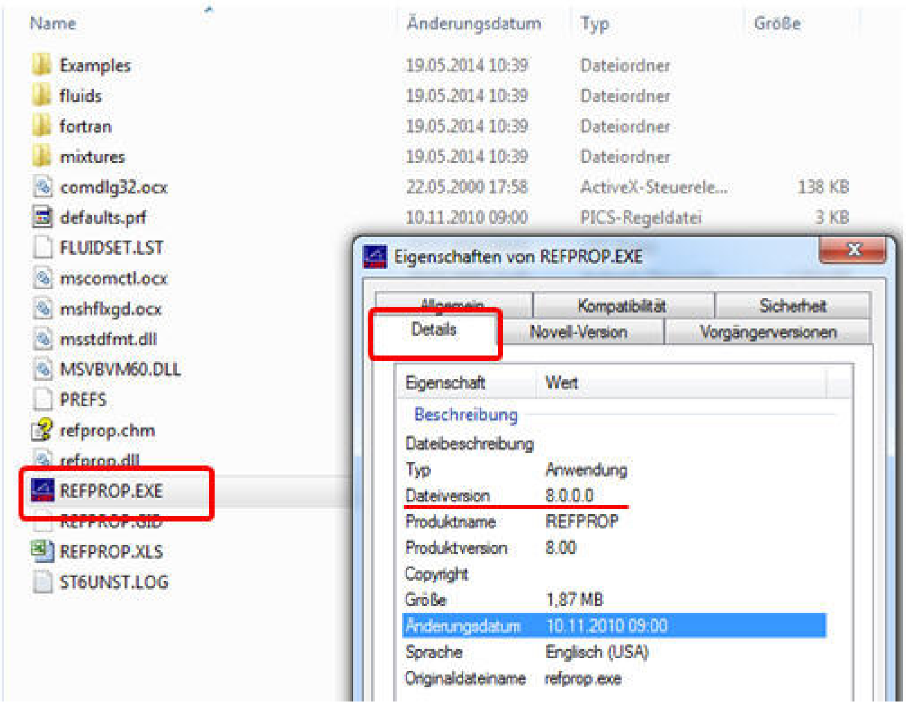
The Control module comes with PID controllers, router channels, function generators and test sequencing for test bench automation drive profile applications. This function can be purchased as an option. The functions of the Control module are discussed in chapter 14.

4.2.2 Climate Module

The climate module supports online and offline enthalpy and entropy calculations and can display the data in the log p-h graph. This module only works in combination with the REFPROP data base of the different coolants like: R134a, R1234yf, R22, R404a, R410a, R507a, R744, R718, R729, R1234ze, R290, R600a, R717. The directory to the REFPROP data base can be configures in the OPTIONS 22.11.

The Climate module can be purchased as an option. The functions of the Climate module are discussed in a separate chapter ACQUISITION 13 in regard to the special formulas and in VIEW in regard to the configuration of the Log p-h diagram 17.23.
Please ensure that you use the latest REFPROP DLL for your climate formulas. In oder do detrmine which REFPROP DLL version you are using right now, enter the file properties of the installer .EXE as indicated in the example below.

- The latest DLL version is: 9.1



[IN_25]

4.2.3 Acoustic Module

The acoustic analysis module was developed to support acoustic and vibration data analysis using FFT and Campbell diagrams. The data presentation in the Campbell diagram can be scaled logarithmic or in linear, A and C weighting. Data export for the PAK software in the ATFX format is supported too. This option can be purchased as an add-on for Professional, Developer and Analysis Editions. The Campbell operation is discussed in chapter 18.24 and the instrument is explained in chapter 19.19.The details about the PAK ASAM ATF/XML export are explained in chapter 18.7.3.

4.3 Software upgrades and maintenance

- Upgrade

You can upgrade your IPEmotion edition any time. The cost impact is the price difference between the list price of your current edition and the edition you choose.

- Maintenance

If you sign a maintenance contract you get free updates at any time you like and you can also benefit from the high priority support service. The maintenance cost are 25% of the software purchasing price. If you like to update an older version to the most reason one you pay for every major release 25% of the list price. Example: If you have IPEmotion major release 2013 Rx and you like to update to IPEmotion 2015 Rx you jump 2 major releases and the update cost is 2 x 25 % = 50% of the list price.

5 Software Licensing

5.1 YouTube resources

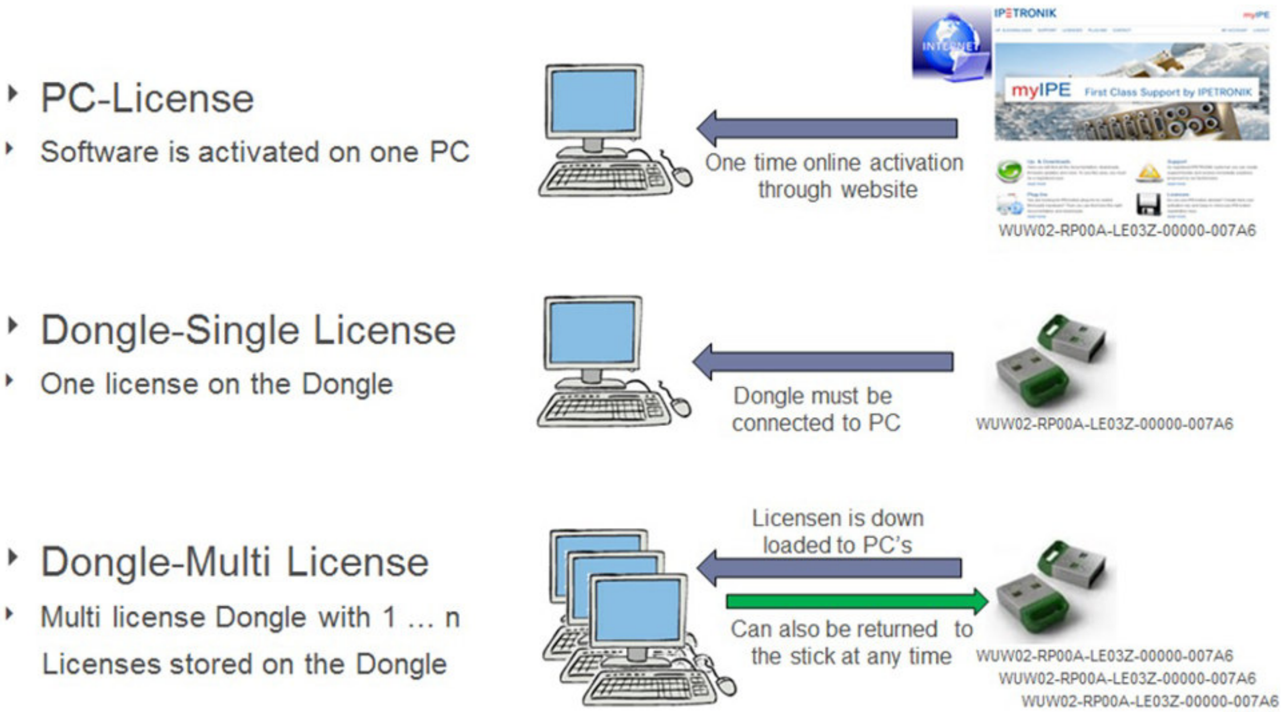
IPEmotion online license activation process: http://youtu.be/CEPdWfh-KnM

5.2 Overview

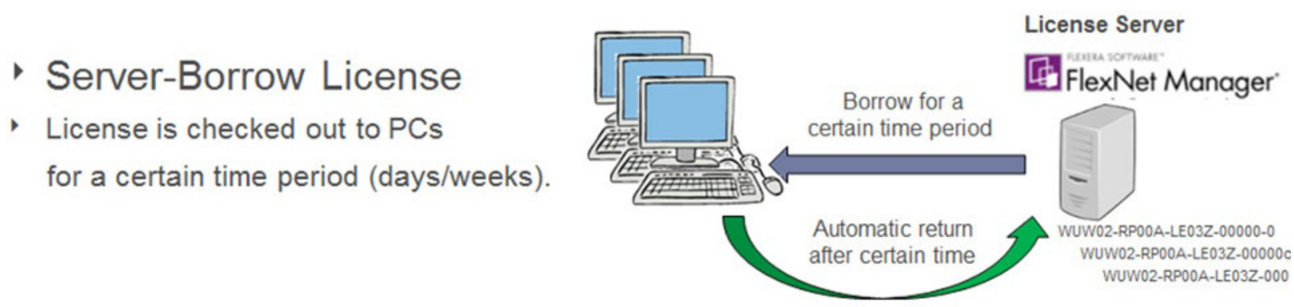
The software only needs ONE license key which includes all features.
License key example: WUW02-RP00A-LE03Z-00000-007A6-00008-00000-00000-00000-00000
The license key includes the following properties:

- Edition: Basic, Lite, Standard, Professional, Developer, Analysis, OEM Edition, Student
- Options: Control Module, Climate Modul, Acoustic Modul (are available for Professional and Developer Edition)
- Type of license management: PC, Dongle-Single/Multi, Server Borrow/Floating

Overview of the different software licensing options:

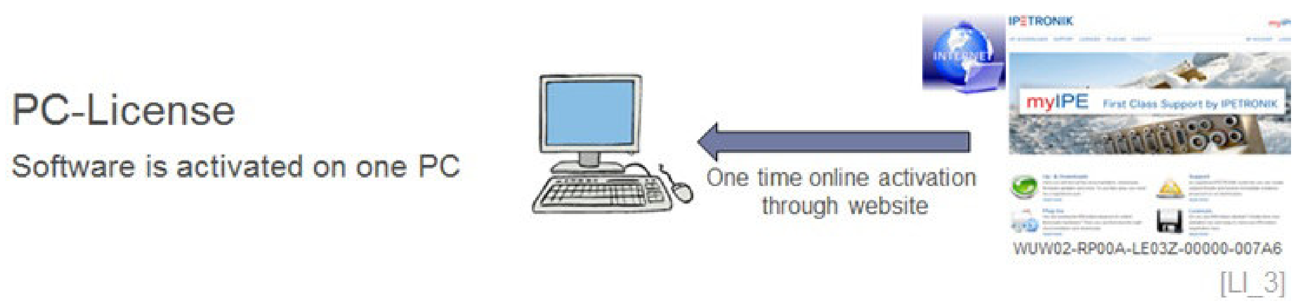


[LI_1]



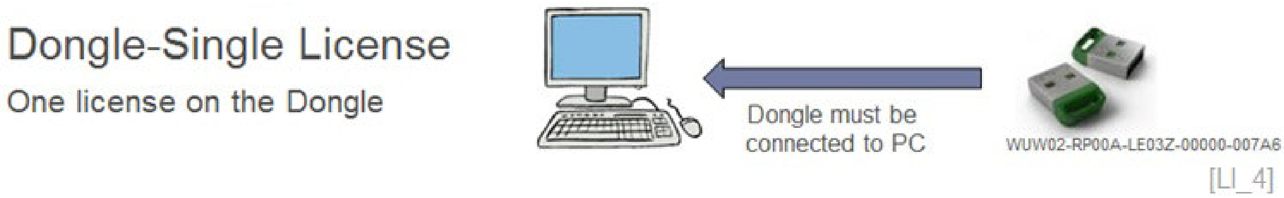
5.3 PC license (Single Seat)

License Type:	PC-License
Description:	The license is created on http://myipe.ipetronik.com/. Customers can create an account on the website and acquire the license key to their account. This license can be activated online with one click in IPEmotion if the PC has an internet connection. A manual activation for standalone PCs is also possible. The license is linked to this specific computer and cannot be transferred to another computer. PC hardware properties are included into the license key.
Recommended Applications:	This type of license management is useful if: - The software is always used on the same computer. - The application is static on one computer e.g. on a test bench. - Using lab computer for a specific application.
Pro:	Activation is necessary. Quite easy to activate the SW through the online activation process.
Con:	License is fixed to one computer. Cannot be moved to other computers.



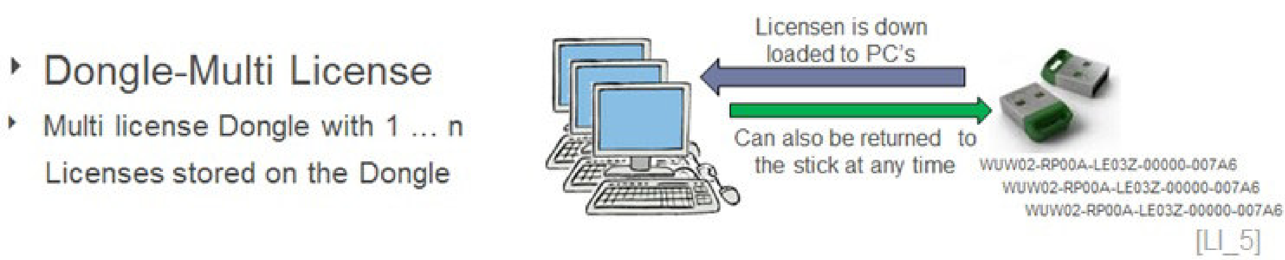
5.4 Dongle - Single License (Single Seat)

License Type:	**Dongle-Single License**
Description:	The license is provided by a dongle. One license key is saved on the dongle. Anyone who has the dongle can use the software. The dongle must be connected to the computer with an IPEmotion installation and the software starts with the corresponding IPEmotion edition and options. The license key is invisible for the user. *******-********-********-******
Recommended Applications:	This type of license management is useful if: - The software is used by different users on different computers.
Pro:	There is no interaction with the IPETRONIK website or account creation involved. The transfer to different computers is easy – just move the dongle.
Con:	The dongle is small and can get lost. One USB port is blocked as the dongle must be connected to the computer when the software is in use. Only one product (IPEmotion Edition) can be stored on the dongle. It is difficult to transfer the dongle to people who are not working on the same site.



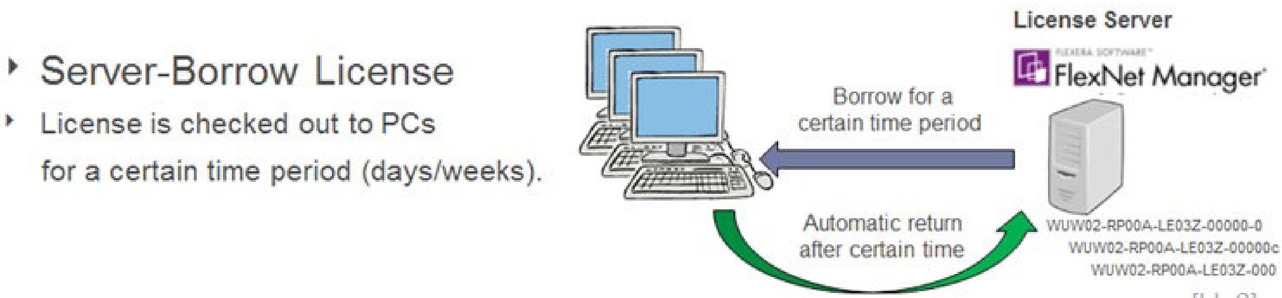
5.5 Dongle - Multi License (Multi Seats)

License Type:	Dongle-Multi License (Multi Seats)
Description:	The license keys are provided by a dongle. On the dongle, 1 âĂę n license keys are saved. Anyone who has the dongle can download a license and use the software. The dongle has to be connected to the computer only the first time to download the license to the computer. A counter is then decrementing the number of licenses stored on the Dongle. Users can see how many licenses are still available on the dongle. The software every time starts with the corresponding IPEmotion edition and modules included in the license key. The license key is invisible for the user. *******-********-********-******
Recommended Applications:	This type of license management is useful if: - Several licenses / users are working with IPEmotion in one department. - The license remains most of the time by the users (static).
Pro:	There is no interaction with the IPETRONIK website and no account needs to be created. The transfer to different computers is easy, provided you know where the dongle is and where the licenses are installed.
Con:	Dongle can get lost. If the PC is lost the license is lost, too. It can be difficult to keep track on which computers the licenses are installed. Only one product (one type of IPEmotion edition) can be stored on one stick. License dongles are usually only handled within one department âĂŞ same site/location.



5.6 Server - Borrow License

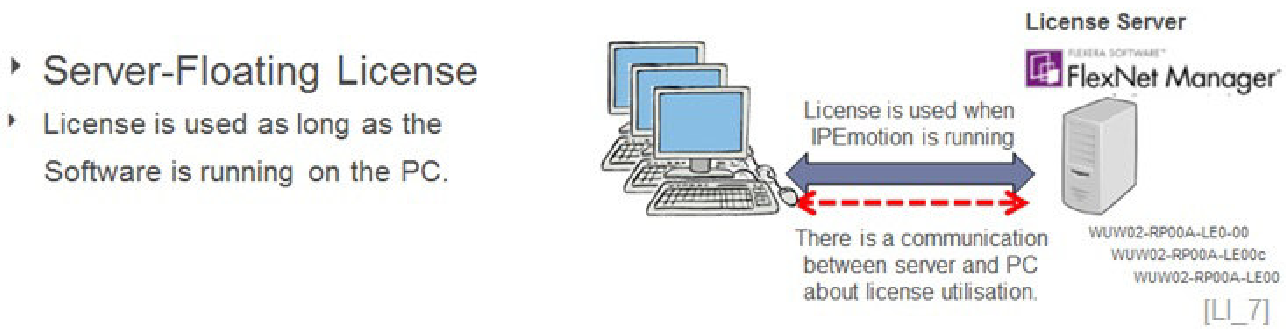
License Type:	**Server Borrow License**
Description:	To manage many licenses and to overcome the problems associated with dongles and PC licenses it is recommend to use the license server. IPEmotion can be licensed by using the FlexNet Server of FLEXERA http://www.flexerasoftware.com/products/flexnet-manager.htm The FlexNet server can host many different IPEmotion editions at the same time and the users can take the licenses they need. You can borrow the license for a certain time period. After this time period the license expires on the computer and is again available on the server.
Recommended Applications:	This type of license management is useful if: - Different software editions are used in the company - Large number of users need to be managed - Useful for all users which need different editions for different tasks - Users can work in different geographic locations and get licenses from the server.
Pro:	The license can never get lost. The administration and updating of licenses is done centrally. The license also works if the computer is not connected to the company network.
Con:	Initial costs and work load to configure FlexNet server. Users need to keep an eye on the expiration date. For server licensing a maintenance contract is required.



[LI_6]

5.7 Server - Floating Licensing

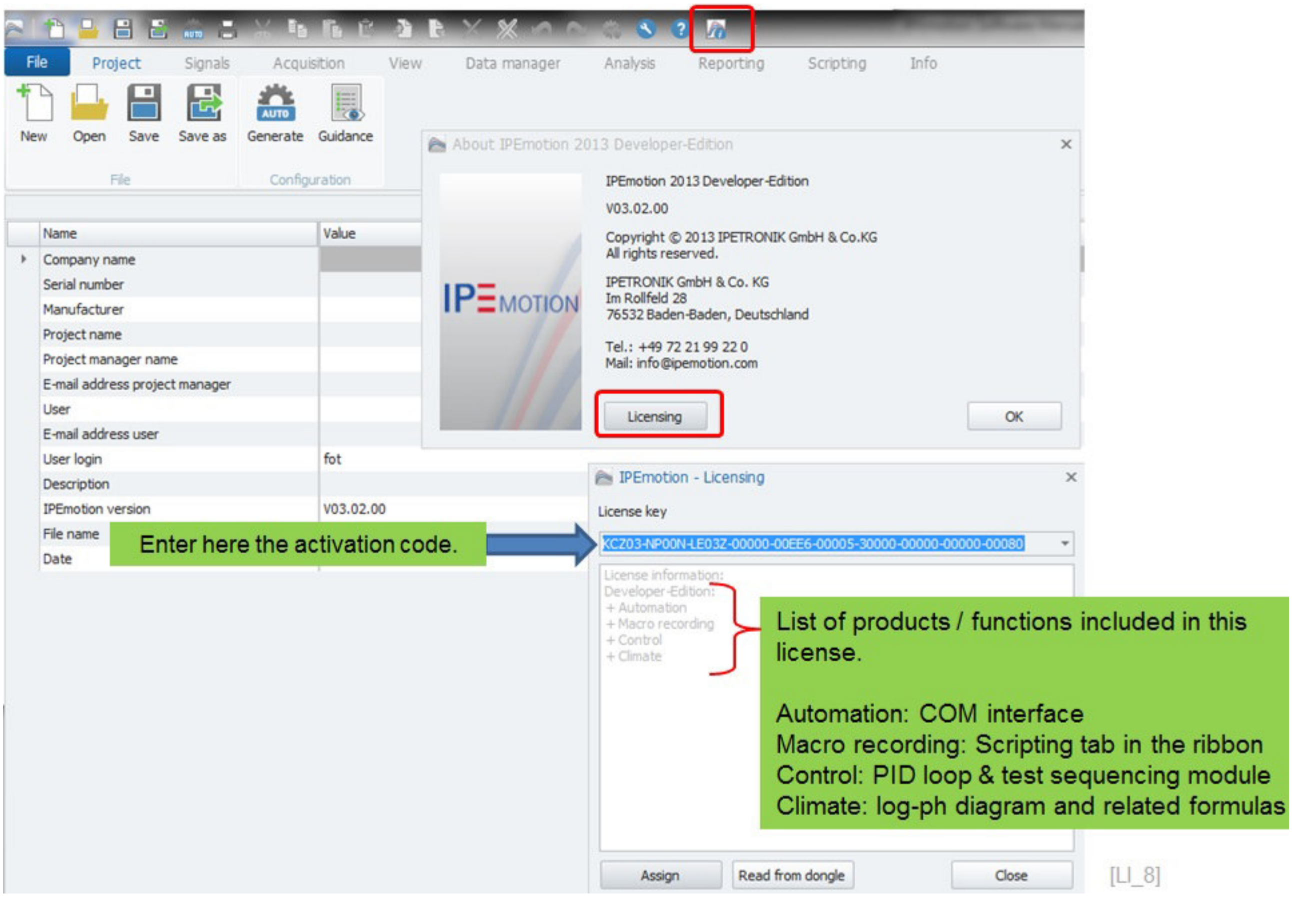
License Type:	Server - Floating License
Description:	To manage many licenses and to overcome the problems associated with dongles and PC licenses it is recommend to use the license server. IPEmotion can be licensed by using the FlexNet Server of FLEXERA. http://www.flexerasoftware.de/products/flexnet-manager.asp The FlexNet server can host many different IPEmotion editions at the same time and the users can take the licenses they need. Users are only blocking the license when the IPEmotion software is running. This is ideal to increase software utilization and to save license costs. The floating licensing requires that the computer is connected to the company network while you are working with IPEmotion. The PC communicates with the server in regular intervals (every few minutes) confirming that the license is still in use.
Recommended Applications:	This type of license management is useful if: - Many different editions are used in the company. - Large number of users need to be managed - Users can work in different geographic location and get licenses from the server. - Useful for all users which need different editions for different tasks. - They can just download the required edition for the task they have from the server and the license is returned automatically when the software is shut down.
Pro:	The license can never get lost. The administration and updating of the licenses is done centrally. License utilization and costs are optimized. Statistics about IPEmotion utilization rates can be generated. Users can easily switch between different editions hosted on the license server depending on the task they have to do.
Con:	Initial costs and work load to establish FlexNet server. Concurrent licenses require that the computer is connected to the company network. For server licensing a maintenance contract is required.



5.8 License activation

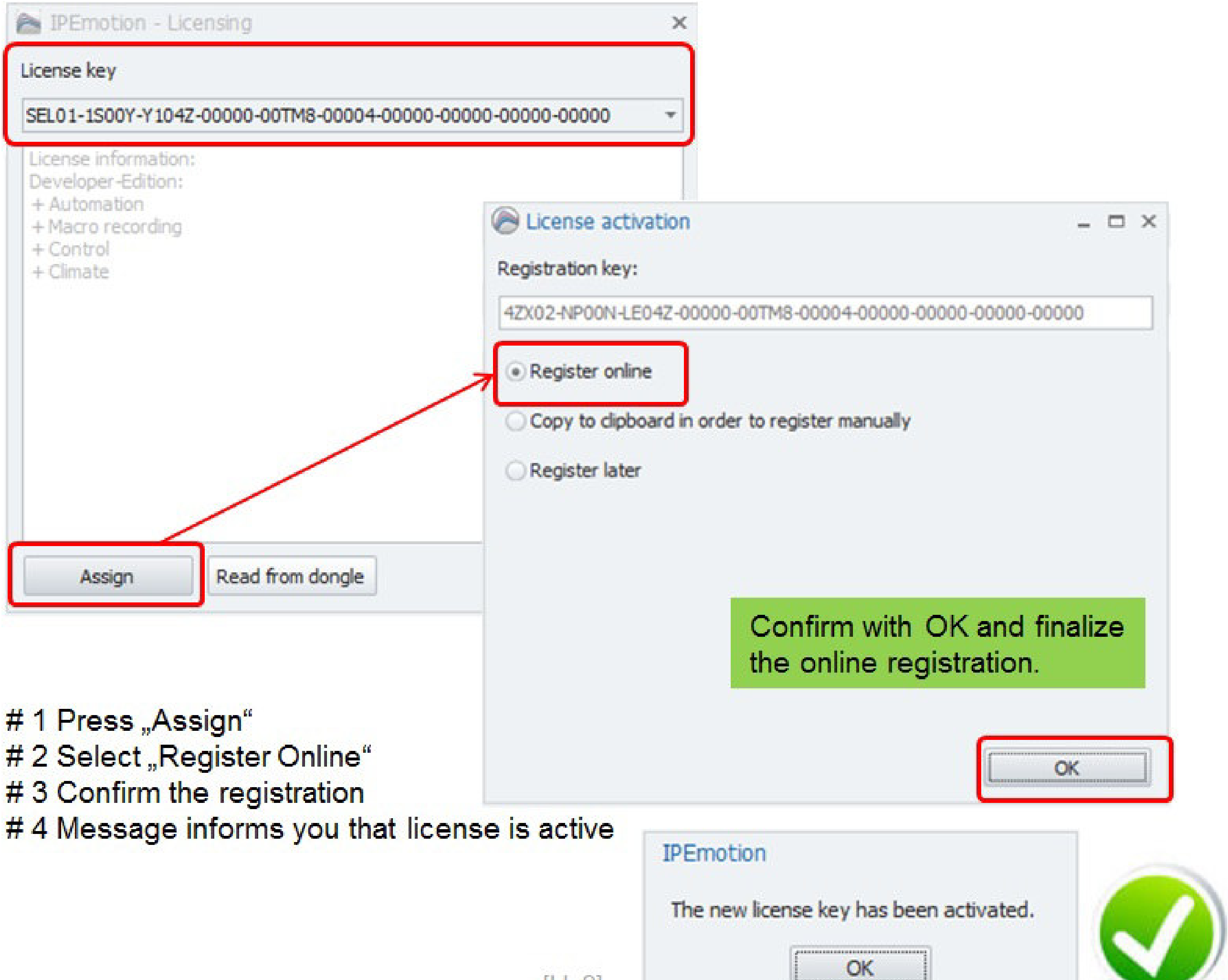
5.8.1 PC license activation

In the first step you need to open the ABOUT dialog. You can access this dialog from the application menu or via the main navigation ribbon.



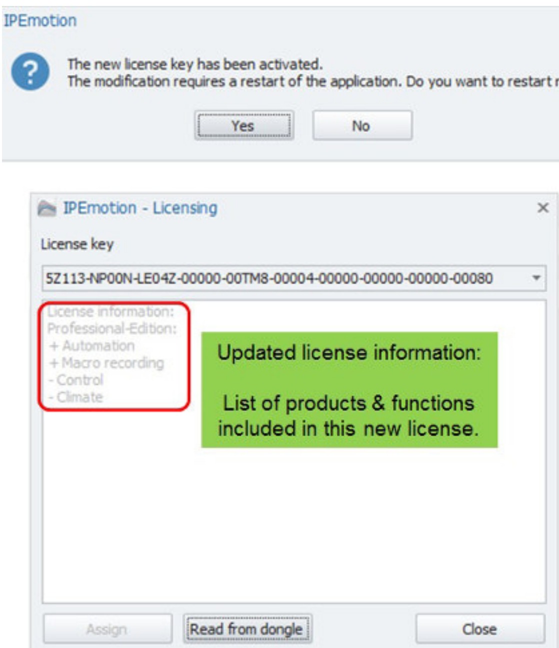
[LI_8]

Enter new activation key: SEL01-1S00Y-Y104Z-00000-00TM8-00004-00000-00000-00000-00000



[LI_9]

After online registration the software needs to be restarted. Opening the license dialog again, you will see the updated license information.

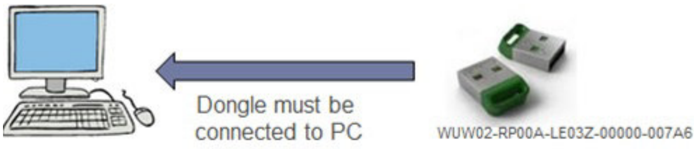


[LI_10]

All activated licenses are stored in the license pull down list which is described in more detail in chapter 5.12.

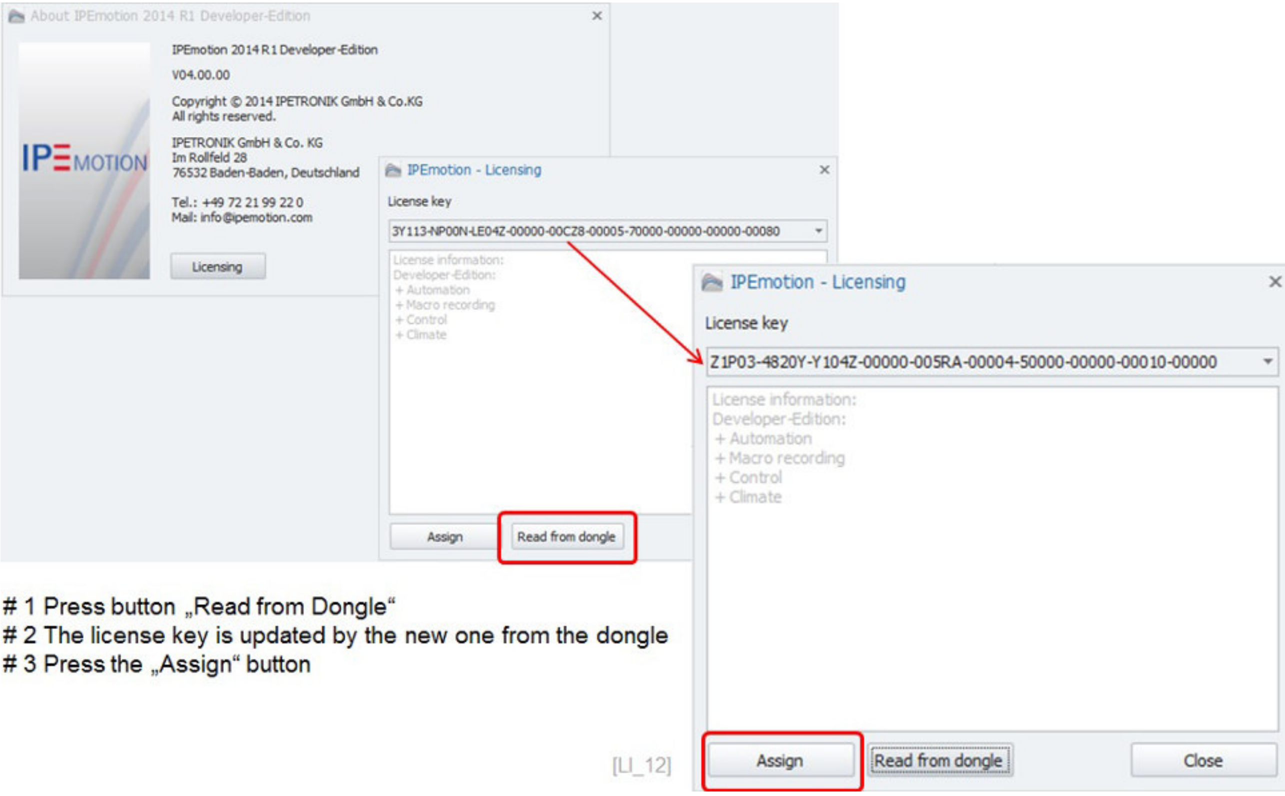
5.8.2 Dongle - single license activation

The activation of the dongle is only required the very first time you use this dongle. When you remove and connect the dongle later to the PC again IPEmotion is automatically recognizing the dongle and starting with the right software edition of the dongle.
In the first step you connect the dongle to your USB port and start the IPEmotion software.



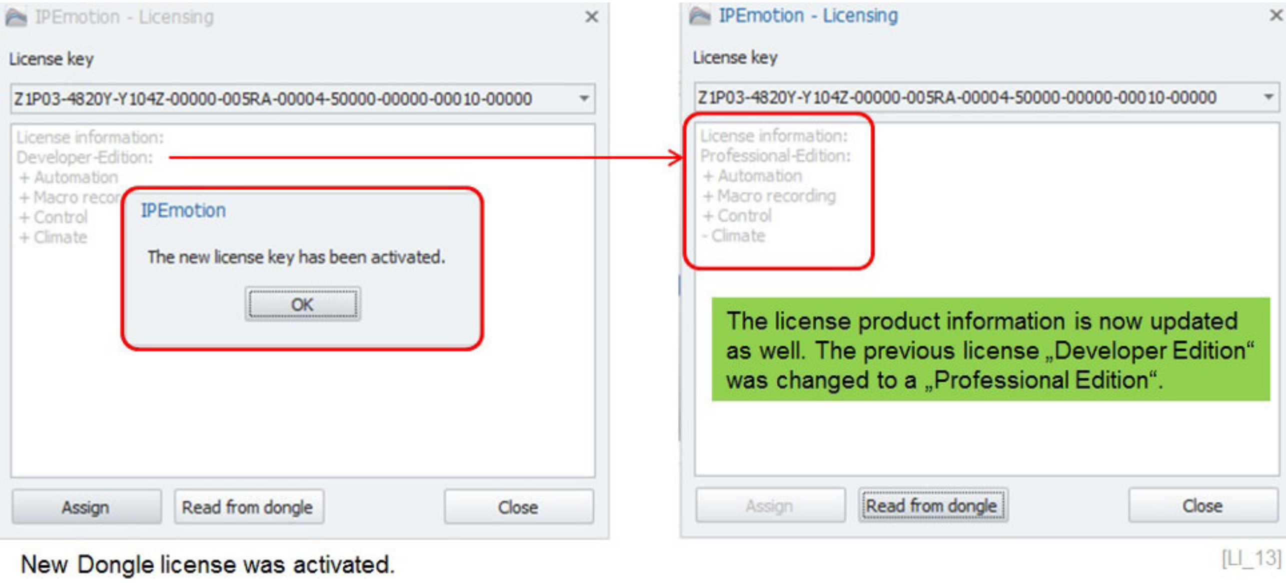
[LI_11]

1. Then you open the license dialog and press the button “Read from Dongle”.
2. The license key is updated in the license key field.
3. After that you need to press the “Assign” button to activate the license.



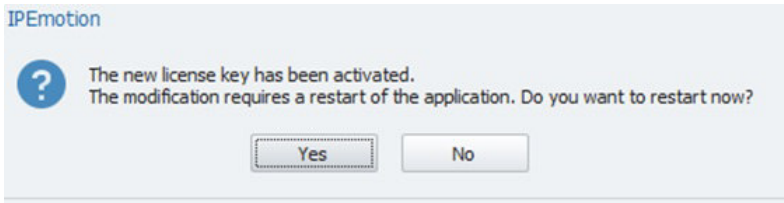
[LI_12]

After you press “Assign” a message box informs you that the new license was activated.
The license product information is updated as well.



[LI_13]

After the activation the software requires a restart.



[LI_14]

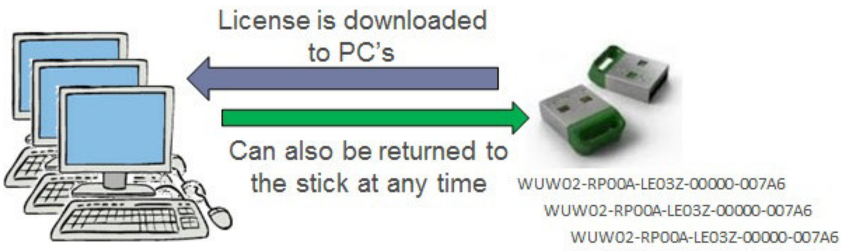
If you start the software without the dongle connected to the PC IPEmotion returns a message that the Basic edition is started due to a missing dongle.

[LI_15]

If you connect the dongle and start the software again you have the edition stored on the dongle. As mentioned in the beginning the activation process is only required the very first time to link the dongle license to the PC. Later on, you only connect the dongle and start the software. All activated licenses are stored in the license pull down list which is described in more detail in chapter 5.12.

5.8.3 Dongle - multi license activation

Rather than having the dongle connected all the time to the PC you can select the multi-license dongle option. The difference of this dongle is that 1 or several license can be stored on the dongle and that you can download a license from the dongle to the PC. After the download the number of licenses is decremented and the dongle can be removed. There is no need to connect the dongle again to start IPEmotion.
The license activation process is the same as discussed above in chapter 5.8.2.



[LI_16]

When you download the license from the dongle the license key is invisible and marked with "**********". In the dialog you can also see how many licenses are available for download. In this example 22 of 30 total.

[LI_17]

After assigning the license to the PC the number of licenses is incremented by one and the dongle can be removed.
If you like, you can return your license to the dongle. In this case you connect the dongle to the PC, open the license dialog and press the "Give" button. After this process your own license is downgraded to a Basic edition after the restart and the number of licenses on the dongle is incremented by one.
All activated licenses are stored in the license pull down list which is described in more detail in chapter 5.12.

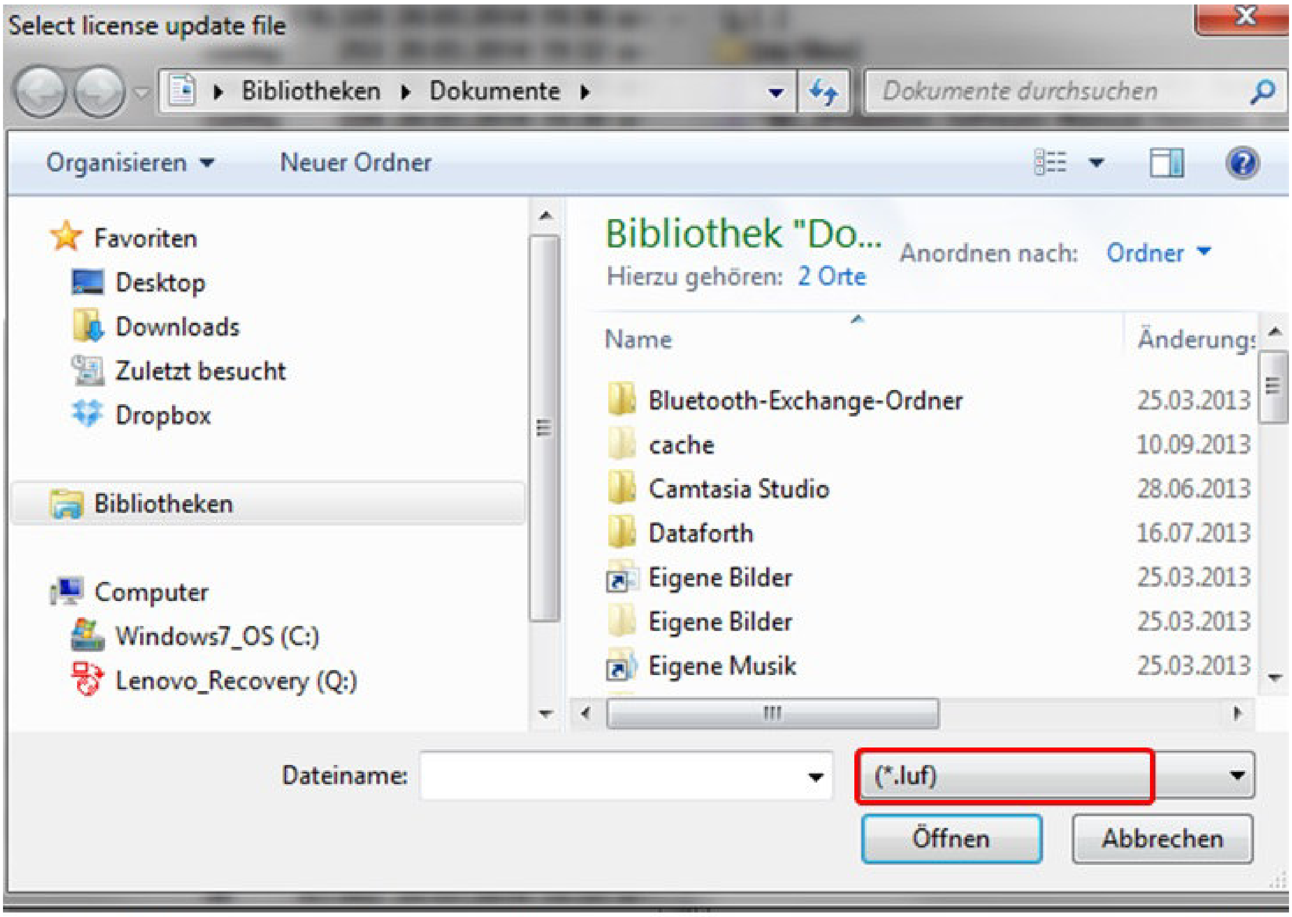
5.8.4 License updating procedure

All licenses are valid for one major release only. Every year in March a new major release is coming to the market. If you like to update your PC, dongle or server license you need to get a new license key from IPETRONIK.
To update a PC license to the new major release is the same process as discussed in chapter 5.8.1.
The updating of dongle licenses requires the following steps.

1. The support team of IPETRONIK requires the dongle serial number
2. Based on the dongle serial number a **.LUF** license file is generated.
3. The .LUF file is send to you.
4. Then you need connect the dongle to the PC and start the dongle update tool: This tool is stored in

   Win 7: c:\Program Files (x86)\IPETRONIK\IPEmotion 2016 R2.1\
   The update toll is called: **IPETRONIK.IPEmotion.DongleTool.exe**

5. When you start the Dongle update tool a file open dialog appears and you can link the LUF file to update the dongle.



Link LUF file to udpate the Dongle license. [LI_18]

Information *If you have a multi license dongle you can update this dongle at any time even if the licenses are not returned from the users. The users can return and download the new license separately after the dongle was updated.*

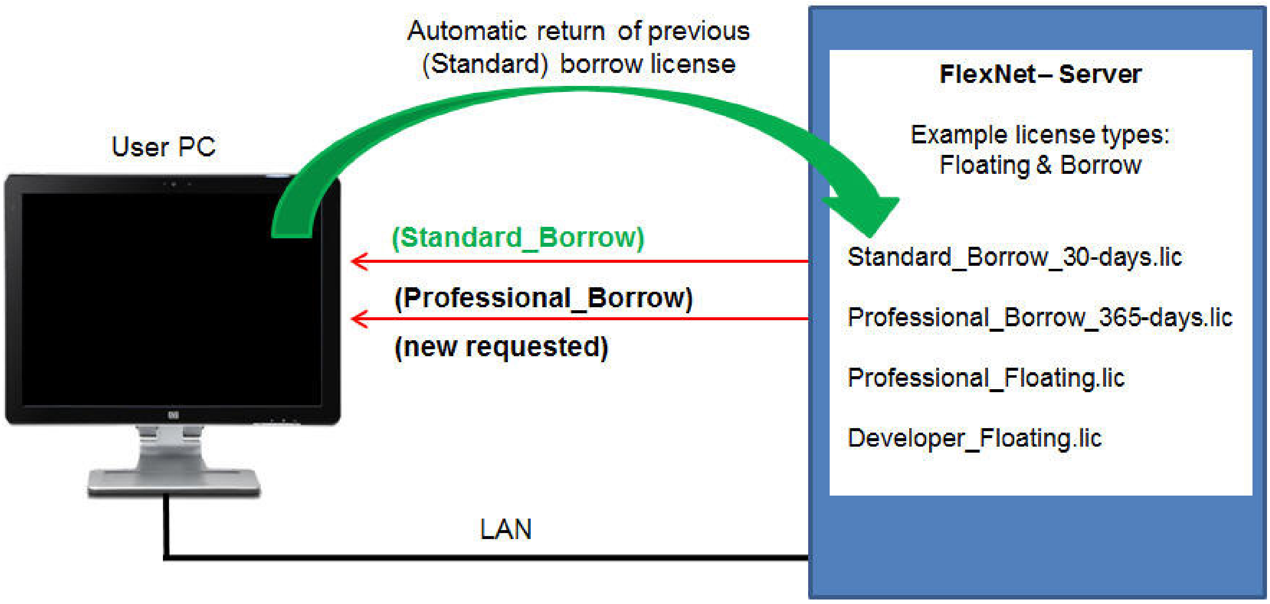
5.9 Server License activation

The server licensing procedure has many advantages to dongle or single PC licensing. The main advantage is that the licenses cannot get lost and that the license utilization can be monitored. On the server different license products can be installed.

As discussed the server can host borrow and floating licenses and many different editions like Lite, Standard, Professional including the different Options like Control or Climate. As the graphic indicates the different license files are stored on the server.

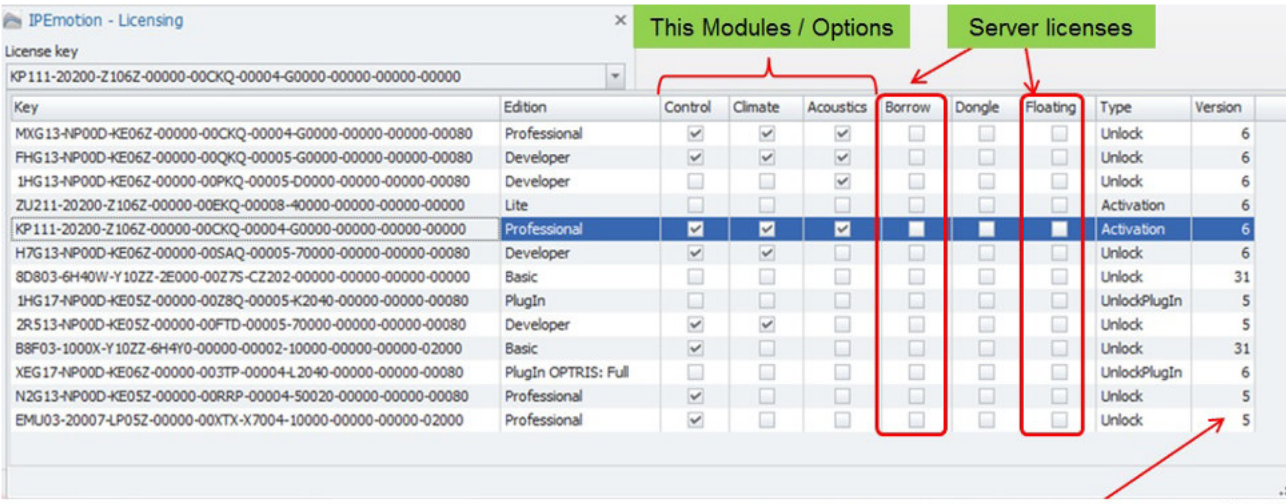
The user (client) requires a server activation key which allows him to retrieve a specific license from the server.

Attention! *In order to retrieve a server license the user needs an activation key which is related to a specific server license edition. The activation keys for every license.lic file is provided by IPETRONIK. The user can borrow one license product only. That means when a new product is requested the previous product is automatically returned to the server. The advantage is that only one licenses product (edition) is stored on the PC and not multiple products.*



[LI_19]

All license keys (activation keys) entered into IPEmotion are stored in the license dialog. After the first activation you can select from the list box which product you like to activate. You do not need to enter the server license again every time if you want to get a license. You just select it from the list. The license list is clearly indicating which products you can select from.



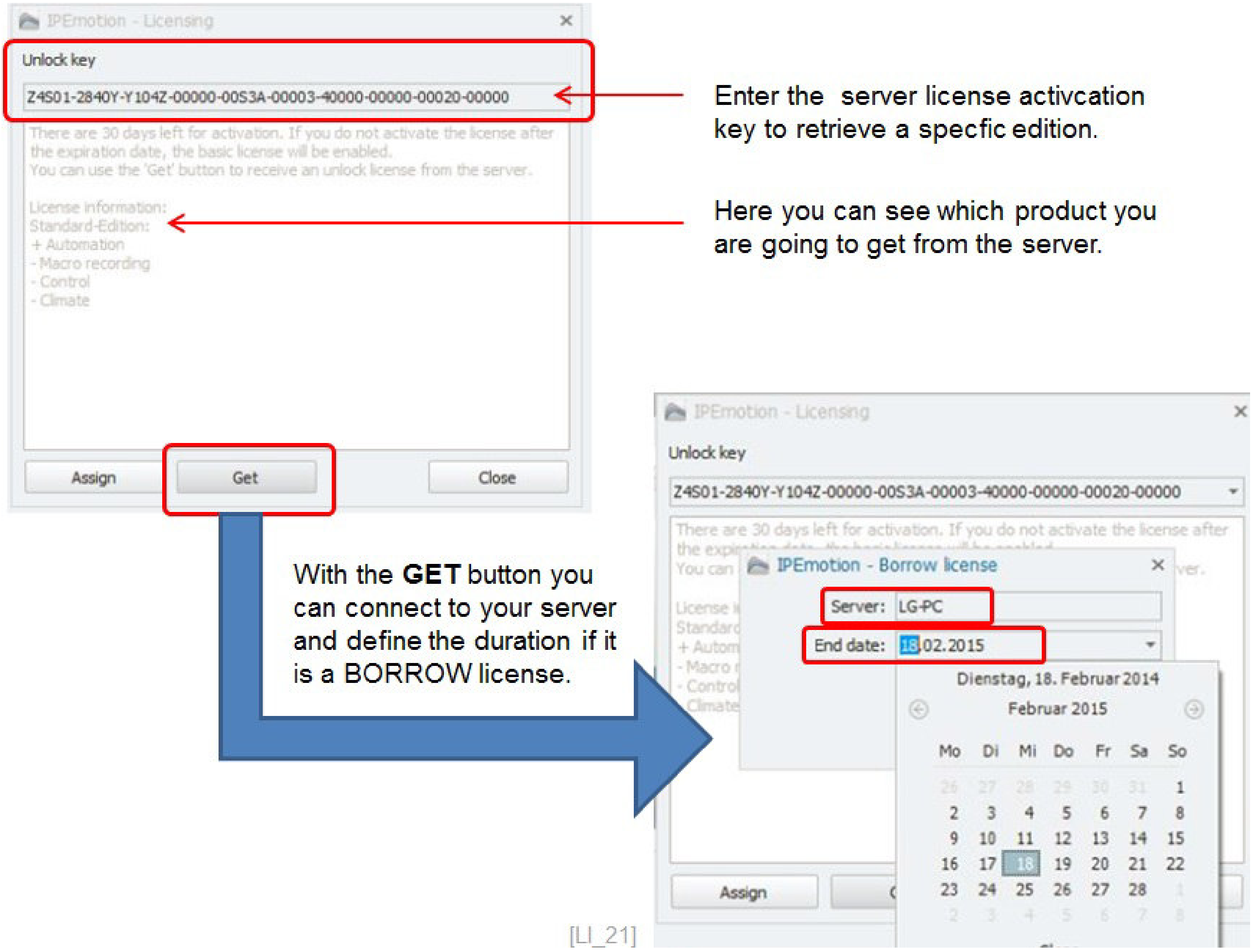
Key	Edition	Control	Climate	Acoustics	Borrow	Dongle	Floating	Type	Version
MXG13-NP00D-KE06Z-00000-00CKQ-00004-G0000-00000-00000-00080	Professional	✓	✓	✓				Unlock	6
FHG13-NP00D-KE06Z-00000-00QKQ-00005-G0000-00000-00000-00080	Developer	✓	✓	✓				Unlock	6
1HG13-NP00D-KE06Z-00000-00PKQ-00005-D0000-00000-00000-00080	Developer			✓				Unlock	6
ZU211-20200-Z106Z-00000-00EKQ-00008-40000-00000-00000-00000	Lite							Activation	6
KP111-20200-Z106Z-00000-00CKQ-00004-G0000-00000-00000-00000	Professional	✓	✓	✓				Activation	6
H7G13-NP00D-KE06Z-00000-00SAQ-00005-70000-00000-00000-00080	Developer	✓	✓					Unlock	6
8D803-6H40W-Y10ZZ-2E000-00Z7S-CZ202-00000-00000-00000-00000	Basic							Unlock	31
1HG17-NP00D-KE05Z-00000-00Z8Q-00005-K2040-00000-00000-00080	PlugIn							UnlockPlugIn	5
2R513-NP00D-KE05Z-00000-00FTD-00005-70000-00000-00000-00080	Developer	✓	✓					Unlock	5
B8F03-1000X-Y10ZZ-6H4Y0-00000-00002-10000-00000-00000-02000	Basic	✓						Unlock	31
XEG17-NP00D-KE06Z-00000-003TP-00004-L2040-00000-00000-00080	PlugIn OPTRIS: Full							UnlockPlugIn	6
N2G13-NP00D-KE05Z-00000-00RRP-00004-50020-00000-00000-00080	Professional	✓						Unlock	5
EMU03-20007-LP05Z-00000-00XTX-X7004-10000-00000-00000-02000	Professional	✓						Unlock	5

This index is indicating which IPEmotion major version is supported in the license.
3 = release 2013 x.x.
4 = release 2014 Rx.x
5 = release 2015 Rx.x
6 = release 2016 Rx.x

[LI_20]

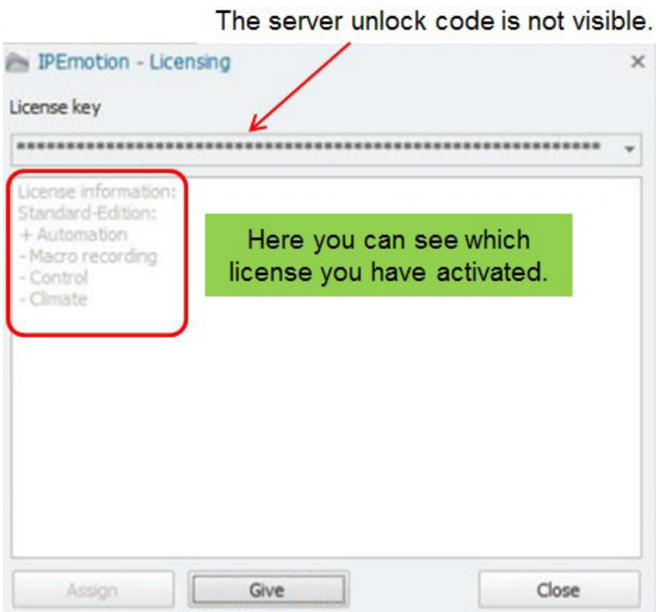
5.9.1 Server - Borrow license

The license activation key is entered into the license dialog and a new window comes up to define the server name where to fetch the license from. Using the borrow license you can decide for how many days you can keep the license. The maximum duration is defined in the license file. You cannot borrow for a longer period. The system suggests a date with the maximum borrow time.



[LI_21]

After the activation from the server the user gets an updated license dialog indicating the activated edition and the included options.

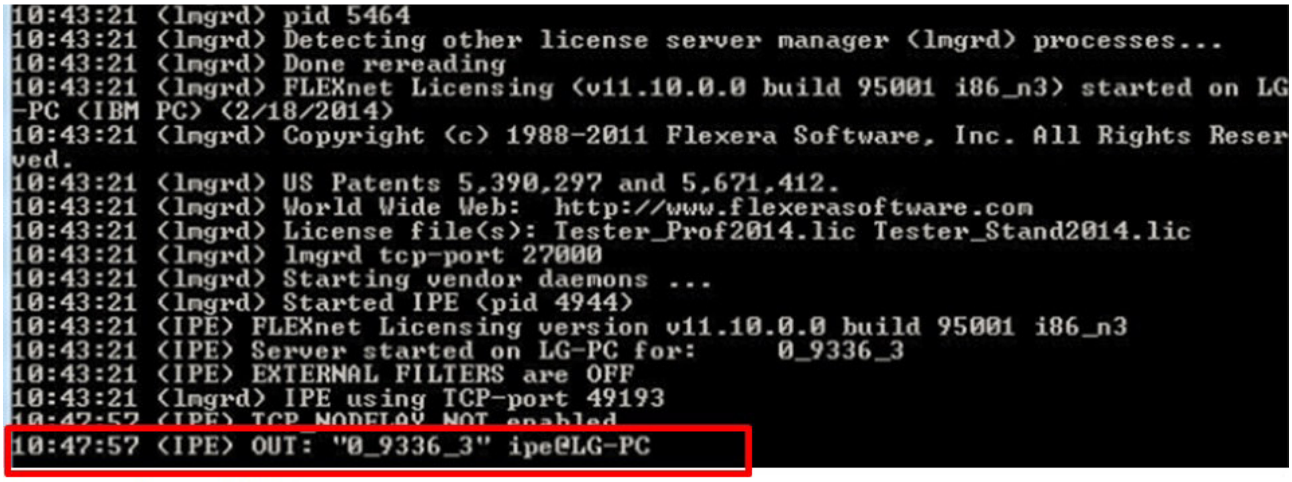


[LI_22]

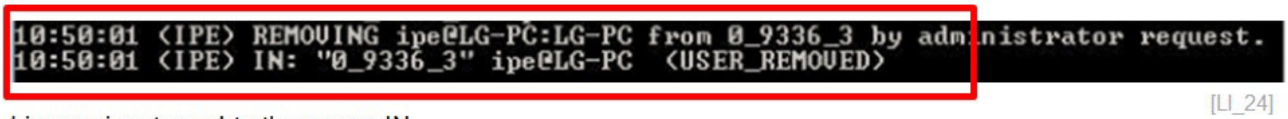
If you try to borrow a license more than 1 year the software is returning an error message. The maximum borrow duration is set to 1 year.

[LI_23]

The server is logging all license movements. The screenshot below shows the OUT and IN movement of a borrow license.



License is checked OUT



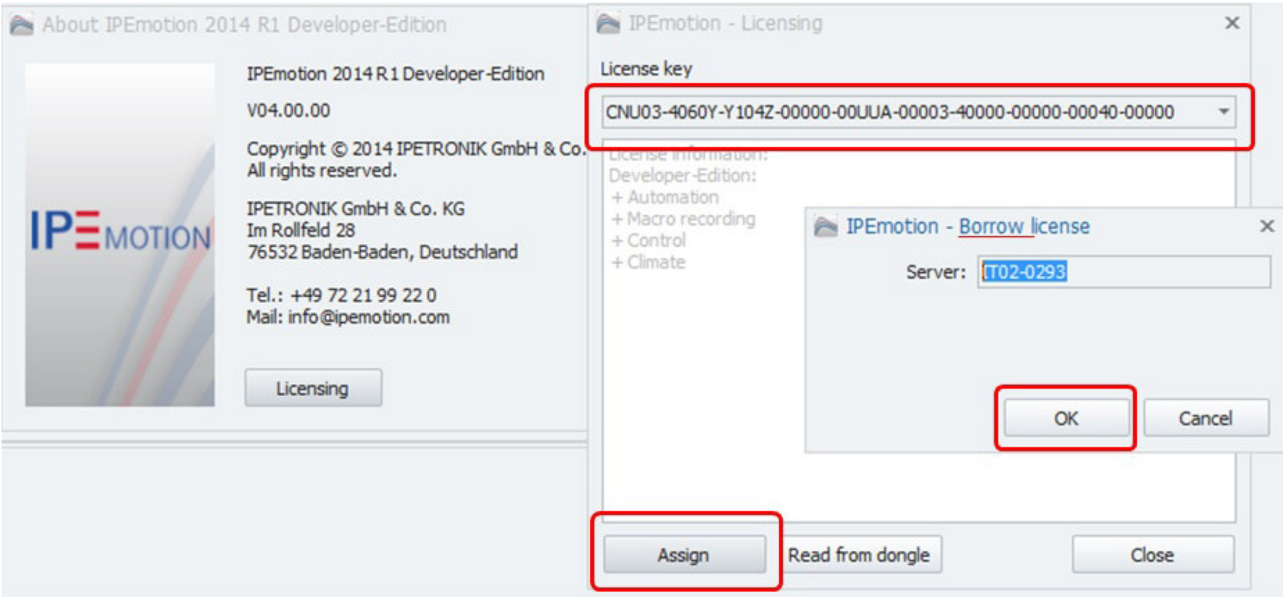
[LI_24]

License is returned to the server IN

5.9.2 Server - Floating licenses

The floating license is working differently than the borrow license. The floating license needs to be activated only one time and every time you start IPEmotion the software is automatically fetching the license from the server.

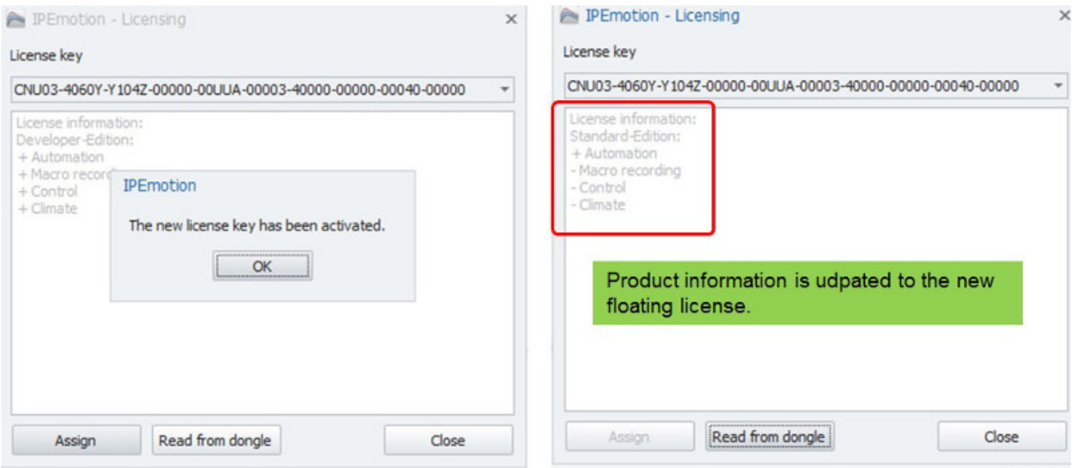
1. Enter the floating license activation key into the license dialog
2. Press “Assign”
3. The server dialog is opened. When going through the license process the very first time you must define the server name one time. It will be saved into the system settings.
4. Confirm the server / computer name with OK



1 Enter Activation code
2 Press „Assign“
3 Window is indiacting the license server (Computer name) and that you will get a Floating license
4 Confirm the dialog with OK

[LI_25]

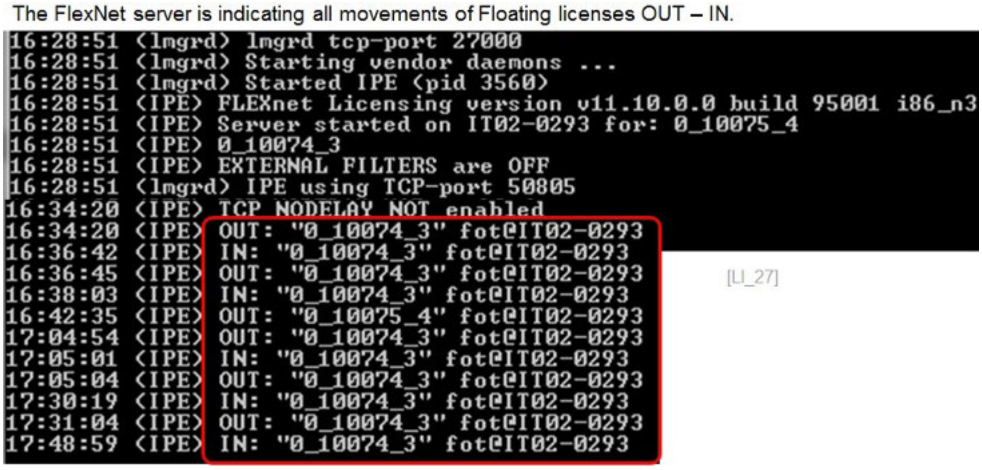
5. When the new license is activated the server is also showing that it is checked out.



[LI_26]

The FlexNet server is also recording all OUT and IN movements of the Floating licenses.

The FlexNet server is indicating all movements of Floating licenses OUT – IN.



[LI_27]

5.10 Overview how to setup up a FlexNet Server

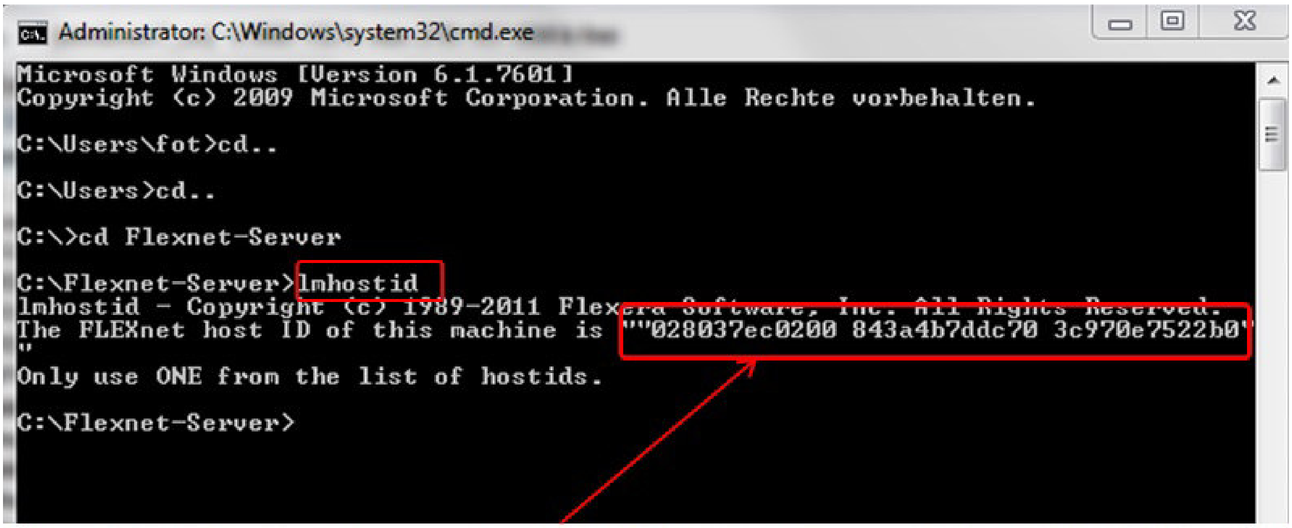
The Server Licensing option is the best solution for corporate installation to provide users many licenses throughout the company and different IPEmotion editions at the same time. IPEmotion is supporting the FlexNet Server of FLEXERA
http://www.flexerasoftware.com/products/flexnet-manager.htm
In order to use the FlexNet licensing technology a FlexNet server needs to be setup together with your IT department. The FlexNet server consists of 4 very small programs.
The licensing process does not require any large processing power of the server. From a technical point the server must be reachable by all users working with IPEmotion.
These FlexNet programs are provided by IPETRONIK who covers all related licensing costs. You do not need to buy any licenses to use the FlexNet server

1. The IT department has to define a server which is suitable for the FlexNet application.
2. Create a folder “Flexnet-Server” on the server and copy all programs provided by IPETRONIK to this folder. The following 4 programs are copied to the FlexNet-Server folder:

IPE	29.06.2012 17:45	Anwendung	1.669 KB
lmborrow	29.06.2012 17:45	Anwendung	1.612 KB
lmgrd	29.06.2012 17:45	Anwendung	1.374 KB
lmhostid	07.06.2012 15:32	Anwendung	1.612 KB

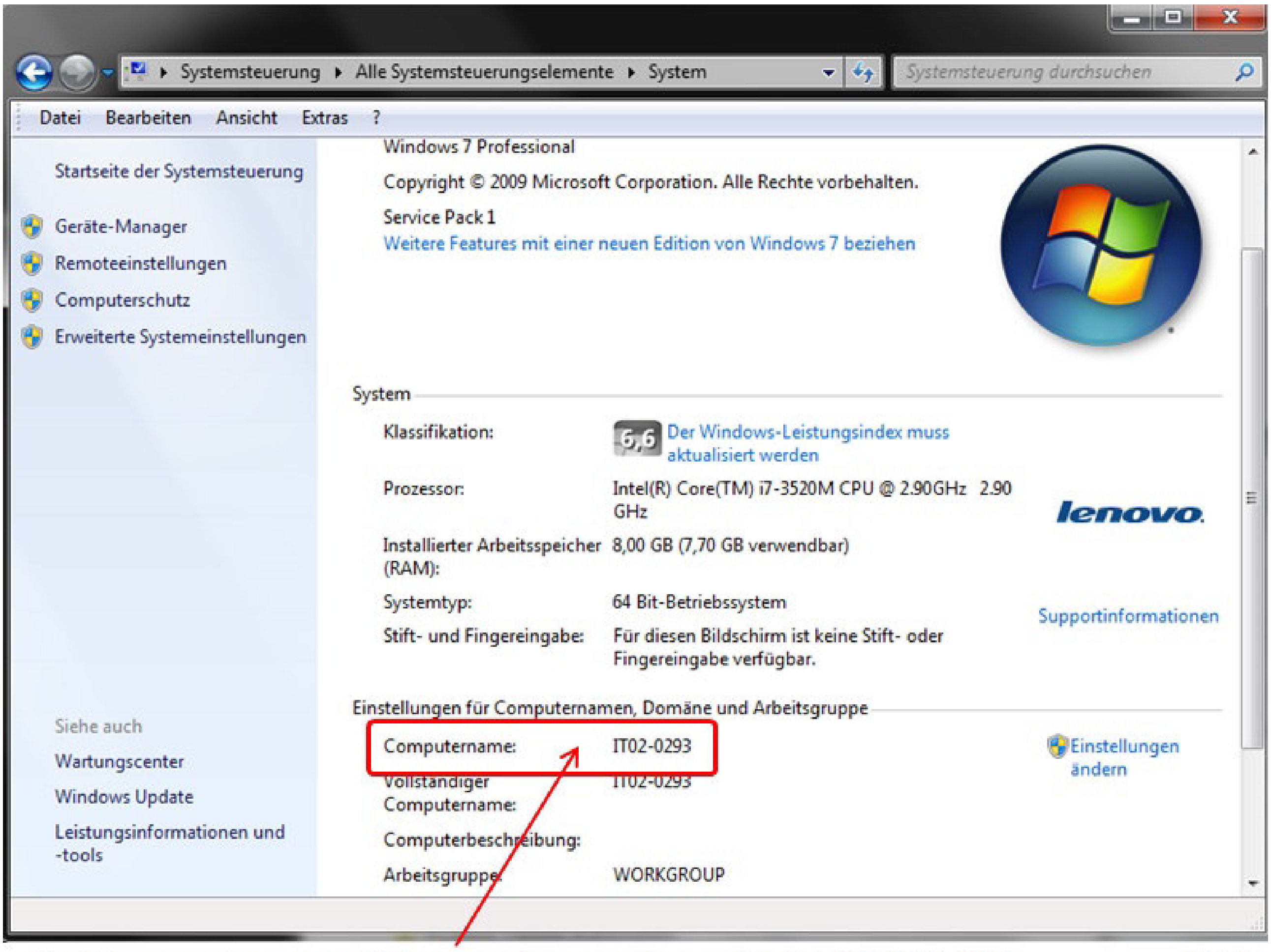
[LI_28]

3. Then the server computer name and the unique Host-ID have to be identified. The licenses will be generated in reference to the unique computer name and Host-ID. This is preventing users from creating duplicated FlexNet servers and running the same license files on multiple servers. The license files have the extension .lic. In order to identify the Host-ID the **lmhostid.exe** needs to be started over a command line.



lmhostid.exe identified the computer Host-ID. This Host-ID is provided to IPETRONIK. [LI_29]

The computer name is identified over the Windows System Manager.



Identify computer name. This computer name is provided to IPETRONIK. [LI_30]

In this example the IT depart should provide IPETRONIK the following information:

Computer name: IT02-0293

Host-ID: 028037ec0200 843a4b7ddc70 3c970e7522b0

4. In the next step IPETRONIK will generate license .LIC files for this specific computer and the corresponding Host-ID. Before the licenses can be created the license properties should be discussed. Each license file is made for one specific server, edition and borrow duration/floating property. As an example you can host several license .lic files on the server like:

   Professional (20 Qty) – Floating

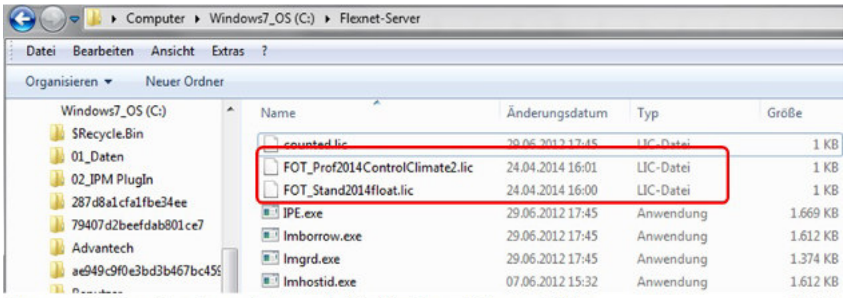
   Professional (10 Qty) – Borrow for 90 days max)

   Professional (20 Qty) – Borrow for 365 days max)

   The following table includes the questions which should be answered by the customer.

Item	Information
Which Edition	Lite Standard Professional Developer Analysis
Which Options	Climate Control
How many licenses	Number
License Type	Floating Borrow (*)
(*) When Borrow licenses are used the maximum borrow duration needs to be defined in days.	Define number of days

5. The license .lic files have to be copied into the Flexnet-Server folder.

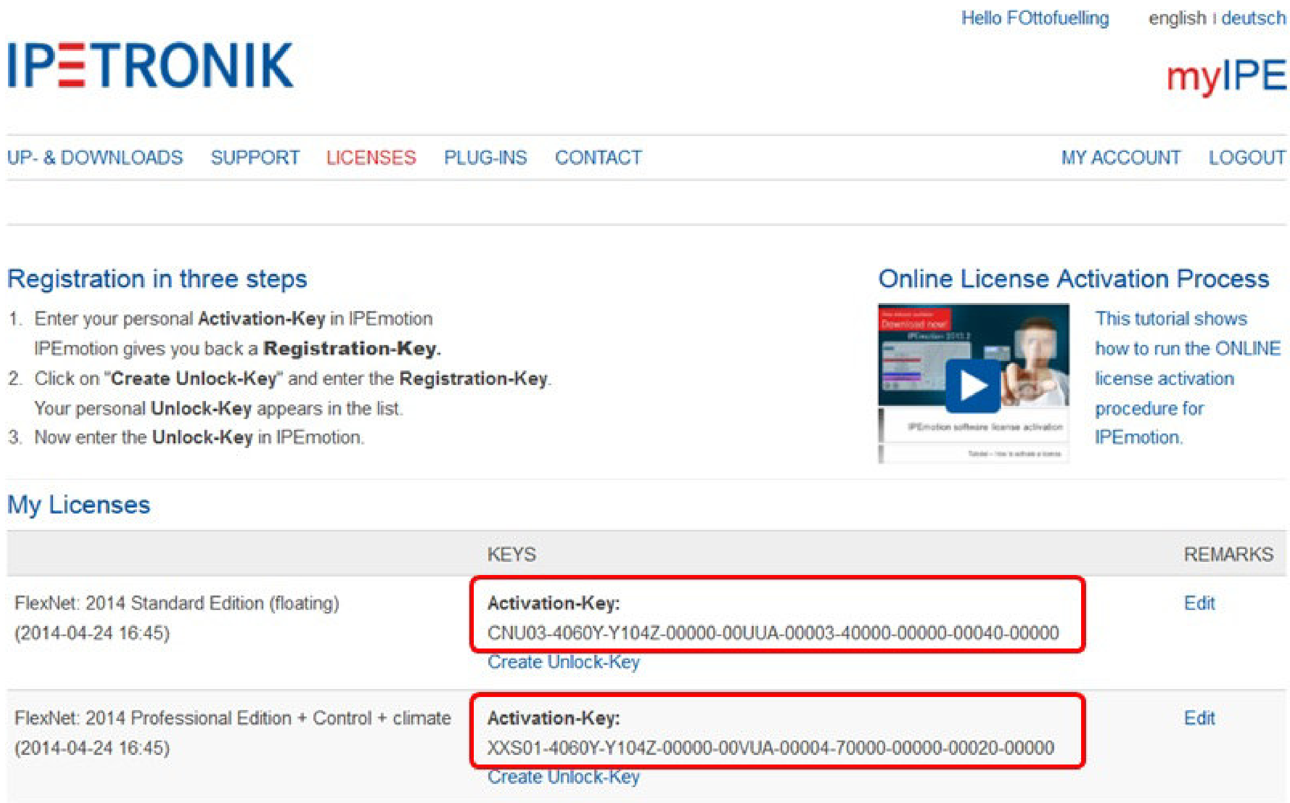


License .lic files. They have to be copied to the Flexnet-Server folder. [LI_31]

6. Now the FlexNet server needs to be started with the corresponding license files. The **lmgrd.exe** is started over a command line: **lmgrd –z –c FOTProf2014ControlClimate2.lic;FOT Stand2014float.lic**

[LI_32]

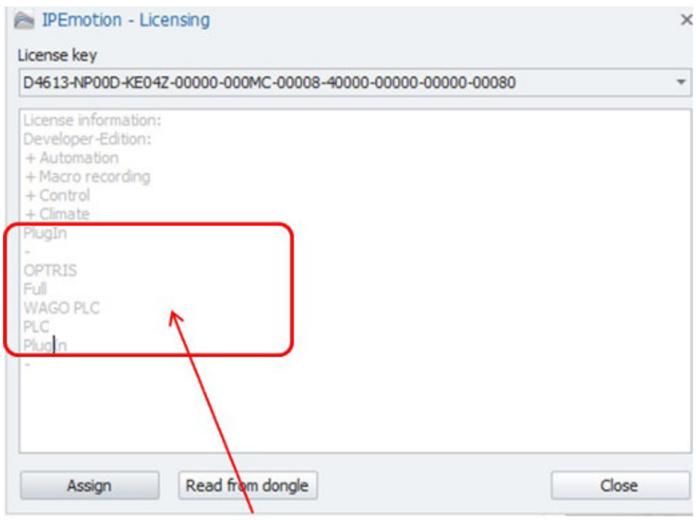
7. The activation keys are provided by IPETRONIK. They are also accessible via the IPETRONIK website. You can now activate the license on your computer. The details are discussed for Borrow and Floating in the chapter above 5.9.



Activation key for the .lic files: [LI_33]
These Activation keys are provided to the users so that they can fetch the required Edition from the server.

5.11 PlugIn Licensing

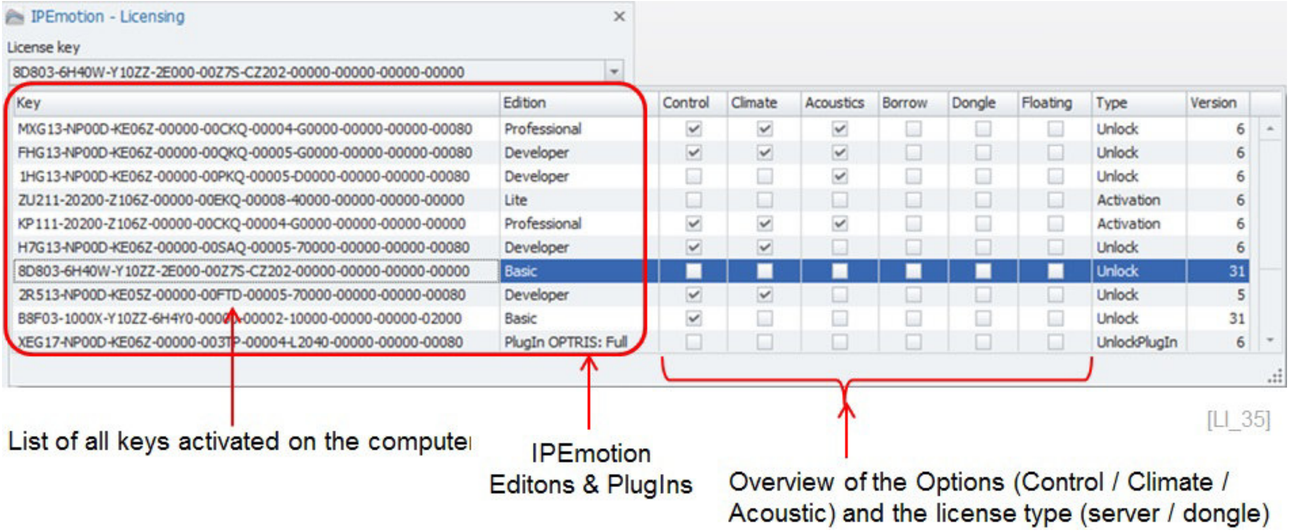
A new business model has evolved where, for example, PlugIns are developed by 3^{rd} party developers. These PlugIns might not be for free. A license key is required to activate these PlugIns. The key can be obtained by IPETRONIK or by the PlugIn developer. PlugIn license keys can be activated through the same process as used for IPEmotion licenses.
A PlugIn is licensed on the same technology as IPEmotion license and available as PC, Dongle or Server licenses. The activation process is the same as described above. When you have activated a PlugIn license you get additional information about the PlugIn and the features in the license dialog.



Information about PlugIn licenses. [LI_34]

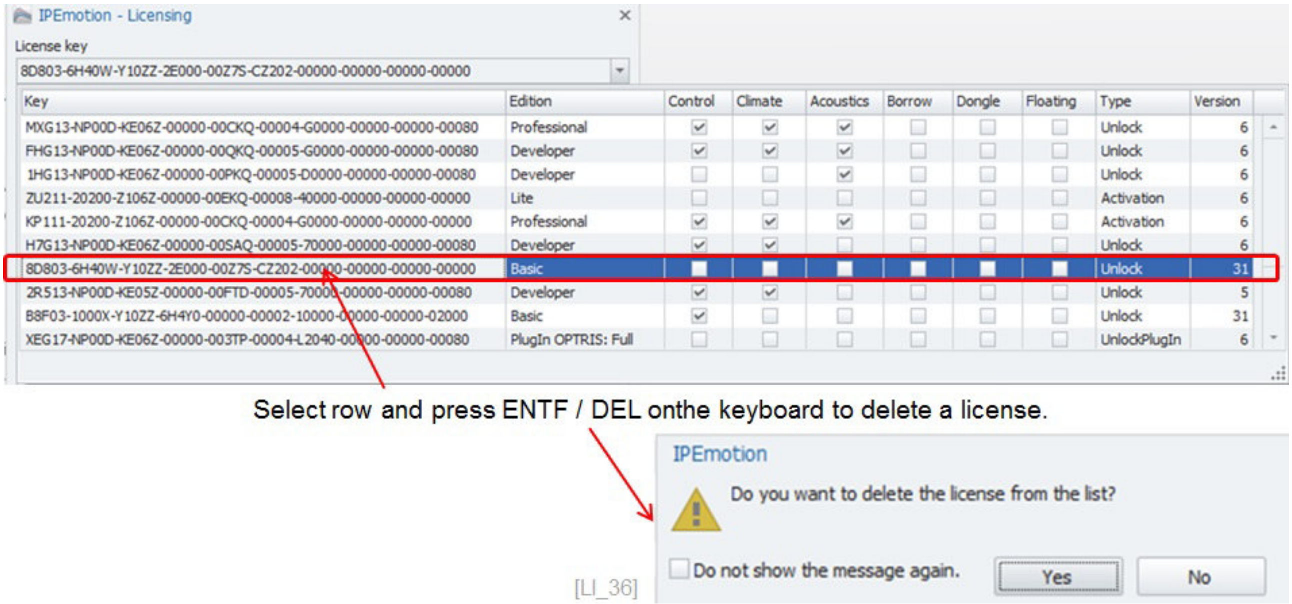
5.12 Managing different license keys via the license list box

The license dialog is a list box remembering all unlocked licenses you have entered over time. The keys and the corresponding editions with all options are listed. This interface makes it very easy to switch between different licenses. Users can switch just by selecting other licenses from the list of products and after program restart, the functions of the selected license are activated. In the past, users had to organize the unlock keys of different editions in separate lists and copy them into IPEmotion every time.



[LI_35]

You can delete activation keys from the licensing dialog. This is convenient for all customers updating to the new major release and who do not need the old license keys any more.



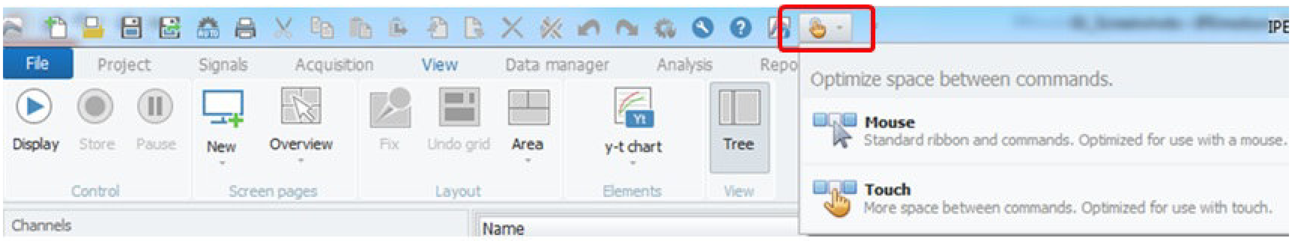
[LI_36]

i **Information** *With the latest activation key you can still operate elderly IPEmotion releases. The license keys are compatible to previous IPEmotion releases.*

6 Application Menu

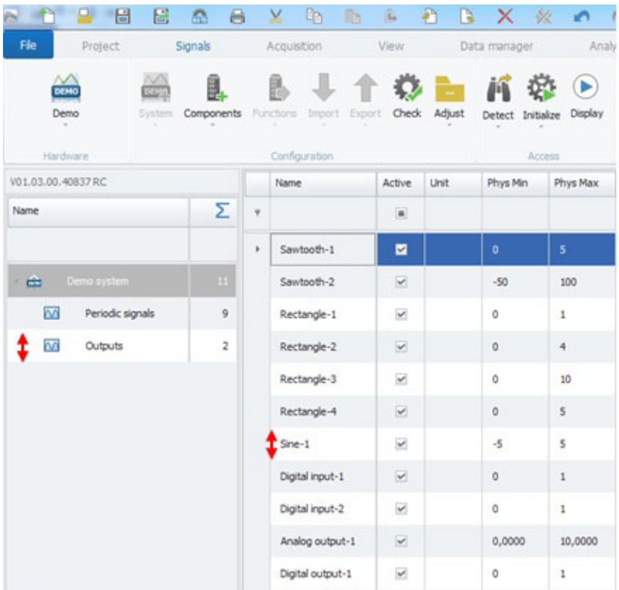
6.1 Touch mode for Tablet PC

You can switch between the default mouse and touch mode. In the touch mode the software can be operated more easily from computer screens supporting touch operation.

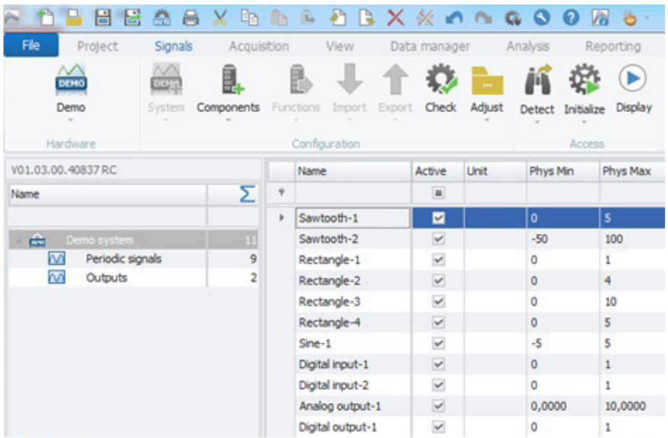


Mouse & Touch mode [AP_1]

In the touch mode the GUI row space is increased.



Touch mode – more row space.

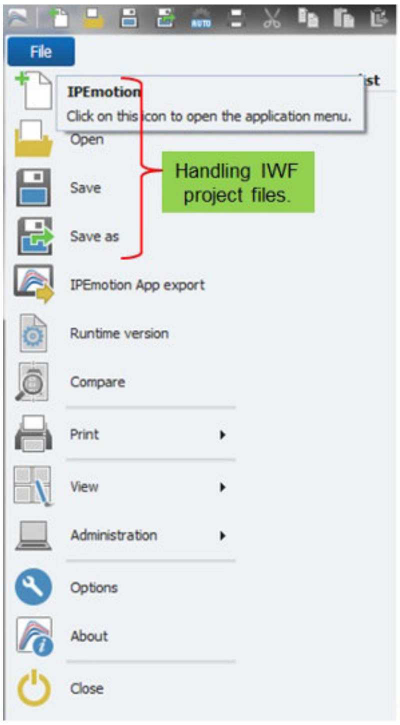


Normal mode [AP_2]

Information *The touch mode is not fully implemented across all configuration dialogs e.g. instrument head up displays.*

6.2 Handling IWF files

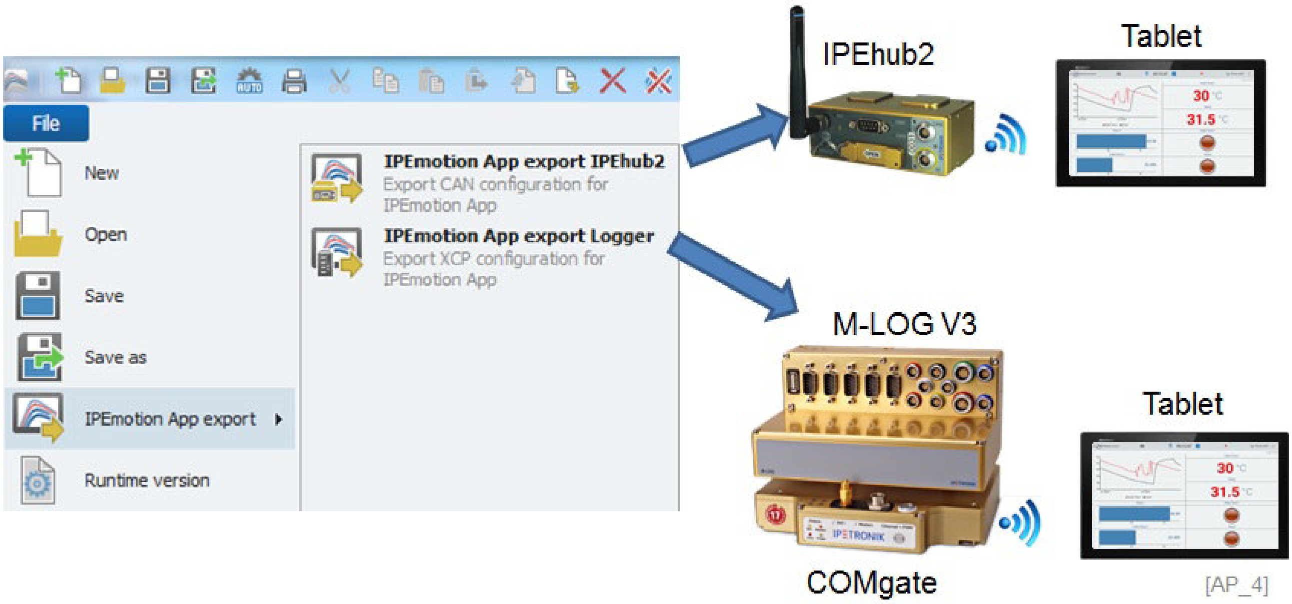
The first four items in the application menu deal with the handling of IWF project files. The complete IPEmotion configuration is stored in an IWF file. Later, we will see that IPEmotion configurations can be saved in sub configurations with different file extensions. You can create a new empty project file, open an existing IWF file, save the current configuration or save the configuration under a different name.



[AP_3]

6.3 App export overview

The new IPEmotion App for Android operating systems gives users the possibility to see online data on smart phone and tablet PCs.
The export of the IPEmotion App configuration (.IAW) is organized in two main system setups. One export is dedicated for measurement setup using IPEhub2. The other export is dedicated for setups using M-LOG together with a COMgate to stream the data to the tablet with IPEmotion App.



[AP_4]

6.3.1 Youtube resource

IPEhub2 and IPEmotion APP - Functional Overview http://youtu.be/HGBeR4kvrDM
IPEhub2 is a 2 channel CAN card with LAN and WLAN interface for CAN bus measurements. The internal storage on a removable SD card add a CAN trace data logger functionality to the unit. The diagram below is indicating a measurement setup of IPEhub2 with data transfer to a tablet running the IPEmotion App based on Android.

[AP_5]

IPEhub2 is implemented on the following PlugIns as a CAN interface:

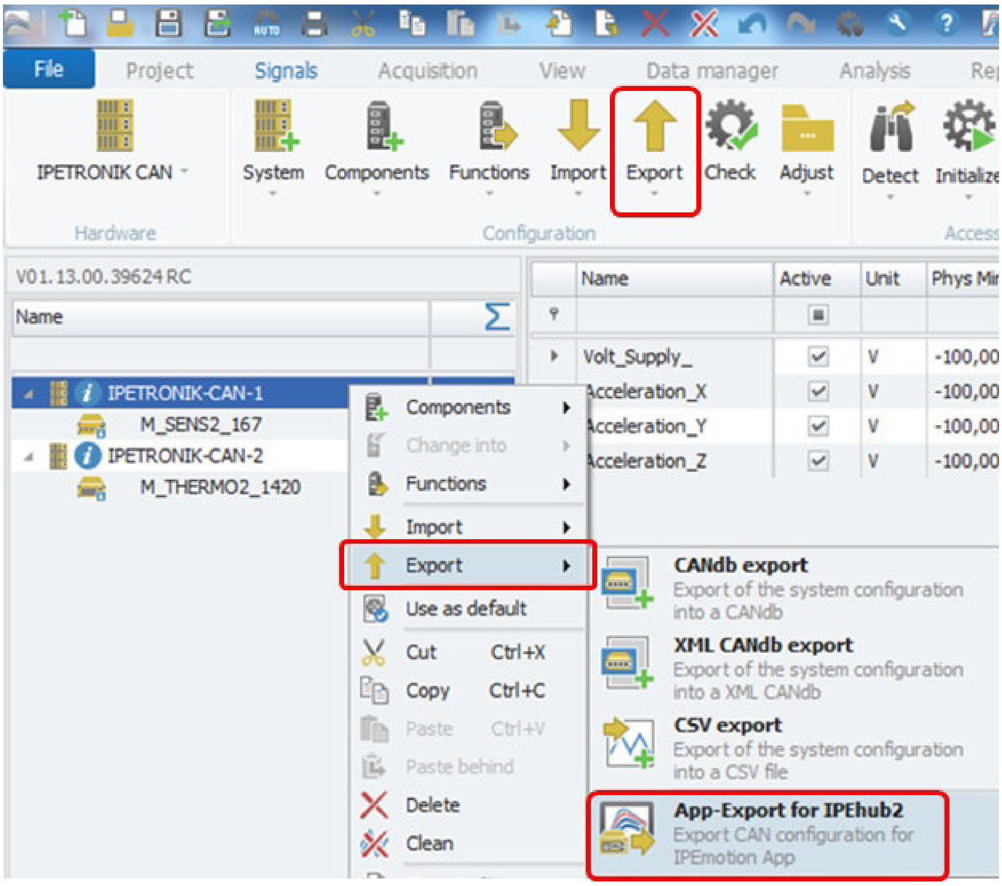
► IPETRONIK CAN PlugIn	V01.13.00
► CAN Acquisition PlugIn	V01.06.00
► Protocols PlugIn	V01.04.02
► X-PlugIn	V02.00.00

You need to establish a LAN or WLAN connection of IPEhub2 to IPEmotion in the first step.

[AP_6]

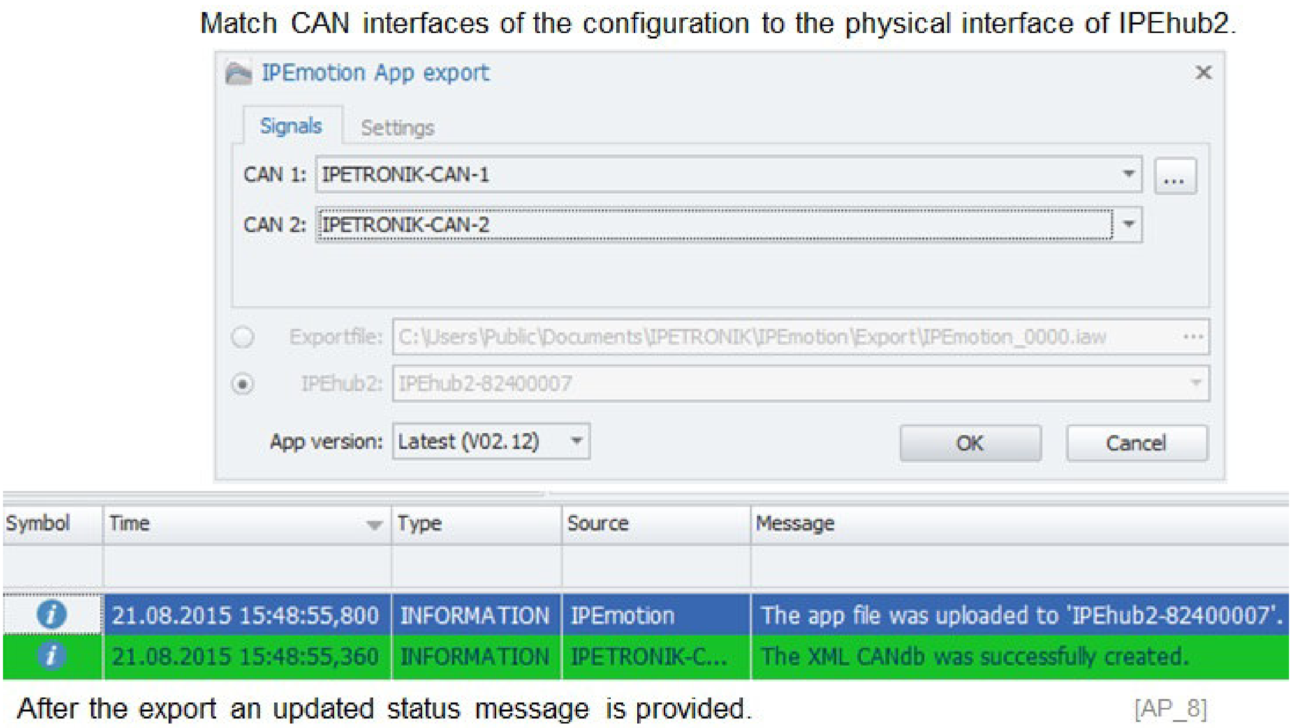
Establish connection to IPEhub2 (example WLAN)

After that you run the automatic hardware detection to recognize the device with modules if any connected. Then you can directly export your measurement configuration from the Application menu or from the PlugIn as indicated below.



[AP_7]

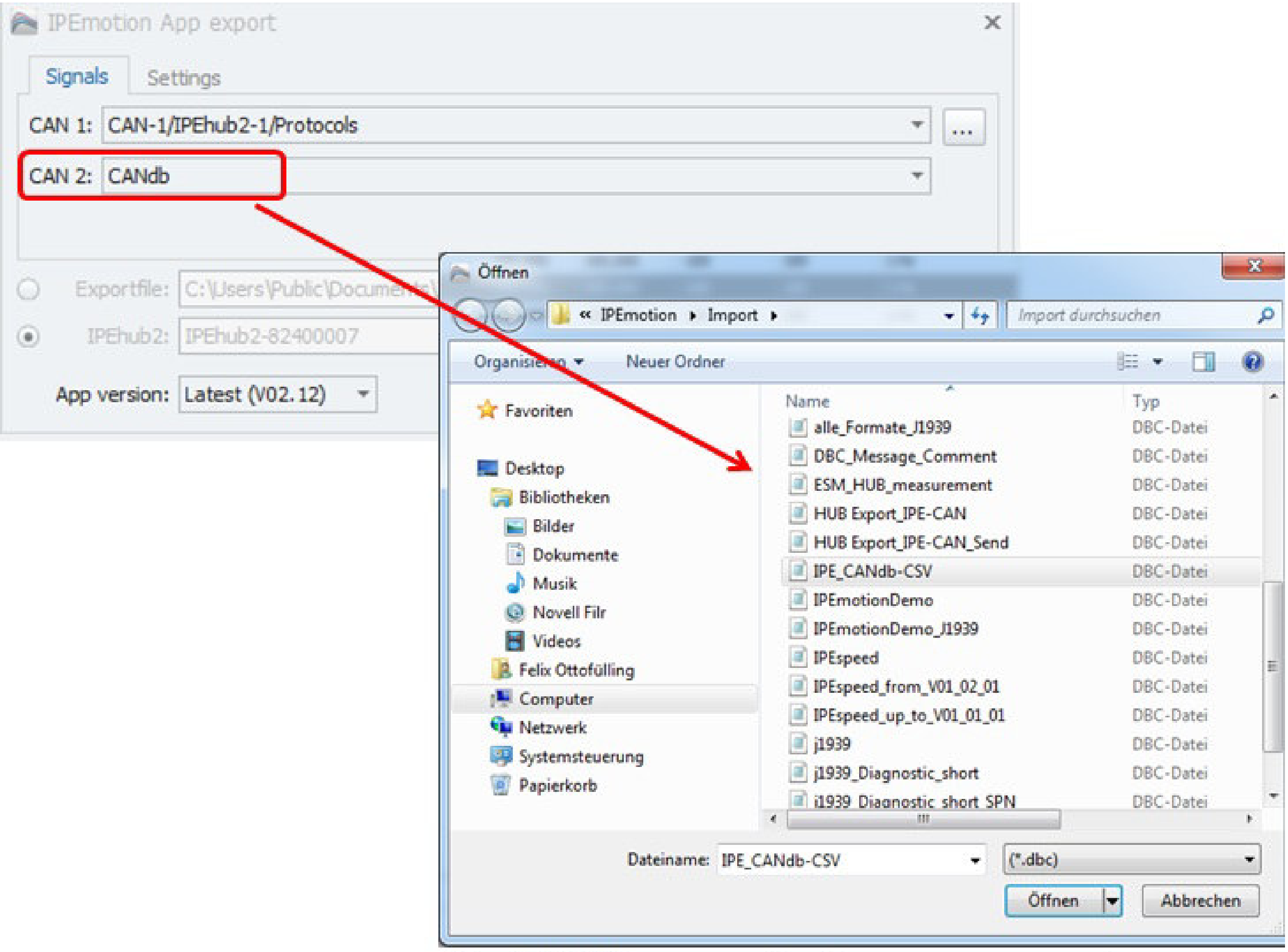
In the export dialog you have to match the configured CAN interface in the different PlugIns like IPETRONIK CAN, Protocols PlugIn or CAN Acquisition the corresponding CAN interfaces of IPEhub2.



[AP_8]

6.3.2 DBC measurement

If you like to perform directly a DBC measurement on CAN1 and / or CAN 2 you can import the DBC. Just select DBC from the drop down list and the dialog takes you directly to the import directory of IPEmotion.

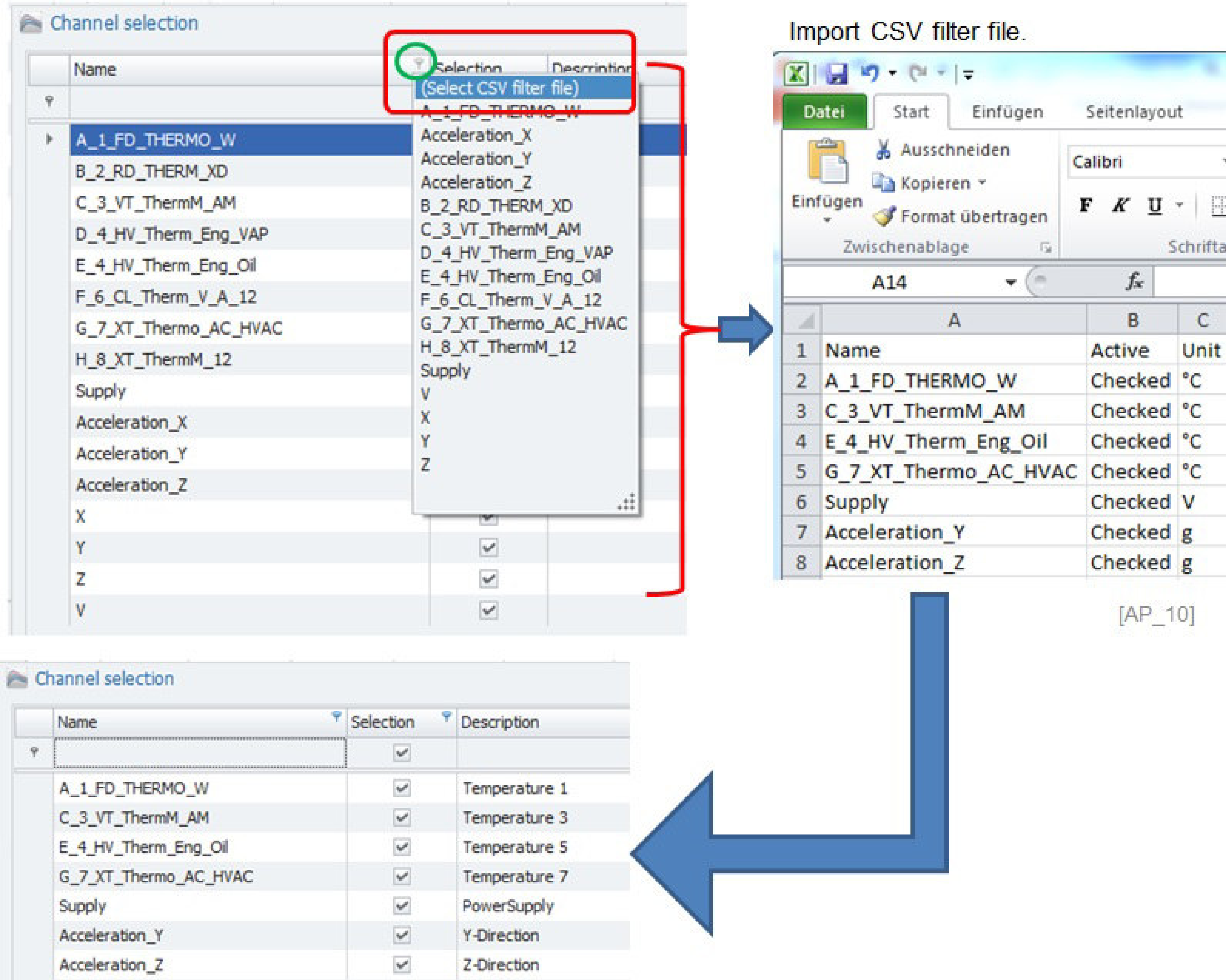


Select DBC file you consider for your measurement. [AP_9]

Information *The IAW App Export is restricted to maximum of 250 channels. The channels are exported by order and the exceeding channels above 250 are not considered in the configuration.*

The app can only support up to 250 measurement channels. Often DBC files include a lot more channels. To de select all undesired channels is a time consuming work. Therefore a CSV filter is implemented. With the CSV filter you can remove easily all channels you do not like to consider for the app measurement.

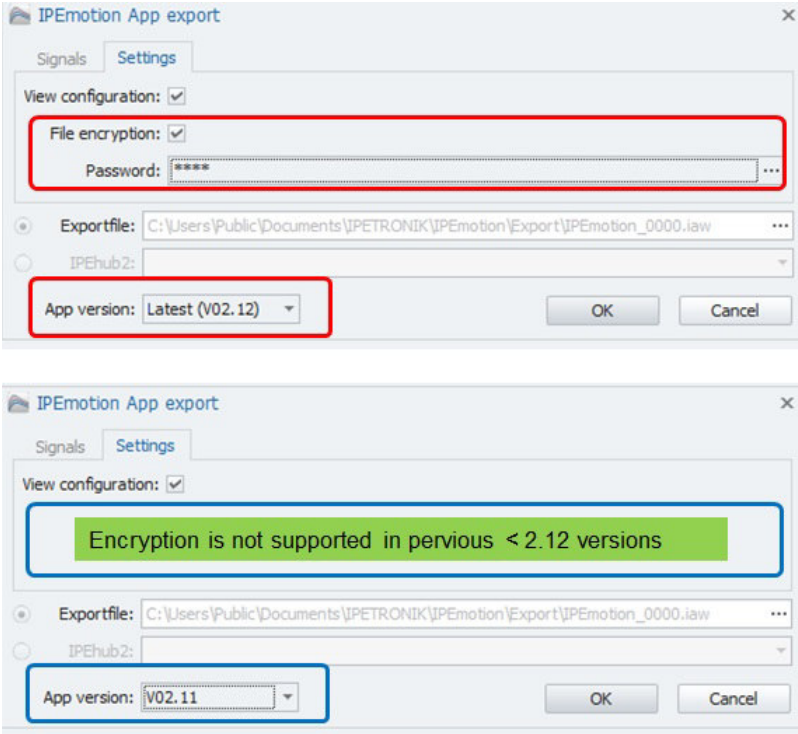
All channels



New channel selection includes only channels from the CSV filter.

6.3.3 IPEmotion App export – settings tab sheet

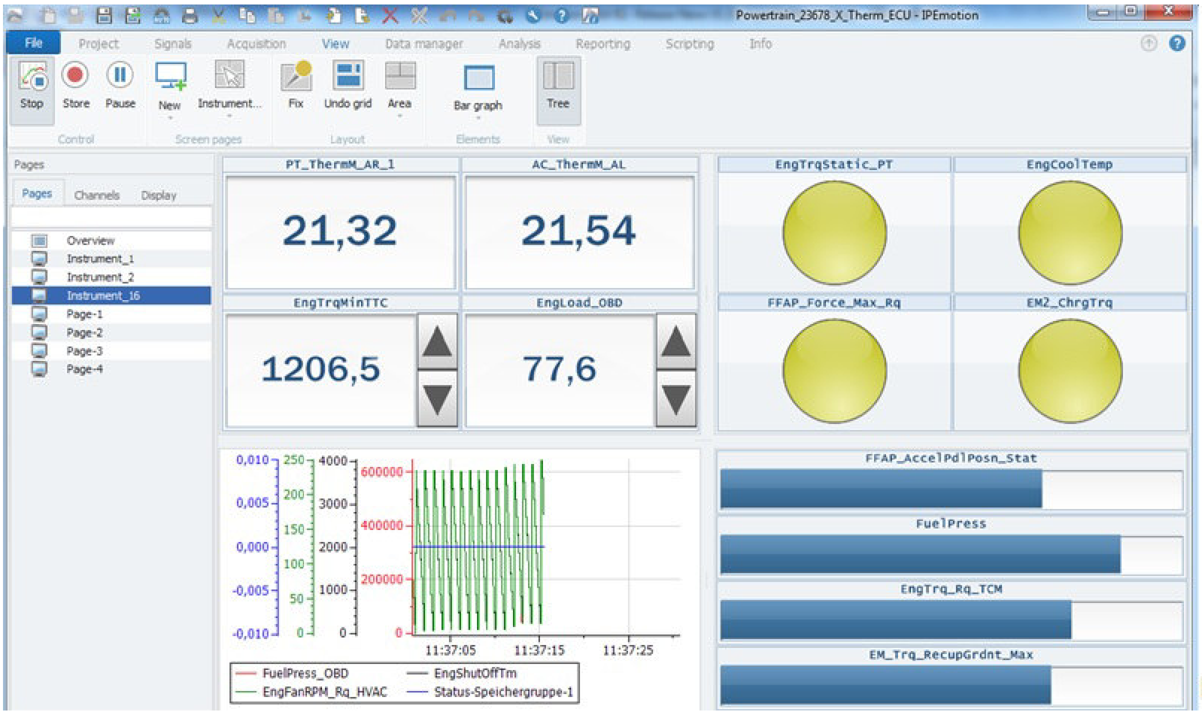
- **App version** — The function of the settings is depending on the selected app version. As the screenshot below is indicating if you select app version smaller 2.12 the settings for file encryption are not supported.



[AP_11]

- **File encryption** — When you enable the file encryption the check box for password is enabled as well. You can then define a password for the IAW file which will be needed to open the App configuration on your tablet.
- **Password** — Define password for the App configuration.
- **View configuration** — When you enable this check box you can transfer instrument and display pages to the App. The IPEmotion VIEW configuration should meet the following criteria: Supported Instruments: Alphanumerical, LED, Bar chart, Yt-chart Instruments per page: 4 max Number of channels per instrument: 4 max Number of pages: 20 max Number of channels in the configuration: 250 max

The screenshot shows all 4 supported instruments with a maximum number of channels assigned by each instrument type. If your VIEW configuration contains other instruments or more channels the exceeding channels and the incompatible instruments are not exported to the App IAW file.

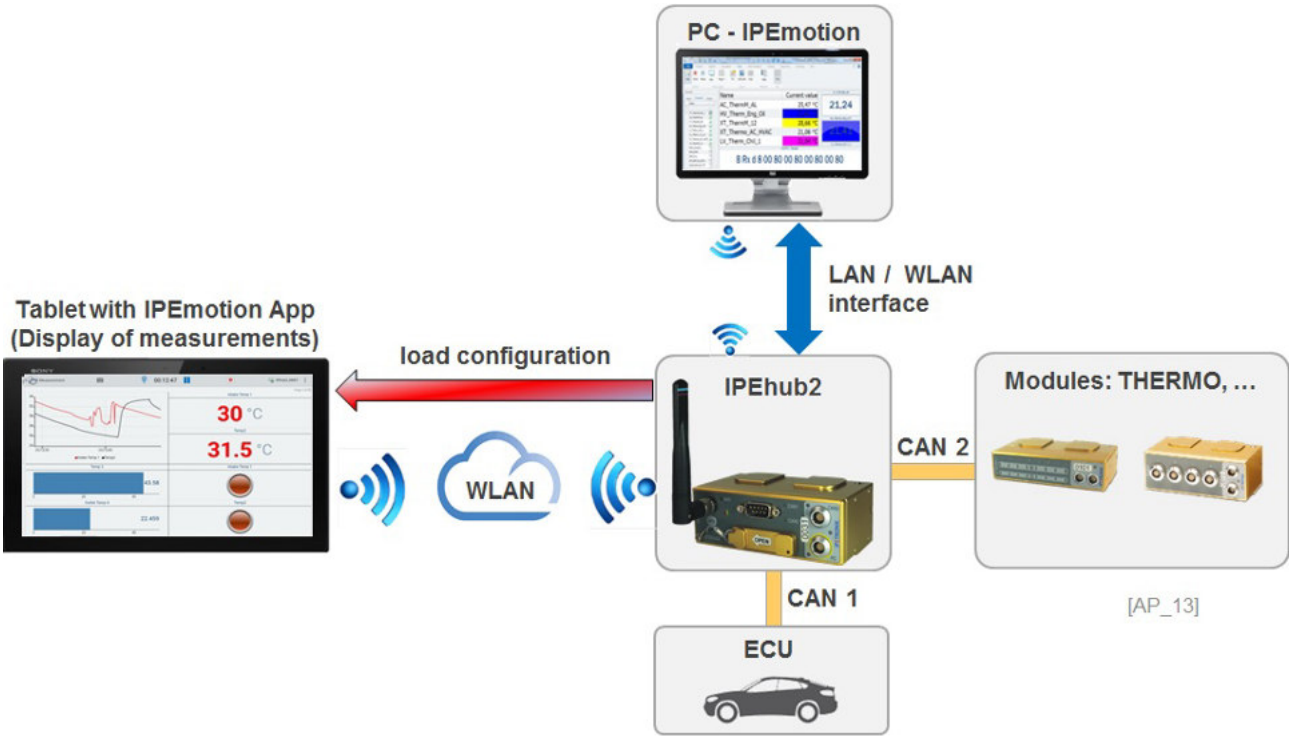


[AP_12]

Information *To import an encrypted IAW configuration you need App version 2.12 or higher.*

6.3.4 IPEmotion App – active configuration import

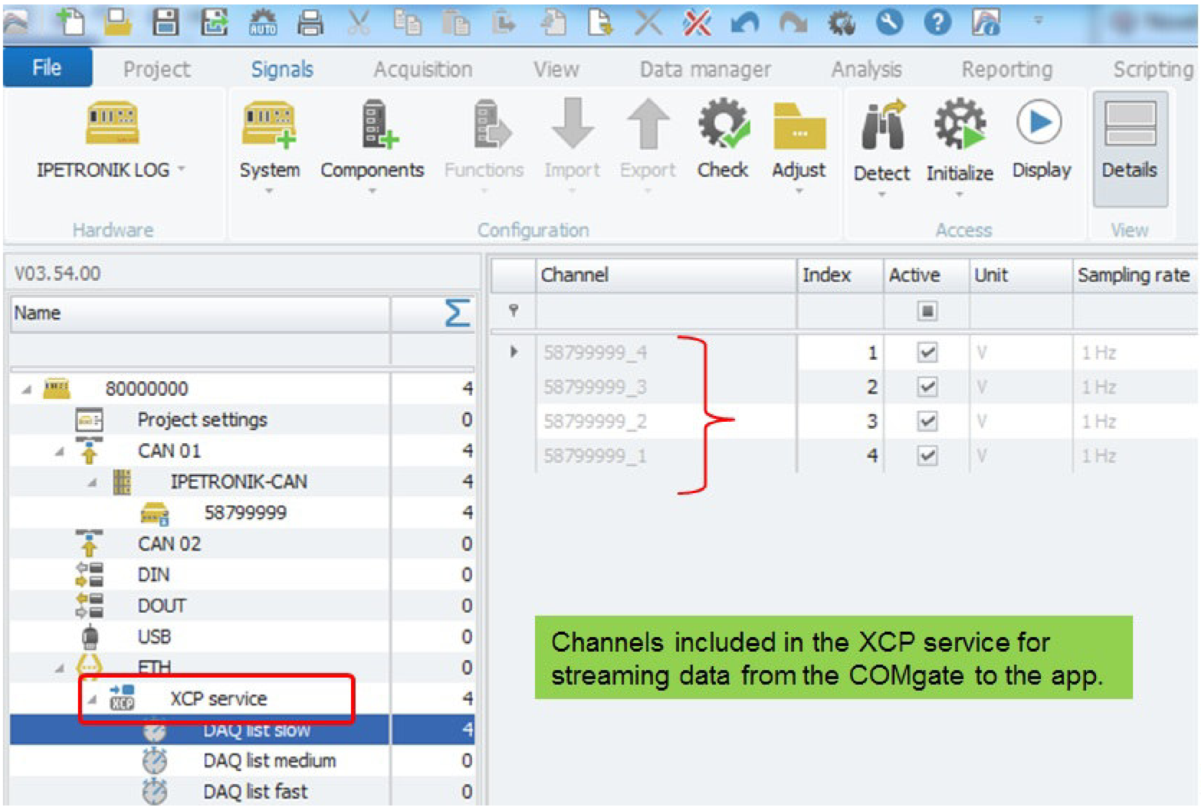
When you have established a WiFi connection from your tablet to the IPEhub2, the IPEmotion App is automatically importing the app configuration file (.IAW) from the non-volatile memory of IPEhub2. You can then directly start with your measurements on the tablet.



[AP_13]

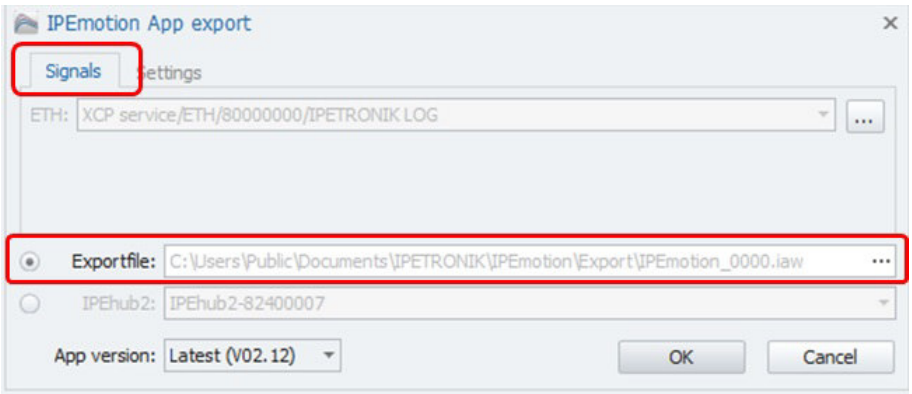
6.3.5 App export for M-LOG with COMgate

The IPEmotion App can receive data from the M-LOG data logger in combination with the COMgate. The COMgate is operating as an access point and all channels included in the XCP Service can be exported to the App. As discussed for IPEhub2 the App can also receive a maximum of 250 channels from the XCP service from M-LOG.



[AP_14]

Export the XCP configuration to the PC.



Export XCP configuration to PC. [AP_15]

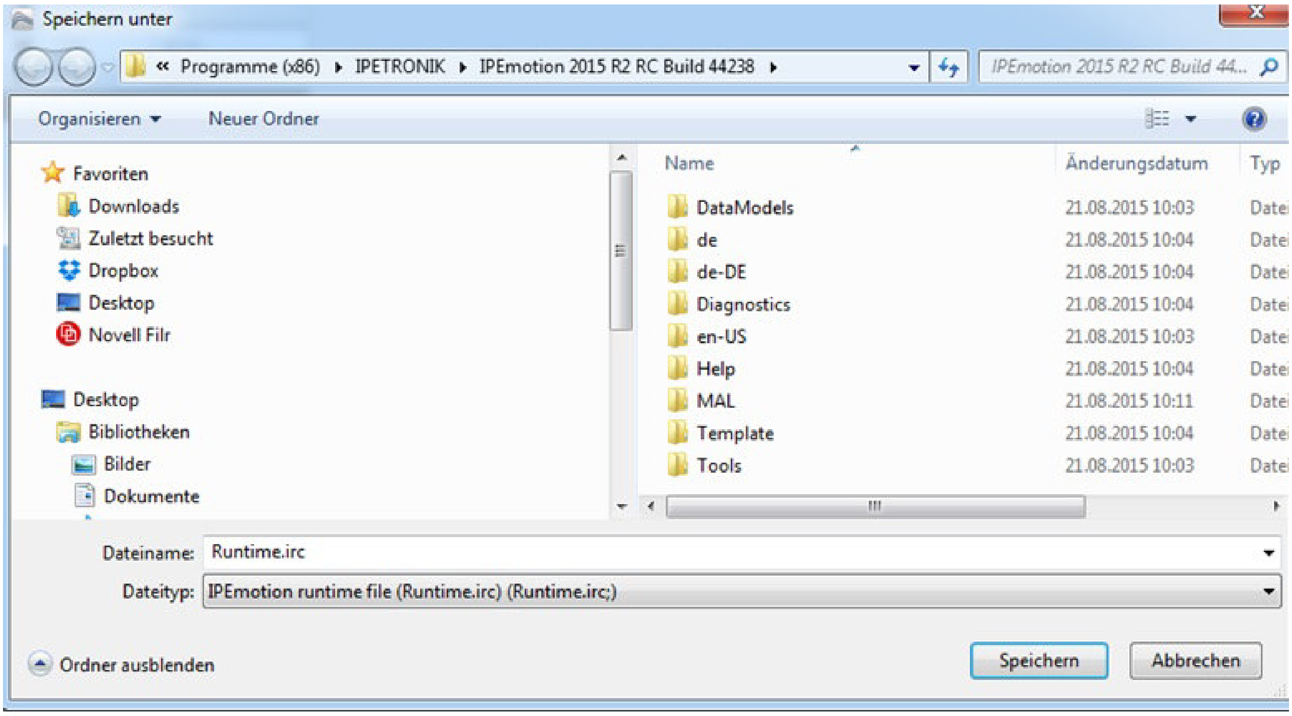
The app configuration has to be transferred manually to the tablet. The IPEmotion App can open the configuration when in the app “Global Settings >Hardware” are set to communication interface to COMgate.

Information *There is a separate manual available which explains the configuration of IPEmotion App together with IPEhub2 and COMgate.*

6.4 Runtime Versions

If you have activated a Developer Edition of IPEmotion you can export runtime IRC files. This runtime files are automatically stored in the installation directory of the IPEmotion version you have currently started.

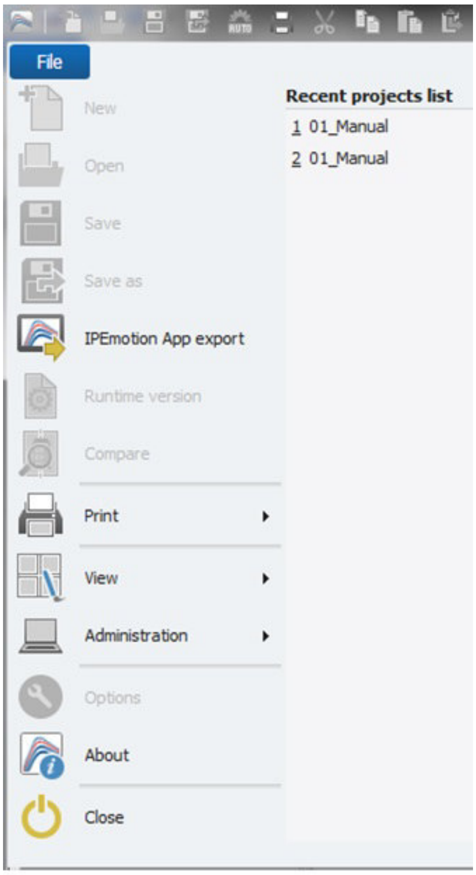
Win7: C:\Program Files (x86)\IPETRONIK\IPEmotion 2016 R2.1



[AP_16]

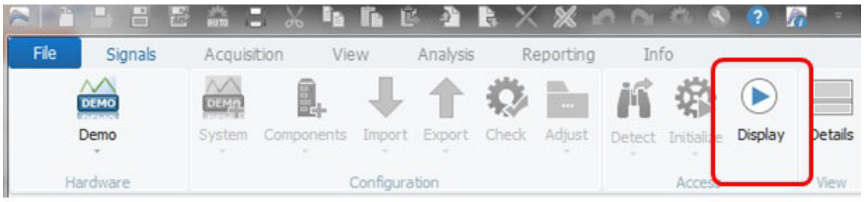
With every program start IPEmotion searches this directory for the Runtime.irc file. If this file is available it will always start the Runtime project.
Runtimes are suitable program solutions for applications which require very limited user interaction like starting and stopping data recording or operating static test bench applications with standardized reporting processes. As soon as the application requires any flexibility to modify the signals configuration or the report output the Runtime application is not suitable. You also cannot switch between different Runtime applications. Only one runtime file with the specific name “Runtime.irc” is automatically loaded at program start. If you like to get back to your original IPEmotion Edition you need to remove or rename the IRC file and start the software again.
The runtime project is an executable with very limited functions. The user of a runtime project can only start and stop data acquisition and storage and load data files in predefined analysis and reporting templates. You can also use analysis tools like zoom, stretch, cursors, etc. . . .
However, you cannot change the GUI interface of the VIEW work area nor can you modify any channels and instruments in the SIGNALS and ANALYSIS work space. The layout designer for customizing reports is also deactivated. The following screenshots of different ribbons are indicating the very limited functions of runtime projects.

- Application Menu of a runtime project



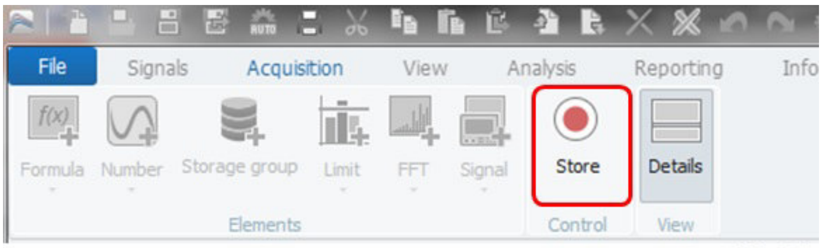
[AP_17]

- Signals



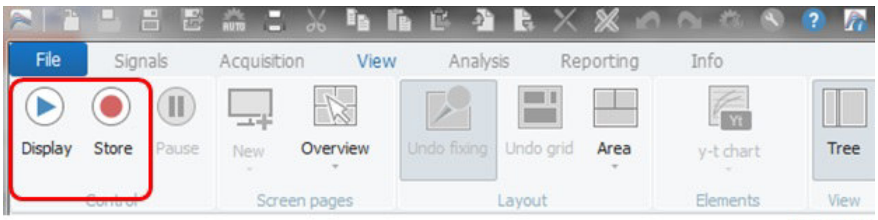
[AP_18]

- Acquisition



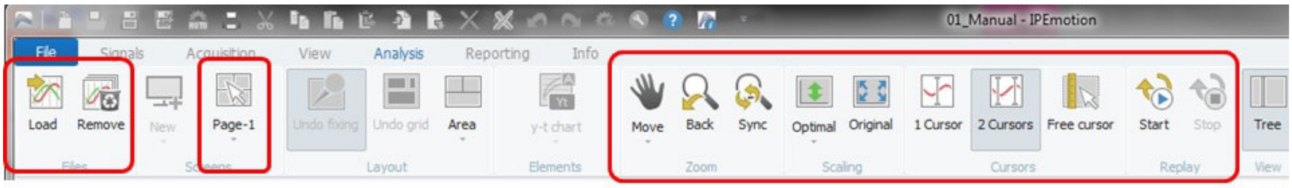
[AP_19]

- View



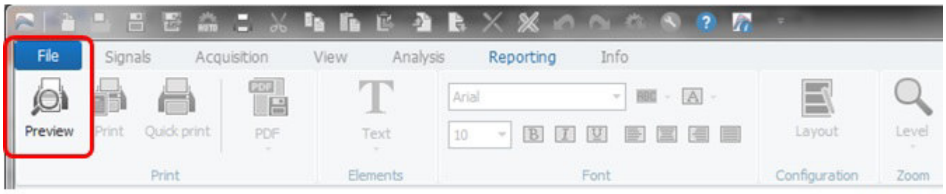
[AP_20]

► Analysis



[AP_21]

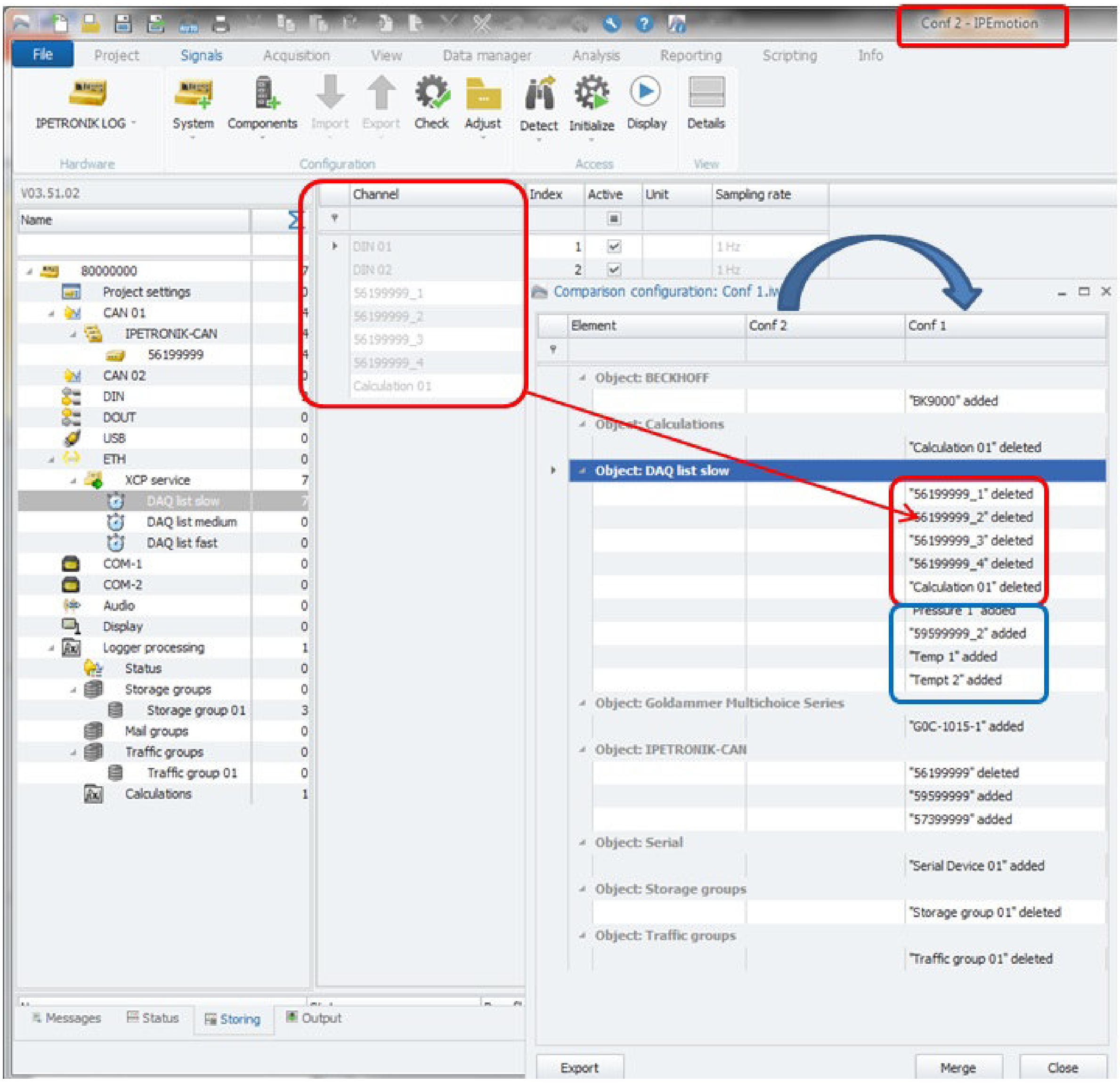
► Reporting



[AP_22]

6.5 Comparing configurations on SIGNALS level

This function compares IWF project files in regard to the signals configuration. Load one configuration and compare it with another IWF project file. The table will show which elements are included (added) in the other configuration or which elements are missing (deleted). In this example Conf 2 is compared to Conf 1. The comparison table is indicating that Conf 1 includes more PlugIns (e.g. Beckhoff, Goldammer, and Serial) than Conf 2.
However, both configurations have the DAQlist (Logger PlugIn) and the IPETRONIK CAN PlugIn in common. The channel list is different, though.

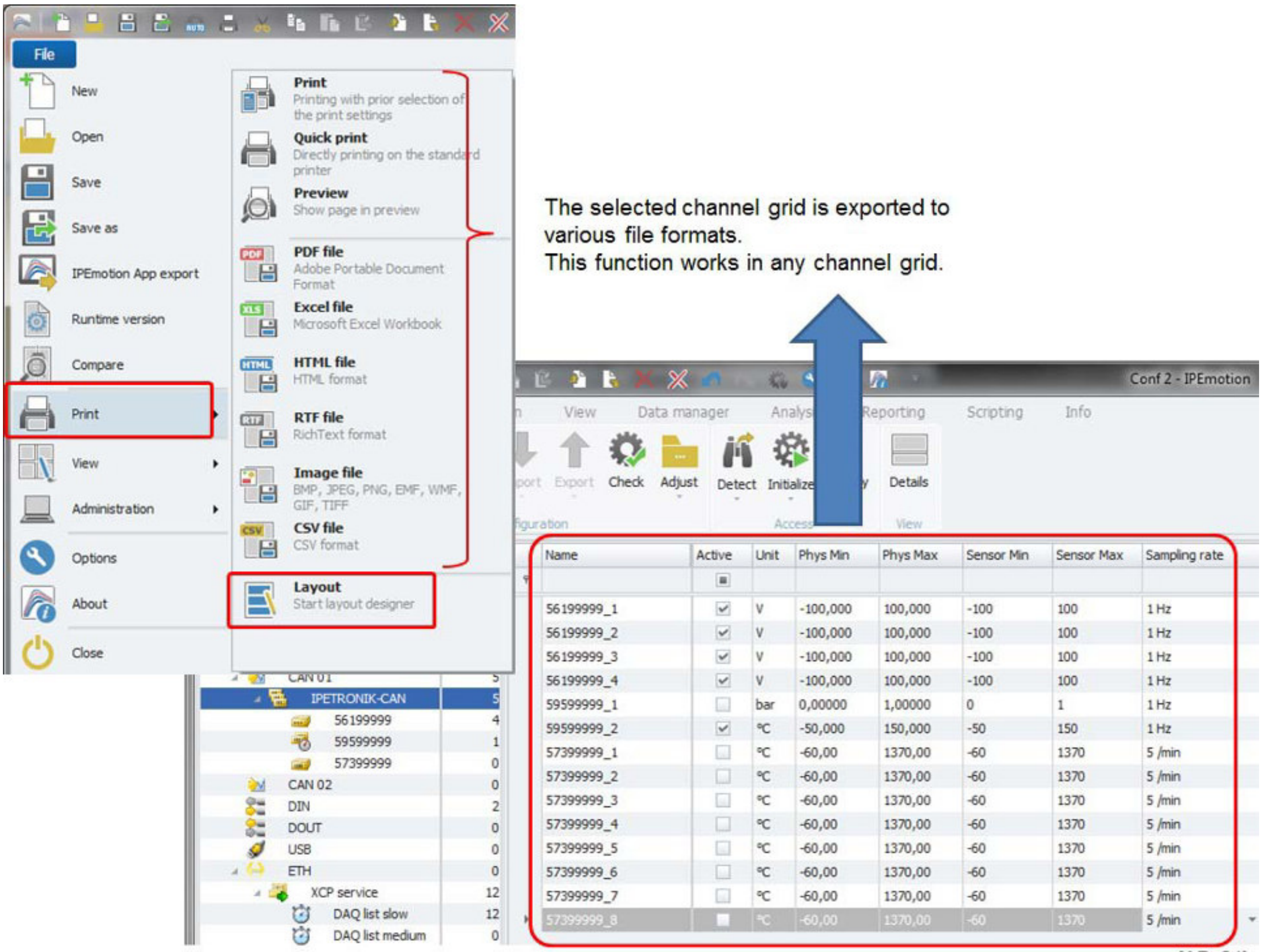


[AP_23]

With the merge function you can combine the signals of both configurations to one common configuration.

6.6 Print

The print function is convenient if you like to export the channel list to another file format for comparing or saving the settings. All visible columns in the grid are exported. This export functionality can be applied to any channel grid in the work spaces of PROJECT, SIGNALS and ACQUISITION and DATA MANAGER. In the DATA MANAGER the print function is limited to 1000 lines. If you load a data file with more than 1000 records you cannot created a PDF file because large data files will overload the PC CPU to create the file. In ANALYSIS and REPORTING you can apply the print functions PDF, HTML and Image file which are the print function of reporting.



[AP_24]

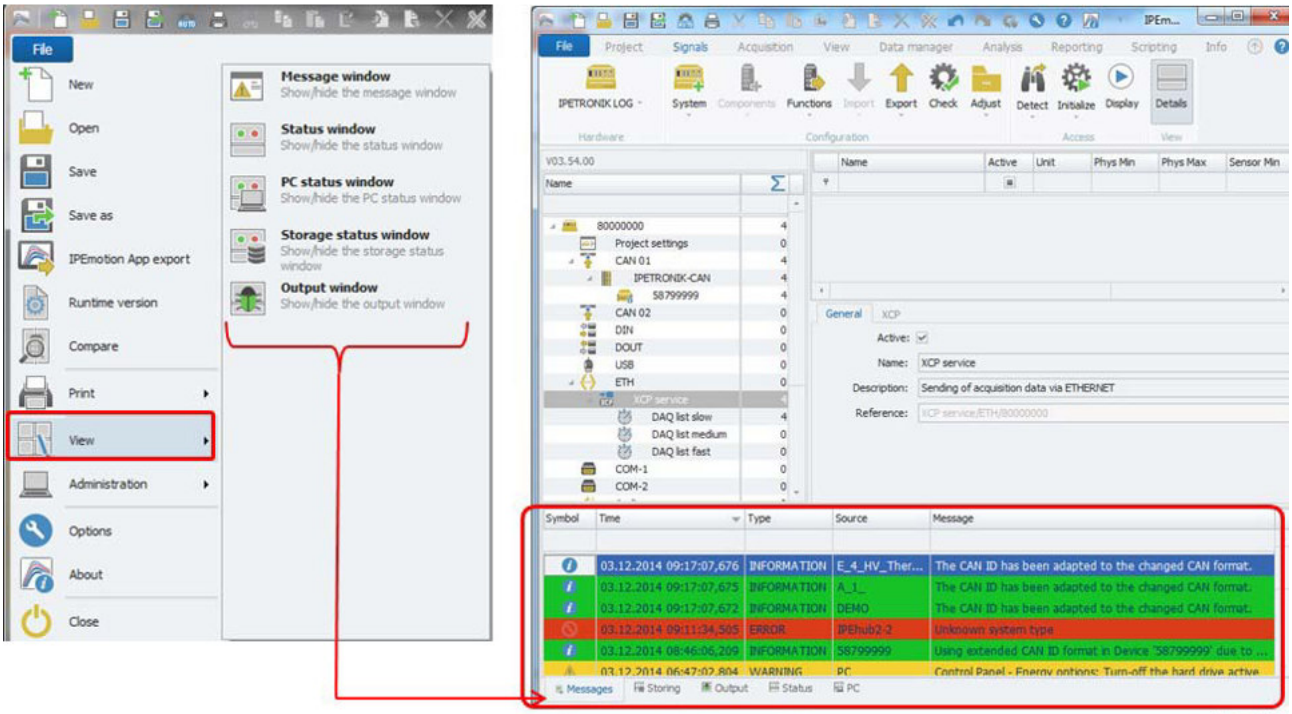
Within the Print application you can start the layout designer which is the configuration tool for customizing your reports. The detailed functions of the layout designer are discussed in the chapter REPORTING 20.3.2.

6.7 View – message docking windows

With VIEW you can show or hide up to five tab sheets in in the bottom line of the application. This tab sheets (docking windows) are accessible in all work spaces and can indicate valuable information for you.

- **Messages** — Indicating all types of error, warning and information messages. This tab sheet is the right place to search for all messages which indicate why things are not working. The time stamp is included, as well, which indicates when the message was generated. All messages are stored in a database which is located in:

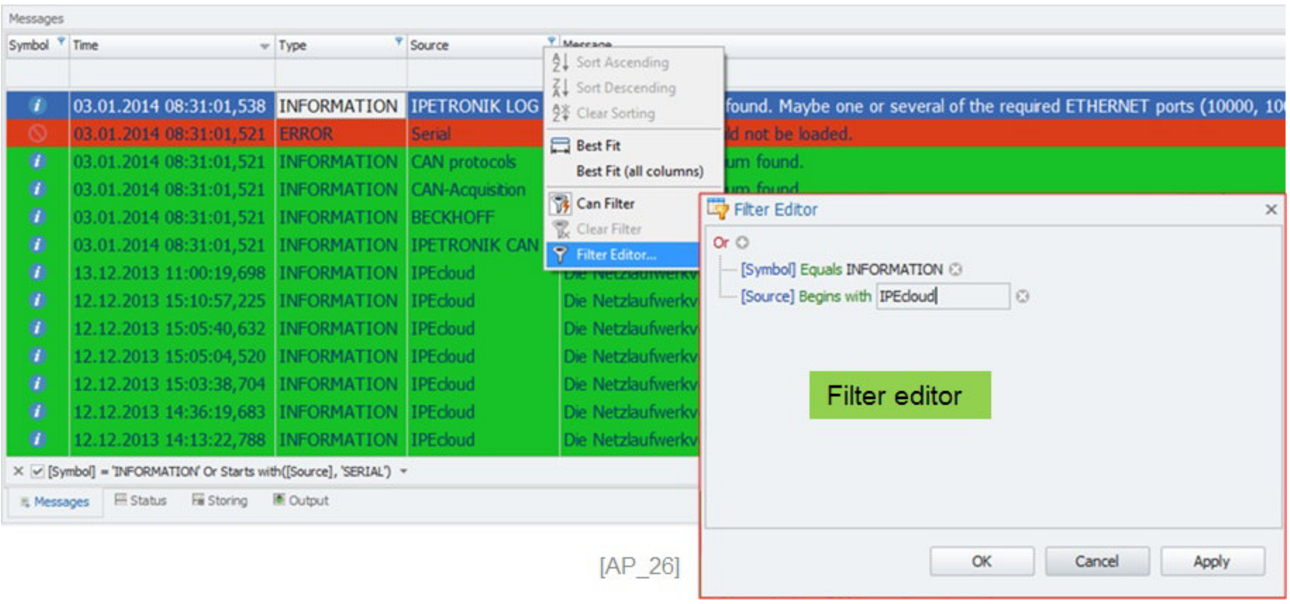
For Win 7 C:\ProgramData\IPETRONIK\IPEmotion 2016 R2.1\Database\LogMessages.db



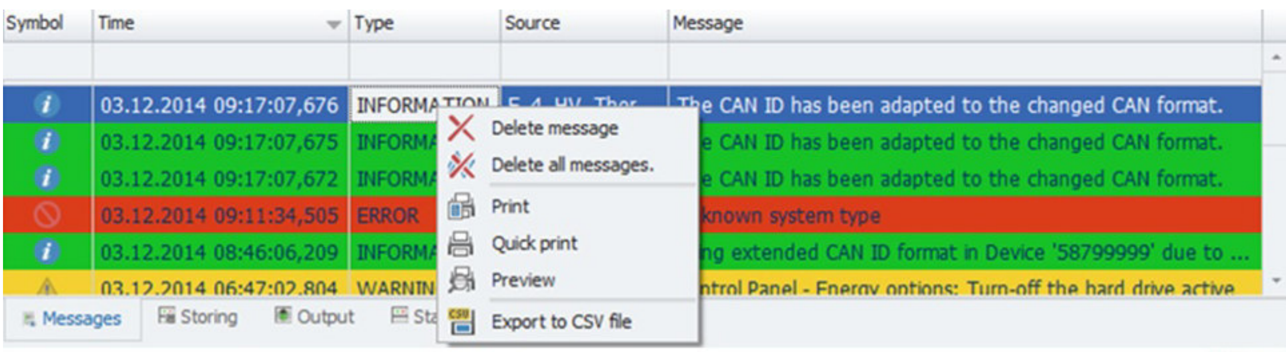
Message docking windows.

[AP_25]

All messages are continuously stored in the data base. You can delete single messages or all messages from the message window. Within each column you can also apply filters and only delete the filtered messages.

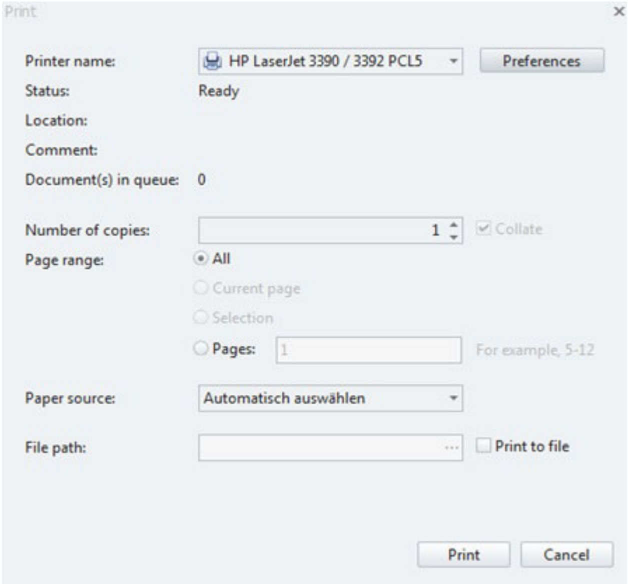


[AP_26]



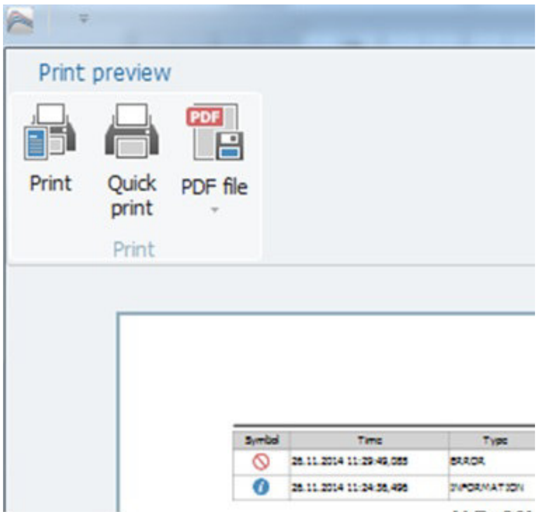
[AP_27]

- ► Delete messages — Here you can delete a single message or all messages stored in the database.
- ► Print — Here you can select the printer and printing options like number of copies or to print to a file.



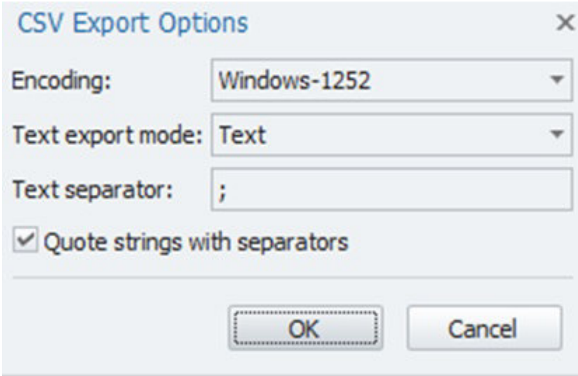
[AP_28]

- ► Quick print — Printing directly to the default printer without a preview.
- ► Preview — Provides a print review with the options to select a printer, print to the default printer directly or to export the report to a PDF file.



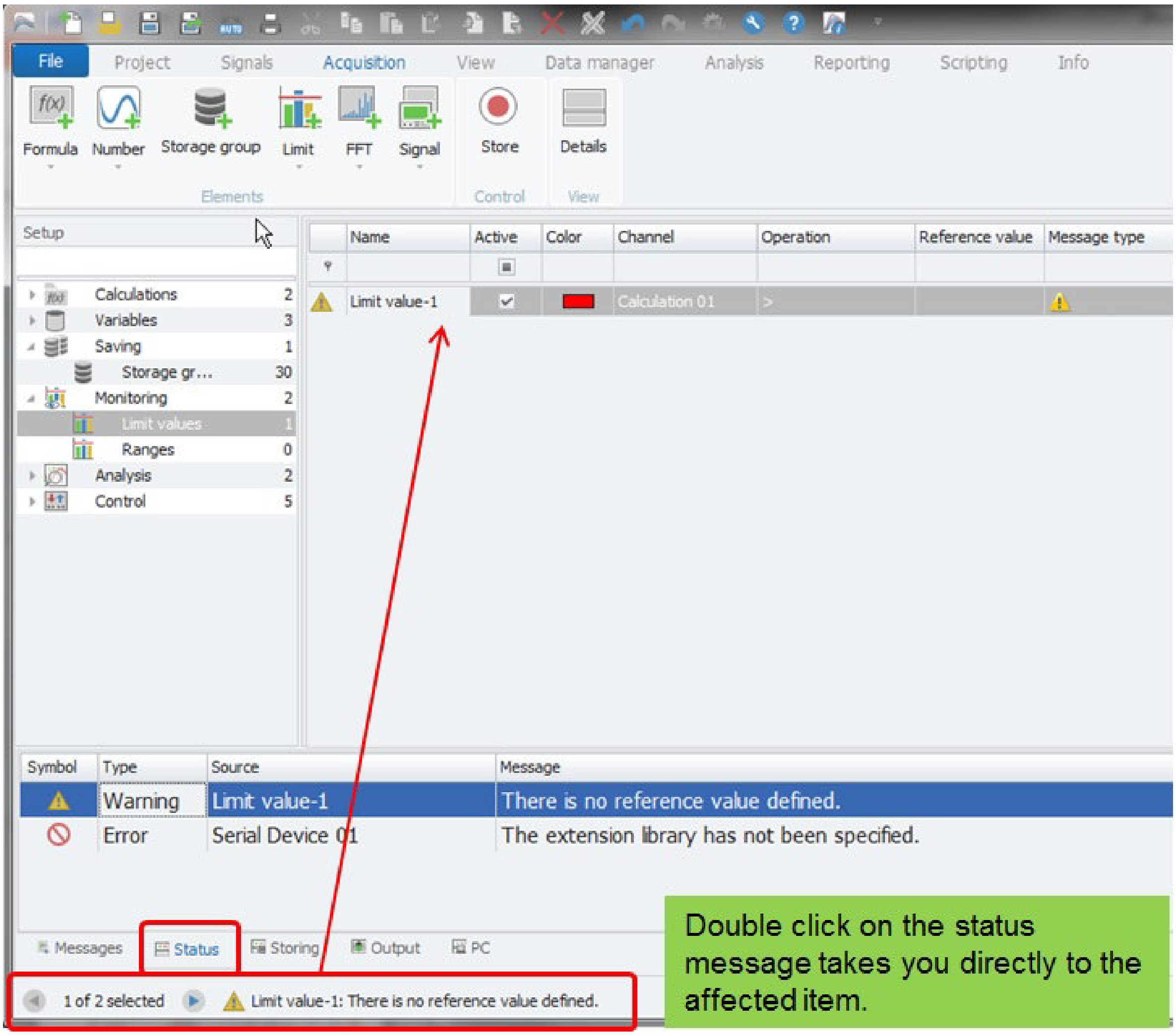
[AP_29]

- **Export to CSV** — Export the data to a CSV file. You can select in the export dialog the encoding, data format (Text, Value), separator. The storage path is the default directory for exports as defined in the OPTIONS >Directory.



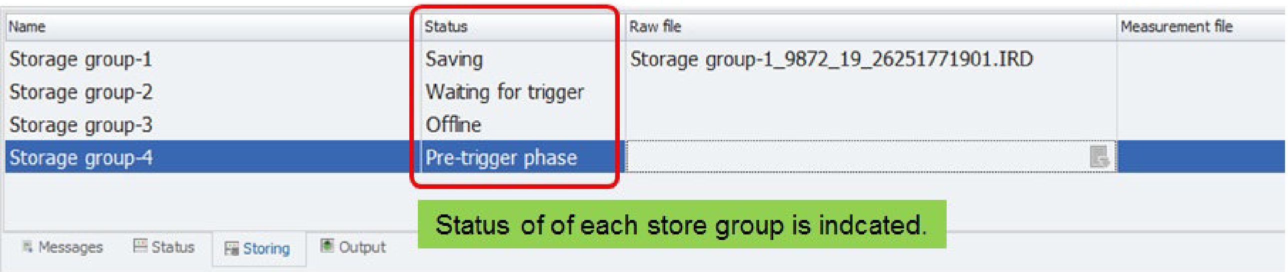
[AP_30]

- **Status** — This tab sheet includes only a fraction of all messages displayed in the message window. These messages are related to configuration inconsistencies. The convenient aspect for you here is: You can double-click on a status message and you will directly jump to the section of the program which generated this message.



[AP_31]

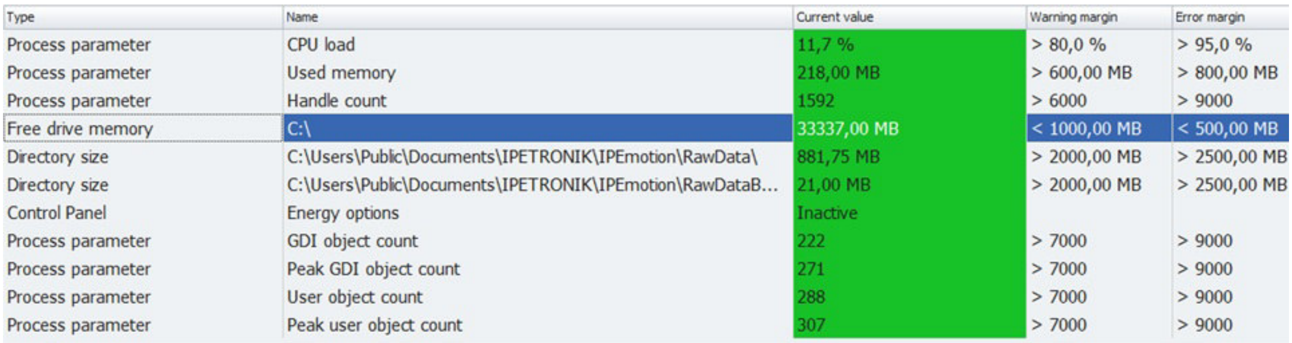
- **Storing** — This window is pointing out if the storage is working and in which status each storage group is operating. The status indication of the storage group depends on the storage group configuration.



Name	Status	Raw file	Measurement file
Storage group-1	Saving	Storage group-1_9872_19_26251771901.IRD	
Storage group-2	Waiting for trigger		
Storage group-3	Offline		
Storage group-4	Pre-trigger phase		

[AP_32]

- **Output** — This window provides output messages for developers.
- **PC** — This window shows PC performance parameters like CPU load, number of threads in use and storage utilization. These parameters reveal if the PC is able to provide enough resources to serve the needs of this IPEmotion application.

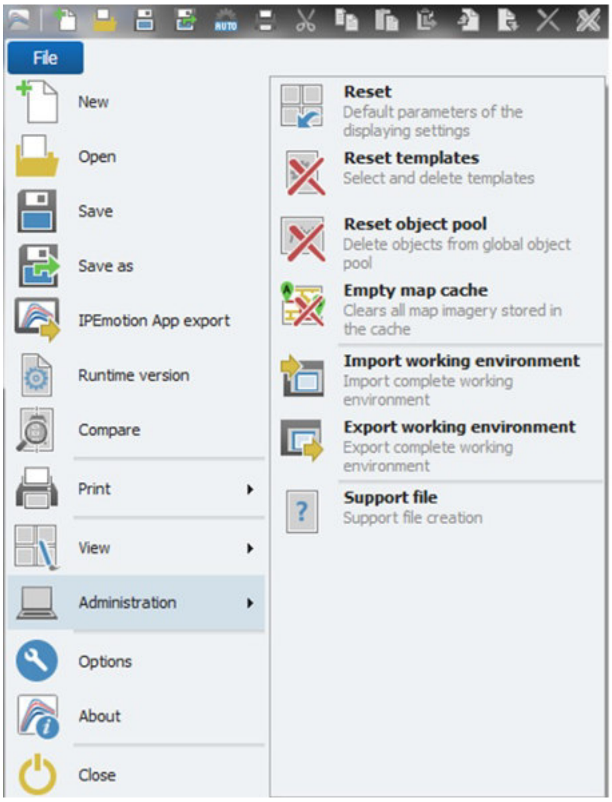


Type	Name	Current value	Warning margin	Error margin
Process parameter	CPU load	11,7 %	> 80,0 %	> 95,0 %
Process parameter	Used memory	218,00 MB	> 600,00 MB	> 800,00 MB
Process parameter	Handle count	1592	> 6000	> 9000
Free drive memory	C:\	33337,00 MB	< 1000,00 MB	< 500,00 MB
Directory size	C:\Users\Public\Documents\IPETRONIK\IPEmotion\RawData\	881,75 MB	> 2000,00 MB	> 2500,00 MB
Directory size	C:\Users\Public\Documents\IPETRONIK\IPEmotion\RawDataB...	21,00 MB	> 2000,00 MB	> 2500,00 MB
Control Panel	Energy options	Inactive		
Process parameter	GDI object count	222	> 7000	> 9000
Process parameter	Peak GDI object count	271	> 7000	> 9000
Process parameter	User object count	288	> 7000	> 9000
Process parameter	Peak user object count	307	> 7000	> 9000

[AP_33]

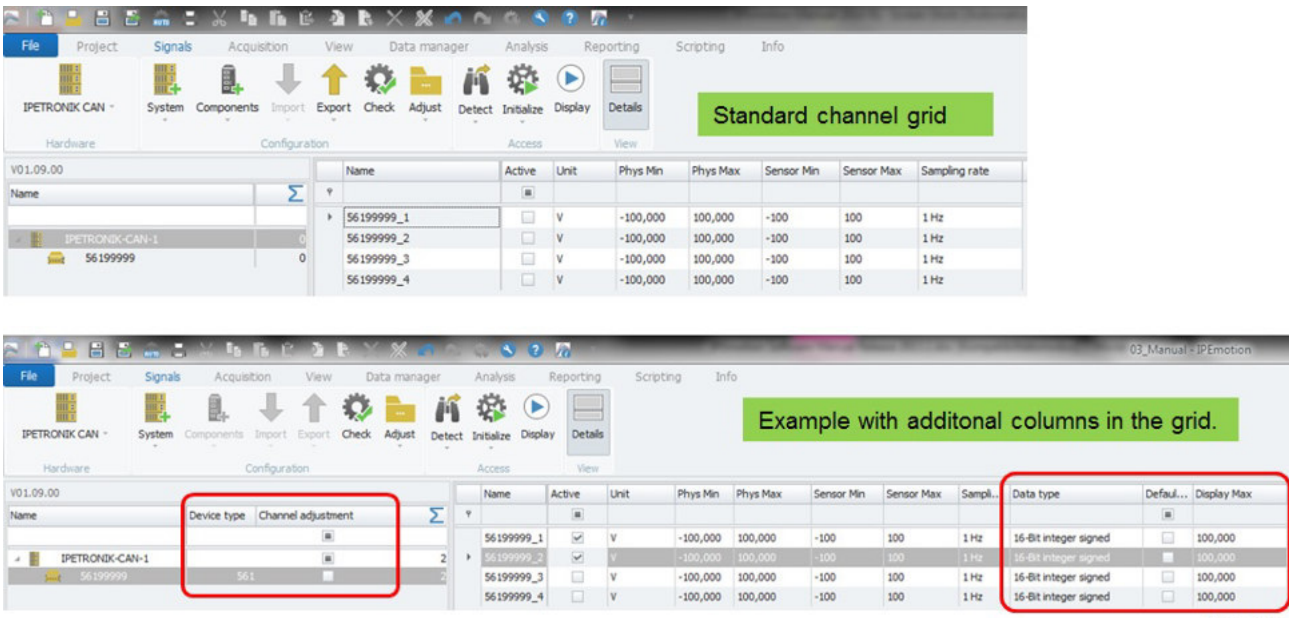
6.8 Administration

Under ADMINISTRATION you can reset global configuration settings to factory default.



[AP_34]

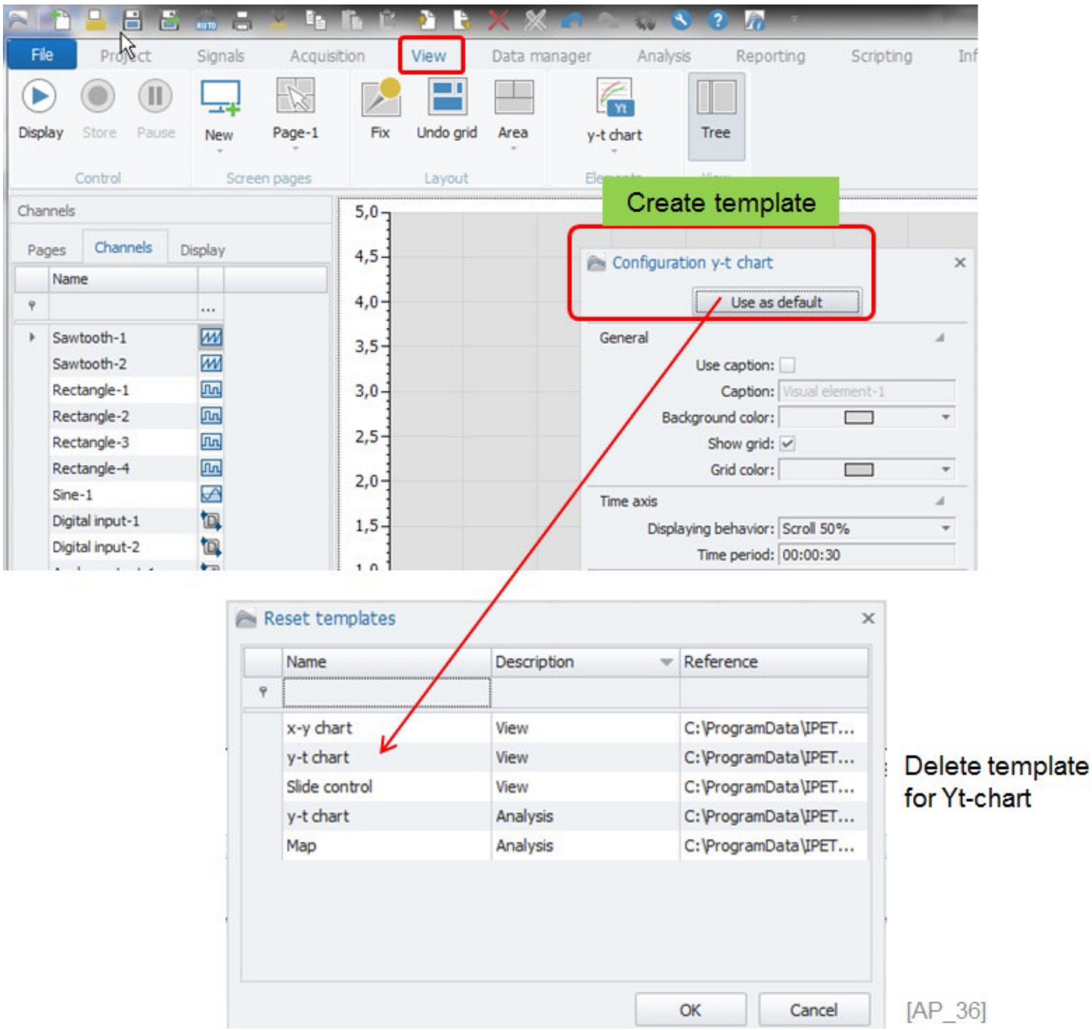
- **Reset** — With the reset functions, many customizing options are set back to factory default. This affects all columns you have added to any type of grid. Customization of the ribbon will be reset, as well. Customizing functions of the ribbon will be explained in chapter 7. The application restarts after the reset.



[AP_35]

- **Reset templates**

In the VIEW and ANALYSIS work area you can define templates for instruments. Once you have defined a template, all instruments will be created in this format. For example, if you like to always have a grey background on your Yt-chart you can save this setting as default. For example see chapter VIEW >Yt- chart properties for more details 17.7.

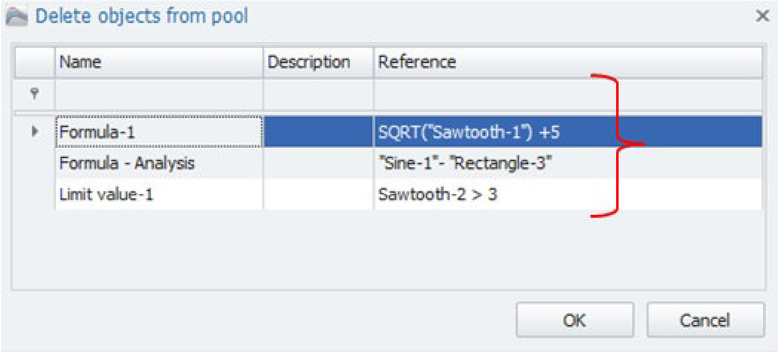


[AP_36]

- **Reset object pool**

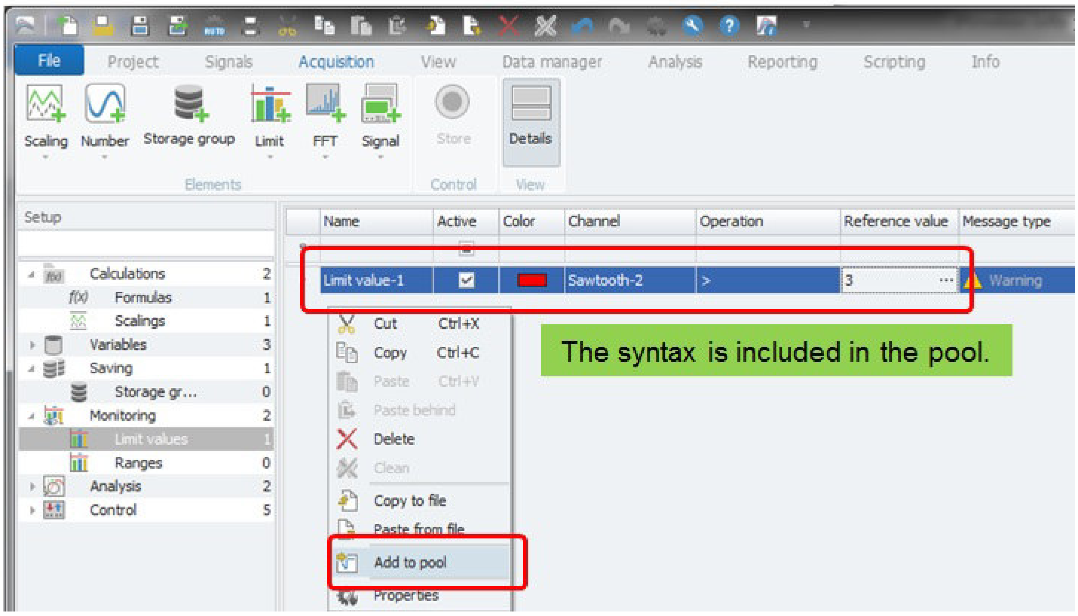
The object pool refers to all items saved to a common repository. Formulas for online and offline calculations and configurations of limit channels can be saved to a pool. You can draw from this pool to build your applications more effectively. Especially when you have complex math operations it is comfortable to save the syntax in a pool. The formulas are saved in the following directory. For more details about the formula pool see chapter 13.2.2.

For Win 7 C:\ProgramData\IPETRONIK\IPEmotion 2016 R2.1\UserSettings\ObjectPool.xml



All formulas and limit channel configurations are saved to the pool.

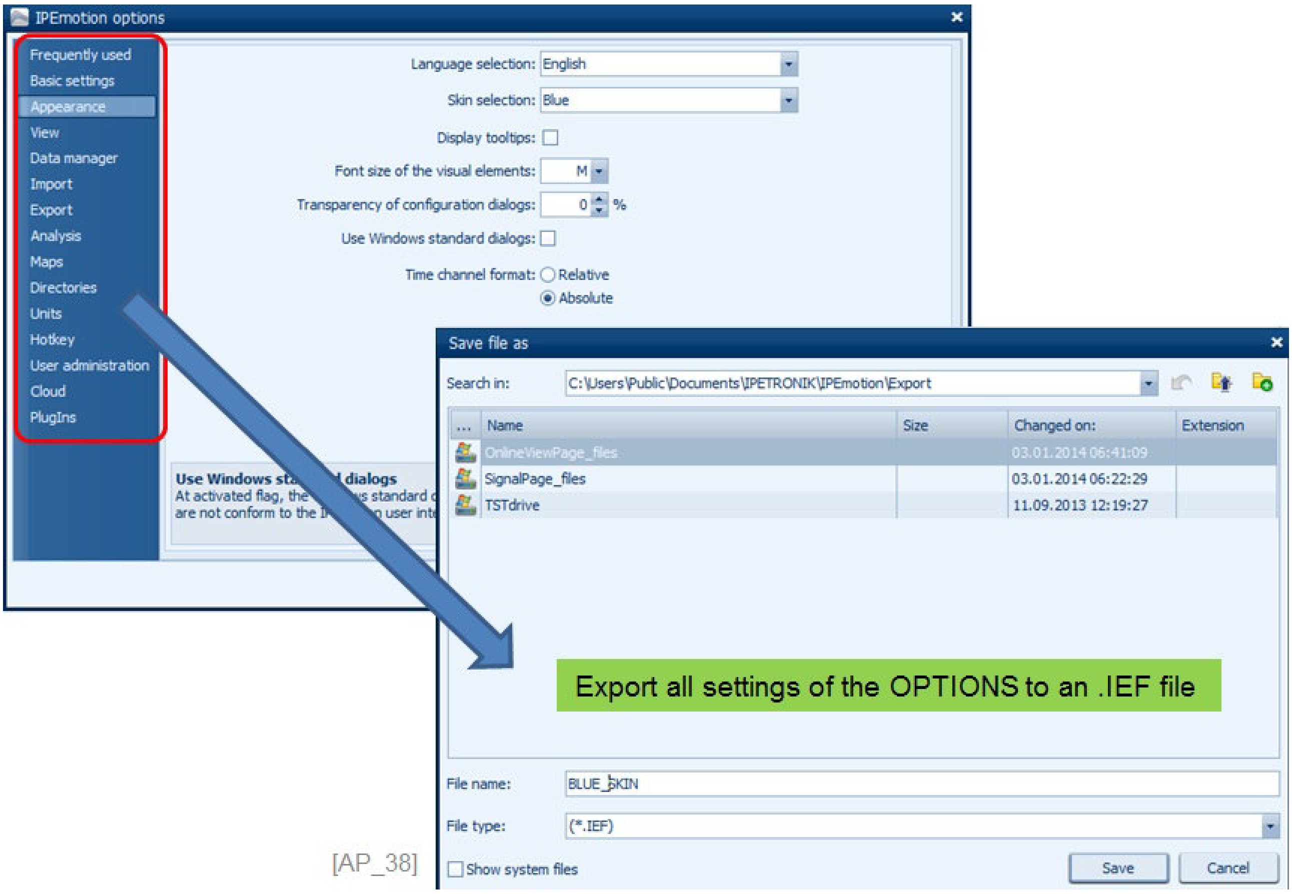
Select the items you like to delete and confirm dialog with OK.



[AP_37]

► Export working environment

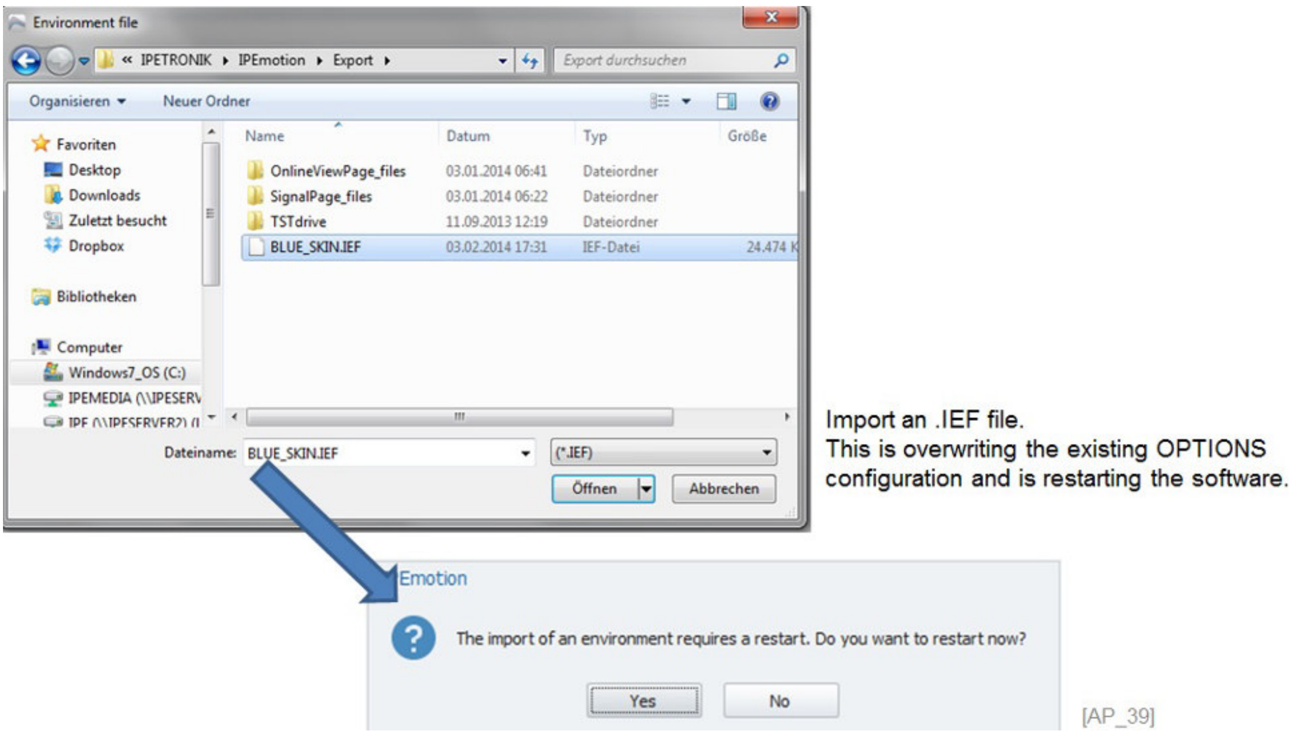
This function exports the settings made under OPTIONS. Every user has his own OPTION configuration and this has an impact on project files (IWF). In order to ensure that a project file works on another computer just like it did on the original PC, it is recommended to export the settings of the OPTIONS to an .IEF file.



[AP_38]

In this example, a BLUE_SKIN configuration is exported to an .IEF file.

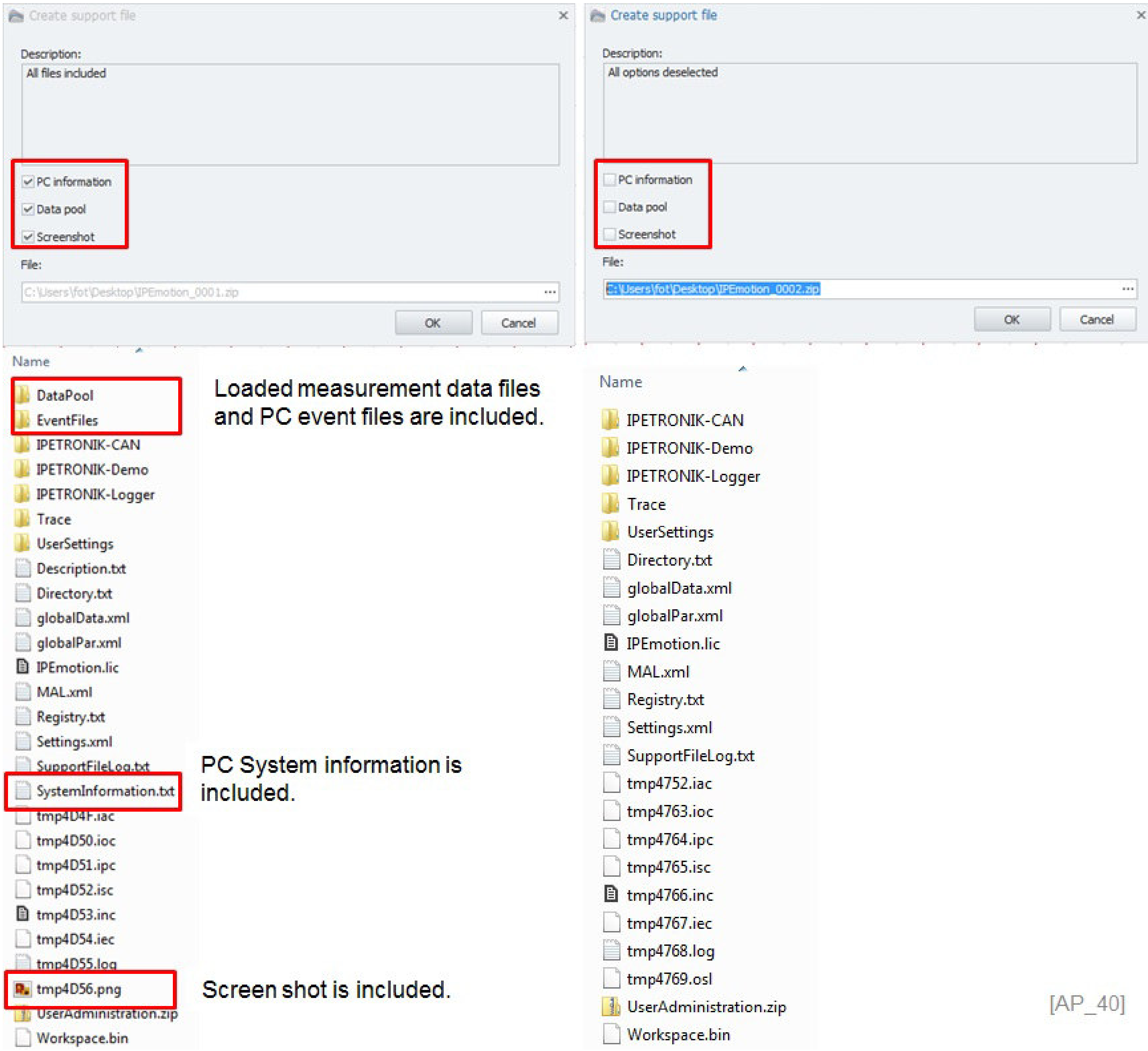
► Import working environment — When the .IEF file (BLUE_SKIN) is imported, the settings of the current options (e.g. V2_Skin) of this computer are overwritten. The software requires a restart after import.



[AP_39]

► Support file

The support file is very important for analyzing problems that may occur with your IPEmotion application. When you generate a new support ZIP file you can decide which files are included. The PC system information, PC event log information and data files from the analysis / data manager work space can be excluded. If you reproduce an error message you can directly integrate this screenshot during the support file generation.



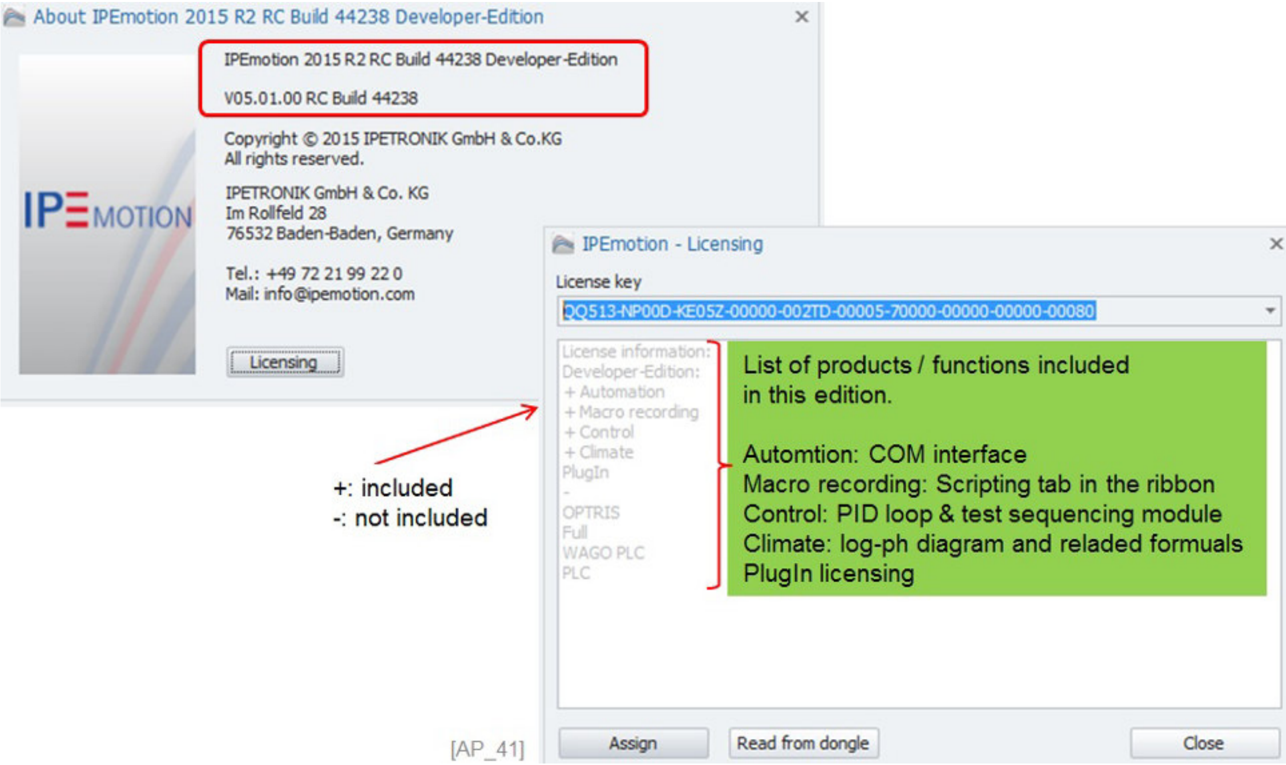
[AP_40]

6.9 Options

In the OPTIONS, you can configure many important settings which have a great influence on your IPEmotion application. For details see chapter 22.

6.10 About

This dialog shows you which version and edition you are currently using. In the ABOUT dialog you can activate new license keys, as well. The license activation for PC, servers or dongles is explained in the chapter Licensing 5.



[AP_41]

6.11 Close

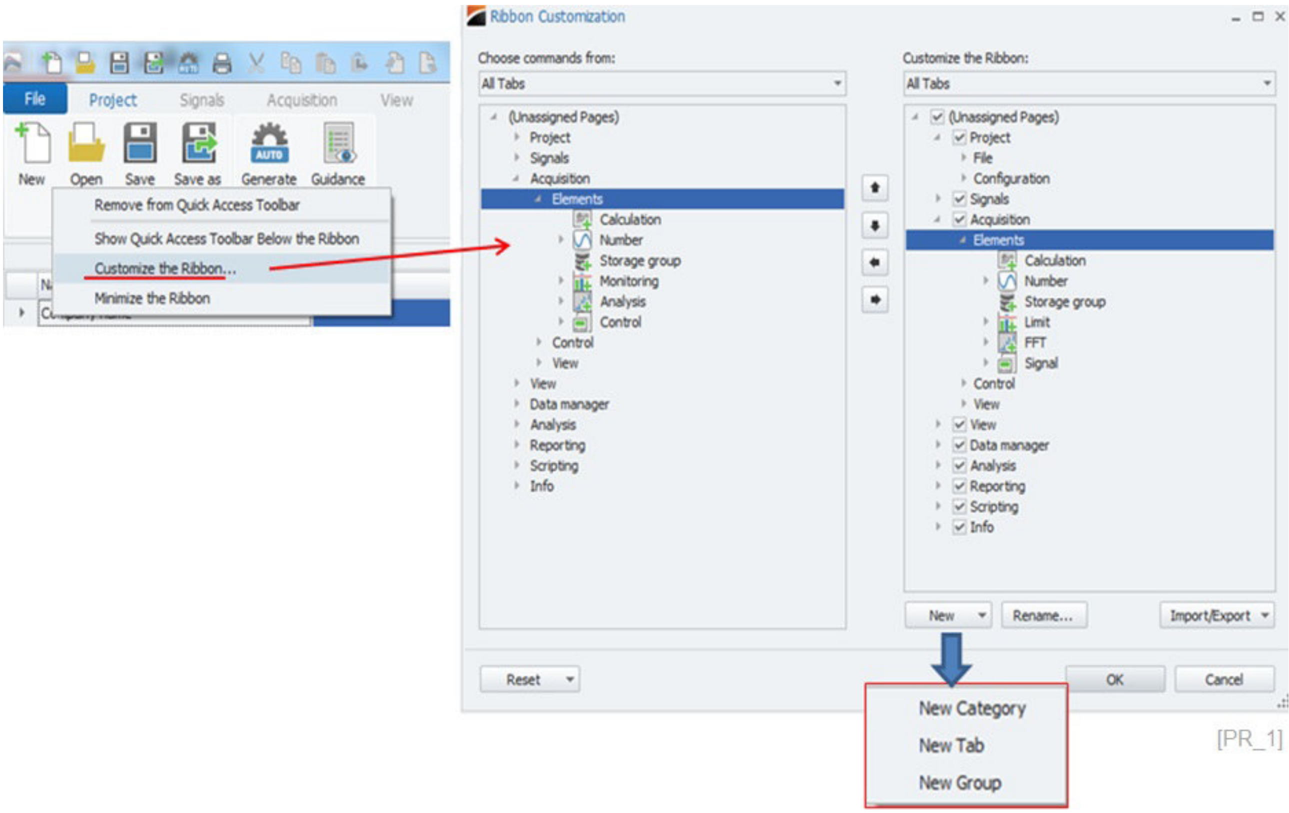
CLOSE exits the application.

7 Customizing your own ribbon

7.1 Customizing icons

To customize the ribbon you can launch a new configuration interface in the ribbon context menu. The main concept is to link commands into any work area where they are most convenient for you. The easiest function is to deactivate tab sheets, rename them or change the order. The 3 main elements for customization will be explained later on.

- Group: container to add functions / commands to an existing tab sheet
- Tab Sheet: new work area which appears in the ribbon of the main navigation
- Category: container to organize tab sheets individually

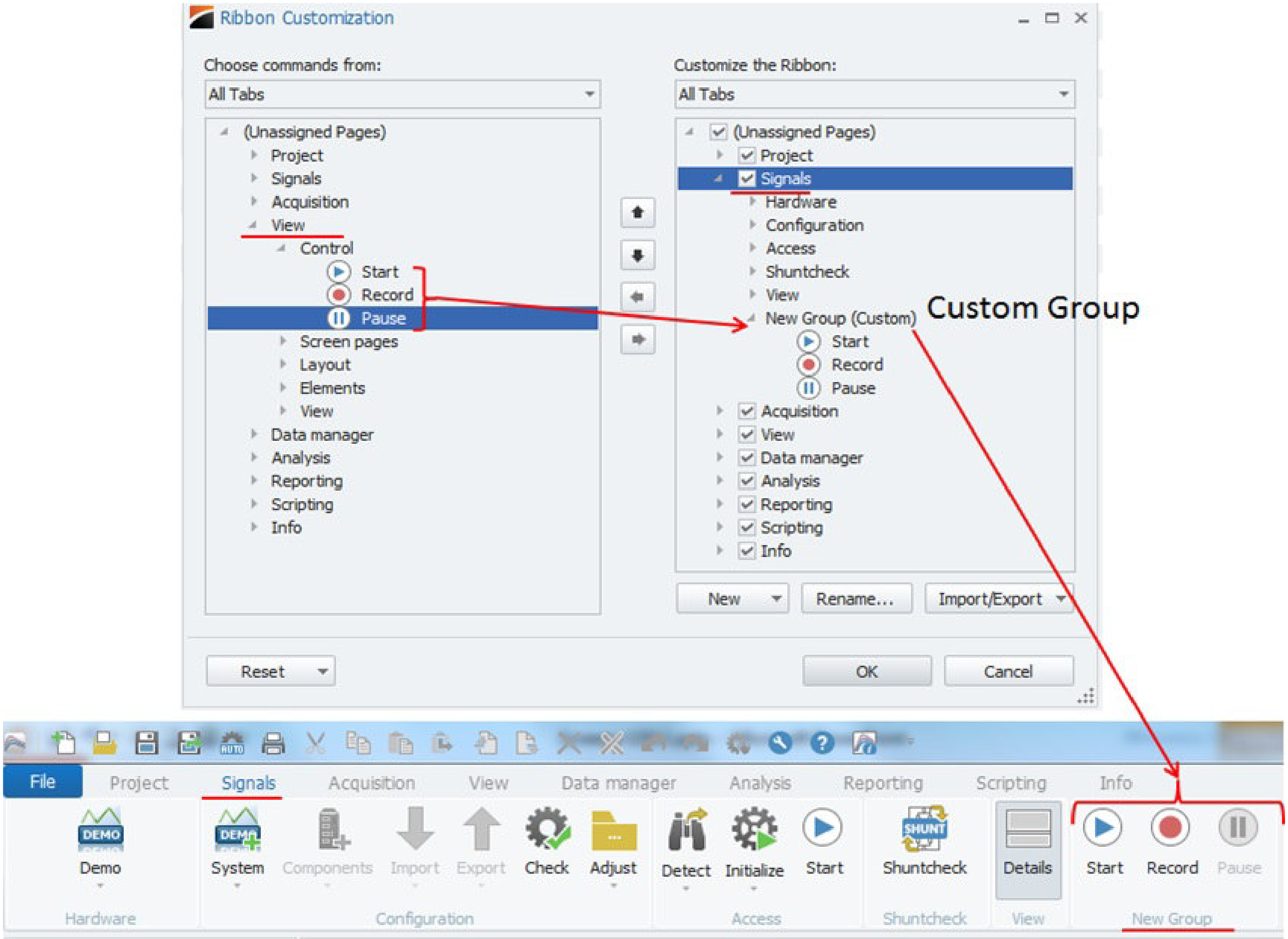


[PR_1]

Information *When you change the language of IPEmotion all ribbon customizations are reset back to factory default.*

7.1.1 Creating a new group

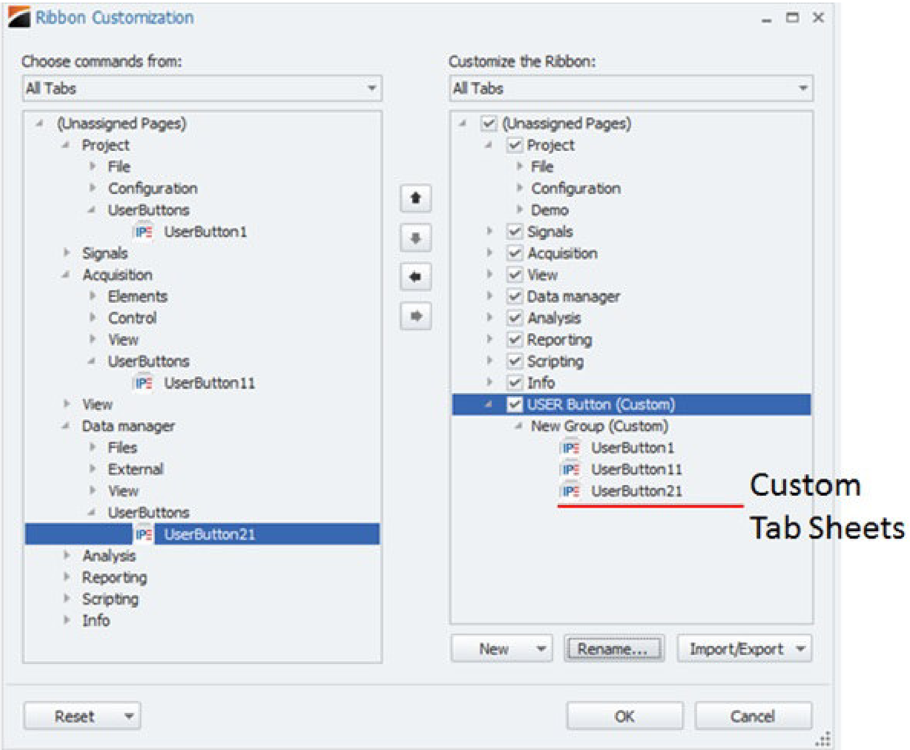
When you create a new group you can link any command into it. Just drag and drop the command. In this example, the Start & Stop data recording command was linked into a new group of the Signals tab sheet. Using drag and drop, you can change the order of groups in the ribbon.



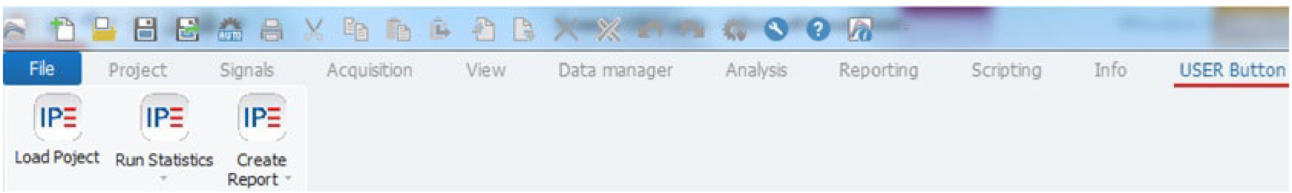
[PR_2]

7.1.2 Creating a new tab sheet

New tab sheets can be added to the overall navigation. You can add tab sheets between existing ones or at the end. Every tab sheet also creates a group automatically so that you can directly link the command into the group. In this example, one new tab sheet for USER BUTTONS was created.

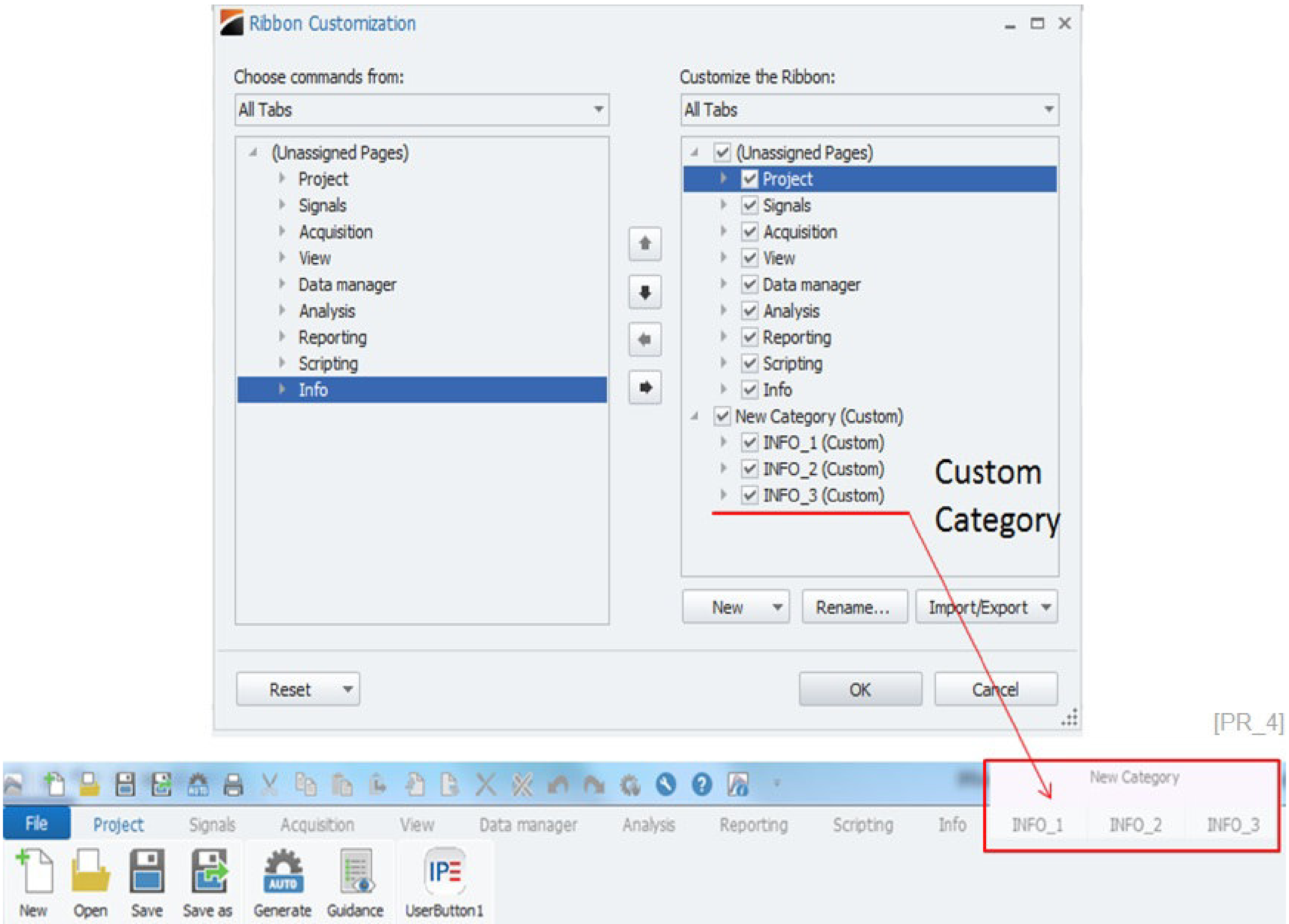


[PR_3]



7.1.3 Creating a new category

A category is a separate container to organize tab sheets and groups. Categories have their own place in the center part of the ribbon.



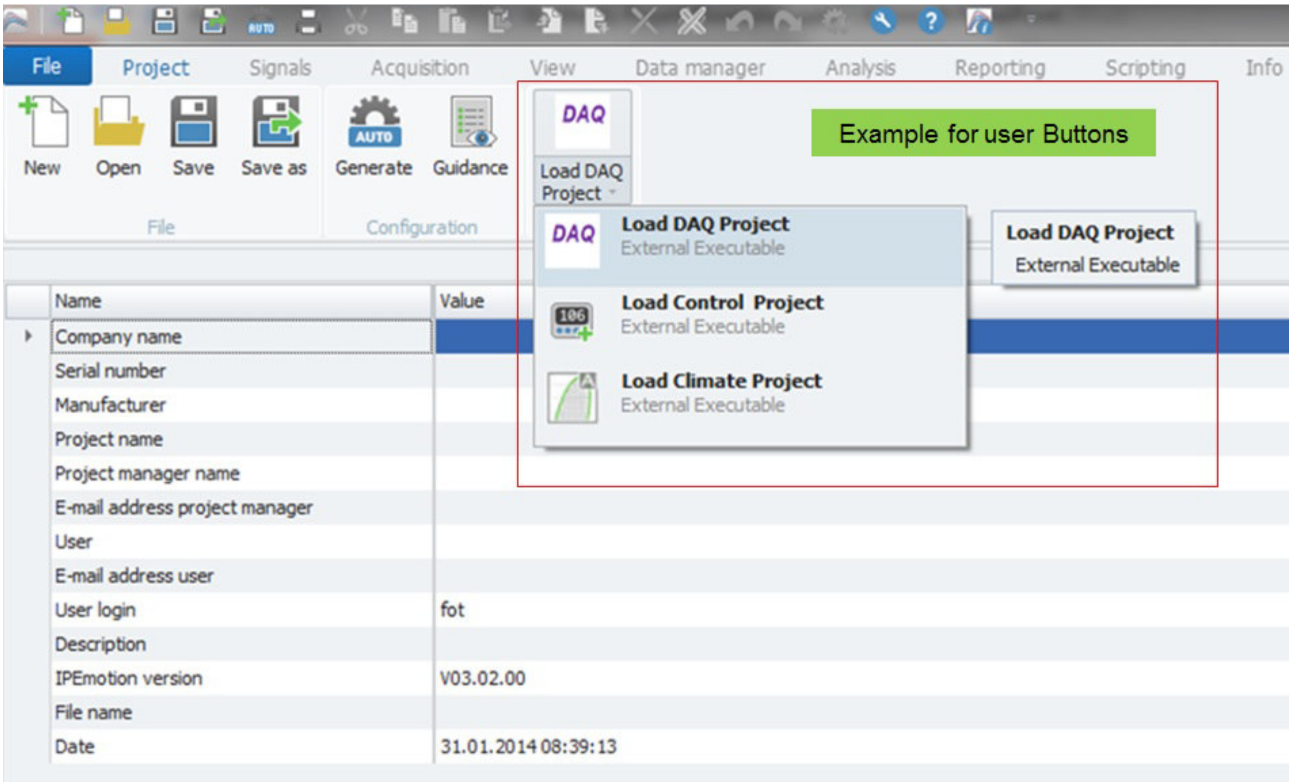
[PR_4]

7.1.4 Ribbon customizing with user buttons

If you customize a ribbon and integrate a user button, it is very important to manage the UserButtons.xml version number. With the release 2014 R1, a version number was introduced. If you increment the version number and restart IPEmotion the changes on the user button will automatically be integrated to the customized ribbon. In previous versions it was required to reset the customized ribbon in order to update the new user button functions. In this case all customized ribbon settings were lost.

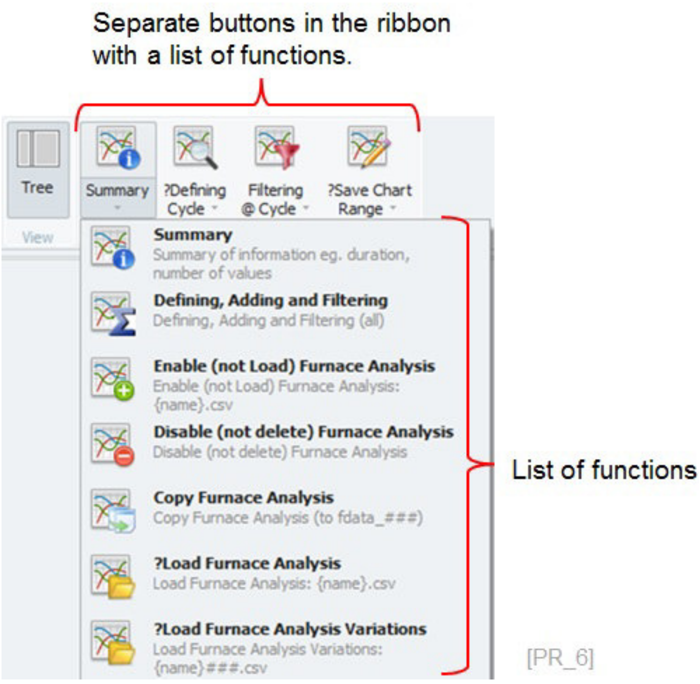
7.2 Integrating your own user buttons to your ribbon

User buttons are a very powerful tool to optimize the efficiency of your application. GUI is improved and very individual functions can be integrated into IPEmotion. You can arrange the buttons on one group and have a drop down list as indicated in the screenshot below.



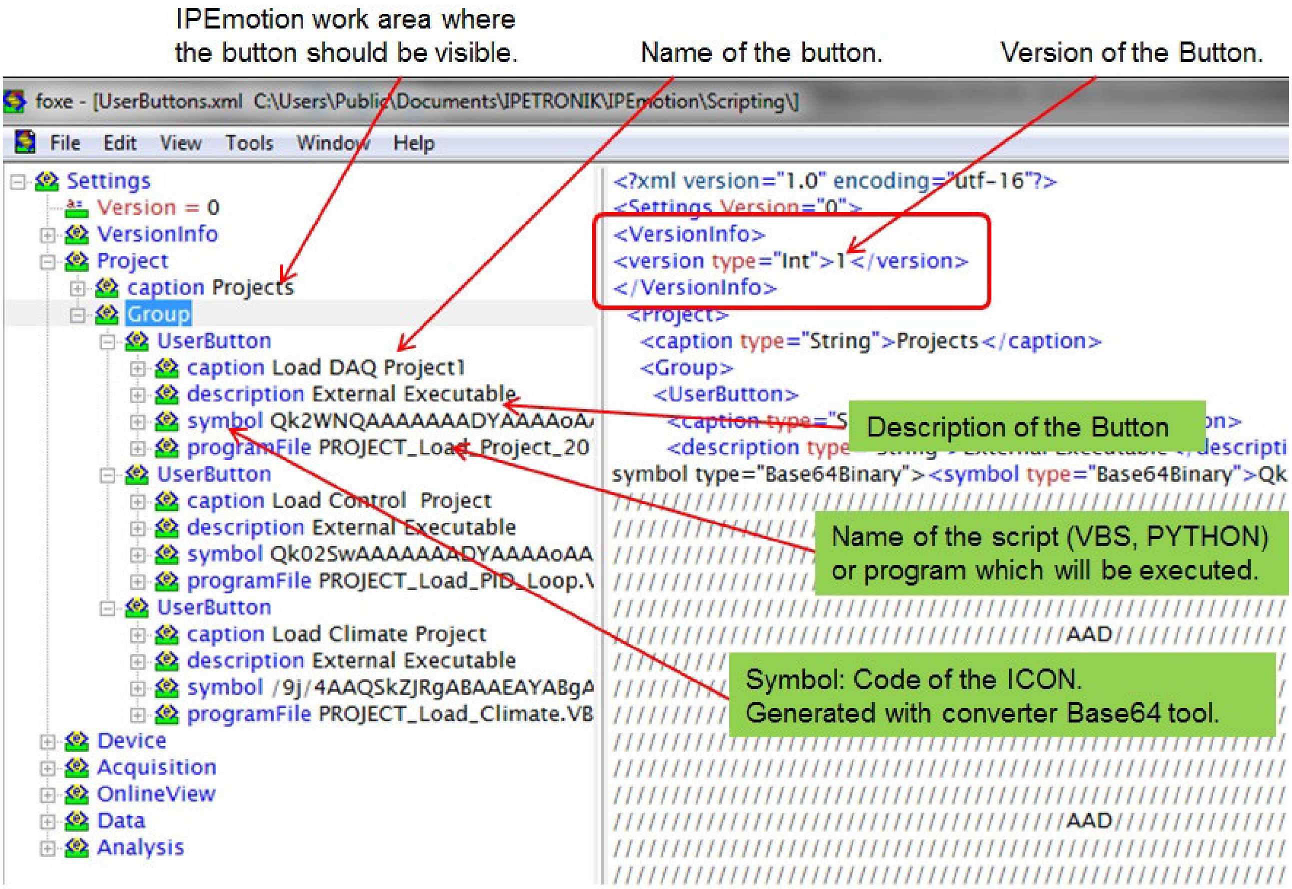
[PR_5]

Another option is to have several user buttons allocated horizontally and to put a list of several sub functions behind each button. The maximal number of buttons in the ribbon is shown in the table below.



[PR_6]

The user buttons are configured in an XML file called **UserButtons.xml**. This file has to be stored in the SCRIPTING directory.
Win 7 C:\Users\Public\Documents\IPETRONIK\IPEmotion\Scripting



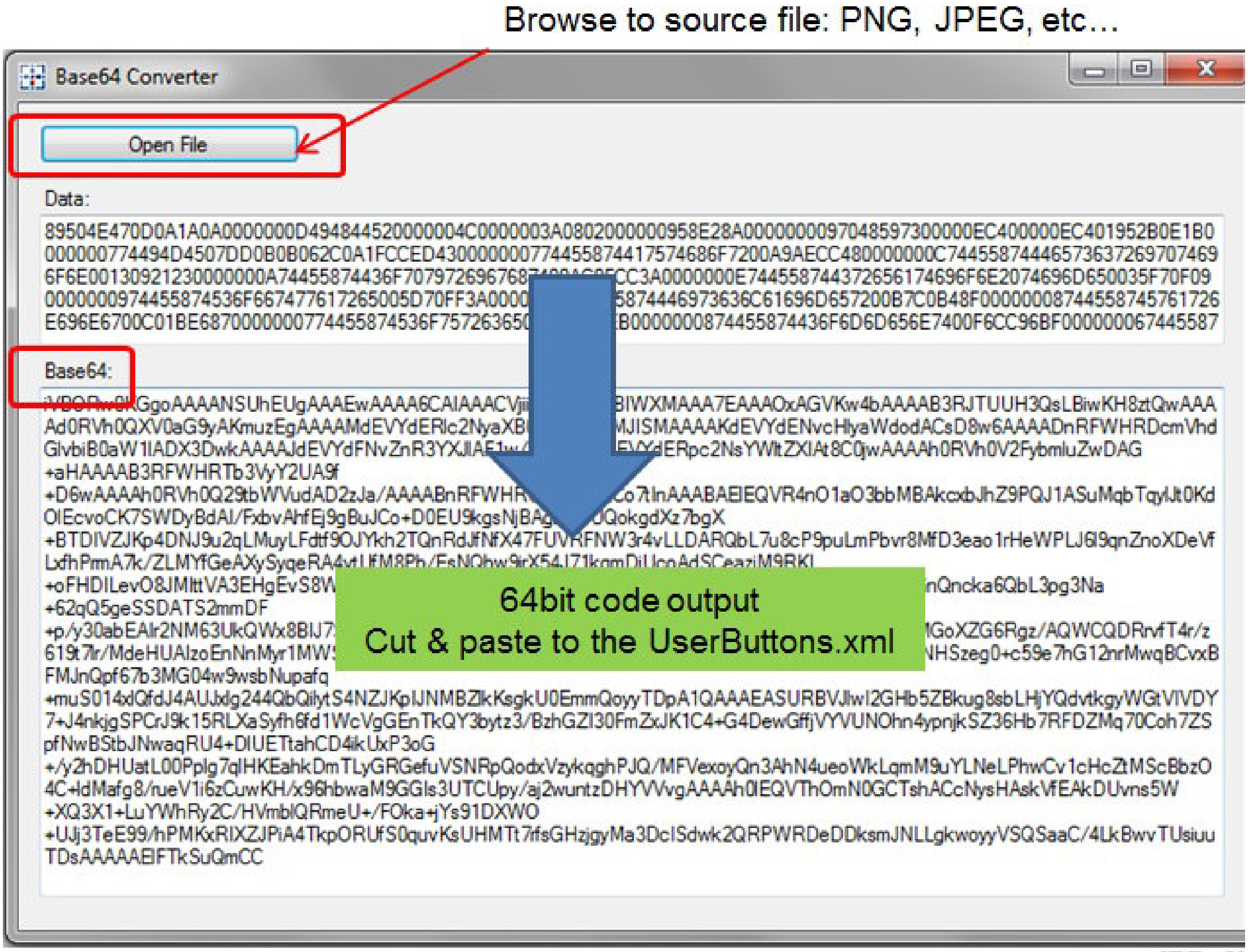
[PR_7]

If you design your own user button you should not use the **UserButtonsDemo.xml** file. This file is exclusively used by IPEmotion for demo applications and it will be overwritten during installation of a new IPEmotion version.
The name space in the UserButtons.xml is slightly different to the work space in IPEmotion. The maximum number of buttons is limited by work space. In vertical direction you can add as many functions as you like.

IPEmotion Workspace	UserButtons.xml	Max. number of Buttons in the Ribbon
Project	Project	5
Signals	Device	10
Acquisition	Acquisition	5
View	OnlineView	5
Data Manager	Data	5
Analysis	Analysis	5
Reporting	Reporting	5
Info	Info	5

7.2.1 Base64bit user button Icon converter

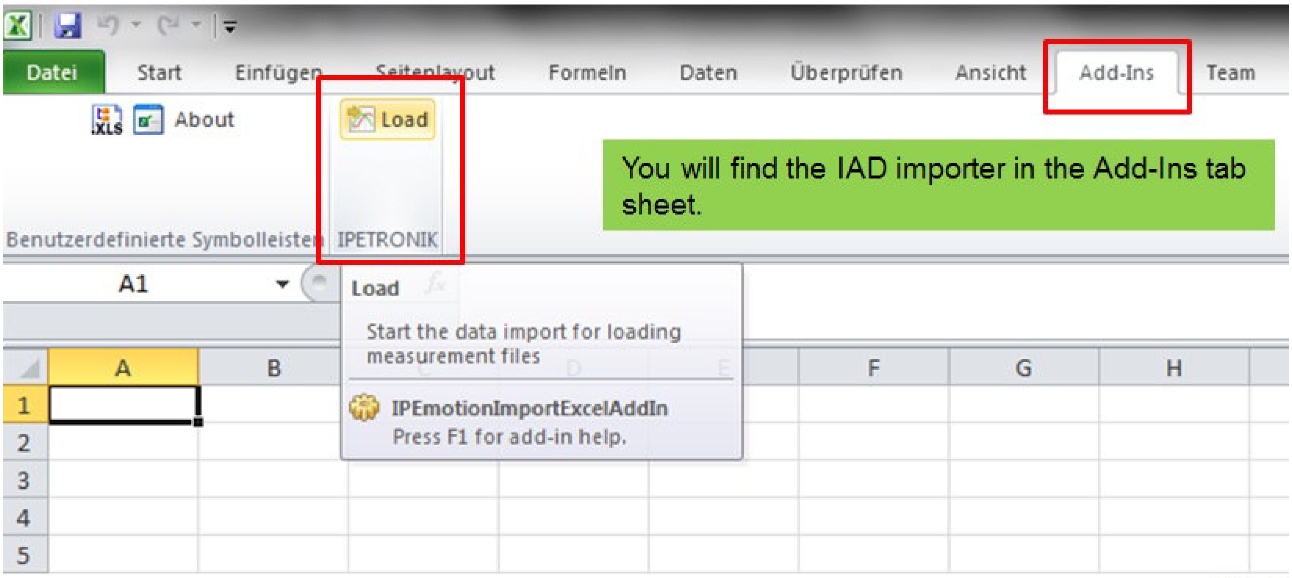
In order to convert your ICONS to the appropriate code you need a converter tool. This tool is installed with each release in the TOOLS directory.
Win7 C:\Program Files (x86)\IPETRONIK**IPEmotion 2016 R2.1**\Tools



[PR_8]

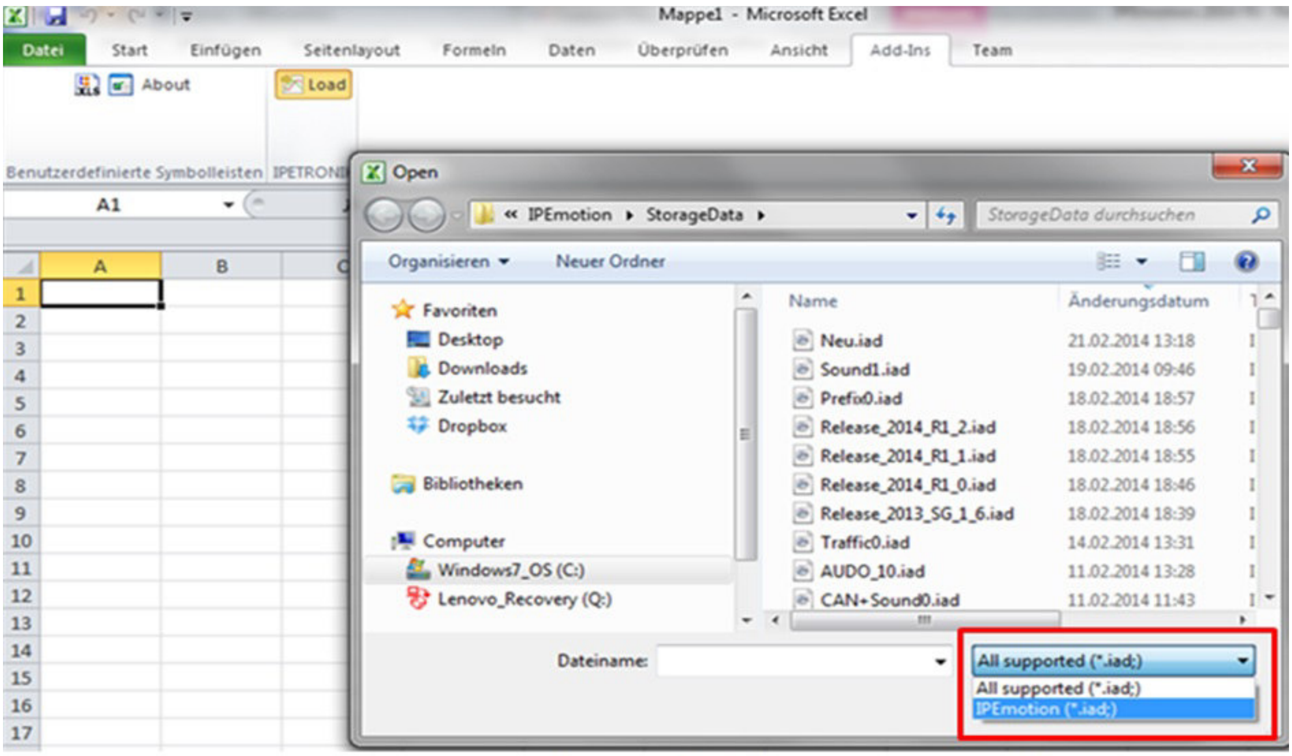
8 Excel 2010 Add-In

The Add-In in Excel allowing to directly import IPEmotion IAD data files into Excel. The Excel Add-In is a separate installer and works for Excel 2010 and higher. The Add-In is limited to 32 bit Excel, at the moment.



[PR_9]

The Excel Add-In can only import IPEmotion IAD data files.

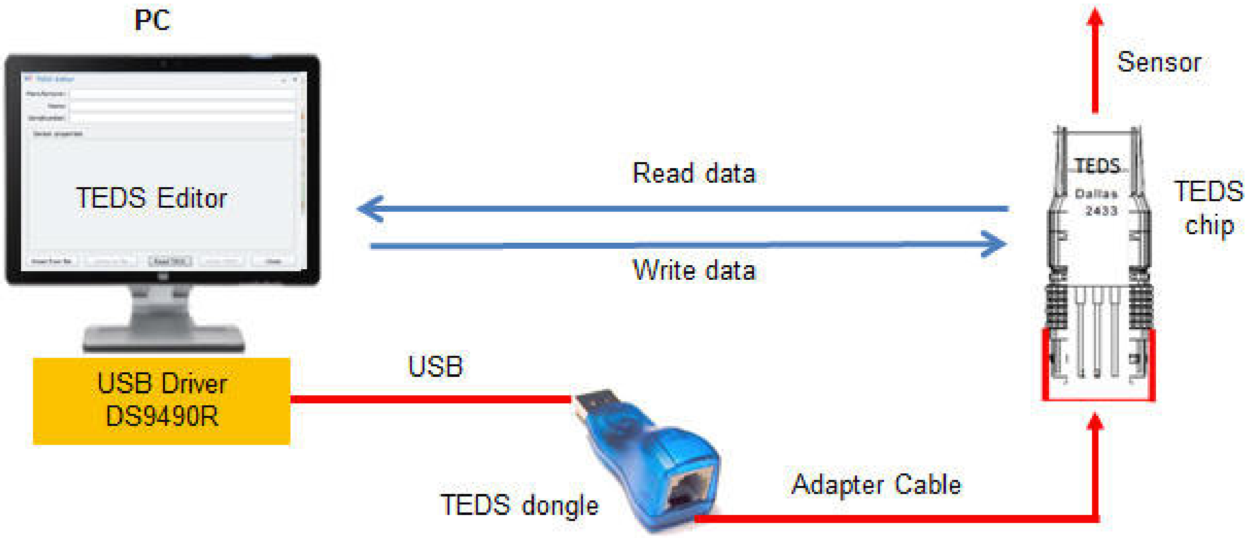


Only .IAD data files are supported for import. [PR_10]

9 TEDS Editor

In order to help our customers to update the TEDS sensor information e.g. after calibration we offer a TEDS editor tool (TEDS editor). Several modules from the IPTRONIK support TEDS Class1 and Class 2 sensors detection function. TEDS is defined as (Transducer Electronic Data Sheet) and includes all information about the sensors scaling definitions. Sensors which include TEDS chips reduce the scaling efforts and scaling errors for the user to a minimum.
TEDS is supported by the following modules with TEDS Class 2:

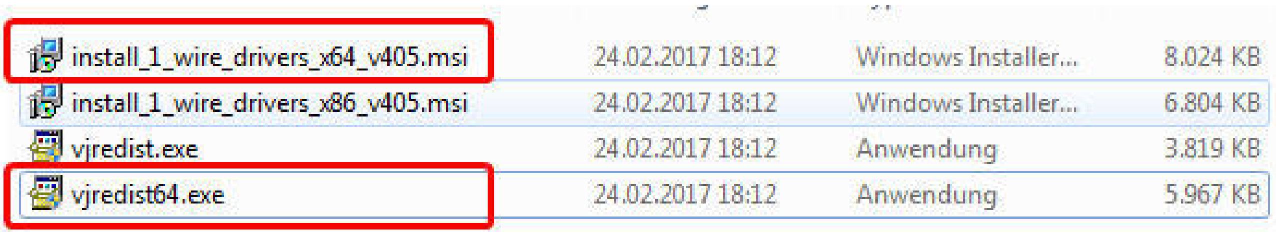
- Sx-STG
- Mx-STG2 6
- Mx-SENS2 4
- M-SENS2



[PR_20]

9.1 Software installation

This TEDS Editor software tool is a separate application and can be operated independently of IPEmotion. The program is installed together with the IPEmotion setup and can be launched from the following directory.
Win7 C:\Program Files (x86)\IPETRONIK**IPEmotion 2017 R1**\Tools\TEDSeditor
As explained above, in order to read and write TEDS data to the TEDS chip an external USB dongle hardware is required. The drivers for the USB dongle are included in the setup of IPEmotion and can be installed from the following directory. The drivers are available as 32 and 64 bit versions.
Win7 C:\Program Files (x86)\IPETRONIK**IPEmotion 2017 R1**\Install



Drivers for the TEDS dongle for 32 or 64 bit operating systems.

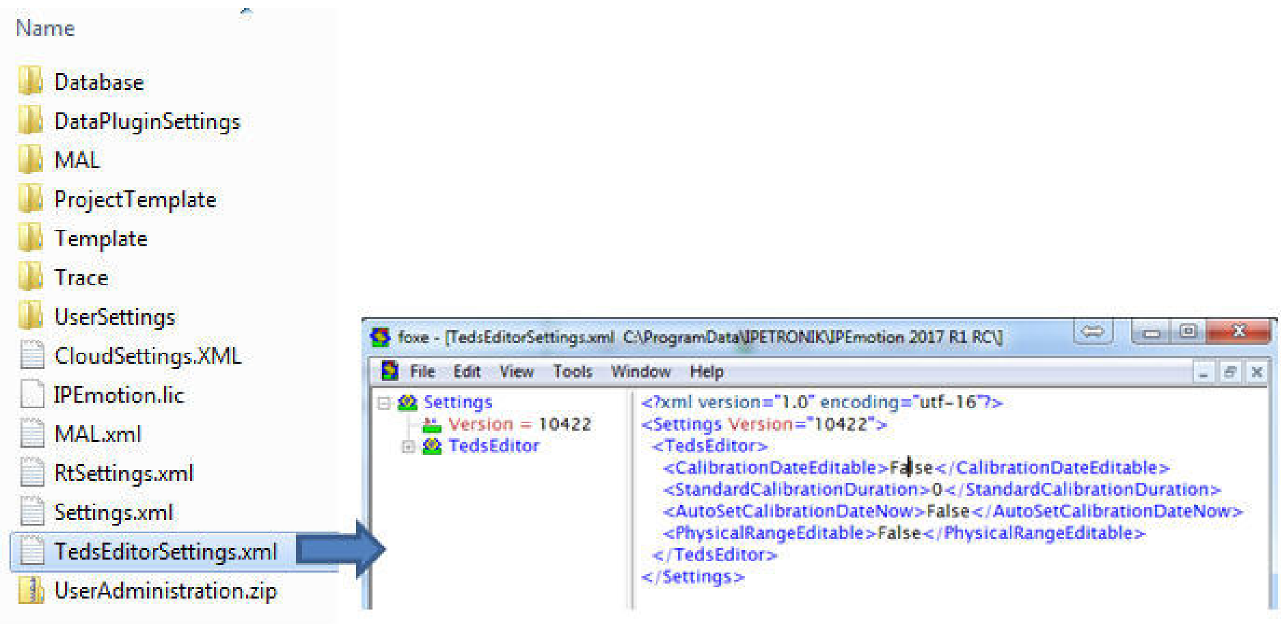
[PR_21]

TEDS dongle

Information *Search for DS9490R to find suppliers for the TEDS dongle hardware.*

9.2 Configuration of the TEDS settings XML

In order to modify TEDS data you need to configure the TEDS settings accordingly. The TEDSEditorSettingsXML file is installed in the following directory together with other important XML setting files.
Win7 C:\ProgramData\IPETRONIK**IPEmotion 2017 R1**



TEDS Editor settings XML

[PR_22]

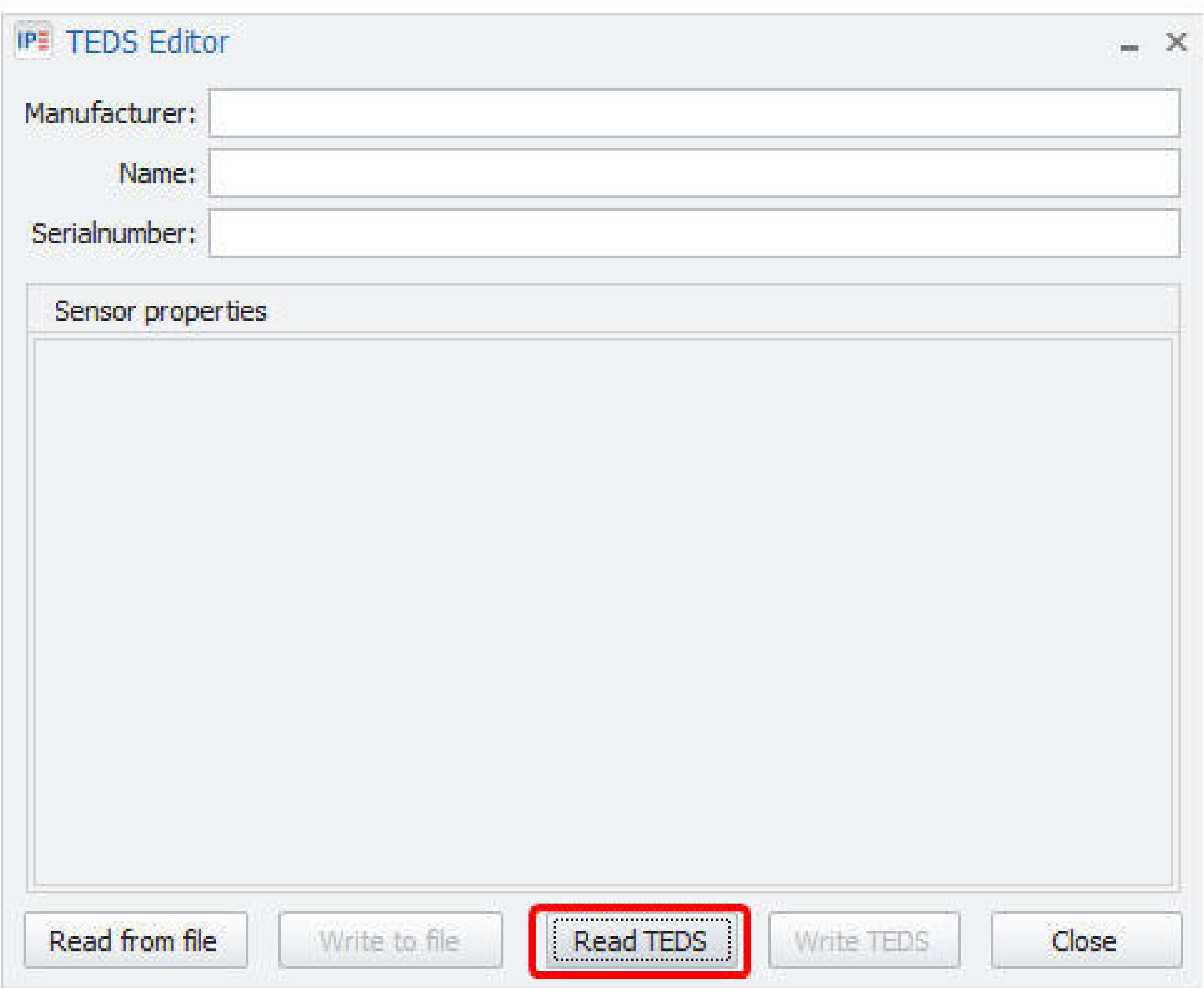
The default setting of the XML file does not allow the user to updated any TEDS data. The settings XML file must be updated in order to make changes through the TEDS editor tool.

With the XML setting you can control the following functions:

- CalibrationDateEditable — With this setting as True you can define the calibration date and the expire date.
- StandardCalibrationDuration — Here you define the time span in days for the expire data. That means the defined duration is automatically added to the calibration date.
- AutoSetCalibrationDateNow — This setting as True defines automatically the date of today as calibration date. The manual input of the calibration data is blocked.
- PhysicalRangeEditable — With this setting as True you can modify the physical scaling properties.

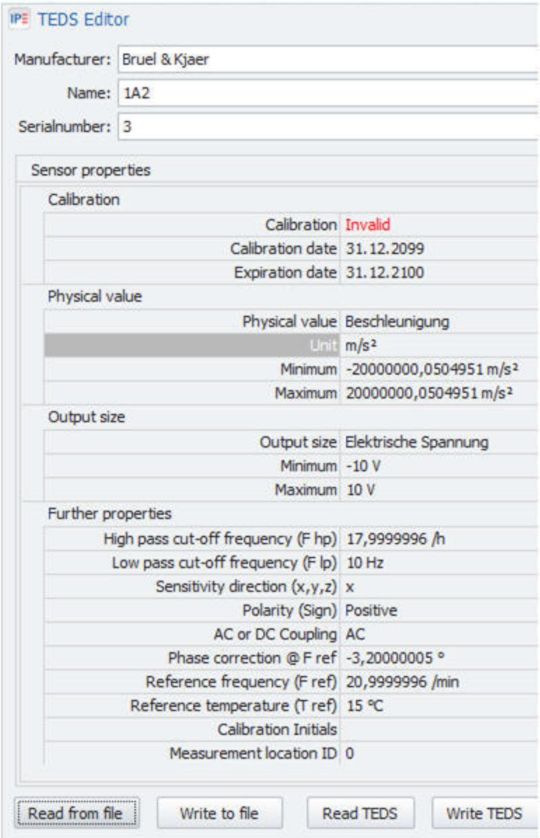
TEDS Editor GUI

When you start the TEDS editor software the following GUI is presented.

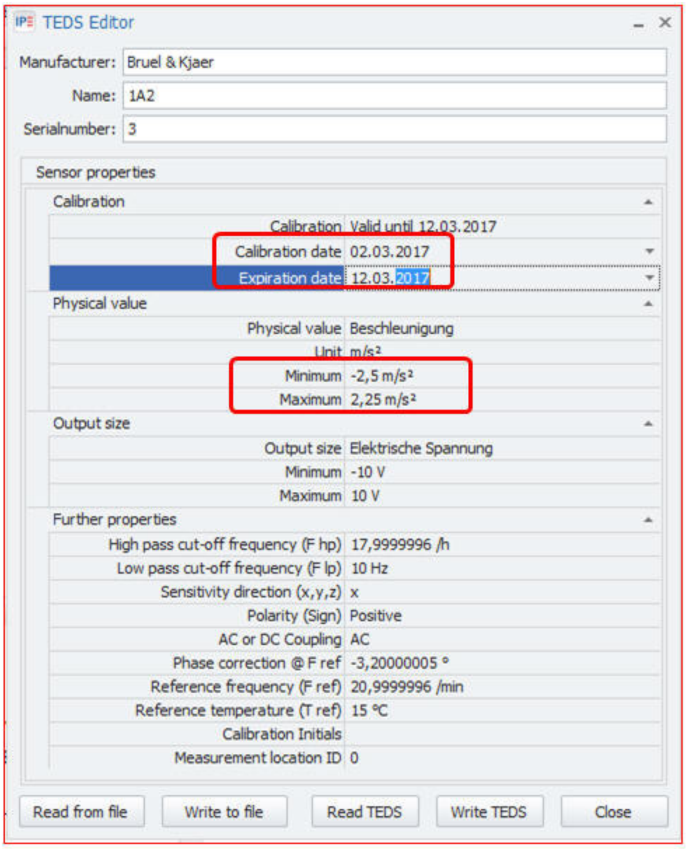


TEDS Editor start screen - empty. [PR_23]

From here you can read TEDS data from any connected sensor via the TEDS dongle. The following screen shot shows data of a sample sensor and the fields which can be modified by the user.

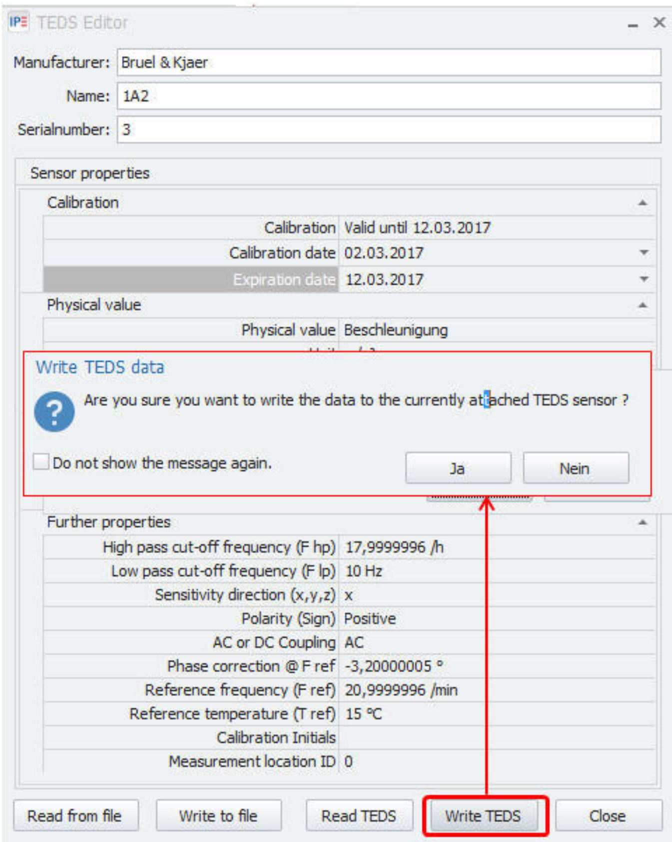


Detected TEDS sensor



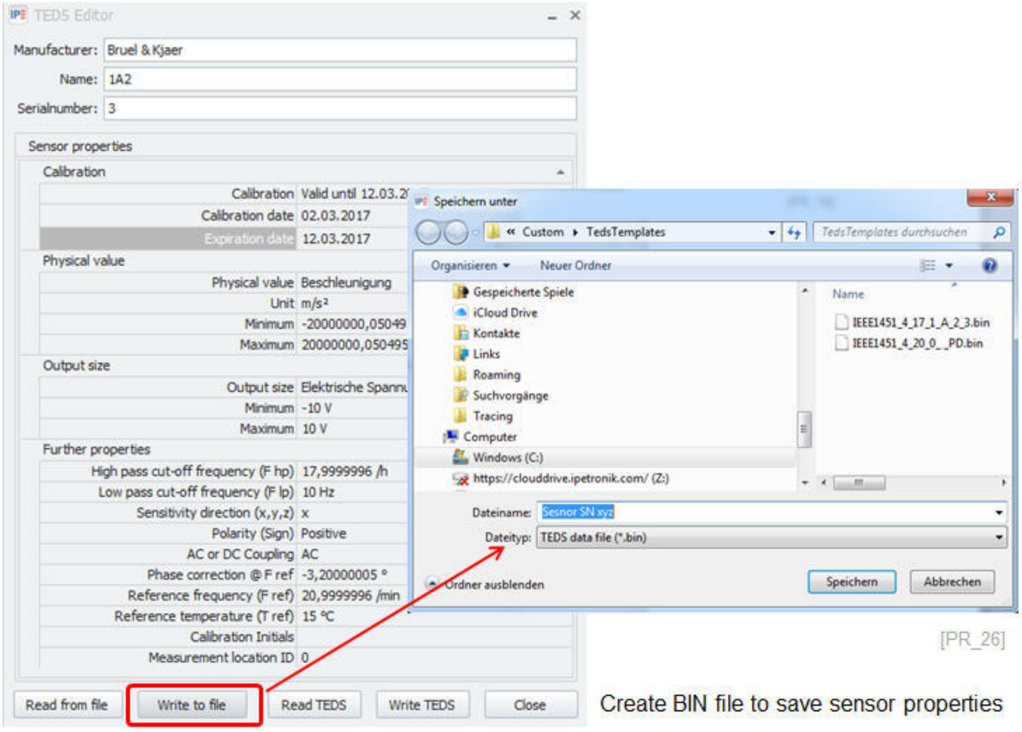
Field editable when defined accordingly in the XMl file. [PR_24]

With the write command the sensor gets after a positive confirmation of the pop up message box updated with the new parameters.



Write TEDS > updated TEDS data of the sensor. [PR_25]

With the function write to file you can export the TEDS definition of the sensor to a BIN. You can use this exported BIN file later with the read (BIN file import) function to check or modify sensor definition offline without any sensor connected to your TEDS dongle.



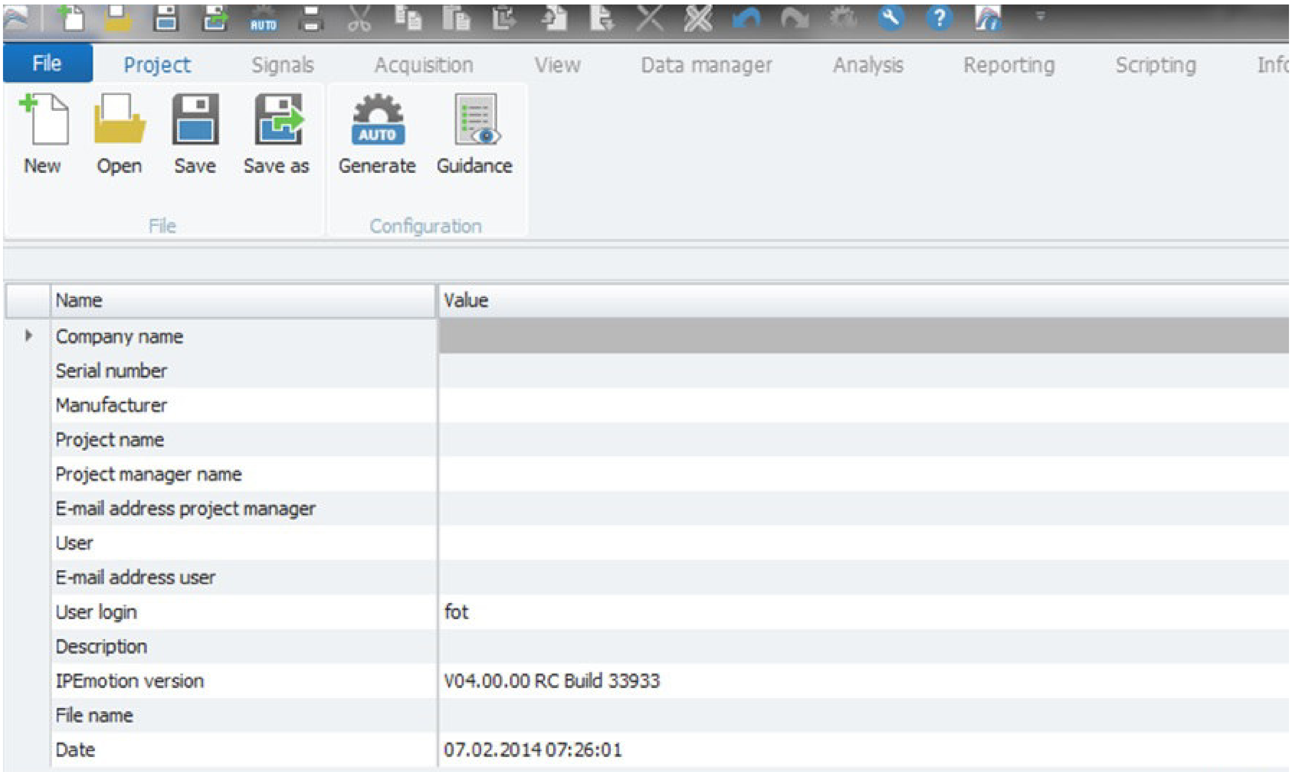
[PR_26]

Create BIN file to save sensor properties

10 PROJECT work space

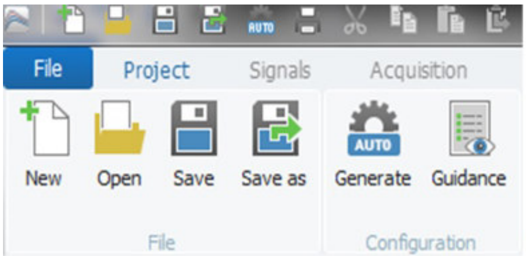
Here you define the project parameters which are saved to the data file.

Example:



[PR_11]

10.1 Ribbon

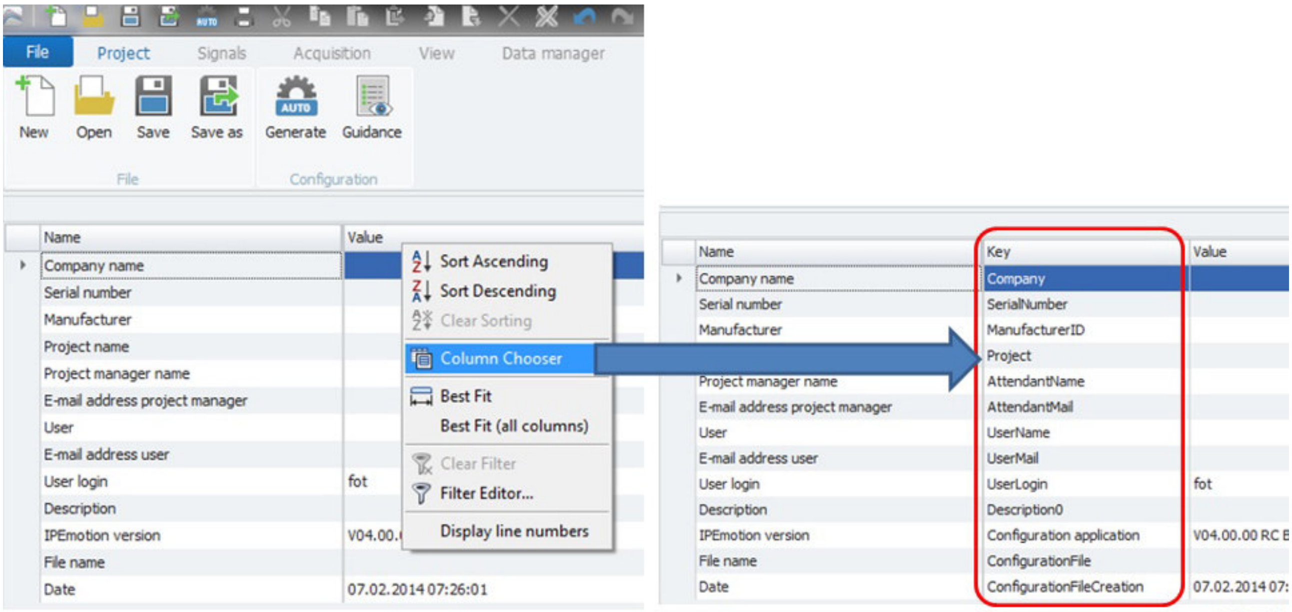


[PR_12]

- ► New — Creates an empty project
- ► Open — Opens file dialog to search for a new IWF configuration
- ► Save — Saves your configuration
- ► Save as — Saves the configuration via a file dialog to define location and name of the IWF file
- ► Generate — Runs an automatic hardware detection and generate an automatic configuration. The function "Generate" is pretty much the same as the function âĂIJFrequently UsedâĂİ in OPTIONS,âĂŞ automatic hardware detection at start
- ► Guidance — Refers to a wizard to set up a guided hardware configuration as discussed in OPTIONS âĂIJFrequently UsedâĂİ âĂŞ Guided Configuration

10.2 Column chooser – KEY field

With the column chooser you can link the field KEY to your parameter list.



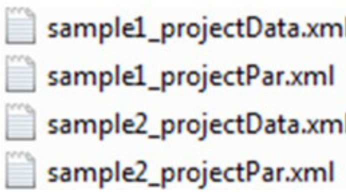
[PR_13]

Information *The field KEY is important because it is the unique identifier if you like to extract parameter values from the data file to your report, later.*

10.3 Creating global parameter XML files

The default project parameters are loaded automatically as soon as you start the software. However, you can modify the parameter list with new entries, list box elements or even with mandatory fields. A couple of templates are located in the following directory.

Win 7 C:\Users\Public\Documents\IPETRONIK\IPEmotion\ProjectTemplate

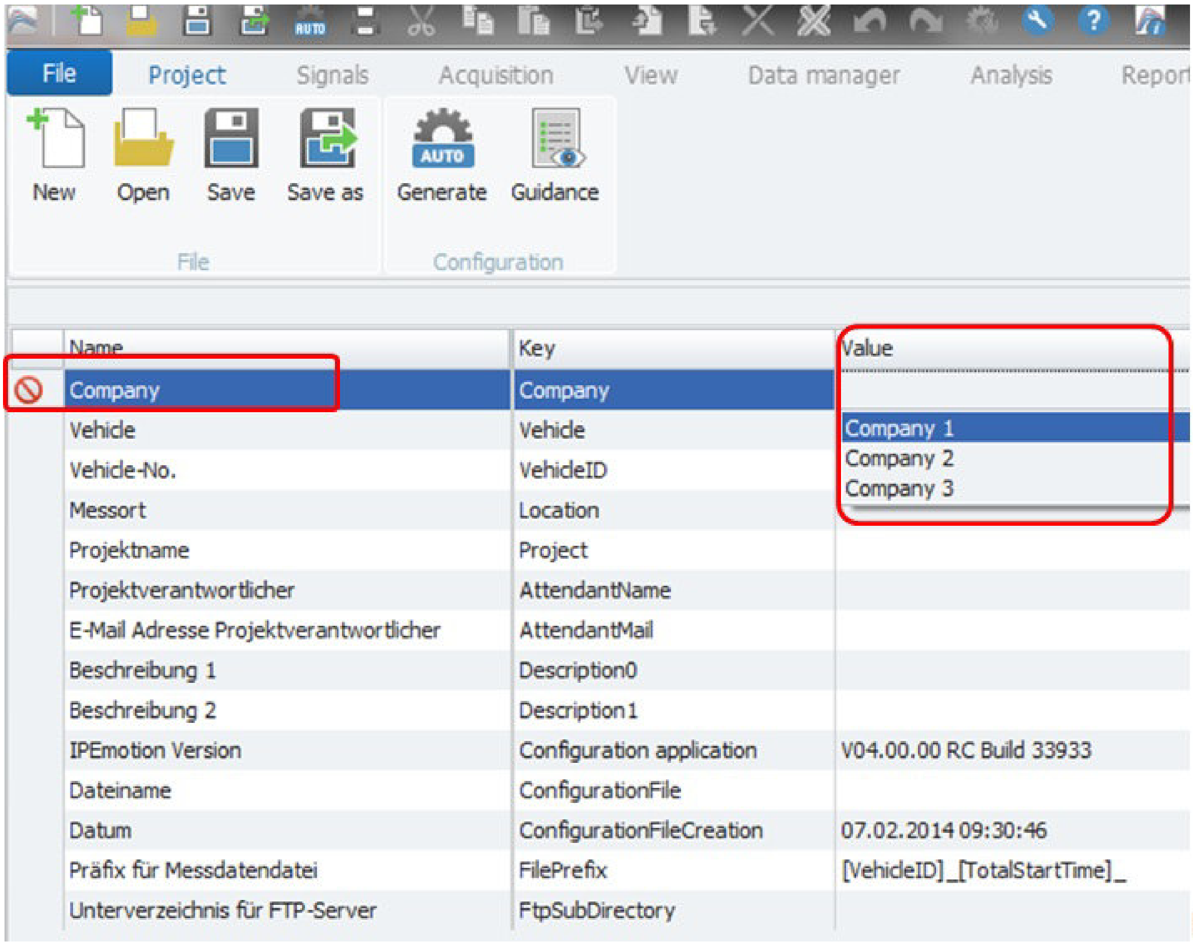


[PR_14]

If you like to setup your own parameter entries, you need to define the following XML files in the directory mentioned above. The sample XML files can be used as a reference to build your IPEmotion project parameters or to build a parameter list for IPETRONIK Logger PlugIn applications. The name of the files are used as follows:

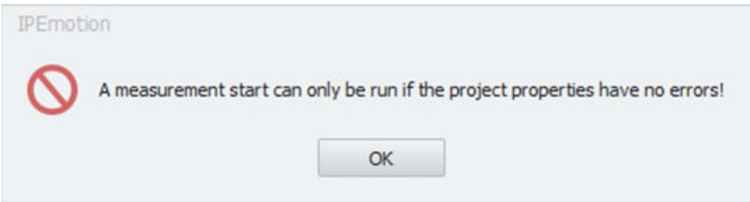
- projectPar.xml — Parameters for the Logger PlugIn
- projectData.xml — Parameters for the Logger PlugIn
- globalPar.xml — Parameters for IPEmotion
- globalData.xml — Parameters for IPEmotion

The example below shows a project parameter list with a mandatory input field for COMPANY which requires a predefined entry from a list box.



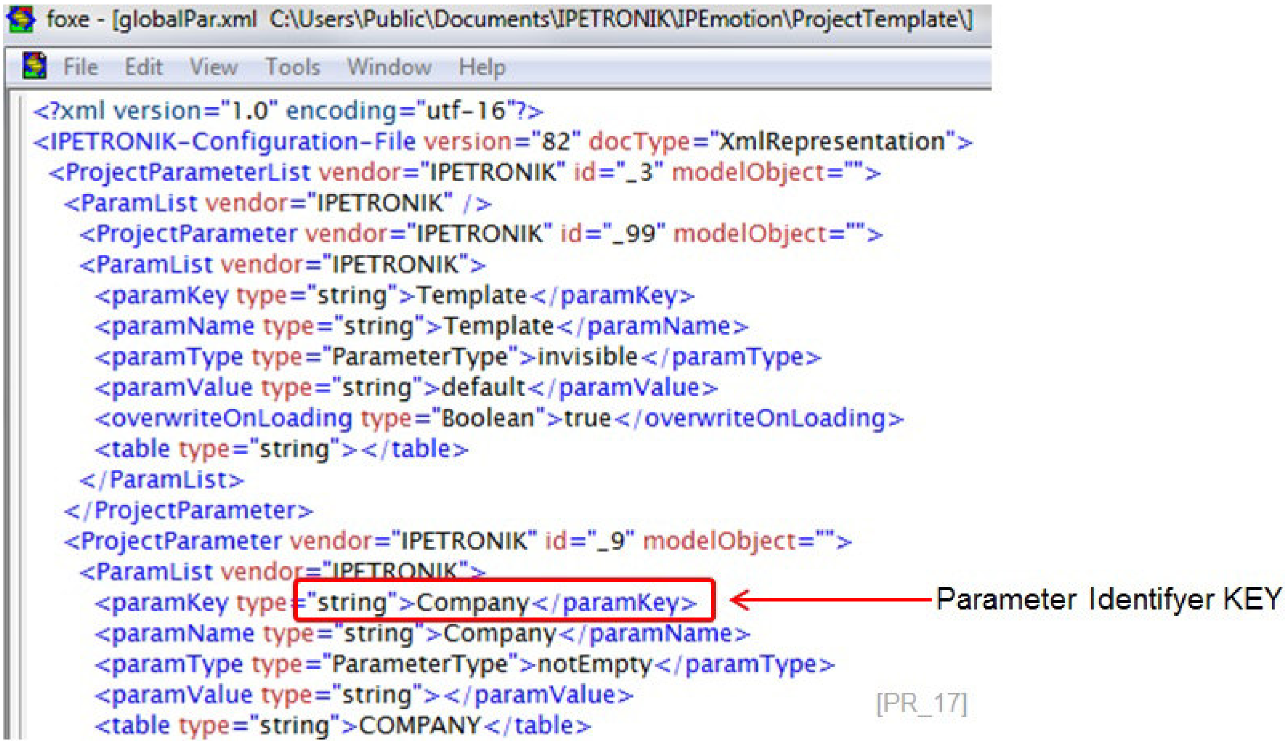
[PR_15]

In this case you cannot start measurement without an entry.



[PR_16]

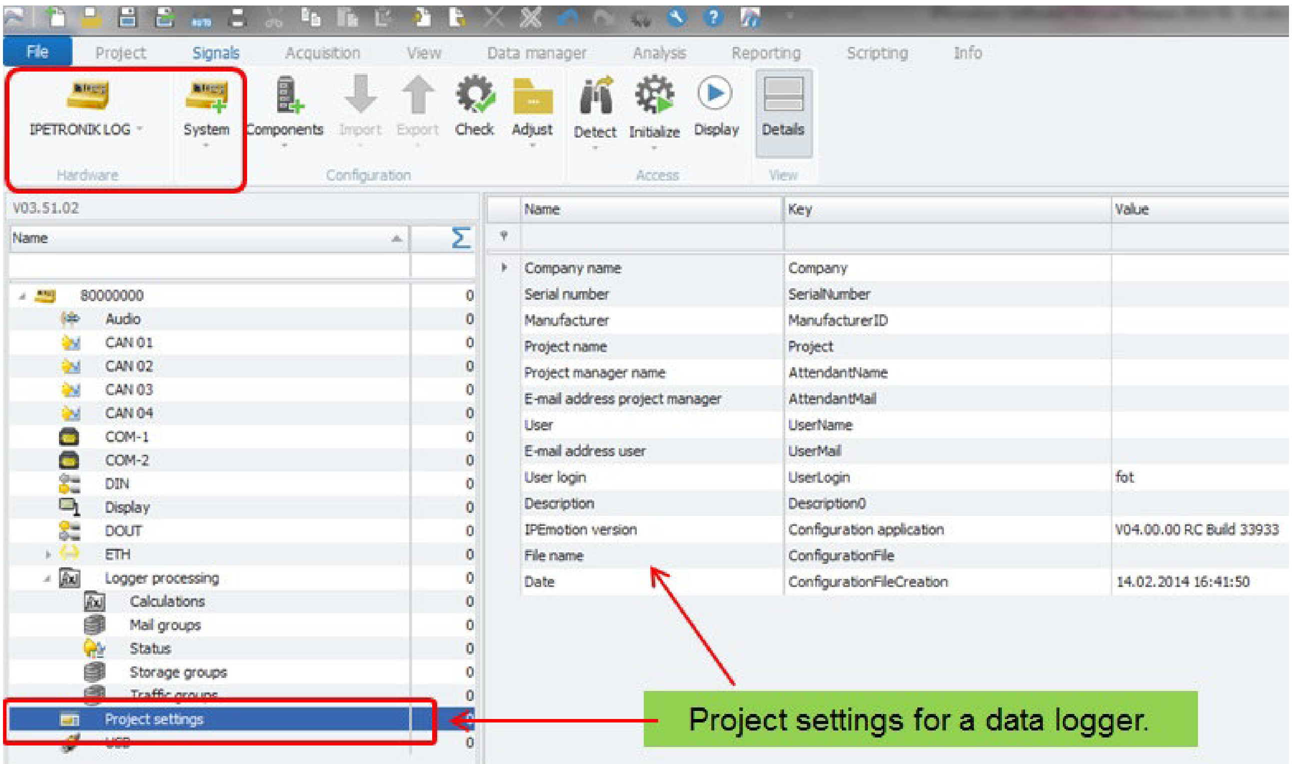
You also need to define a KEY for every new entry in the globalPar.XML file. The KEY field is very important later on if you like to extract parameters from the data file (IAD) or the project (IWF) and show them on your report.



[PR_17]

10.4 Creating project parameter XML files for the logger

The IPETRONIK data loggers have their own project parameter sheet implemented in the Logger PlugIn. These project parameters are then included in the data files created by the data logger.

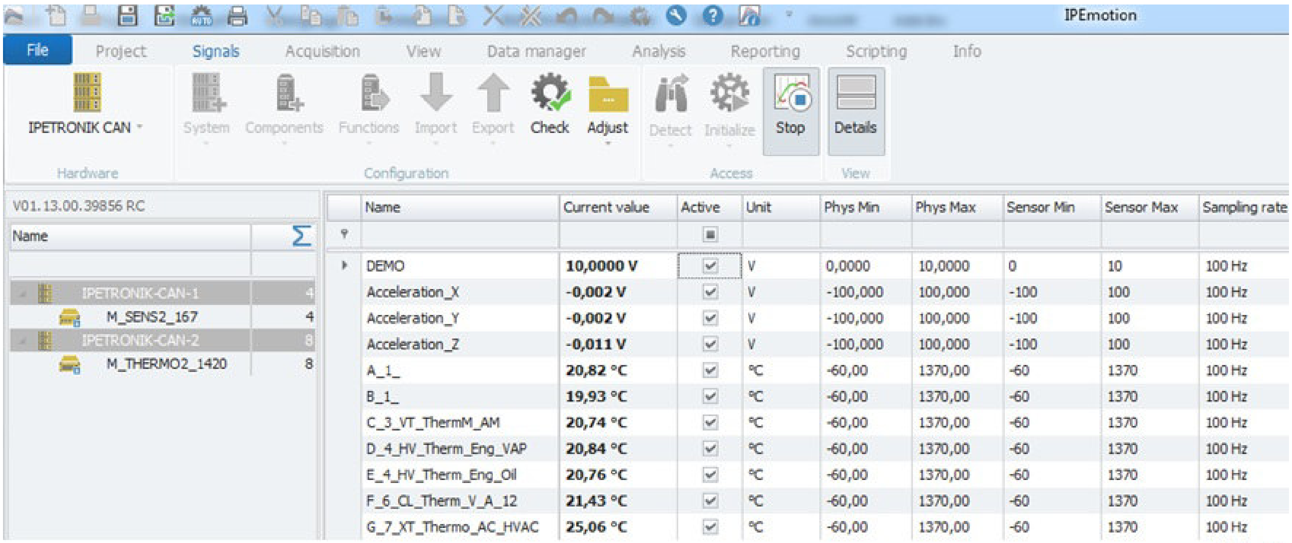


[PR_18]

11 SIGNALS work space

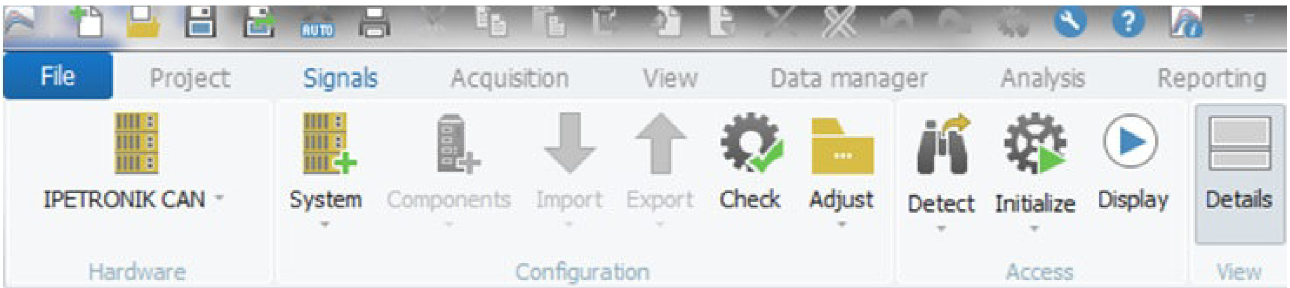
The SIGNALS work space is dedicated to configure your PlugIns and take measurements.

Example:



[SI_1]

11.1 Ribbon



[SI_2]

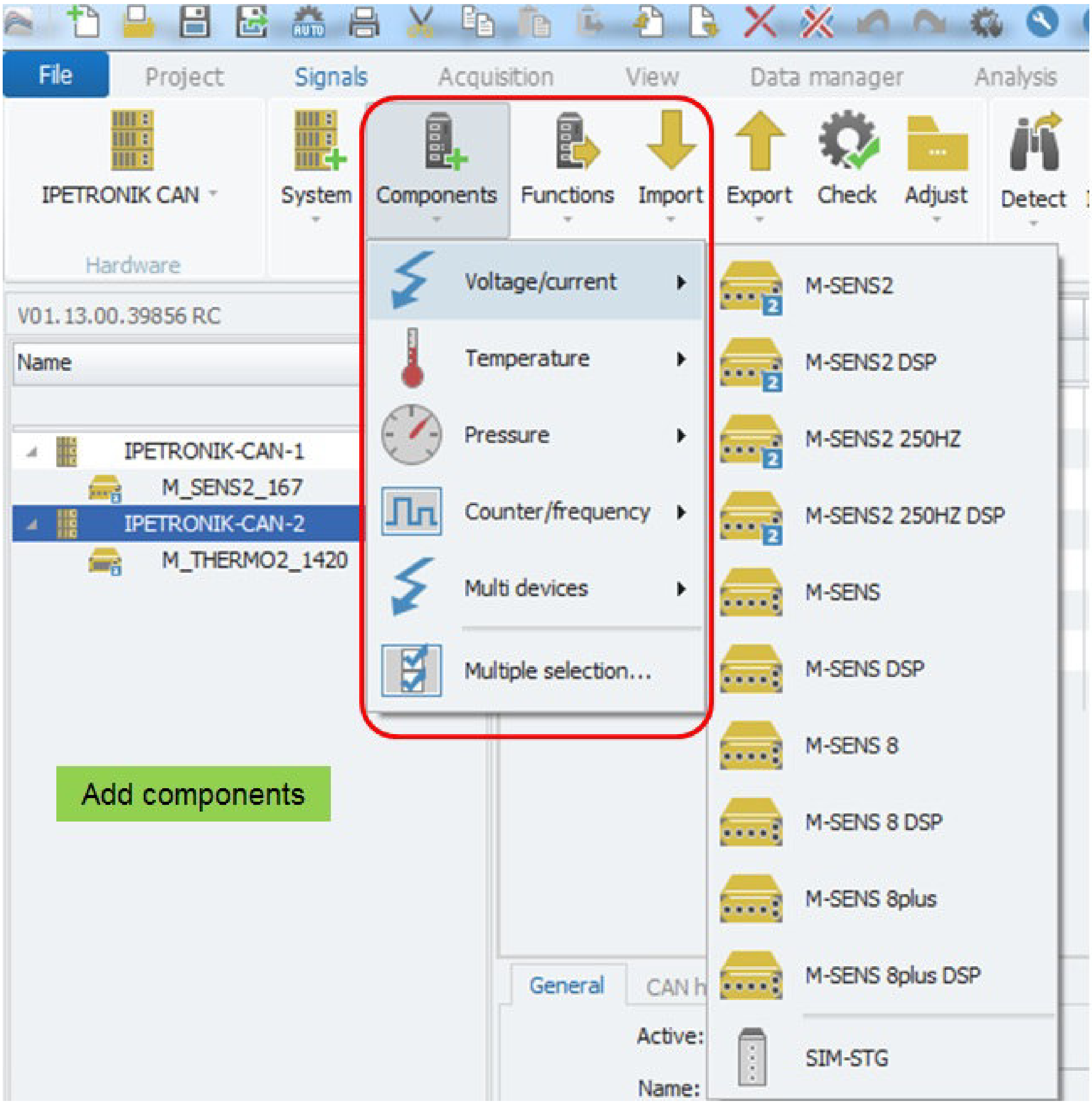
11.1.1 Hardware / PlugIn

Select the hardware / PlugIn you would like to use. The drop down list includes all PlugIns which were activated in OPTIONS >PlugIns. See chapter 22.16.

Tip *Sometimes user experience that they cannot access the list box and make manual configurations. In this case, in OPTIONS > Basic Settings the measurement configuration by MPC data base file was activated. See chapter 22.2.1.*

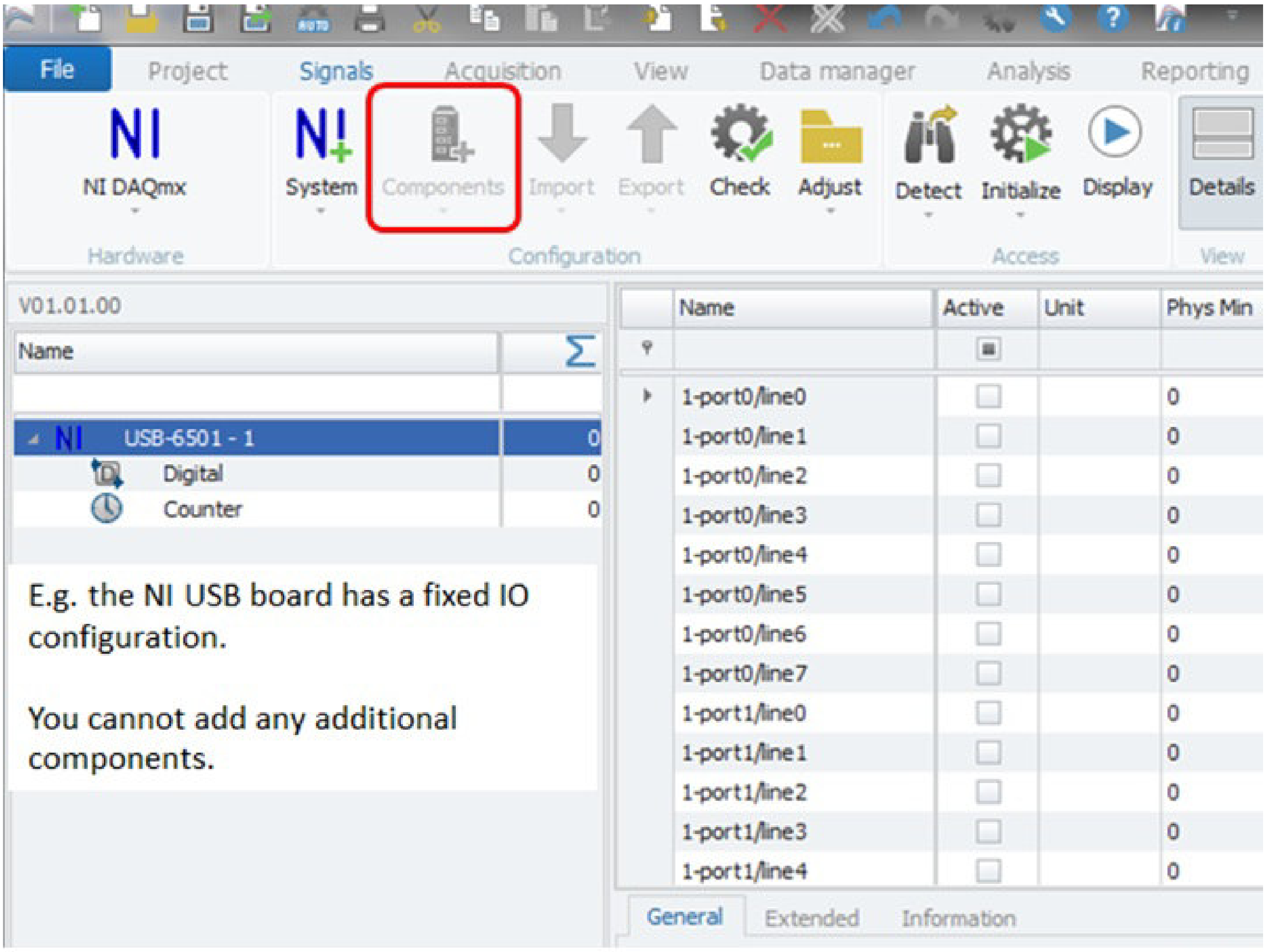
11.1.2 System

The system is the next level below the selected PlugIn. The system basically is the specific hardware or interface you are using to set up your data acquisition system. Each PlugIn consists at least of one system. Depending on the hardware you may be able to add components or not. This depends on the modularity of the hardware and of how the PlugIn is programmed. If you have a modular DAQ hardware you can add components: Example: IPETRONIK CAN PlugIn.



[SI_3]

If you have a system with a fixed IO configuration you cannot add any components. Example: NI PlugIn



[SI_4]

11.1.3 PlugIn overview for description file import and export

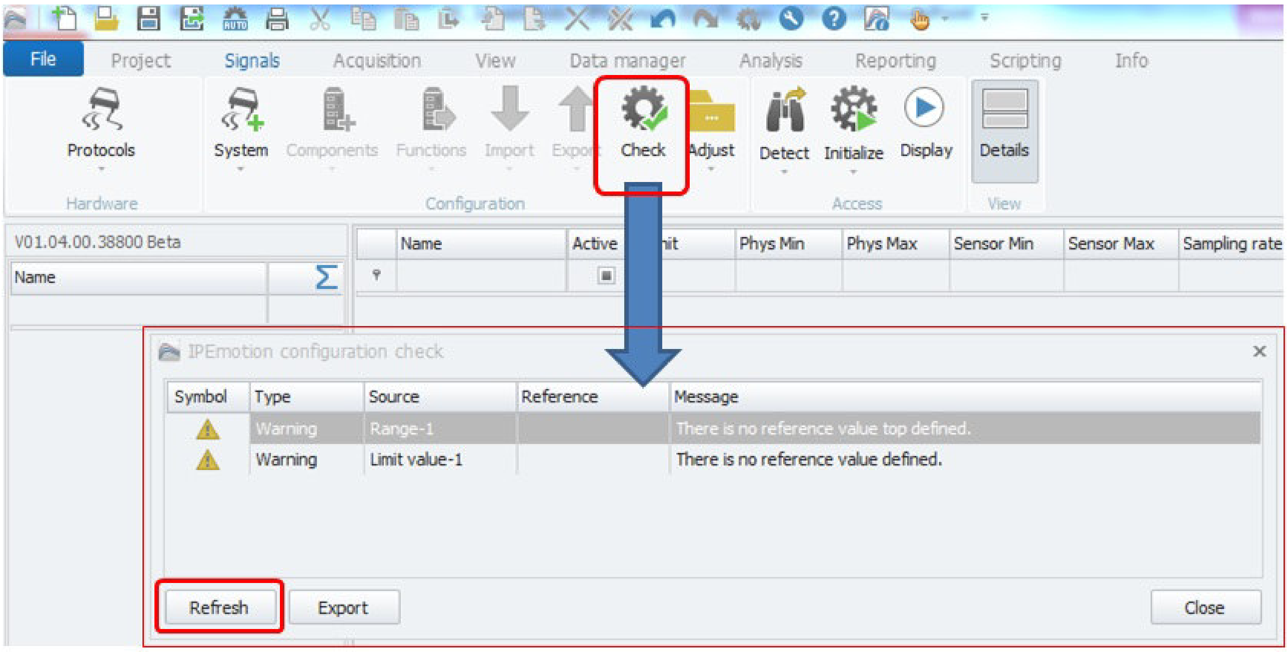
Whether a PlugIn supports import or export functions also depends on the PlugIn implementation. The import is usually a shortcut to build your configuration. The following list will show you what kind of files can be imported and exported by the PlugIns. The import and export functions depend on the selected interface of the system or module. See also SIGNALS chapter 11.5.4.

IPETRONIK PlugIns	Interface Level	Configuration Imports	Configuration Exports
IPETRONIK CAN	System	No	CANdb (DBC) CANdb XML IPEmotion App (IAW)
IPETRONIK X	System	No	A2L CANdb(DBC) CANdb XML IPEmotion App (IAW)
	Component	No	A2L
	FlexRay	Autosar (ARXML) A2L FlexRay Parameter FIBEX	A2L
IPETRONIK Log	System	TESTdrive measurement files TESTdrive measurement files with ring buffer TESTdrive Log Files	TESTdrive configuration file (MFC)
	CAN	CANdb (DBC) Autosar (ARXML) A2L Diagnostics (IDF) UDS (XML) GM-LAN (XML	
	ETH - XCP		A2L IPEmotion App (IAW)
	ETH - FlexRay	Autosar (ARXML) A2L FlexRay Parameter FIBEX	A2L
	ETH - CAN	CANdb (DBC) Autosar (ARXML) A2L UDS (XML)	CANdb (DBC) CANdb (XML) IPEmotion APP (IAW)
CAN Send	CAN	CANdb (DBC) Autosar (ARXML)	CANdb CANdb XML IPEmotion App (IAW)
CAN Acquisition	CAN	CANdb (DBC) Autosar (ARXML)	CANdb CANdb XML IPEmotion App (IAW)
Protocols	CAN	Traffic measurement Traffic sending A2L GM-LAN J1939 OBD	CANdb
PCAN-USB Pro Lin	Component	CANdb (DBC / XML) LIN (LDF)	

3rd Party PlugIns	Interface Level	Configuration Imports	Configuration Exports
ADDI-DATA	System	No	No
Advantech APAX	System	No	No
Advantech ADAM	System	No	No
Beckhoff	System	No	No
WAGO	System	No	No
WAGO Controller (licensed)	**System**	**Yes - Codesys EXP file**	**No**
Scales	System	No	No
SIEMENS	System	S7P and Symbol table	No
Profibus DP	Component	GSD file	No
HBM	System	No	No
Gantner	System	No	No
Velleman K8055	System	No	No
Goldammer	System	No	No
ETHERNET	System	No	No
Serial	System	No	No
Yokogawa	System	No	No
IOtech	System	No	No
PC Sound	System	No	No
Video	System	No	No
GPS	System	No	No
National Instruments	System	No	No
Technikmedia AVR-NET-IO	System	No	No
Technikmedia ATMEL	System	No	No
Technikmedia Modbus (licensed)	**System**	**No**	**No**
OPTRIS (licensed)	**System**	**No**	**No**
OPC (licensed)	**System**	**No**	**No**

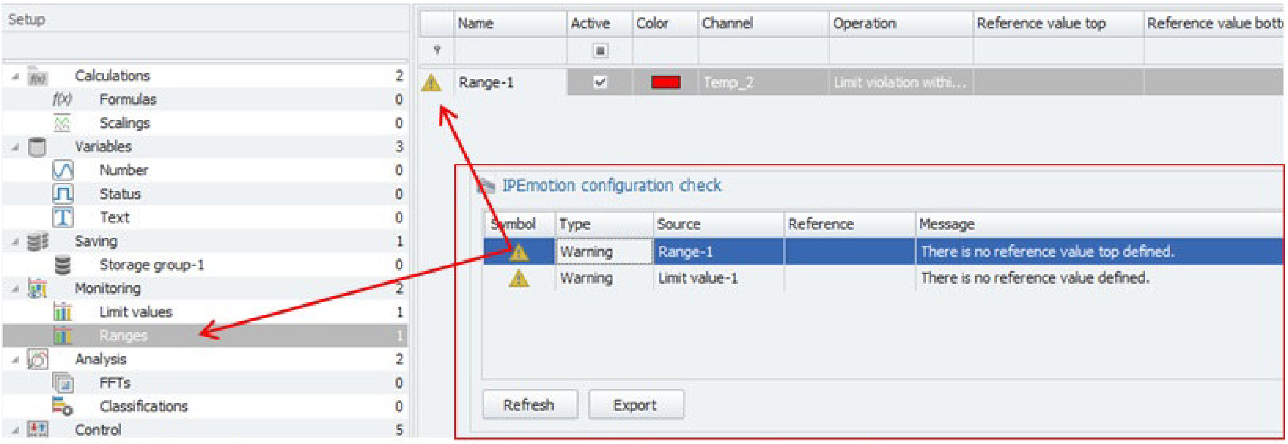
11.1.4 Configuration check

This function checks the configuration on consistency. However, this function does not work for all PlugIns. Messages are only returned if the PlugIn supports the checking function. The configuration check function for example considering duplicate channel names across all active PlugIns across the SIGNALS and ACQUISITION work space. A comfortable function for message refresh and configuration error searching is implemented in the configuration check function.



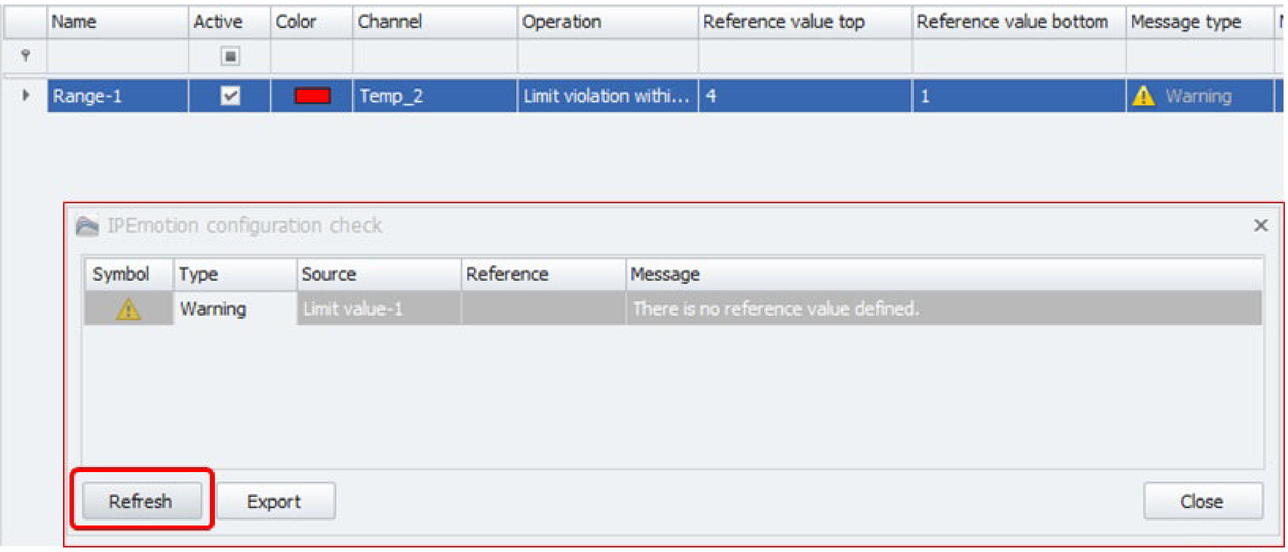
Refresh in the message window. [SI_5]

You can directly jump to the channel in the check window for the messages as indicated in the example below of the “Range-1” channel.



Double click on the message in the check window to reach the channel. [SI_6]

You can update the configuration and correct errors while the check window is open. With the refresh button you can update the message list.



Hit refresh button after the errors are corrected. > Message list is updated. [SI_7]

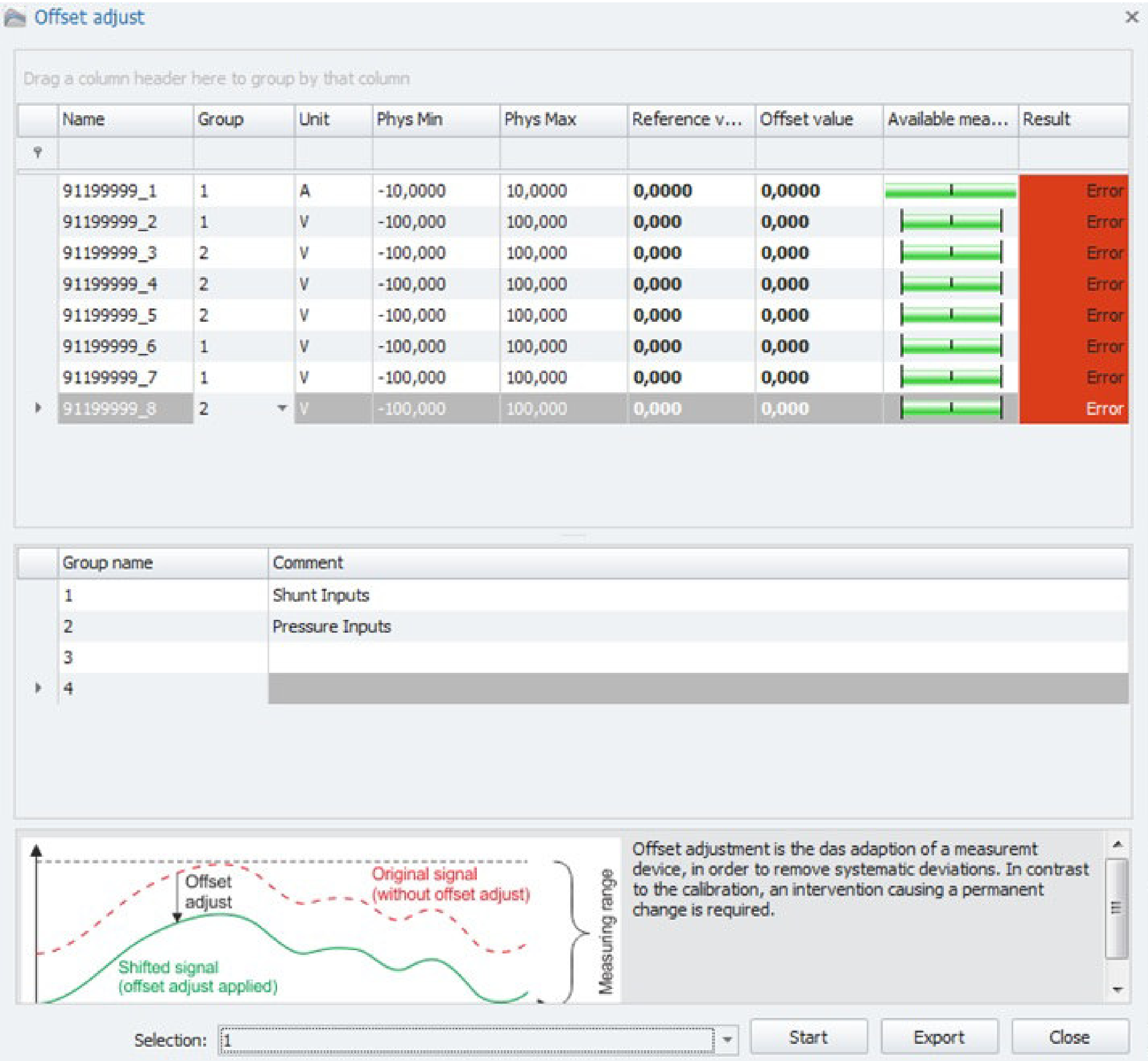
11.2 Adjusting functions

11.2.1 Database

This function will automatically update all sensors of the configuration with the latest entries of the sensor data base. Details on the sensor data base are discussed in chapter 11.9.
If you perform a configuration (IWF) and use sensors from the sensor data base and run the **Adjust Database** function, the software automatically retrieves the latest sensor configuration from the data base. With this process you can automatically update all sensors with the latest calibration data from the data base in one click.

11.2.2 Offset

The offset adjustment is implemented for the IPETRONIK Mx-SENS and Sx-STG modules. You will find more derails in the IPETRONIK X-PlugIn documentation.



[SI_8]

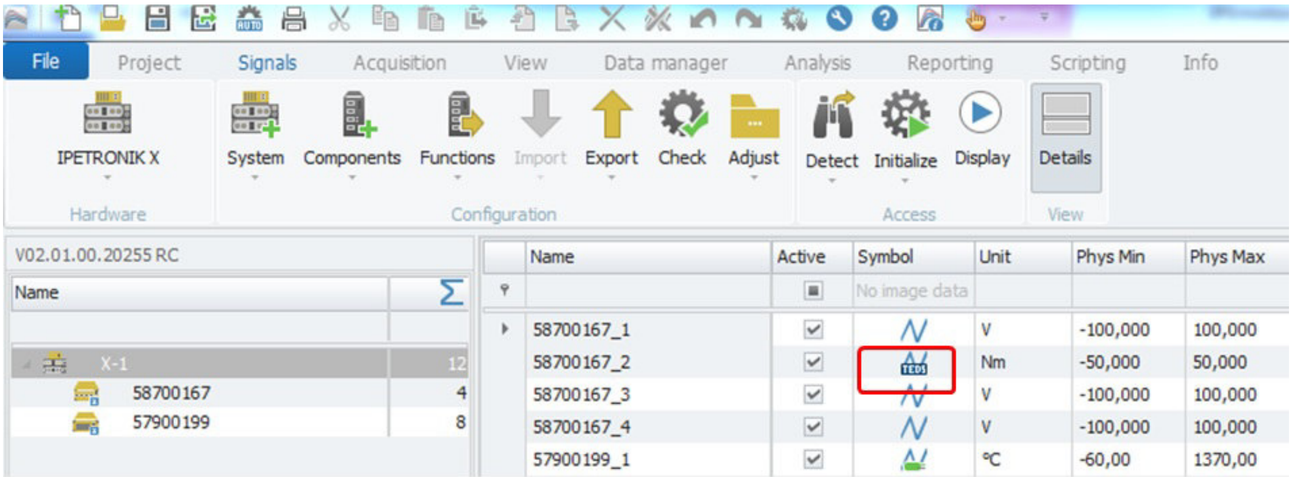
11.2.3 TEDS

The TEDS (Transducer Electronic Data Sheet) adjustment is implemented for the IPETRONIK Sx-STG strain gauge module and M-SESN2 which supports TEDS sensors. This function only works if TEDS sensors are connected to the Sx-STG module. A TEDS sensor data base is supported. If the Sx-STG module detects a TEDS sensor, you can save it to a separate database file called **IPESensorDatabase.xmt**. The main advantage is being able to configure TEDS sensors offline.

Win7: C:\Users\Public\Documents\IPETRONIK\IPEmotion\Database\IPESensorDatabase.xmt

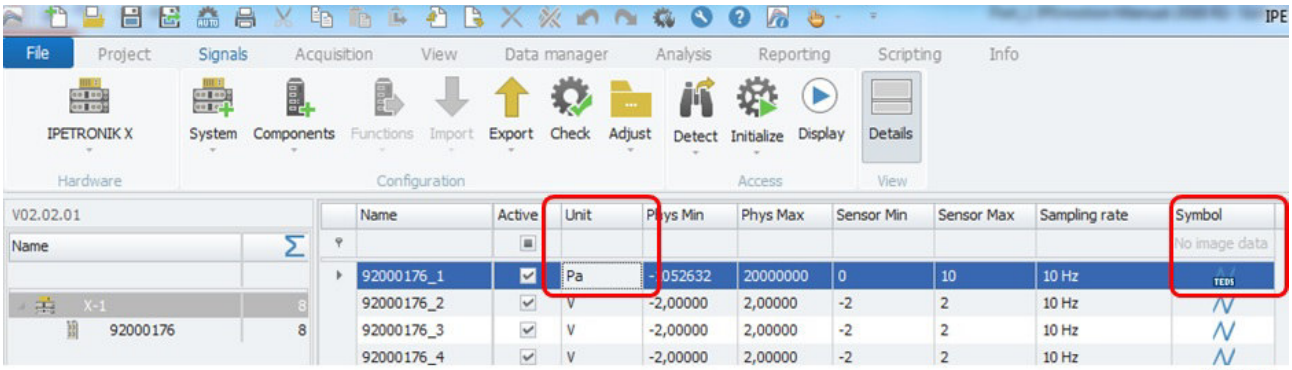
When a hardware detection is executed and TEDS sensors are connected to the analog inputs the TEDS symbol is visible provided the symbol column is activated in the channel grid. The following modules support TEDS:

- Sx-STG and M-SENS2. More modules will be supporting TEDS class 2 sensors in the future.



Detect TEDS sensors. [SI_9]

TEDS sensor detection with automatic unit transformation
When you detect TEDS sensors you can define an automatic unit conversion. This function is needed when the unit defined for the sensor does not meet the unit format required for the measurement application. In order to activate this feature you have to make an additional entry in the **Settings.XML** file.
In this example the standard sensor was detected with the unit [Pa].

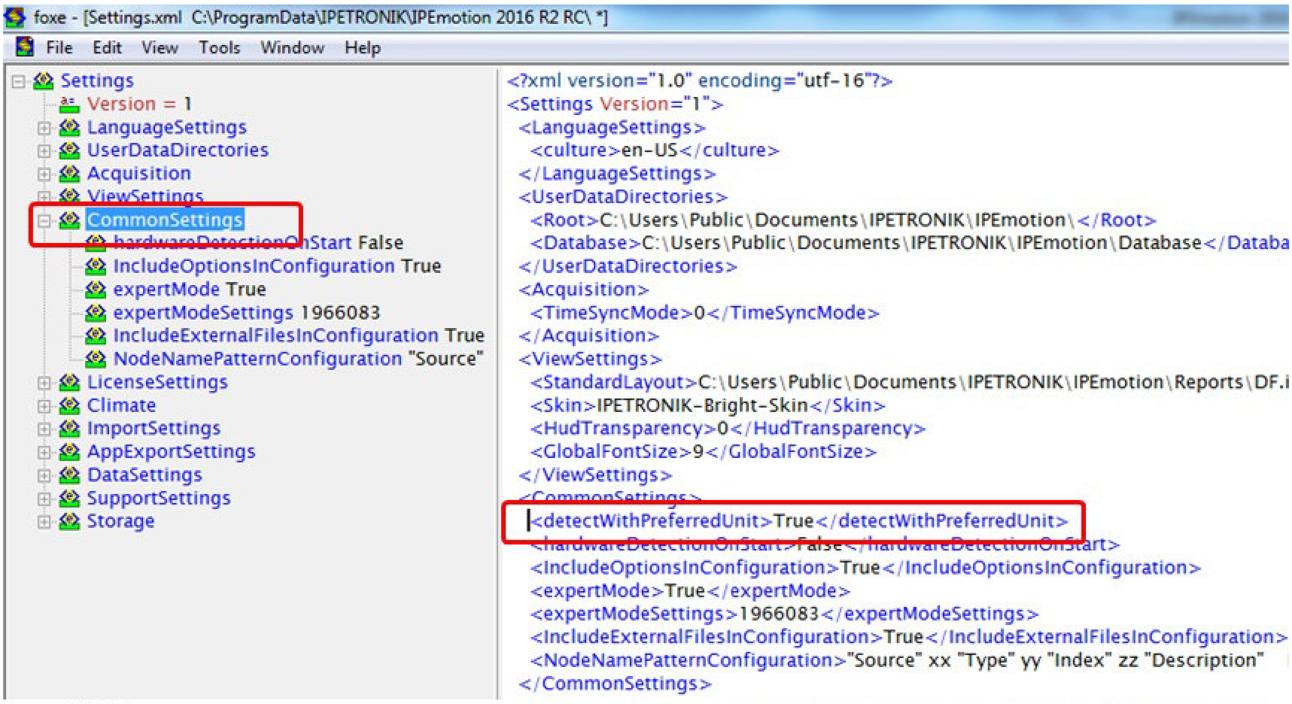


TEDS sensor default unit: Pa [SI_10]

When you add the following code into the settings.XML file the unit are automatically converted to the preferred unit defined in the OPTIONS >Unit settings.

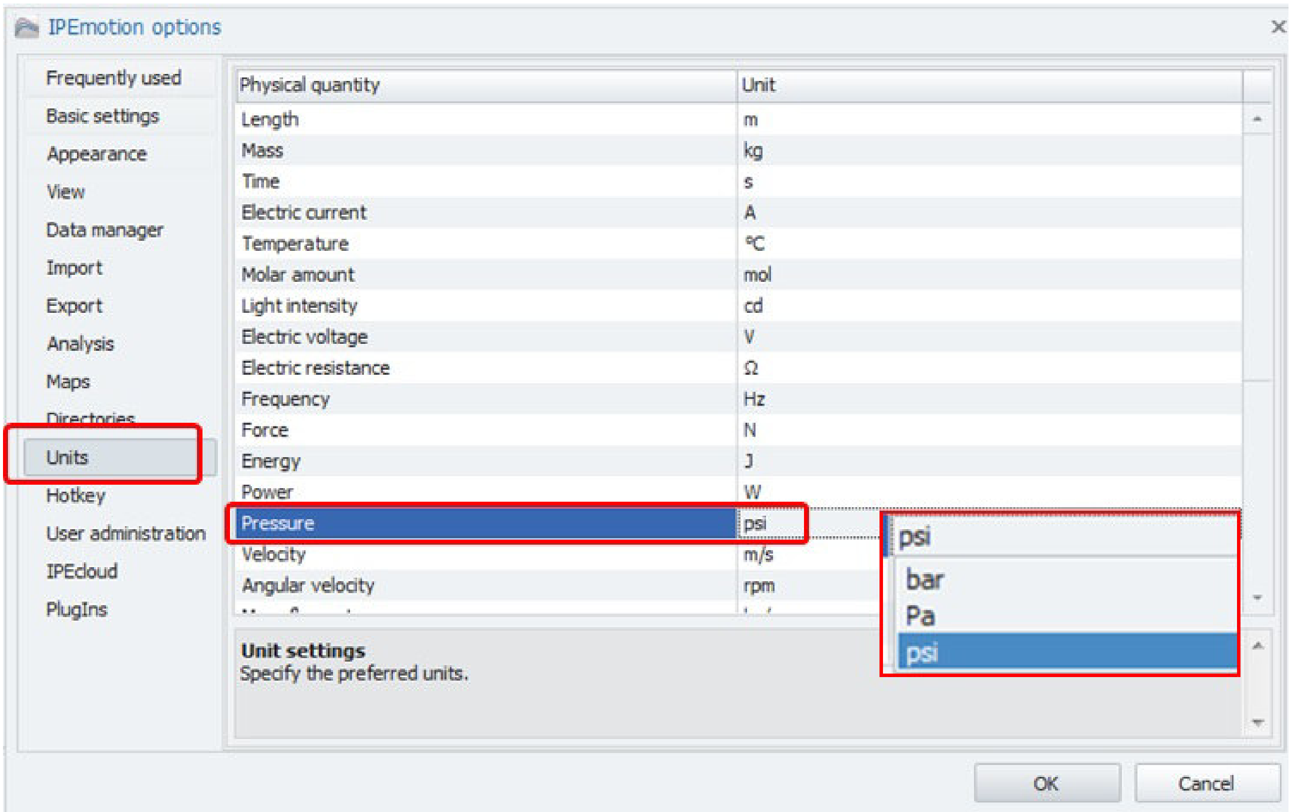
- Win 7: C:\ProgramData\IPETRONIK\IPEmotion 2016 R2**Settings.XML**

The new entry in the XML file should be:
<CommonSettings>
<detectWithPreferredUnit>**True** </detectWithPreferredUnit>
</CommonSettings>



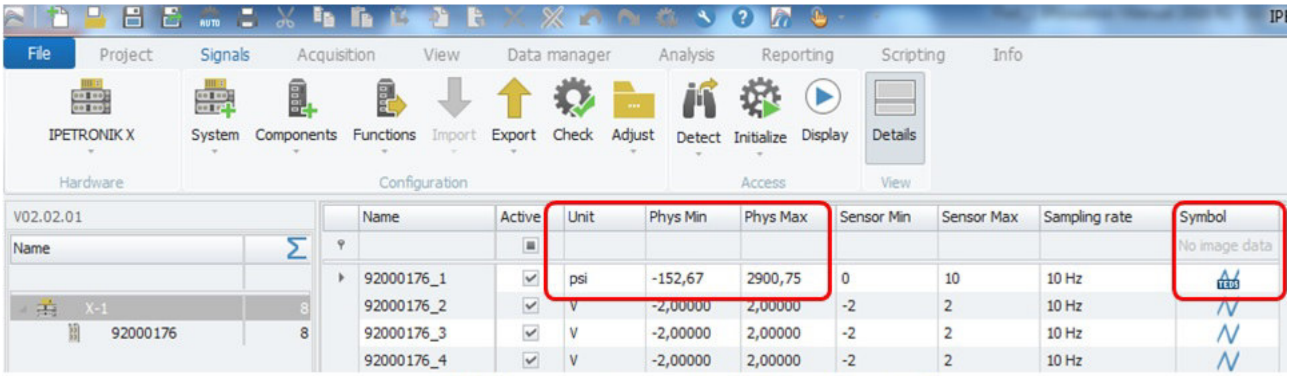
[SI_11] Add new function for TEDS unit conversion to Settings.xml.

The default unit defined in the OPTIONS >Units is [PSI]



Example for default unit for PRESSURE: [PSI] [SI_12]

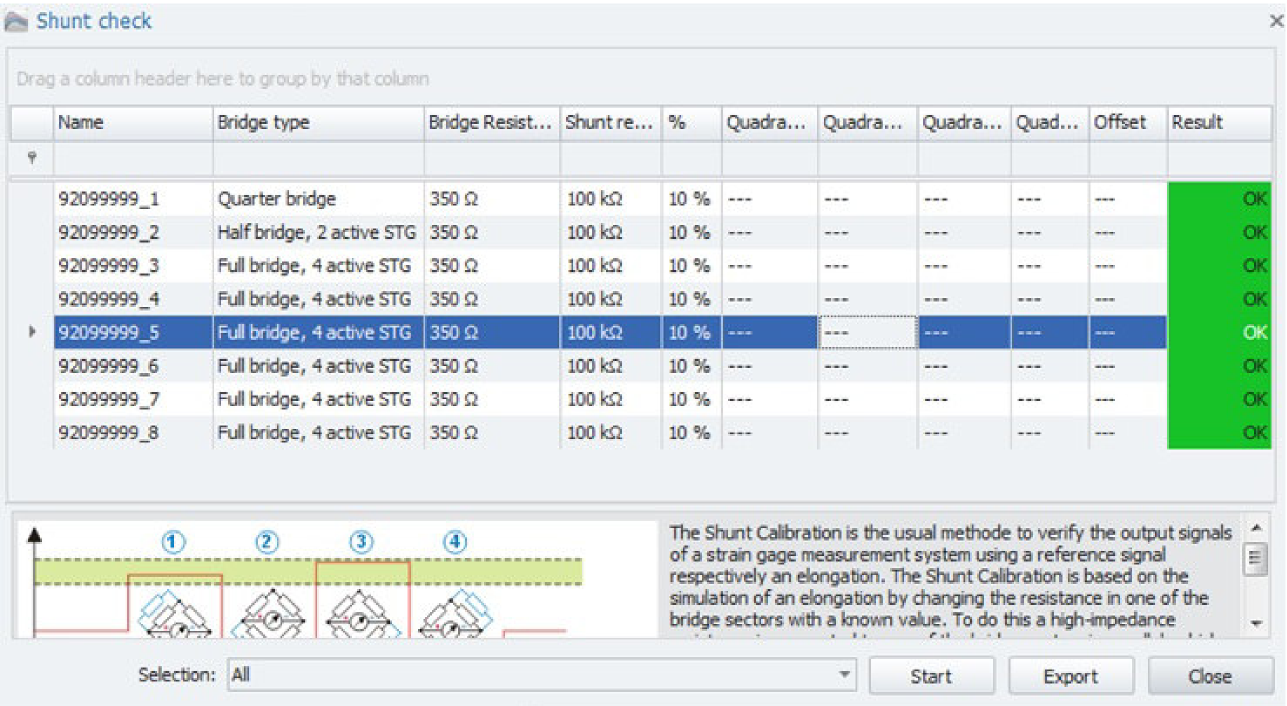
The displayed and converted scaling is now automatically changed to [PSI].



TEDS sensor changed to [PSI] scaling / unit [SI_13]

11.2.4 Shunt Check

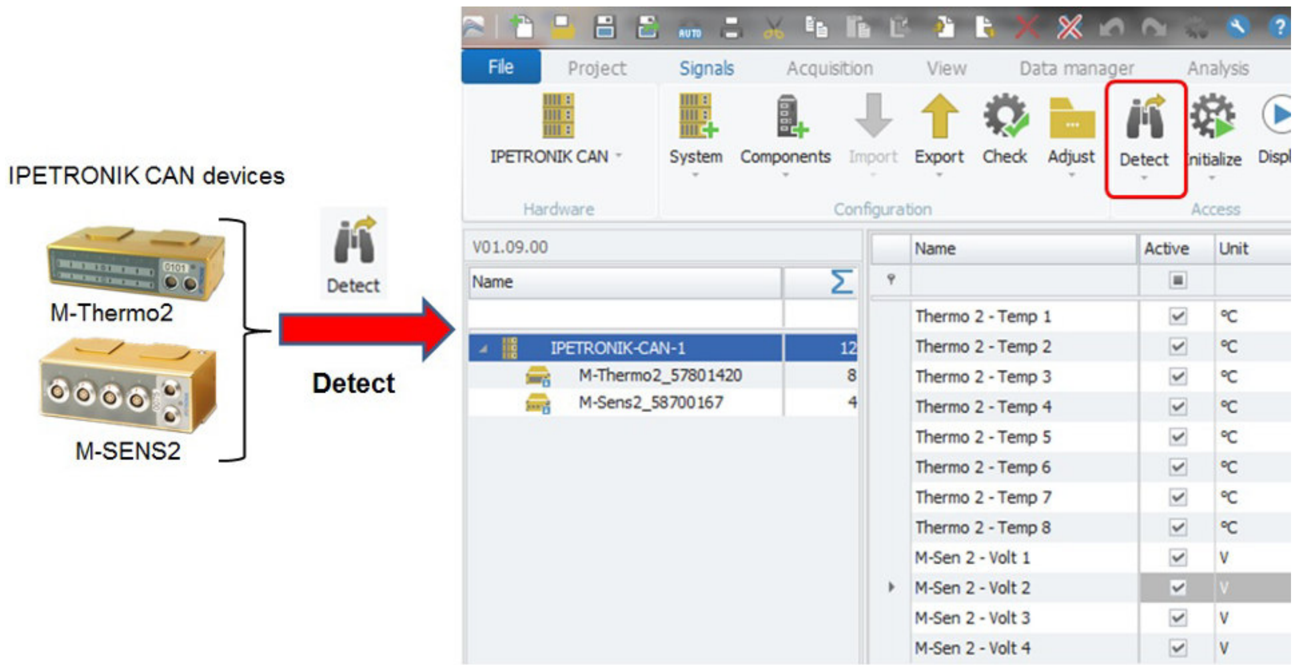
The shunt check function is only implemented for the IPETRONIK strain gauge module Sx-STG. Find more details in the PlugIn manual of the X-Modules.



[SI_14]

11.3 Detect

The DETECT function is a very convenient function to identify any hardware connected to IPEmotion. Not every PlugIn supports automatic hardware detection. Usually, USB device interfaces support automatic hardware detection. The device detection via TCP/IP is currently only supported by the IPETRONIK PlugIn LOG and the Gantner PlugIn.
The DETECT function is applied to all active PlugIns. The DETECT function is only required the very first time when you start to set up your measurement configuration. If the hardware configuration is changing by adding or removing modules, you need to execute the SYNCHRONIZE function to update the complete hardware configuration in the device tree. The SYNCHRONIZE function is explained in detail in chapter 11.3.2.



The modules are automatically created in the device tree. [SI_15]

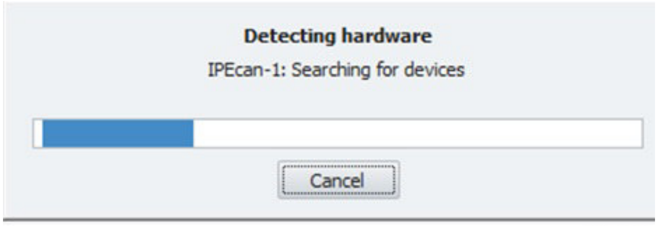
Attention! *If you execute the DETECT function the complete configuration of SIGNALS of all connected devices is recreated. Additionally, all the configurations from the ACQUISITION work space are removed.*

IPETRONIK PlugIns	Automatic Hardware Detection
IPETRONIK CAN	**Yes**
IPETRONIK X	**Yes**
IPETRONIK Log	**Yes**
CAN Send	**Yes**
CAN Acquisition	**Yes**
Protocols	**Yes**
PCAN-USB Pro Lin	No

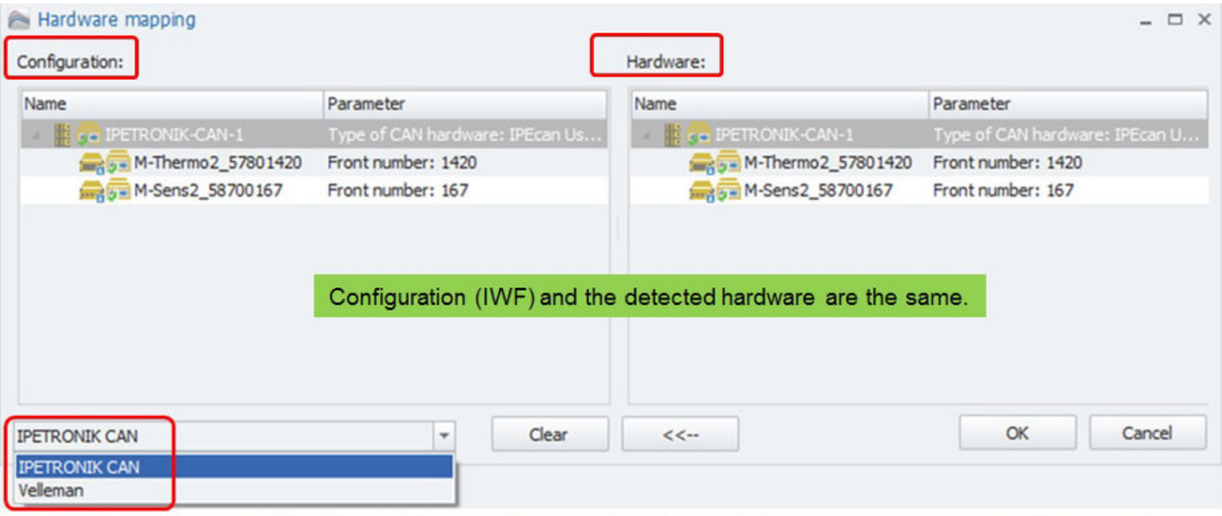
3rd Party PlugIns	Automatic Hardware Detection
ADDI-DATA	No
Advantech APAX	No
Advantech ADAM	No
Beckhoff	No
WAGO	No
WAGO PLC	No
Scales	No
SIEMENS	No
Profibus DP	No
HBM	No
Gantner	**Yes**
Velleman K8055 / VN110	**Yes**
Goldammer	**Yes**
ETHERNET	No
Serial	No
Yokogawa	No
IOtech	No
PC Sound	**Yes**
Video	**Yes**
GPS	**Yes**
National Instruments	**Yes**
Technikmedia AVR-NET-IO	No
Technikmedia ATMEL	No
Technikmedia Modbus	No
OPC	Yes
OPTRIS	**Yes**

11.3.1 Mapping

The hardware MAPPING is a very convenient function for merging configuration (IWF) files to the currently connected hardware. If you execute the MAPPING function, the current configuration is compared to the currently connected hardware. IPEmotion is starting the hardware detection to identify all currently connected modules.



[SI_16]

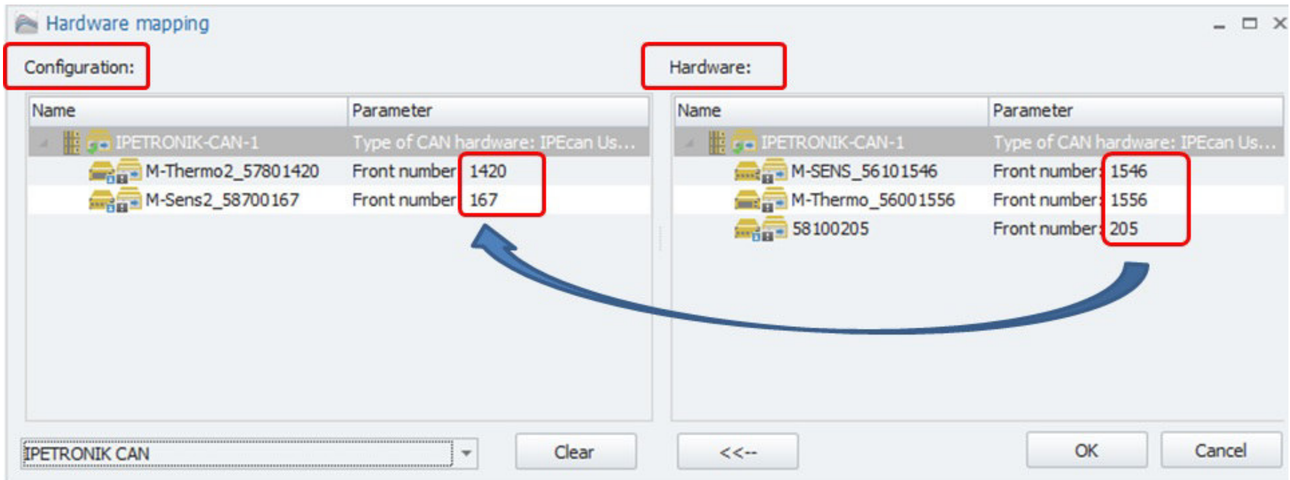


[SI_17]

The Mapping function compares the current configuration (IWF) to the currently detected hardware across all active PlugIns.

Information *The MAPPING function is therefore only supported for those PlugIns which support automatic hardware detection.*

In the following you will see an example how to use the mapping function in practice. There are applications in which the same configuration is applied to different hardware setups. For example, each IPETRONIK module has an unique front number and using the mapping function, the actual hardware configuration can be matched to the project configuration (IWF).

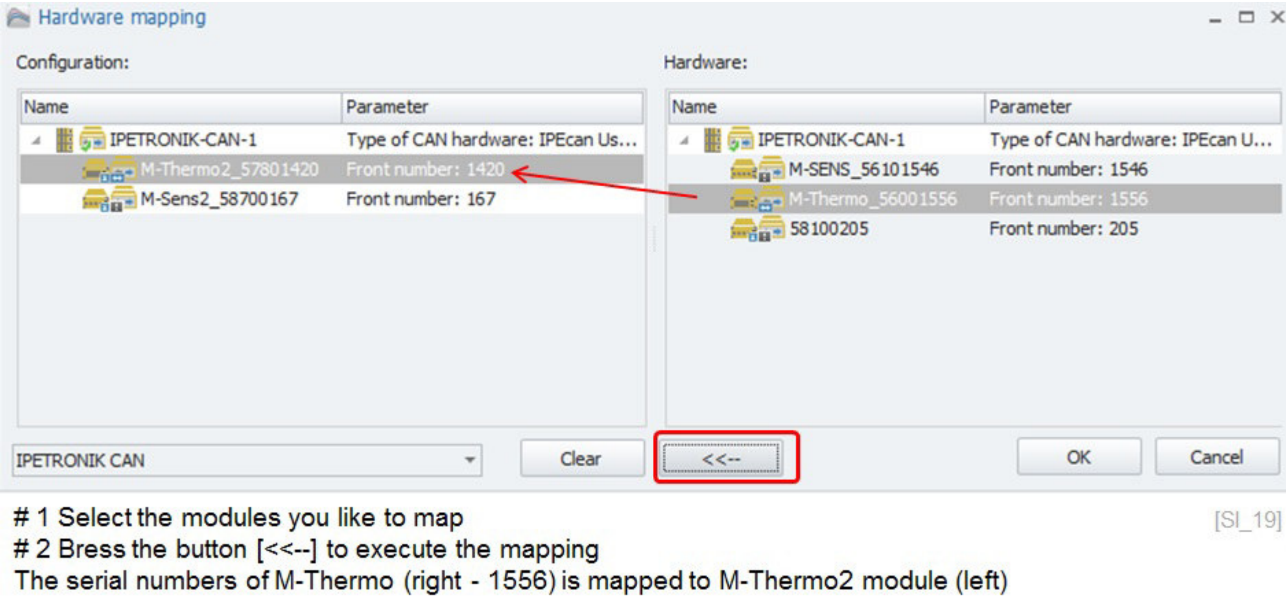


Configuration (left) and the detected hardware (right) window are different.

- different module types
- different front/serial numbers

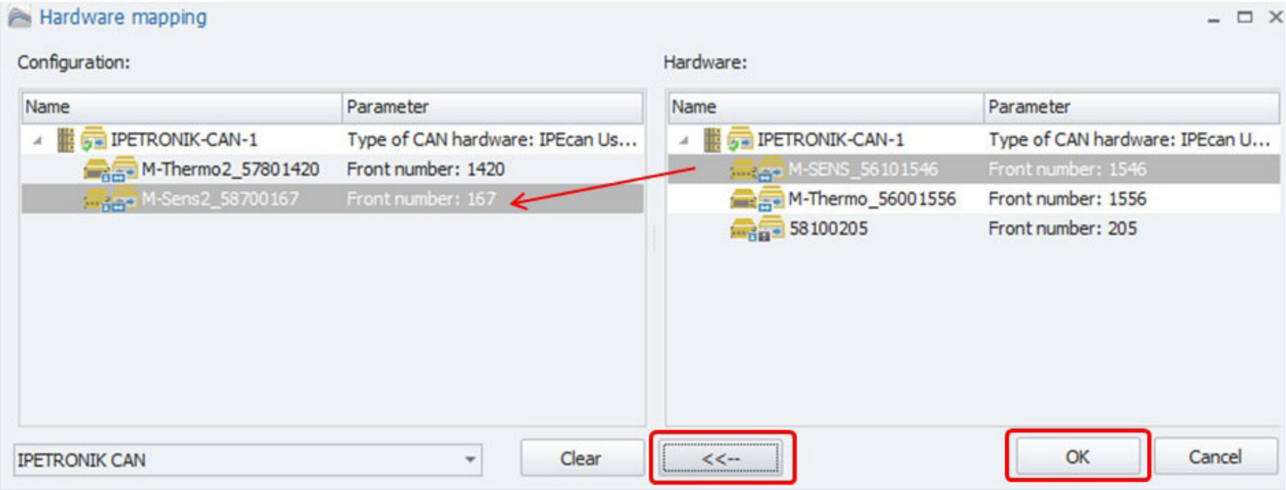
[SI_18]

#1) In the first MAPPING step the M-Thermo module (right) is transferred to the configuration.



[SI_19]

#2) In the second MAPPING step the M-SENS module (right) is transferred to the configuration.

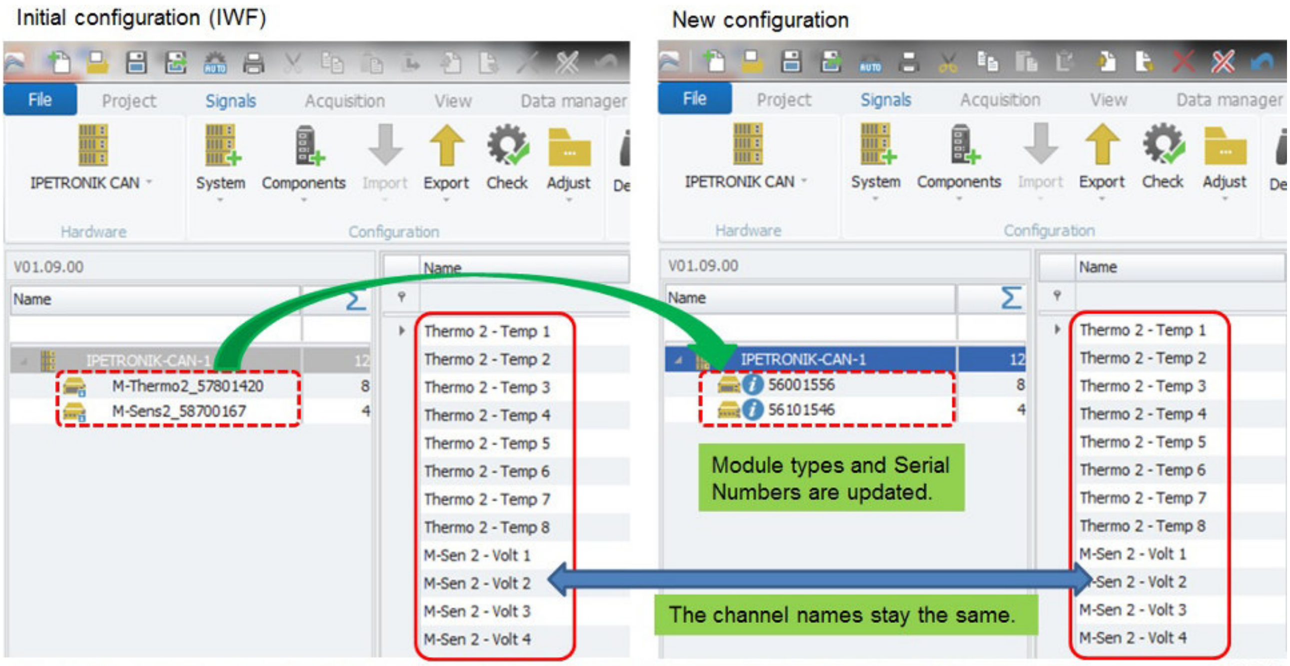


\# 1 Select the modules you like to map (M-SENS)
\# 2 Bress the button [<<--] to execute the mapping
\# 3 Press OK to confirm and finalize the mapping process.
The serial numbers of M-SENS (right - 1546) is mapped to M-SENS2 module (left - 167)

[SI_20]

Information *The Mapping function can be applied across different modules types. The system is not preventing you from mapping for example a M-RTD (PT100) module to a M-SENS module. The channel names stay the same but the measurement ranges and scaling is changed from VOLT to Temperature PT100.*

If you compare the configuration before and after the MAPPING, you will see that the channel definition is unchanged and that the module types and serial numbers are updated in the device tree.

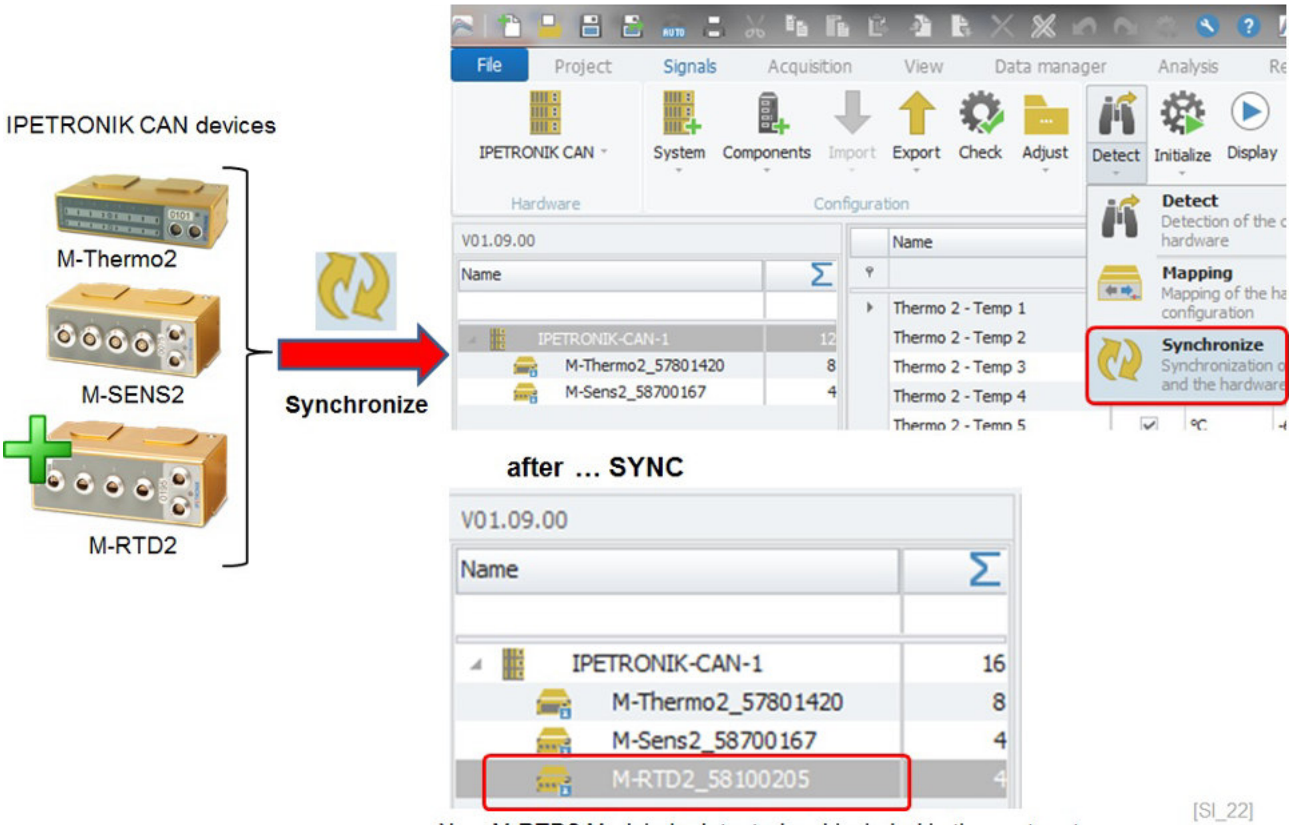


After the mapping process the initial configuration is updated by the new modules types, serial numbers, etc.

[SI_21]

11.3.2 Synchronize

The SYNCHRONIZE function is designed to update an initial configuration (IWF) with an updated hardware setup. This function is the counterpart of the DETECT function. As discussed above the DETECT function is creating your initial module setup. In practice the module setup can change where new modules are added or removed to the configuration. With the SYNCHRONIZE function you update your modules easily to your configuration.

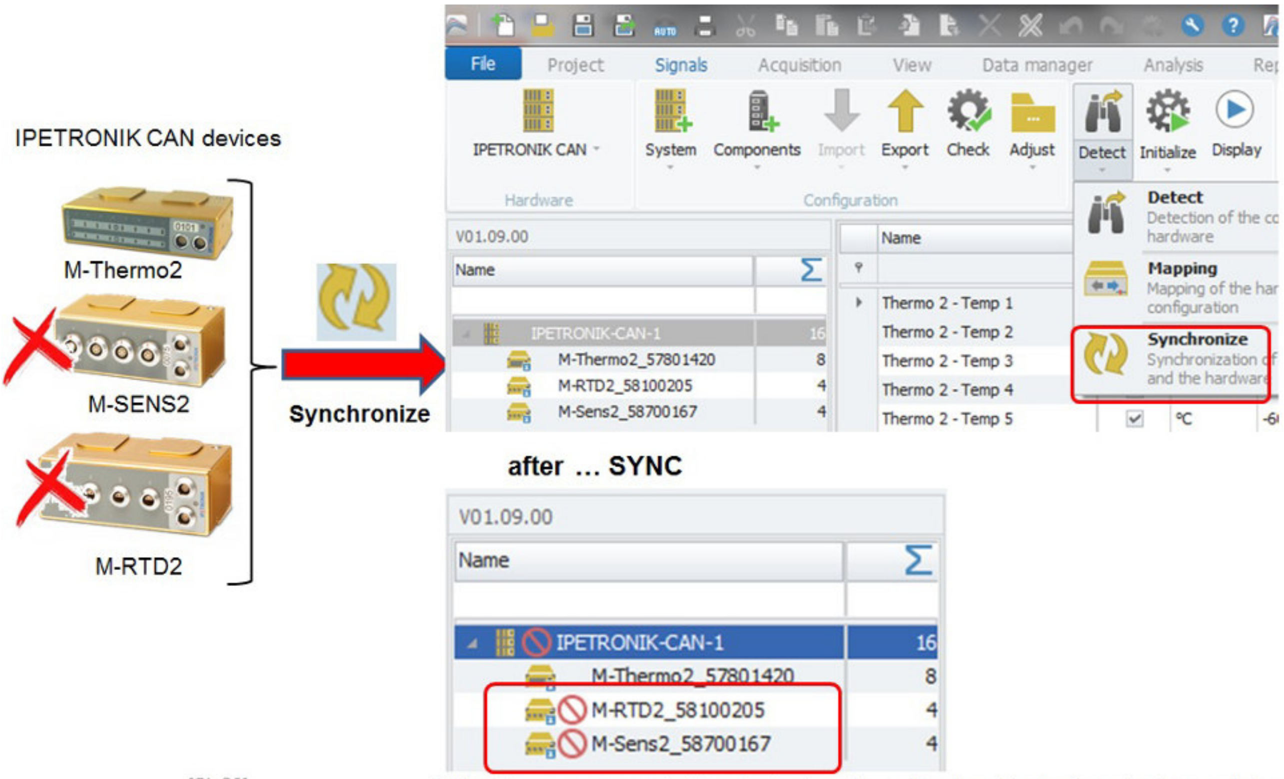


[SI_22]

New M-RTD2 Module is detected and included in the system tree.

Information *The SYNCHRONIZE function is not changing any configurations defined in the ACQUISITION work space.*

The SYNCHRONIZE function can also be applied to identify which modules are missing and cannot get detected.

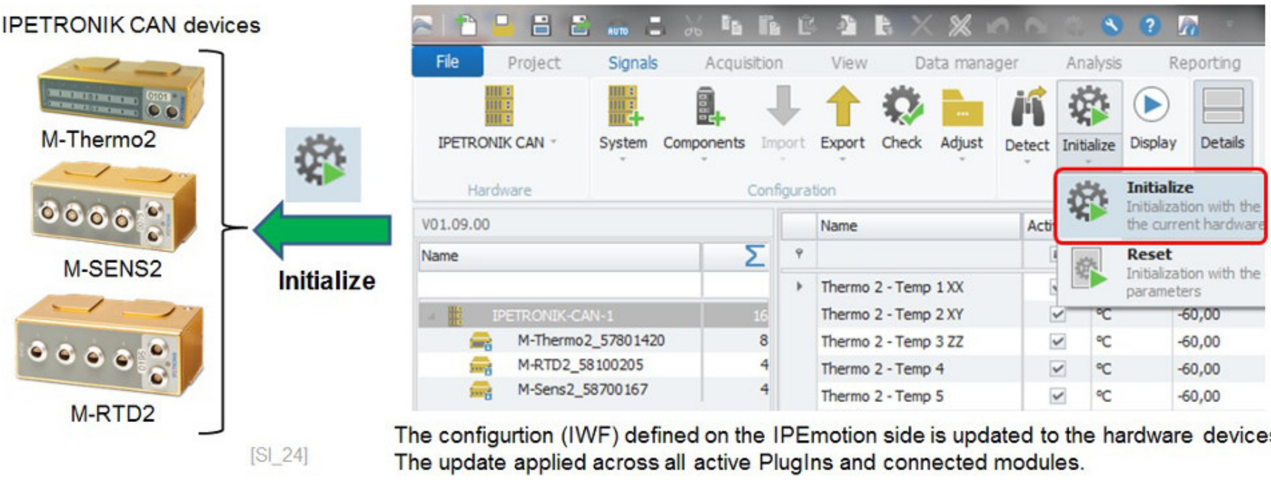


[SI_23]

2 Modules are removed. The device tree is updated and indicates missing modules.

11.4 Initialize

With the INITIALIZE function you can test the communication between your hardware and IPEmotion. If there are configuration errors or the hardware cannot be reached, messages are returned. Depending on the PlugIn version, error, info or warning icons are indicated.



The configurtion (IWF) defined on the IPEmotion side is updated to the hardware devices.
The update applied across all active PlugIns and connected modules.

The INITIALIZE function is also updating the hardware with the latest configuration parameters defined in IPEmotion. The configuration is downloaded to the devices. So when you run a hardware detection the latest configuration settings like channel name, scaling etc. . . are automatically retrieved from the module and displayed in IPEmotion.
However, in many cases the hardware cannot store a configuration. In this case, the configuration is only on the PC side but is not transferred and stored in the hardware.
The IPETRONIK modules store the following configuration settings internally *:

- Channel name
- Physical units
- 2-Point scaling
- Free 2 point scaling
- Factor offset scaling
- Sensor measurement range
- STG mode
- Data type (format)

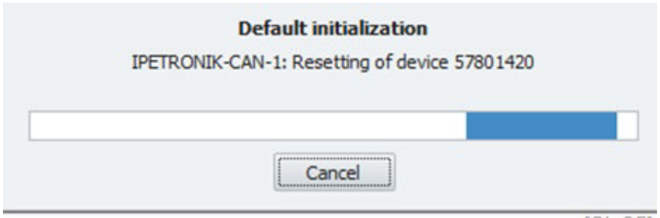
The following configuration settings **are not stored** in the IPETRONIK modules internally *:

- Channel description
- No value
- V-TAB (see section 11.8.7)
- V-TAB range (see section 11.8.6)
- Multi point scaling (11.8.4)

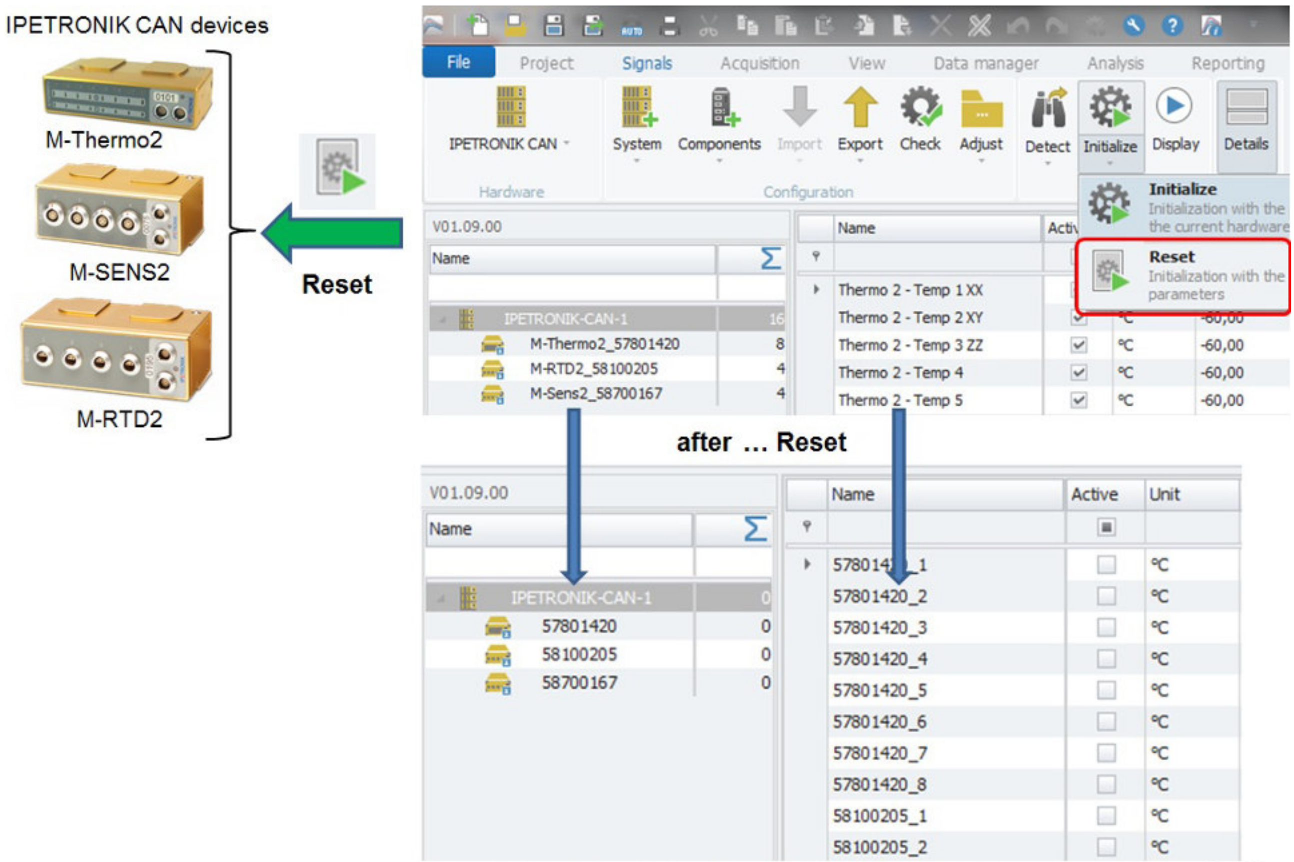
(*) Depending on the module there may be other specific settings which can be stored or not be stored in the devices.

11.4.1 Reset

The reset function is relevant for instruments which can store a configuration in the device. After reset, all configurations stored inside the device are set back to factory default.



[SI_25]

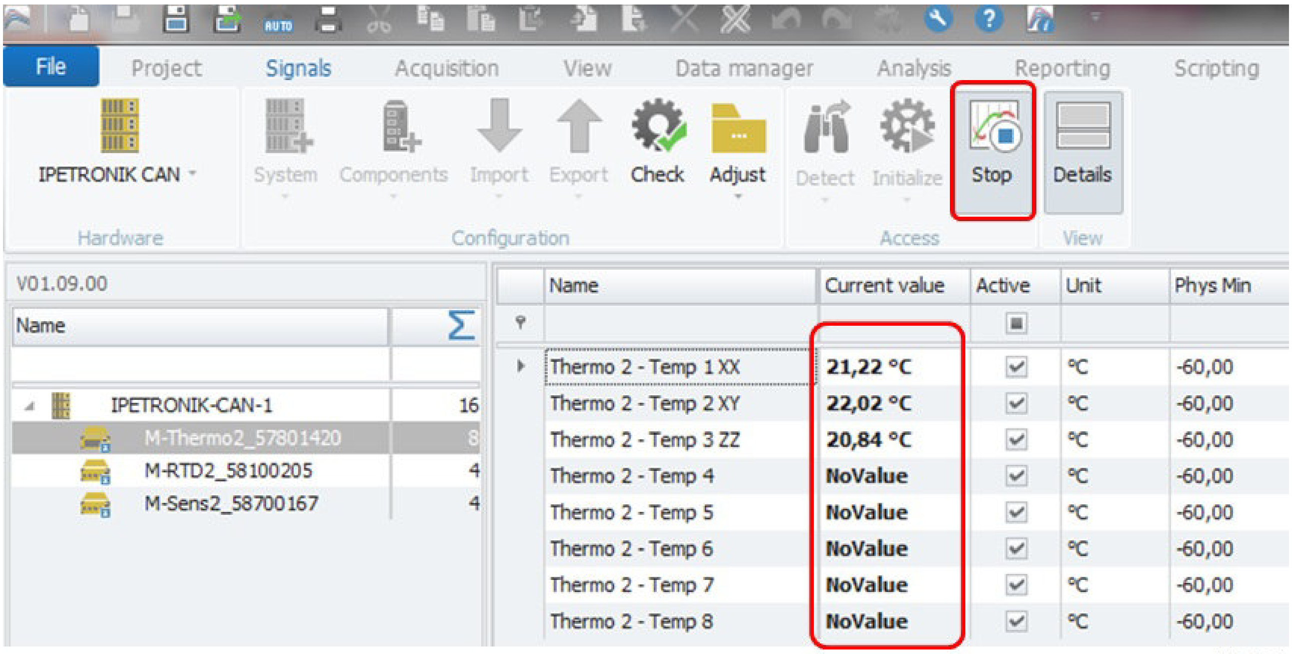


After Reset the module settings are set back to factory default values. [SI_26]

Information *The RESET is applied to all PlugIns which support the RESET function. The function is implemented and used for IPETRONIK modules and data loggers as these instruments can store a configuration.*

11.4.2 Display

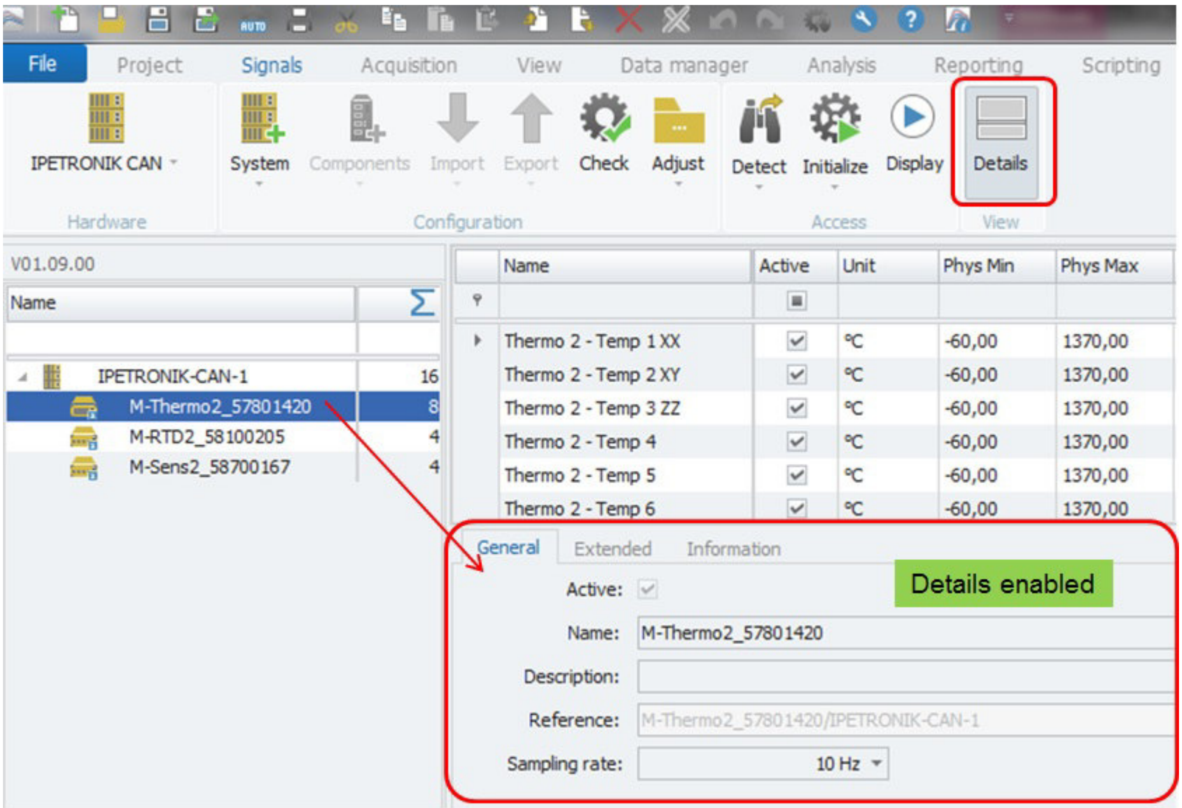
The Display button turns your configuration into measurement mode. Then you will see measurement values for all active channels.



Online measurements. [SI_27]

11.4.3 Details

With the Details button in the ribbon you can display or hide all tab sheets for systems, modules and channels configuration.

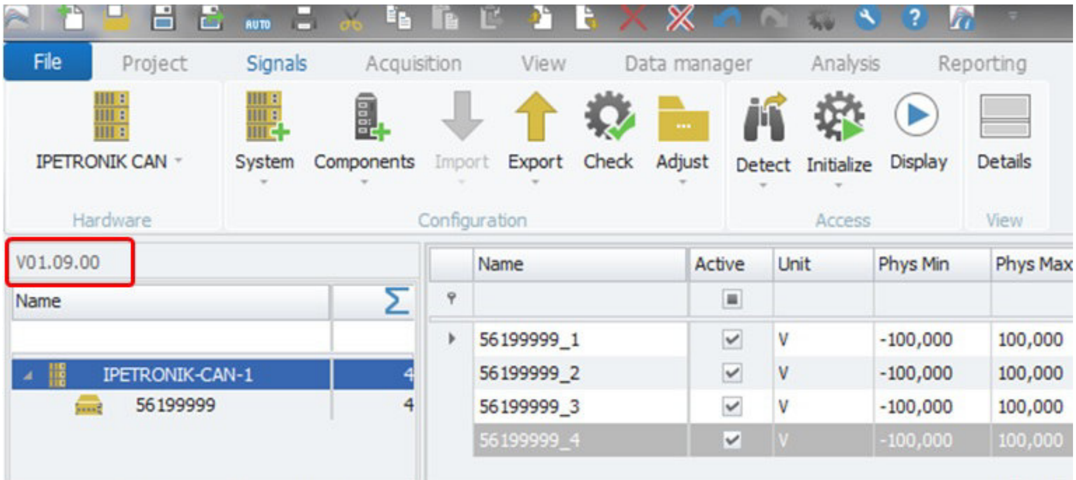


[SI_28]

11.5 Device / System / Module Tree

11.5.1 PlugIn version

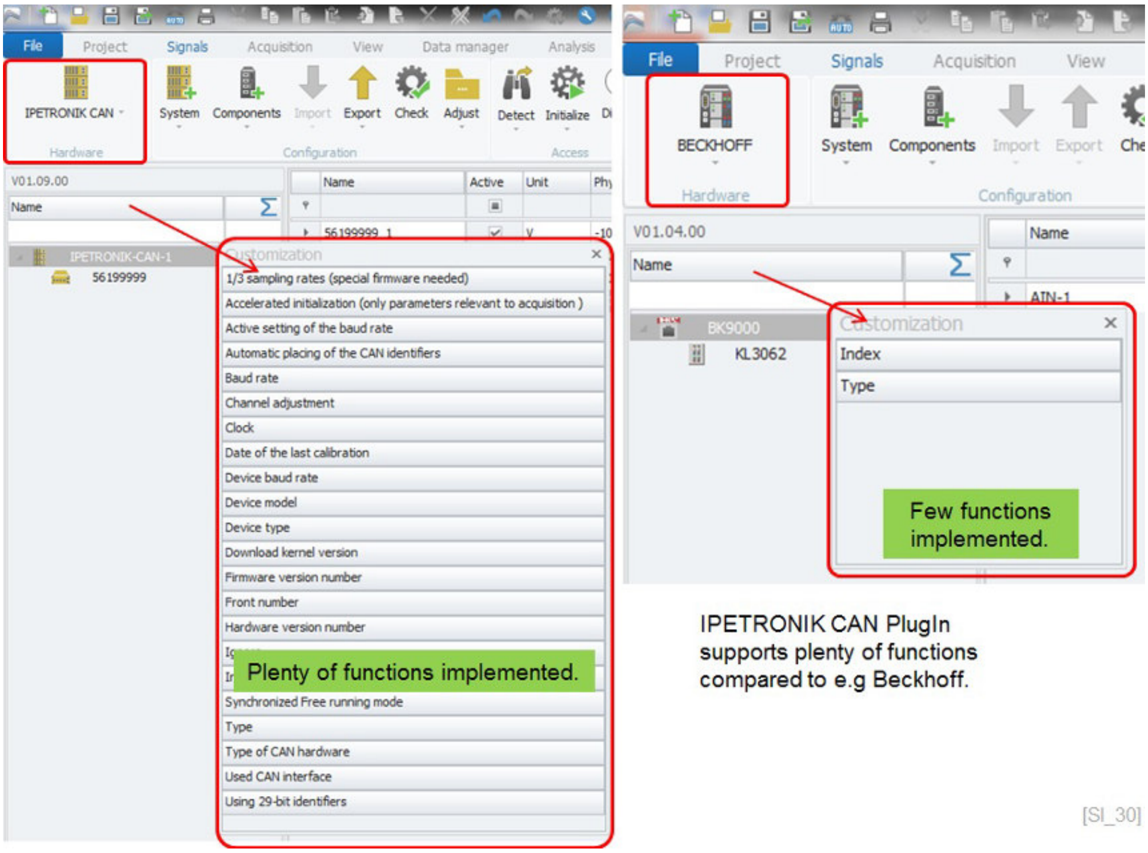
If you select a PlugIn from the active hardware list, you will see the currently loaded PlugIn version. For changing the PlugIn version you need to go back to OPTIONS >PlugIns. There you can switch to previous versions. An equal sign (=) behind the PlugIn version indicates that you will always use this version even if a more recent PlugIn version has been installed. For more details see OPTIONS >PlugIn 22.16.3.



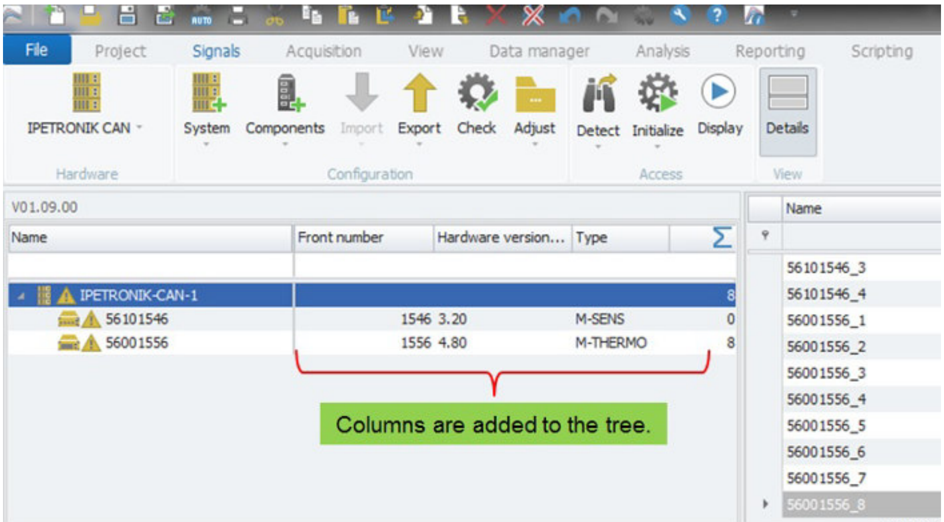
Active PlugIn version is indicated. [SI_29]

11.5.2 Column chooser

In the system tree you can activate a column chooser. In the system tree you can activate a column chooser by right click on the column header. This is a very useful function to add additional properties to your devices and modules. The scope of functions in the column chooser depends on the PlugIn. Some PlugIns support plenty of functions and other PlugIns have limited ranges of functionality.



IPETRONIK CAN PlugIn supports plenty of functions compared to e.g Beckhoff. [SI_30]

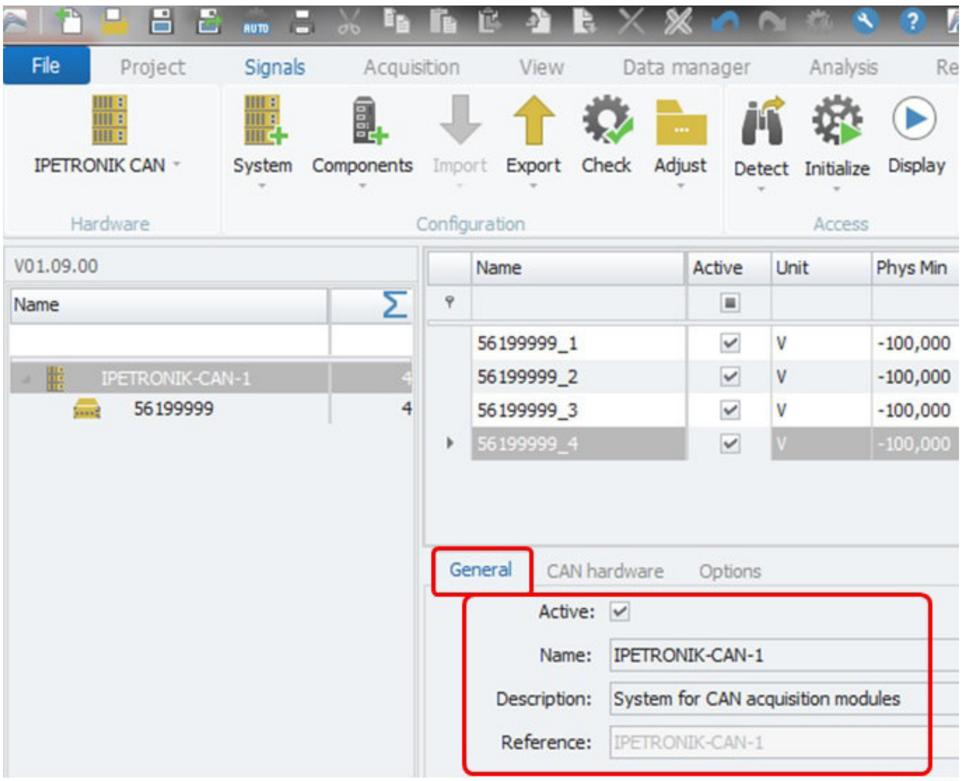


[SI_31]

11.5.3 Device configuration tab sheet

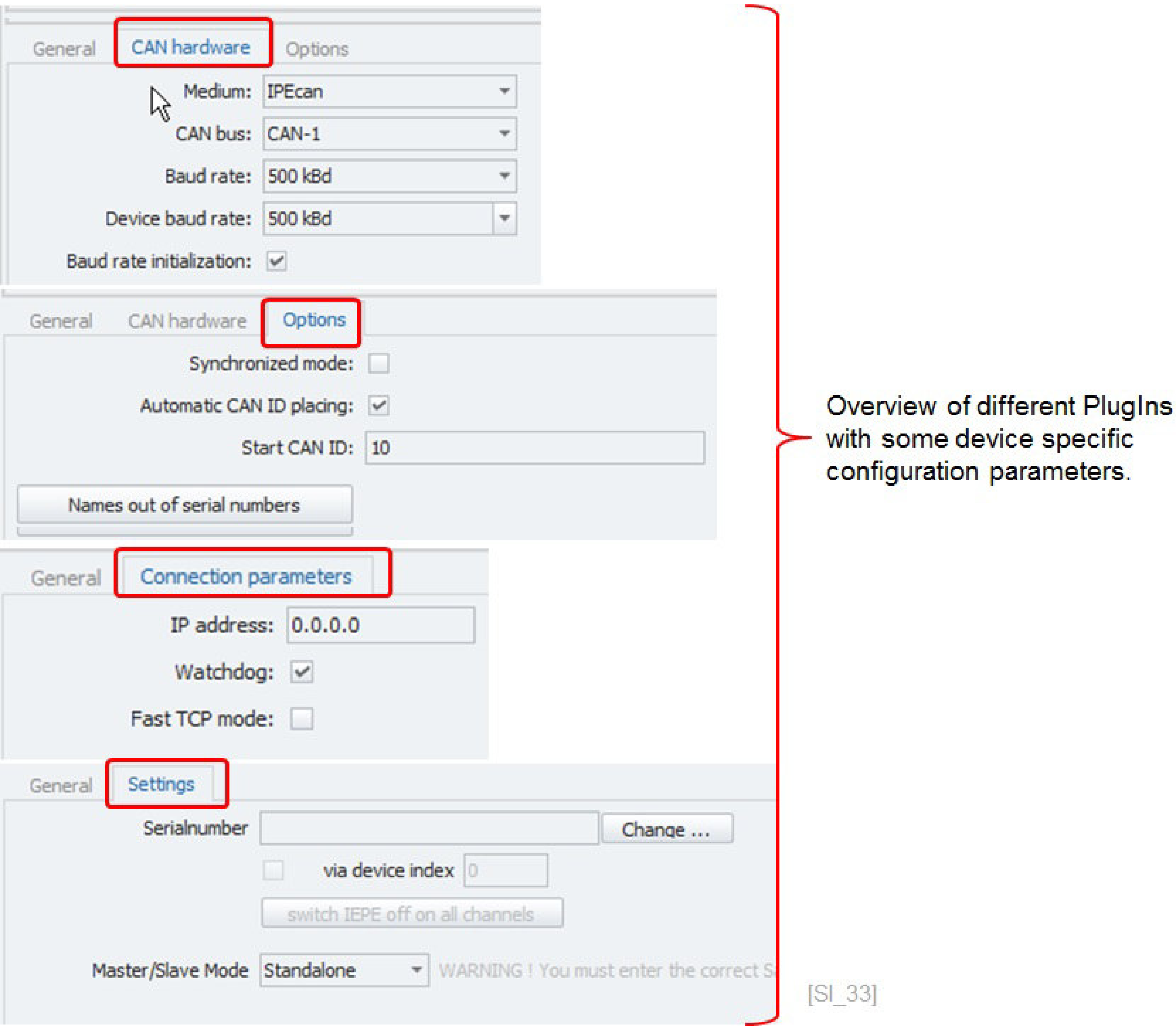
The device configuration tab sheet covers the basic description of any device or system. It is standard for all PlugIns. The covered items are:

- Active — Checkbox to activate or deactivate a system on top level
- Name — Default name - can be changed to any individual description
- Description — Default description - can be changed to any individual description
- Reference — Is automatically generated and very useful for checking device links. The reference will be discussed in detail in the next section where channels are discussed
- Sample rate — Some instruments support a global sample rate and therefore they have an input field to enter the sample rate for all IO modules on device level



[SI_32]

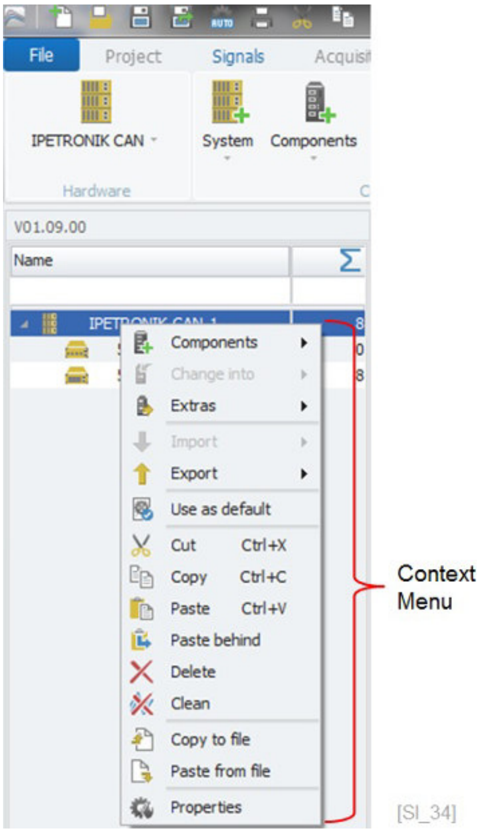
There are also plenty of device-specific tab sheets which are individual to certain PlugIns. Detailed descriptions about different settings are part of the PlugIn manuals.



[SI_33]

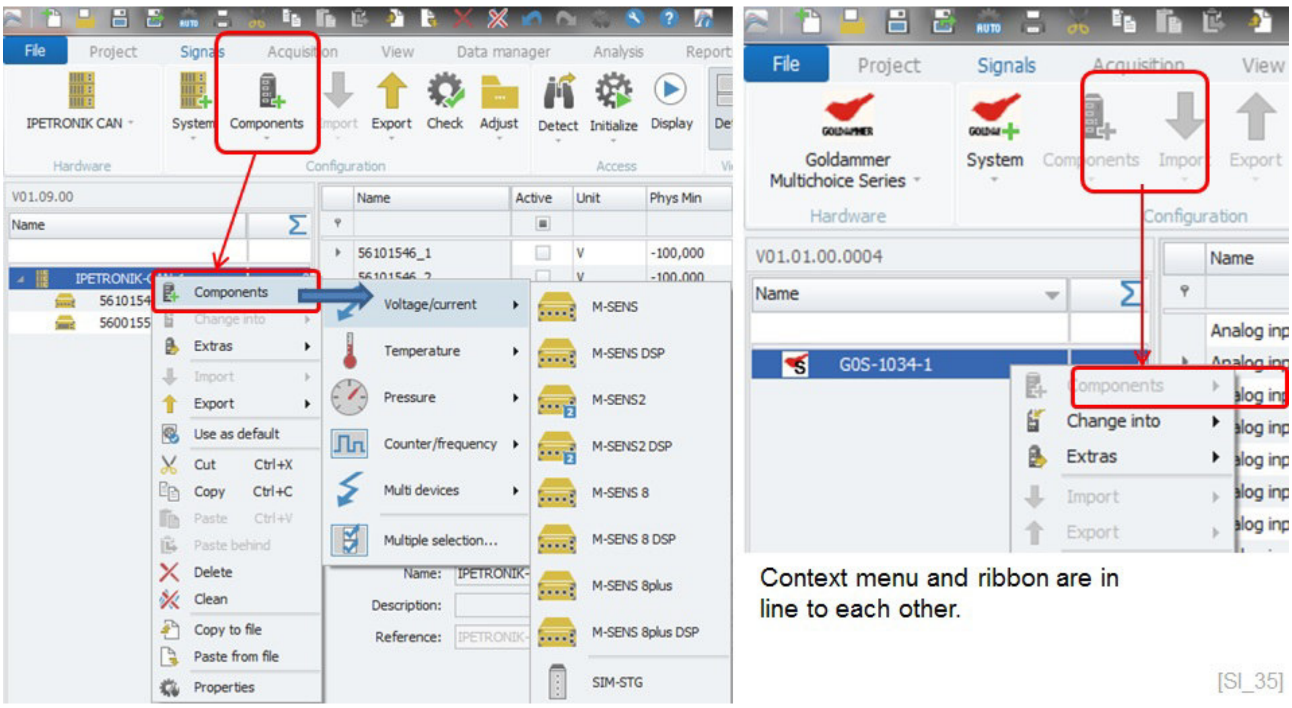
11.5.4 Context menu for system, modules and channels

The context menu offers convenient functions for setting up your application. With right click to the system, module or channel you can access the context menu. The functions provided in the context menu depend on the PlugIn. Some PlugIns offer plenty of functions and other just provide some basic functions.



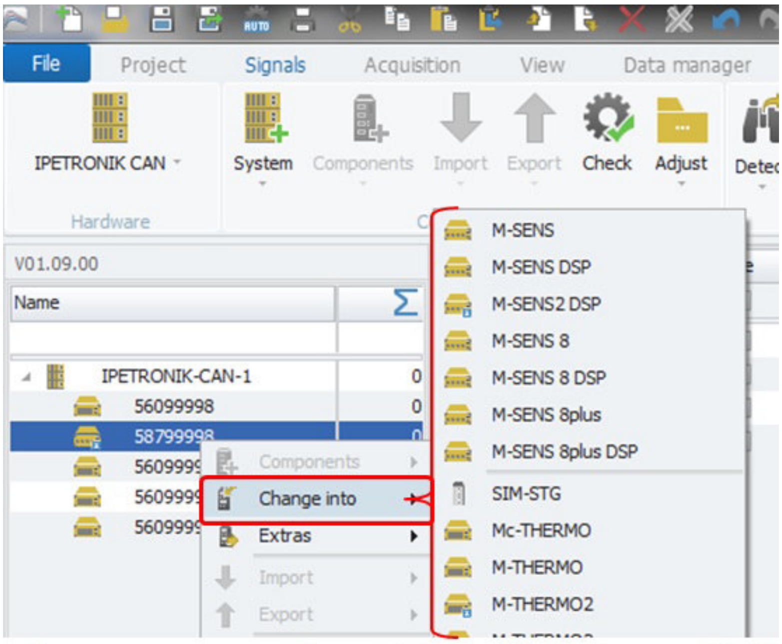
[SI_34]

- ► Components — You can add components if the PlugIn supports a modular hardware structure. The example shows two different PlugIns. If the ribbon does not support any components, the function is deactivated in the context menu.



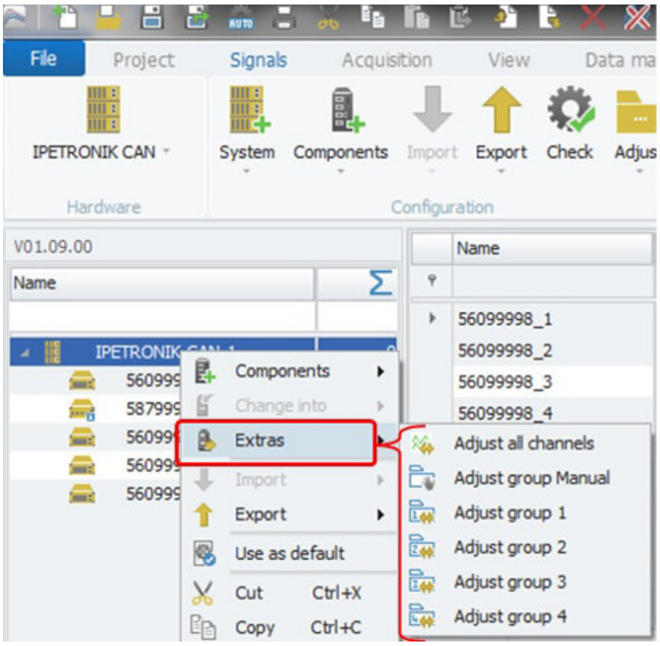
[SI_35]

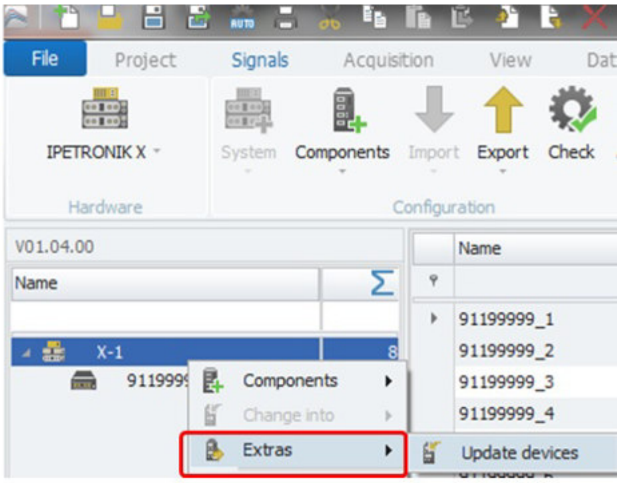
- **Change into** — This function can convert a component/module to another type. Basically, if you build your configuration offline and you change the type of some modules without rebuilding the complete configuration, you switch modules with the "Change into" function.



Change a component (IO module) to a different type. [SI_36]

- **Extras** — This function covers PlugIn-specific functions

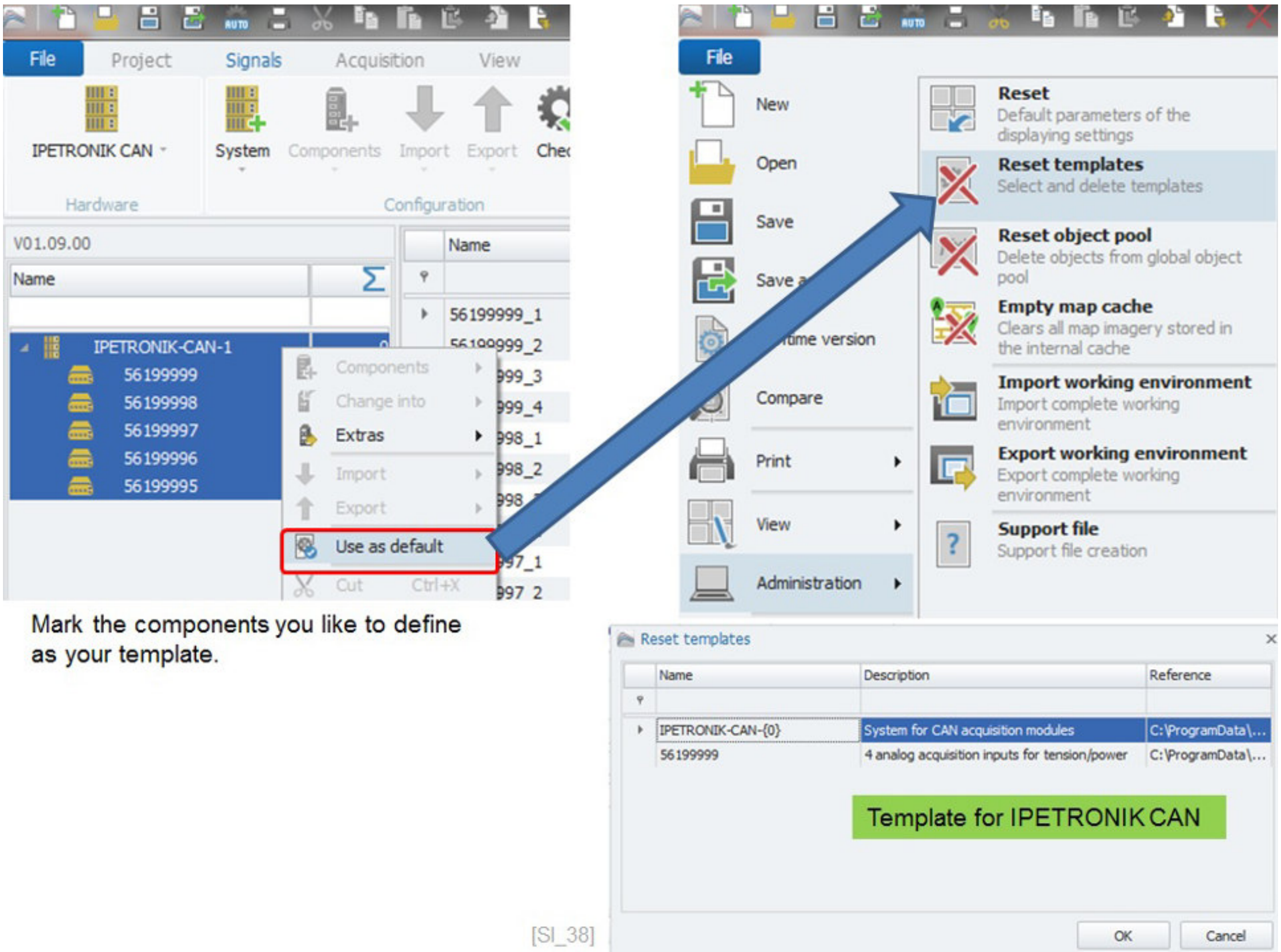




The item Extras covers PlugIn specific special features.

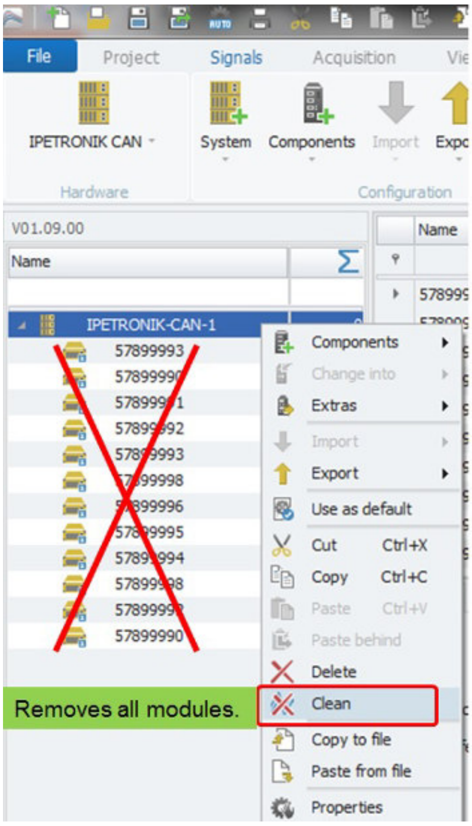
[SI_37]

- **Import / Export**: This function refers to the same function as implemented in the main ribbon. There are plenty of different import and export functions available. It is mainly related to configuration files like A2L, CANdb, Autosar etc. They are discussed in the previous chapter 11.1.3
- **Use as default**: This function is useful for all users who need to create the same configuration several times. If you save your master configuration as DEFAULT, all systems are created with this order of modules, automatically. The default configuration is saved and can be deleted in the Application menu as discussed in detail in the OPTIONS. You can only define one template for one interface. E.g. you cannot have different module configurations for IPETRONIK CAN 1



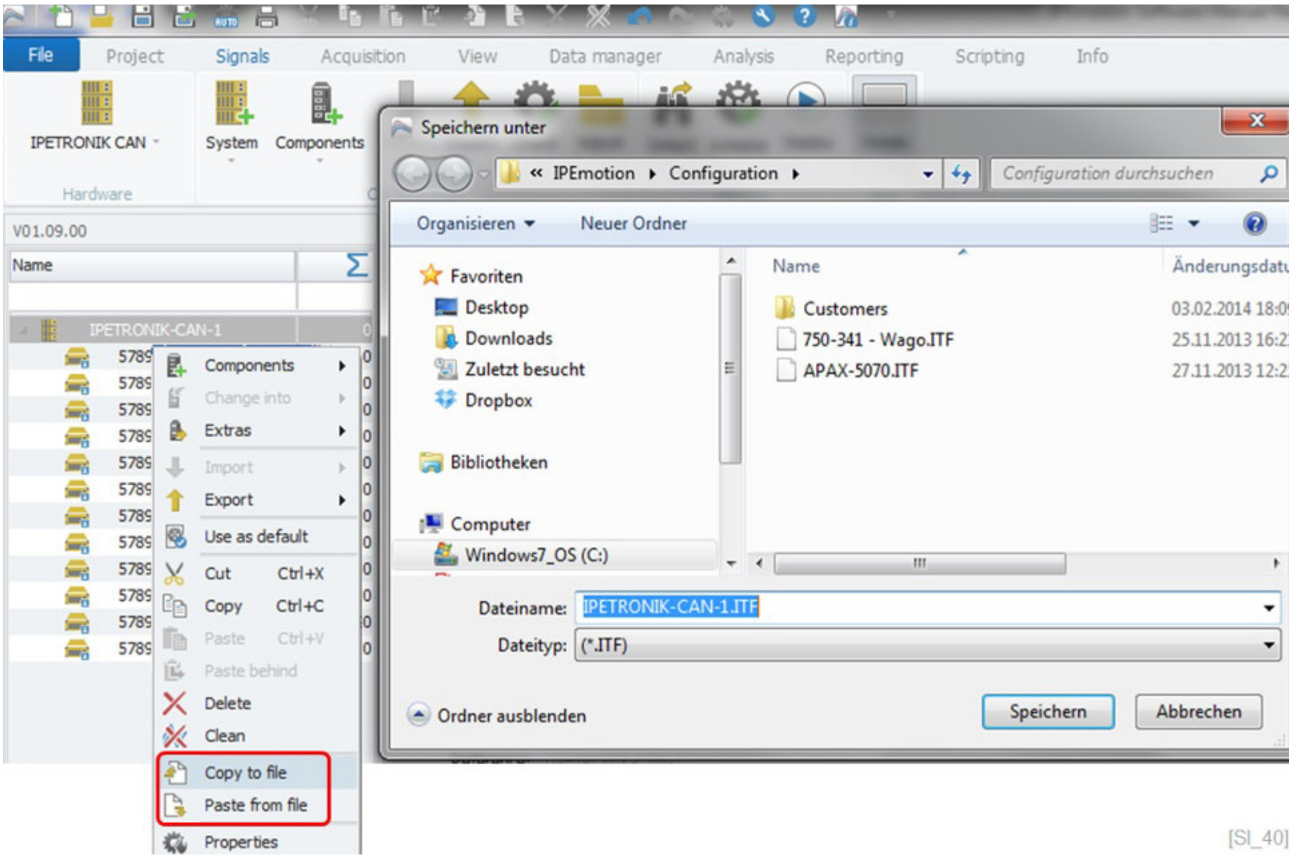
[SI_38]

- **Cut**: With the cutting function you can cut out selected modules. After cutting components you can paste them in other sections of the system tree. There is a difference between "Paste" and "Paste behind"
- **Paste**: Insert one module
- **Paste behind**: Inserting all modules you have cut out and paste them behind a selected module
- **Copy**: With the copying function you can eplicate modules or a list of selected modules
- **Delete**: With "Delete" you permanently remove the items from this configuration
- **Clean**: The "Clean" function only works on an interface or system level. With this function you can remove all modules beneath the interface



[SI_39]

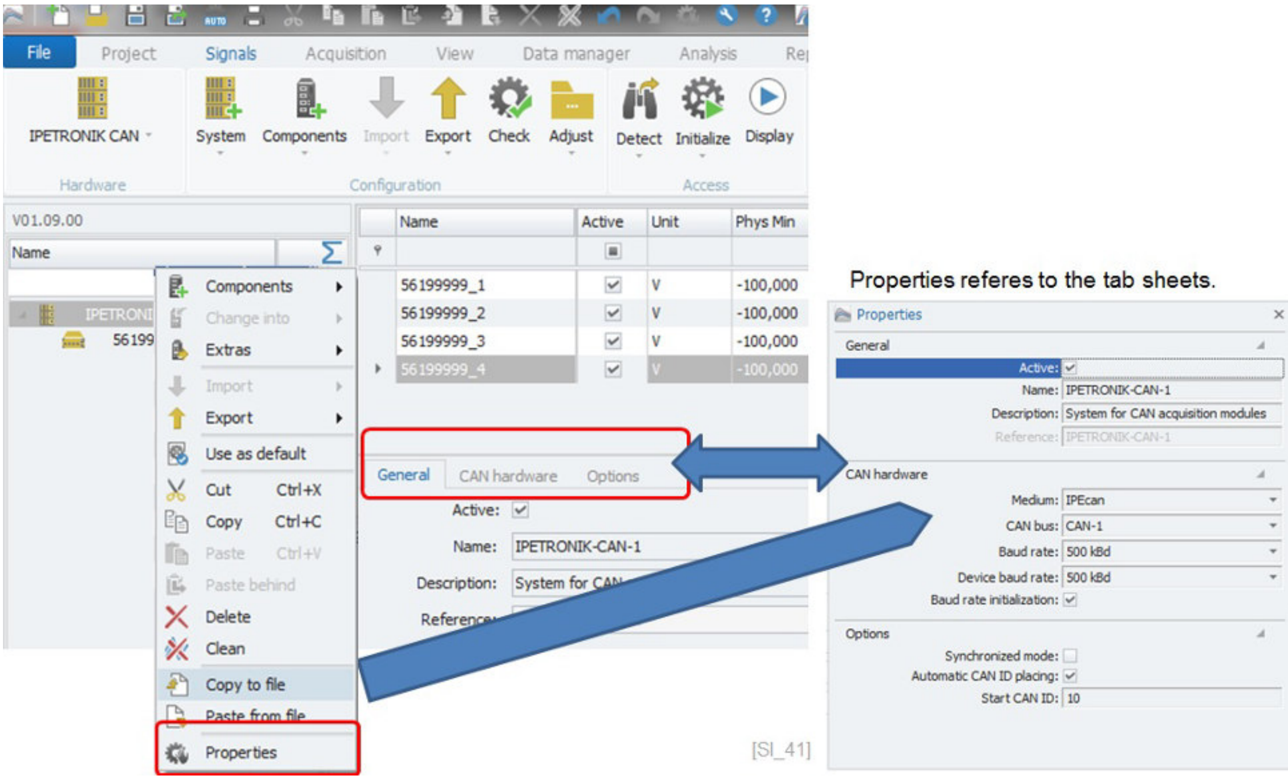
- ► Copy to file — With this function you can save module configurations in a separate file with the extension ITF. This ITF file can be imported, as well
- ► Paste from file — Import ITF files. They include all selected modules, channels and configuration elements



[SI_40]

- **Properties**

If you select "Properties" from the context menu, another display opens up summarizing the tab sheets for configuration. The properties are context- sensitive. If you select a module you will get the context for module configuration. If you open the connect menu on channel level you will see all configuration tab sheets related to the channel.

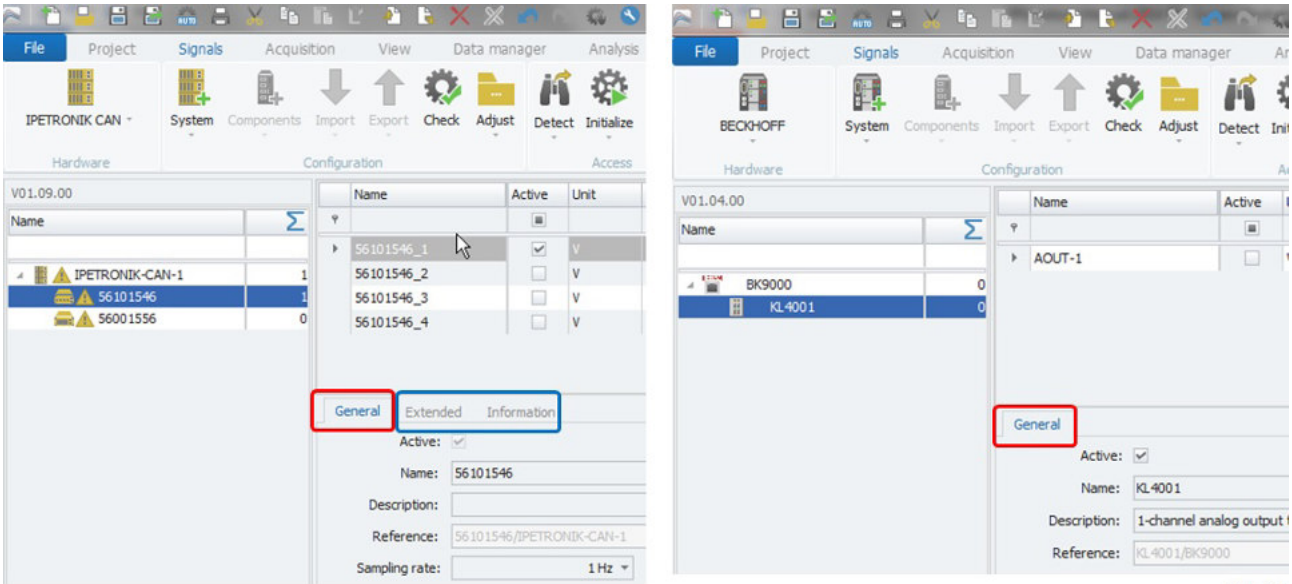


[SI_41]

11.5.5 Module configuration tab sheet

On module level, beside the GENERAL tab sheet some PlugIns support module-specific tab sheets to configure the hardware.

► Active	Checkbox to activate or deactivate a module
► Name	Default name - can be changed to individual names
► Description	Default description - can be changed to any individual description
► Reference	Is automatically generated and very useful for checking module links. The reference will be discussed in detail in the next section where channels are discussed
► Sample rate	Some instruments support a sample rate on module level and therefore they have an input field to enter the sample rate for an IO module on module level



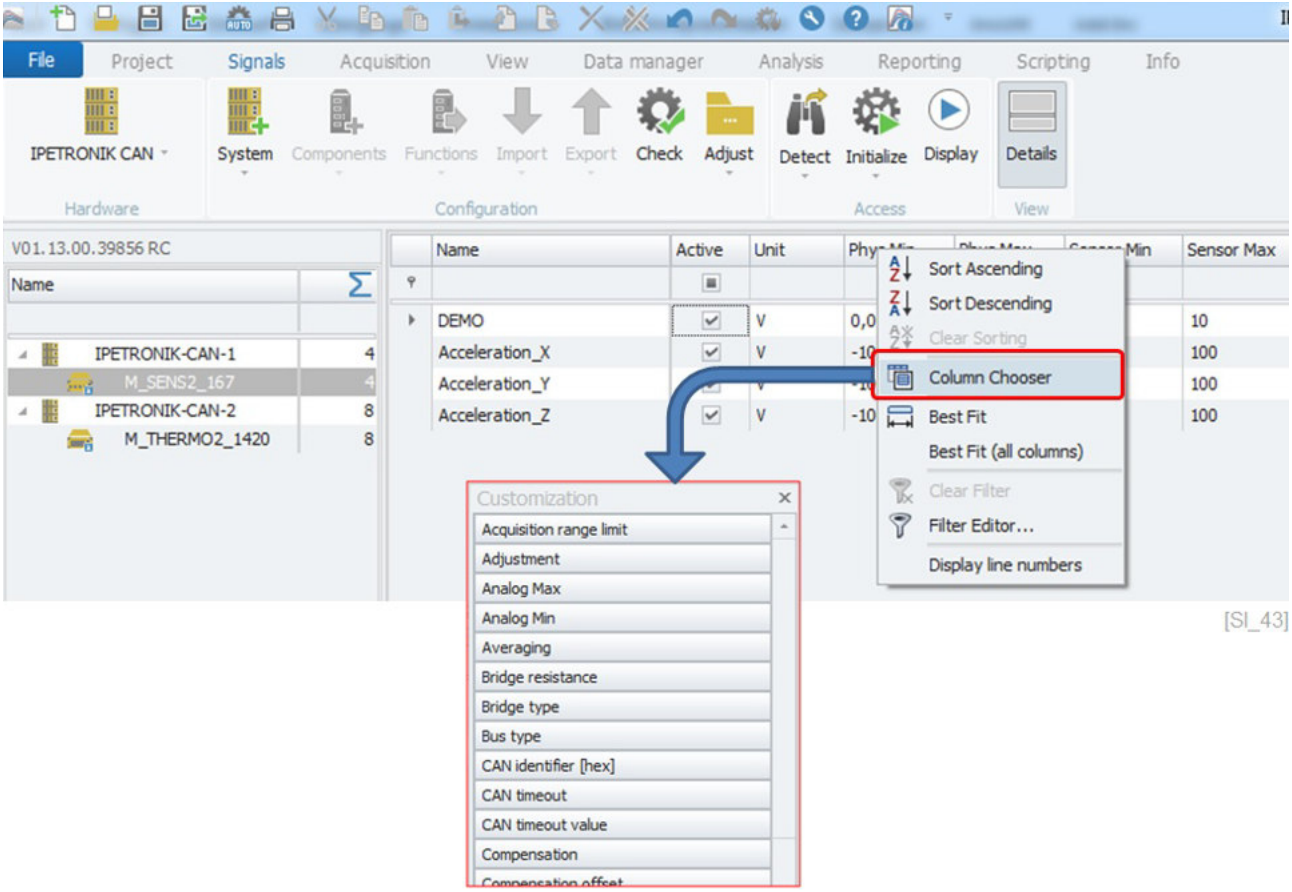
[SI_42]

All modules have at least a GENERAL configuration tab sheet.
Module specific settings - if available - are implemented in additonal tab steets.

11.6 Channel configuration parameters

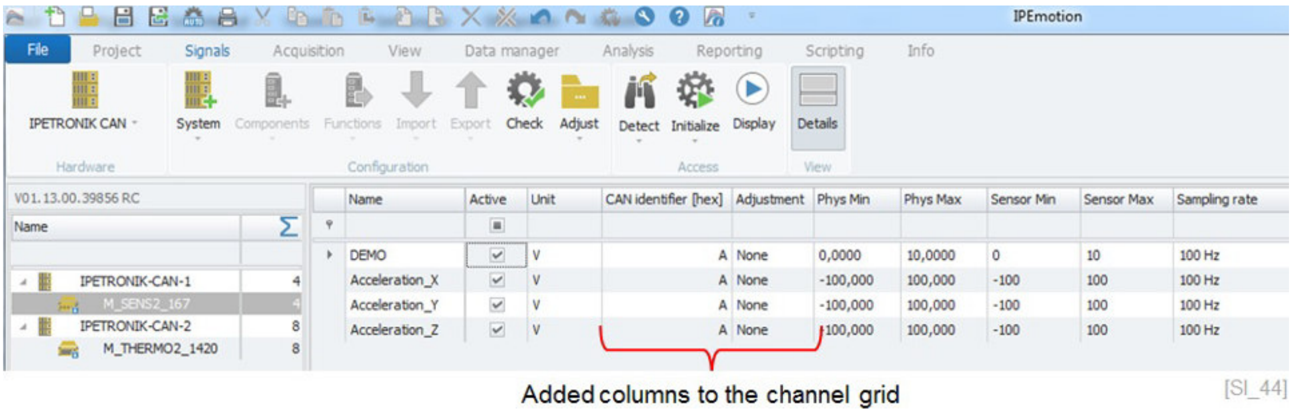
11.6.1 Column chooser in the channel grid

In the channel grid head line you can access a context menu to add additional columns to your channel grid. The available columns are depending on the PlugIn.



[SI_43]

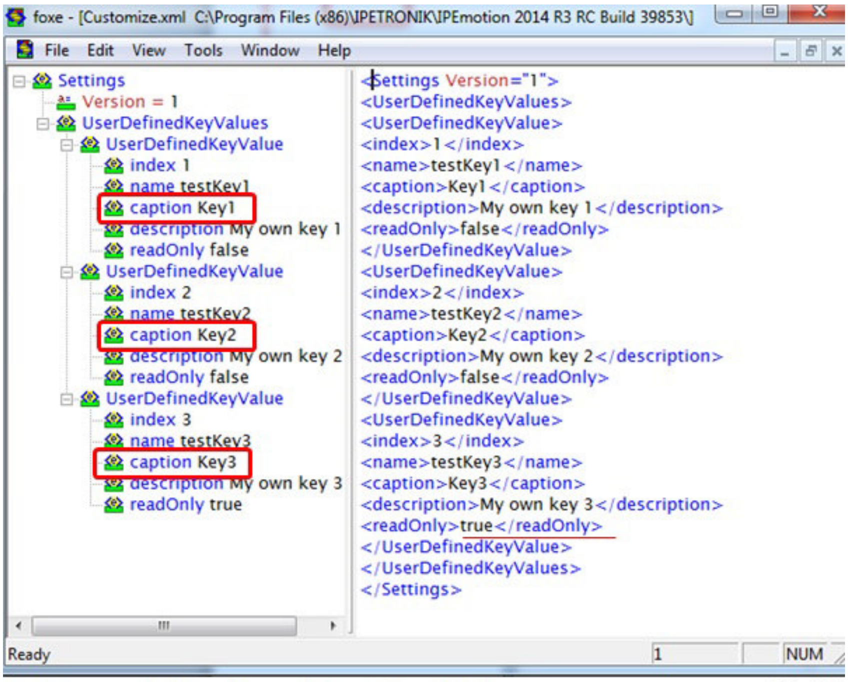
Example of channel grid with 2 additional columns.



[SI_44]

You can add your own columns into your channel grid. In order to add individual columns you need to create in the installation directory a new xml file called: **Customize.XML.**

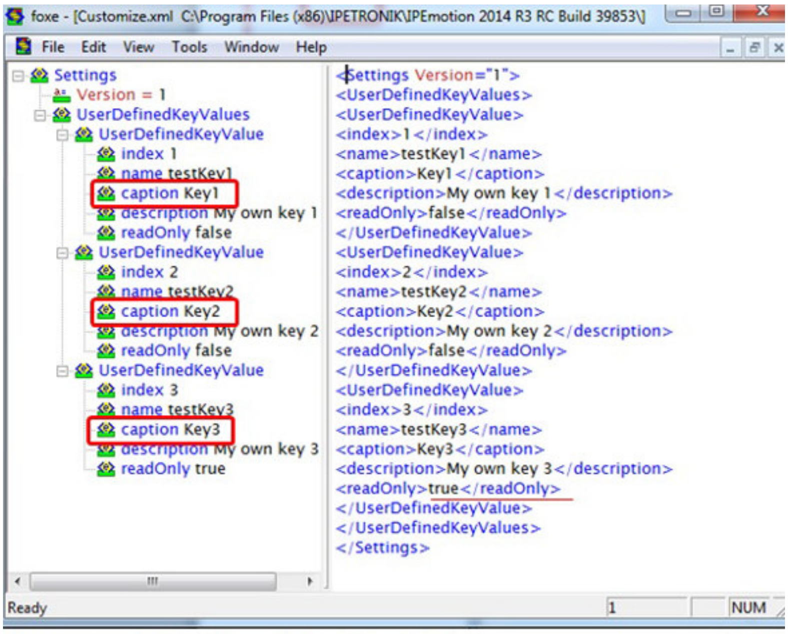
Win 7 C:\Program Files (x86)\IPETRONIK\IPEmotion 2016 R1**Customize.xml**



Customize.XML – User defined key fields. [SI_45]

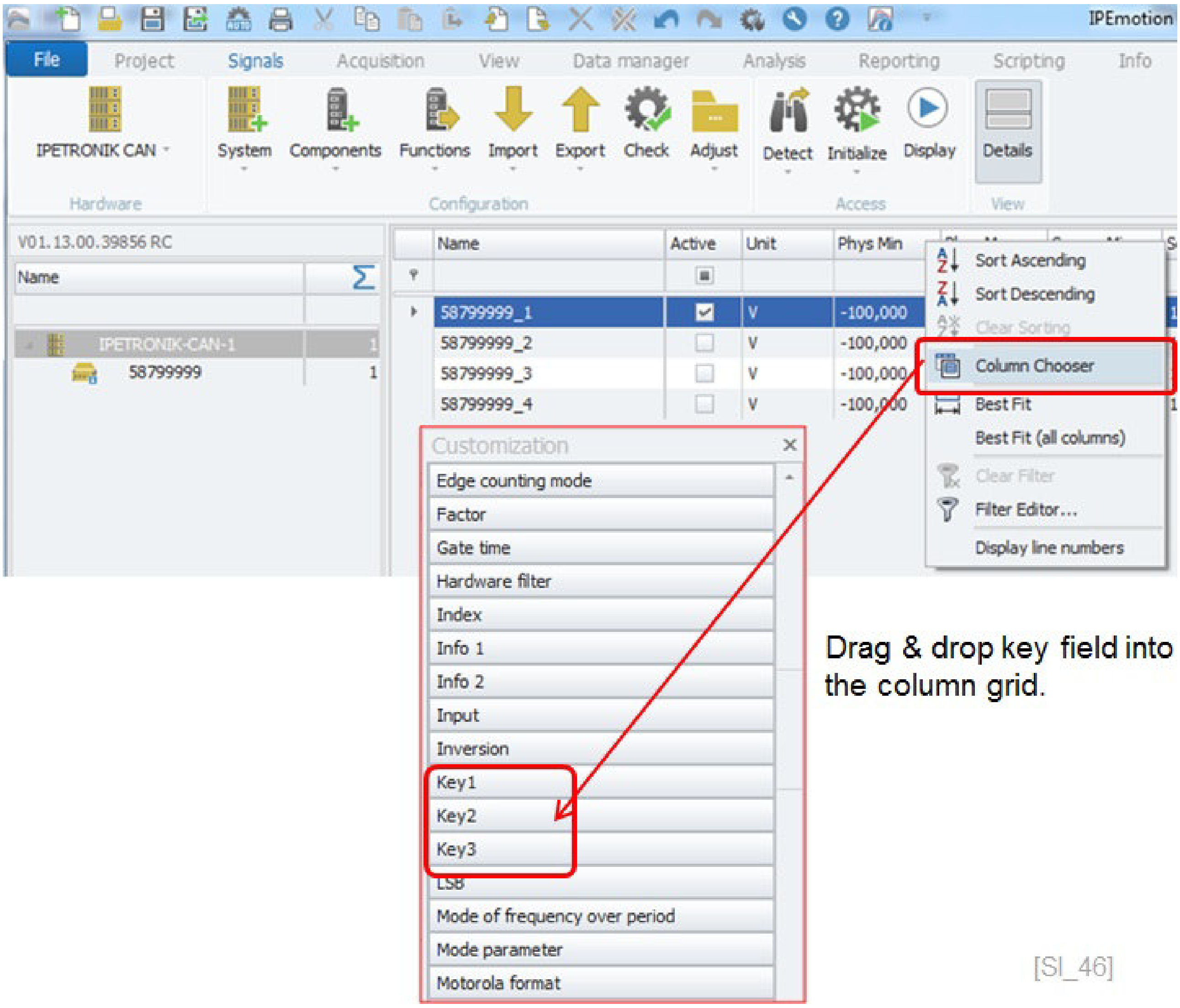
With the “readOnly” status (true/false) you define if the field can be edited though the channel grid.
XML Code to be included in the **customize.xml** file:

```
<Settings Version="1">
<UserDefinedKeyValues>
<UserDefinedKeyValue>
<index>1</index>
<name>testKey1</name>
<caption>Key1</caption>
<description>My own key 1</description>
<readOnly>false</readOnly>
</UserDefinedKeyValue>
<UserDefinedKeyValue>
<index>2</index>
<name>testKey2</name>
<caption>Key2</caption>
<description>My own key 2</description>
<readOnly>false</readOnly>
</UserDefinedKeyValue>
<UserDefinedKeyValue>
<index>3</index>
<name>testKey3</name>
<caption>Key3</caption>
<description>My own key 3</description>
<readOnly>true</readOnly>
</UserDefinedKeyValue>
</UserDefinedKeyValues>
</Settings>
```



Customize.XML – User defined key fields. [SI_45]

The following screenshot shows a channel grid which includes 3 individually defined “KEY fields”.



[SI_46]

The **Customize.xml** file can be used also to show key-value pairs in the DATA MANAGER tree 18.2.5.

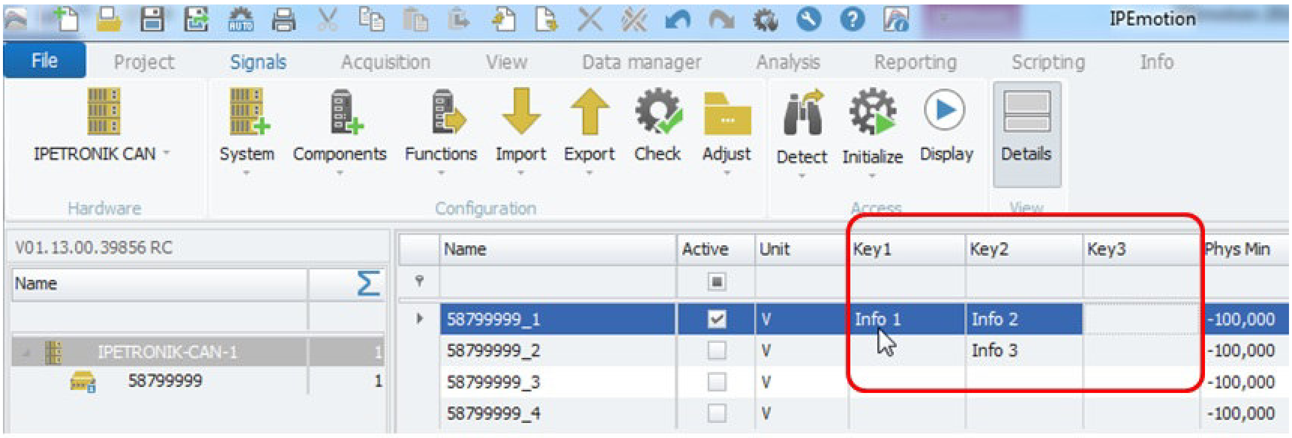
11.6.2 General tab sheet

This tab sheet covers general channel settings

- **Active** — Checkbox to activate or deactivate a channel
- **Name** — Default name - can be changed to individual names
- **Description** — Default description - can be changed to any individual description
- **Reference** — Is automatically generated and very useful to check where the channel is linked to

11.6.3 Defining list box entries of channel names

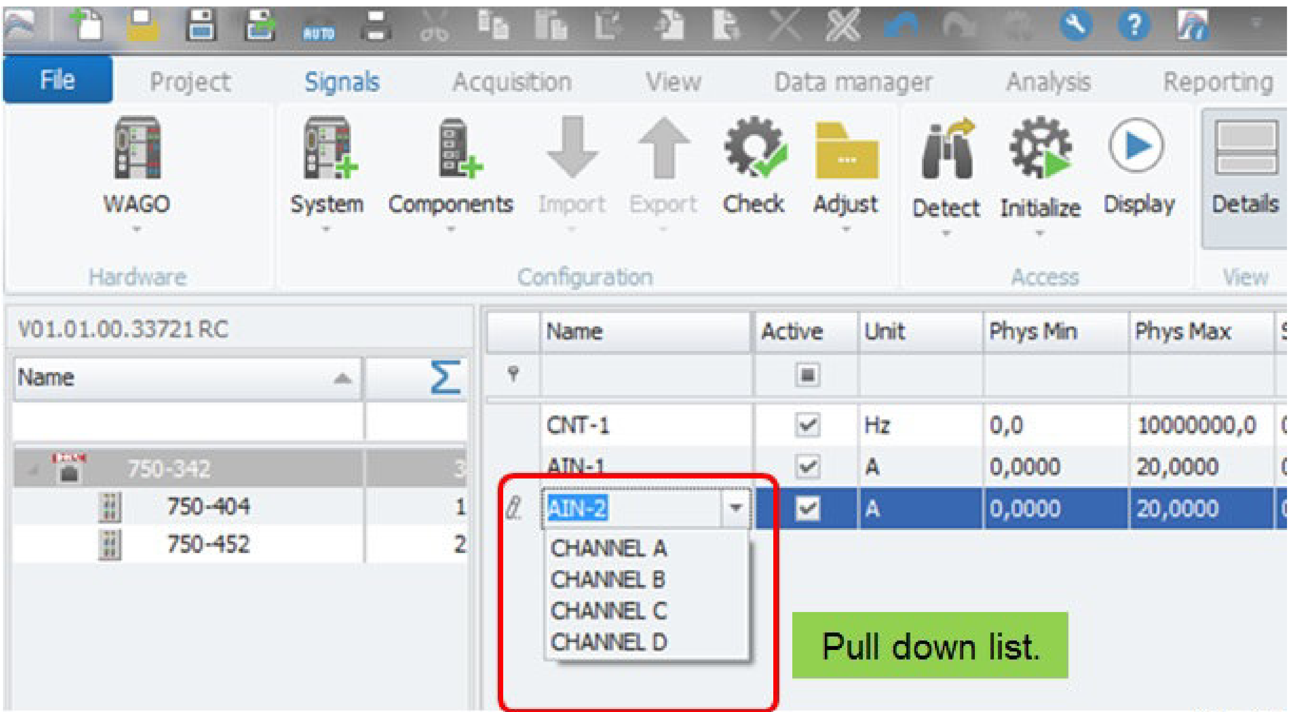
For the channel name you can also define a pull down menu.



Customized fields “Key1...3” in the channel grid. [SI_47]

The entries of the pull down menu are stored in a CSV file with the name (ChannelNames.csv) in the following user settings directory.

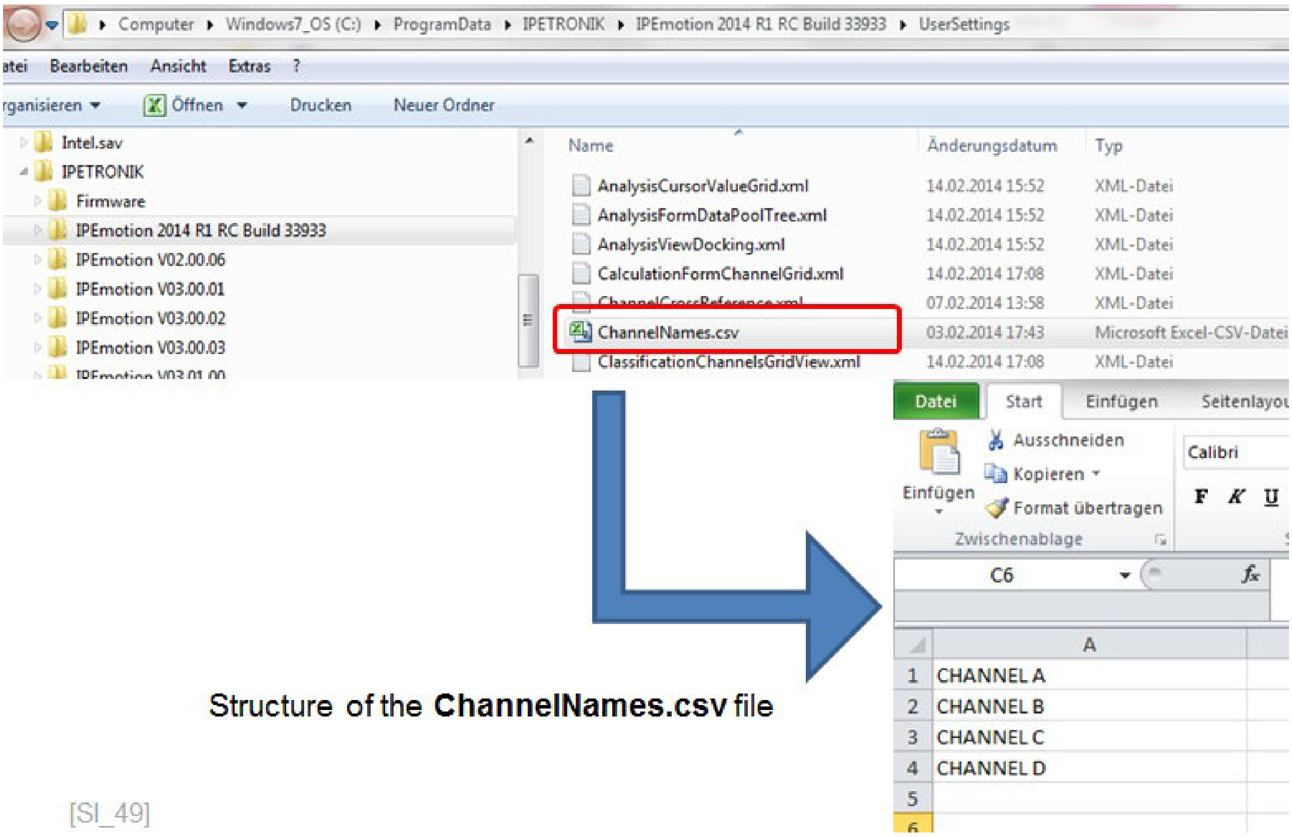
Win 7 C:\ProgramData\IPETRONIK**IPEmotion 2016 R2.1**\UserSettings



[SI_48]

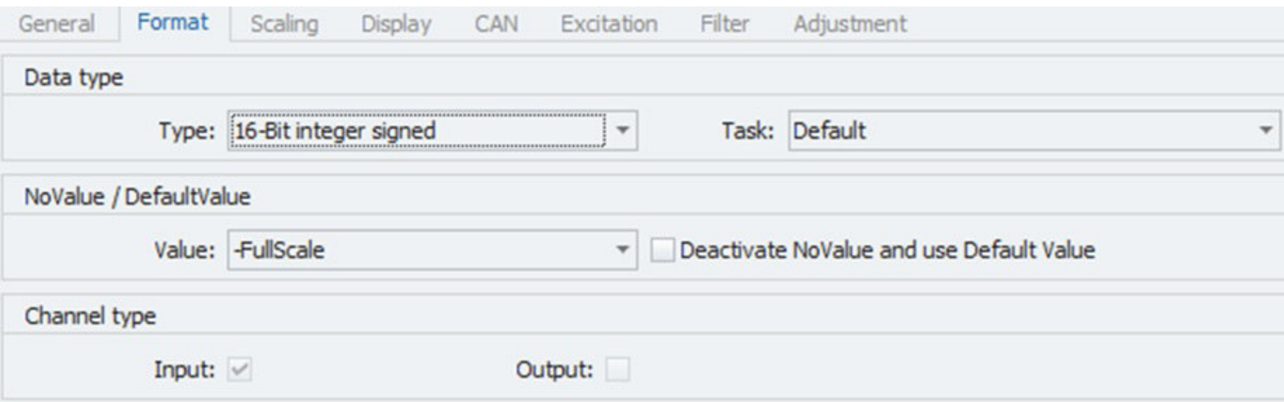
11.6.4 Format tab sheet

The FORMAT tab sheet is only visible for users who activate this function in OPTIONS >Expert mode >Extended tabs in chapter 22.3.1. In the Format tab sheet we can configure a couple of functions which are usually only relevant for demanding users. The different configuration functions are explained below.



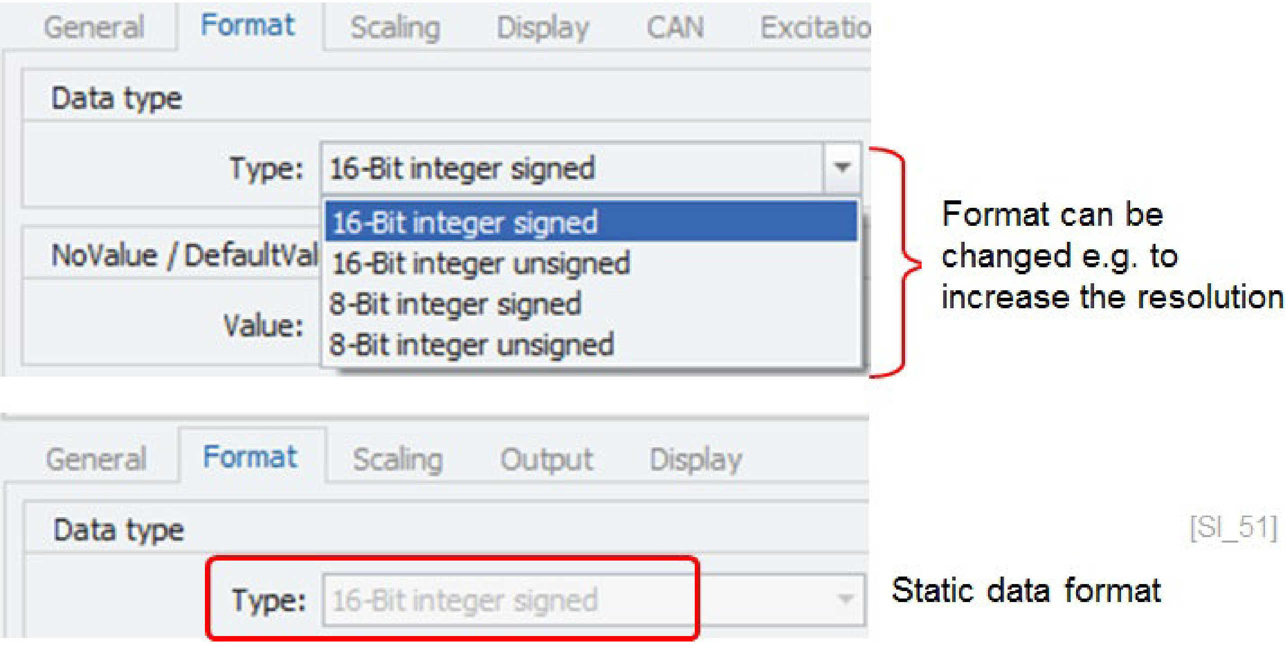
[SI_49]

- **►** Data type — This refers to the data format (resolution) of the measurements. Depending on the module / instrument, sometimes different formats are supported. On most of the instruments, it is not possible to change the configuration of the data type. They always transmit data in the same format. For IPETRONIK modules the signed or unsigned format is important. The 8 bit format is still included because of historic reasons.



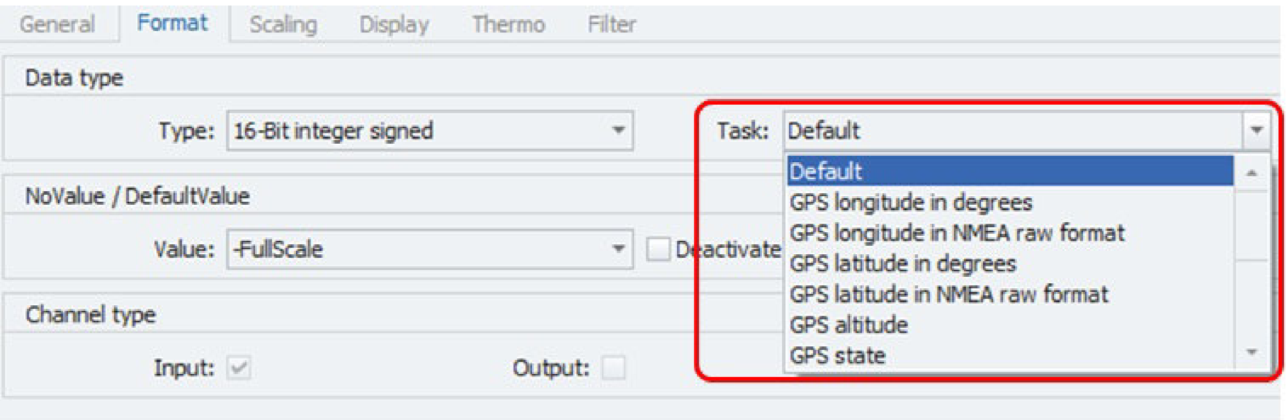
[SI_50]

- **Task** — The task is a very special setting developed for some specific PlugIns
- **Task: GPS Recording** — The settings for a special task are needed for the IPETRONIK IPEspeed GPS receiver. This sensor sends the NMEA protocol in a special format and in order to convert this signal to a standard format which can be used by IPEmotion, the measurement channels need an additional configuration. A reference CANdb file and a IWF project file are included in each IPEmotion installation



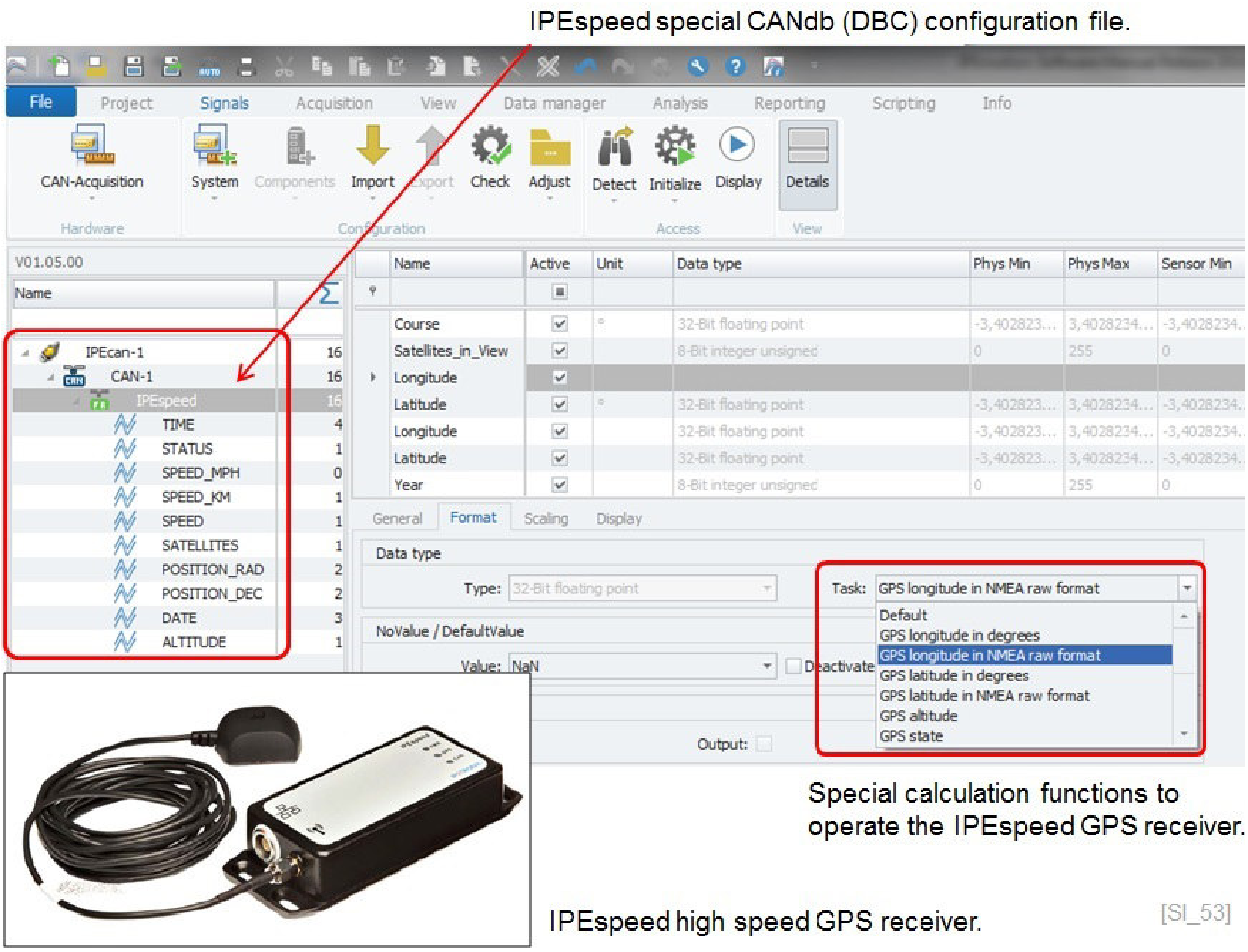
[SI_51]

A correct configuration of the task is also required when you would like to save or export data in the GPX format. The coordinats longitude, latitude and altitude are only correctly interpreted in the GPX export when the corresponding task is defined. See also GPX export in chapter DATA MANAGER 18.7.5.



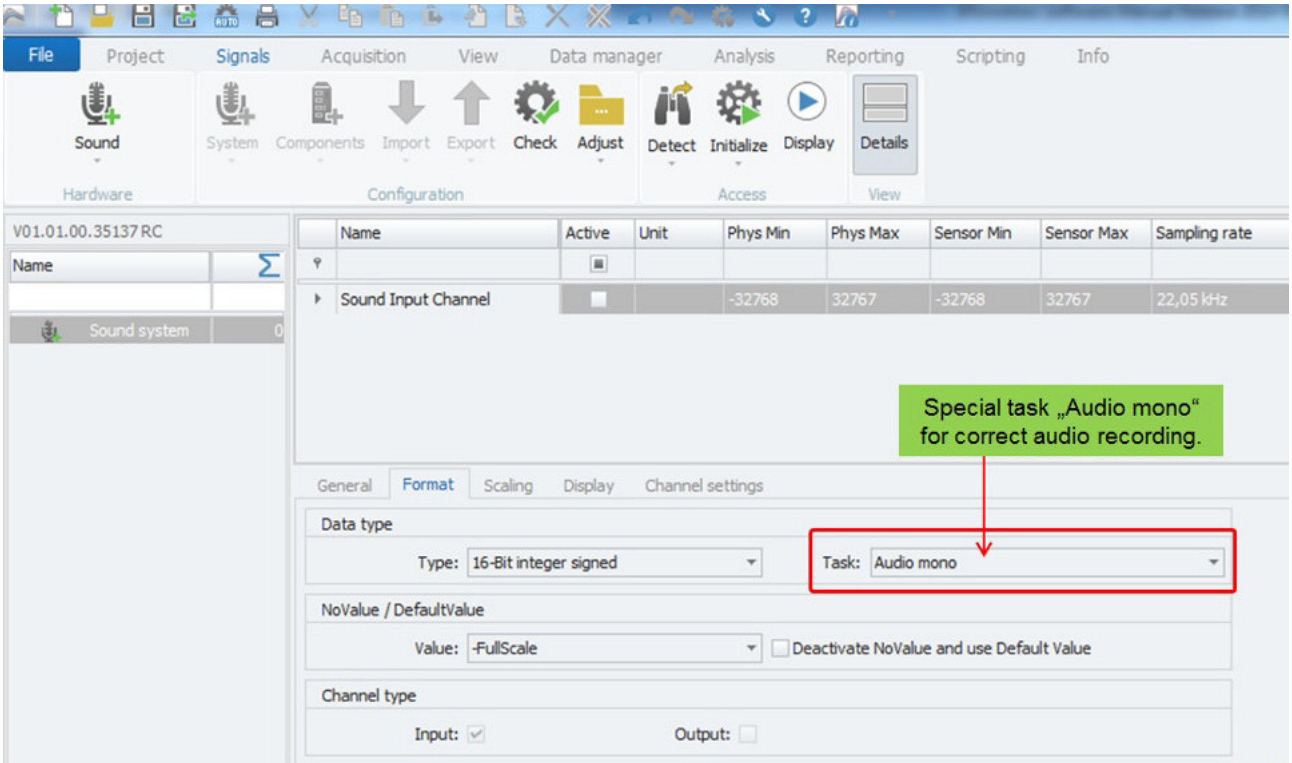
[SI_52]

- **Task: Audio Recording** When you like to record audio / sound over the PC-Sound Demo PlugIn you should check the setting of the Task which is by default set to "Audio mono" if you have PlugIn version V01.02.00. When you run a previouse PlugIn version you need to change the task manually to "Audio mono"



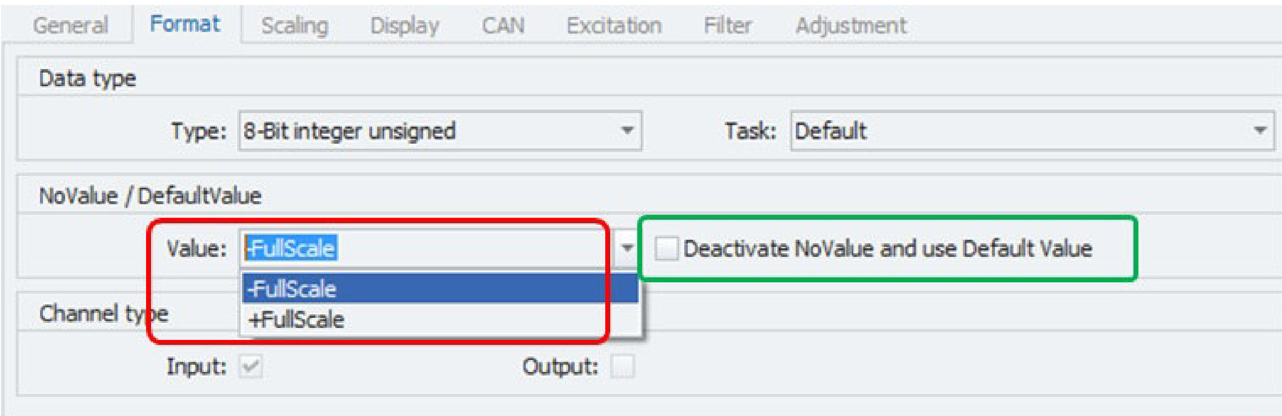
[SI_53]

- **NoValue** This configuration is important for all users who would like to see a certain behavior when NO measurements received in IPEmotion. The default configuration is that No Values are recorded in the data file. They are indicated as NoValue in the DATA MANAGER. In the Yt- chart in the ANALYSIS work space you will see missing data points in the graph. The software will always store No VALUE in the data file irrespectively what you select from the drop down box



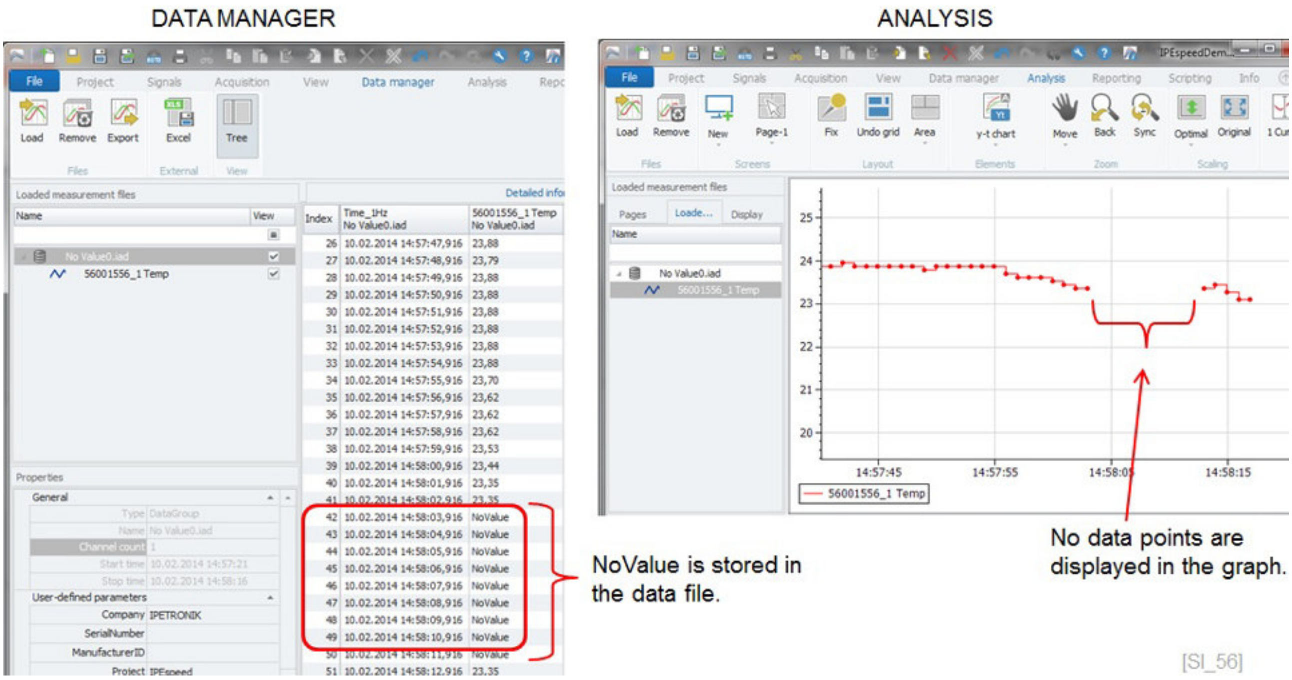
[SI_54]

In the data file NoValue is stored and in the diagrams you will see missing data points.

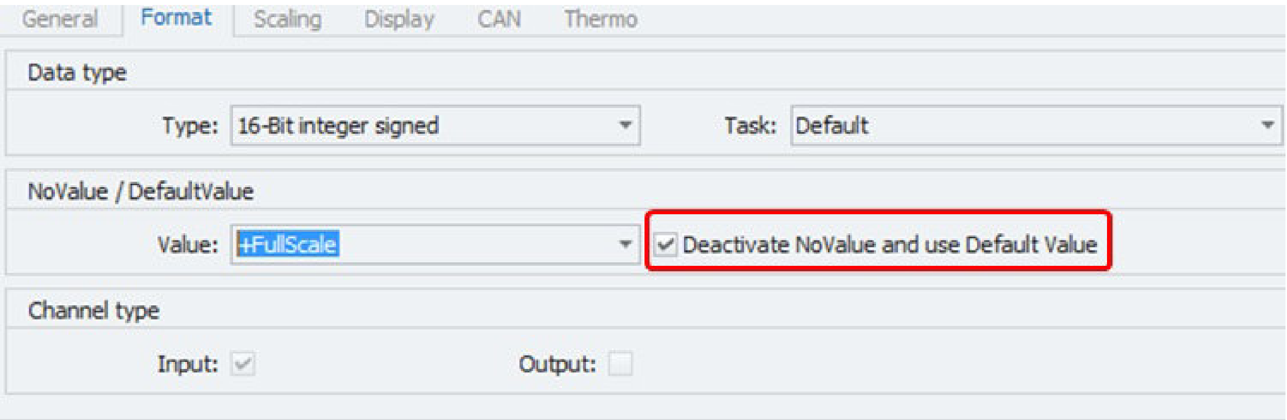


Drop down selection has no impact when check box „Deactivate Novalue…“ is deactivated. [SI_55]

- DefaultValue — Another configuration option is a check box to enables the DefaultValue. With this check box you change the storage and display behavior when no measurements are received. With the check box you can show and store + FullScale, − FullScale or NULL as a numerical value. You can only select NULL if you have a signed +− measurement range) data format. An unsigned measurement is only covering positive measurements.



[SI_56]



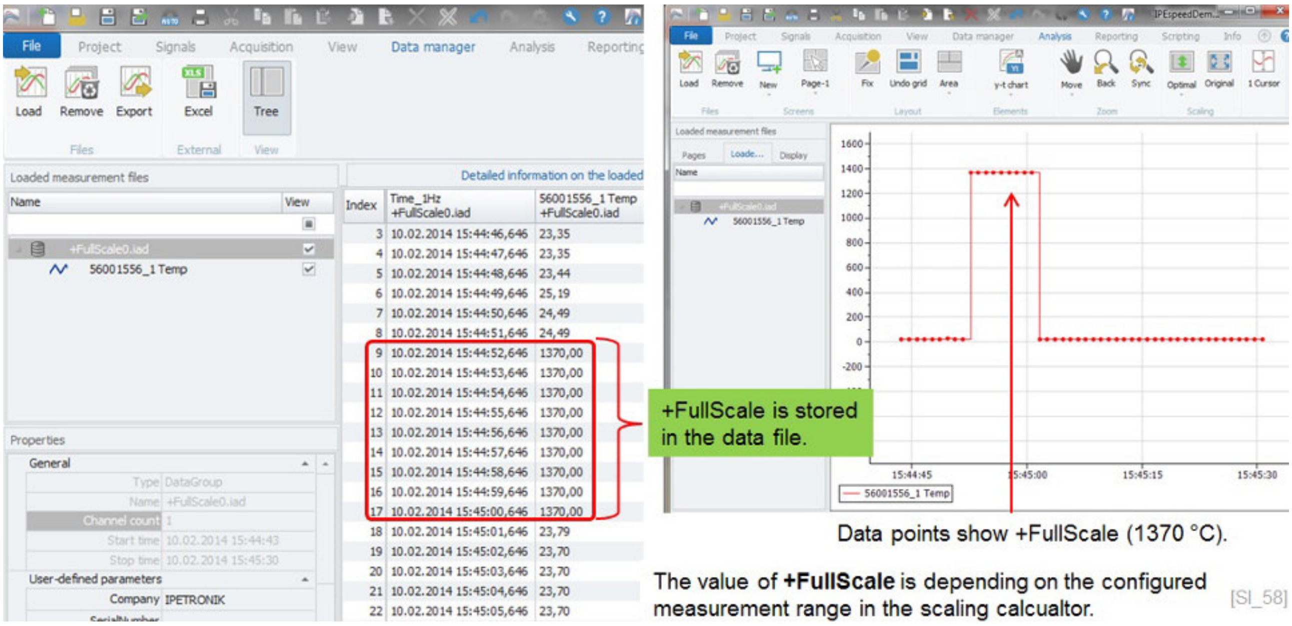
Filter has an impact when check box „Deactivate NoValue…“ is activated.
In this example +FullScale of the measurement range will be stored.

[SI_57]

The NoValue configuration also has an impact on the data display in the VIEW work area. As the screen shot below indicates. When the check box “Deactivate NoValue and use Default Value” is not activated the instrument will show always Novalue.

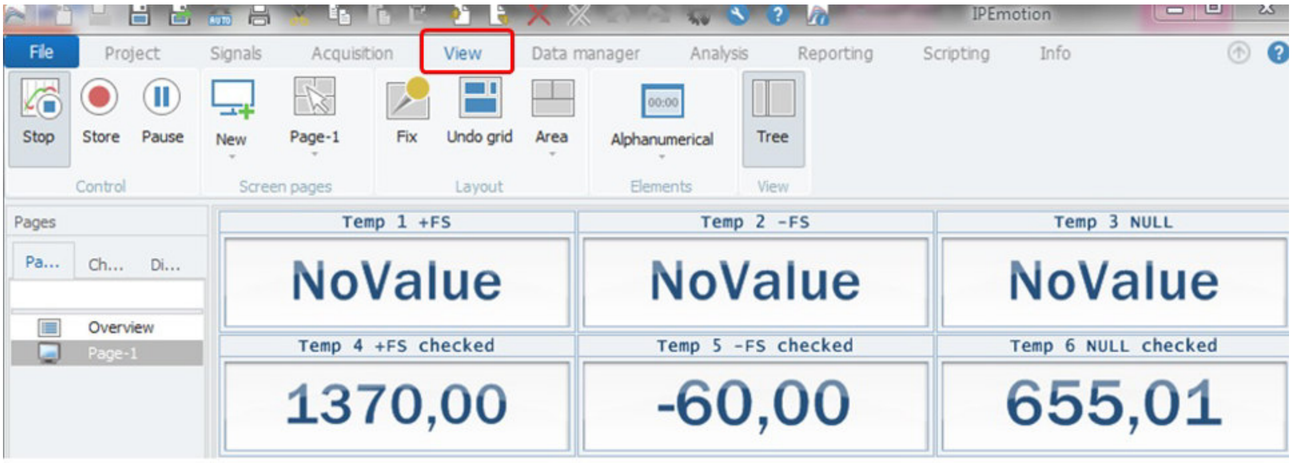
However if the check box “Deactivate NoValue and use Default Value” is activated you will enable the the list box entries and the instrument will show the selected values for:

- + Full Scale
- - Full Scale
- Null

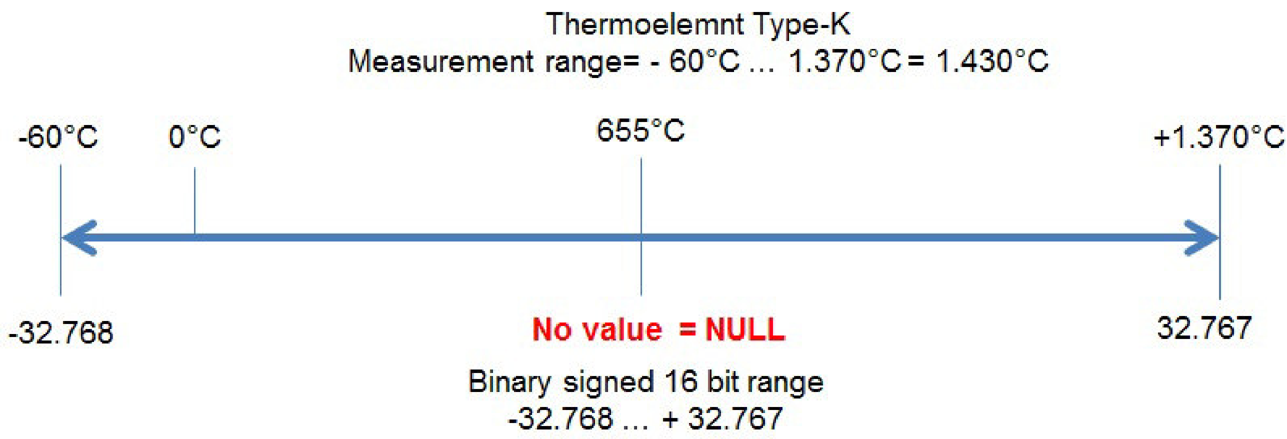


[SI_58]

- Default Value Null — The DefaultValue (NULL) is related to the Null value of the binary measurement range. If you select a signed 16bit (2^16 = 65536) measurement range, the temperature signal for the IPETRONIK thermo module is split up between the values -65.536 and +65.536 as the graphic demonstrates below

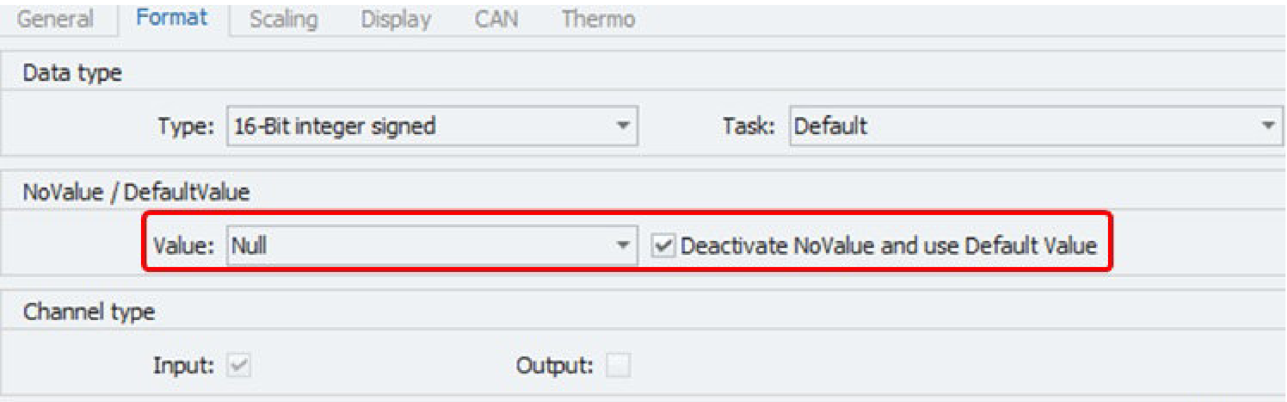


[SI_59]



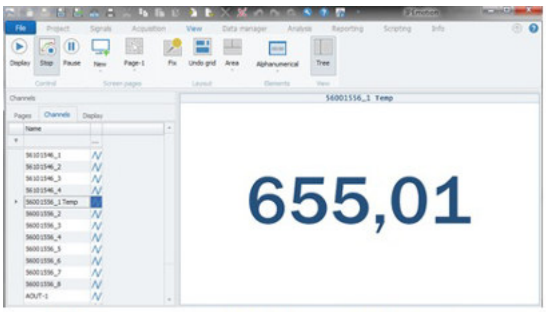
Temp 4 +FS checked	1370,00 °C	✓	°C
Temp 5 -FS checked	-60,00 °C	✓	°C
Temp 6 NULL checked	655,01 °C	✓	°C

[SI_60]

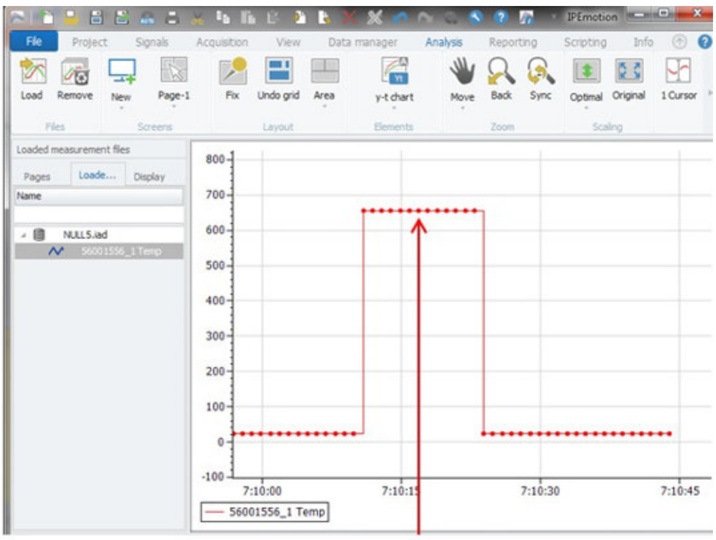


[SI_61]

The binary NULL value of this measurement range is $655\,°\mathrm{C}$. This value is then indicated to the online instruments and stored in the data file.

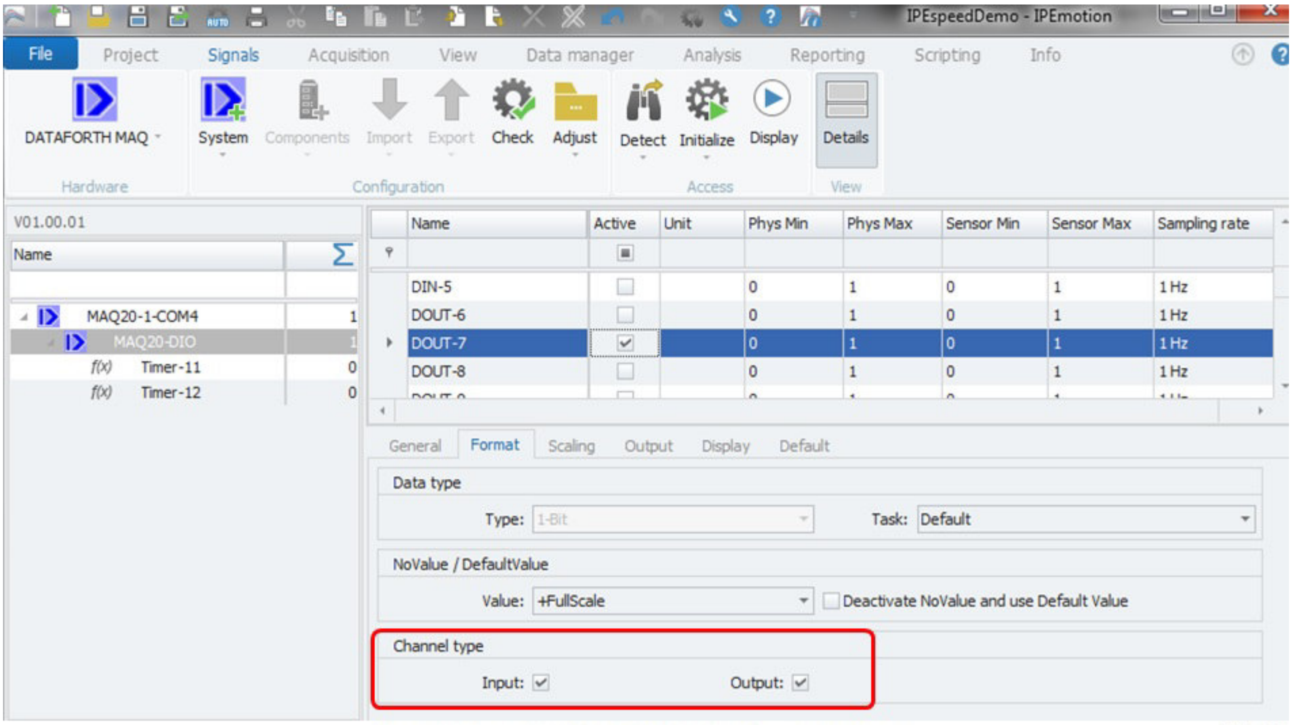


When you select NULL as a NoValue the Thermoelement Type-K will show 655°C.



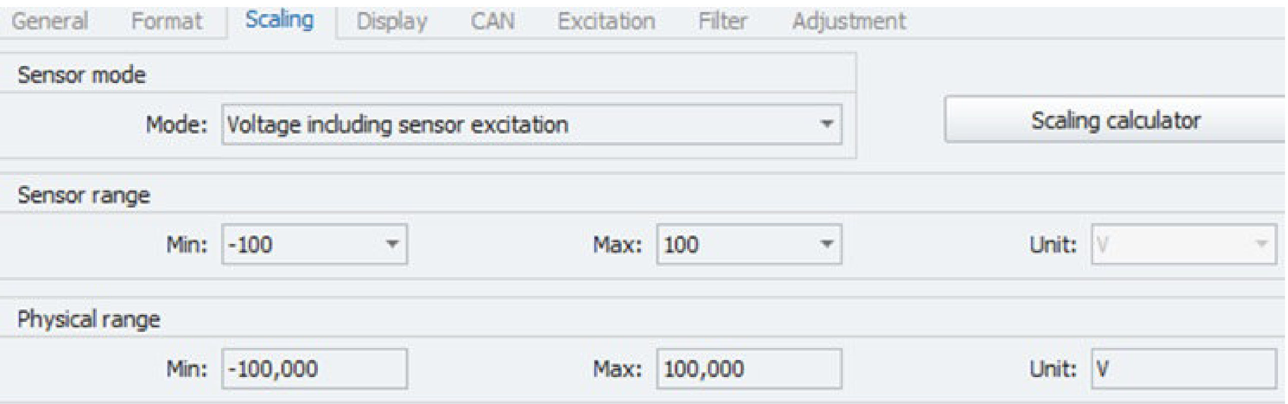
Data points for NULL show 655 °C. [SI_62]

- **Channel type** — The channel type indicates the data direction INPUT or OUTPUT. Output channels can be updated through manual entries, through slide controllers or alphanumerical displays in the VIEW work area. Some PlugIns support channels which can be operated as input and output. In digital IOs you will also quite often find the option to change the channel direction input to output or vice a versa through this checkbox



Operated as Input and Output at the same time. [SI_63]

11.7 Channel Scaling – defining ranges and engineering units

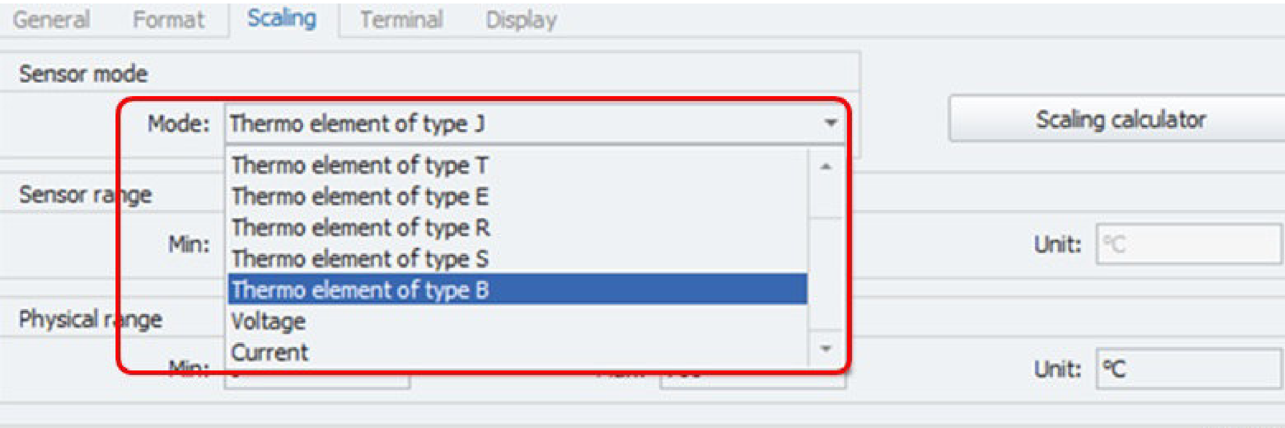


[SI_64]

The basic scaling operations can be defined directly in the scaling tab sheet. The scope of functions depends on PlugIn and IO module type. Some inputs, especially analog inputs, support many different functions and ranges and provide more scaling options.

11.7.1 Sensor mode

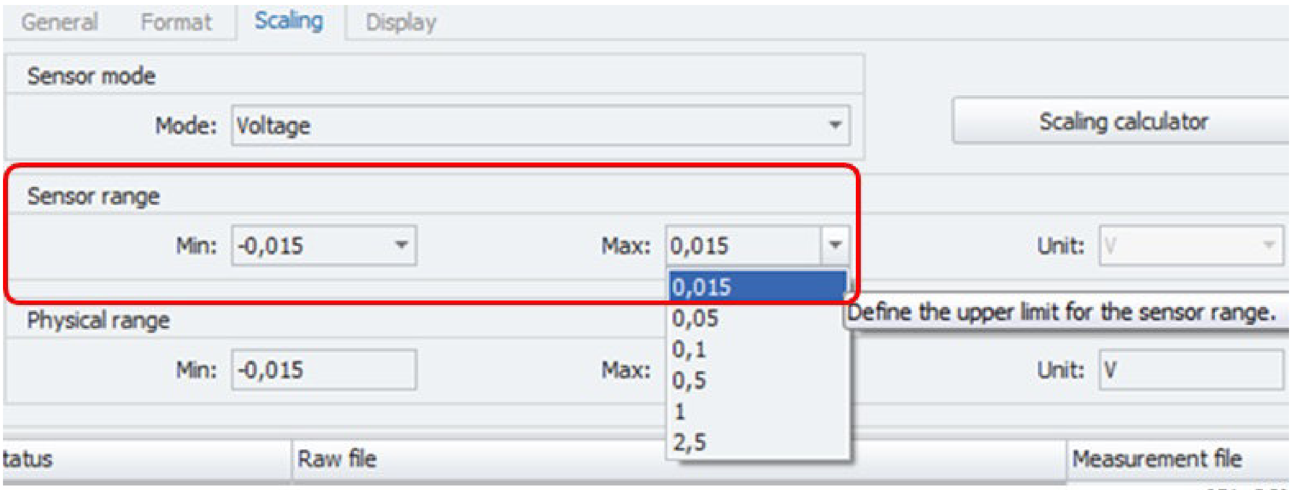
The sensor mode covers the main measurement type, for example Volt or Current, accelerometers (ICP). You select the sensor mode from your drop-down list. In this example, the analog input module supports many different measurements of thermo element, voltage or current. The supported sensor modes are defined by the PlugIn and you can only select the mode which is supported. Many modules only support one static sensor mode.



[SI_65]

11.7.2 Sensor range

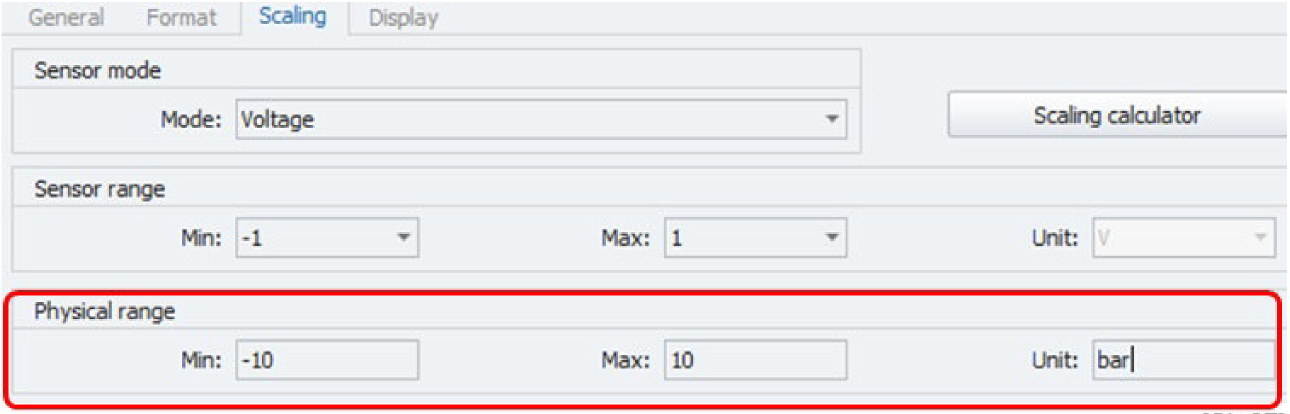
The next configuration option is the sensor measurement range. The range is related to the measurement mode. For thermo elements, the measurement range is redefined and cannot be changed. The available voltage and current measurement ranges depend on the functionality of the analog input. In the example below you can select ranges from 15 mV (0,015V) up to 2,5 Volt. The Unit is automatically linked to the selected measurement mode Voltage >V or current >A or temperature >C and cannot be changed manually. It is defined by the PlugIn developer.



[SI_66]

11.7.3 Physical range – Engineering units

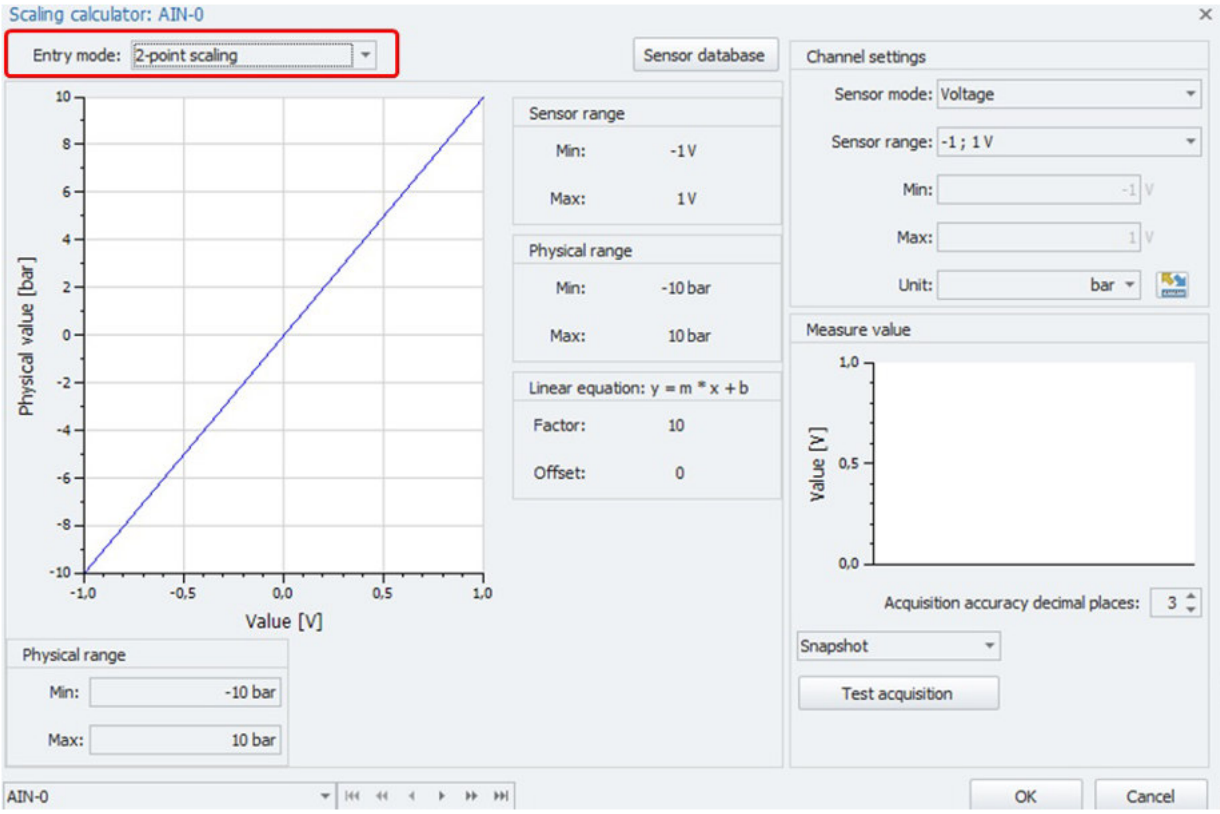
The physical range is related to your engineering units. Here you define into which unit (mm, bar, etc.) the electrical signal is converted.



[SI_67]

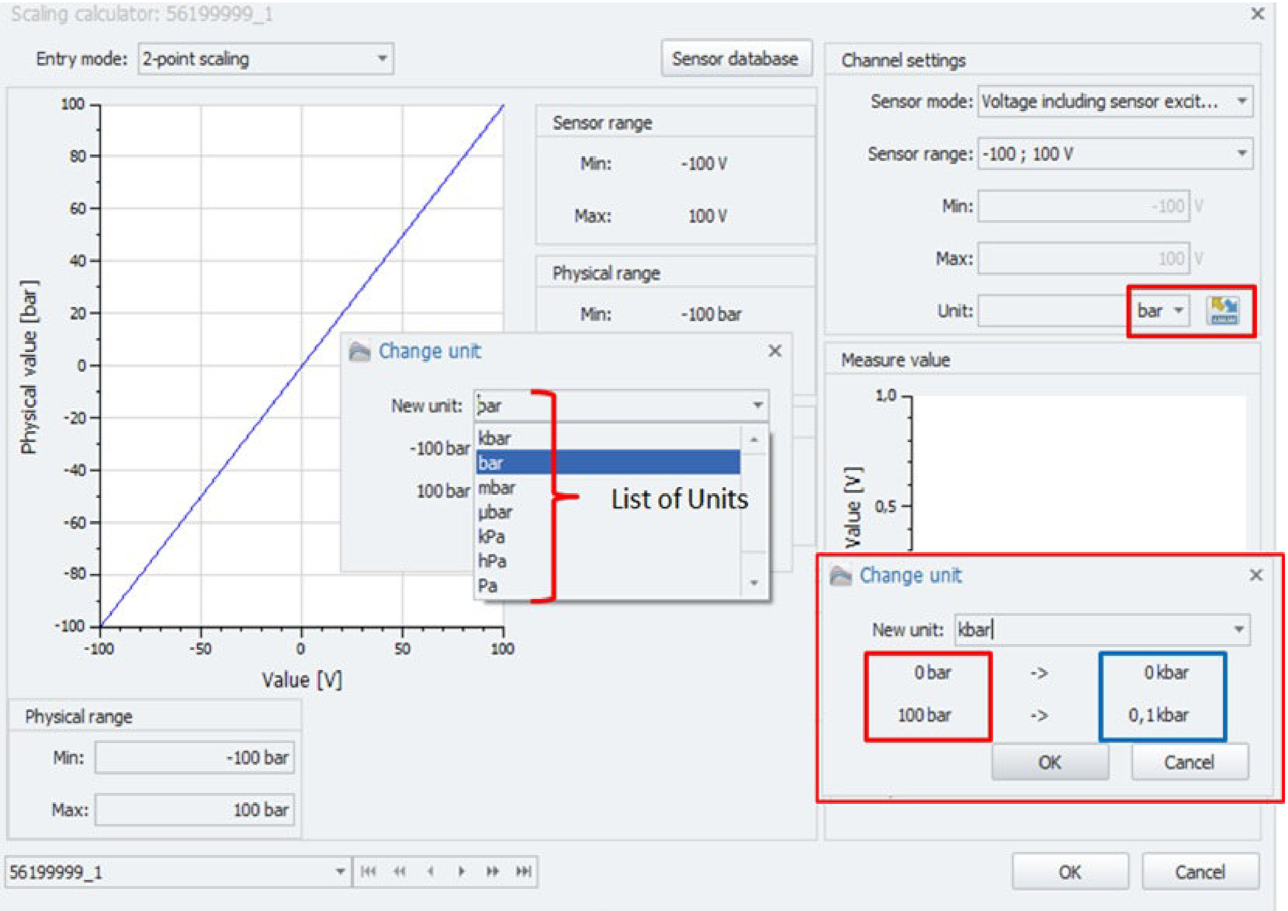
11.8 Scaling calculator – for advanced scaling functions

For advanced scaling functions you can use the scaling calculator. This interface provides many different scaling functions which will be discussed later on.



[SI_68]

- ► Sensor mode — is related to the type of measurement mode as discussed above
- ► Sensor range — is related to the measurement range as discussed above
- ► Unit — To simplify the conversion between engineering units you can use the change unit editor. Switching between units only works within the same engineering unit family like temperatures, pressures, weight, energy, etc.



[SI_69] Example: Changing **bar** into **kbar**.

The main advantage is that the new engineering unit automatically converts the physical measurement range. As shown in the screenshot, **100 bar** are automatically converted to **0,1 kbar**. This conversion also works across different metric standards.

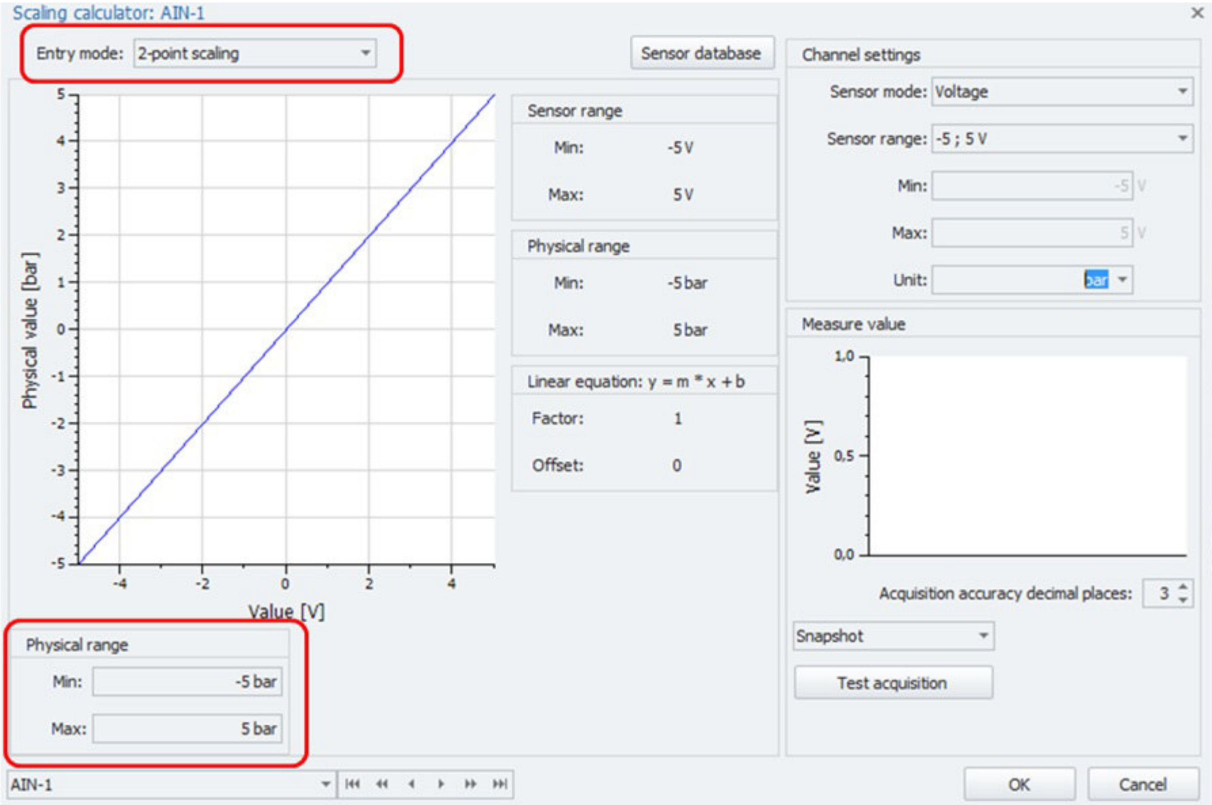
Changing for example:

- Pressure — Bar >kbar >mbar >psi >etc.
- Temperature — C >K >F

An overview of all supported engineering units can be found in the OPTIONS chapter 22.12.

11.8.1 2-point scaling

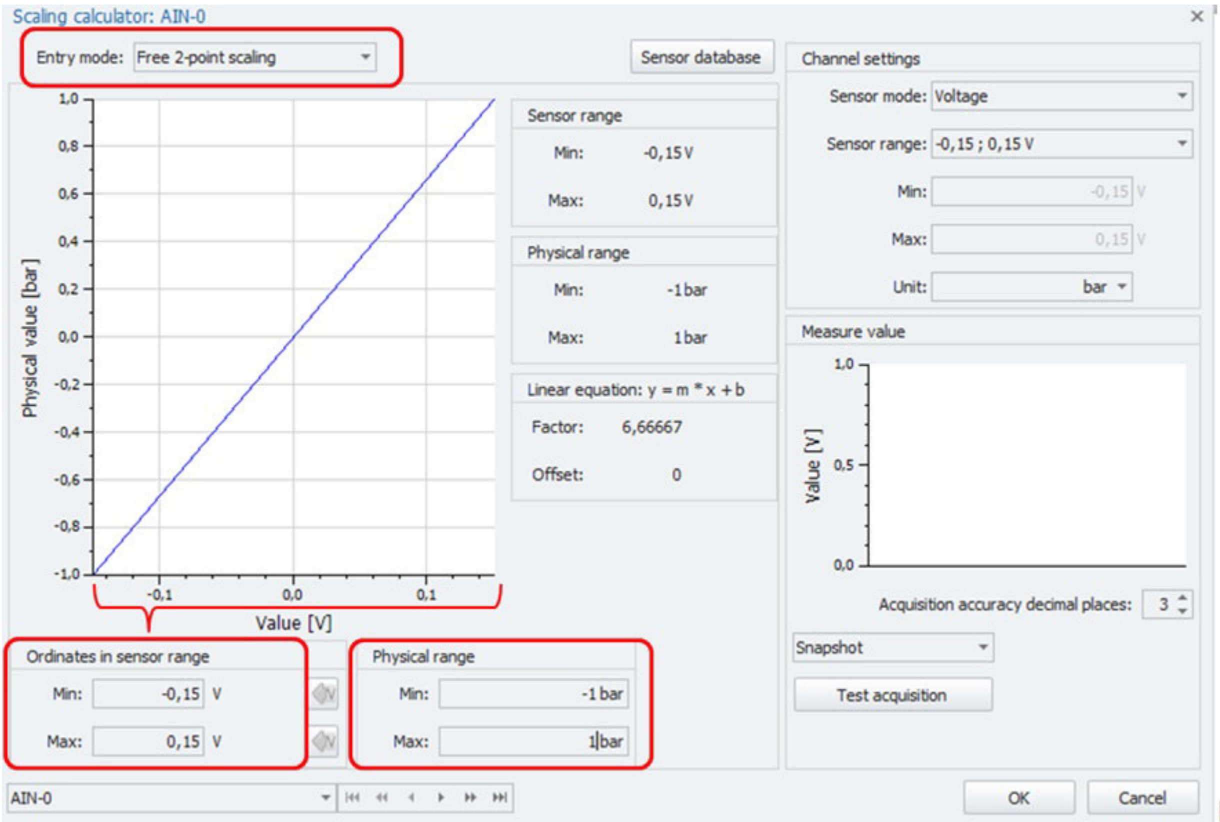
This is a classical scaling configuration using two points, usually the MIN and MAX value of the physical range of the sensor. The scaling information is included in the data sheet / calibration sheet of the sensor.



[SI_70]

11.8.2 Free 2-point scaling

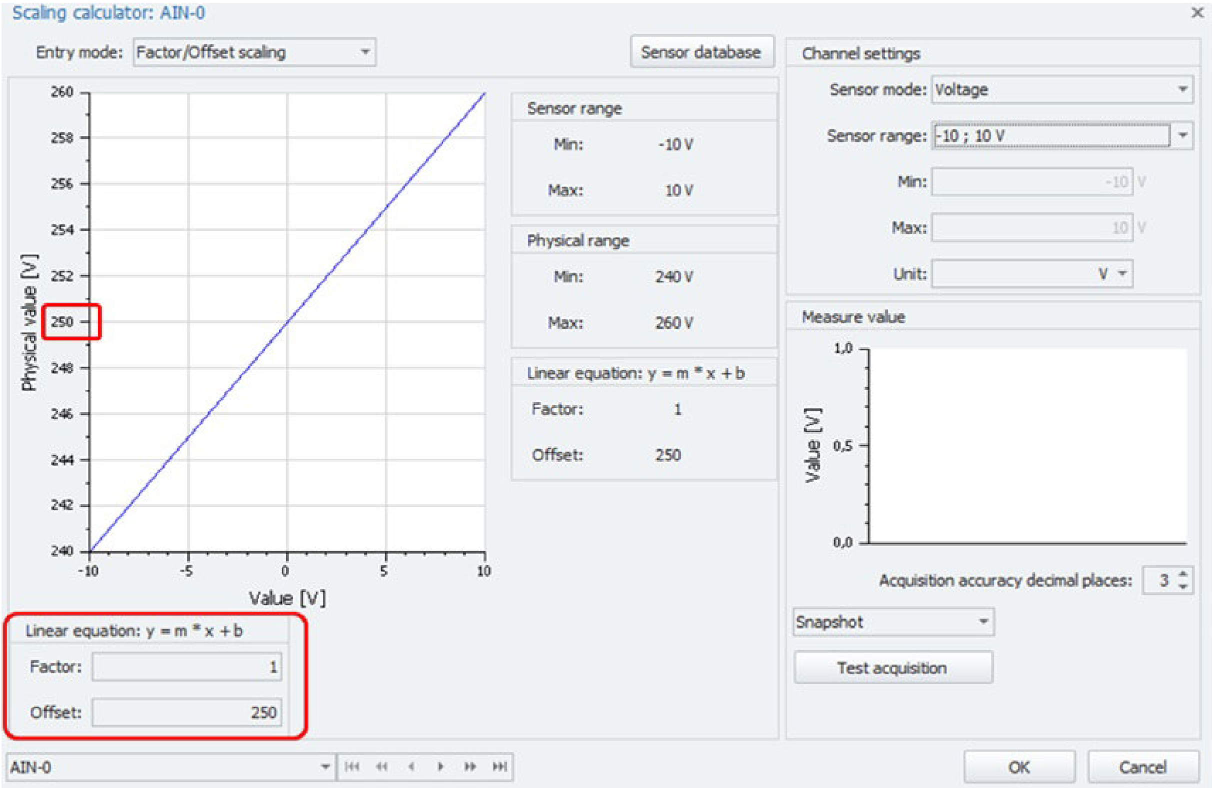
This scaling mode offers the possibility to scale the sensor range and the physical range (engineering units) at the same time.



[SI_71]

11.8.3 Factor/Offset scaling

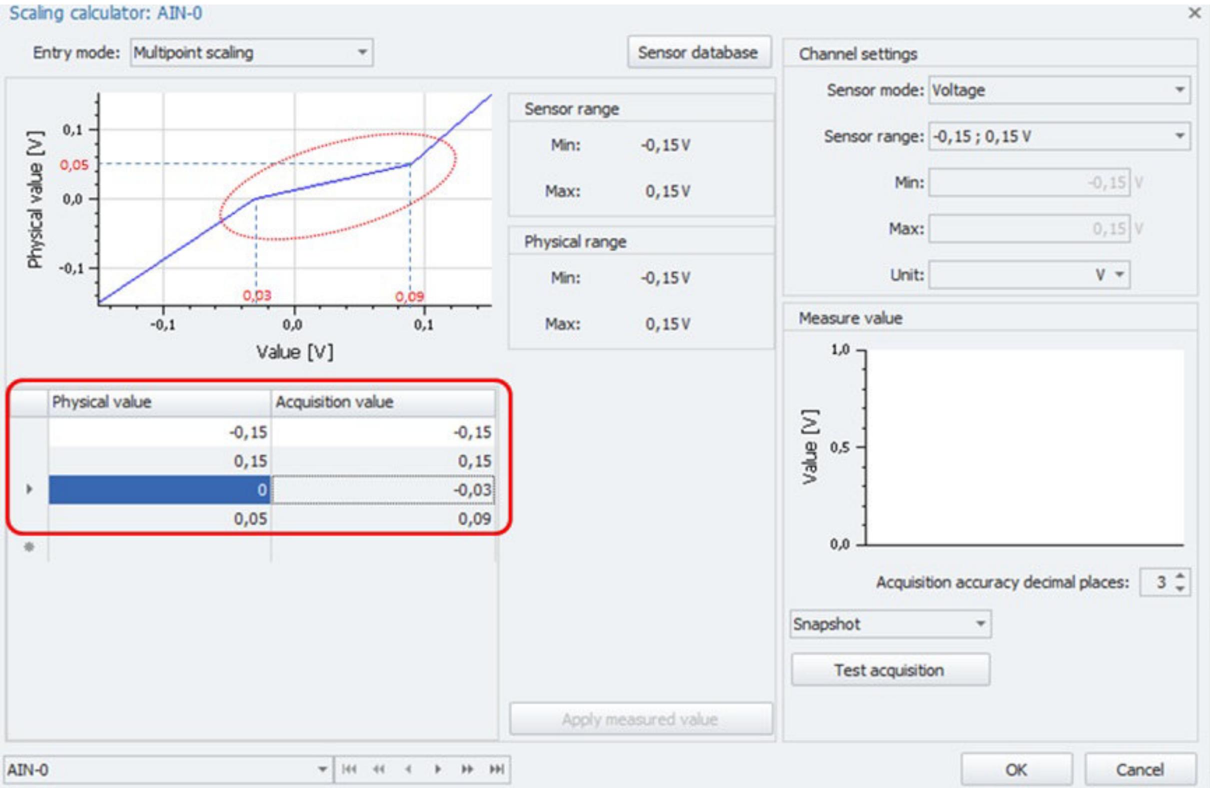
This scaling method uses the equation Physical value (y) = m *x + b (b= offset) with (m = slope factor). The m-factor influences the slope >1 steeper slope / <1 flatter slope. The offset-b shifts the physical value by a constant value.



[SI_72]

11.8.4 Multipoint scaling

The multipoint scaling is a scaling method that allows to define a nonlinear scaling with as many data points as possible.

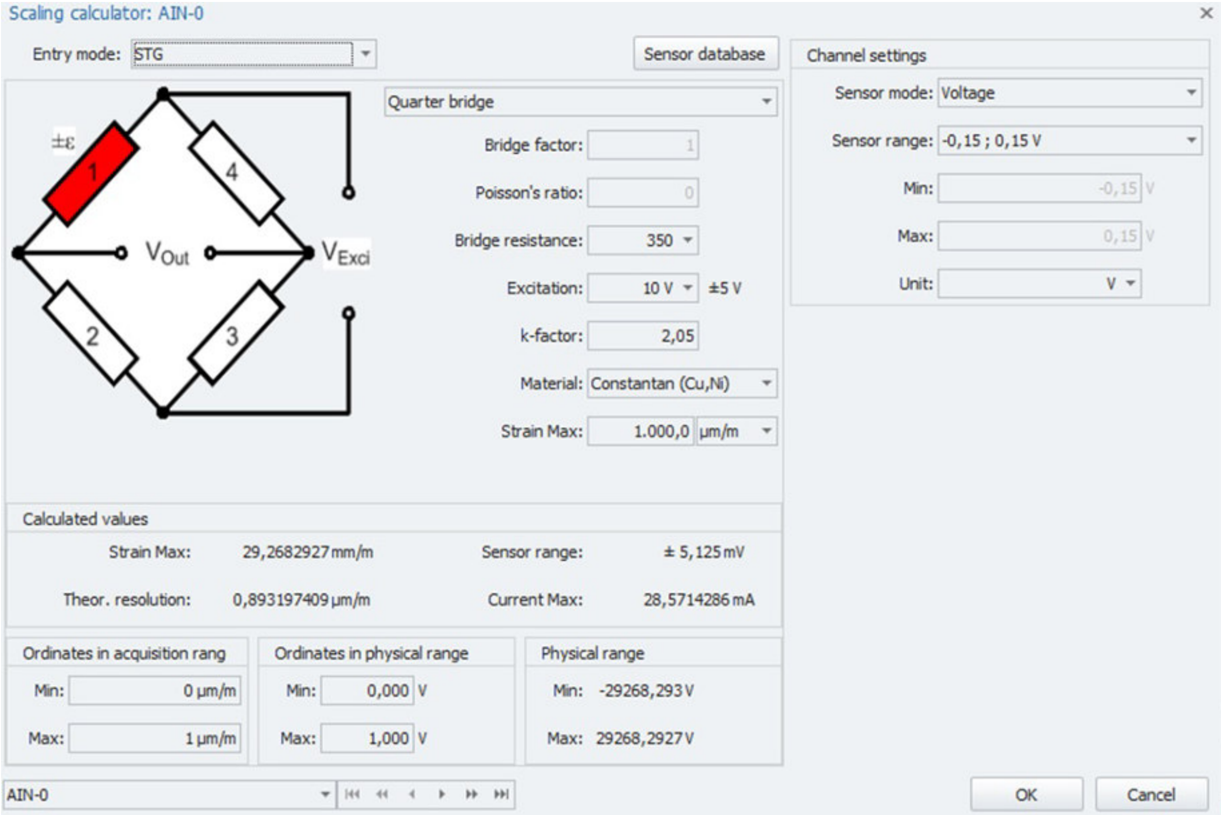


[SI_73]

⚠ ***Attention!*** *The multipoint scaling parameters are only stored in IPEmotion. They are not transferred to the instrument unless the instrument is supporting this function. See chapter 11.4.*

11.8.5 STG Strain gauge

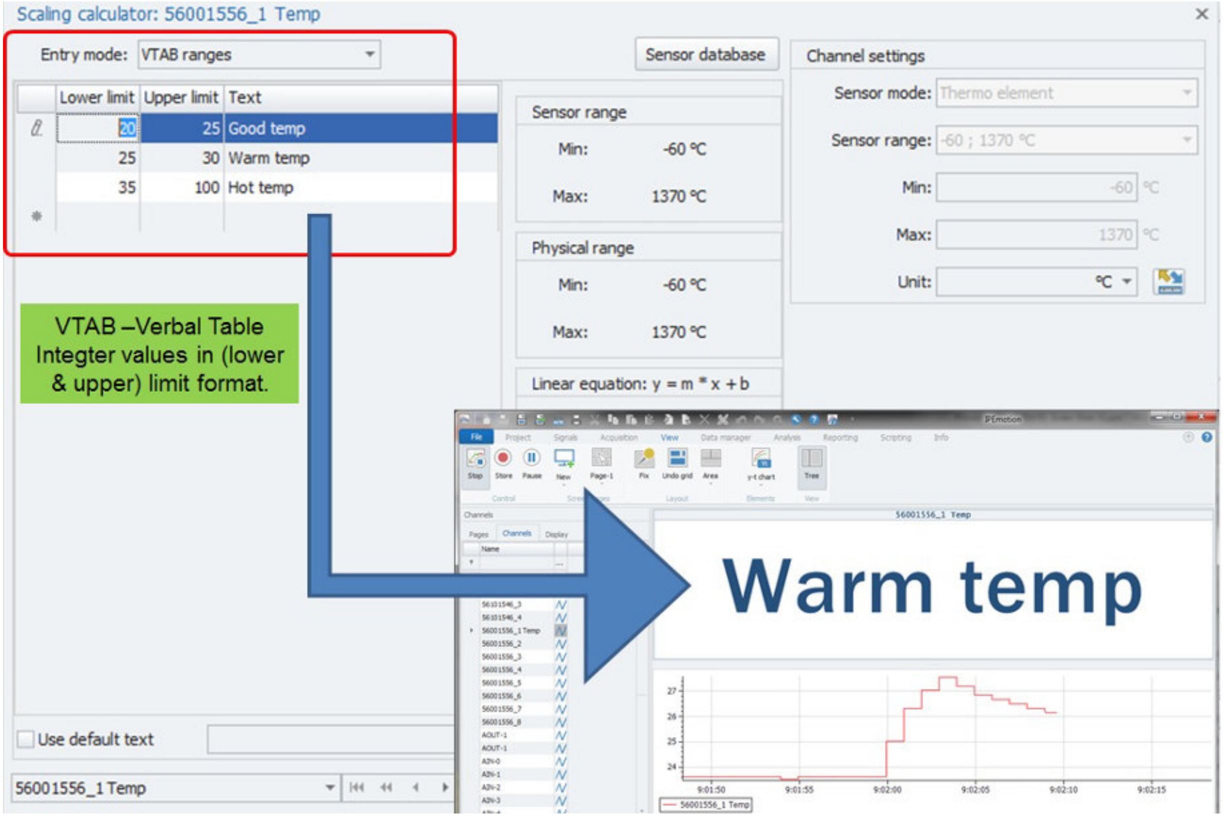
In this interface, strain gauge bridge types like 1/4; 1/2 or full, etc. can be configured.



[SI_74]

11.8.6 VTAB range

This scaling method converts measurements of a specific range into a text message. If the measurement value is in a defined range you can see the corresponding text information on an alphanumerical instrument in the VIEW work area.



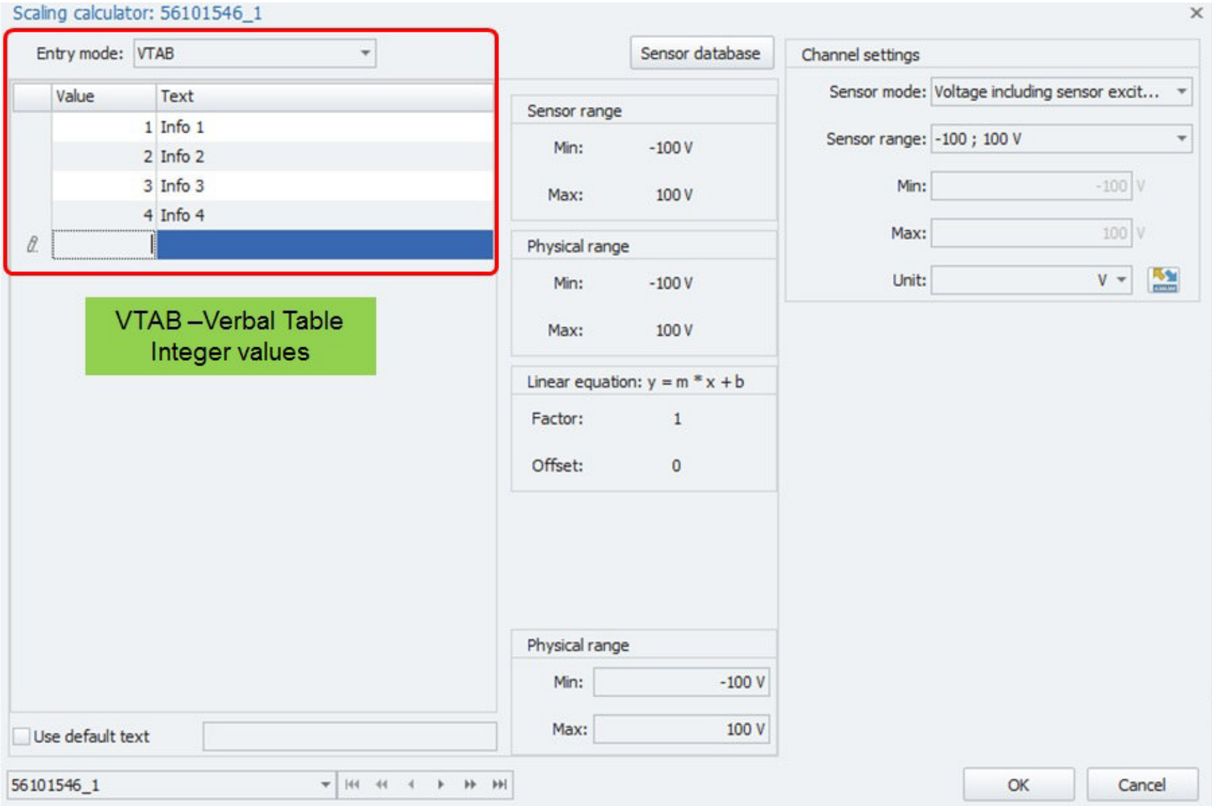
[SI_75]

⚠ ***Attention!***

The multipoint scaling parameters are only stored in IPEmotion. They are not transferred to the instrument unless the instrument is supporting this function. See chapter 11.4.

11.8.7 VTAB

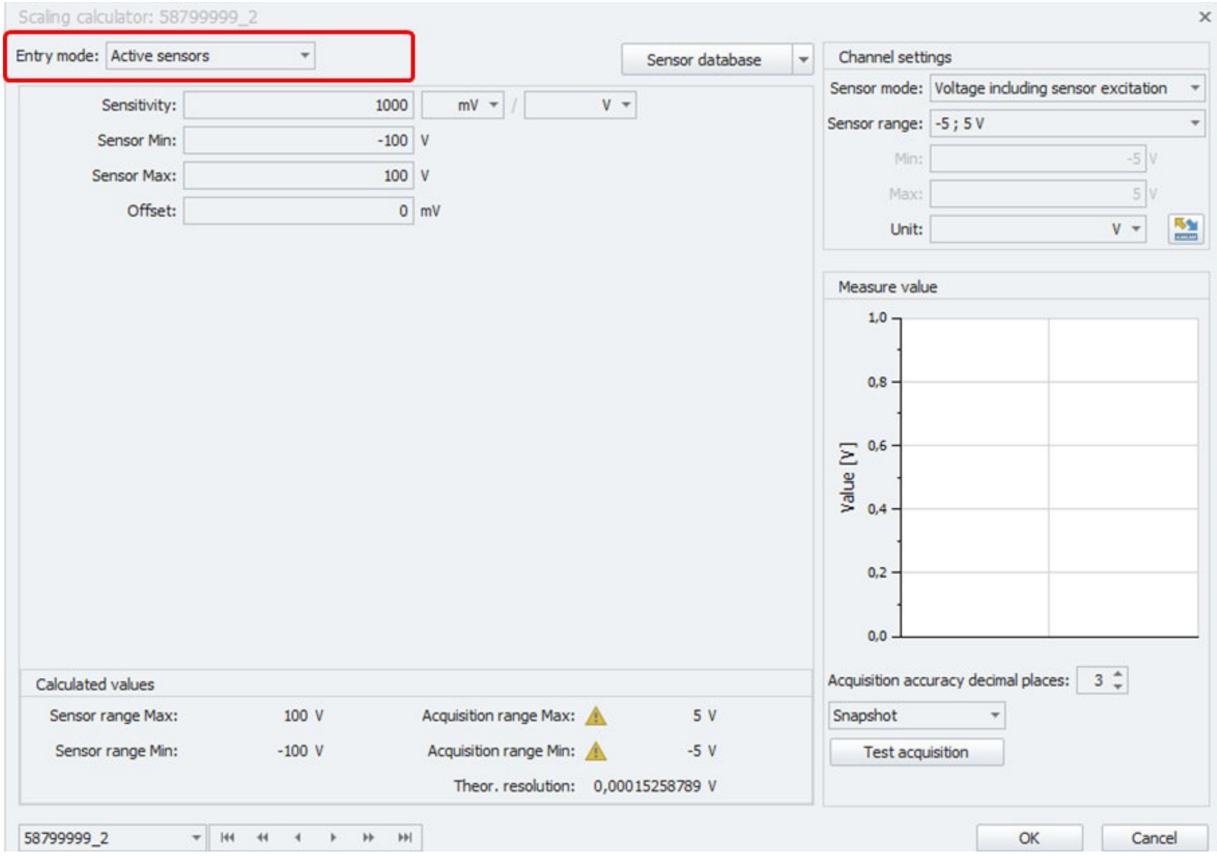
In this mode you can relate a specific integer (1, 2, 3, 4, ..) value to a specific text display. You can display this text on the VIEW work area for example in an alphanumerical instrument.



[SI_76]

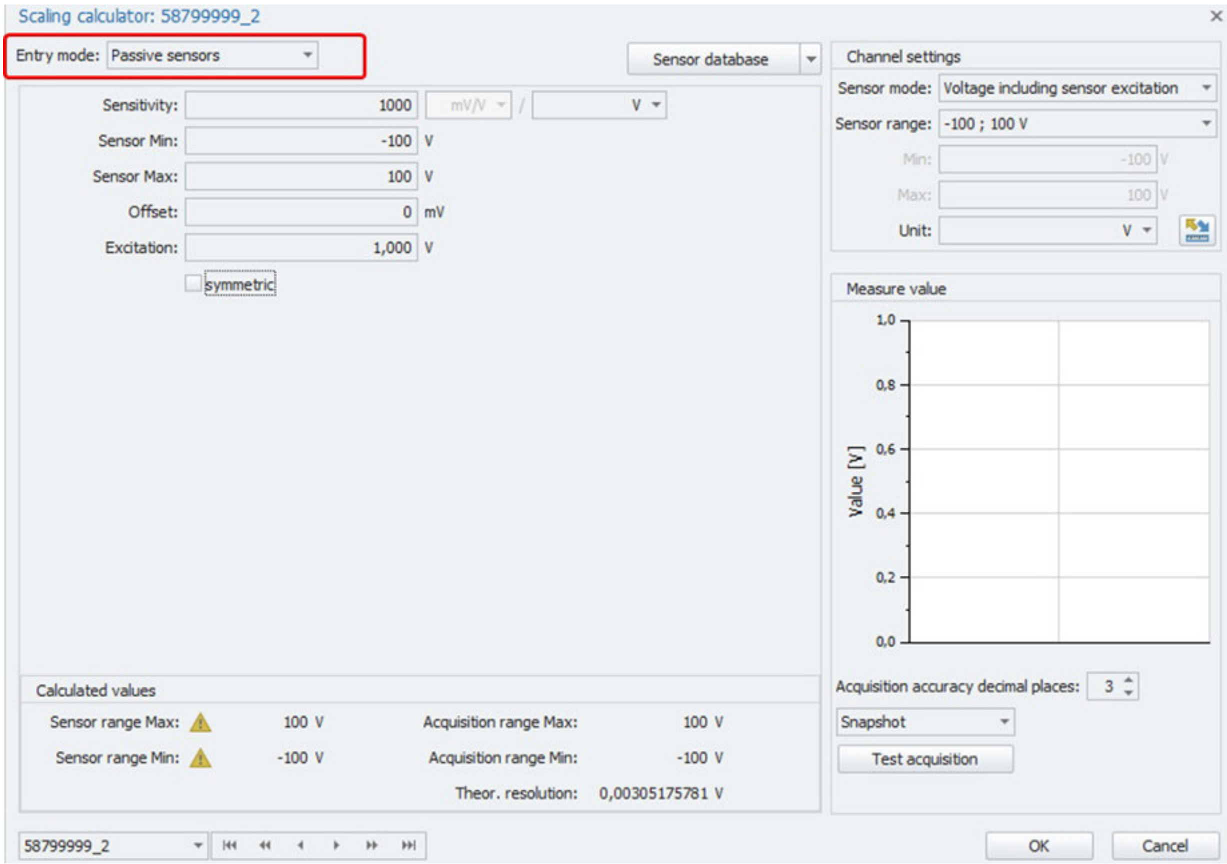
⚠ ***Attention!*** *The multipoint scaling parameters are only stored in IPEmotion. They are not transferred to the instrument unless the instrument is supporting this function. See chapter 11.4.*

11.8.8 Active Sensors



[SI_77]

11.8.9 Passive Sensors

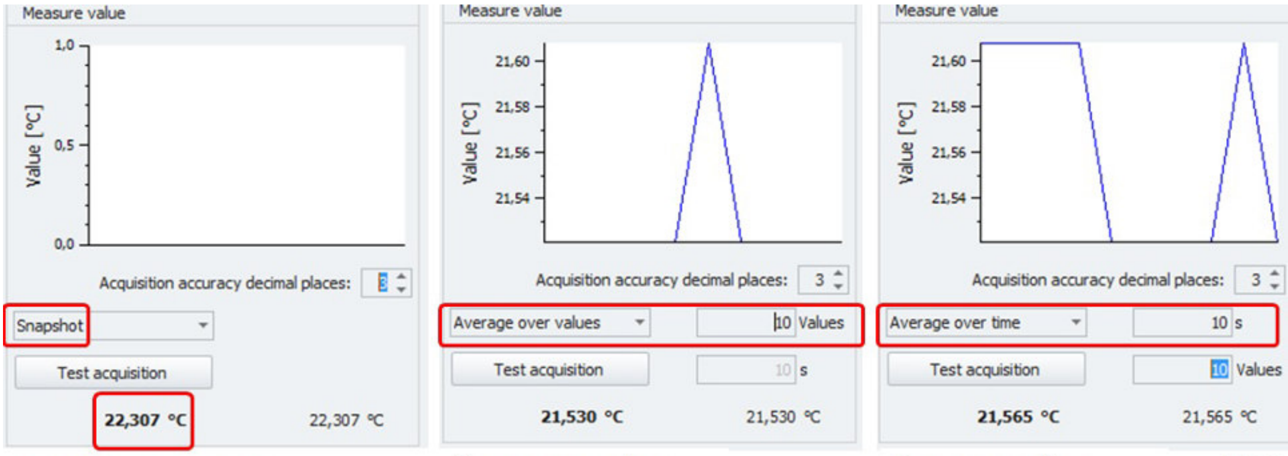


[SI_78]

11.8.10 Snapshot – Test Measurement

You can perform a test measurement within the scaling calculator to check your scaling and to see the actual measurements. Three different test measurements are supported:

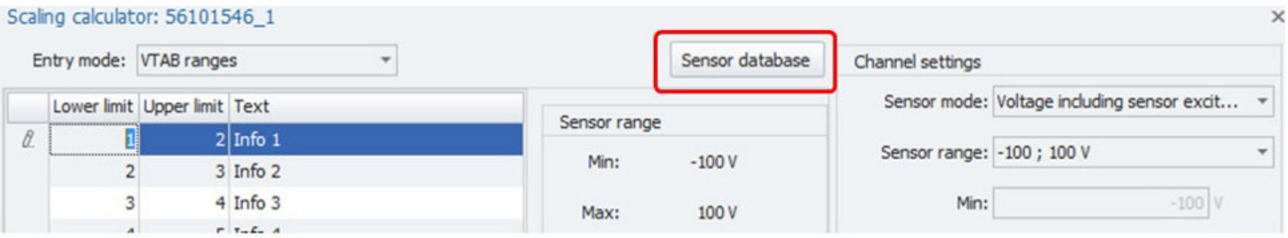
- Snapshot
- Average over values
- Average over time



Snapshot measurement Average over values Average over time [SI_79]

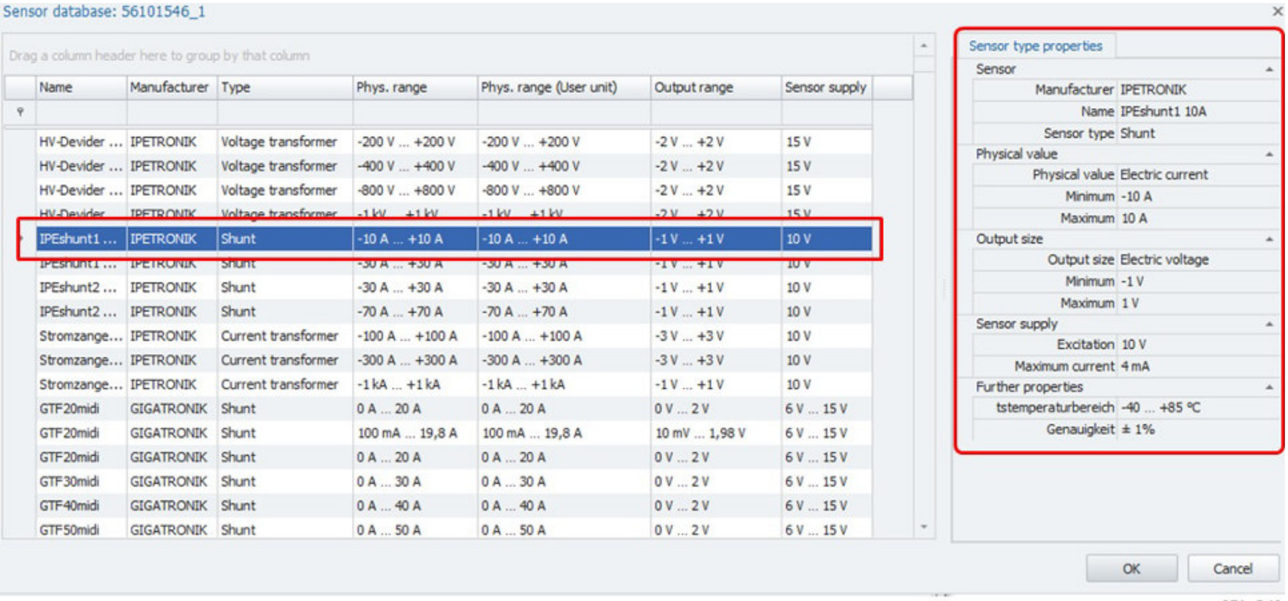
11.9 Sensor database in the scaling calculator

The scaling calculator supports a sensor database. In this database, the scaling parameters of many different sensors are included. If you select a sensor from the database, you have directly defined the measurement range and the physical range and, if needed, a sensor excitation.



[SI_80]

In this example, you see a shunt for high current measurements. This shunt can measure +-10 Amperes and the output of the shunt is +-1 Volt. The sensor requires a 10 Volt sensor excitation.



[SI_81]

11.9.1 Adding new Sensors - Sensor Database Editor

The sensor database (SDB.exe) is installed with each IPEmotion installation in the following directory:

Win7 C:\Program Files (x86)\IPETRONIK**IPEmotion 2016 R2.1**\Tools

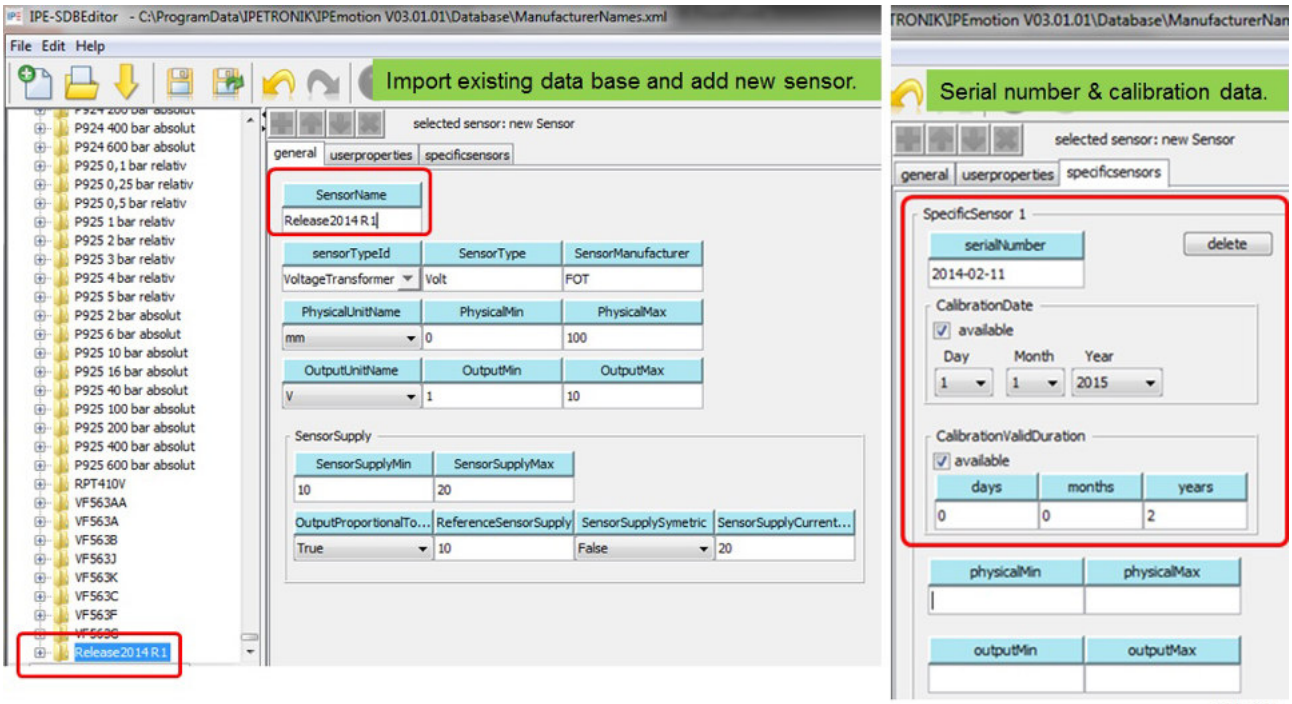
If you like to add your sensor to the existing standard database, it is recommended to import the standard sensor database. The database is installed in the following directory.

Win7 C:\ProgramData\IPETRONIK**IPEmotion 2017 R1**\Database

You can also create your own sensor database XML file from scratch. If you like to use your own database file you have to store it in the right directory and give the file the correct name: **IPESensorDatabase.xml**

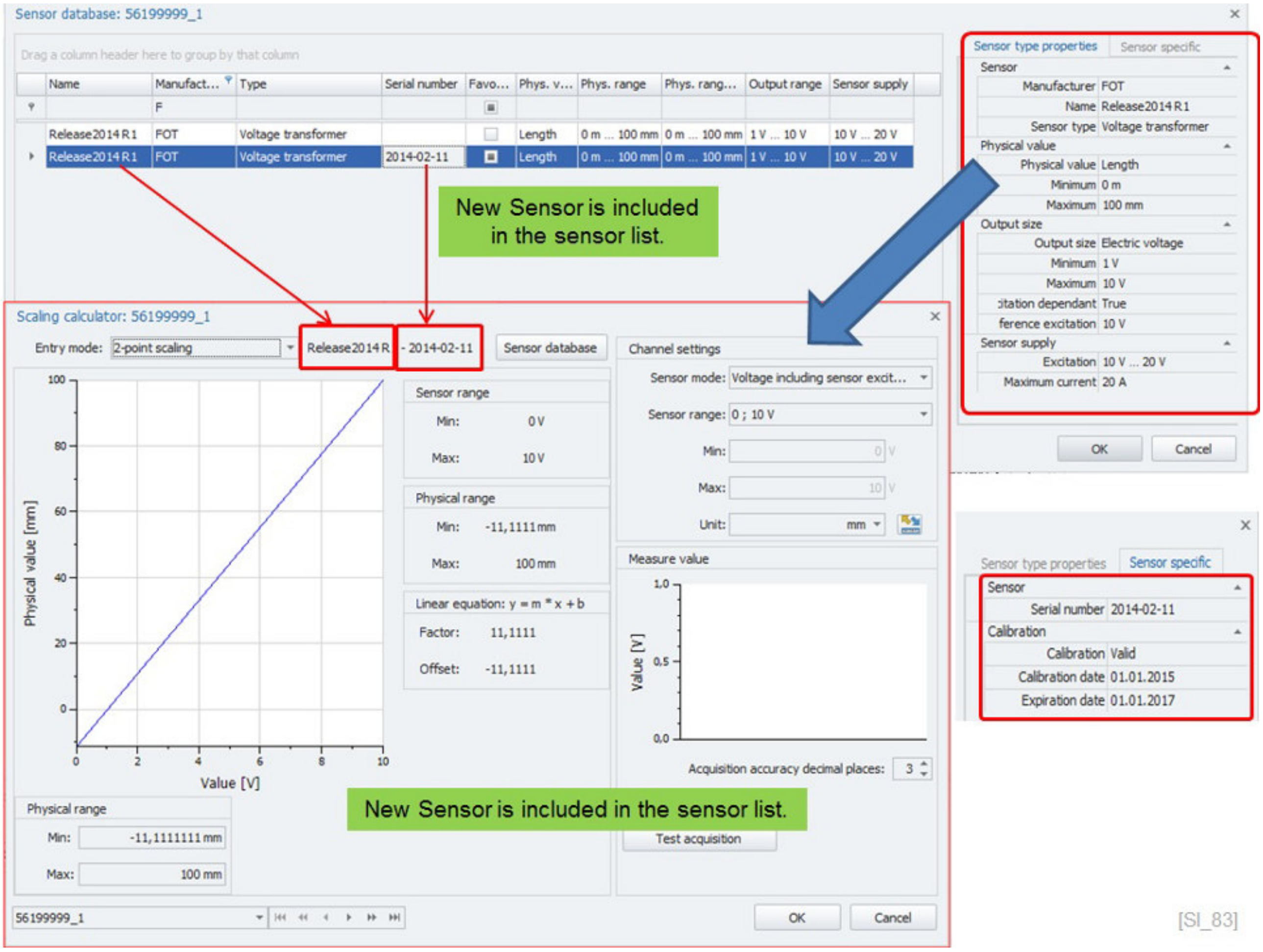
IPEmotion can only work with one database XML file.

You can add new sensor by means of the SensorDB editor. This tool is installed along with IPEmotion and entries can be made through the GUI.



[SI_82]

If you save the new sensor and restart IPEmotion, the new sensor will be included in the database and can be selected for channel scaling. Serial numbers and calibration dates can be defined, as well.



However, you can import your own database from Excel using the import function of the SensorDB Editor. The import function is explained in the help manual of the SensorDB Editor.

11.9.2 The database format

The standard Excel template for importing sensors has the following structure:

- sensorName
- sensorTypeId (see next page for details)
- sensorType
- sensorManufacturer
- physicalUnitName
- physicalMin
- physicalMax
- outputUnitName
- outputMin
- outputMax
- sensorSupplyMin
- sensorSupplyMax

- outputProportionalToSupply
- referenceSensorSupply
- sensorSupplySymetric
- sensorSupplyCurrentMax
- propertyName1
- propertyValue1
- propertyName2
- propertyValue2
- propertyName3
- propertyValue3
- serialNumber
- calibrationDate
- calibrationValidMonths
- calibrationValidDays
- physicalMin
- physicalMax
- outputMin
- outputMax

The Sensor type ID

- 0 = UNKNOWN // User-defined sensor
- 1 = DisplacementTransducer // Displacement transducer
- 2 = LoadCell // Load cell
- 3 = Shunt // Shunt
- 4 = CurrentTransformer // Current transformer
- 5 = VoltageTransformer // Voltage transformer
- 6 = ForceTransducer // Force transducer
- 7 = PressureTransmitter // Pressure transmitter
- 8 = AbsolutePressureTransmitter // Absolute pressure transmitter
- 9 = GaugePressureTransmitter // Gauge pressure transmitter
- 10 = DifferentialPressureTransmitter // Differential pressure transmitter
- 11 = FlowRateTurbine // Flow rate turbine
- 12 = PistonFlowmeter // Piston flow meter
- 13 = ScrewFlowmeter // Screw flow meter
- 14 = VortexSheddingDevice // Vortex shedding device
- 15 = Accelerometer // Accelerometer
- 16 = TriAxialAccelerometer // Triaxial accelerometer
- 17 = TorqueMeter // Torque meter
- 18 = Counter // Counter
- 19 = StrainGauge // STG
- 20 = LVDT // LVDT
- 21 = StrainGaugeBridge // STG bridges (Strain)
- 22 = TemperatureSenso // Temperature senso

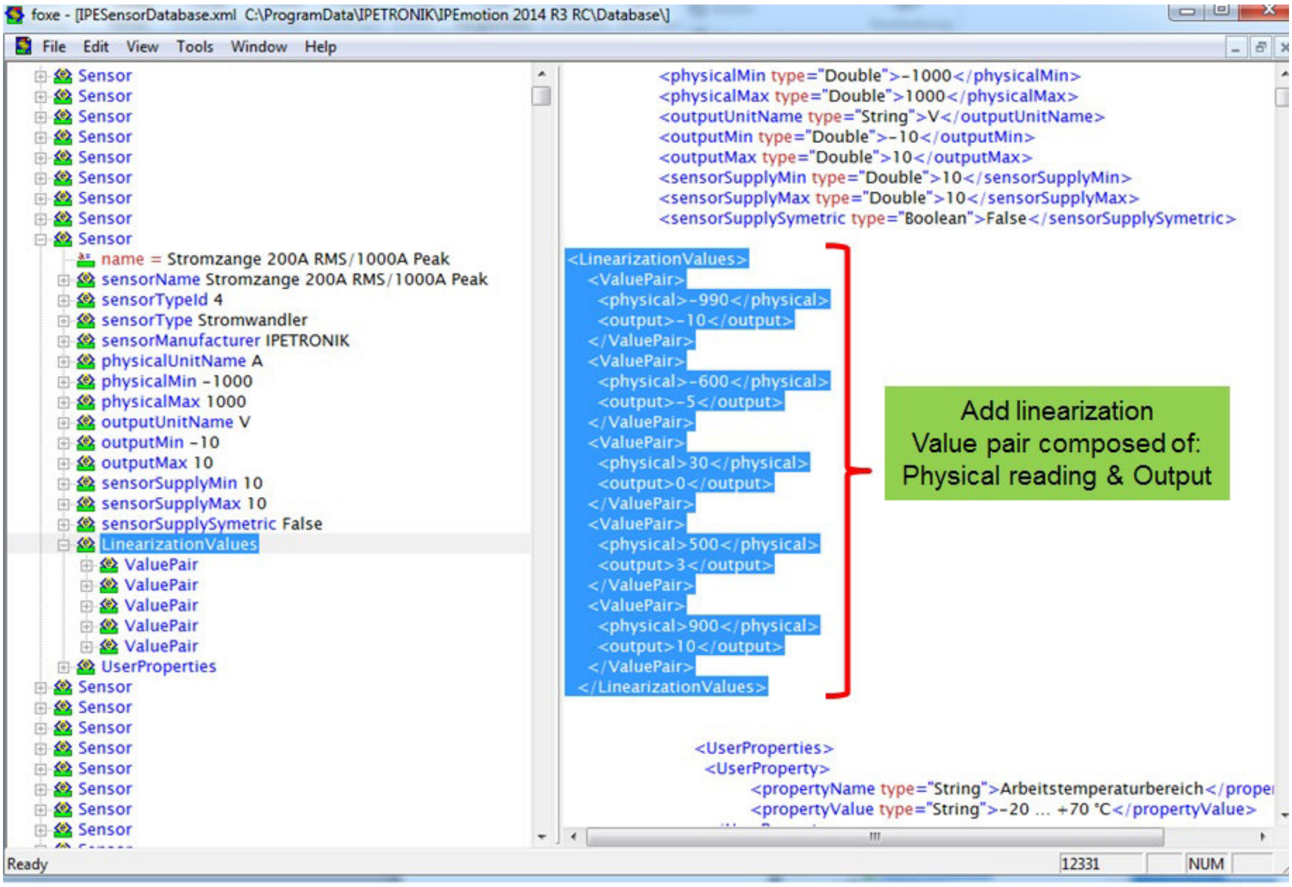
If none of the predefined types meets your requirements, you can add user-defined types to the sensor database. The “sensorTypeId“ value must be set to 0. A short description text should classify the corresponding sensor.
If you want to use sensors of the same type within the sensor database, use the ”SpecificSensors” entry. Each one of the sensors must get a unique serial number (”serialNumber”). In addition, each one of these sensors can get a calibration date (“calibrationDate”), as well as a period of validity of the calibration (”CalibrationValidDuration”) including the data ”calibrationnValidYears”, ”calibrationValidMonths”, and ”calibrationValidDays”. Furthermore, the values for ”physicalMin”, ”physicalMax”, ”outputMin”, and ”outputMax”, which can be found in the data sheet, can be overwritten by values, which are read at the calibration.
You can add non-relevant information for the functionality of the sensor data base like the working temperature range under the ”UserProperties” entry. These are Key/Value pairs, which are used for displaying the information. Please note that these data are not used in any calculation.
All the sensor data is stored in an XML file with the following structure.

The sensor names (“sensorName”) must be unique!

```
<Sensor name="Sensor2">
<sensorName type="String">Sensor2</sensorName>
<sensorTypeId type="Int32">7</sensorTypeId>
<sensorManufacturer type="String">IPETRONIK</sensorManufacturer>
<physicalUnitName type="String">bar</physicalUnitName>
<physicalMin type="Double">1</physicalMin>
<physicalMax type="Double">50</physicalMax>
<outputUnitName type="String">V</outputUnitName>
<outputMin type="Double">-4</outputMin>
<outputMax type="Double">4</outputMax>
<sensorSupplyMin type="Double">-5</sensorSupplyMin>
<sensorSupplyMax type="Double">5</sensorSupplyMax>
<sensorSupplyCurrentMax type="Double">0.01</sensorSupplyCurrentMax>
<PreferedSensorModes>
<sensorMode />
</PreferedSensorModes>
<UserProperties>
<UserProperty>
<propertyName type="String">Genauigkeit</propertyName>
<propertyValue type="String">+- 4,7 %</propertyValue>
</UserProperty>
</UserProperties>
<SpecificSensors>
<SpecificSensor>
<serialNumber type="String" />
</SpecificSensor>
<SpecificSensor>
<serialNumber type="String">SN01277</serialNumber>
<calibrationDate type="Date">2012-04-04</calibrationDate>
<CalibrationValidDuration>
<calibrationValidYears type="Int32">1</calibrationValidYears>
<calibrationValidMonths type="Int32">6</calibrationValidMonths>
<calibrationValidDays type="Int32">0</calibrationValidDays>
</CalibrationValidDuration>
<outputMin type="Double">-3.895</outputMin>
<outputMax type="Double">4</outputMax>
</SpecificSensor>
</SpecificSensors>
</Sensor>
```

11.9.3 Multipoint linearization

The sensor data base is supporting sensor linearization functions. You can add for sensors multipoint linearization into sensor data base XML file. In the XML file you can add value pairs of “Physical reading / Sensor Output”.

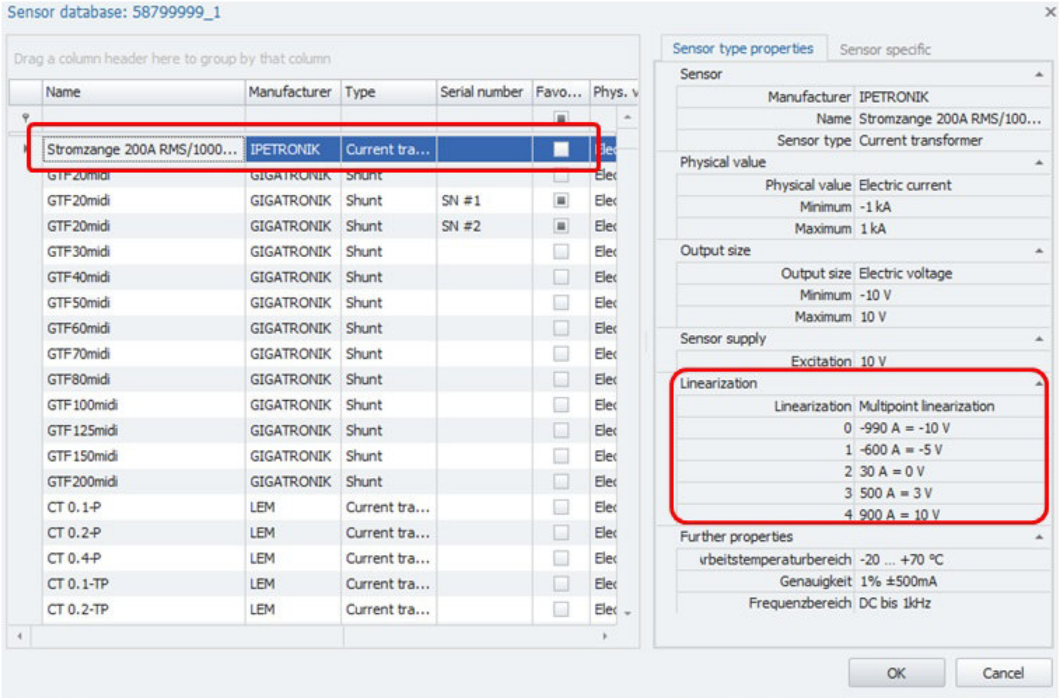


[SI_84]

Information

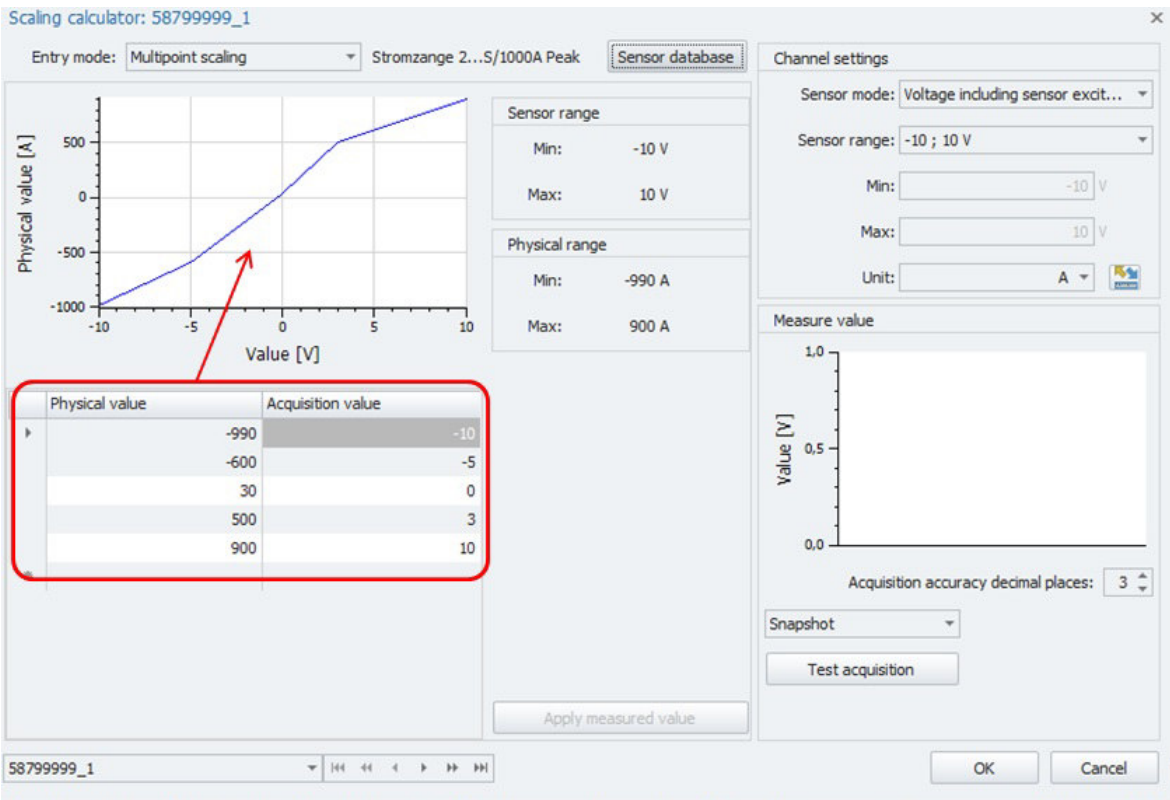
The sensor specific linearization information can only be added through the XML file directly. The Sensor Database Editor and the corresponding CSV/Excel import function is ***currently not supporting*** *this function.*

When you select a sensor with linearization values they are directly indicated in the sensor parameter overview. In this example the scaling is integrated to the “Sensor type properties”.



[SI_85] Linearization values are indicated.

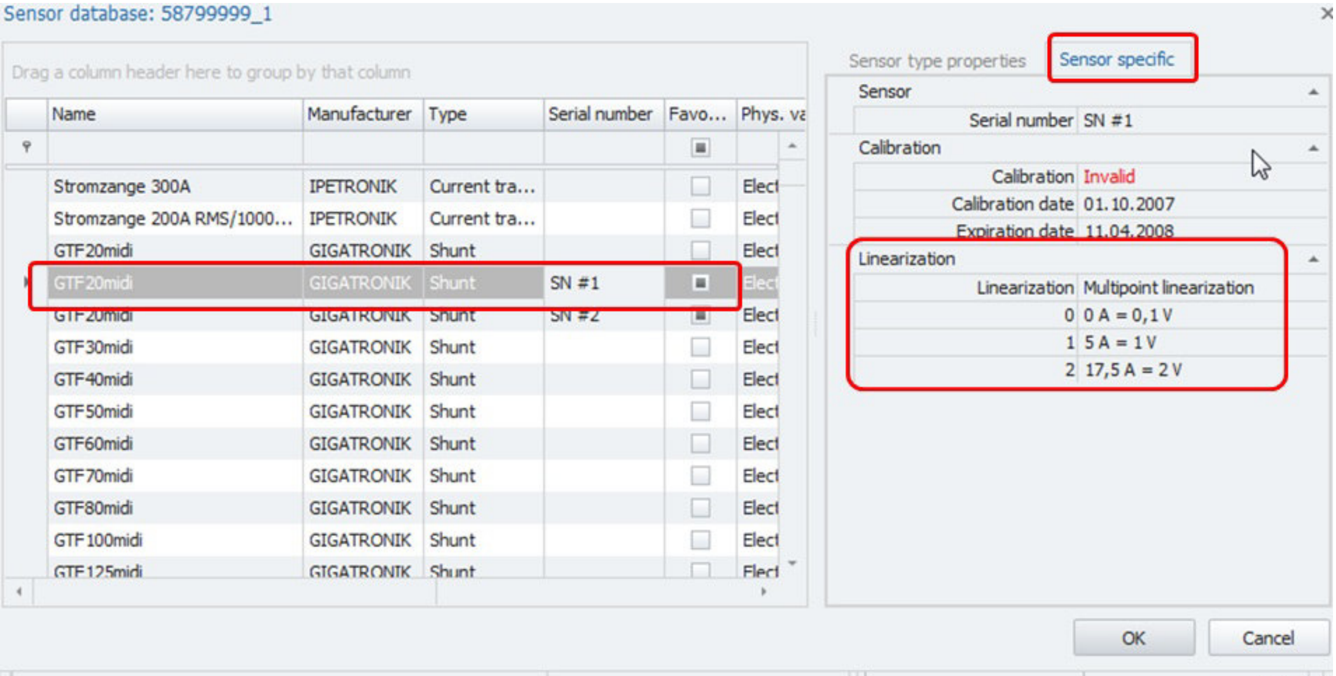
The linearization values are imported from the sensor database into the multipoint scaling mode with a graphical presentation of the calibration curve.



[SI_86]

Multi point scaling is directly integrated to the scaling calculator with a graphical presentation of the calibration curve.

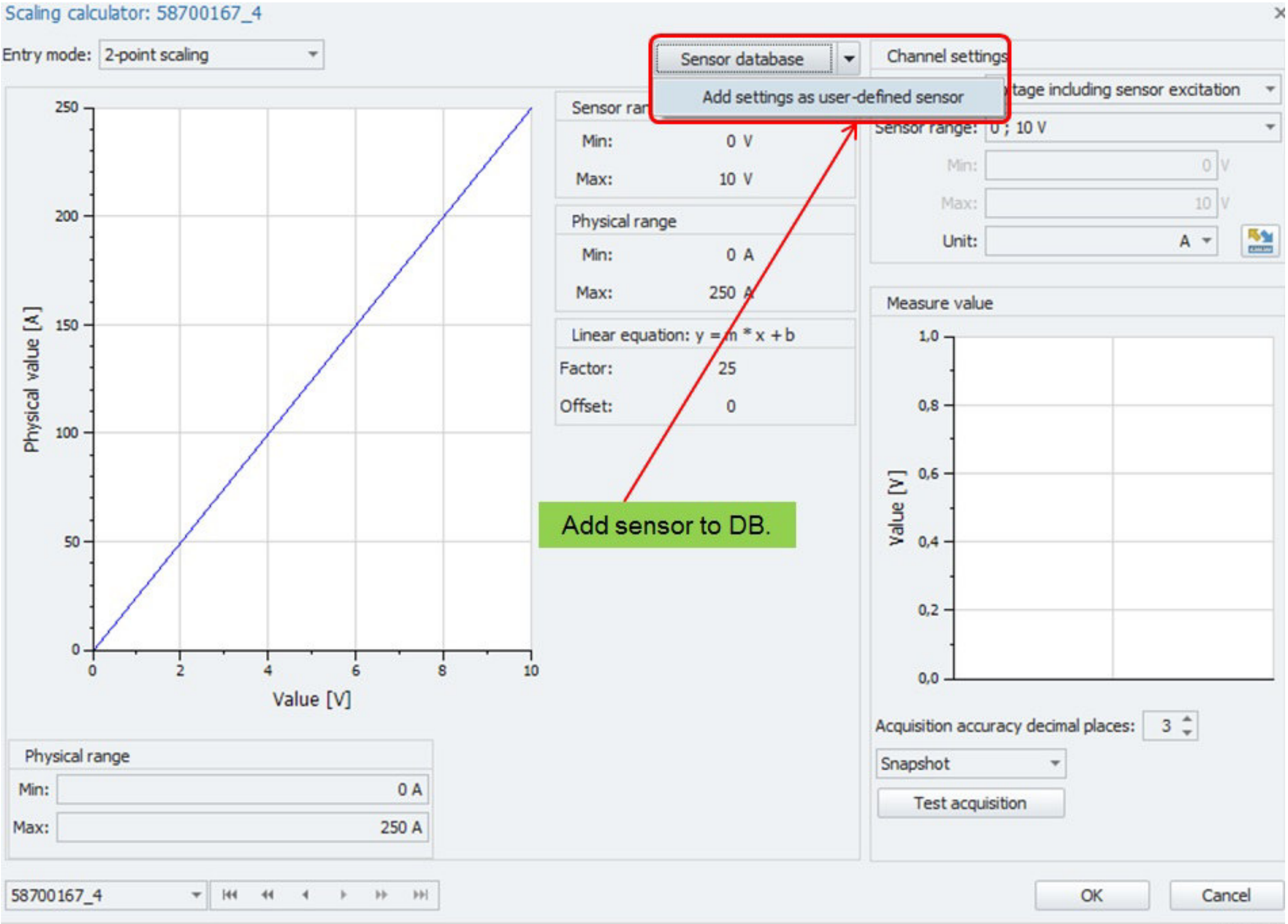
You can integrate multi point scaling also to the “Sensor specific” properties.



[SI_87]

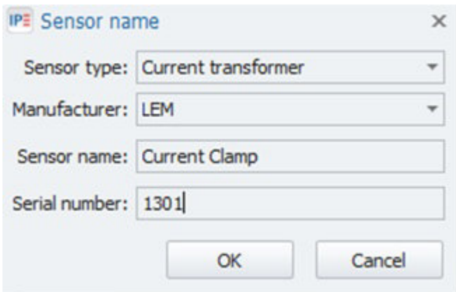
11.9.4 Adding new Sensors – through the Scaling Calculator

The sensor data base is a powerful tool to simplify the channels scaling and reduce scaling error. You can now add your own sensor to the data base. All the settings defined in the sailing interface are saved to the data base. All scaling entry modes are supported to add individual sensors 11.8.



Sensor definition from the scaling calculator is the basis for the sensor. [SI_88]

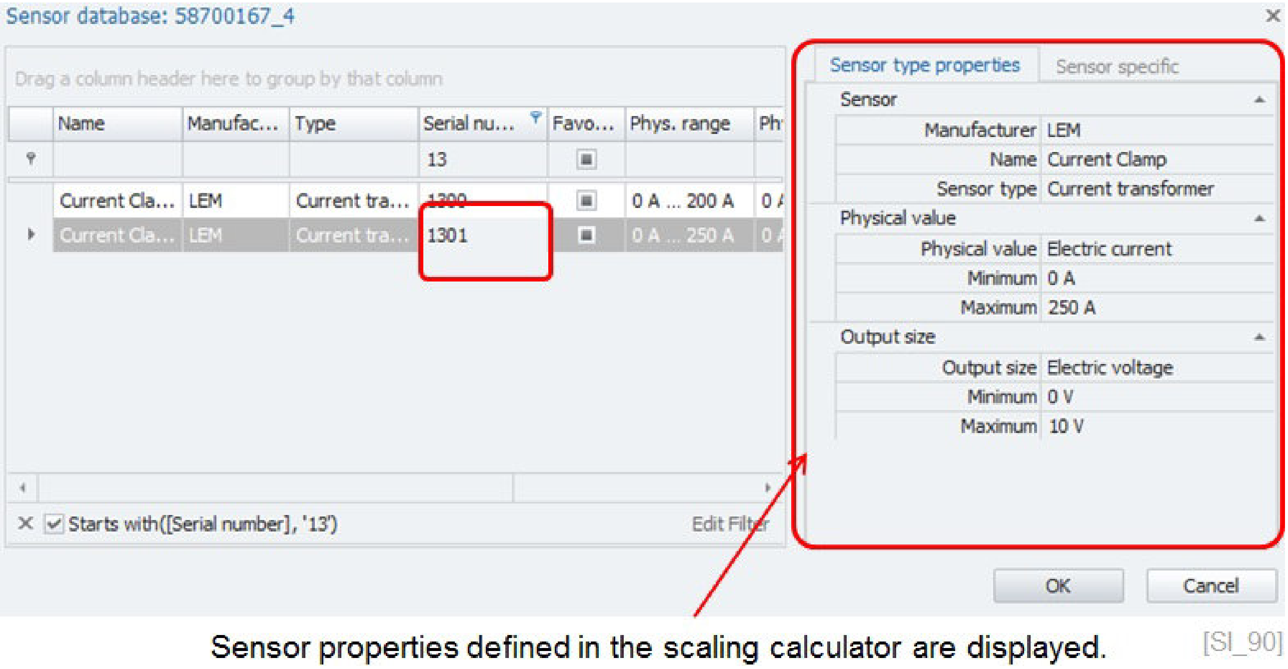
When the sensor parameters are defined you add the sensor header information by accessing the add button.



[SI_89]

Define sensor header information.

After you have created the sensor in the data base you can search for your sensor. The example below shows the parameters as defined in the scaling calculator.



[SI_90]

When a sensor was added to a user define sensor data base file it is saved in:

- C:\Users\Public\Documents\IPETRONIK\IPEmotion\Database\ IPESensorDatabase.xmu
- Extension u = user defined sensor data base.

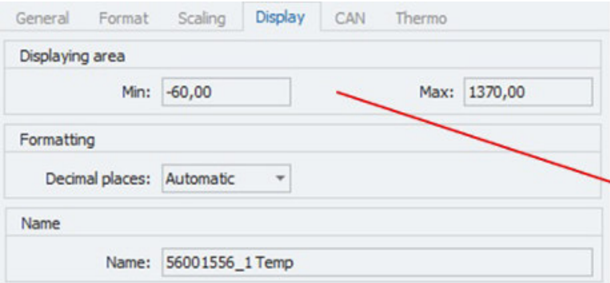
If you like to modify a manually created sensor you need select the sensor from the sensor data base and you can modify settings in the scaling interface. With the function save sensor to data base the modifications are overwritten.

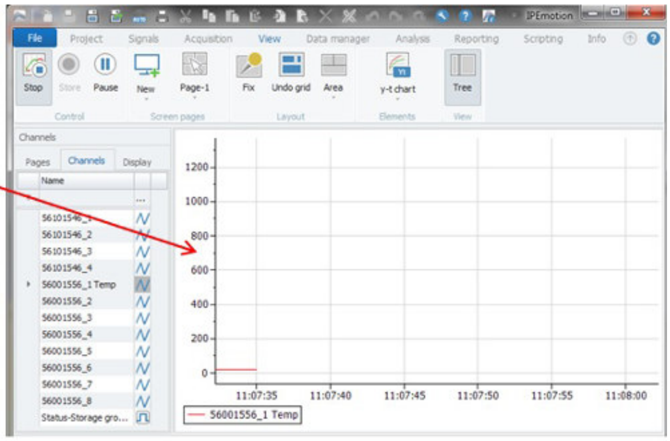
Information *Note: There is no possibility to delete a sensor from the sensor data base. If you need to remove a sensor permanently you need to delete it from the XML files.*

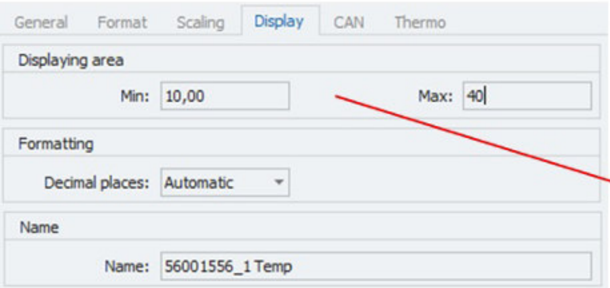
11.10 Display tab sheet

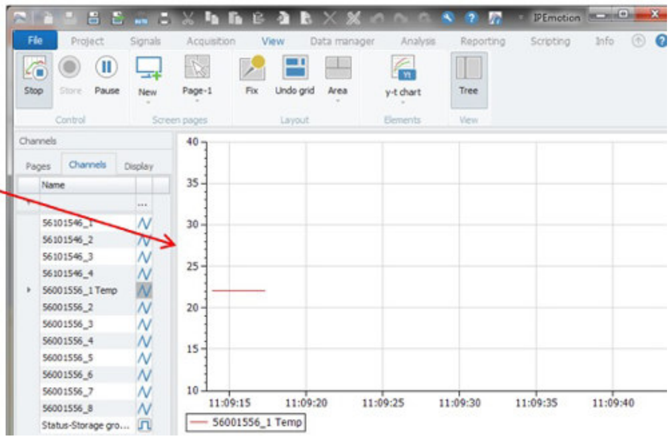
This tab sheet covers display settings for the online VIEW work area. The Display tab sheet is also relevant for formula channels and scaling channels 13.3.3. The main configuration elements are:

- Display Area — Covers the initial Y-axis scaling of the Yt-chart



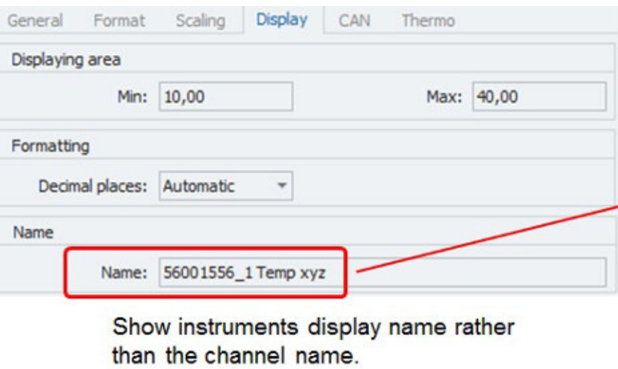


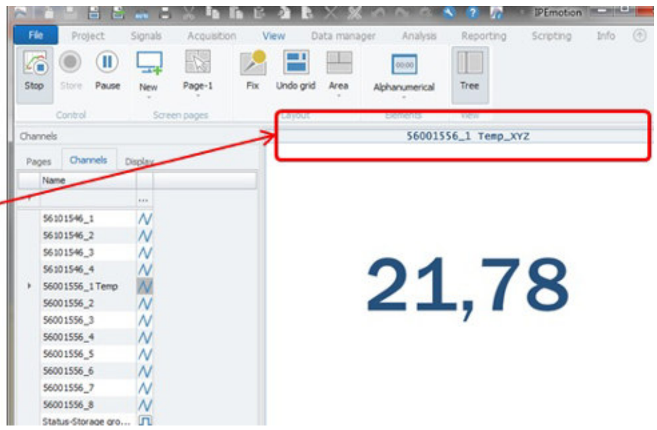




[SI_91]

- Formatting — Covers the decimal places. The default setting is Automatic which will show as many decimal places as provided by the PlugIn
- (Display) Name — Covers the display name which can differ from the channel name. The display name is only relevant for the VIEW work area. The display name will not be used for formulas and other functions like limit or range monitoring. If you like to see the display name on the instruments, you will have to activate this function in OPTIONS >VIEW 22.5.4

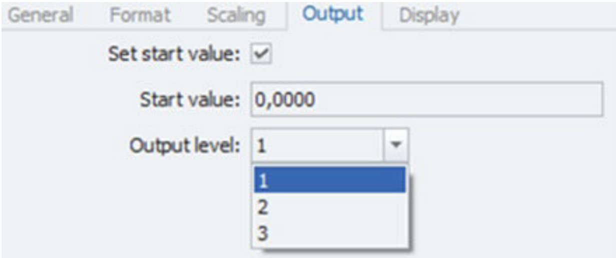




[SI_92]

11.11 Output tab sheet for output channel

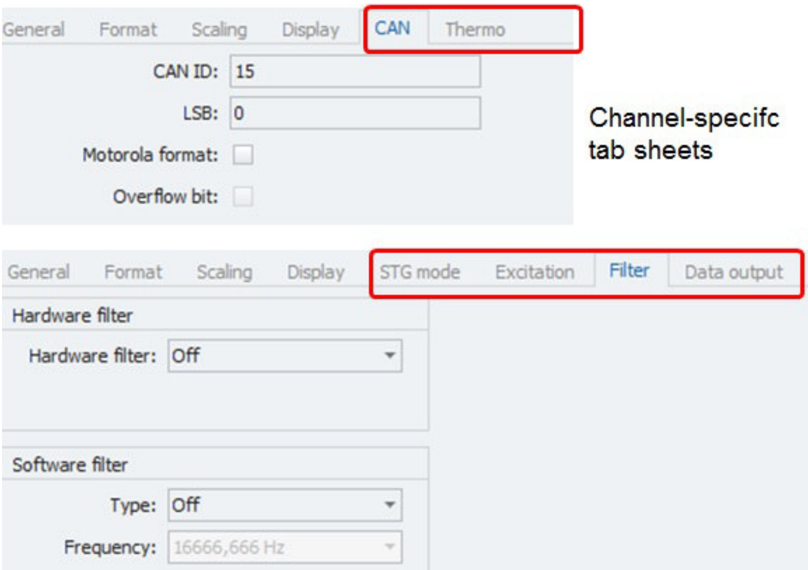
The output tab sheet is only visible for analog and digital output channels. Its main function is to define a start value. This value will be set to the output when you start the measurement. You can also define an output level. The output level is related to the user administration which is discussed in detail in OPTIONS >User administration 22.14.



[SI_93]

11.12 Channel-specific tab sheets

Each PlugIn can have channel-specific tab sheets to cover additional configuration functions. There are many individual functions which are discussed in the PlugIn manual in more detail. Some examples are shown below.

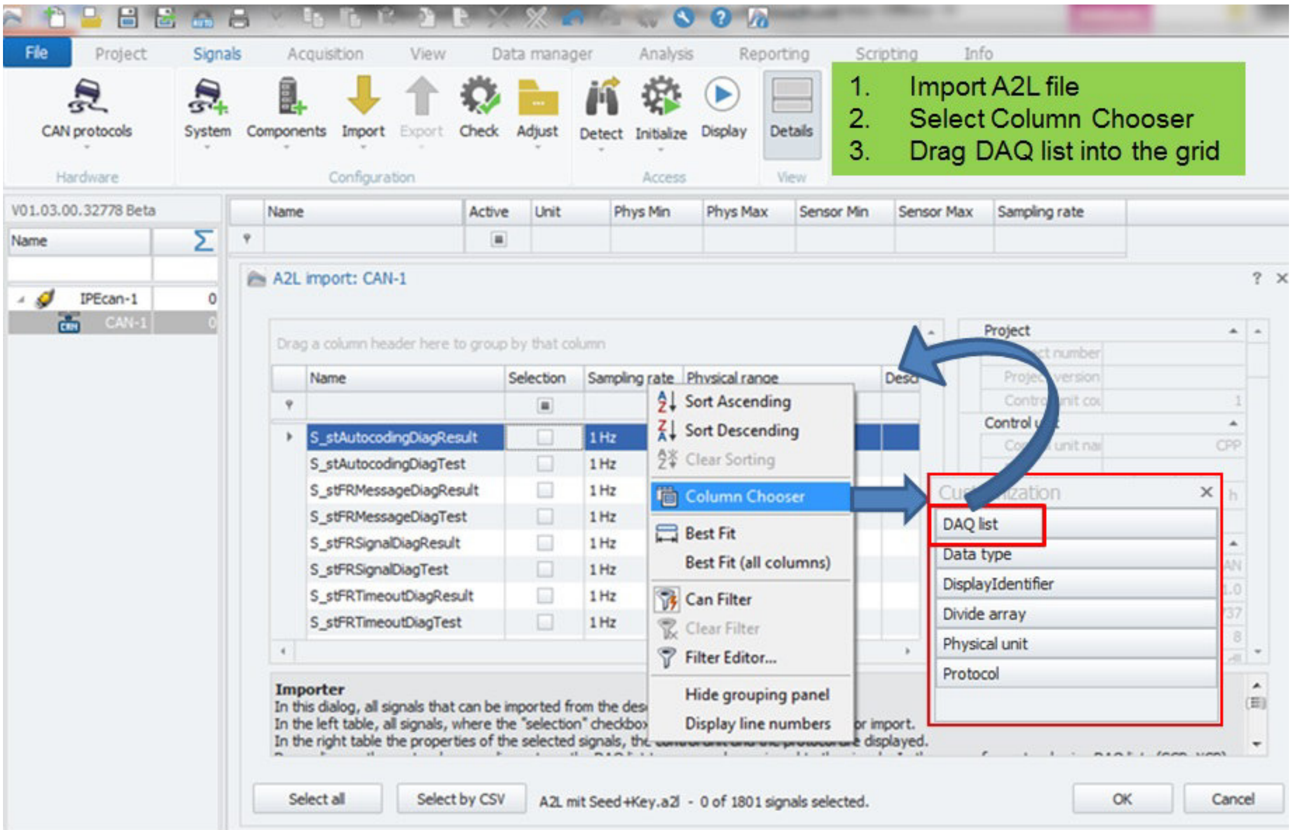


[SI_94]

12 Import functions for description files

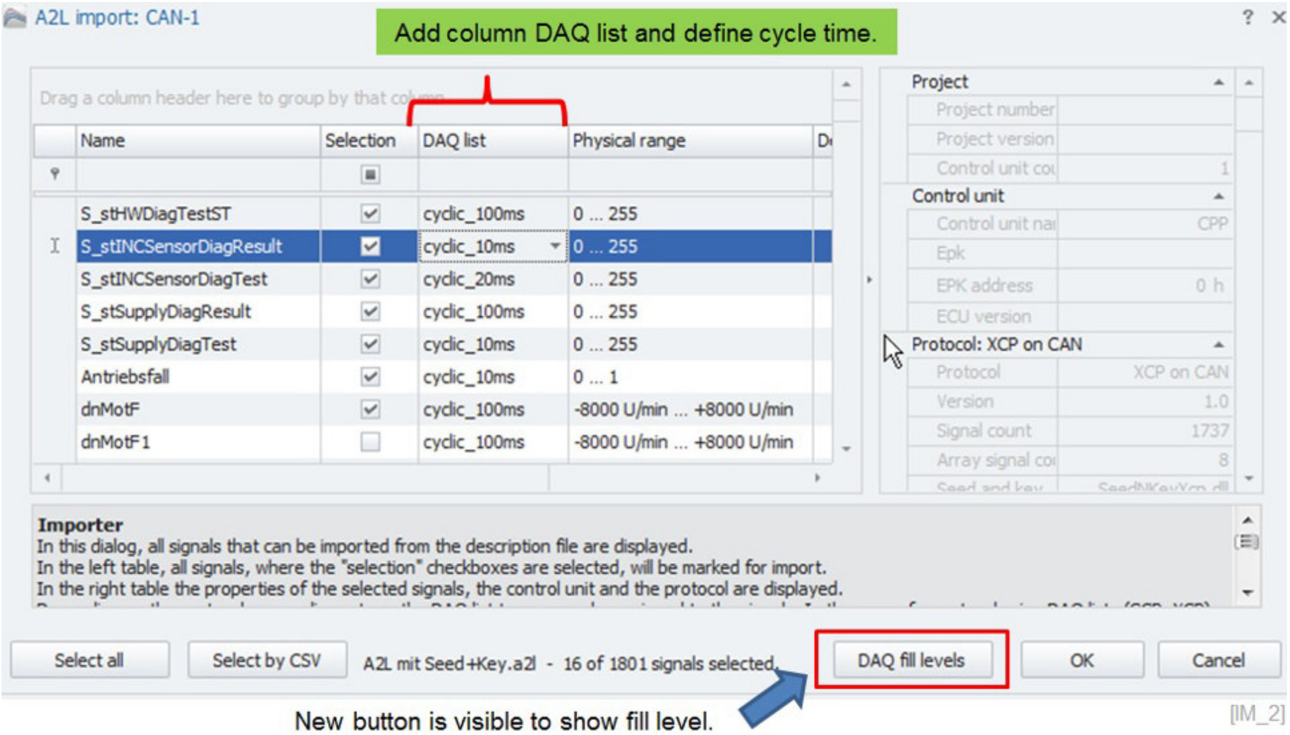
12.1 A2L DAQ list with graphical filling level indication

Measurements on ECUs can easily reach the performance limits if many measurements are required. With this graphical import and filling level indication overview you can now clearly identify which signals are measured and which signals are rejected. To activate the DAQ list filling level indication, you have to add the DAQ list from the column chooser to your channel grid as shown below.



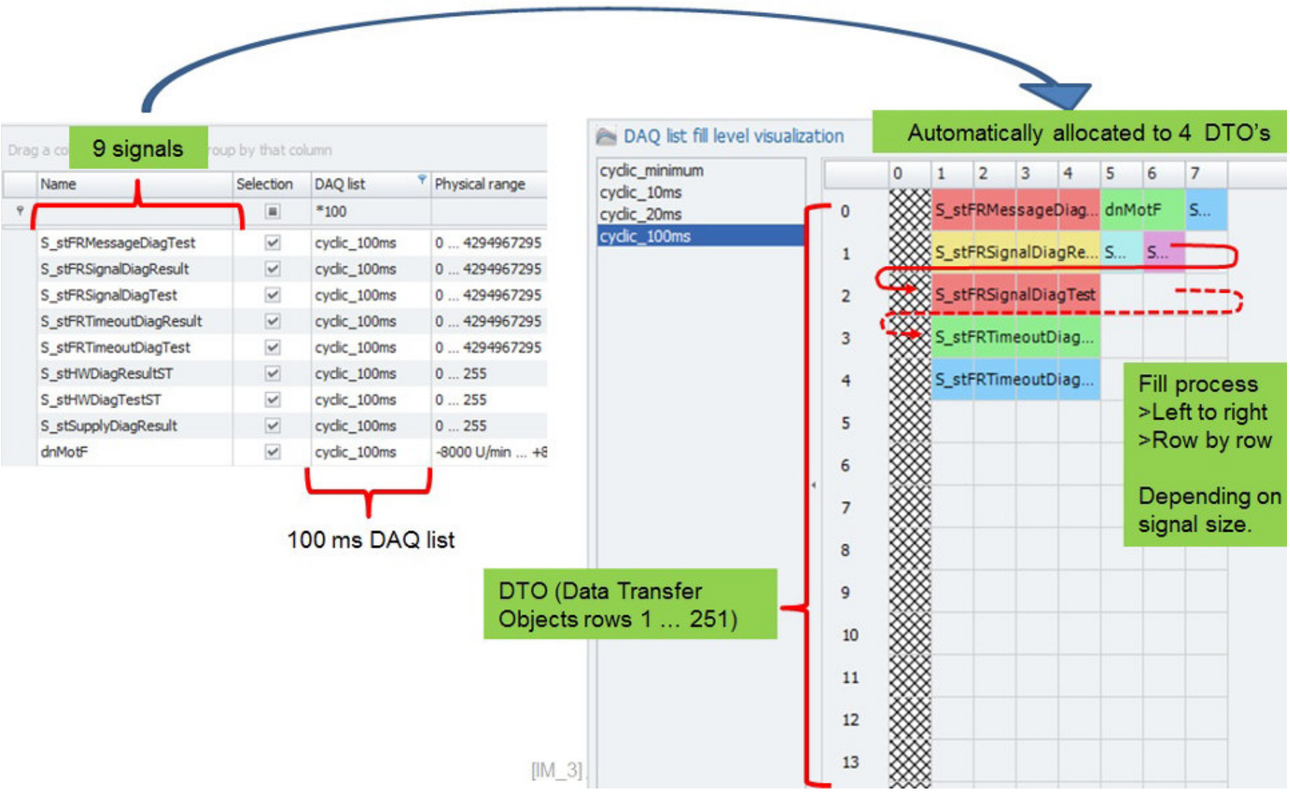
[IM_1]

Then you will see a new button to open the graphical DAQ filling level indication.



[IM_2]

When you open the graphical filling level indication you will see how the signals are allocated to the Data Transfer Objects (DTO). The number of supported DTO's is defined by the A2L file. In one DTO row you can have several signals. The color is randomly selected and is a visual aid showing how many byte a signal is utilizing from a DTO.



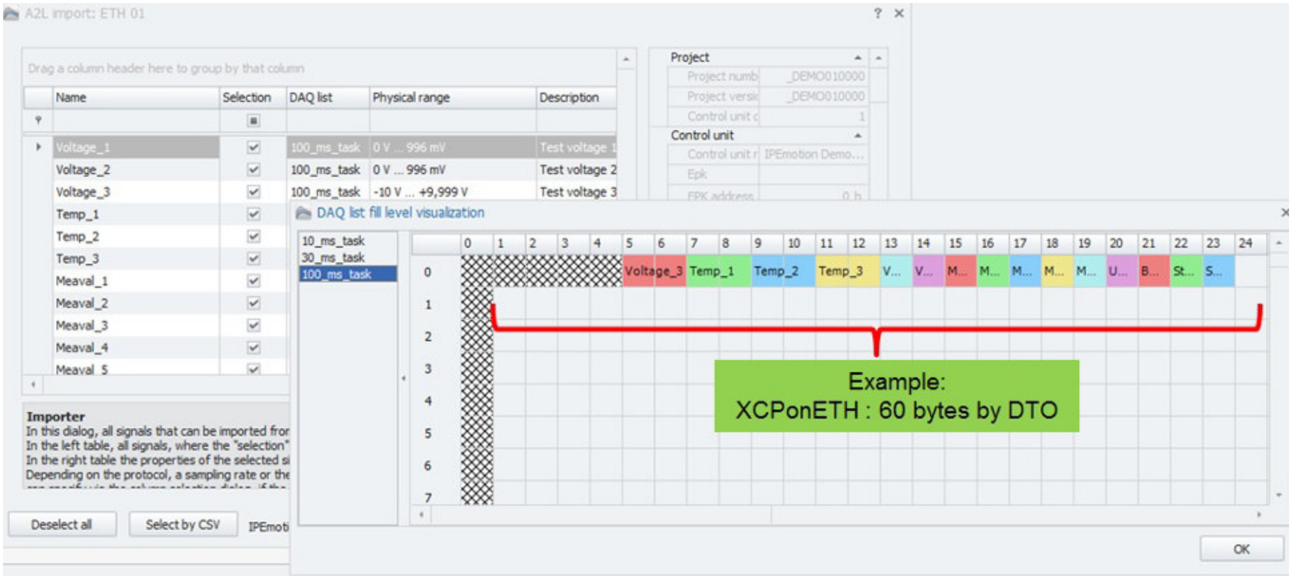
[IM_3]

12.1.1 DAQ list filling process

The import dialog fills the DAQ list in an optimized way in order to use as much of the available capacity as possible. The maximum capacity for signal measurement of a DTO is 7 byte for CCP measurements and XCPonCAN. The first byte is used for the address header.

Example 1:

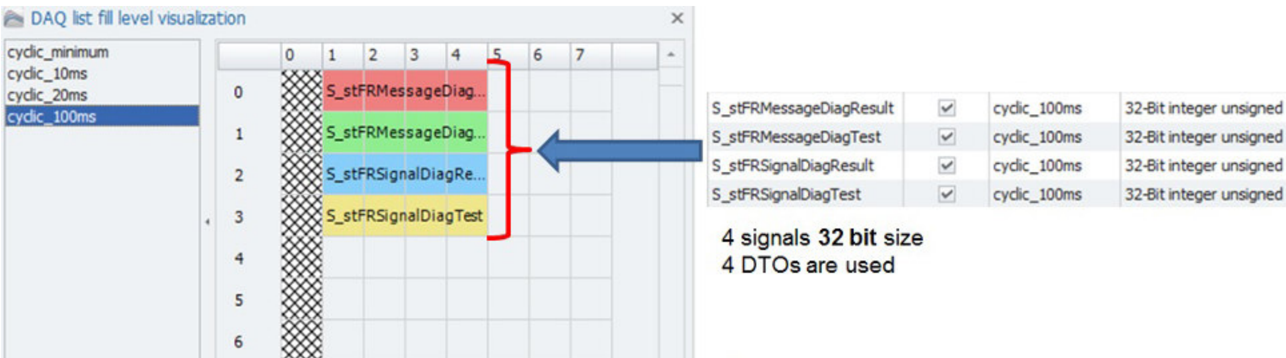
In comparison of you take an A2L file and measure XCPonETH on the Ethernet interface of IPETRONIK aata loggers like M-LOG have a lot more byte capacity on the DTO. The number of available bytes is defined in the A2L file. In the screenshot below you can see the import dialog and the DTO fill level for an XCPonETH measurement with 60 byte capacity on each DTO.



[IM_4]

Example2:

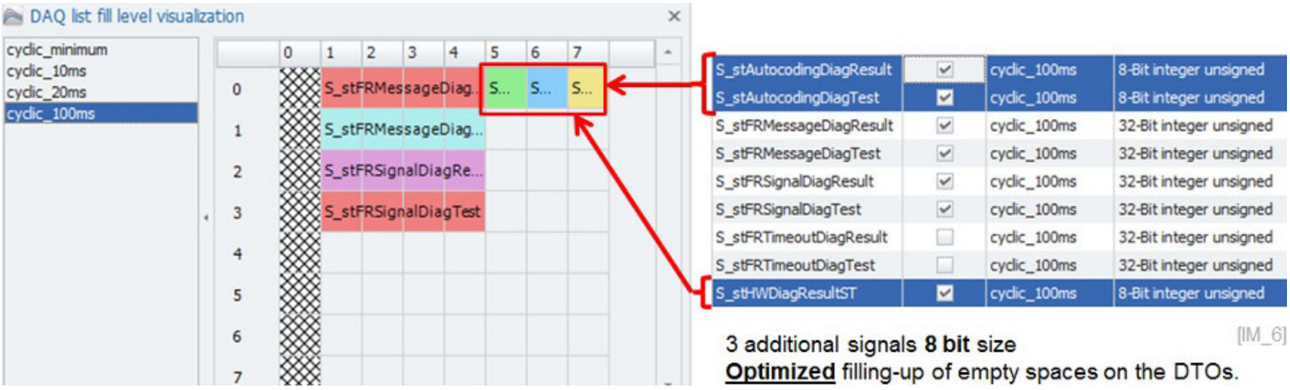
In the screenshot below you can see that 4 DTOs are used for four 32-bit signals It is not possible to fill 2 signals of 32-bit signals in one 7 byte DTO.



[IM_5]

Example 3:

In the following example, 3 additional 8-bit signals are activated. Now you can see that the IPEmotion software automatically fills up the 3 empty bytes on the first DTO (Data Transfer Object).



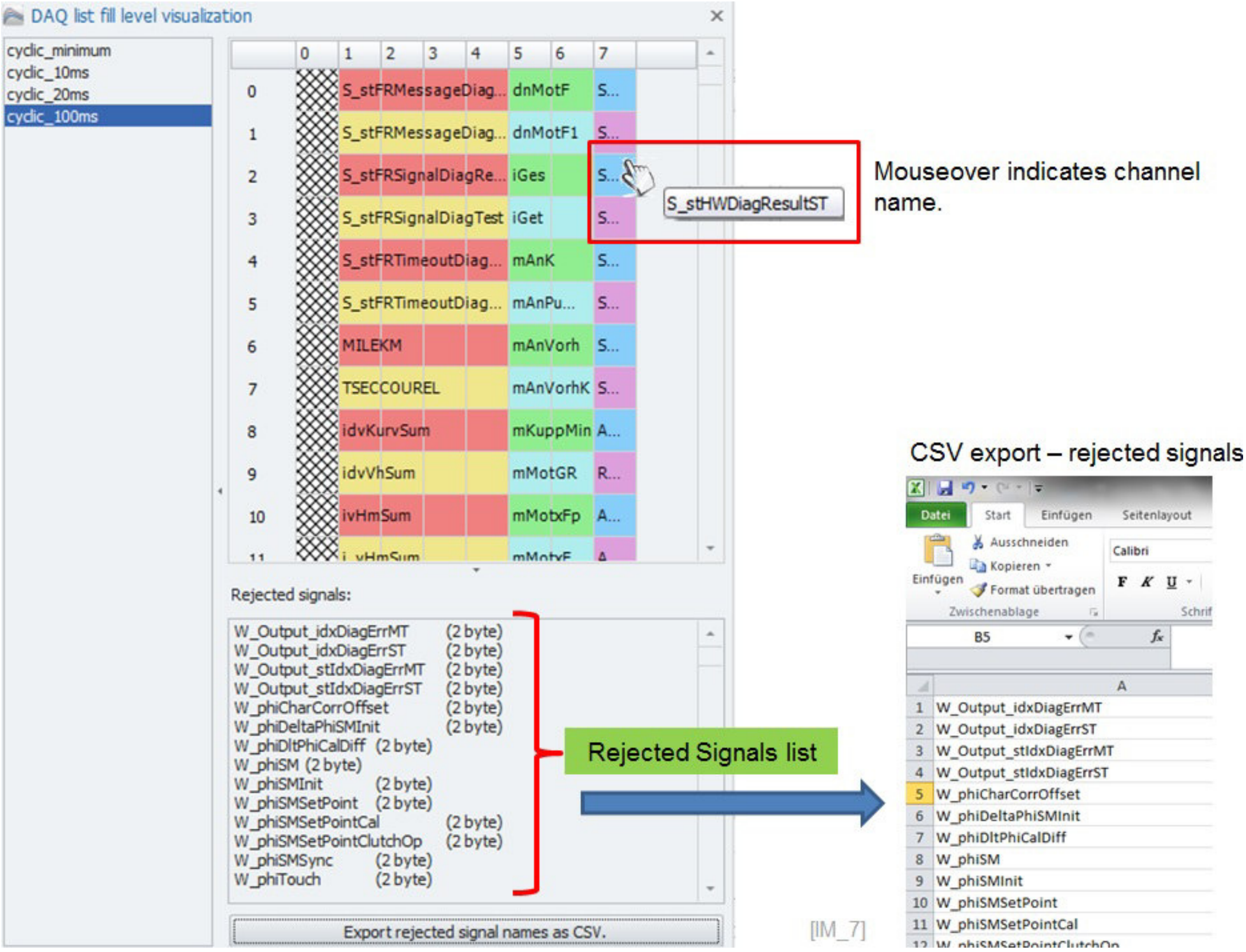
[IM_6]

Information

The allocation of signals to DTOs is optimized by IPEmotion, internally. It cannot be influenced by users. Some A2L files support the reading of multiple signals from one common DTO address. In this case several signals are allocated to the same DTO address and the mouse over tip text is indicating all channels grouped together in this DTO.

12.1.2 DAQ list overflow – rejected signal export

If you activate more channels than the DAQ list is able to support, you can create a list of rejected channels which can be exported to CSV. With the mouse over function you can read the channel names which are included in the DAQ list.

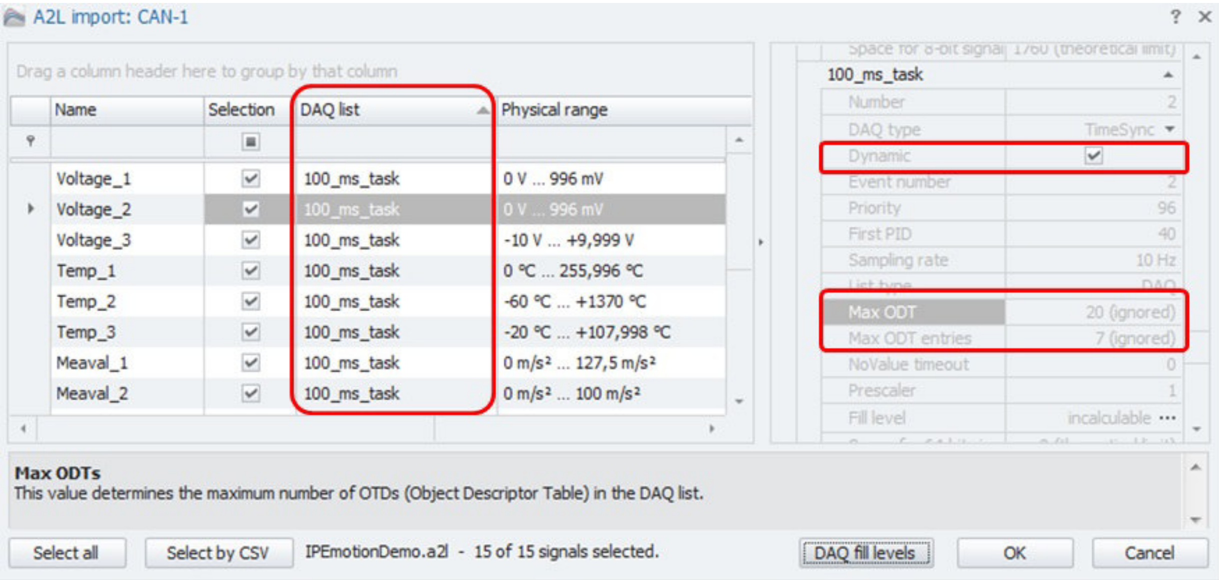


[IM_7]

12.2 Edit A2L dynamic DAQ list ODT values during the import

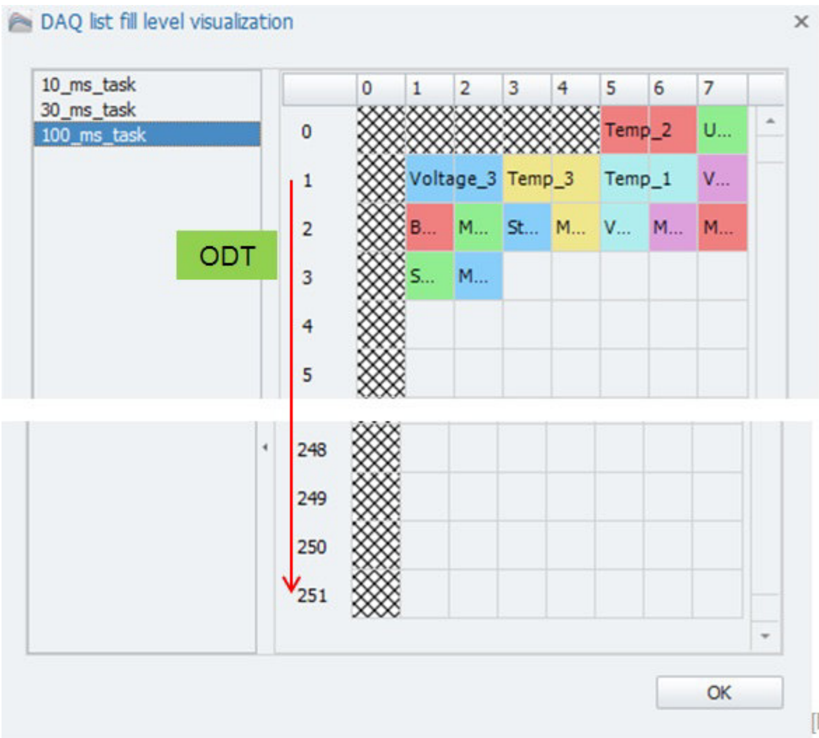
When you import an A2L file for dynamic DAQ list measurements e.g. for XCPonCAN on your ECU the import dialog considers by default the maximum ODT count = 252. (ODT = Object Descriptor Table). The DAQ list fill level calculation is based on the default assumption that the 252 ODT can be serviced by the ECU.

In practice the user tend to overload the dynamic DAQ list why adding to many ODT. This problem can be solved in the way that the user can define in the import dialog the appropriate values for the MAX ODT and MAX ODT entries to calculate the fill level correctly.



[IM_8]

Dynamic DAQ list setting: Where the MAX ODT values are not considered (ignored) for fill level calcualtion.



[IM_9]

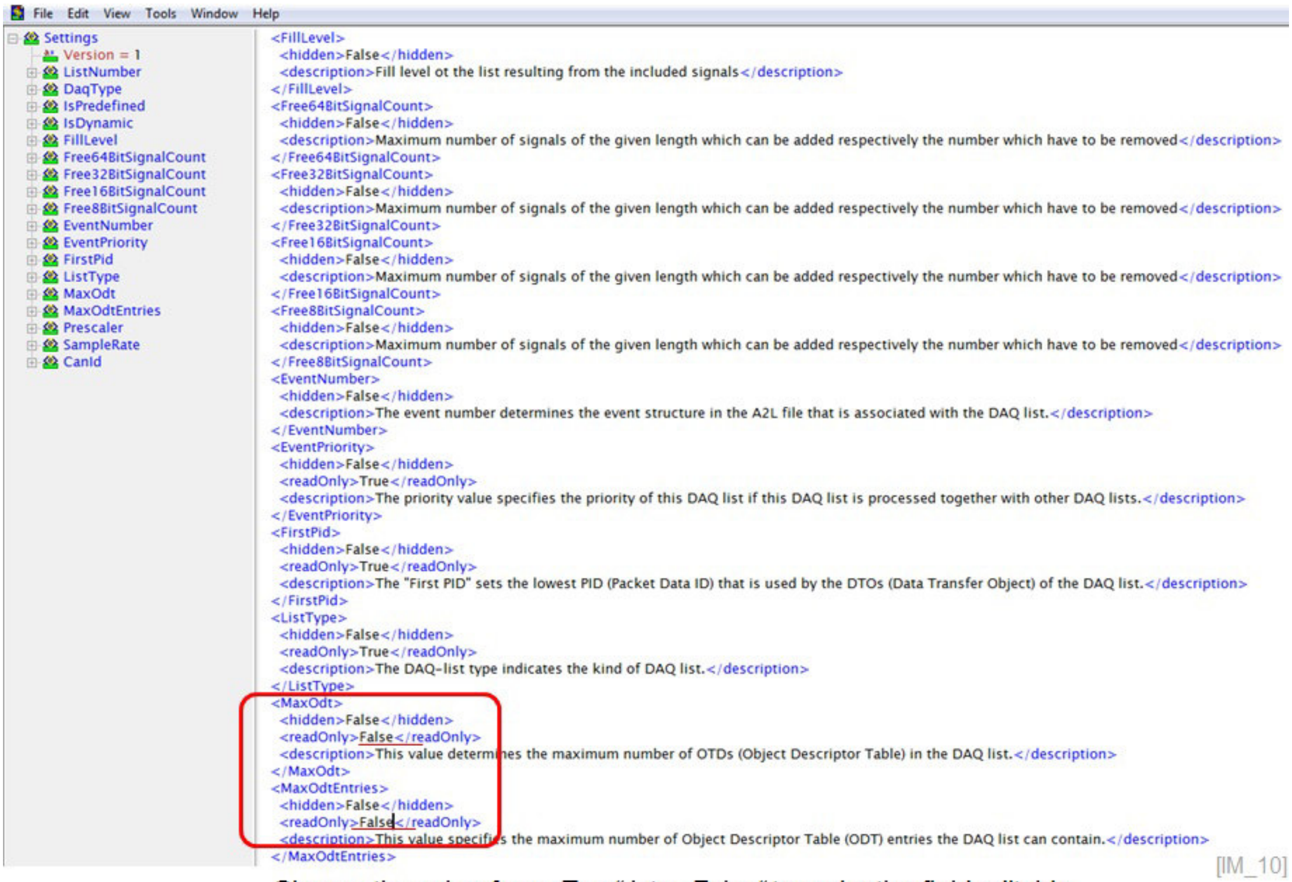
252 ODT's are considered as availabel capacity for fill level calcualtion.

If you now like to calculate the DAQ list fill level correctly you must correct the values for **MAX ODT** and **MAX ODT Entries**. In order to do this you can take a template file from the following directory:

- C:\ProgramData\IPETRONIK\IPEmotion 2016 R1 RC\Template\DaqListXcpCan.xml

This file has to be transferred into the following directory:

► C:\ProgramData\IPETRONIK\IPEmotion 2016 R1 RC\UserSettings **DaqListXcpCan.xml**

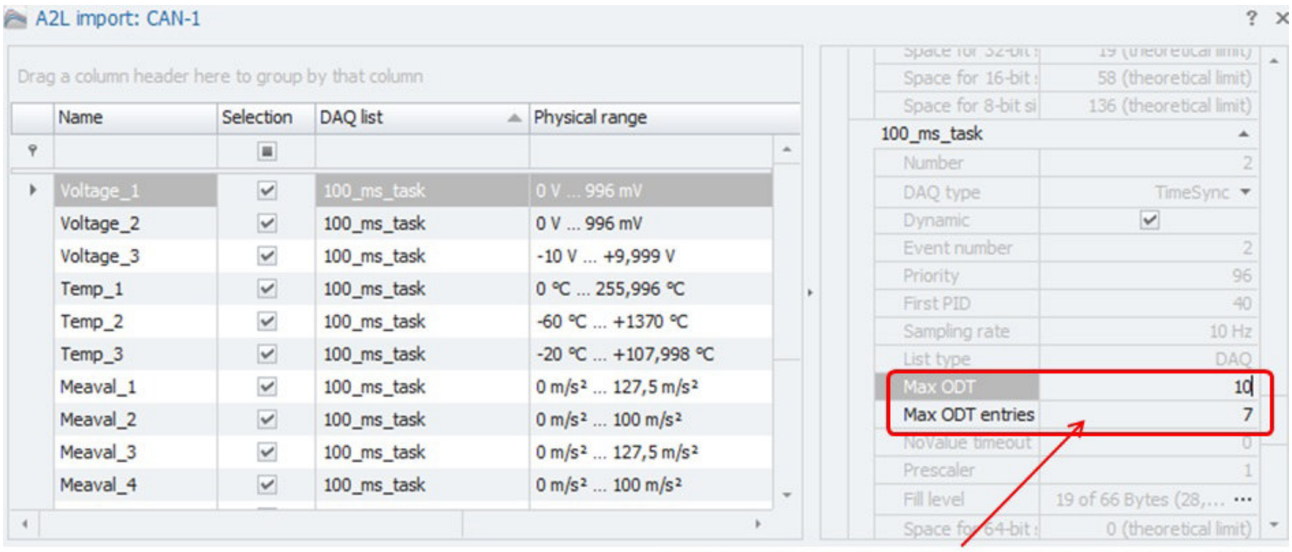


[IM_10]

Change the value from „True“ into „False“ to make the field editable.

You need to close IPEmotion and edit the XML file and set the values for Max ODT and max ODT Entries for read only into “FALSE”.

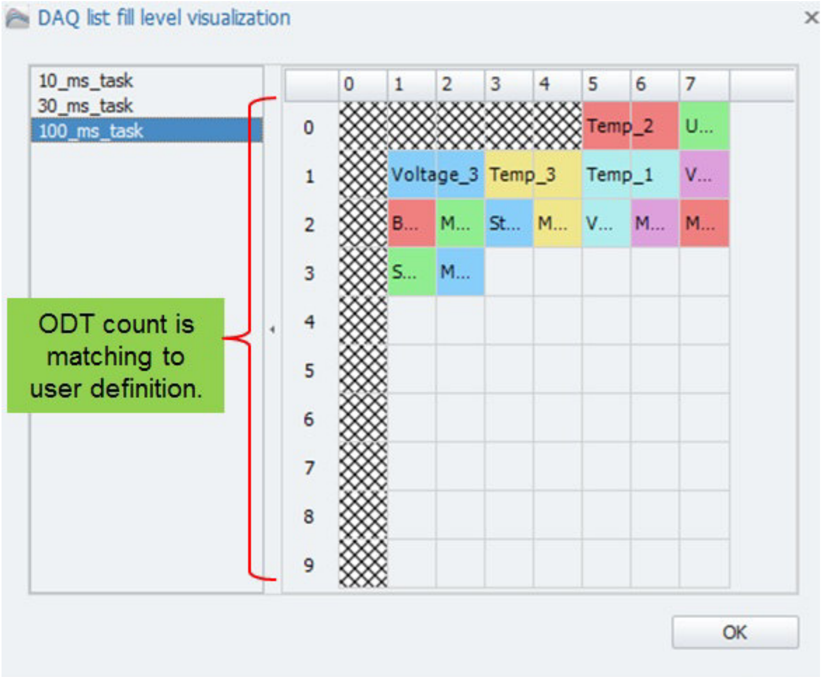
With this setting in the XML file you are able to modify the ODT setting in the import dialog.



Editable fields for user defined ODT count.

[IM_11]

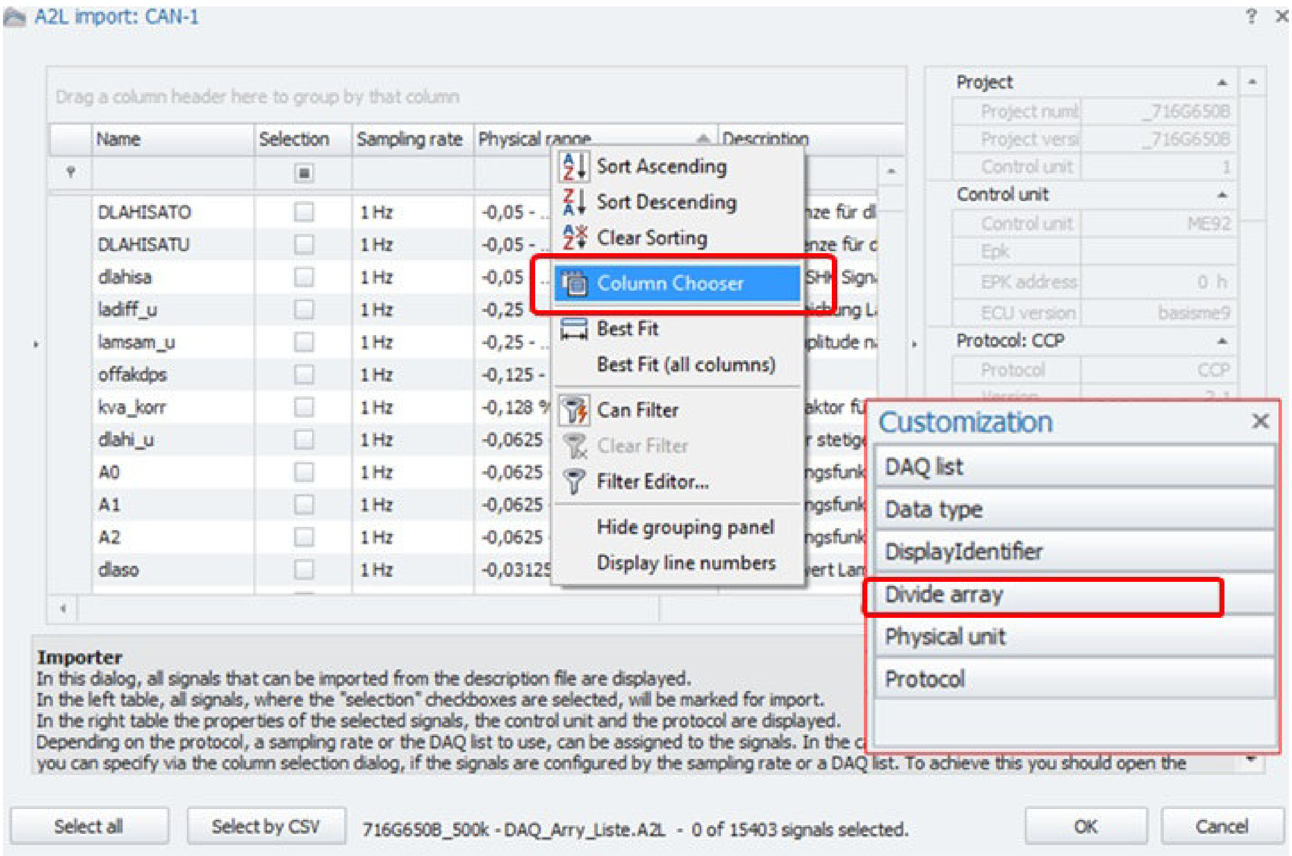
In the example above the MAX ODT count was set to 10 and the fill level calculation is now considering this value.



[IM_12]

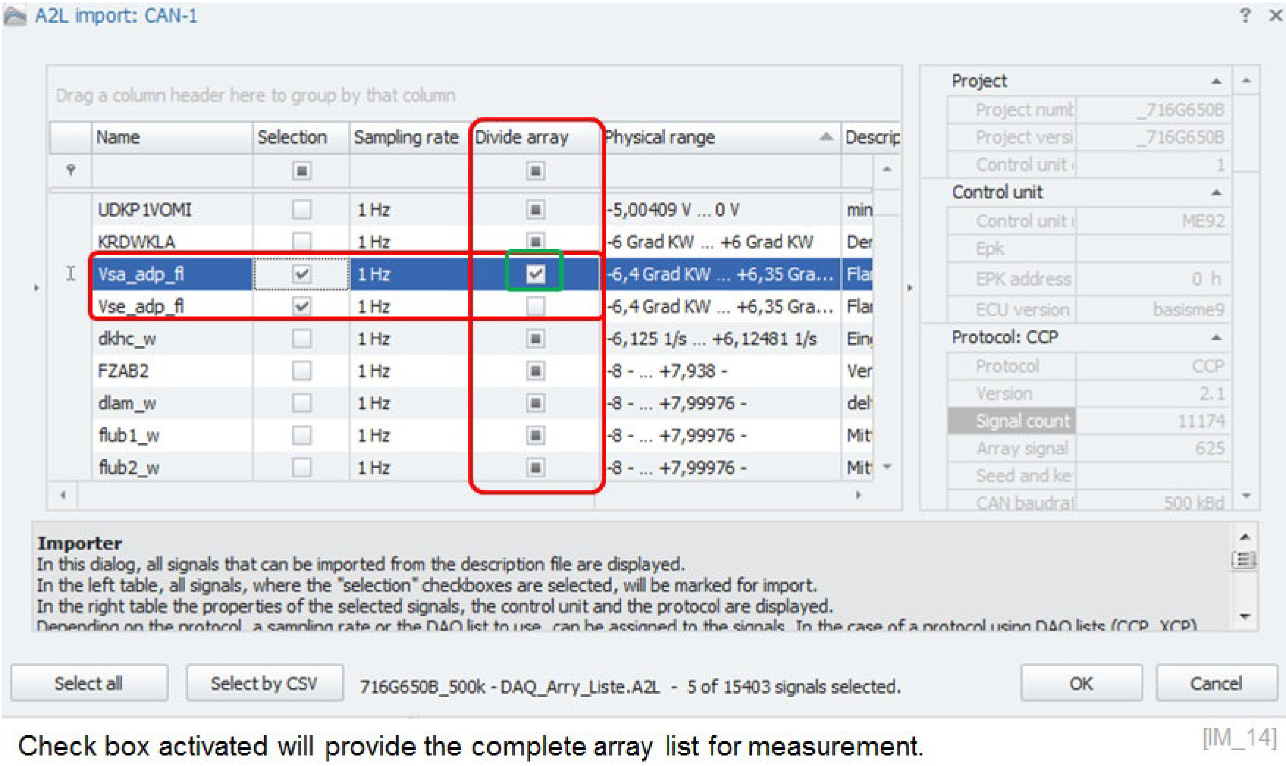
12.2.1 Import array signals

The A2L import is supporting array signals. Array signals are basically grouping several measurements together to one channel. In order to import the array signals you need to add in the import dialog from the column chooser the field “**Divide array**” to the channel grid.



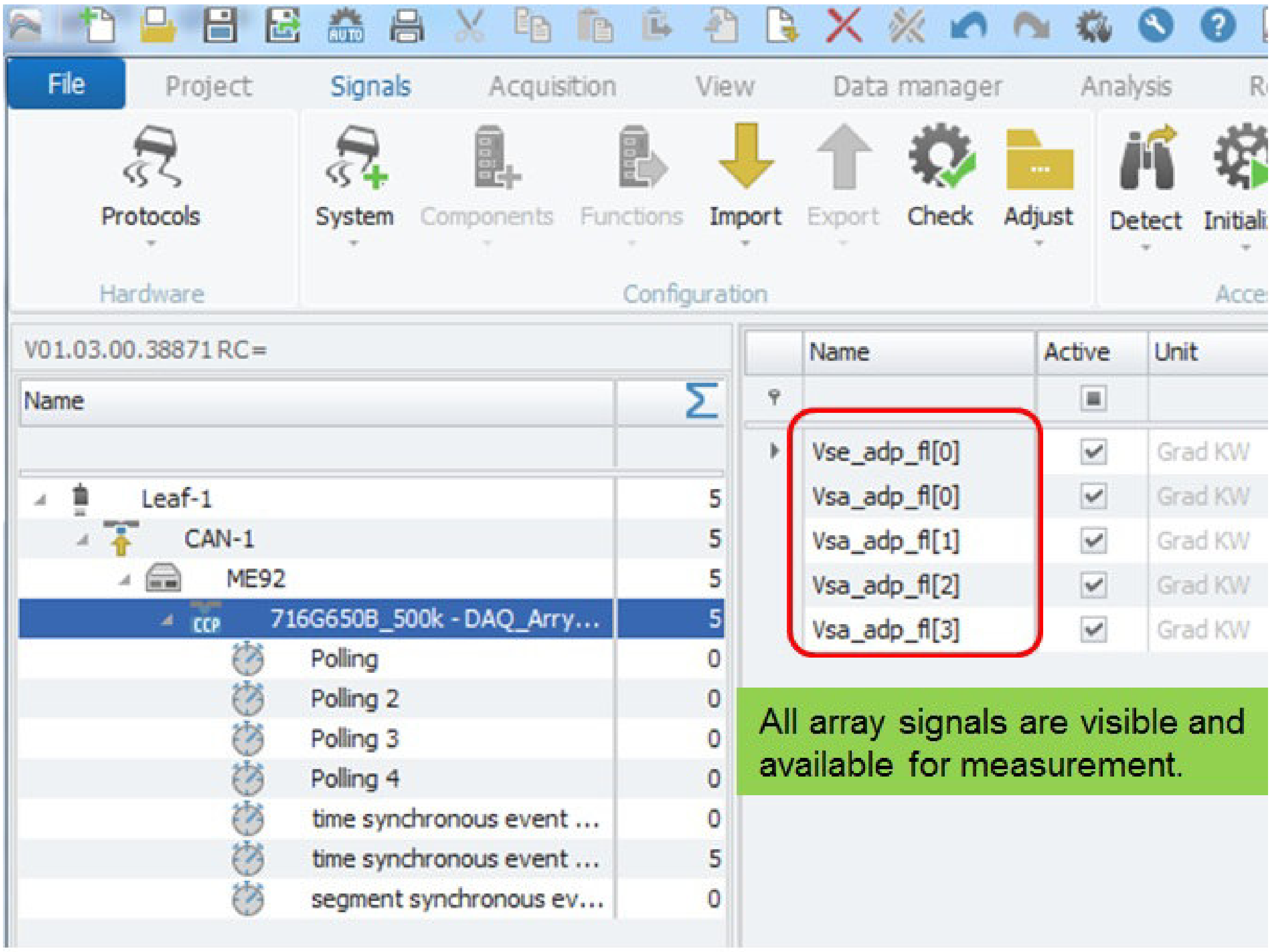
Select “Divide Array” column. [IM_13]

When the array column is included in the channel grid, you can activate the check boxes which include array signals.



[IM_14]

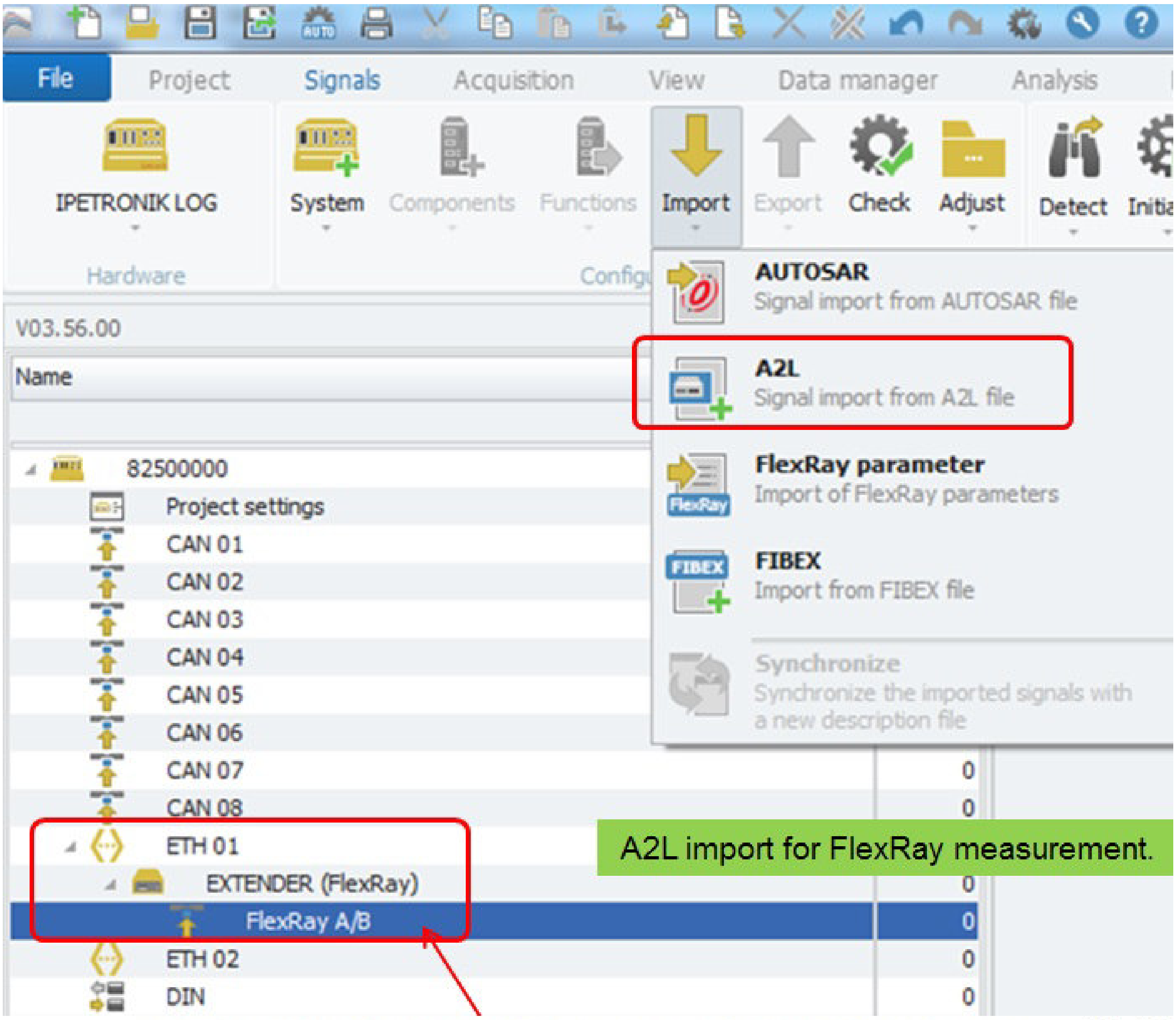
After the import the array signals are all listed and available for measurement.



[IM_15]

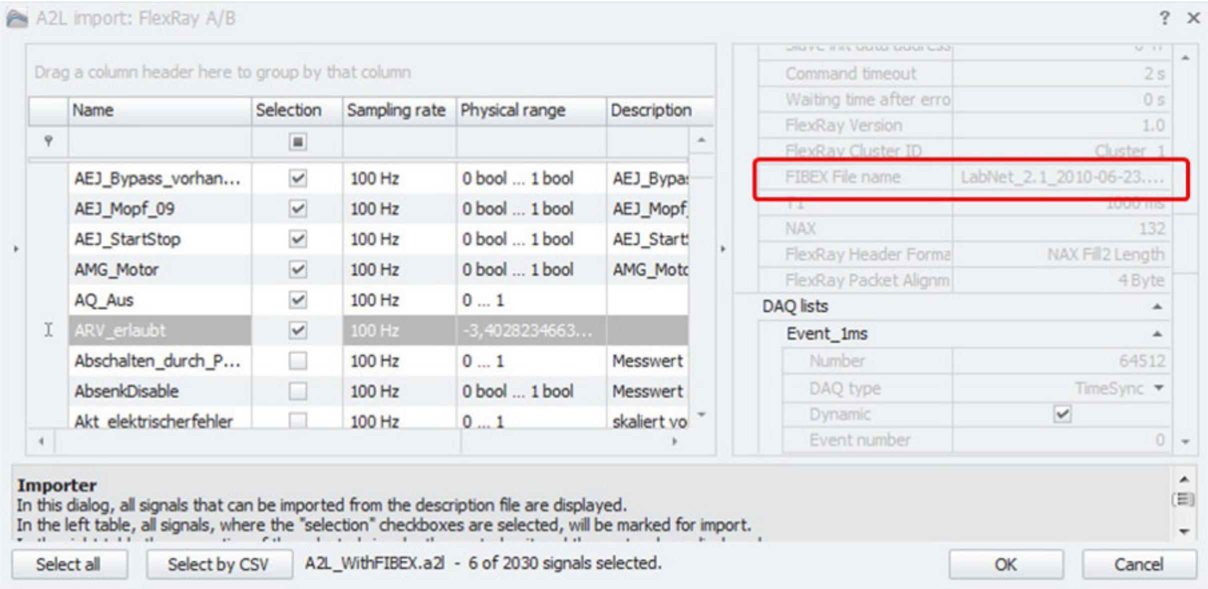
12.2.2 A2L import with additional FlexRay parameters import

When you have an A2L description file for a FlexRay protocol measurement and the A2L is not including any FlexRay parameter the import process will open automatically a file open dialog to load the parameter file.



FlexRay extender for FlexRay measurement with data loggers. [IM_16]

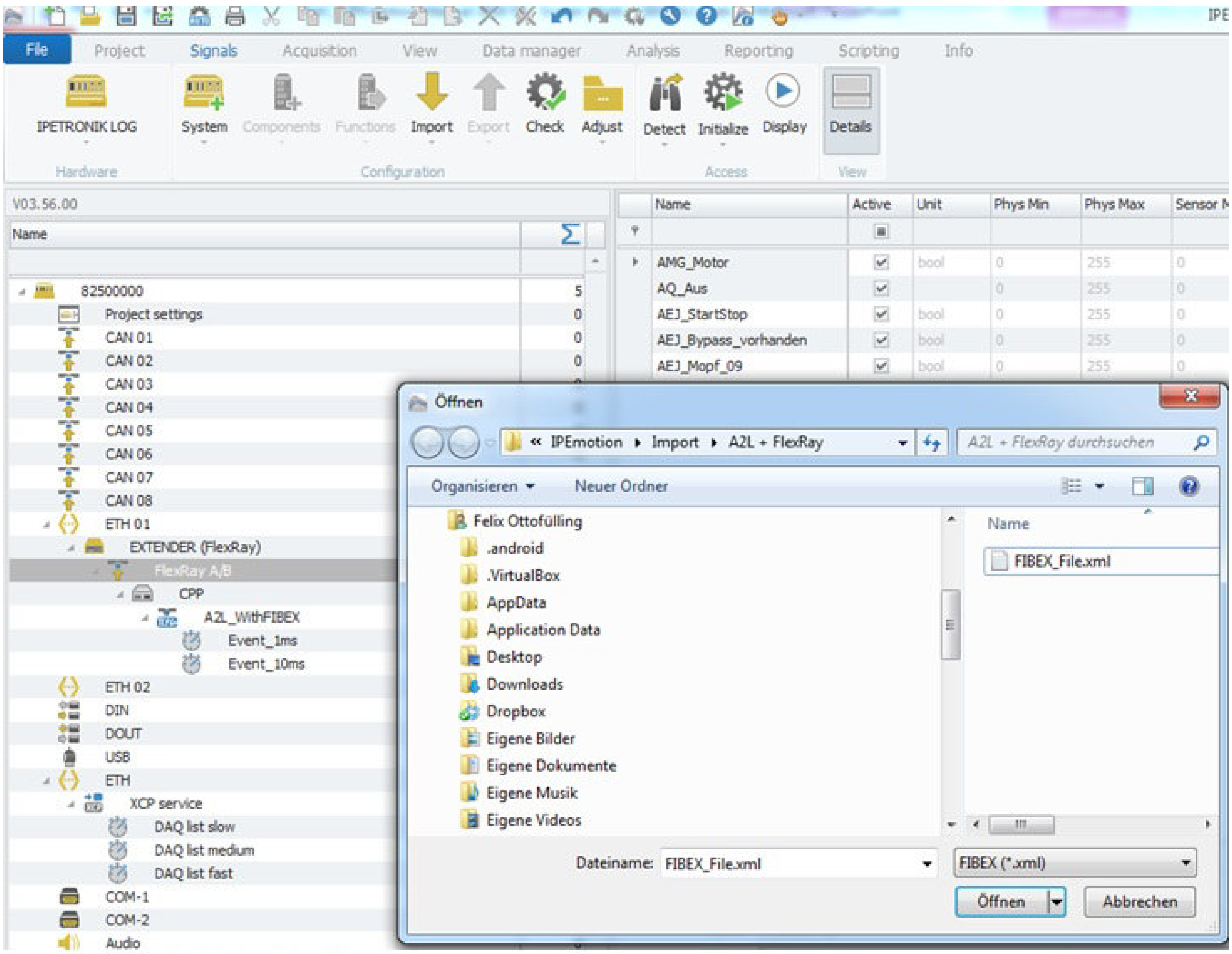
Import dialog to select the FlexRay signals.



[IM_17]

Import dialog to select the XCPonFlexRay signals. Link to the FlexRay pamater XML file for Ecu communication.

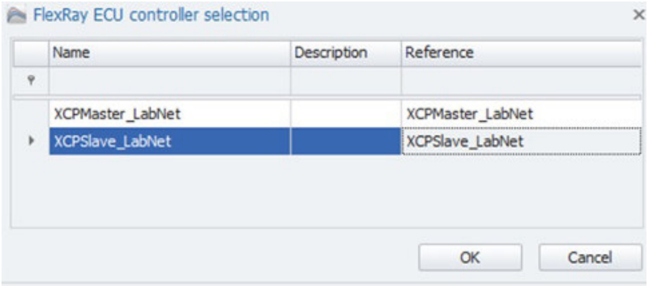
When the FlexRay parameter file as defined in the A2L is not available a second import dialog will be opened automatically.



Automatically new import dialog to select FlexRay parameter file.

[IM_18]

New dialog, to select FlexRay parameters.

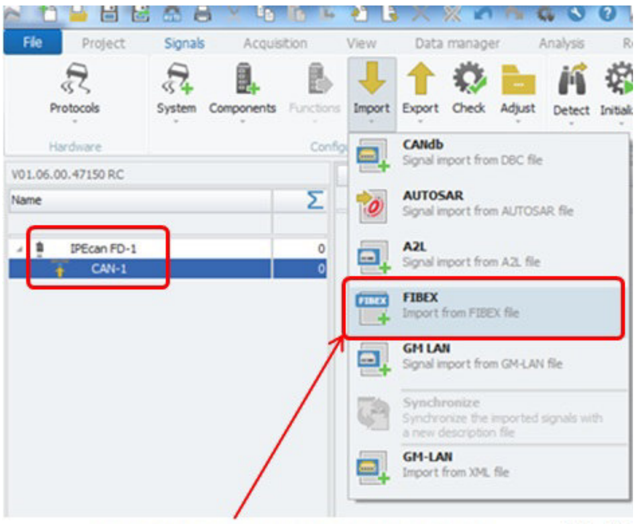


Select FlexRay parameters for ECU communication. [IM_19]

12.3 FIBEX import

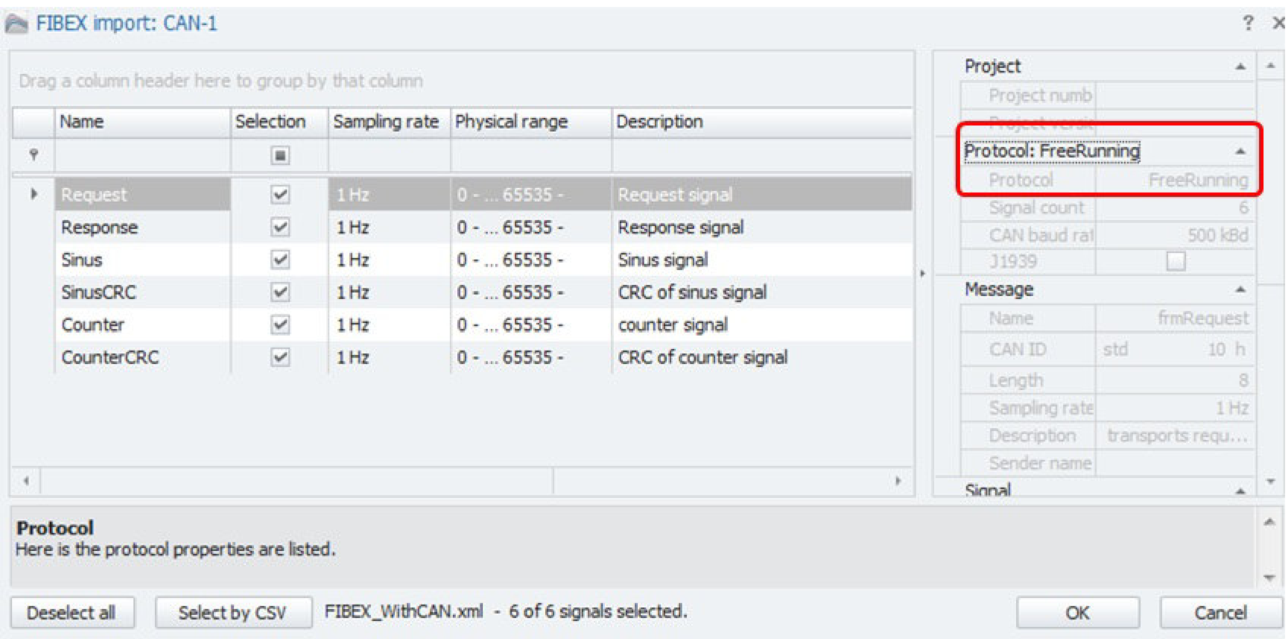
12.3.1 Import CAN signals from FIBEX files

You can import on all PlugIn supporting CAN interfaces for CANdb measurements now a FIBEX file. When the FIBEX file includes CAN messages it is an adequate replacement for the DBC file.



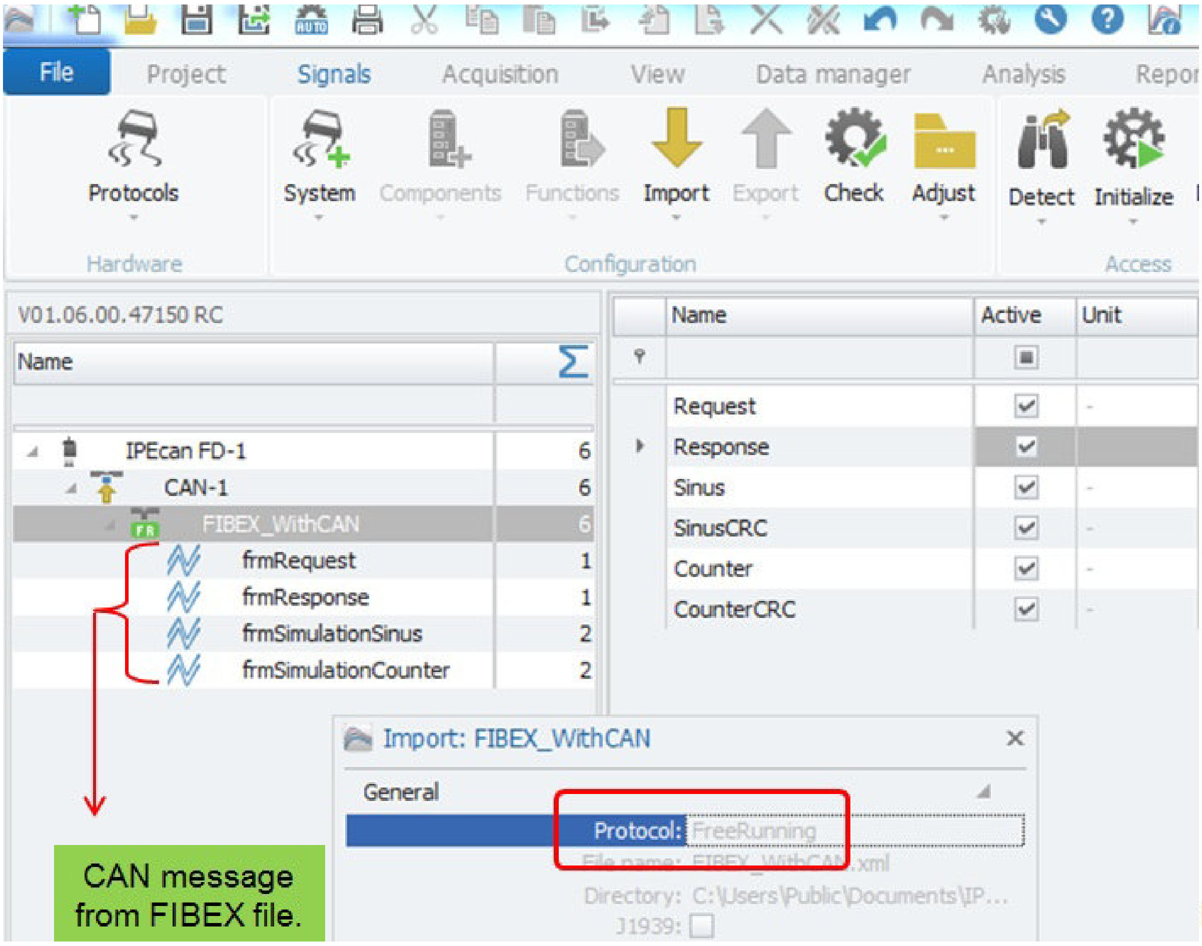
FIBEX import on all CAN interfaces. [IM_20]

The import dialog is indicating in the protocol header “Free running”.



Import dialog of a FIBEX file inclusing free running CAN signals. [IM_21]

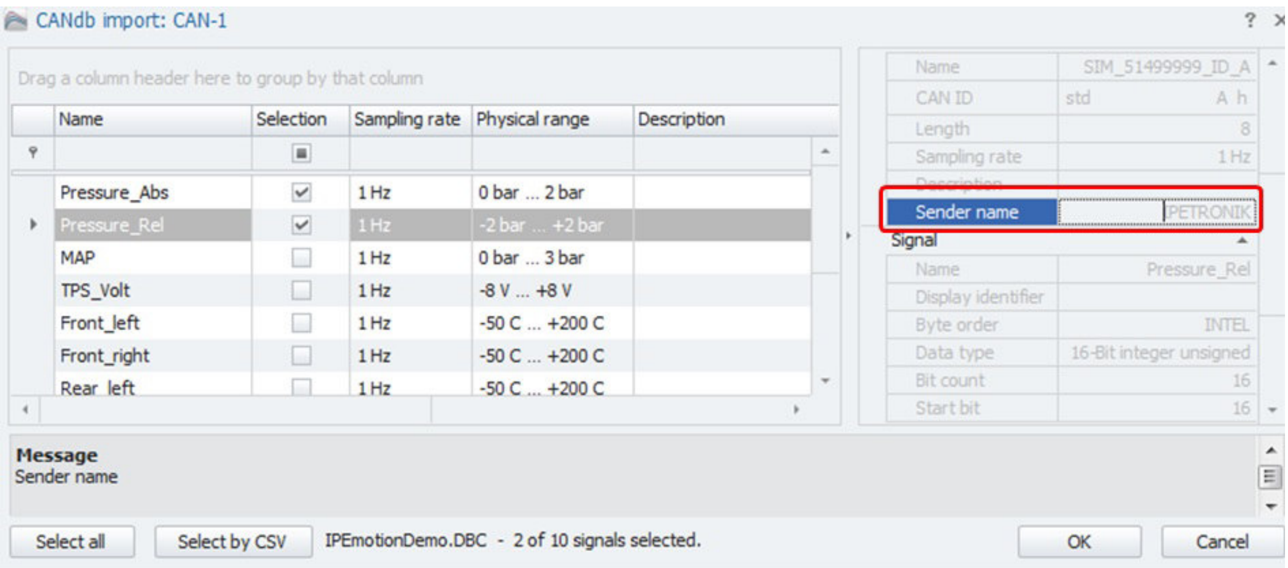
After the import you see you CAN messages and the channel.



[IM_22]

12.3.2 Display of Sender name for FIBEX, DBC, AUTOSAR messages

The import properties of the CAN, FIBEX and AUTOSAR messages include now the sender name when defined in the description file.



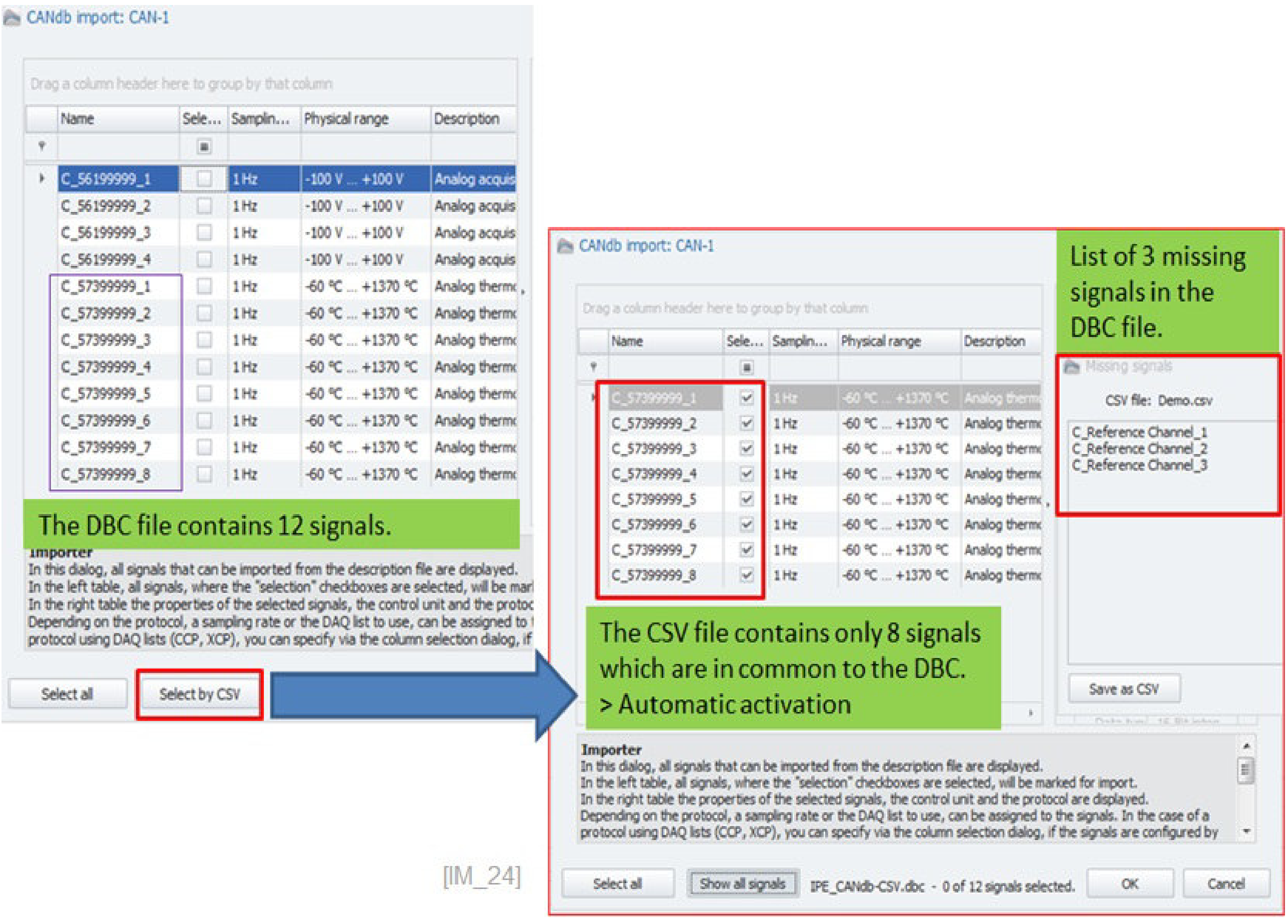
Example: DBC import dialog including the „Sender name“. [IM_23]

12.4 Description file import with CSV file for channel reference

The CSV reference file significantly improves the description file import and channel activation. Especially when you are working with large description files with many channels, sometimes you are uncertain if all required channels are included in the description file. It is also time-consuming to search and activate only the relevant channels for your specific measurement manually.

With the CSV reference file you can compare your description file to a CSV channel list. This comparing process covers two functions:

- All matching channel names from the CSV reference list are automatically activated. This saves a lot of time compared to activating channel by channel.
- All the channels which are included in the CSV file but not in the description file are listed in a separate "missing channels" list. Missing channels can be saved in a separate CSV file for later analysis purposes.

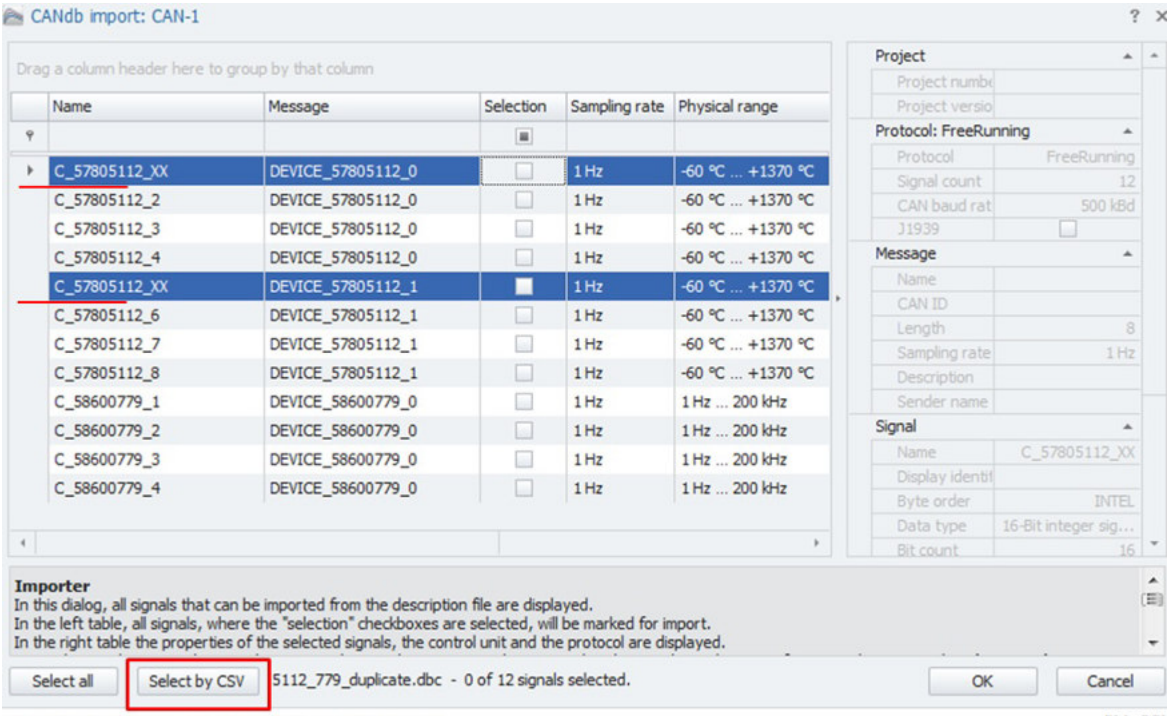


[IM_24]

Information *A second filter criteria can be added to the CSV file to optimize the import, e.g. to specify sample rate or DAQ list settings in the import process.*

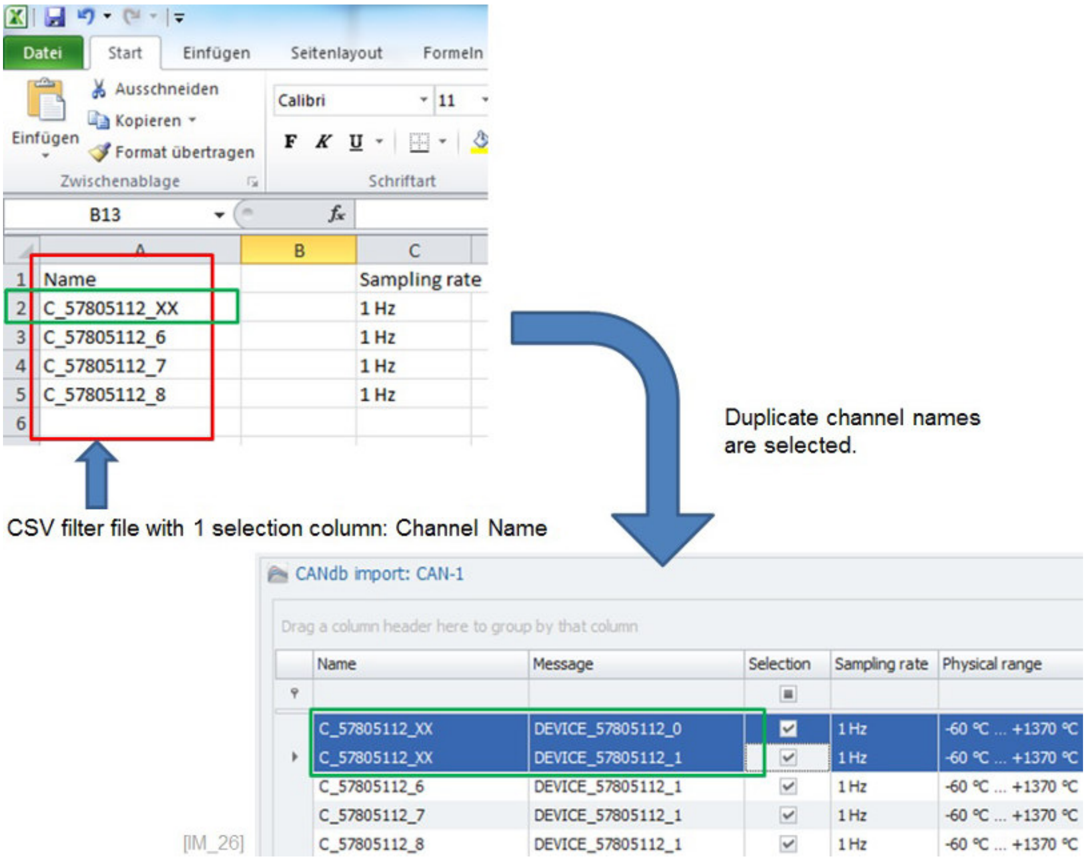
12.4.1 Multi column CSV selection for description file imports (DBC, A2L)

The CSV filter can support additional columns apart from the channel name to select dedicated channels in your description file import. In the example below you see how a DBC import can be improved by adding the message name as a second selection criteria.



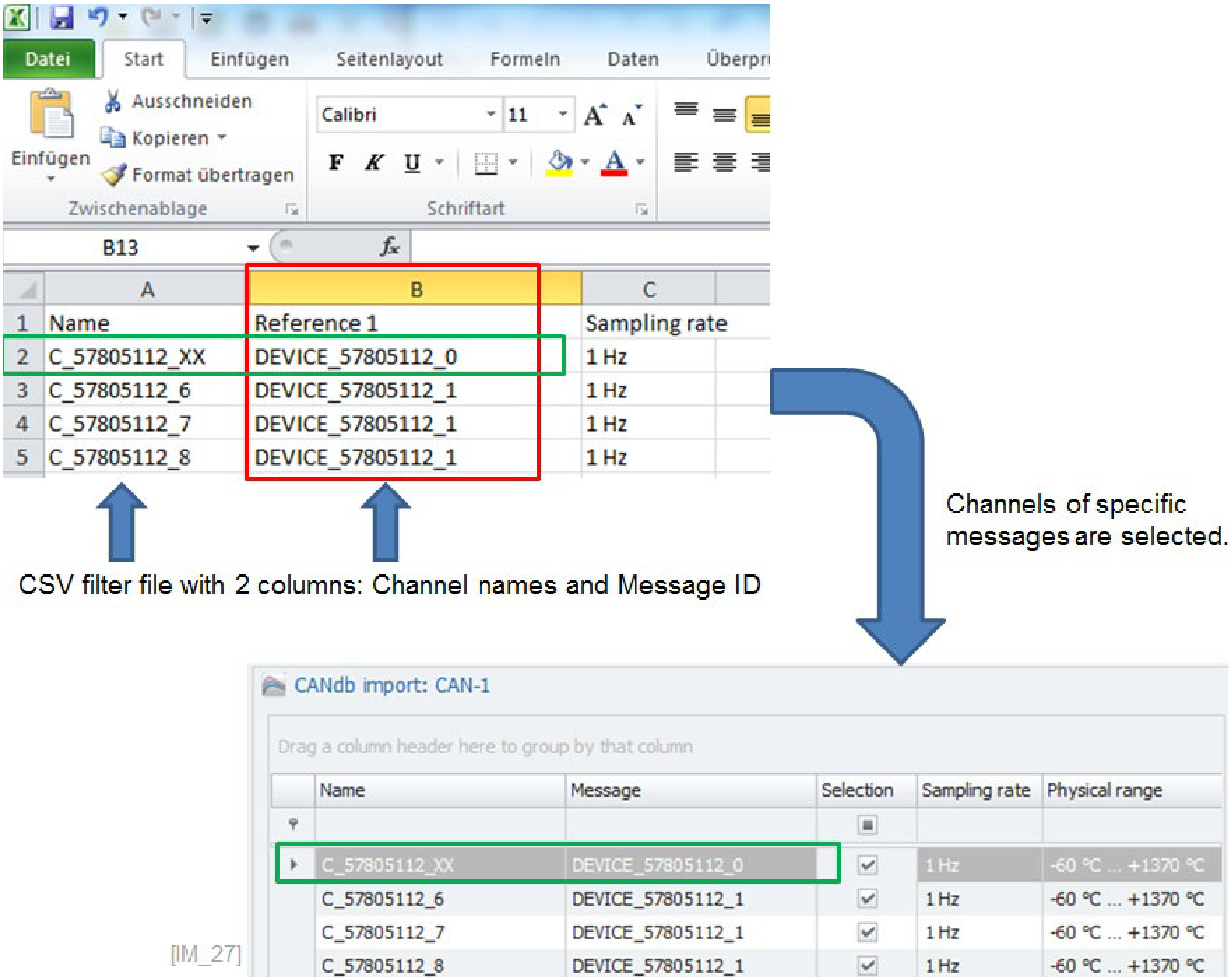
DBC import with duplicate channel names. [IM_25]

In this example we define only the channel names as selection criteria. In this case duplicate channels across the whole DBC file get selected during the import process.



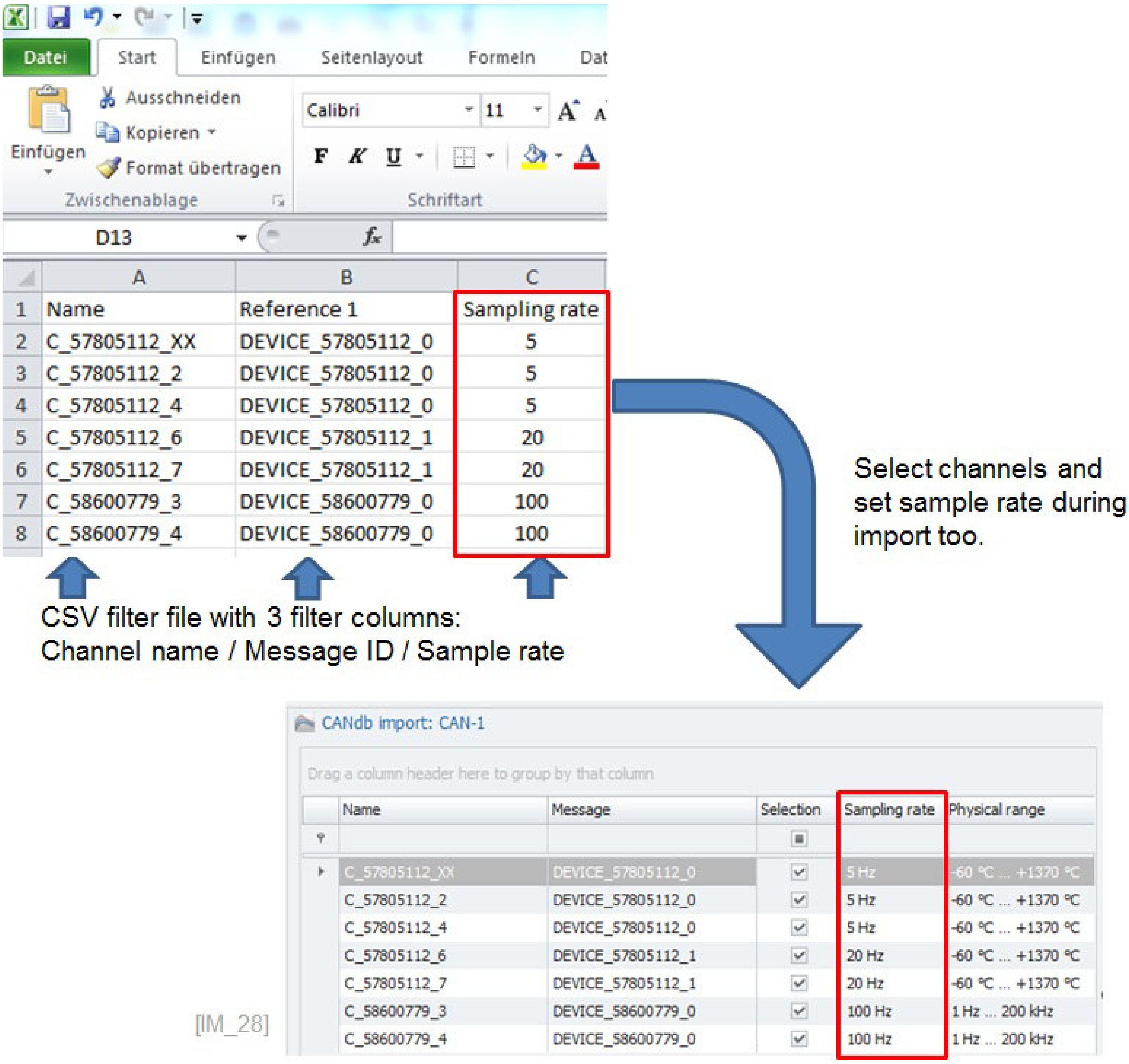
[IM_26]

If you add the message ID to the selection criteria in column 2, you can pick the specific channels of the messages you are interested in.



[IM_27]

If you like you can set during the DBC import the sample rate by message ID too.



[IM_28]

The sample definition can be located on column 2 also. It is not required that the sample rate definition must be located on column 3 at any time.
When you are using CSV filter for A2L import you can select channels by channel name in the first column and associated to the signal a DAQ list or sample rate during the import too.

12.4.2 Check duplicate channel names during description file import

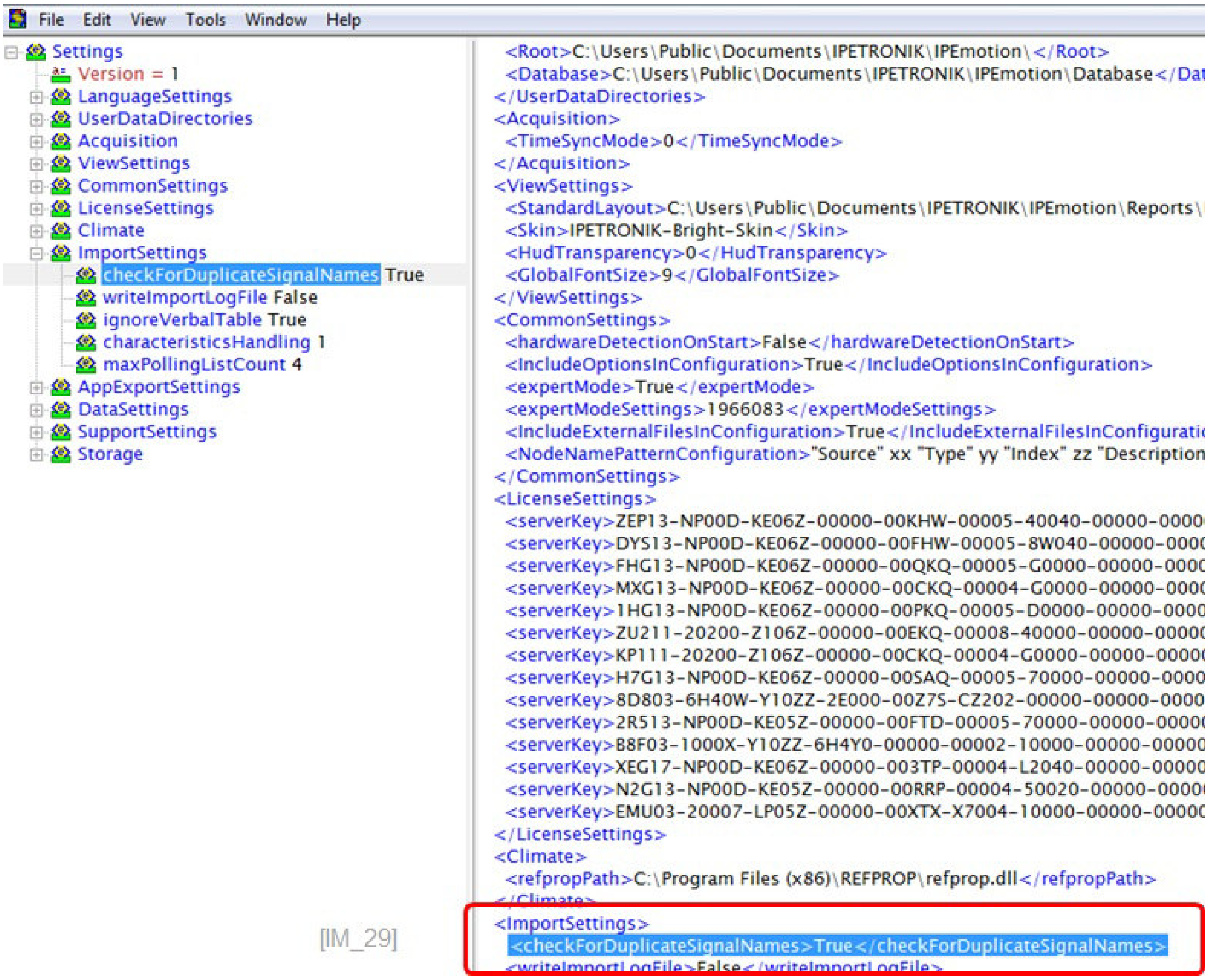
When run an import of any description file (DBC, FIBEX, A2L, …..) the import process can check for any duplicate channel name and provide a dialog to resolve duplicate channel name conflicts.

In order to activate this feature you have to make an additional entry in the **Settings.XML** file.

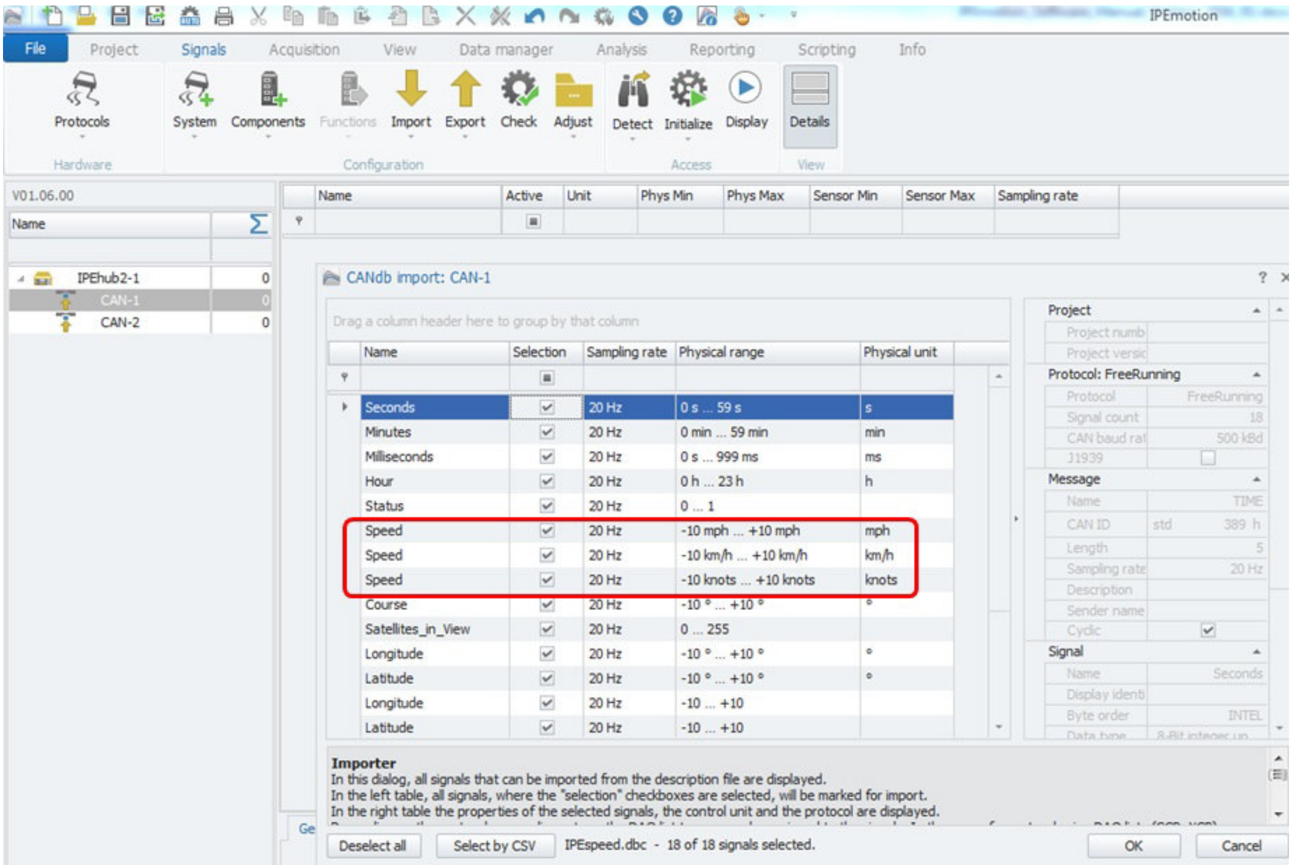
- Win 7: C:\ProgramData\IPETRONIK\IPEmotion 2016 R2**Settings.XML**

The new entry in the XML file should be:

<ImportSettings>
<checkForDuplicateSignalNames>**True**</checkForDuplicateSignalNames>
<ImportSettings>

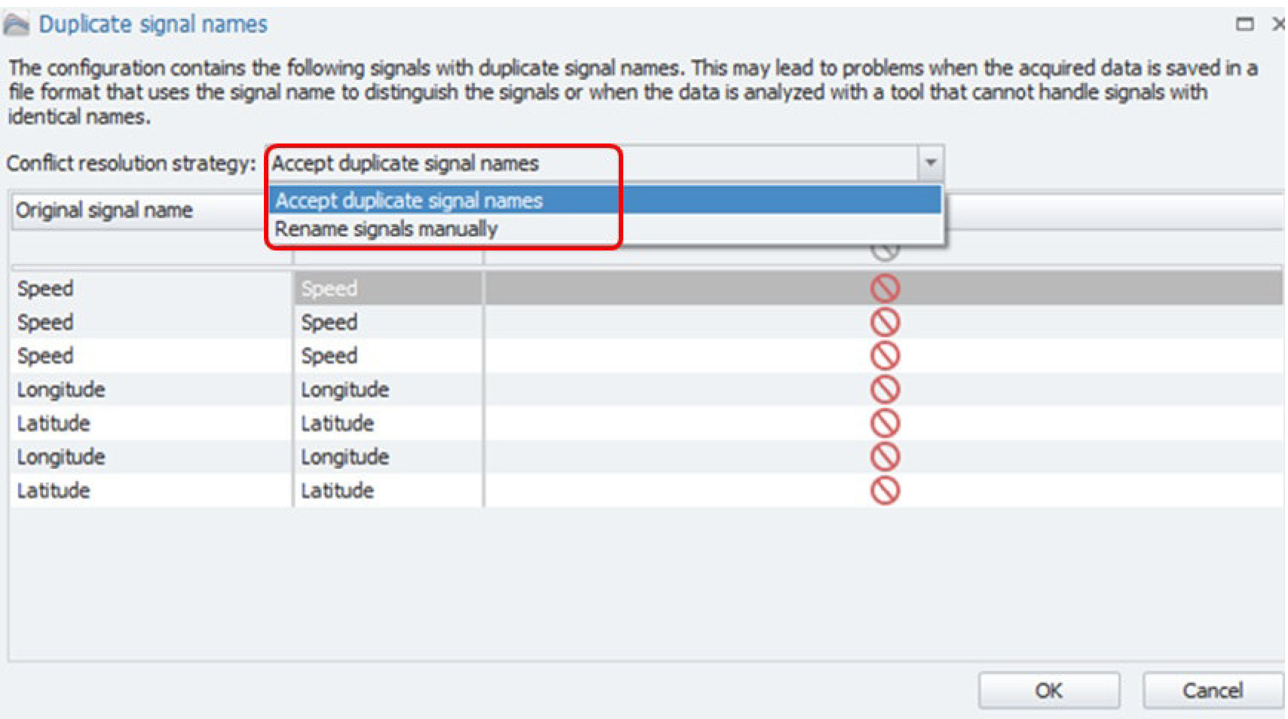

File Edit View Tools Window Help
Settings
Version = 1
LanguageSettings
UserDataDirectories
Acquisition
ViewSettings
CommonSettings
LicenseSettings
Climate
ImportSettings
checkForDuplicateSignalNames True
writeImportLogFile False
ignoreVerbalTable True
characteristicsHandling 1
maxPollingListCount 4
AppExportSettings
DataSettings
SupportSettings
Storage
<Root>C:\Users\Public\Documents\IPETRONIK\IPEmotion\</Root>
<Database>C:\Users\Public\Documents\IPETRONIK\IPEmotion\Database</Dat
</UserDataDirectories>
<Acquisition>
<TimeSyncMode>0</TimeSyncMode>
</Acquisition>
<ViewSettings>
<StandardLayout>C:\Users\Public\Documents\IPETRONIK\IPEmotion\Reports\
<Skin>IPETRONIK-Bright-Skin</Skin>
<HudTransparency>0</HudTransparency>
<GlobalFontSize>9</GlobalFontSize>
</ViewSettings>
<CommonSettings>
<hardwareDetectionOnStart>False</hardwareDetectionOnStart>
<IncludeOptionsInConfiguration>True</IncludeOptionsInConfiguration>
<expertMode>True</expertMode>
<expertModeSettings>1966083</expertModeSettings>
<IncludeExternalFilesInConfiguration>True</IncludeExternalFilesInConfigurati
<NodeNamePatternConfiguration>"Source" xx "Type" yy "Index" zz "Description
</CommonSettings>
<LicenseSettings>
<serverKey>ZEP13-NP00D-KE06Z-00000-00KHW-00005-40040-00000-0000
<serverKey>DYS13-NP00D-KE06Z-00000-00FHW-00005-8W040-00000-000
<serverKey>FHG13-NP00D-KE06Z-00000-00QKQ-00005-G0000-00000-000
<serverKey>MXG13-NP00D-KE06Z-00000-00CKQ-00004-G0000-00000-000
<serverKey>1HG13-NP00D-KE06Z-00000-00PKQ-00005-D0000-00000-0000
<serverKey>ZU211-20200-Z106Z-00000-00EKQ-00008-40000-00000-0000
<serverKey>KP111-20200-Z106Z-00000-00CKQ-00004-G0000-00000-0000
<serverKey>H7G13-NP00D-KE06Z-00000-00SAQ-00005-70000-00000-0000
<serverKey>8D803-6H40W-Y10ZZ-2E000-00Z7S-CZ202-00000-00000-0000
<serverKey>2R513-NP00D-KE05Z-00000-00FTD-00005-70000-00000-0000
<serverKey>B8F03-1000X-Y10ZZ-6H4Y0-00000-00002-10000-00000-00000
<serverKey>XEG17-NP00D-KE06Z-00000-003TP-00004-L2040-00000-00000
<serverKey>N2G13-NP00D-KE05Z-00000-00RRP-00004-50020-00000-0000
<serverKey>EMU03-20007-LP05Z-00000-00XTX-X7004-10000-00000-0000
</LicenseSettings>
<Climate>
<refpropPath>C:\Program Files (x86)\REFPROP\refprop.dll</refpropPath>
<ImportSettings>
<checkForDuplicateSignalNames>True</checkForDuplicateSignalNames>

[IM_29]



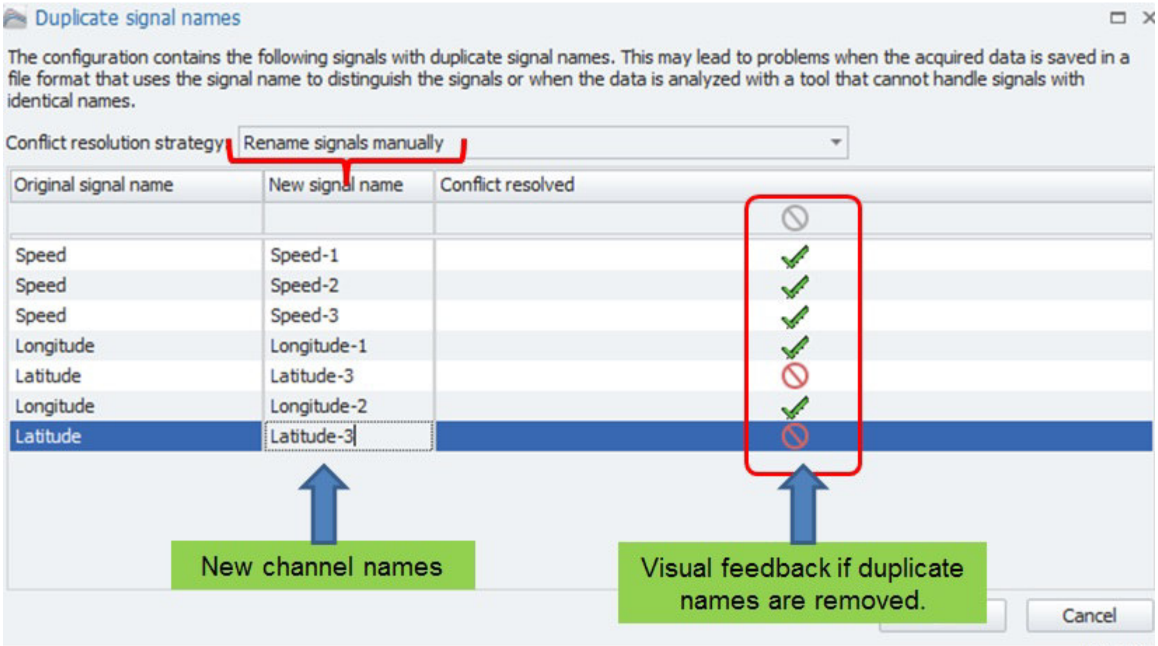
Duplicate channel names are selected during the import. [IM_30]

With the new entry in the Settings.XML file the import dialog will guide you to a new dialog highlighting all duplicate channels out of the selected channel list. There are to functions available in the drop down list:



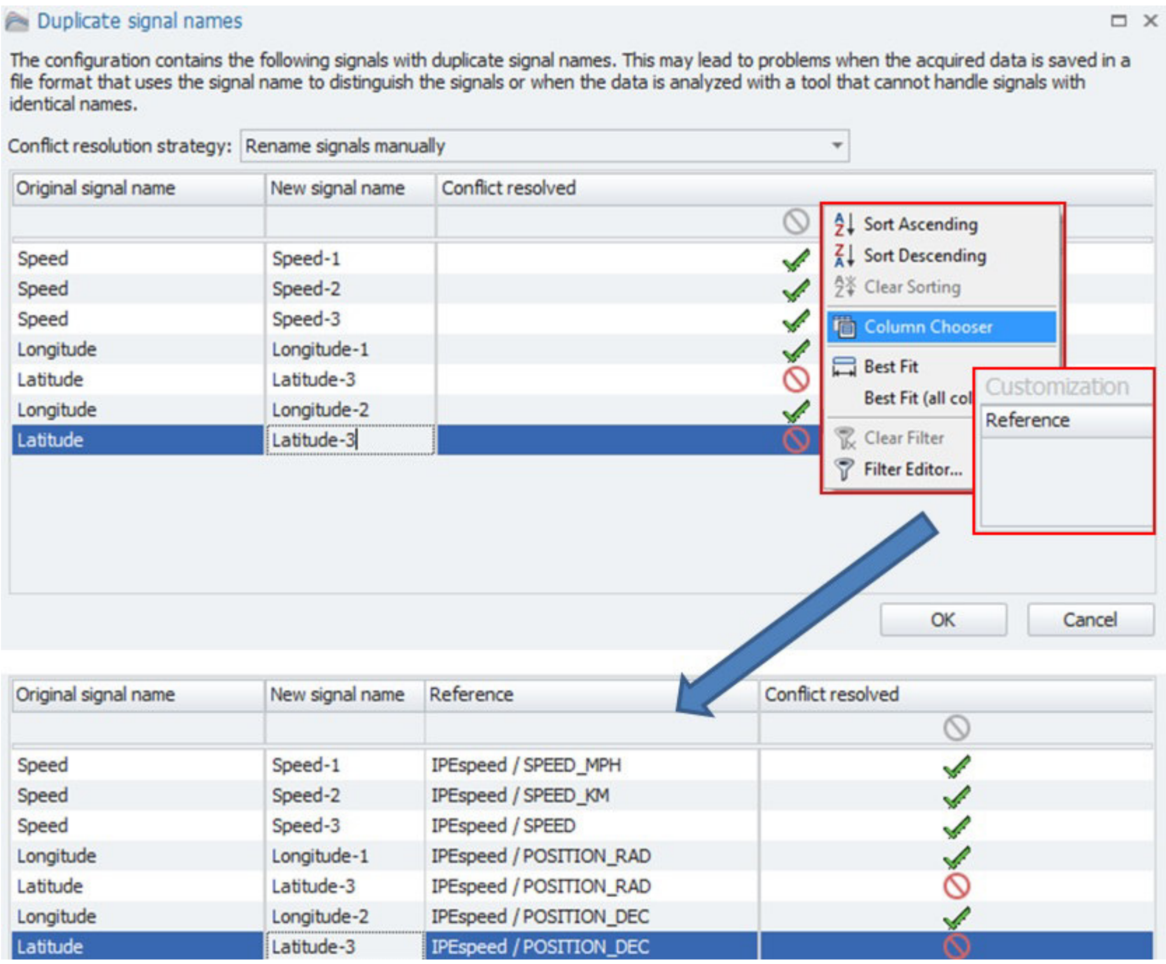
Dialog to resolve duplicate channel entries. [IM_31]

- Accept duplicates — With this function you accept the duplicates and confirm them
- Rename signals — When you select the rename function you have to edit the channel names in the grid



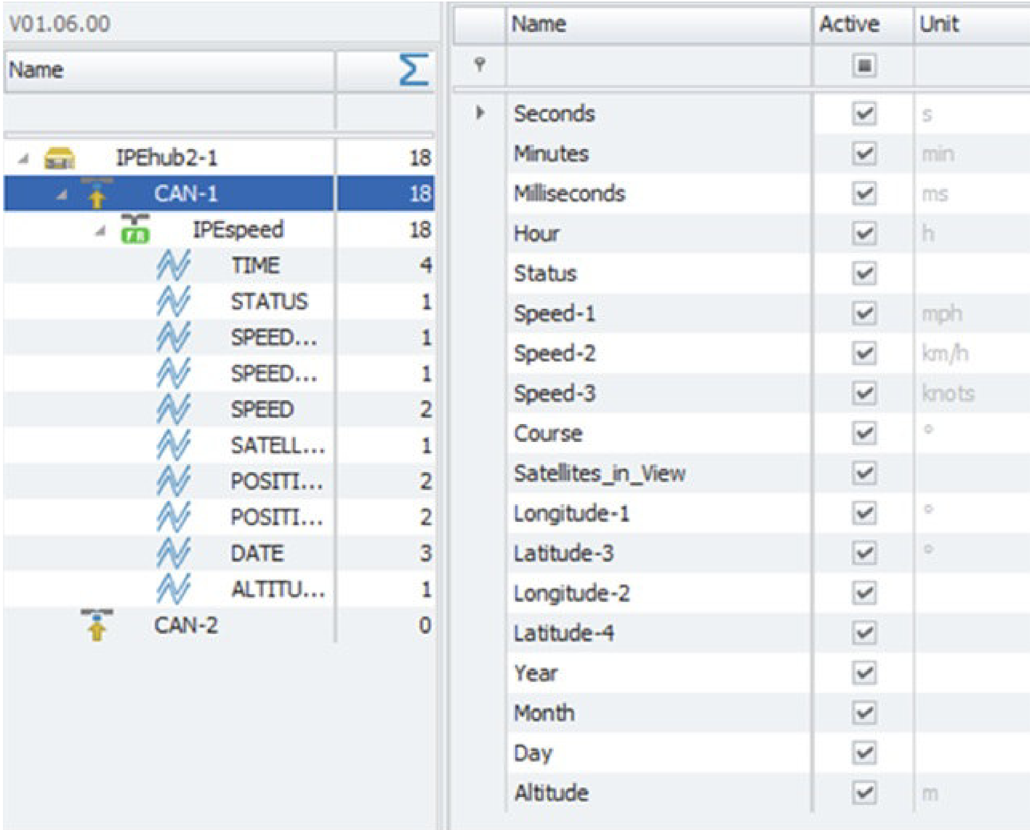
[IM_32]

Apply column chooser to get information about the channel reference.



[IM_33]

When all duplicate conflicts are resolved the import can be finalized and all channels are renamed.

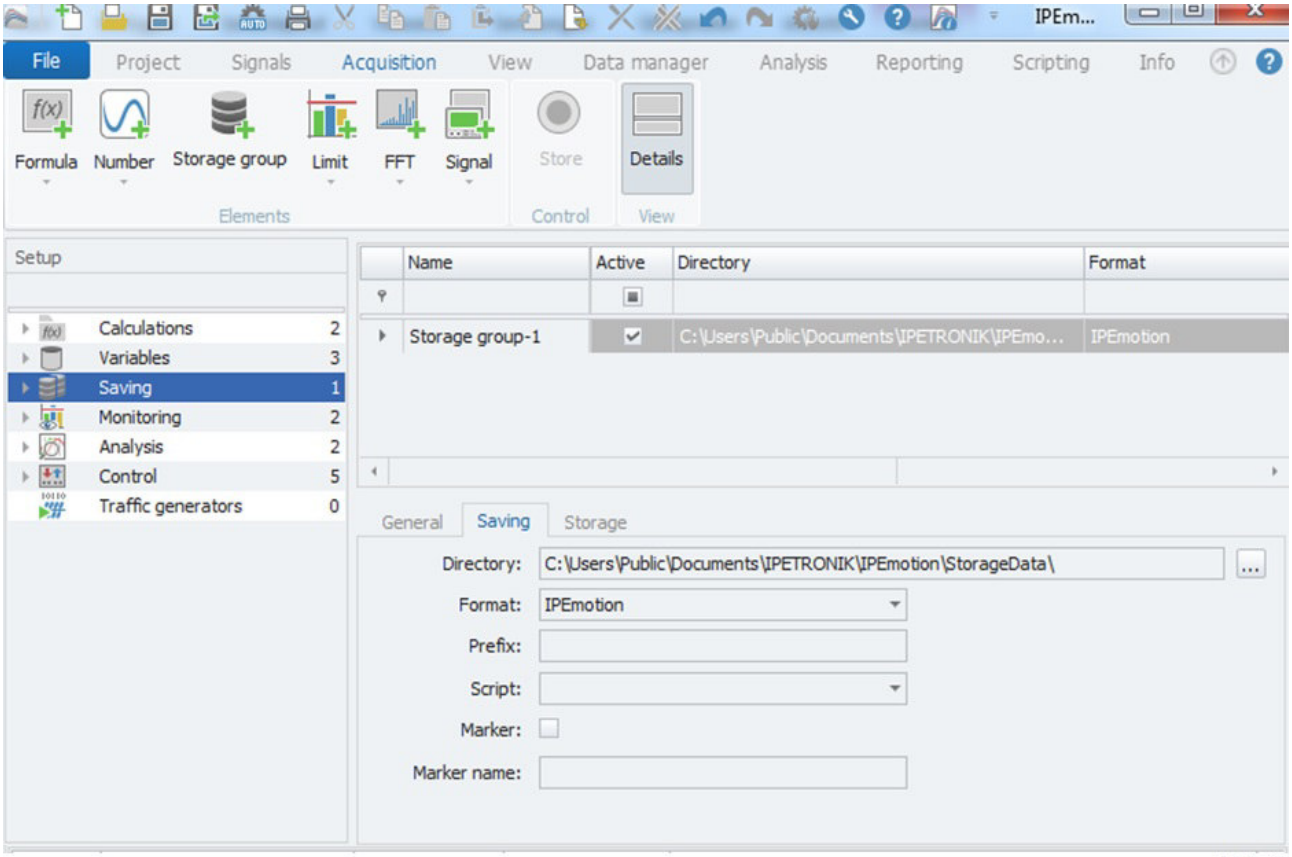


Channels are all renamed. [IM_34]

13 ACQUISITION workspace

The ACQUISITION work space is dedicated to store data, to run online math and logic functions, monitor on thresholds and analyze data through the classification and the Fast Fourier Transformation (FFT).

Example:

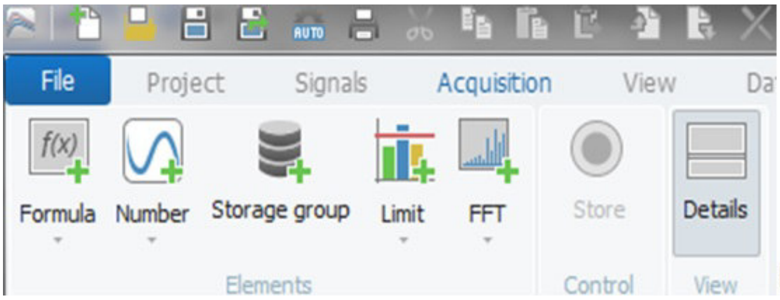


[AC_1]

Information

The screenshot was taken with a Professional Edition not including options like CONTROL or CLIMATE. When you have a license which includes options, more functions and formulas are accessible. See chapter Software Editions > Options for more details 4.2. Note: The Traffic generator is not included in Basic, Lite, or Standard Edition.

13.1 Ribbon



[AC_2]

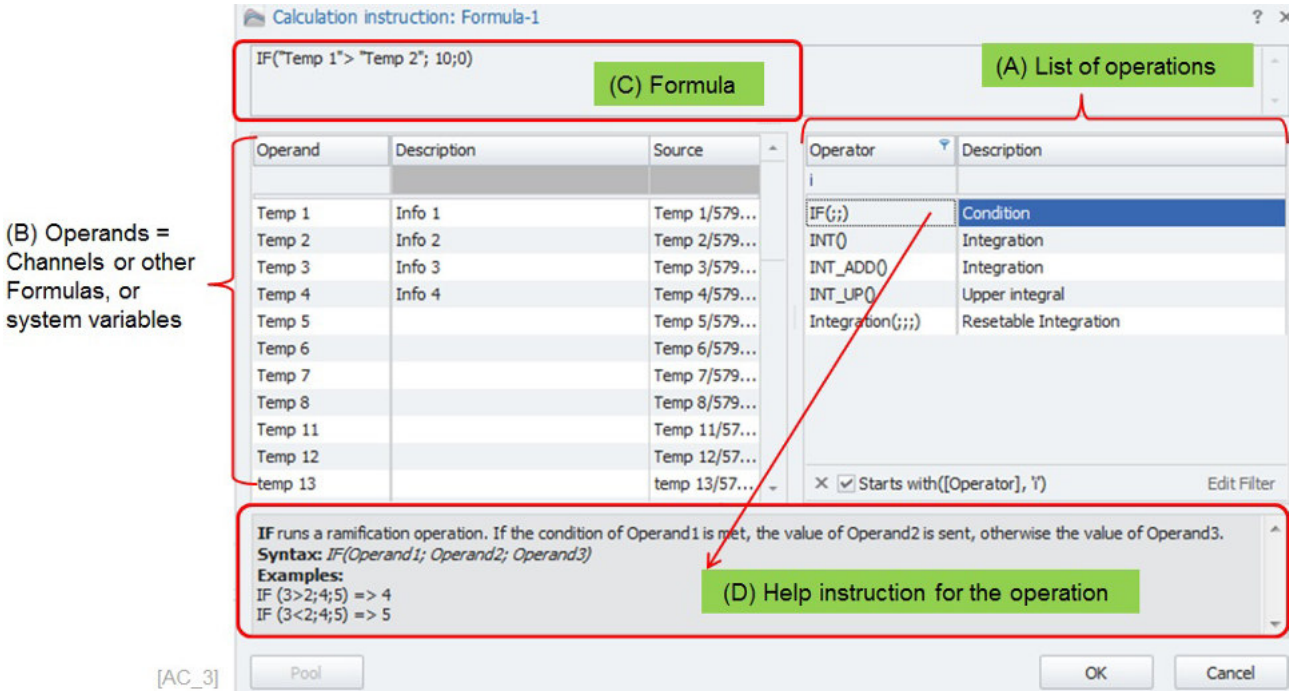
► Formula	Here you can create formulas and add formulas to a pool
► Number	Number refers to variables in general which consist of Number, Status, Text
► Storage Group	Here you can save channels to data files
► Limit	Is related to Limit and Range monitoring
► FFT	Fast Fourier Transformation for dynamic signal analysis

13.2 Calculations

13.2.1 Formula parser

IPEmotion uses the same formula interface in all parts of the application. This refers to online formulas, offline formulas in the analysis or limit and range channels which will be discussed later in this chapter. Also, the trigger conditions of the storage group can be defined through a formula. It is very convenient as you work with the same interface all the time. You can enter the syntax directly into (C) the formula field. You do not need to build your expression by picking operations from the list.

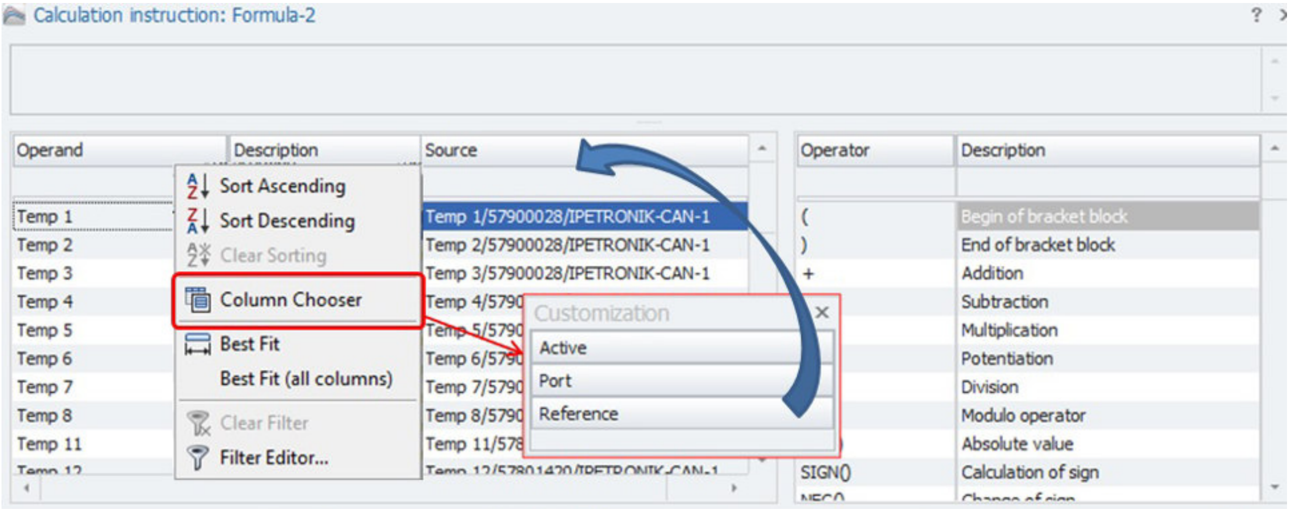
The formula parser is organized in the following 4 sections:



[AC_3]

- ► (A) Here you have a list of all supported operations and math functions.
- ► (B) List of channels or other formulas you have already created.
- ► (C) Here you will see your formula / expression which will be calculated based on the syntax of the operation and the related channels.
- ► (D) The lower part provides some online help instructions of how to use the operation.

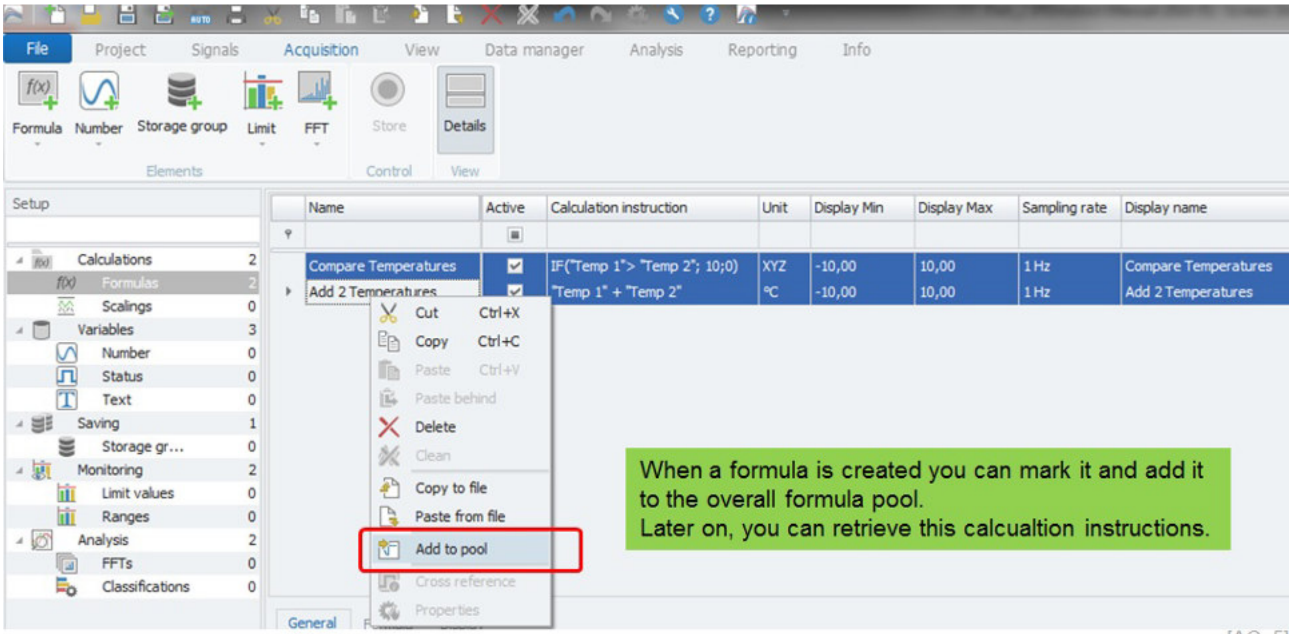
Use the column chooser to add additional channel properties to your channel grid. This could be for example the source in order to identify clearly where the channel originates from.



Drag channel properties from the column chooser to your channel grid. [AC_4]

13.2.2 Add formula to formula pool

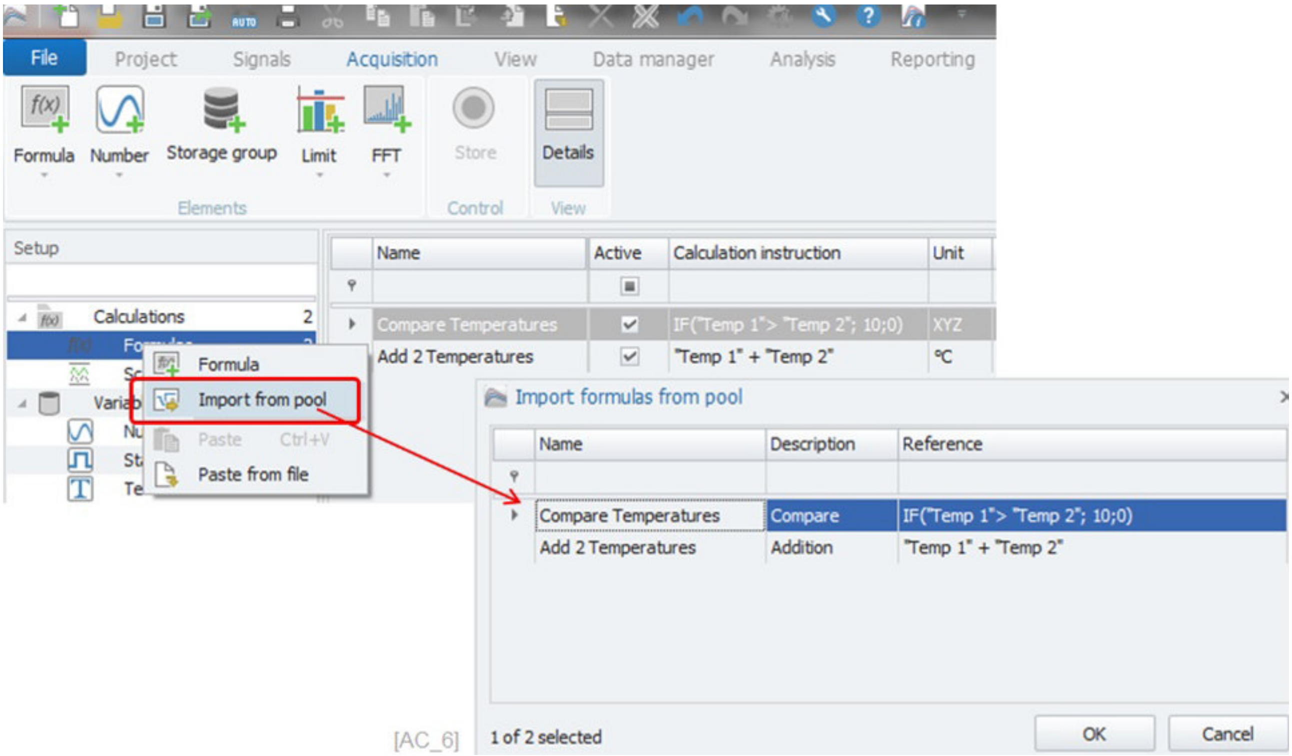
If you want to keep the syntax for later use you can add the formula to the pool. Select /highlight the formula channels and use the context menu to add them to the pool.



[AC_5]

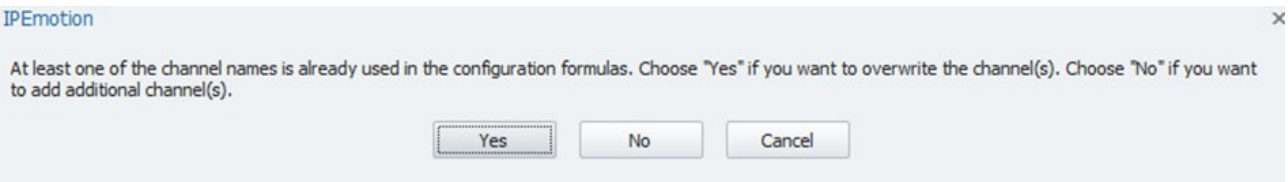
13.2.3 Import / retrieve formulas from the pool

The formula pool is maintained centrally for all parts of the program. Formulas you create for online calculations in ACQUISITION are also available in the ANALYSIS or DATA MANAGER work space. If you want to see all stored formulas and update or delete entries you need to refer to the APPLICATION menu > Reset Object Pool 6.8.



[AC_6]

While importing formulas from the pool, the import dialog is checking formula name and syntax. When the system detects a formula already existing you get a warning message about the dublicate formula name with an option to overwrite the existing formula or to create a duplicate entry.



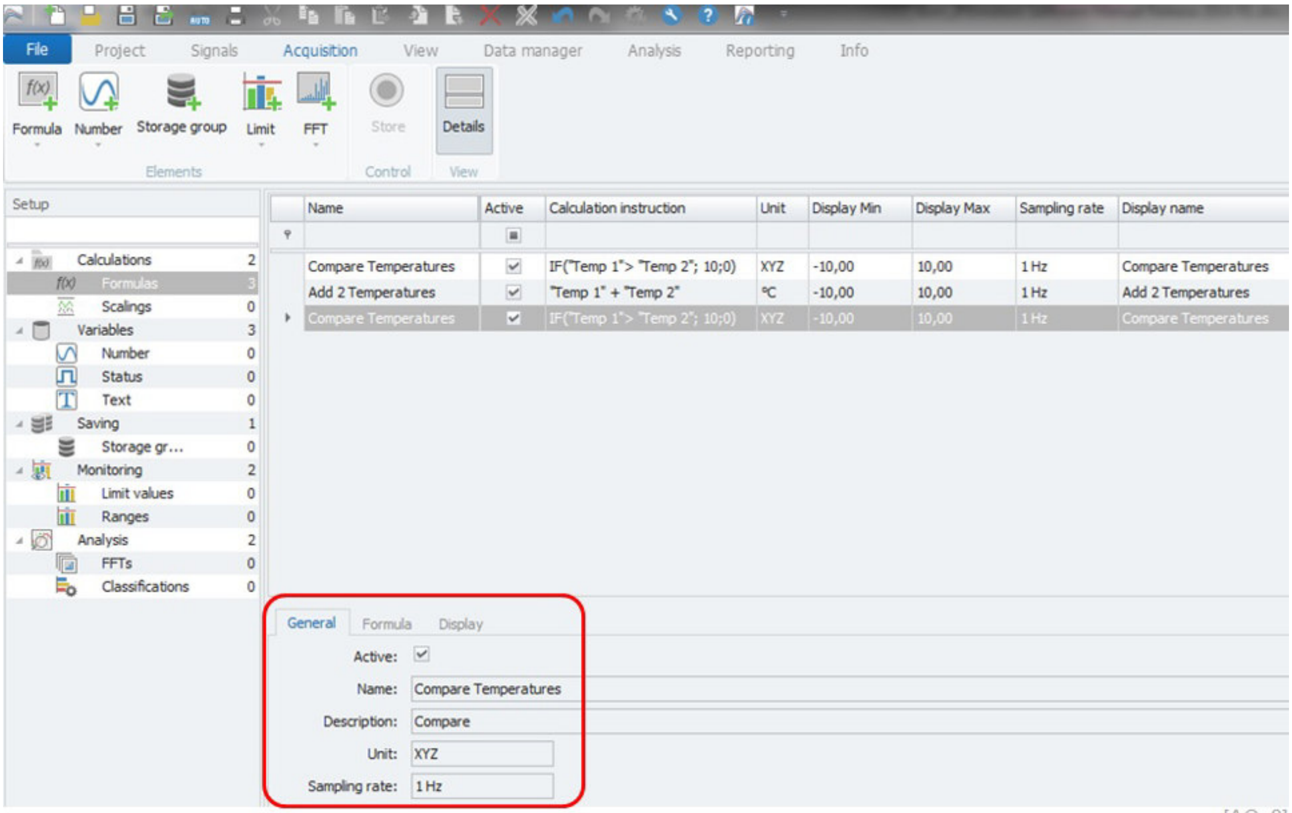
[AC_7]

13.3 Configurations for formula channels

When a formula is created you can edit the formula afterwards in the channel grid or through the context menus below.

13.3.1 General tab sheet

The General tab sheet refers to the general properties of the formula channel.

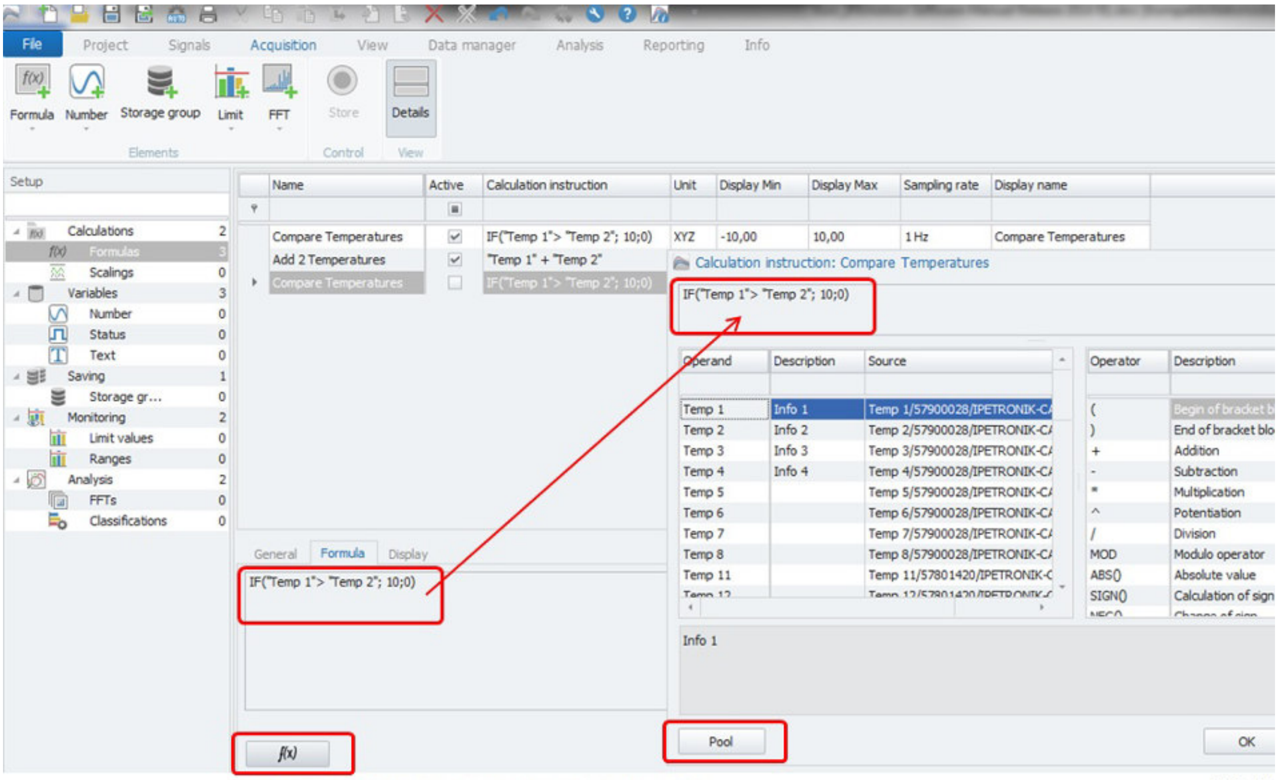


[AC_8]

- **Active** — Activate channel to execute the computations
- **Name** — Default formula / channel name
- **Description** — Add an additional description for the formula
- **Unit** — Symbol to show engineering unit of the channel
- **Sample rate** — Refers to the cycle time of how often a channel executes the calculation. The sample rate can be higher, lower or equal to the sample rate of the operands (source channels). Good results are achieved if the sample rate of the math channel matches the sample rate of the source channel.

13.3.2 Formula tab sheet

In the Formula tab sheet you can edit the formula or retrieve another formula from the formula pool.

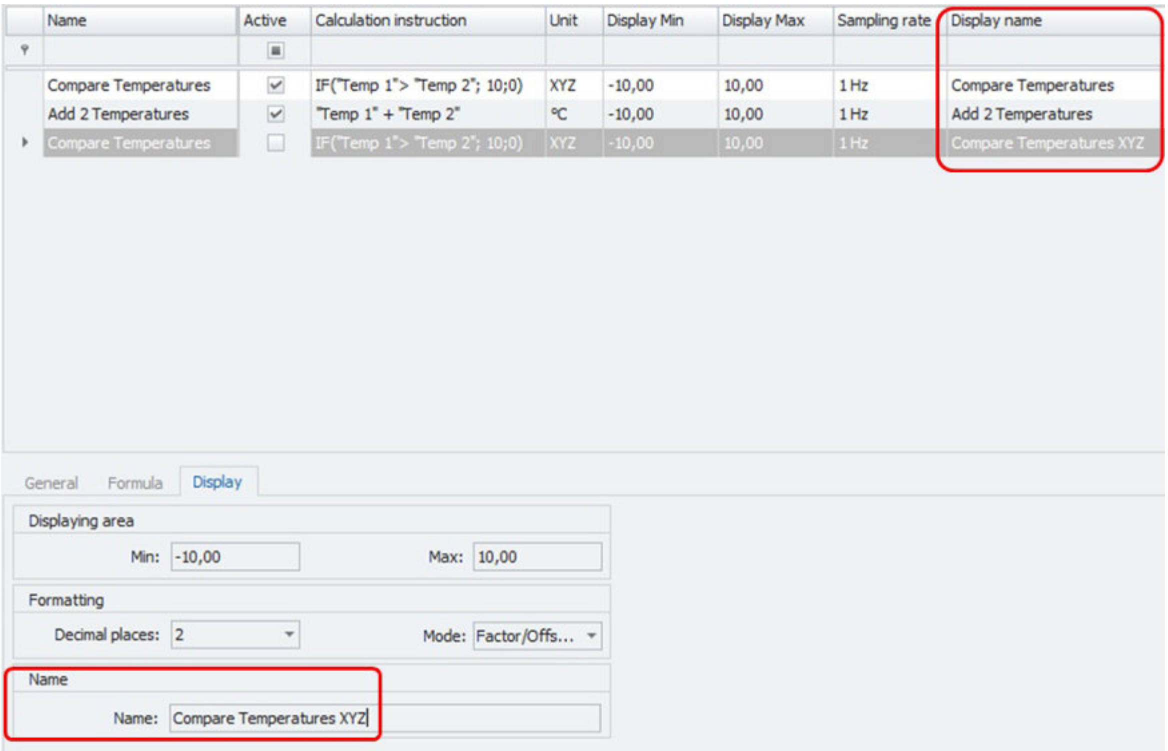


Update the formula and / or access the pool.

[AC_9]

13.3.3 Display tab sheet

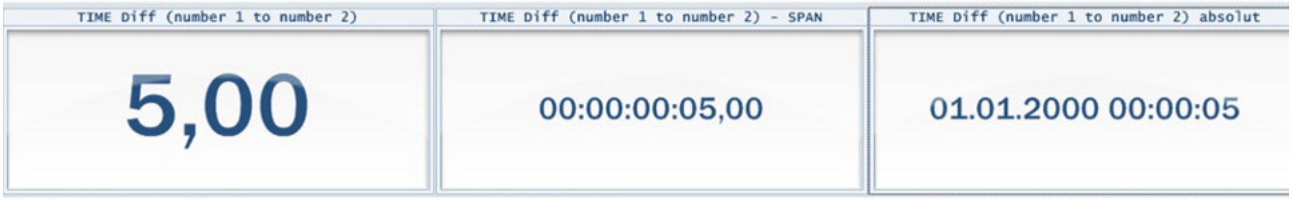
In the Display tab sheet you can define settings for data presentation in the VIEW instruments. The same settings were discussed in the SIGNALS chapter 11.10.



[AC_10]

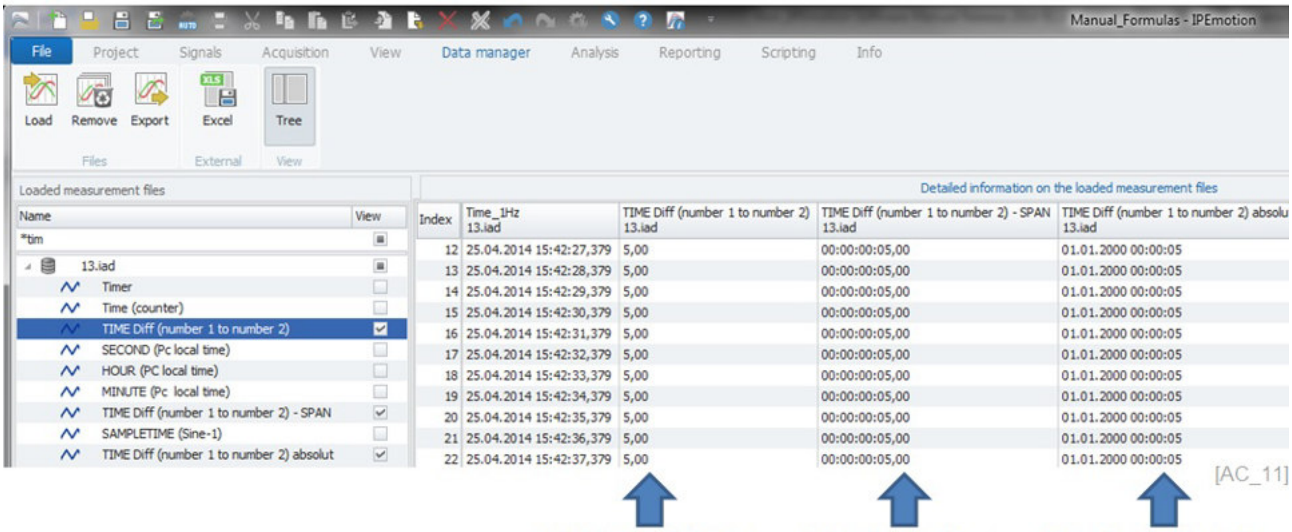
- **Display area** Covers the default setting of the Y-axis in the Yt- and XY chart
- **Formatting** Covers the number of decimal places in numerical instruments
- **Mode** With the mode you can influence how the result of the formula channel are displayed and stored
- **Mode - Factor/Offset** This is the standard default display of the data
- **Mode - Time Span** This mode is particular useful when you have math functions which count time. Rather than displaying a number e.g. = 120 [seconds] it is presented as HH:MM:SS = 00:02:00
- **Mode - Absolute Time** This mode is adding the date as well to the time stamp

Display of the results of the same fomular with 3 different MODE settings in VIEW in an alphanumerical instrument.



Mode: Factor/Offest Mode: Time Span Mode: Absolute Time

In the data file the results are stored according to the selected mode.



[AC_11]

Mode: Factor/Offest Mode: Time Span Mode: Absolute Time

- **(Display) Name** With this name you can define a different name compared to the channel name which will be visible on the online VIEW instruments. Provided you have activated the function in the OPTIONS > View 22.5.4.

13.4 Overview of all operations: math and logic functions

Operations and descriptions:

- + Addition — "Channel 1" + "Channel 2"
- – Subtraction — "Channel 1" – "Channel 2"
- * Multiplication — "Channel 1" * "Channel 2"
- / Division — "Channel 1" / "Channel 2"
- MOD — The modul operator calculates the remainder of a division for integer numbers. Integer numbers have no fractional or decimal components.
  Syntax: "Operand1" MOD "Operand2"
  Examples: (11 / 3 = 3 + remainder 2) 11 = (3*3) +2
  11 MOD 3 => 2 or 12 MOD 7 => 5
- ABS () — The absolute function converts a negative value into a positive one. The terms need to be put into brackets
  Syntax: ABS ("Channel1")
  Example: -33,5 changed to 33,5 or 22,7 remains 22,7
- SIGN () — The SIGN function returns the sign of the numeric term, which is written in brackets. Depending on the read number, the function returns the values as follows:
  Syntax: SIGN ("Channel1")
  Example:
  -33,5 at negative numbers, SIGN returns -1
  26,3 at positive numbers, SIGN returns 1
  0 C at zero, SIGN returns 0
- NEG () — The NEG function changes the sign. Negative readings are changed to positive and positive readings are changed to negative.
  Syntax: NEG ("Channel1")
  Example: -33,5 changed to 33,5
  26,3 changed to -26,3
  0 C remains 0
- PREV () — PREV sends the operands previous value. The result of the first calculation is NoValue if the optional initial value is not defined. If the initial value is sent, it is used as result of the first calculation.
  Syntax: PREV(Operand), PREV(Operand; Initial value)
  Examples:
  PREV ("Channel 1") sends the value of "Channel 1" from the previous calculation cycle, the result of the first calculation is NoValue.
  PREV ("Channel 1"; 10) sends the value of "Channel 1" from the previous calculation cycle, the result of the first calculation is 10.
- PREVN () — PREVN sends the operand's previous value with a settable depth. The result of the first calculations are NoValue if the optional initial value is not defined. If the initial value is sent, it is used as result of the first calculations.
  Syntax: PREVN(Operand; Depth), PREVN(Operand; Depth; Initial value)
  Examples:
  PREVN("Channel 1"; 2) sends the value of "Channel 1" from the last but one calculation cycle, the result of the first calculation and the second calculation is NoValue.
  PREVN("Channel 1"; 2; 10) sends the value of "Channel 1" from the last but one calculation cycle, the result of the first and the second calculation is 10.

- **=** Equal compares Operand1 to Operand2. When the condition is true the formula returns value 1. When the condition is not true it returns the value 0.
  Syntax: "Operand1" = "Operand2"
- **<>** Unequal compares Operand1 to Operand2. If the values do not match, the function returns 1, otherwise when both operands have the same value the function returns 0.
  Syntax: Operand1 <> Operand2
- **<** Less compares Operand1 to Operand2. If the condition is not true the function returns 1, otherwise when Operand1 is greater than Operand2 the function returns 0.
  Syntax: Operand1 < Operand2
- **<=** Less or Equal compares Operand1 to Operand2. If the condition is not true the function returns 1, otherwise when Operand1 is greater than Operand2 the function returns 0.
  Syntax: Operand1 <= Operand2
- **>** Greater compares Operand1 to Operand2. If the condition is true the function returns 1, otherwise when Operand1 is smaller than Operand2 the function returns 0.
  Syntax: Operand1 > Operand2
- **>=** Greater or equal compares Operand1 to Operand2. If the condition is true the function returns 1, otherwise when Operand1 is smaller than Operand2 the function returns 0.
  Syntax: Operand1 >= Operand2
- **AND** Logical AND operator compares two conditions. When both conditions are true value 1 is returned, otherwise 0.
  Syntax: (Condition1) AND (Condition2)
  Example:
  (2.4 > 1.2) AND (21.3 <34.1) => 1
  (2.4 <1.2) AND (21.3 <34.1) => 0
  (2.4 > 1.2) AND (21.3 = 34.1) => 0
  (2.4 <1.2) AND (21.3 = 34.1) => 0
- **OR** Logical OR operator compares two conditions. When one condition is true the operation returns 1, otherwise 0.
  Syntax: (Condition1) OR (Condition2)
  (2.4 > 1.2) OR (21.3 <34.1) => 1
  (2.4 <1.2) OR (21.3 <34.1) => 1
  (2.4 > 1.2) OR (21.3 = 34.1) => 1
  (2.4 <1.2) OR (21.3 = 34.1) => 0 (both conditions are not true)
- **XOR** Refers to the logical Exclusive-Or operator. If exactly one of the partial conditions is true value 1 is returned, otherwise 0.
  Syntax: (Condition1) XOR (Condition2)
  (2.4 > 1.2) OR (21.3 <34.1) => 0
  (2.4 <1.2) OR (21.3 <34.1) => 1
  (2.4 > 1.2) OR (21.3 = 34.1) => 1
  (2.4 <1.2) OR (21.3 = 34.1) => 0
- **SHL** Moves Operand1 by the number of bit positions defined by Operand2 to the left. The system is multiplying Operand1 with 2^(Operand2)
  Syntax: "Operand1" SHL "Operand2"
  1 SHL 2 => 4 calculation 1 * 2^2 = 4
  12 SHL 1 => 24 calculation 12 * 2^1 = 24
- **SHR** Moves Operand1 by the number of bit positions defined by Operand2 to the right.
  Syntax: "Operand1" SHR "Operand2"
  1 SHR 2 => 0 calculation 1 / 2^2 = 0,25 > converted to 0
  12 SHR 1 => 6 calculation 12 / 2^1 = 12

- SIN — Sine function
- COS — Cosine function
- TAN — Tangent function
- SINH — Hyperbolic sine function
- COSH — Hyperbolic cosine function
- TANH — Hyperbolic tangent function
- ASIN — Arc sine function
- ACOS — Arc cosine function
- ATAN — Arc tangent function
- EXP () — Natural exponential function e^x. Euler exponential function. Euler's number "e" is approximately 2.718.
  Syntax: EXP ("Operand1")
  EXP(1) = 2,72 calculation 2,718^1 = 2,72
  EXP(2) = 7,39 calculation 2,718 * 2,718 = 7,39
  EXP(3) = 20,09 calculation 2,718 * 2,718 * 2,718 = 20.09
- LOG () — 4,Common logarithm (log10) is the logarithm to the base 10.
  Syntax: LOG("Operand1")
  LOG(100) = 2 calculation 10 * 10 = 100
  LOG(1000) = 3 calculation 10 * 10 * 10 = 1000
- LN — Natural logarithm is the logarithm to the base "e". Euler's number "e" is approximately 2.718. The natural logarithm is the counterpart to the natural exponential function (EXP).
  Syntax: LN("Operand1")
  LN(2,72) = 1
  LN(7,389) = 2
  LN(20,09) = 3
  SQRT() This function calculates the square root of a positive number.
- IF (;;) — The IF condition compares "Condition1" and returns, if true, the value of "Operand2". If the condition is not true it returns the value of "Operand3".
  Syntax: IF("Condition1";"Operand2";"Operand3")
  IF("Operand1"> 10;100;-5)
- ANDB — Corresponds to the bitwise And operator. All common bits of Operand1 and Operand2 are returned as a result; all other bits return the value 0.
  Syntax: Operand1 ANDB Operand2
  27 as binary code: 1 1 0 1 1
  12 as binary code: 1 1 0 0
  13 as binary code: 1 1 0 1
  4 as binary code: 0 1 0 0
  27 ANDB 12 => 8
  27 as binary code: 1 1 0 1 1
  12 as binary code: 1 1 0 0
  calculation 27 = 16+8+2+1 AND 12 = 8+4
  27 ANDB 13 => 9
  27 as binary code: 1 1 0 1 1
  13 as binary code: 1 1 0 1
  calculation 27 = 16+8+2+1 AND 12 = 8+4+1 > (8+1) = 9
  27 ANDB 4 => 0 no common bit pattern

Decimal Values 0 to 15
Dualsystem

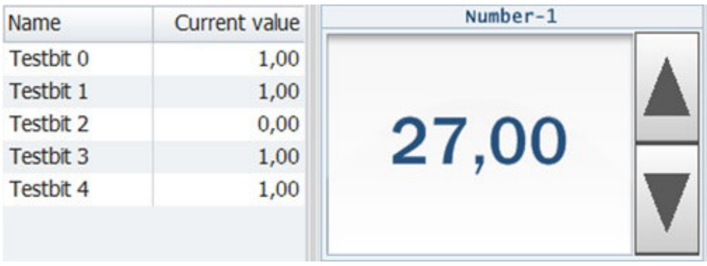
Value	8 4 2 1
Null	0 0 0 0
one	0 0 0 1
two	0 0 1 0
three	0 0 1 1
four	0 1 0 0
five	0 1 0 1
six	0 1 1 0
seven	0 1 1 1
eight	1 0 0 0
nine	1 0 0 1
eleven	1 0 1 1
twelve	1 1 0 0
thirteen	1 1 0 1
fourteen	1 1 1 0
fifteen	1 1 1 1

- **ORB**
  Corresponds to the bitwise Or operator. All bits, which are set in at least one operand, are also set in the result; all other bits result in 0.
  Syntax: Operand1 ORB Operand2
  Examples:
  27 as binary code: 1 1 0 1 1
  12 as binary code: 1 1 0 0
  31 as binary code: 1 1 1 1 1
  27 ORB 12 => 31
  27 ORB 13 => 31
  27 ORB 8 => 27

- **XORB**
  Corresponds to the bitwise Exclusive-Or operator. All bits, which are set in exactly one operand, are also set in the result; all other bits result in 0.
  Syntax: Operand1 XORB Operand2
  27 as binary code: 1 1 0 1 1
  12 as binary code: 1 1 0 0
  23 as binary code: 1 0 1 1 1
  Examples:
  27 XORB 12 => 23
  27 XORB 13 => 22
  27 XORB 8 => 19

- **NOTB**
  Corresponds to the bitwise Not operator. All bits, which are set in the operand, are not set in the result; all other bits are set in the result.
  Syntax: NOTB(Operand1)
  Examples:
  NOTB(27) => 4294967268 (11111111111111111111111111100100)
  NOTB(12) => 4294967283

- **TESTBIT (;)**
  The function returns the bit value of the Operand for the position defined.
  Syntax: TESTBIT(Operand;1)
  Example:
  27 as binary code: 1 1 0 1 1
  TESTBIT(27;0) = 1
  TESTBIT(27;1) = 1
  TESTBIT(27;2) = 0
  TESTBIT(27;3) = 1
  TESTBIT(27;4) = 1



[AC_12]

- **TESTMASK ()**

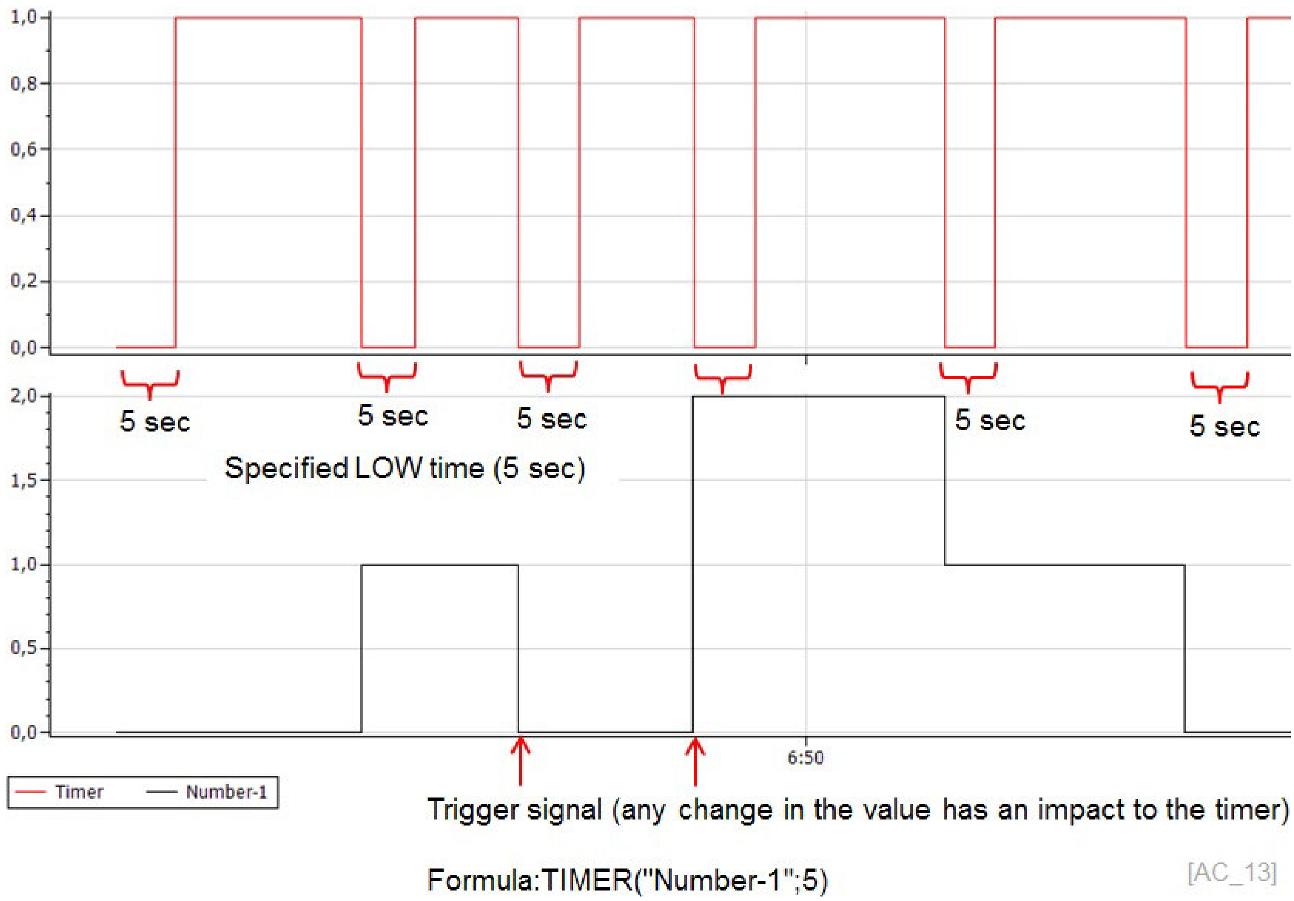
  Runs a comparison with the fixed bit mask 0xFFFFFFFF.
  Syntax: TESTMASK(Operand1)
  Examples:
  TESTMASK(27) => 1
  TESTMASK(0) => 0
  HEX: FFFFFFFF
  DEC: 4294967295
  BIN: 11111111111111111111111111111111 (32 bit)
  The application:
  If at least one bit is set in Operand1, the result is 1, otherwise 0

- **TESTMASKS (;)**

  Runs a comparison with a definable bit mask. If at least one bit is set in Operand1, as well as, in Operand2, the result is 1, otherwise it is 0.
  Syntax: TESTMASKS(Operand1; Operand2)
  Examples:
  TESTMASKS(27; 6) => 1
  27 = 11011
  6 = 110
  TESTMASKS(27; 4) => 0
  27 = 11011
  4 = 100 > no common bit

- **TIMER (;)**

  This function generates a permanent HIGH signal. When Operand1 is changing the value the function returns a LOW (value 0). After the time defined in Operand 2 the function is jumping back to HIGH (value 1).
  Syntax: TIMER(Operand1;Operand2)
  Examples:
  TIMER("Channel1";10)
  This function works in the opposite direction to the MF (MonoFlop) discussed further below.



[AC_13]

- ► MIN ()

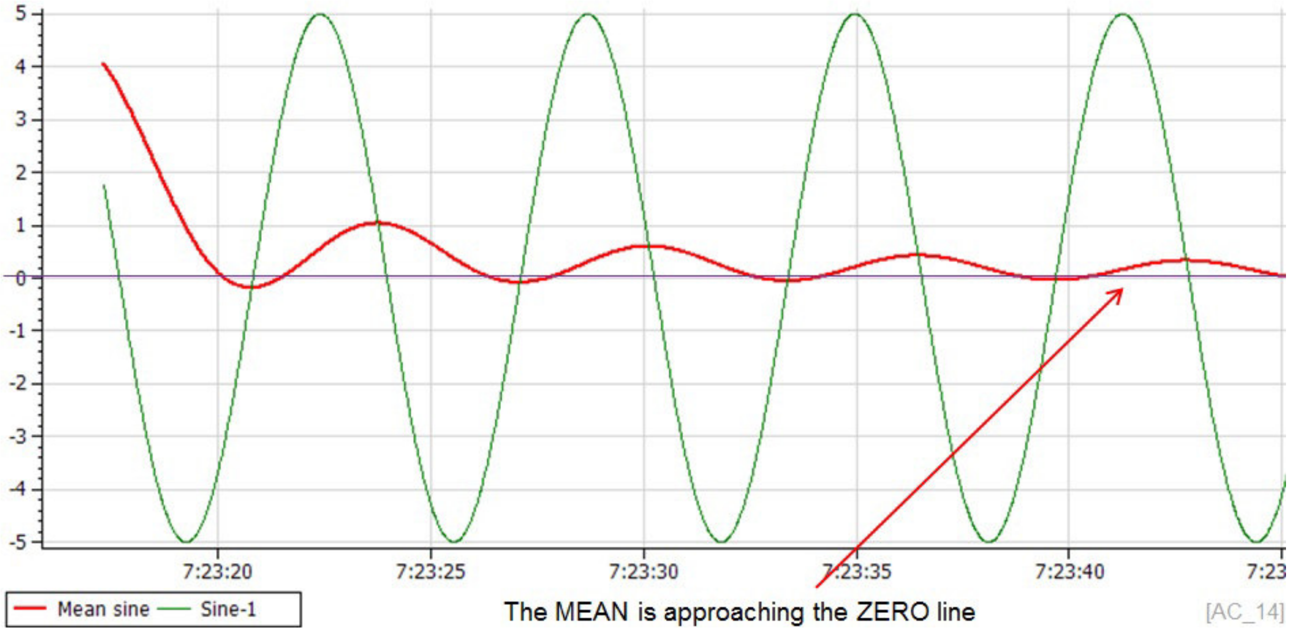
  Detects the operand's minimum. The calculation uses all valid values and stores the smallest value.
  Syntax: MIN(Operand)
  Examples:
  MIN("Channel1")

- ► MAX ()

  Detects the operand's maximum. The calculation uses all valid values and stores the biggest value.
  Syntax: MAX(Operand)
  Examples:
  MAX("Channel1")

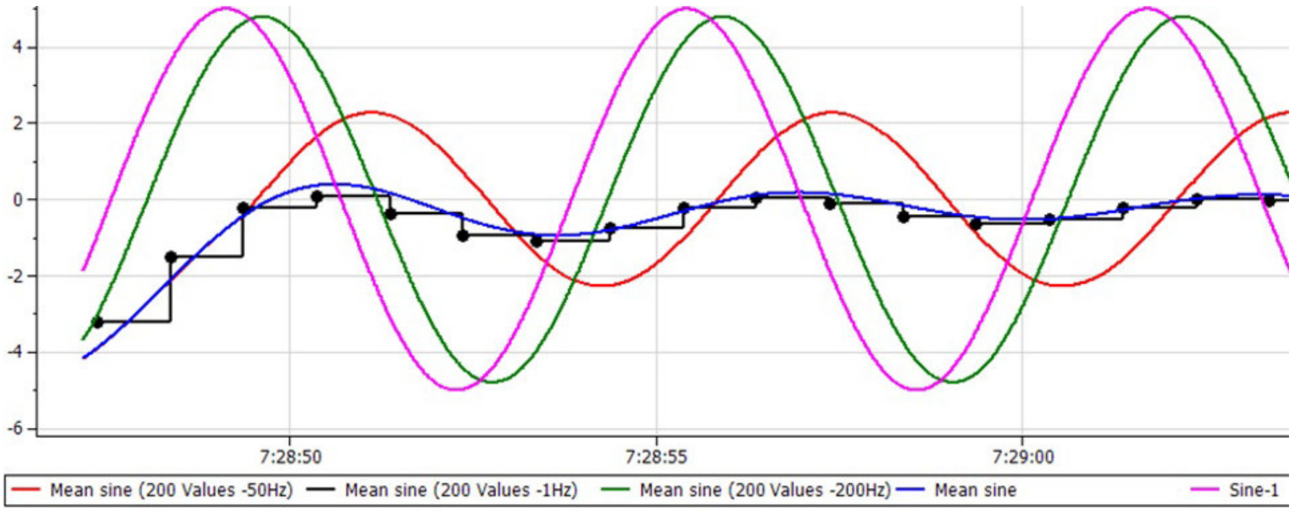
- ► MEAN ()

  This function calculates an average. One average calculation considers all values from the start of recording. If a "certain number of values" is defined the mean calculation considers this amount of values and returns the value. The sample rate of the formula has also an impact on the results.
  Syntax: MEAN(Operand)
  Syntax: MEAN(Operand;number of values)
  Examples:
  MEAN("Channel 1")
  Calculates the average of Channel 1 over all valid values.
  MEAN("Channel1"; 10)
  Calculates the average of Channel 1 over the last 10 values.



[AC_14]

The Mean calculation below is based on a 200 Hz signal (resolution). The frequency of the sine wave is slow with 0,1 Hz so in 60 seconds 10 periods are recorded.

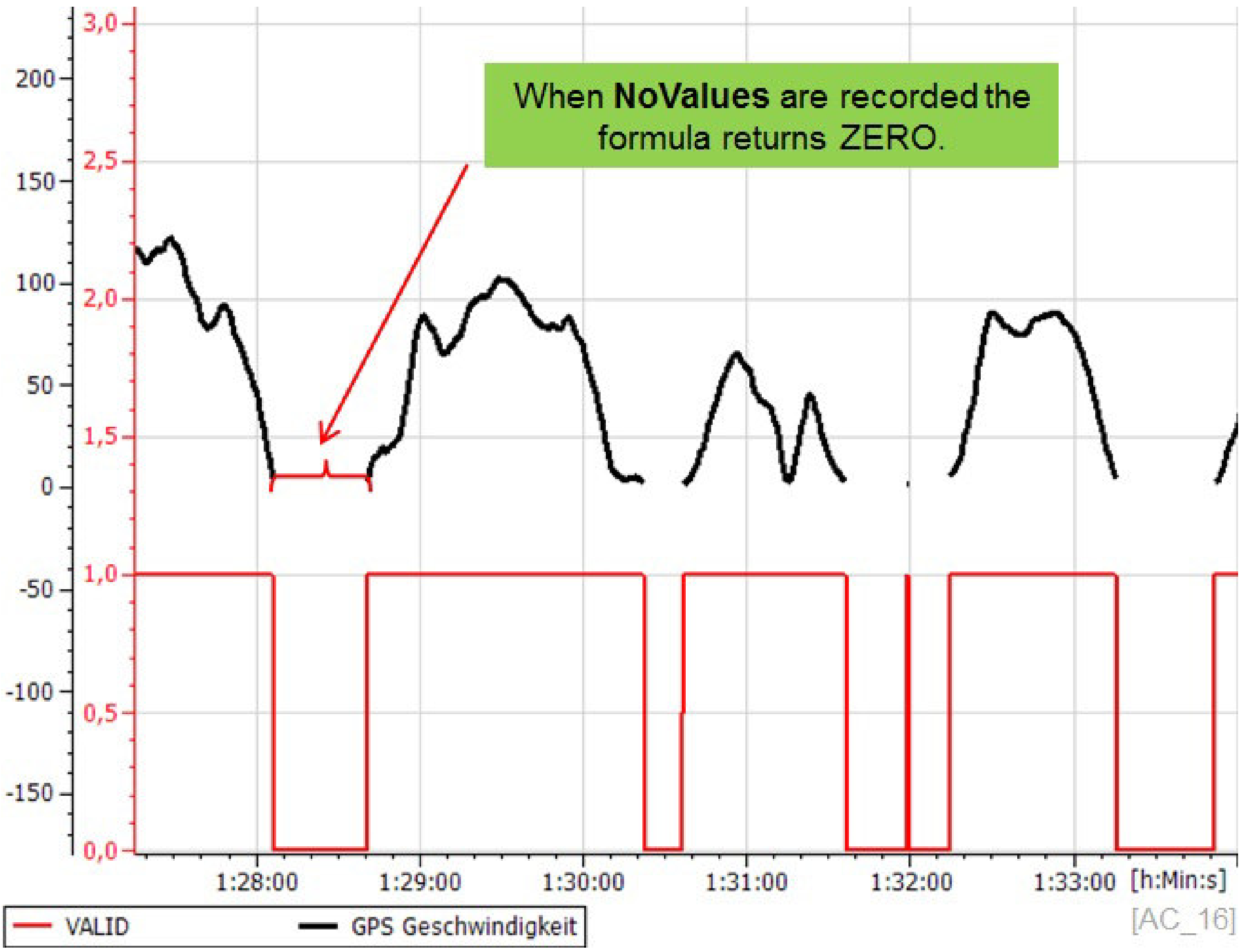


	Name	Active	Calculation instruction	Unit	Display Min	Display Max	Sampling rate	Display name
	m							
	Mean sine (200 Values -200Hz)	☑	MEAN("Sine-1"; 200)		-10,00	10,00	200 Hz	Mean sine (200 Values -200Hz)
	Mean sine (200 Values -50Hz)	☑	MEAN("Sine-1";200)		-10,00	10,00	50 Hz	Mean sine (200 Values -50Hz)
	Mean sine (200 Values -1Hz)	☑	MEAN("Sine-1";200)		-10,00	10,00	1 Hz	Mean sine (200 Values -1Hz)
▸	Mean sine	☑	MEAN("Sine-1")		-10,00	10,00	200 Hz	Mean sine

[AC_15]

You can see that the sliding mean calculation is affected by the sample rate of the formula.

- **MINOR ()** — The function returns the smaller value of Operand1 and Operand2.
  Syntax: MINOR(Operand1; Operand2)
  Examples:
  MINOR(6.23; 1.9) => 1.9
  MINOR(2.41; -4.1) => -4.1
- **MAJOR ()** — The function returns the greater value of Operand1 and Operand2.
  Syntax: MAJOR(Operand1; Operand2)
  Examples:
  MAJOR(6.23; 1.9) => 1.9
  MAJOR(2.41; -4.1) => -4.1
- **VALID ()** — This function checks Operand1 for validity (NoValue). If only one operand is used, 1 is sent in case of a valid value and 0 in case of an invalid value. If a second operand is used, the value of Operand2 is sent in case of invalidity of Operand1 (even if it corresponds to NoValue); otherwise the value of Operand1 is sent.
  Syntax: VALID(Operand1)
  VALID(Operand1, Operand2)
  Examples:
  VALID(1.45) => 1.0
  VALID(NaN) => 0.0
  VALID(1.45; 2.31) => 1.45
  VALID(NaN; 2.31) => 2.31
  VALID(NaN; NaN) => NaN



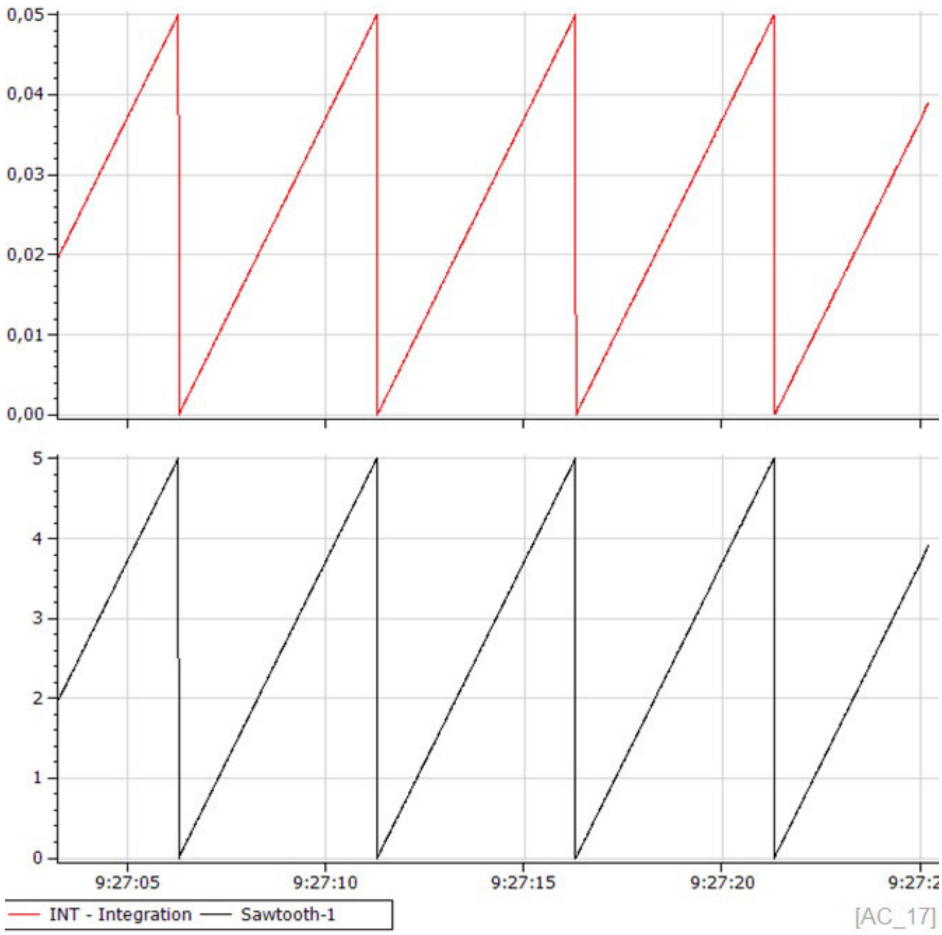
[AC_16]

- FLOOR () — This function rounds a floating point number down to the next smaller integer.
Syntax: FLOOR(Operand)
Examples:
FLOOR(13.53) => 13.0
FLOOR(2.41) => 2.0

- CEIL () — This function rounds a floating point number up to the next greater integer.
Syntax: CEIL(Operand)
Examples:
CEIL(13.53) => 14.0
CEIL(2.41) => 3.0

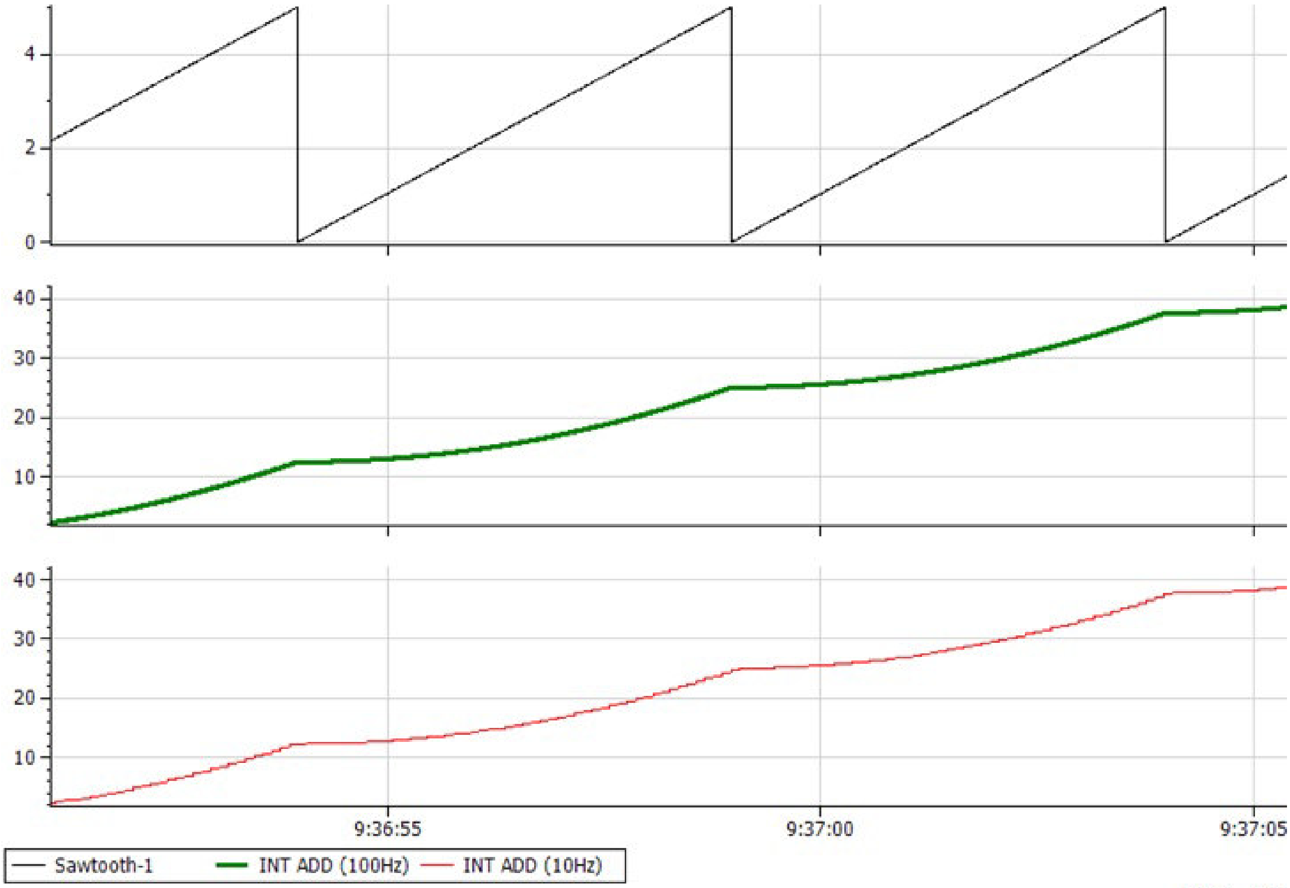
- ROUND () — This function rounds a floating point down to the next smaller integer if the floating point rest is less than 0.5. This function rounds a floating point up to the greater integer if the floating point rest is greater than or equal to 0.5.
Syntax: ROUND(Operand)
Examples:
ROUND(13.53) => 14.0
ROUND(2.41) => 2.0

- INT () — The integration calculates the operand's integral with the calculation formula "((Op1(t) + Op1(t-1) / 2) * DeltaT".
Syntax: INT(Operand)
Examples:
INT("Channel 1")
It is calculating the actual area under the actual sample and previous sample. This is then multiplied with deltaT. In this case deltaT of the 100Hz Sawtooth Signal = 0.01s
Example: (5,00+4,99)/2*0.01=0,04995



[AC_17]

- INT_ADD () — This function,calculates the operand's integral with the calculation formula "((Op1(t) + Op1(t-1) / 2) * DeltaT" and adds this value to the previous result.
  Syntax: INT_ADD(Operand)
  Examples:
  INT_ADD("Channel1")



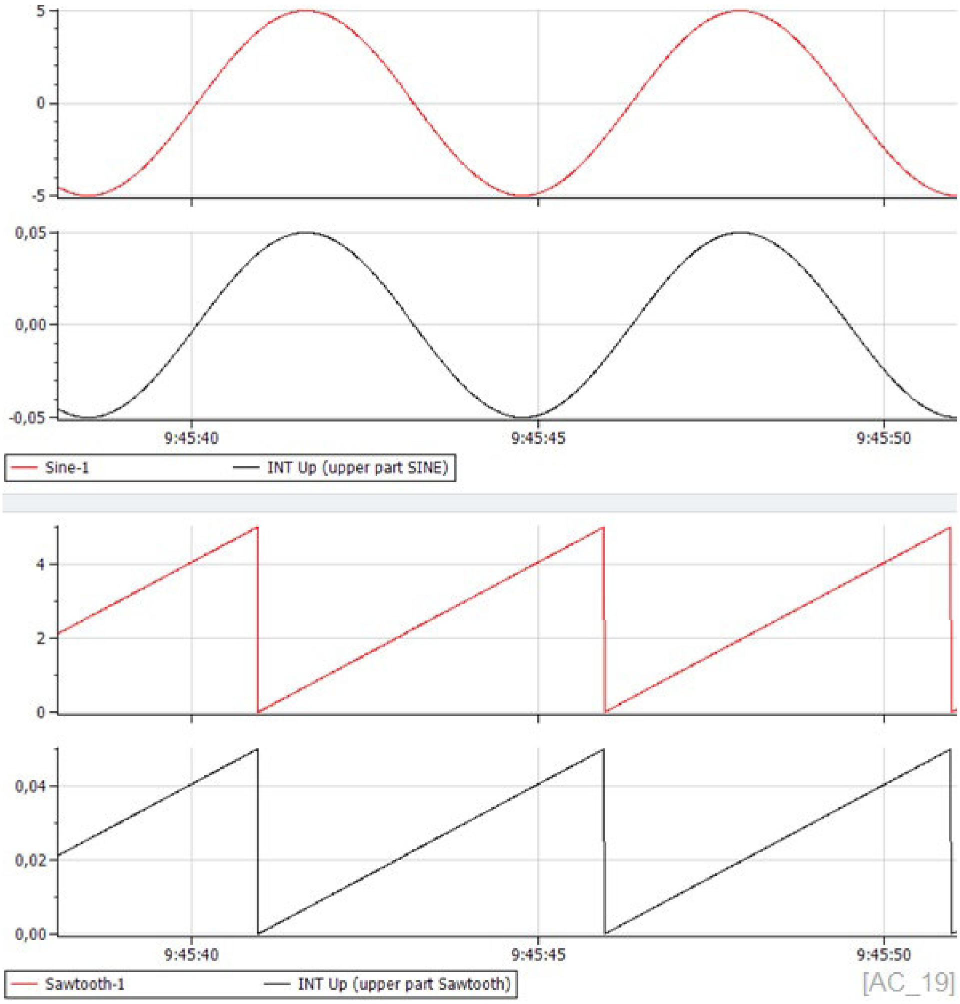
[AC_18]

INT ADD (10Hz)	☑	INT_ADD("Sawtooth-1")	-10,00	10,00	10 Hz	INT ADD (10Hz)
INT ADD (100Hz)	☑	INT_ADD("Sawtooth-1")	-10,00	10,00	100 Hz	INT ADD (100Hz)

The sample rate of the channel has no impact on the calculated result.

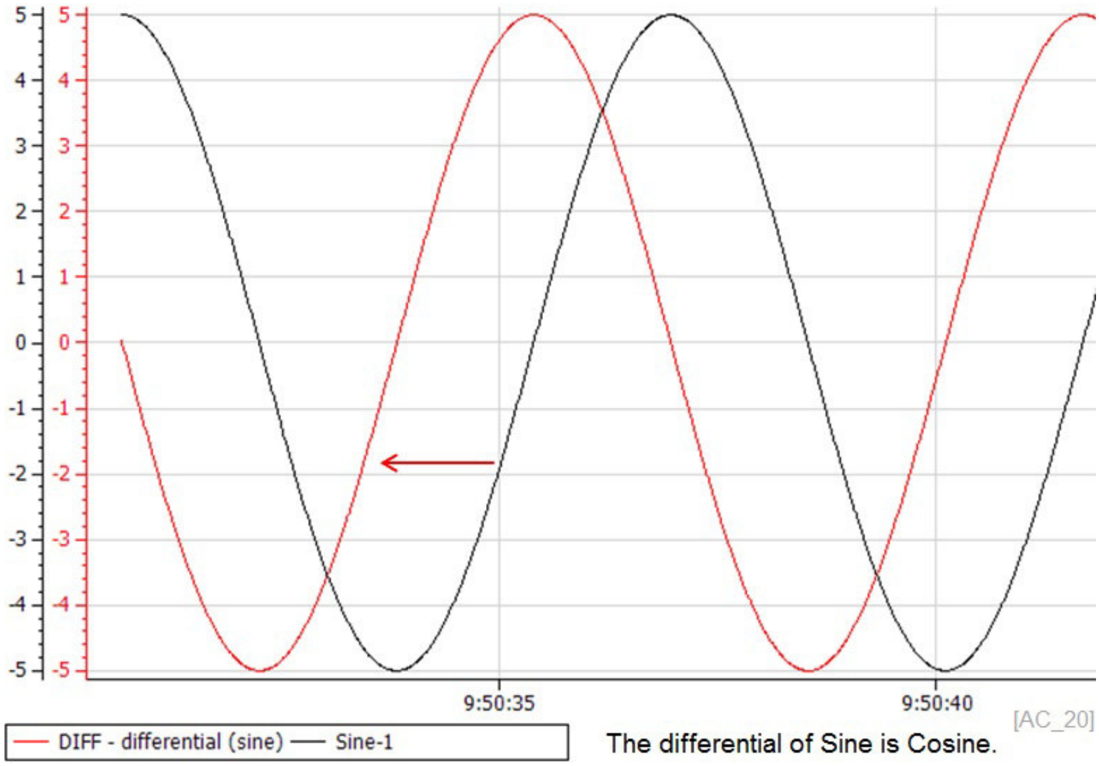
► INT_UP ()

This function sends the upper integral with the calculation formula "Op1 * DeltaT".
Syntax: INT_UP(Operand)
Examples:
INT_UP("Channel1")
Almost same as "INT" but here no average of actual sample and previous sample, it is made simpler (and faster) here only the "upper" sample = actual sample is used.
Example:
DeltaT of Sine 100Hz=0.01s
5,00*0,01=0,05



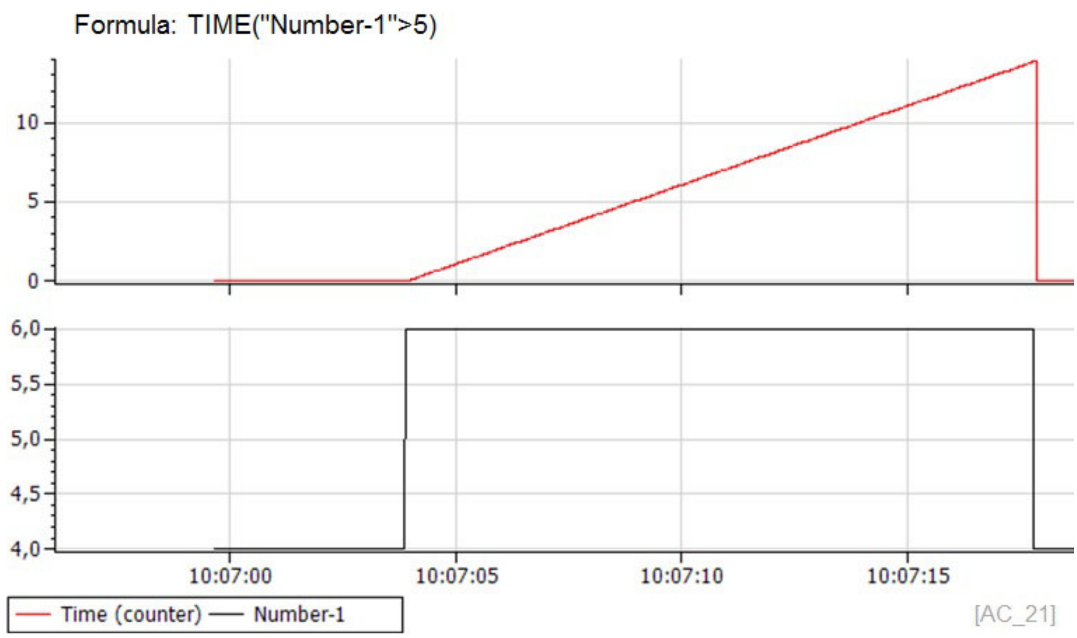
[AC_19]

- ► DIFF () This function differentiates the operand with the calculation formula (Op1(t) - Op1(t-1)) / DeltaT.
Syntax: DIFF(Operand)
Examples:
DIFF("Channel1")



[AC_20]

- ► TIME () This function counts time in seconds. If the condition is true counting starts. If the condition is not true anymore the channel returns ZERO.
Syntax: TIME(Operand)
Examples:
TIME("Channel1" > 5)
Example: When the channel "Number-1" has a value > 5 the time counter starts to count seconds. When the condition is not true the time counter is set back to ZERO.

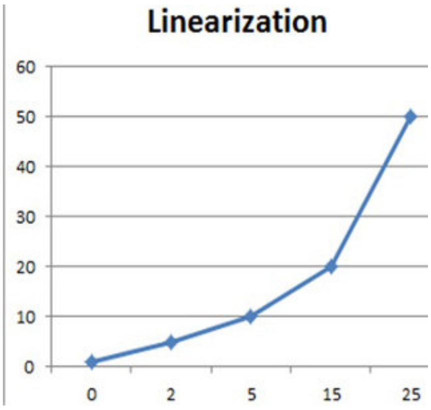


[AC_21]

- LIN ()

This is a linearization function with defined nodes. 2 to 16 nodes can be defined. Entering the input values should result in the function monotonously rising. Enter the nodes in an ascending order and use semicolon as separators. When the value of Operand1 is out of the linearization range the start or end value will be displayed.
Syntax: LIN("Operand1"; x-Node-1;y-Node-1; x-Node-2;y-Node-2; .....; x-Node-16;y-Node-16)
Examples:
LIN("Operand1";0;1;2;5;5;10;15;20;25;50)

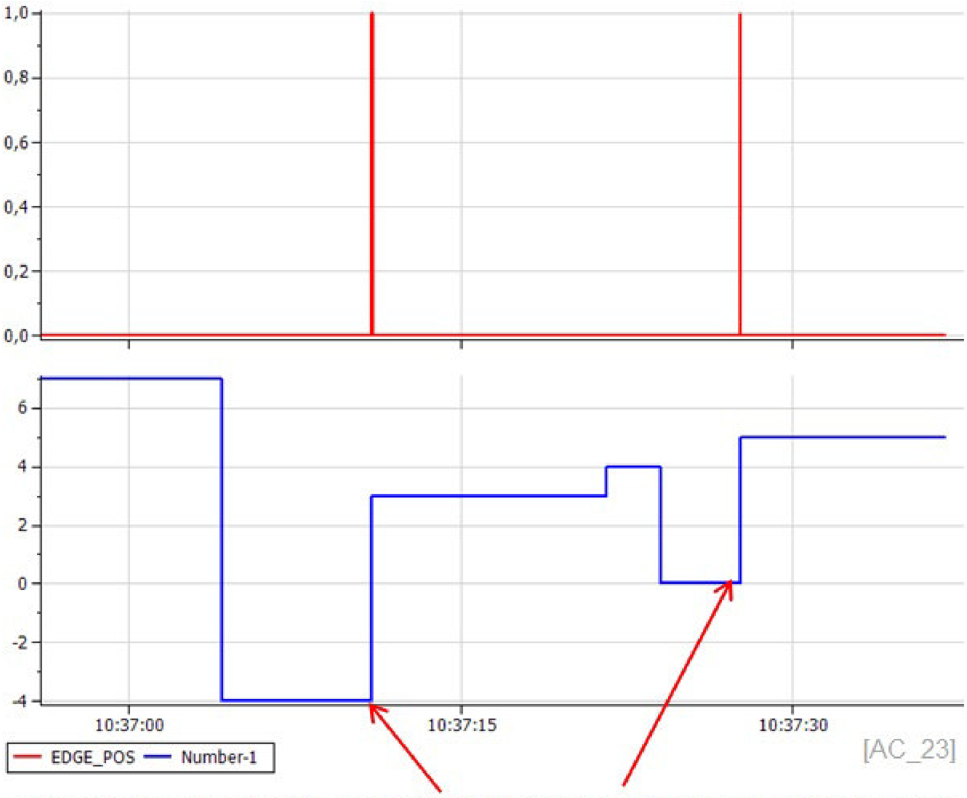
	X	Y
Node 1	0	1
Node 2	2	5
Node 3	5	10
Node 4	15	20
Node 5	25	50



[AC_22]

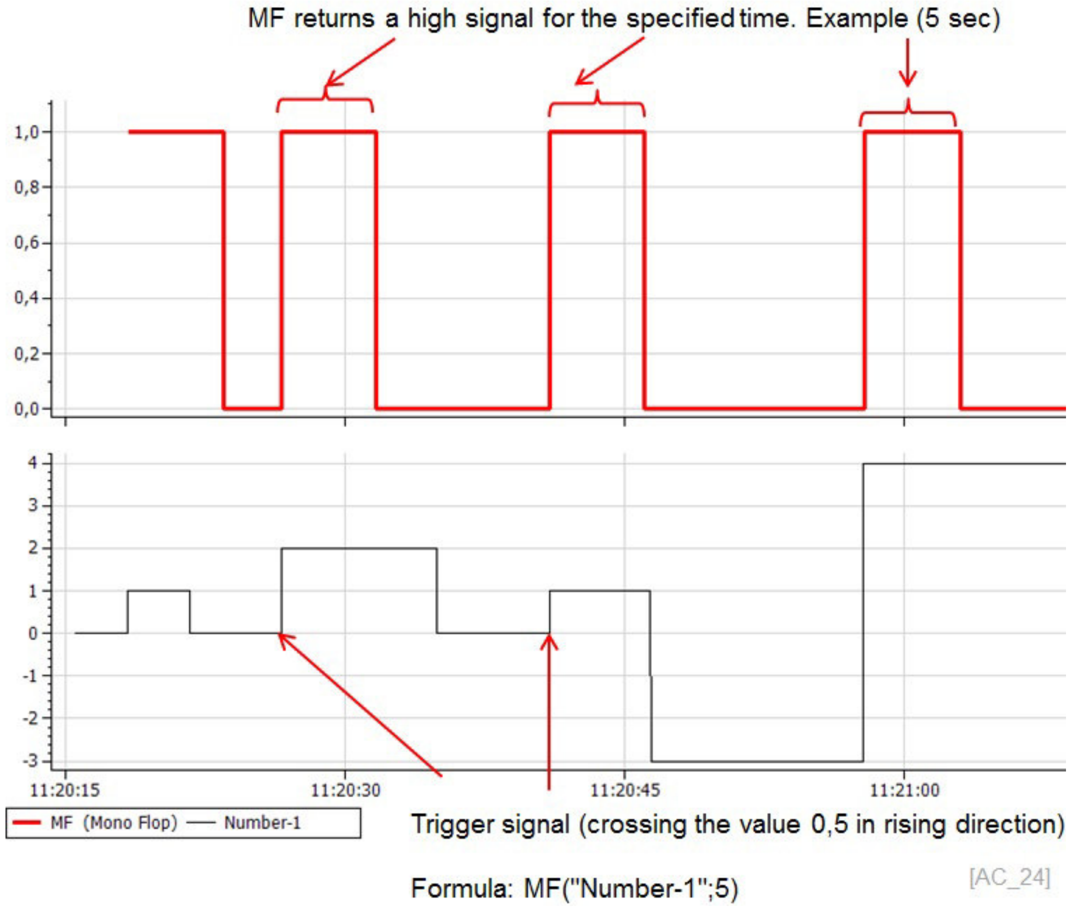
- EDGE_POS ()

This function returns HIGH (1) if the operand crosses the range [0 to 1] in a rising direction.
Syntax: EDGE_POS(Operand)
Examples:
EDGE_POS("Channel1")
Change 0 > 1 returns HIGH (1)
Change 0,5 > 1,3 stays LOW (0) no impact
Change 3 > 4 stays LOW (0) no impact
Change -5 > 2 returns HIGH (1)



Rising edge crossing the range [0 to] 1 returns a HIGH value by the formula.

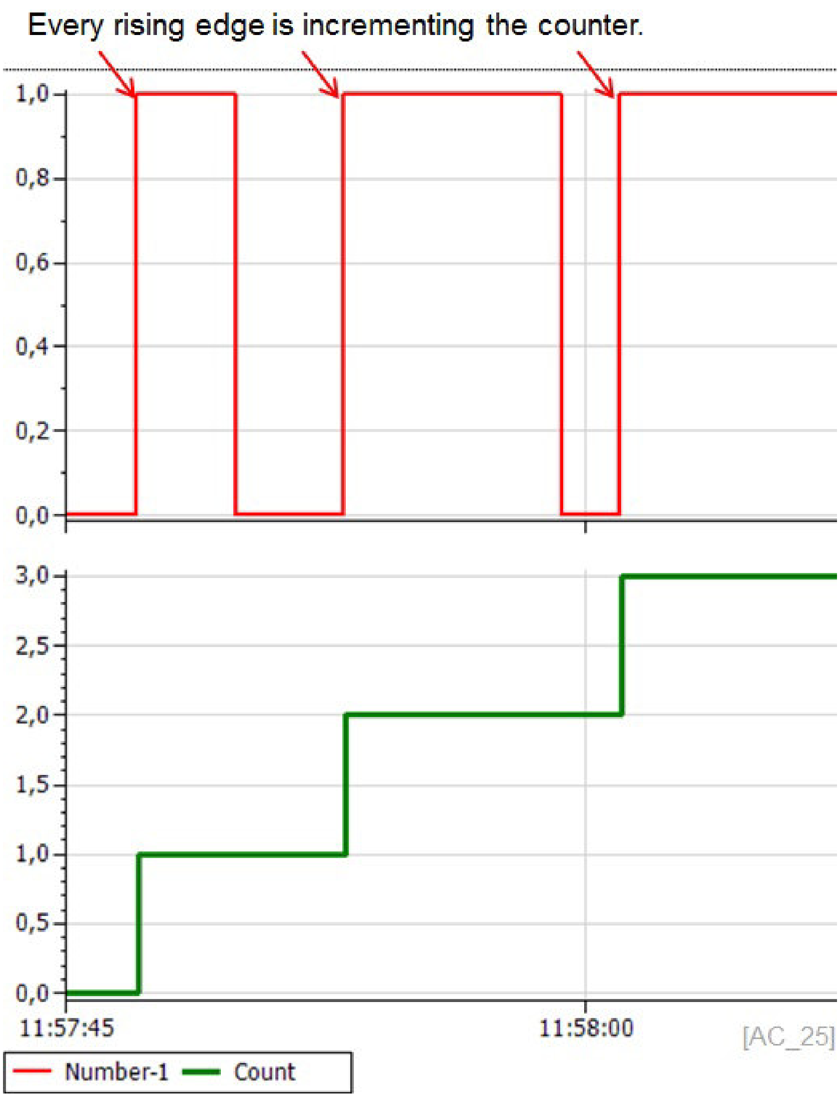
- EDGE_NEG () — This function returns HIGH (1) if the operand crosses the range [0 to 1] in a falling direction.
Syntax: EDGE_POS(Operand)
Examples:
EDGE_POS("Channel1")
Change 3 > 0 returns HIGH (1)
Change 2,5 > 0,5 stays LOW (0) no impact
Change 3 > -5 returns HIGH (1)
- TFF () — This Flip Flop inverts the result of a rising edge of Operand1.
Syntax: TFF(Operand1)
Examples:
TFF("Channel1")
Changes the result from 0 to 1 if "Channel 1" changes from less than 0.5 to greater than or equal to 0.5. The operation of this function needs to be clarified.
- MF() — MF works as Monoflop. If Operand1 changes from less than 0.5 to greater than or equal to 0.5 the result is HIGH (value 1). The result stays HIGH for the specified "Time" in seconds. When the next positive edge is detected the function returns again a HIGH signal (value 1).
Syntax:
MF(Operand1; Time)
MF(Operand1; Time; Retrigger)
Examples:
MF("Channel1"; 5)
If "Channel1" changes from less than 0.5 to greater than or equal to 0.5. The result is HIGH (1) for 5 seconds and the set back to LOW (0). Retrigger function: If "Channel1" changes from less than 0.5 to greater than or equal to 0.5 within time and retrigger = 1 then time is extended with time seconds (in example 5 new seconds).



[AC_24]

- **COUNT (;)**

This function calculates the number of rising edges of Operand1 and can be reset by a rising edge of Operand2.
Syntax: COUNT(Operand1 ; Operand2)
Examples:
COUNT("Channel1"; "Channel2")
Increments the result each time when "Channel1" changes from less than 0.5 to greater than or equal to 0.5. If "Channel 2" changes from less than 0.5 to greater than or equal to 0.5 the result is set to zero.



- **TIMEDIFF (;)**

This function calculates the time difference between a rising edge of Operand 1 and a rising edge of Operand 2.
Syntax: TIMEDIFF(Operand1 ; Operand2)
Examples:
TIMEDIFF("Channel1"; "Channel2")
Increments the time difference if "Channel 1" changes from less than 0.5 to greater than or equal to 0.5. If "Channel 2" then changes from less than 0.5 to greater than or equal to 0.5 the time difference is set as the result.

Time between both rising edges is about 3,1 sec

The TIMEDIFF function is indicating this difference in the graph.

► SECOND ()

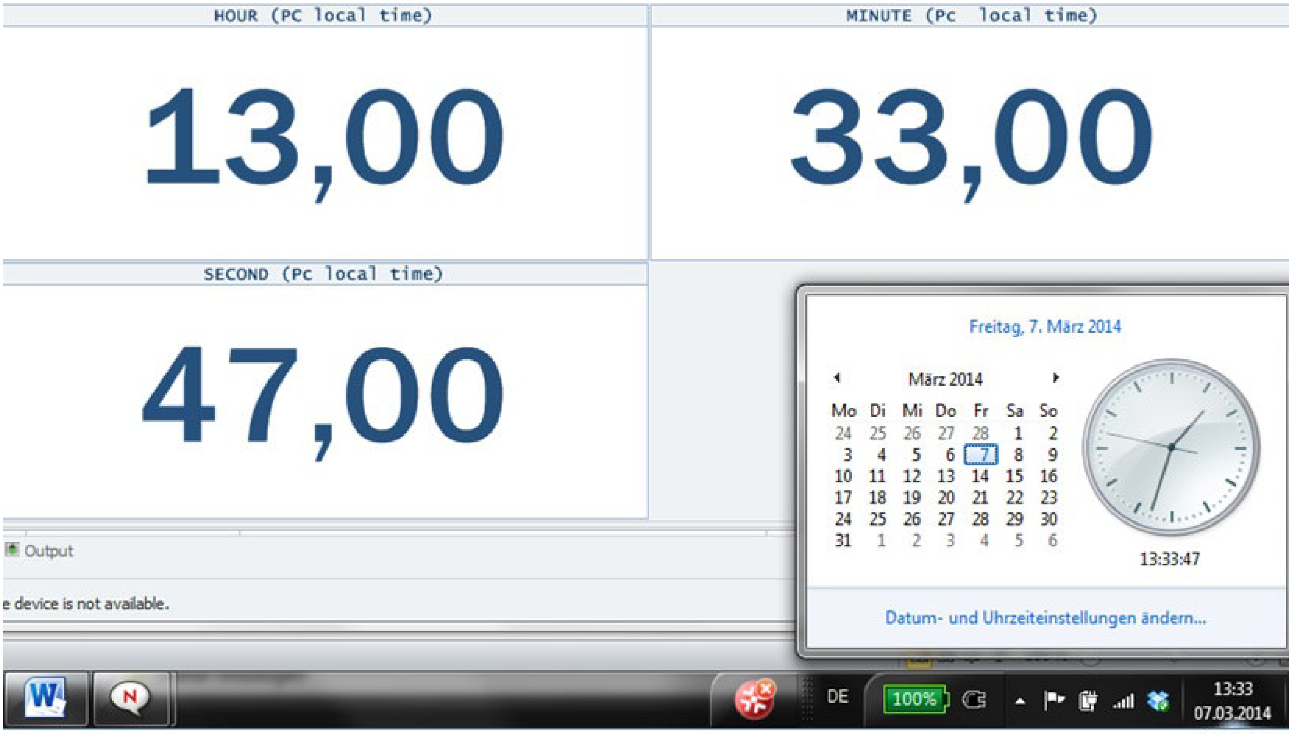
This function extracts the seconds from a local PC time.
Syntax:
SECOND(Operand)
SECOND(LOCALTIME)
Example:
SECOND(LOCALTIME) returns the seconds of the PC clock
SECOND(424366820) => 20 Function needs to be clarified.

► MINUTE ()

This function extracts the minutes from a local PC time.
Syntax:
MINUTE(Operand)
MINUTE(LOCALTIME)
Example:
MINUTE(LOCALTIME) returns the minutes of the PC clock
MINUTE(424366820) = 40 Function needs to be clarified.

► HOUR ()

This function extracts the hours from a local PC time.
Syntax:
HOUR(Operand)
HOUR(LOCALTIME)
Example:
HOUR(LOCALTIME) returns the minutes of the PC clock
HOUR(424366820) = 15 Function needs to be clarified.



[AC_27]

The function of the filters is explained in detail in the DATA MANAGER and ANALYSIS work space.

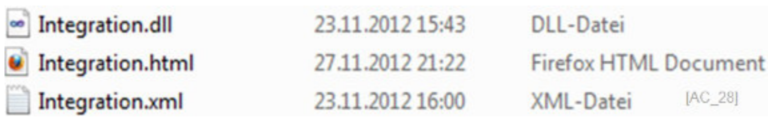
- FLT_BW_LP () — Applies a Butterworth low pass filter on a channel at a given frequency (Hz) and filter order (1-8 with 8 being the highest quality).
  Syntax:
  FLT_BW_LP(Operand; Cut-Off Frequency; Order; Sample rate)
  Examples:
  FLT_BW_LP("Channel 1";25;8;500) filters "Channel 1"
  Removes frequencies above 25 Hz. The source channel is sampled at 500 Hz. See chapter 18.28.2.
- FLT_BW_HP () — Applies a Butterworth high pass filter on a channel at a given frequency (Hz) and filter order (1-8 with 8 being the highest quality).
  Syntax:
  FLT_BW_HP(Operand; Cut-Off Frequency; Order; Sample rate)
  Examples:
  FLT_BW_HP("Channel 1";25;8;500) filters "Channel 1"
  Removes frequencies below 25 Hz. The source channel is sampled at 500 Hz. See chapter 18.28.3.
- FLT_BW_BP () — Applies a Butterworth band pass filter on a channel at a given frequency range (Hz) and filter order (1-8 with 8 being the highest quality).
  Syntax:
  FLT_BW_BP(Operand; Lower Boundary; Upper Boundary; Order; Sample rate)
  Examples:
  FLT_BW_BP("Channel 1";12;25;8;500) Filters "Channel 1" and removes frequencies below 12 Hz and above 25 Hz. The source channel is sampled at 500 Hz. See chapter 18.28.4.

- **FLT_BW_BS ()** Applies a Butterworth band stop filter on a channel at a given frequency range (Hz) and filter order (1-8 with 8 being the highest quality).
  Syntax:
  FLT_BW_BS(Operand; Lower Boundary; Upper Boundary; Order; Sample rate)
  Examples:
  FLT_BW_BS("Channel 1";12;25;8;500)
  Filters "Channel 1" and removes frequencies between 12 and 25 Hz. The source channel is sampled at 500 Hz. See chapter 18.28.5.
- **SAMPLERATE ()** This function returns the frequency of incoming messages / measurements. When you have 100 incoming messages per second the result is
  Syntax: SAMPLERATE(Operand)
  Example:
  SAMPLERATE(Sine-1) = 100
  The Sine-1 channel of the demo PlugIn has a sample rate of 100Hz.
- **SAMPLETIME ()** This function calculates the time difference between two incoming messages / measurements.
  Syntax: SAMPLETIME (Operand)
  Example:
  SAMPLETIME (Sine-1) = 0,010 Sec = 10ms
  The Sine-1 Channel of the demo PlugIn has 100Hz.
- **ANGLE (;)** This function calculates the angle from the source channels of your recorded data in the cartesion format. The order of Operand 1 and Operand 2 in the formula has NO impact of the calculated results.
  Syntax: ANGLE (Operand1 ; Operand2)
- **RADIUS (;)** This function calculates the radius from the source channels of your recorded data in the cartesion format. The order of Operand 1 and Operand 2 in the formula has an impact of the calculated results.
  Syntax: RADIUS (Operand1 ; Operand2)
  See chapter 19.5.2.

13.5 Add user-defined formulas

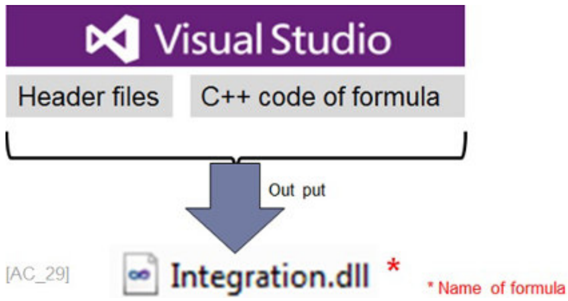
IPEmotion offers the functionality to integrate your own formulas. The main benefit for you is that you define complex functions in one DLL file which only needs the operands and returns the values. In many cases the syntax builder is not sufficient to execute complex math functions. Another advantage is that you can hide the internal calculations in the DLL and protect your knowledge. A user-defined formula consists of 3 elements.

- DLL covers the internal calculation
- HTML covers the help instructions which are displayed in the lower window of the Formula Parser
- XML this file links the formula to IPEmotion

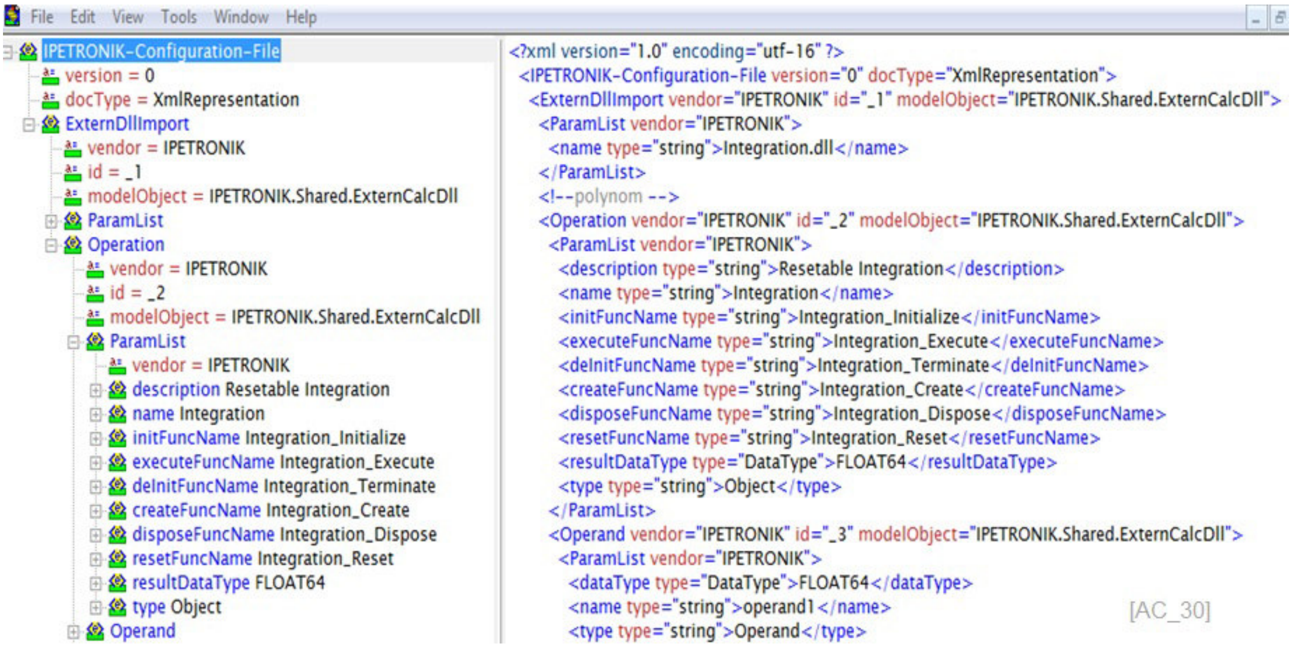


The process is the following: You develop your formula as C++ code and generate a DLL file.

.

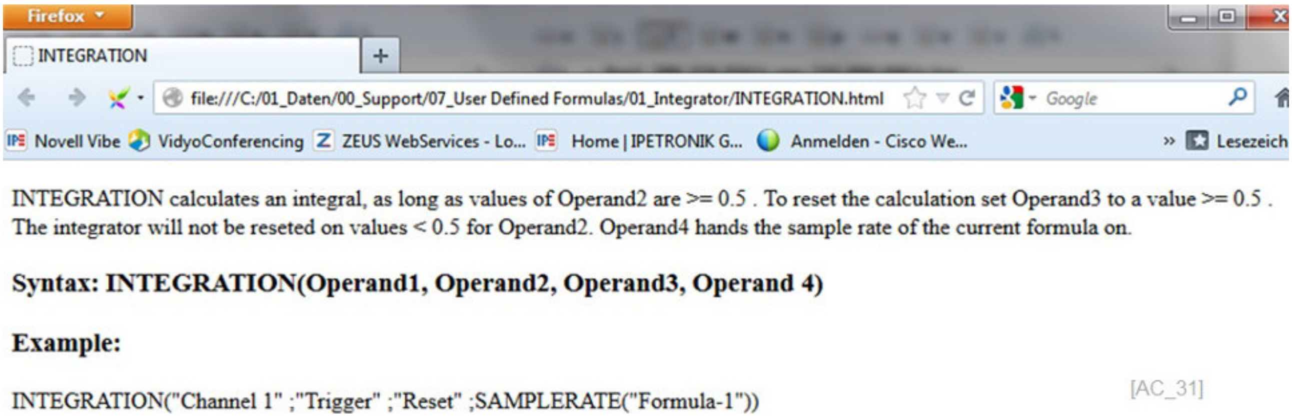


Then you define the XML file IPEmotion needs to recognize the formula correctly and to execute the calculations.



[AC_30]

The help file is not mandatory. It is an aid to show how to use the formula correctly.

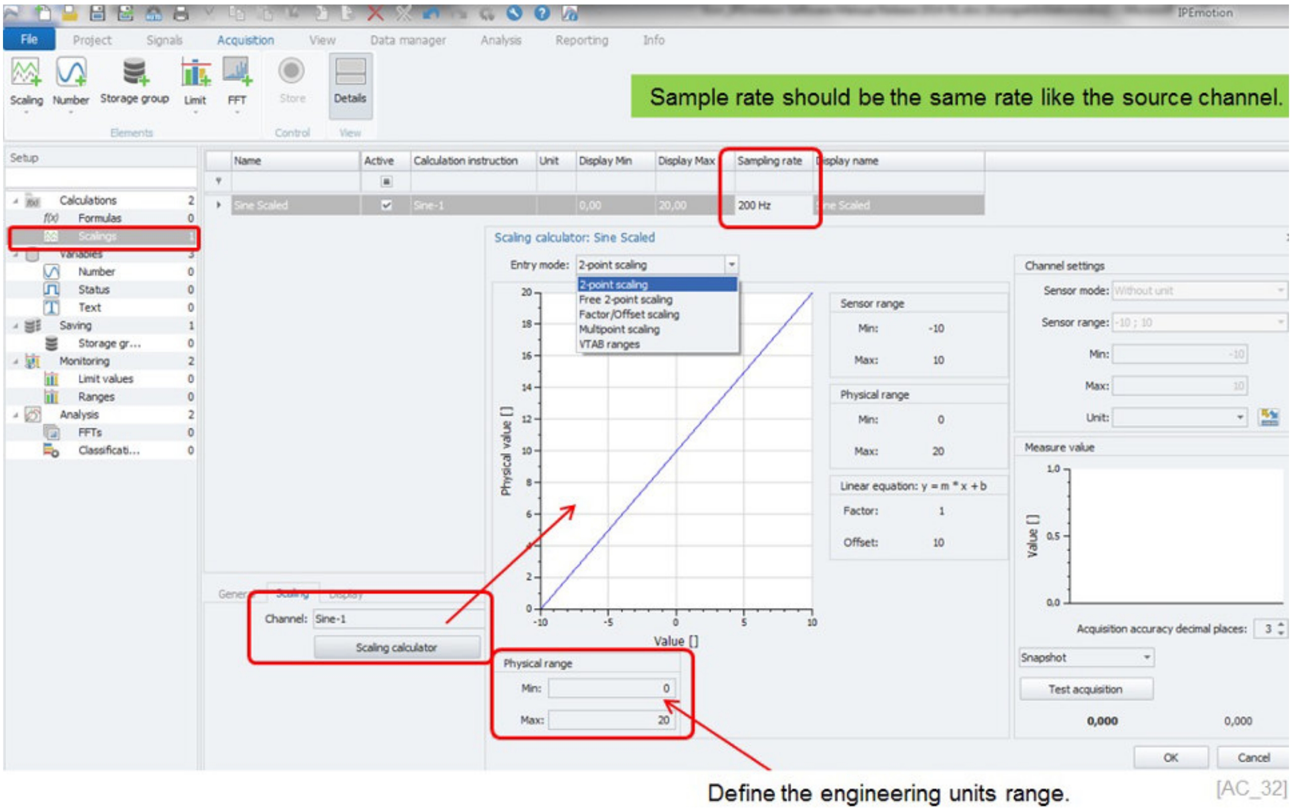


[AC_31]

The files need to be installed in the following directories:
DLL and the XML file are stored in the UserOperation folder. The directories are different depending on the IPEmotion version:
For win7: C:\Users\Public\Documents\IPETRONIK\IPEmotion\Custom\UserOperation
The help file needs to be translated and copied to all language folders the help file should be available in.
HTML file: C:\Program Files (x86)\IPETRONIK\IPEmotion 2016 R2.1\Help**en-US**

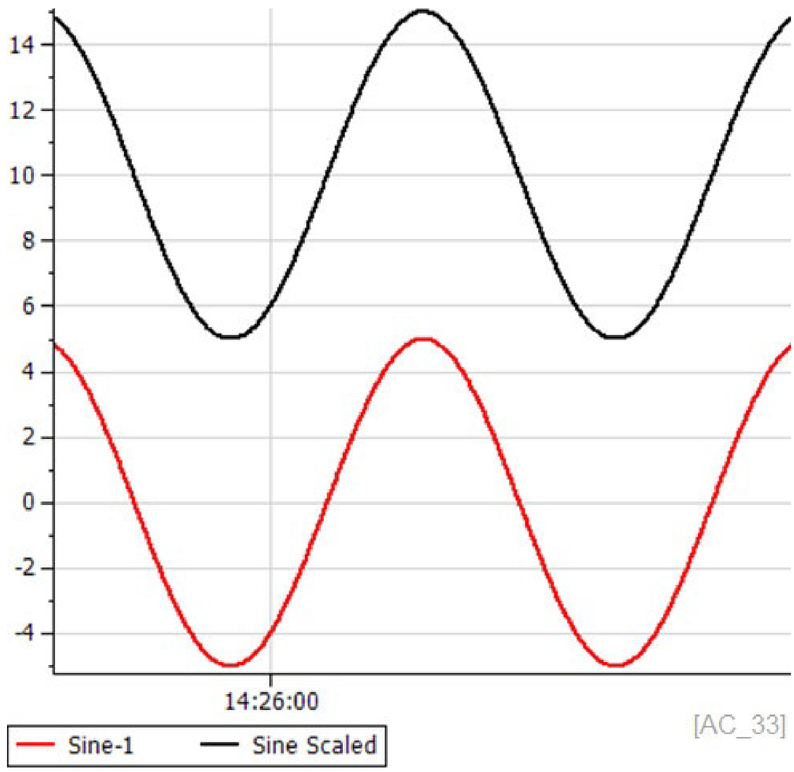
13.6 Scaling for any Channel

Channel scaling is mainly dedicated for input / output channel in the SIGNAL work space. However, with the scaling channel in the ACQUISITION work space you can additionally scale any type of formula or variable channel.



[AC_32]

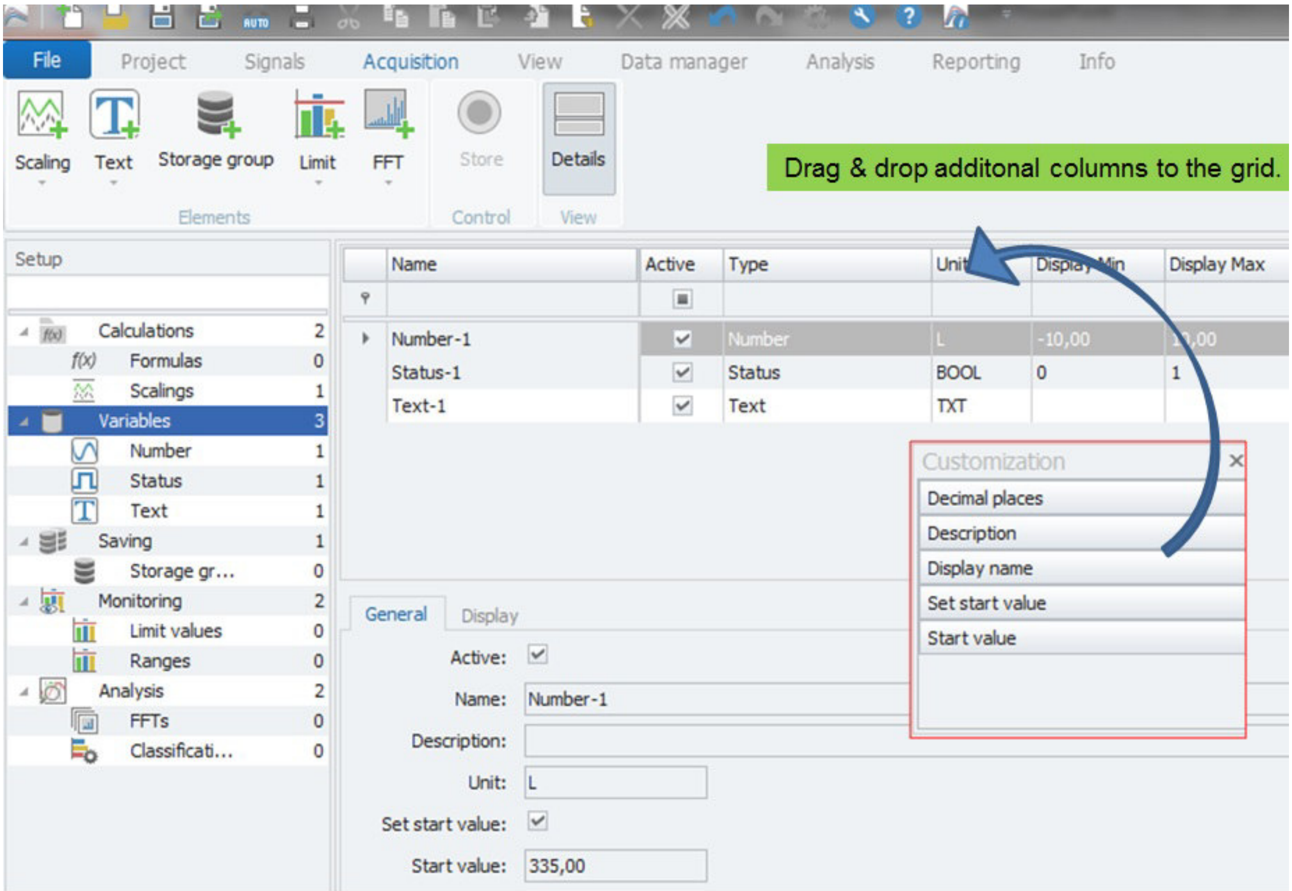
The example below compares the original source signal Sine-1 and the scaled one.



[AC_33]

13.7 Variables

Variables are very important channels to store values or to integrate them into formulas in order to dynamically change calculations through updated variables. Usually, the variables are not visible for you. You have to activate the variables in the OPTIONS > Expert Mode > Variable Configuration. See chapter 22.3.4. With the column chooser you can add additional columns to the grid.



[AC_34]

For each variable type you can define the following settings:

- **Active** — Active variables are considered in the related functions
- **Name** — Name of variable
- **Description** — Description to add supplementary information to the channel. The description is stored in the store files and also exported to other file formats
- **Unit** — You can enter any unit
- **Set Start Value** — With this checkbox you will activate the start value function. A specific number or text will be displayed at measurement start.
- **Start Value** — The actual value which will be made visible and which will be stored. For some applications it is very important that the measurement is started with a specific first value in order to ensure that all calculations and logic functions are operating correctly.

13.7.1 Number Variables

Number variables accept numeric values only.

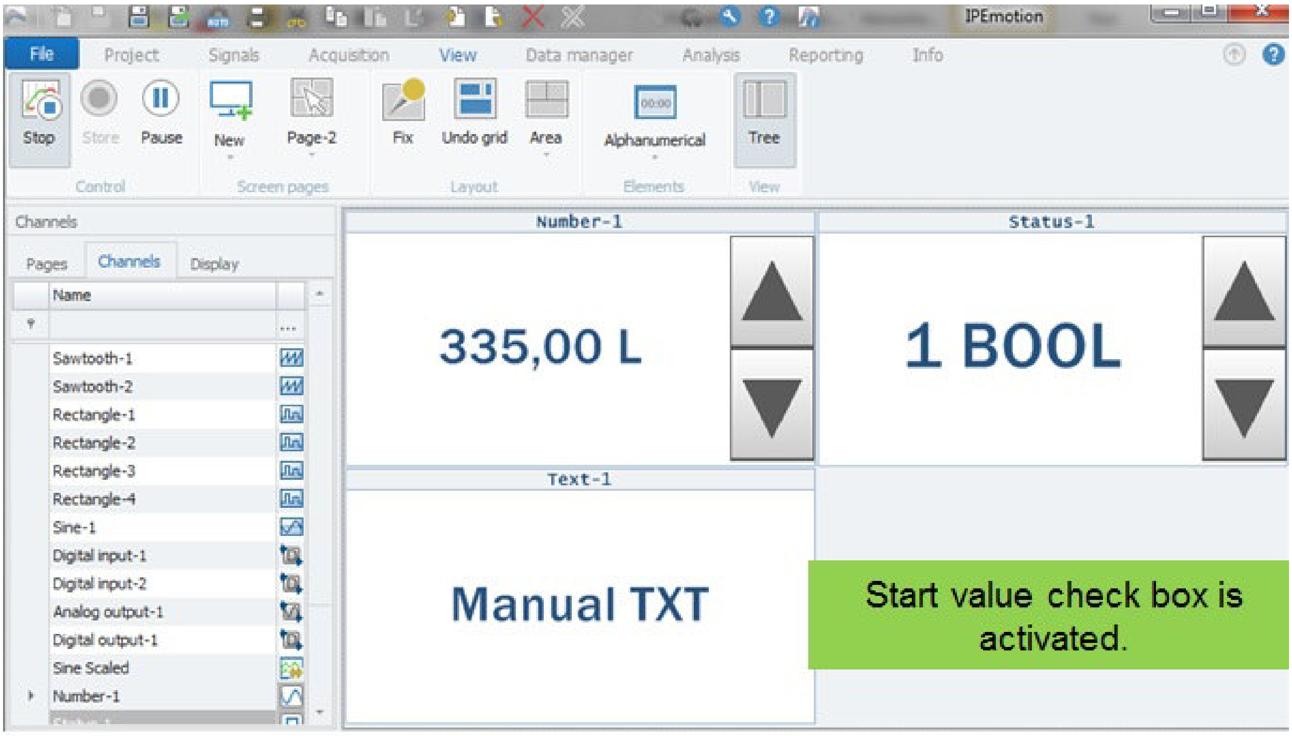
13.7.2 Status Variables

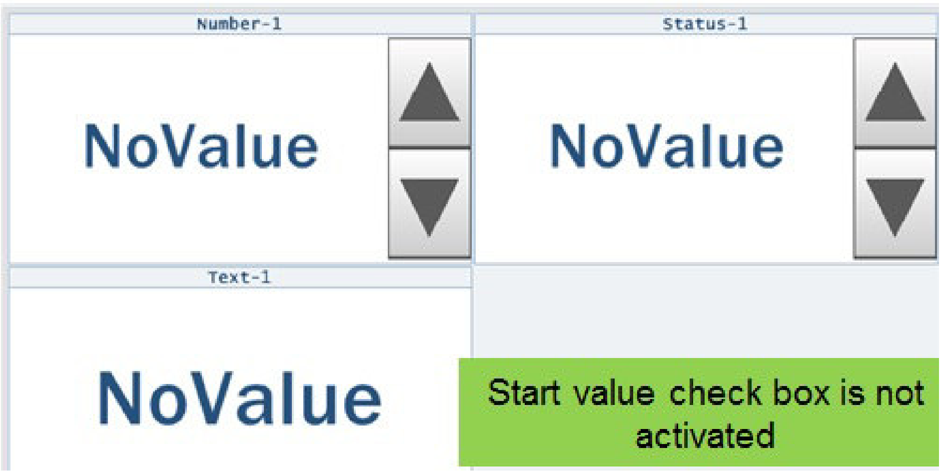
Status variables only accept 0 or 1 status values.

13.7.3 Text Variables

Text variables accept text and numbers.

The screenshot below indicates the different behavior with activated and defined start values and deactivated start values which display “NoValue” in the instruments.

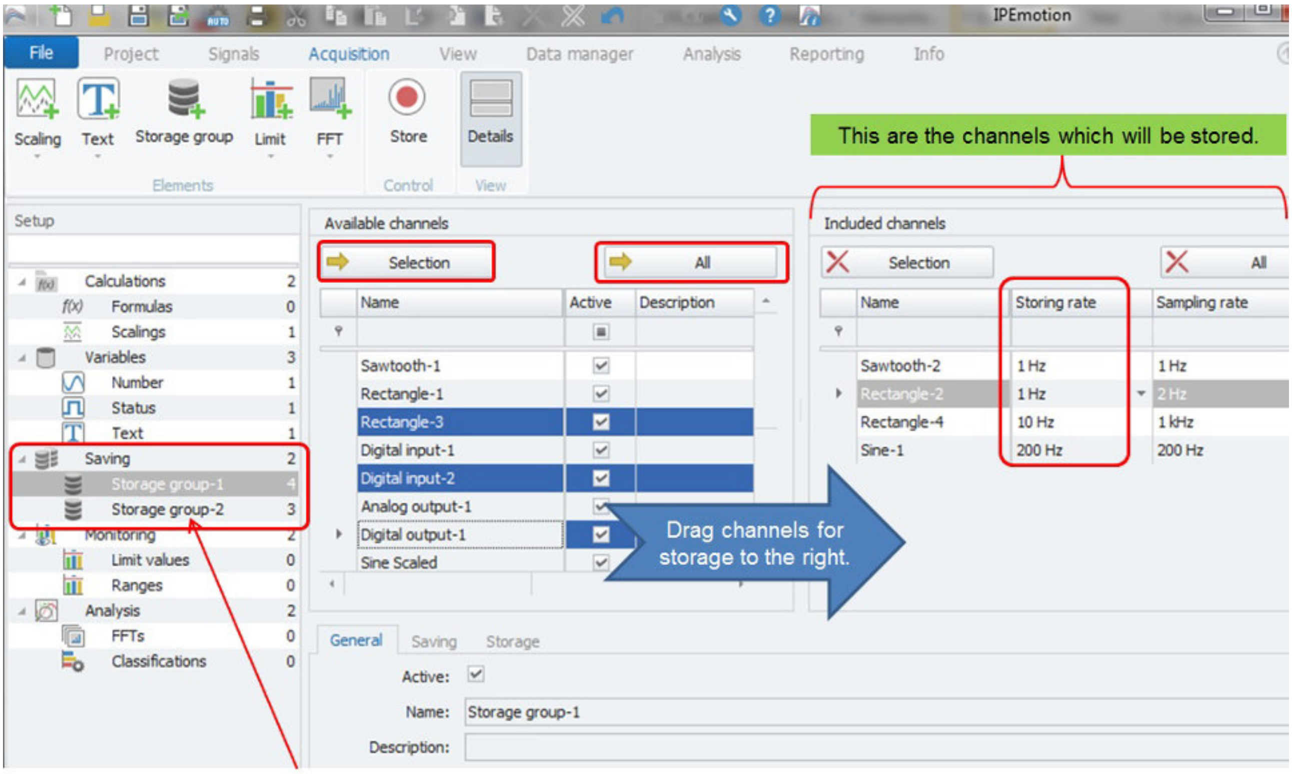




[AC 35]

13.8 Data Saving – Storage Groups

The data storage function is an important function of a data acquisition software. IPEmotion is designed in a way that the data storage functions run in the highest task classes to ensure a safe operation of the data saving process. Other functions which update the GUI to show online data on graphs and diagrams have a lower task priority. The most important highest priority threads are the storage functions and the test sequencing functions if you use the CONTROL module which will be discussed at the end of this chapter.



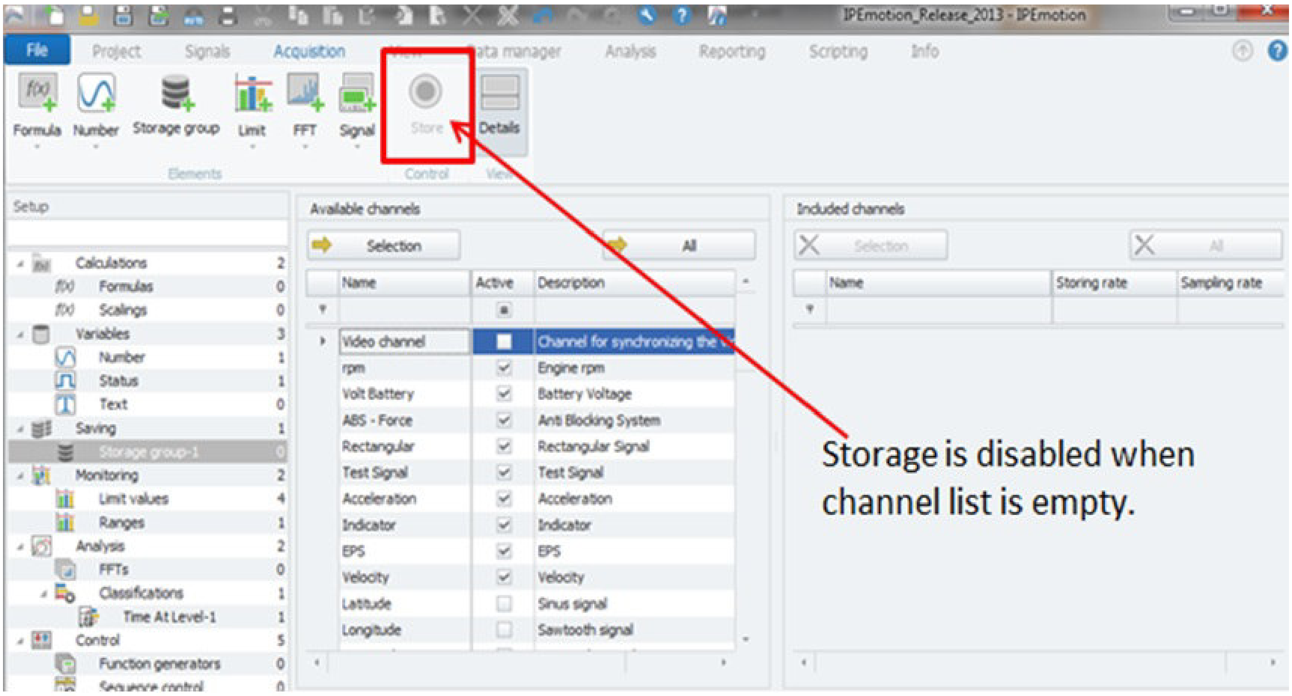
Overview of the storage groups. [AC_36]

One store group is automatically created by IPEmotion. On the left side you see all channels and with drag and drop or through selections you can move channels to the right side. All channels on the right side are stored in the data file.
A status channel is related to every store group. When storage is active (saving mode) the status of this channel is HIGH and is recorded with the value 1.

13.8.1 Data storage only enabled when channels are included

The data storage button is only enabled when channels are included in the store group.

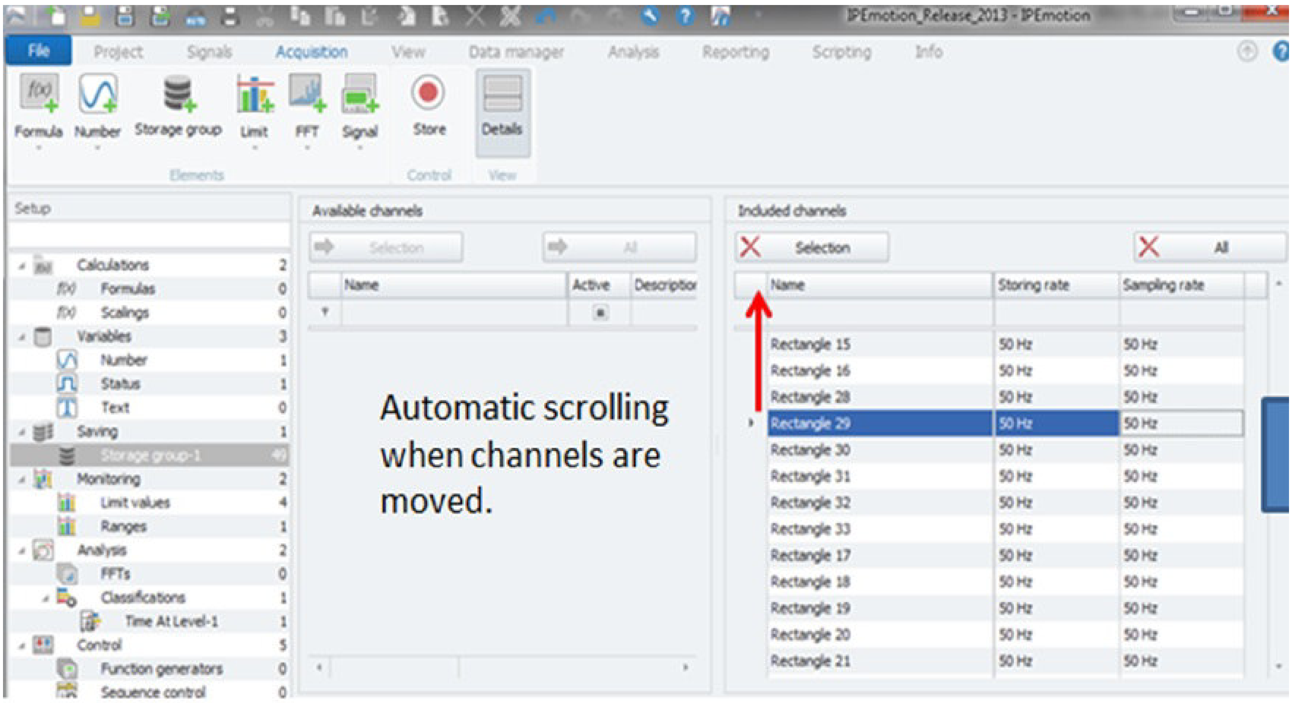
⚠ ***Attention!*** *The button is enabled even if the channels included in the store group are not activated. In this case, the data file will be empty.*



[AC_37]

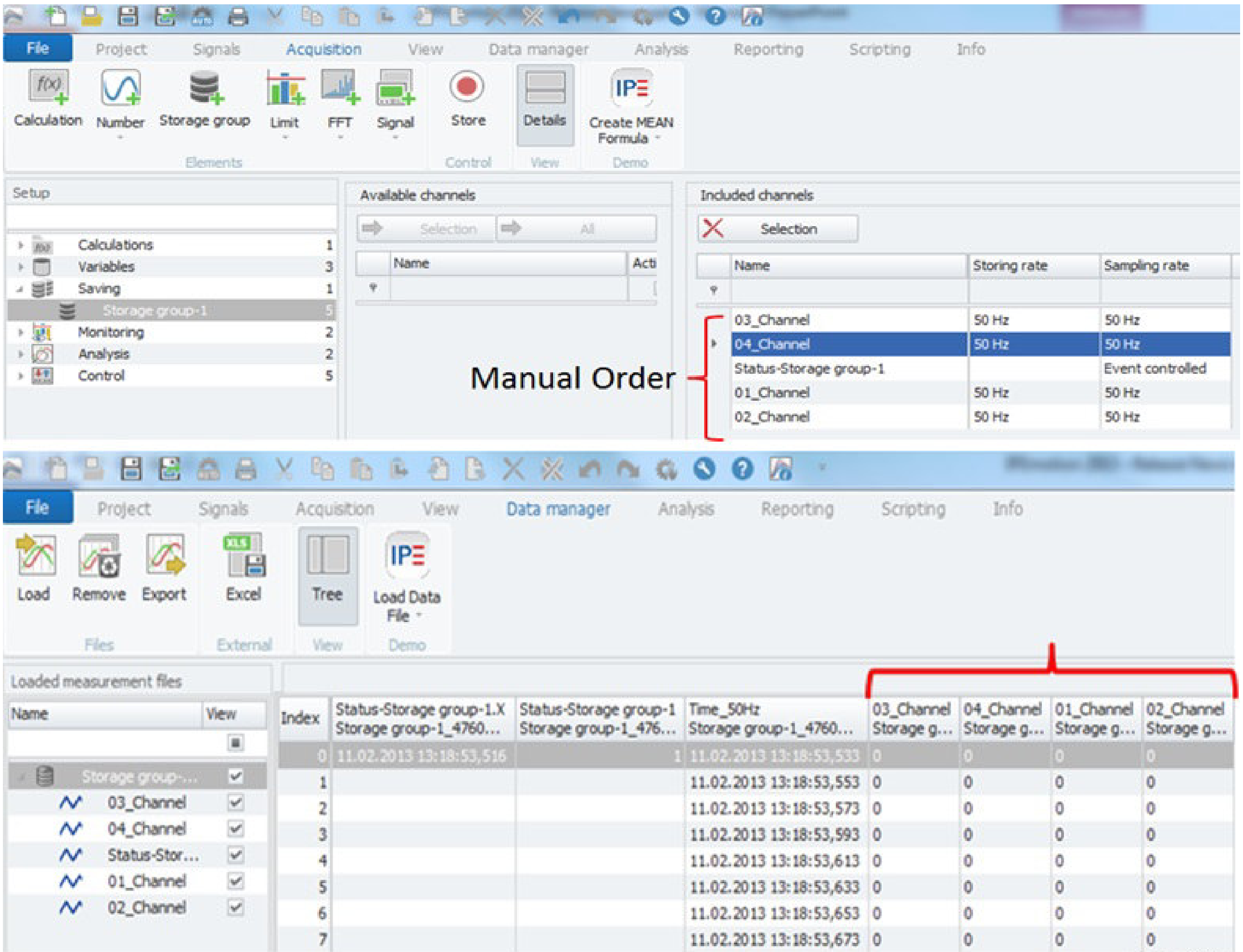
13.8.2 Automatic scrolling function at moving channels in the channel list

You can change the order by moving channels up and down. In channel lists with many items this is easy because a scroll bar is available. The channel list is automatically scrolling when you reach the top or bottom end of the channel grid.



[AC_38]

The order of the channels in the store group can be manually modified. Just drag and drop the channels to the required position. The order of channels in the store group is also considered in the data manager and in the data export.

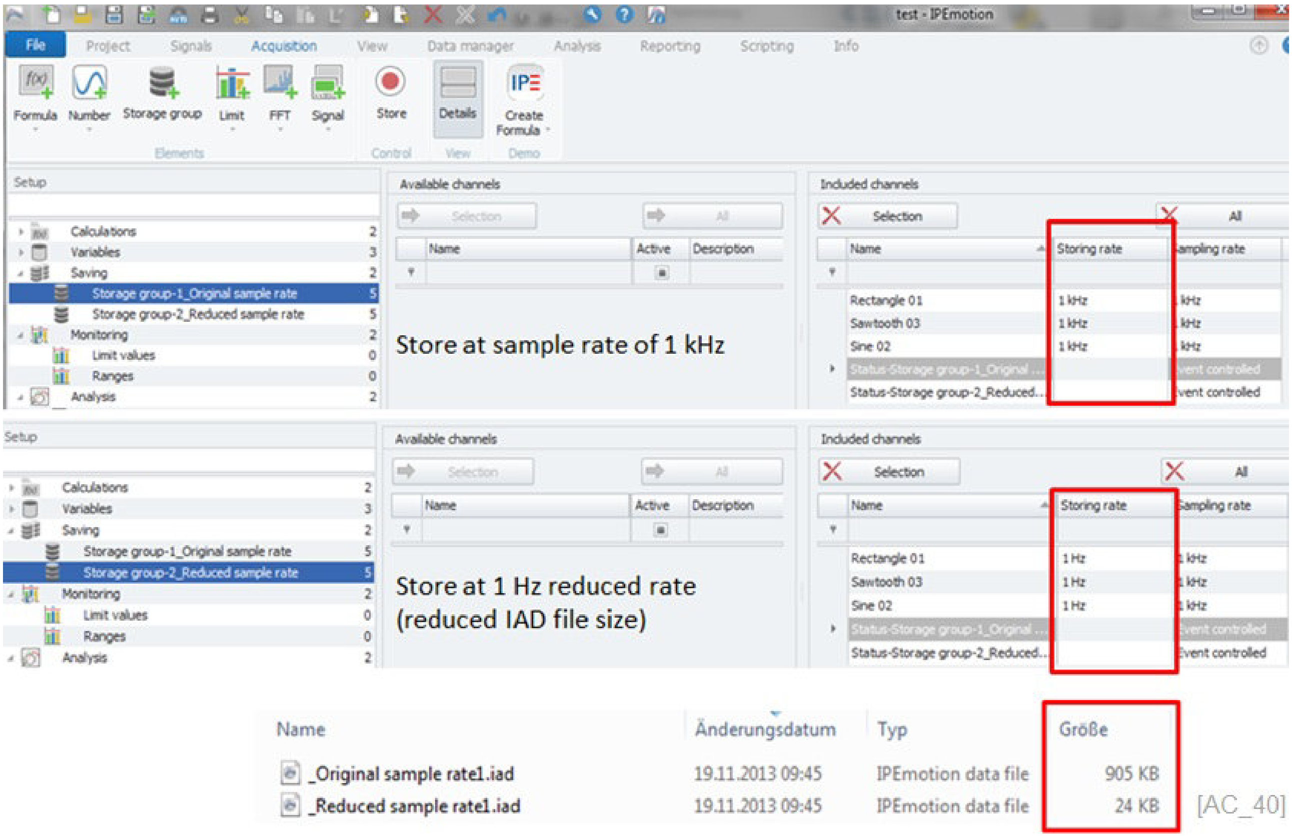


[AC_39]

13.8.3 Storage rate – reduce data file size

You may want to reduce the data file size by reducing the storage rate. Therefore you can define a storing rate smaller than the sample rate of the inputs. This function is just reducing the number of samples. If you measure 100 Hz and you store at 10 Hz, 90 samples are not stored.

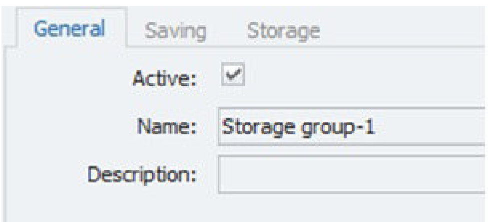
When you reduce the storage rate, this has an immediate effect on the final IAD data file size. With the storage rate reduced, the files are also getting smaller.



[AC_40]

13.8.4 Storage Group – General tab sheet

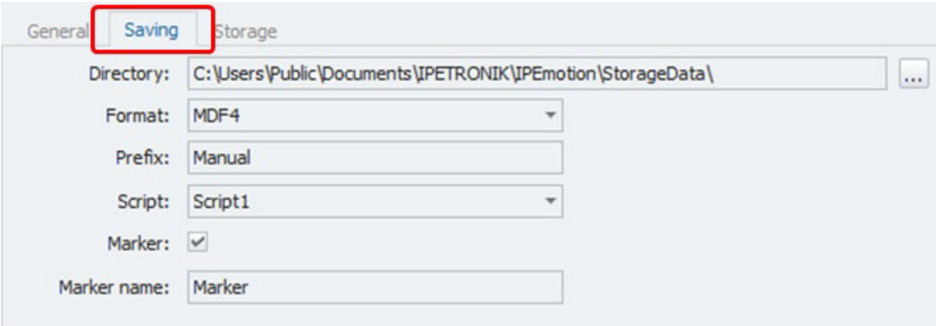
In the general tab sheet you define the status active / inactive storage group, the name and an optional additional description.



[AC_41]

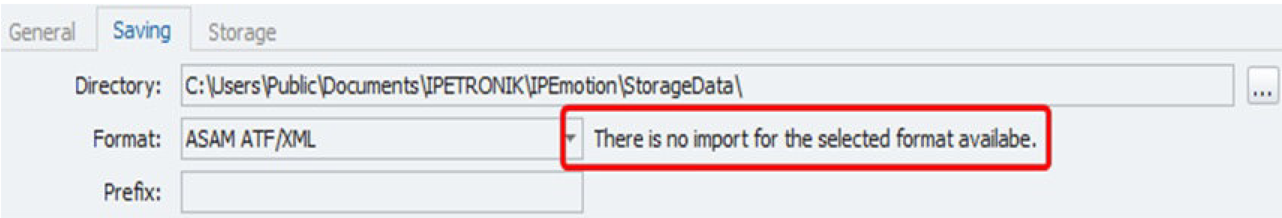
13.8.5 Storage Group – Saving tab sheet

The saving tab sheet is very important as you can configure many saving options.



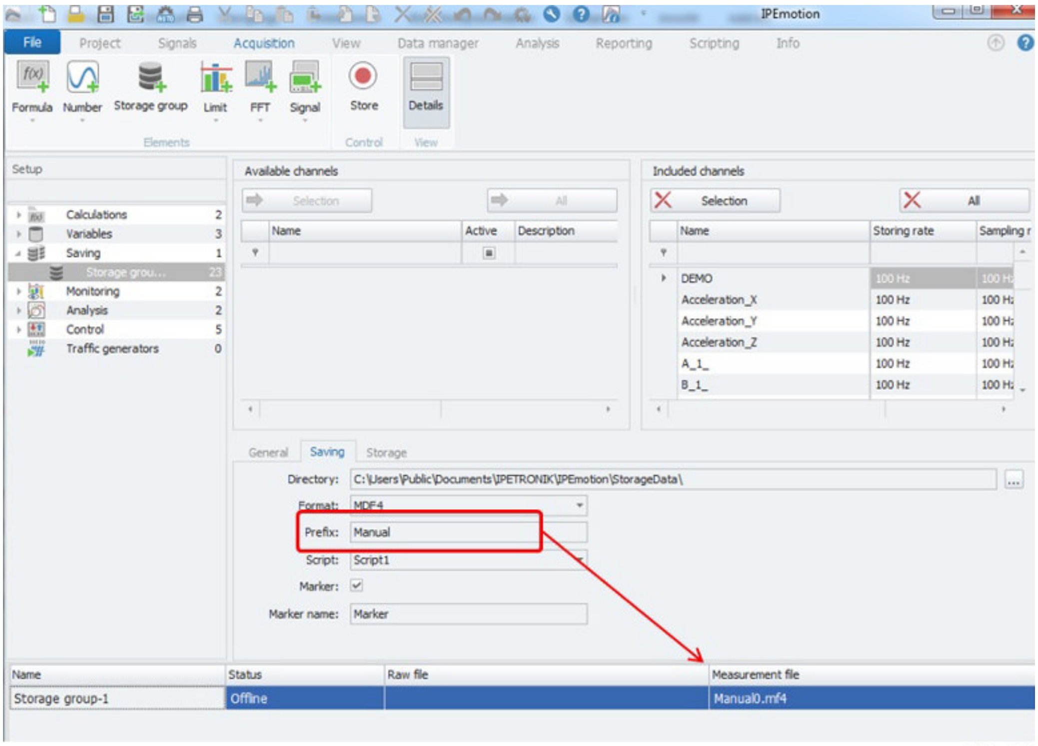
[AC_42]

- **Directory** — The default directory is defined in the OPTIONS > Directory. For more details see chapter 22.11.
- **Format** — When you select a data storage format from the dropdown list which is not supported for import you will get a message that an import is not supported.



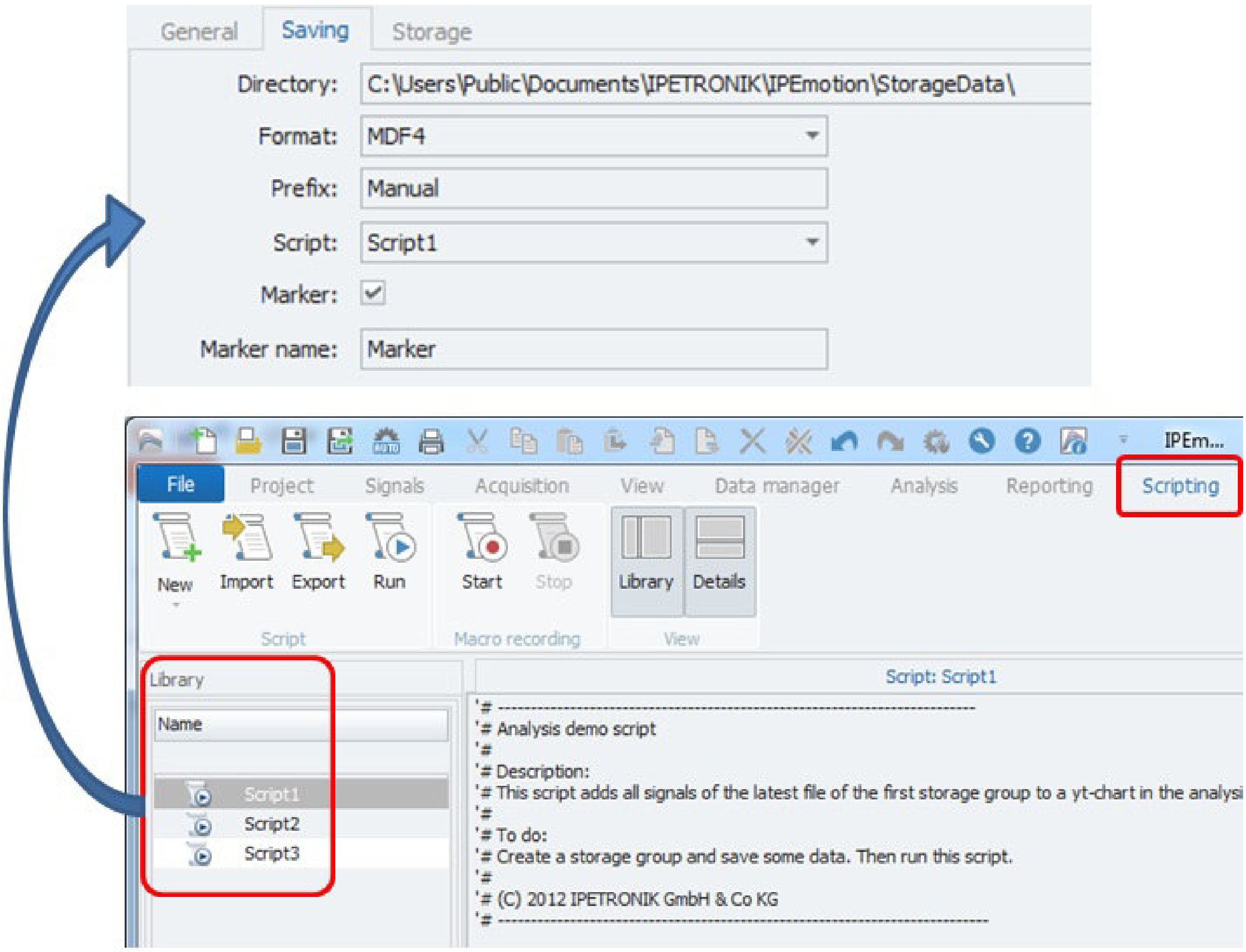
[AC_43]

- **Prefix** — With the prefix you can define a name for the data file. When you generate several data files they are indexed through an incrementing counter



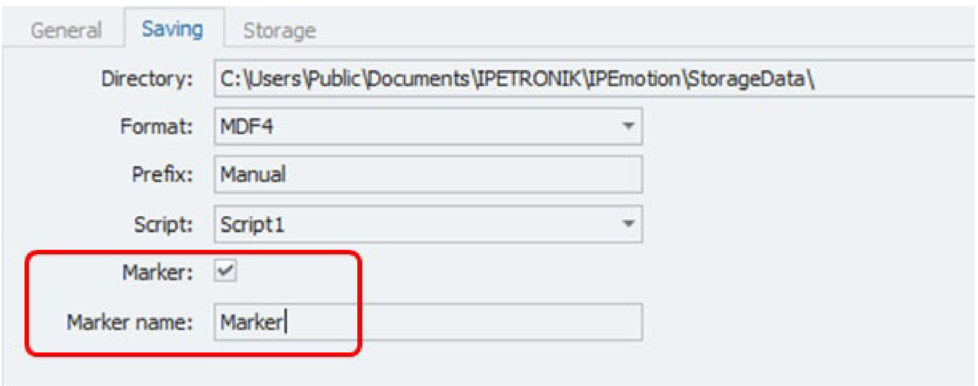
Measurement file with prefix. [AC_44]

- **Script** — In Script you can select from a pull down menu all scripts created in the SCRIPTING work space. The script will be automatically executed when the storage is finished.



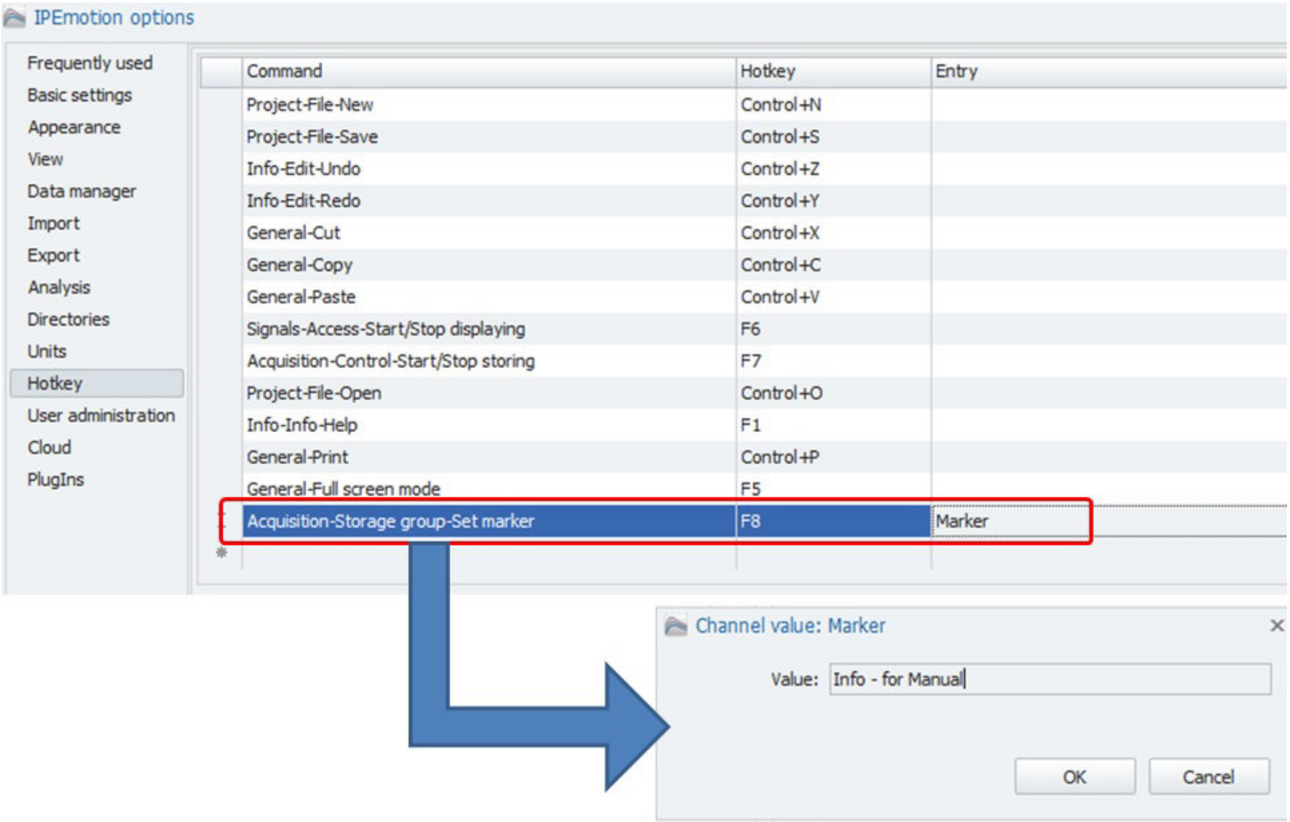
Scripting work space in Professional and Developer Edition. [AC_45]

► Marker — Marker channels are important for adding text comments to a data file. You can include a generic Text channel from the variables or a special Marker channel from the storage group options to save text information during data recording.



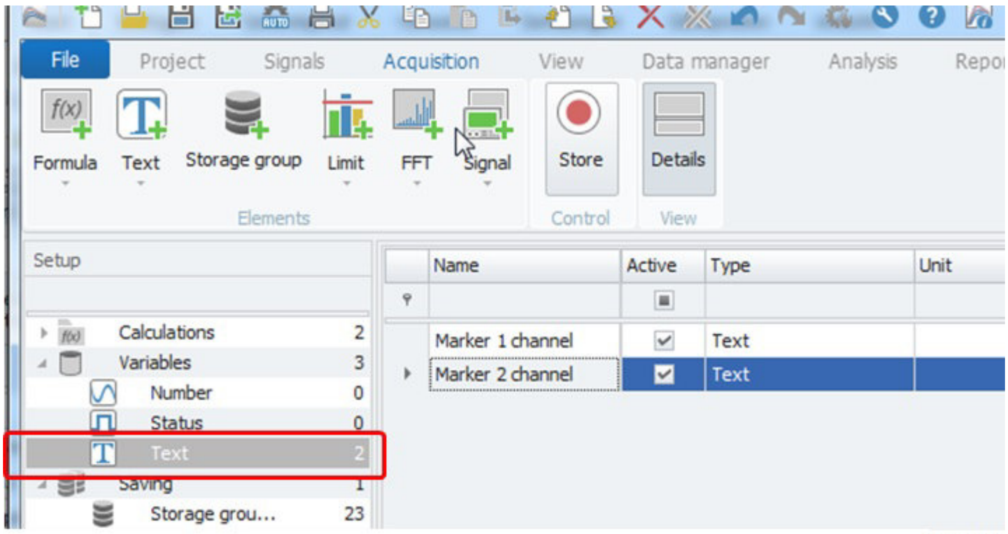
[AC_46]

► Marker - HotKey — If you like to operate a marker through a hotkey please see OPTIONS > HotKey chapter 22.13. When you define a HotKey for the Marker channel and you hit this hotkey during recording you will get a pop-up message box to enter your comment.



Marker input window comes up. [AC_47]

- Marker - Text channel: To add text information (comments) to your data file you can link the text channels to an alphanumerical instrument. Through this instrument you can add text comments to the data file.

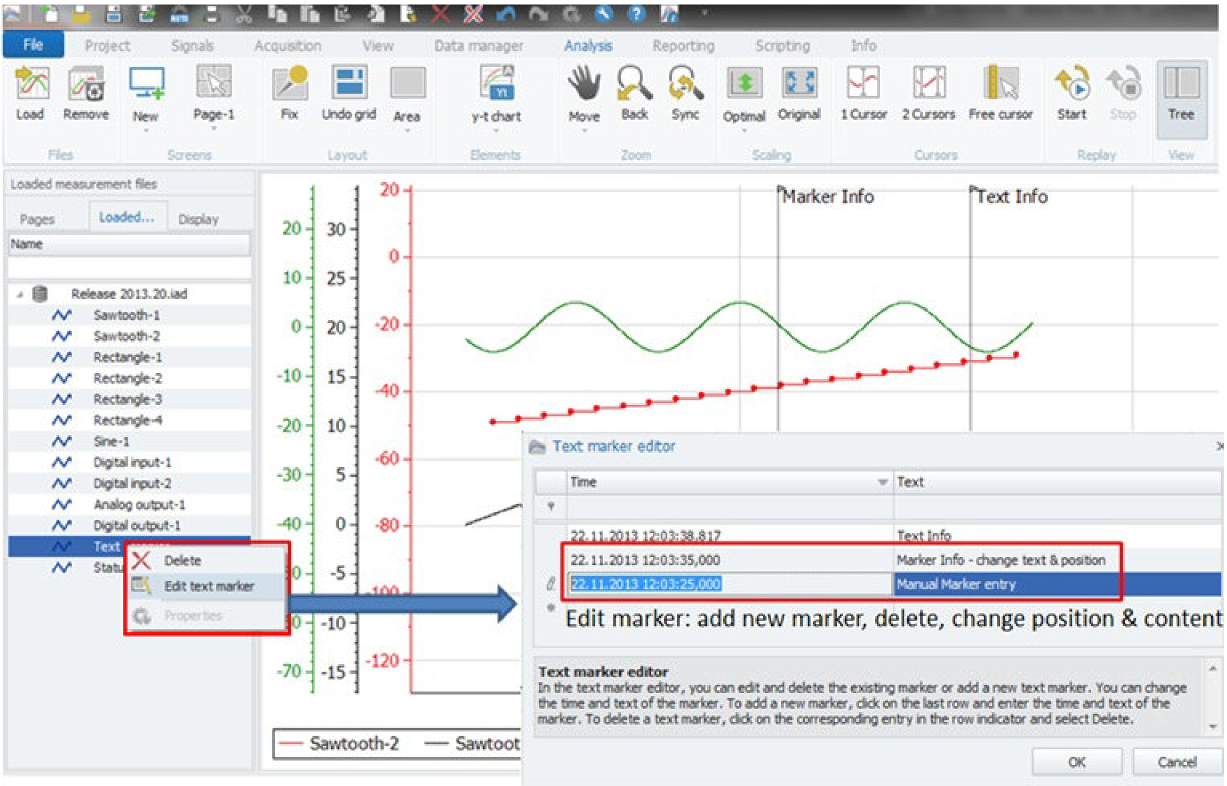


User Text variables for marker recording in the data files [AC_48]

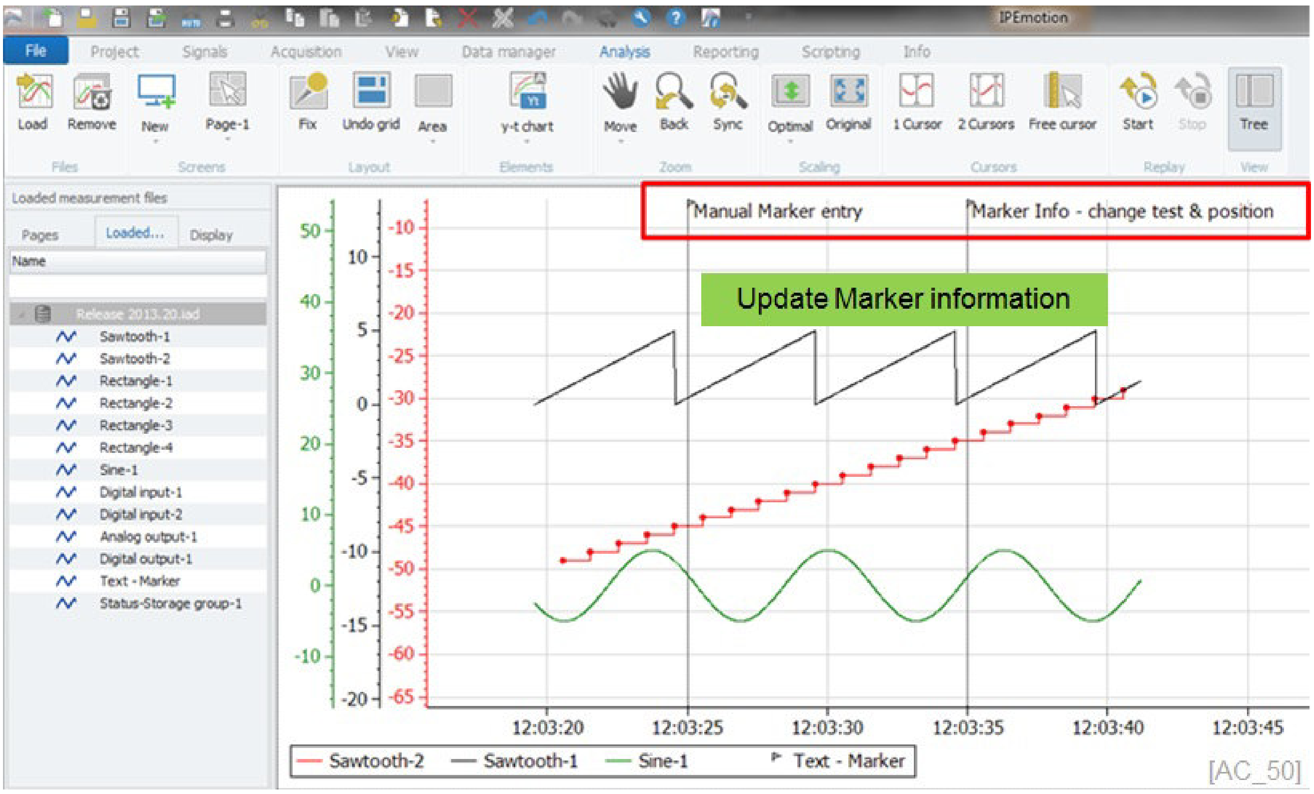
When one or more text channels are included in the data file, they can be modified in the ANALYSIS work space. You can select from the following different transactions.

- To add new text comments for a specific time stamp
- Rename and change the text comment of an existing marker
- Change the position of an existing marker
- Delete a marker from the file

When you have applied all the marker changes the graph gets updated with the new marker information as indicated on the screenshots below. In order to save the updated marker information you need to export the data to a new file.



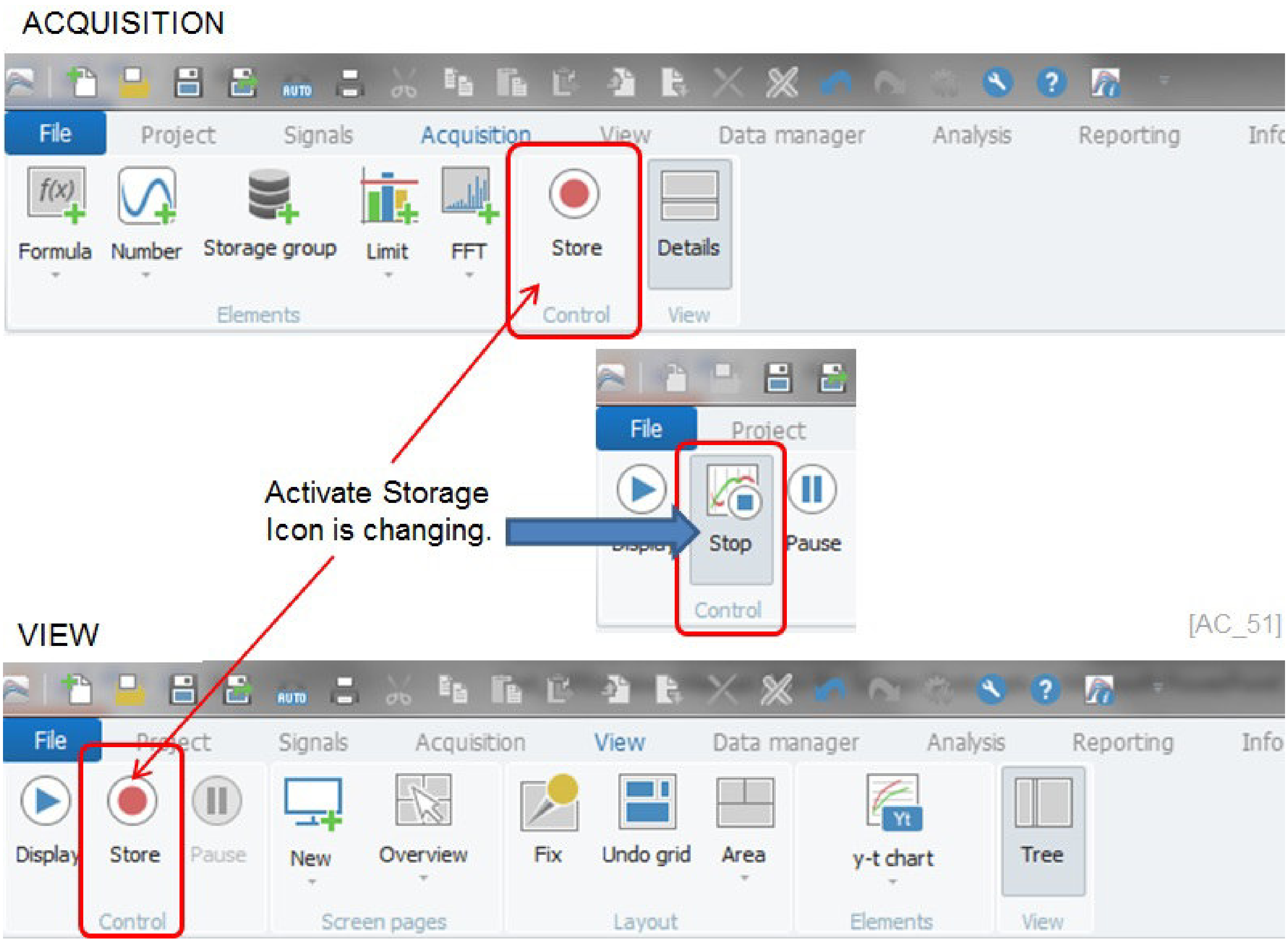
[AC_49]



[AC_50]

13.8.6 Storage Group – Storage tab sheet

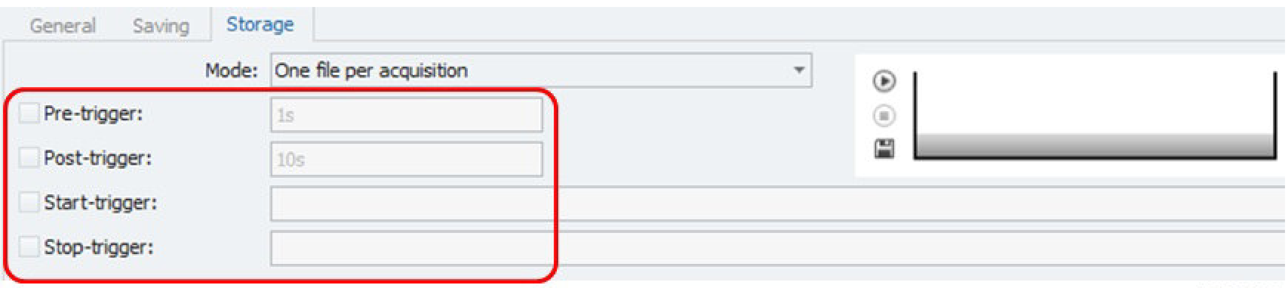
The storage tab sheet is related to the storage trigger functions. The standard storage group operation is to activate / deactivate the data storage through the store button in the ribbon. You can access the storage button in the ACQUISITION and VIEW work space.



[AC_51]

Information		*You can activate / deactivated data storage without stopping the overall measurement. The data storage can be operated independently from the overall measurement (display) of online values in instruments.*

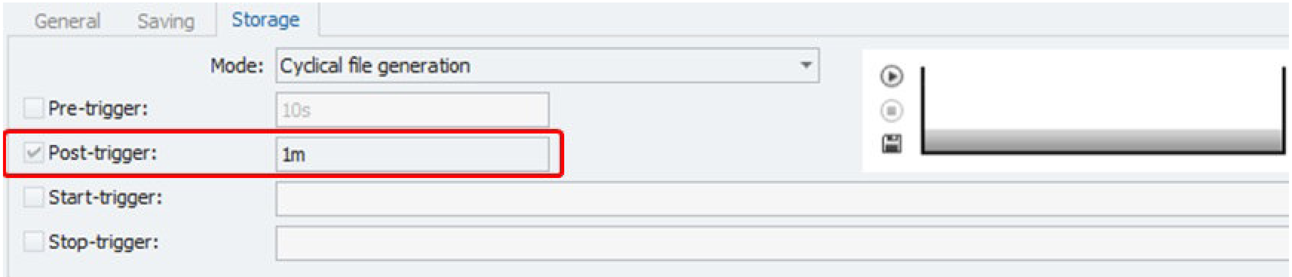
- Storage Mode — You can select from 3 different storage modes
- One file per acquisition — In this storage mode you start and stop data storage through the buttons in the ribbon. The trigger conditions are disabled



Trigger configurations are disabled.

[AC_52]

- Cyclical file generation — In this storage mode you can define the Post-trigger time in [s, m, h].When this mode is selected the software is automatically generating a file after the Post-trigger time has elapsed. You need to activate the storage only one time through the ribbon and then the files are automatically generated in the defined time interval.



Cycle time is defined though „Post-trigger“

[AC_53]

- Triggered data storage

This storage mode offers you the largest flexibility to define trigger events for the data storage process. You can define Pre- and Post-trigger times. Depending on the selected trigger configuration the graphic is updated to visualize the storage process. With a Pre-trigger you can capture data and events before the trigger condition is true. This function is very practical if you need to analyze signals before the trigger event. With the Post-trigger time you define for how long the storage will remain active even if the trigger condition is not true anymore. When you only define Pre- and post-trigger times you can still operate the data storage through the Store button in the ribbon. However, you are not obliged to.

[AC_54]

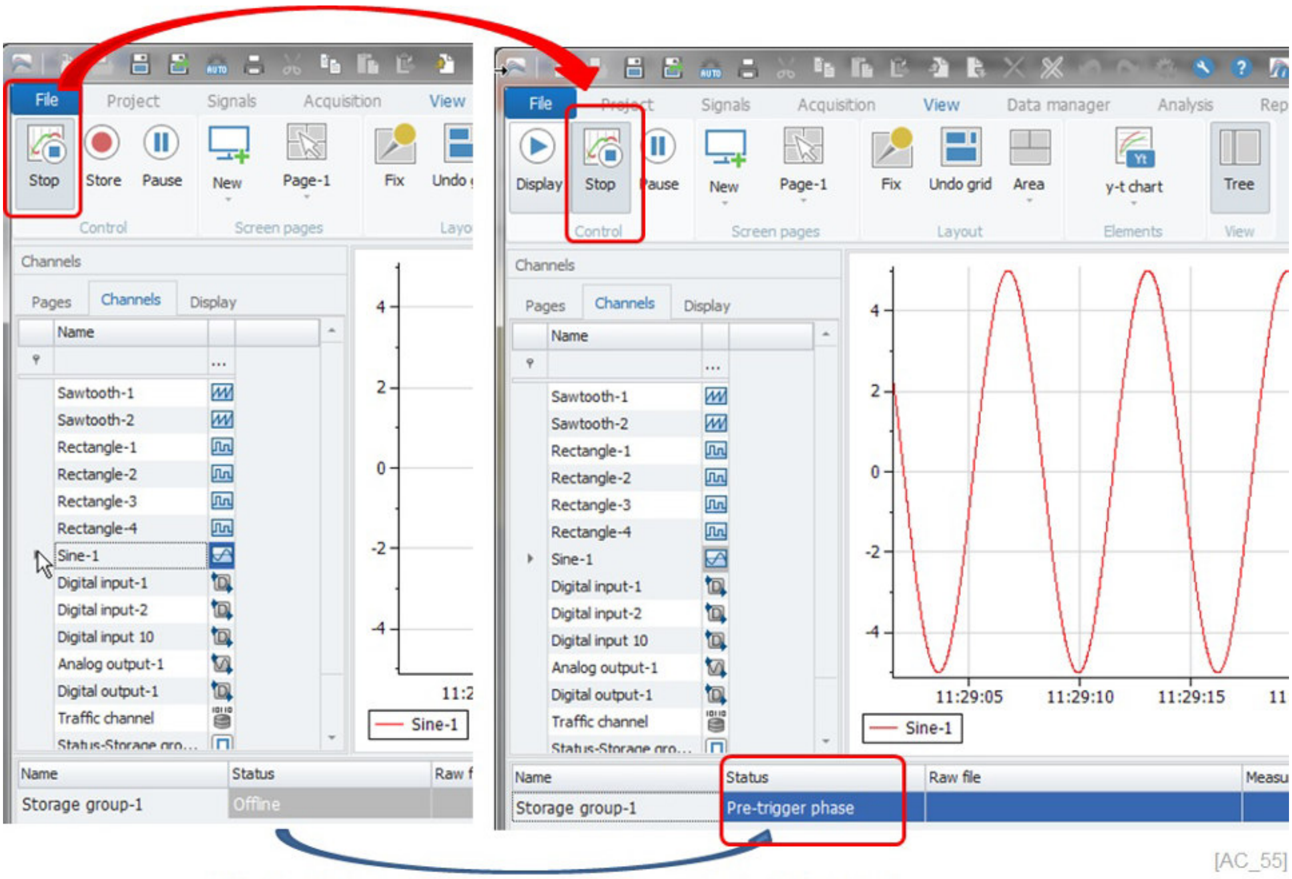
The Start and Stop Trigger can be defined through the Formula Parser interface. You are free to define any trigger condition taking math and logic functions supported by the Formula parser. In the example above, a limit monitoring function was configured to start and stop the data recording when a digital Input is HIGH (> 0,5) or LOW (<0,5).

Information

Please note that the activation of the measurement (online data is displayed on the screen) never activates the storage process. If you want to activate the data storage you need to hit the store button. This is also needed when you have configured a triggered data storage.

Information

In many cases users think they need to start the measurement and the trigger condition will start the data saving. This is not true. The overall data saving needs to be armed / activated and in the storage status window you will see a status message like Offline or Pre-trigger/Storing and Waiting. The storage status windows were discussed in the application menu in chapter Administration > View 6.6.

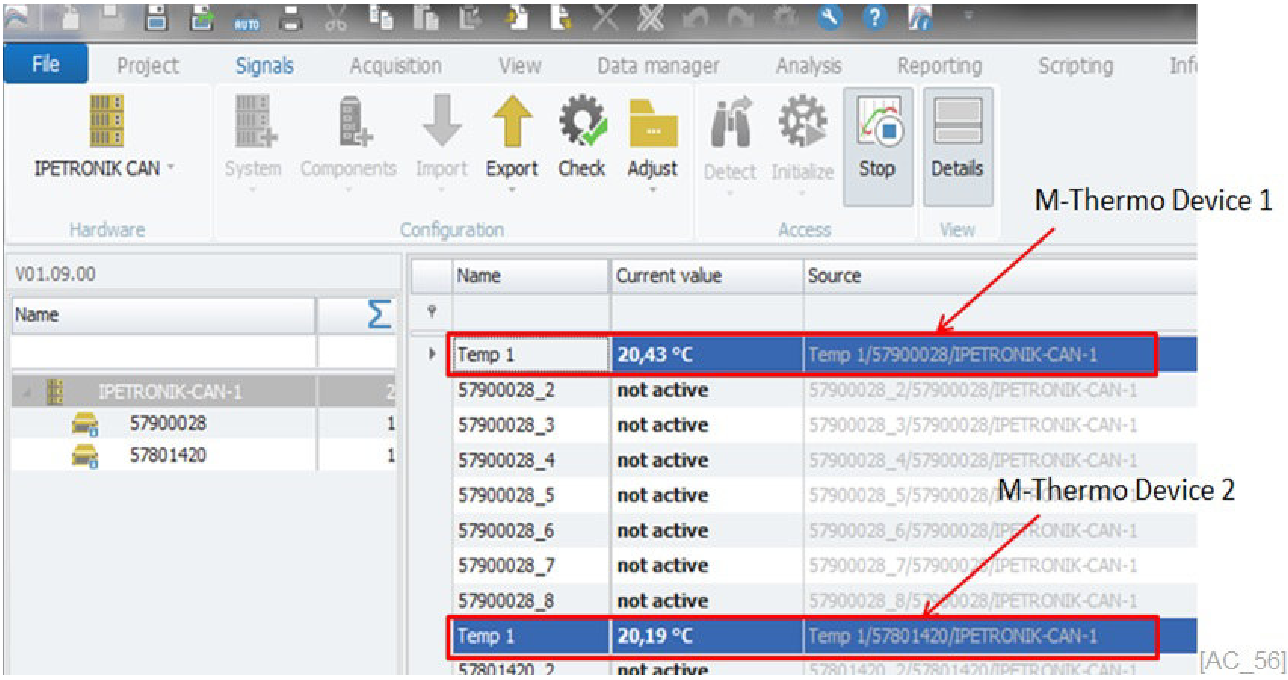


[AC_55]

Display of online data is not automatically activating data storage.

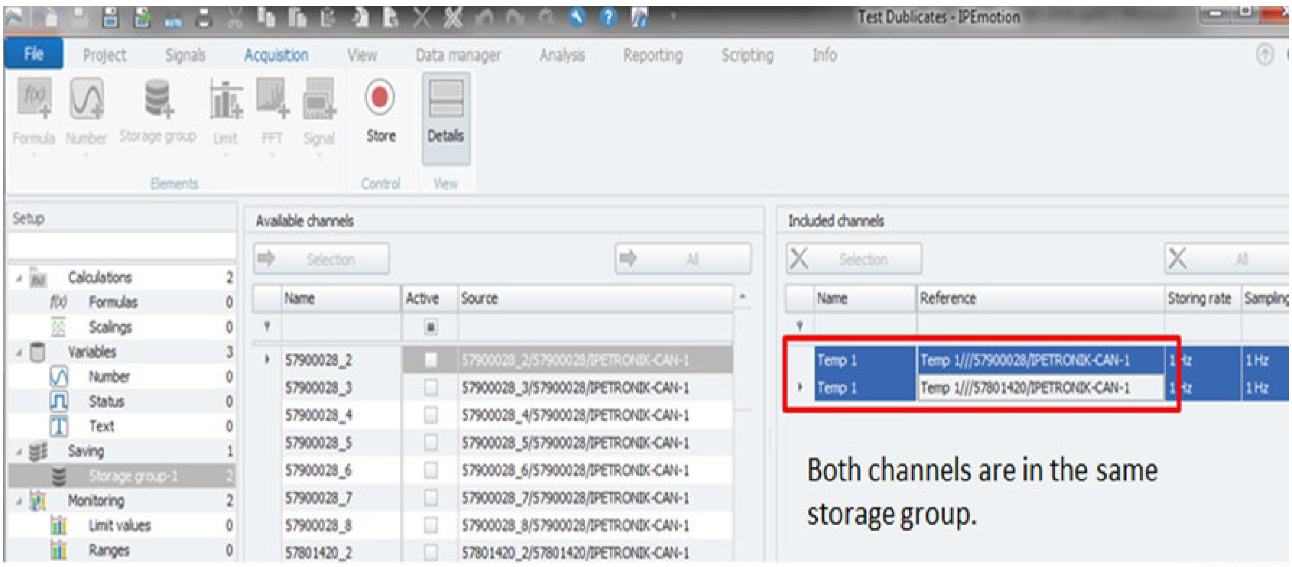
13.9 Storing duplicate channel names

You can store duplicate channel names in a storage group, in case these channels have different sources. It is mandatory that duplicate channel names have different sources / references. For example, having one measurement module or ECU or a common CAN interface and you define a duplicate channel name, it is still rejected and cannot be stored.



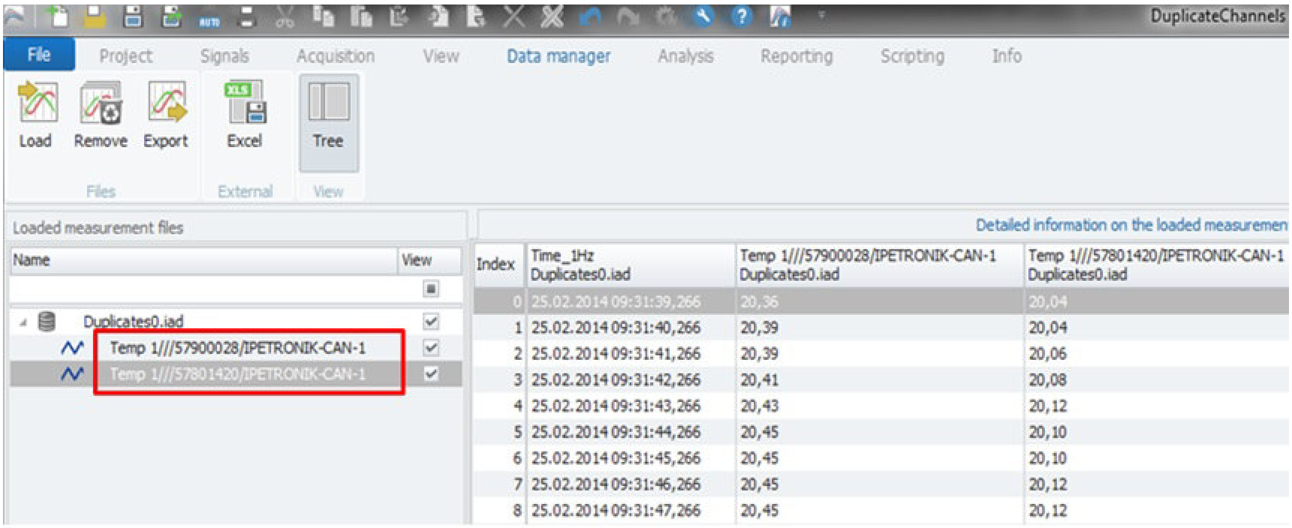
[AC_56]

Both channels named “Temp 1” come from two different devices and can be stored in a common storage group. It is recommend that you add the column Reference.



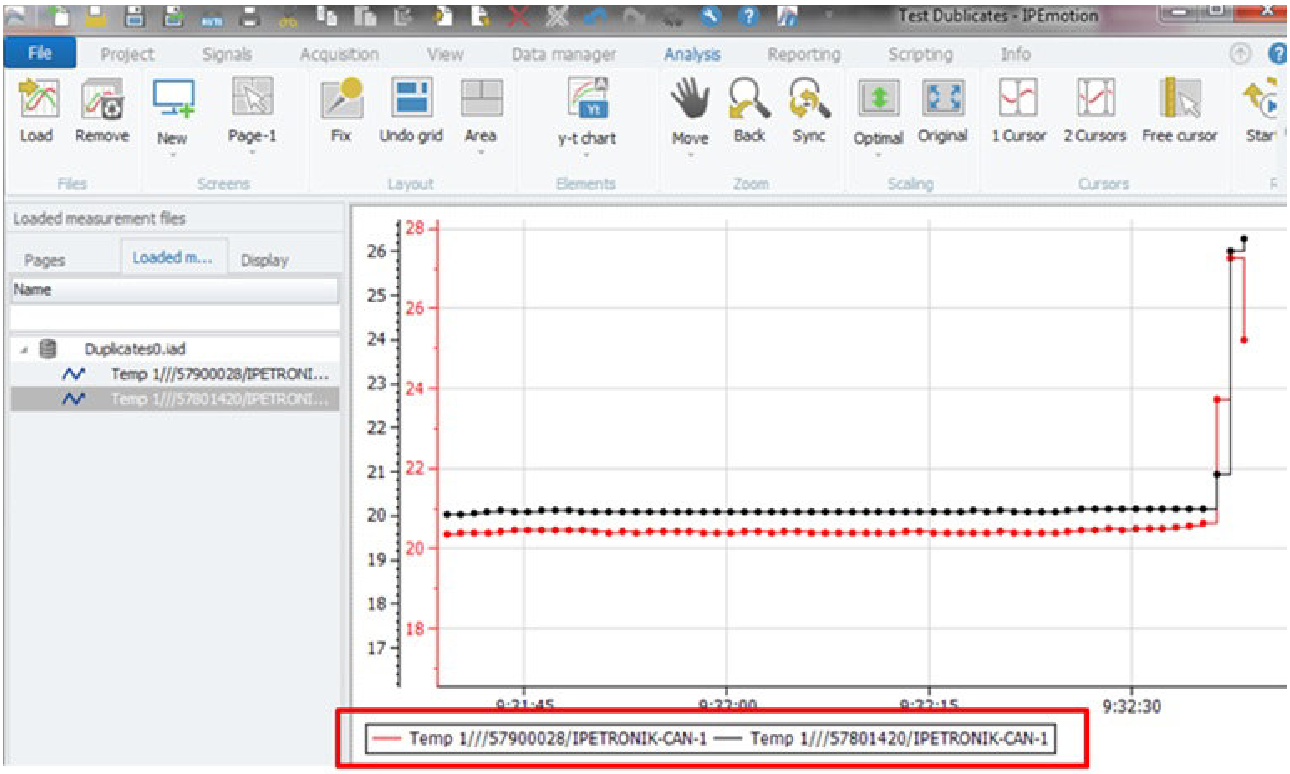
[AC_57]

In DATA MANAGER you will see a transformed channel name. The duplicate channel names include the sources.



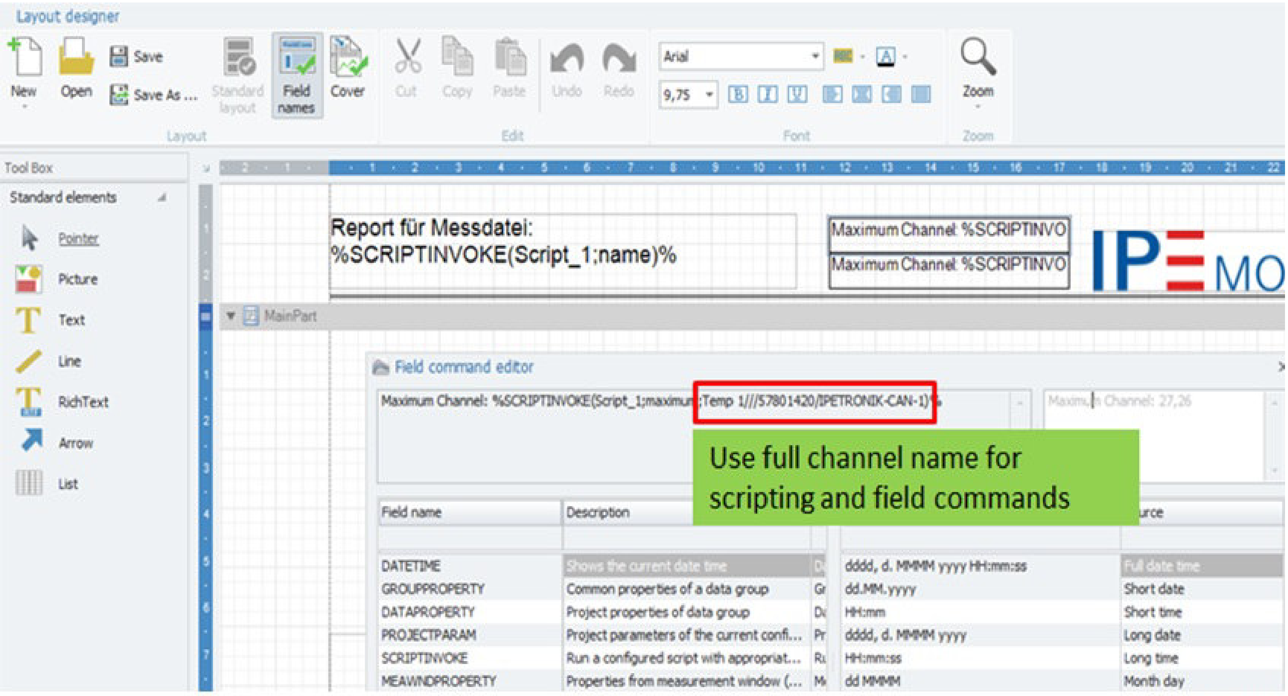
Channel source is added to the channel name.
Temp 1 is transformed to ***Temp 1///57801420/IPETRONIK-CAN-1*** [AC_58]

In ANALYSIS the Yt- chart indicates where source channels are coming from. The Y-axis cannot be merged.

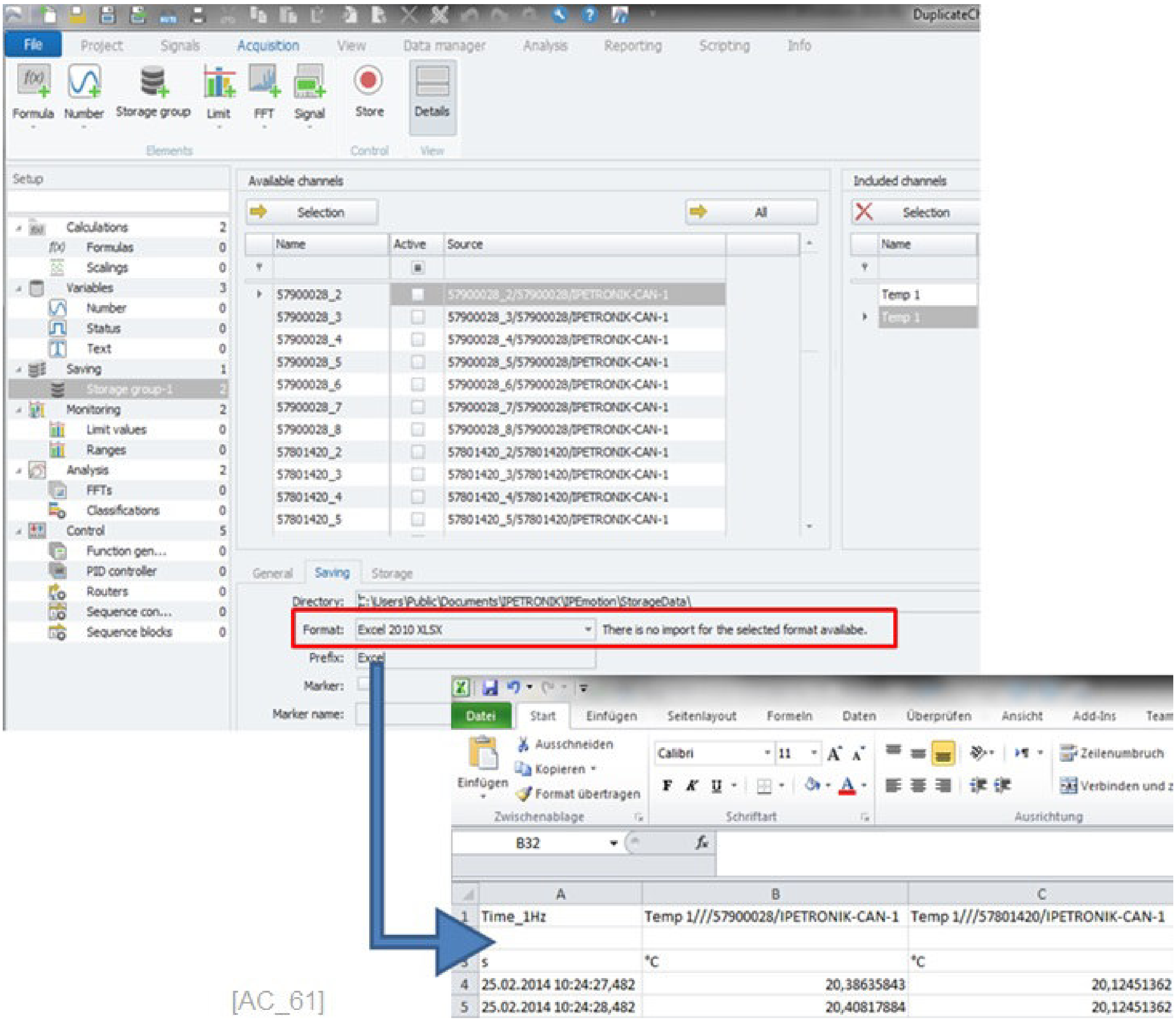


Channel source is included in the legend. [AC_59]

If you like to use field commands in the reporting, you have to address the new channel name which includes the source running your calculations.


Layout designer
Report für Messdatei:
%SCRIPTINVOKE(Script_1;name)%
Field command editor
Maximum Channel: %SCRIPTINVOKE(Script_1;maximum;Temp 1///57801420/IPETRONIK-CAN-1)%
Use full channel name for scripting and field commands

[AC_60]

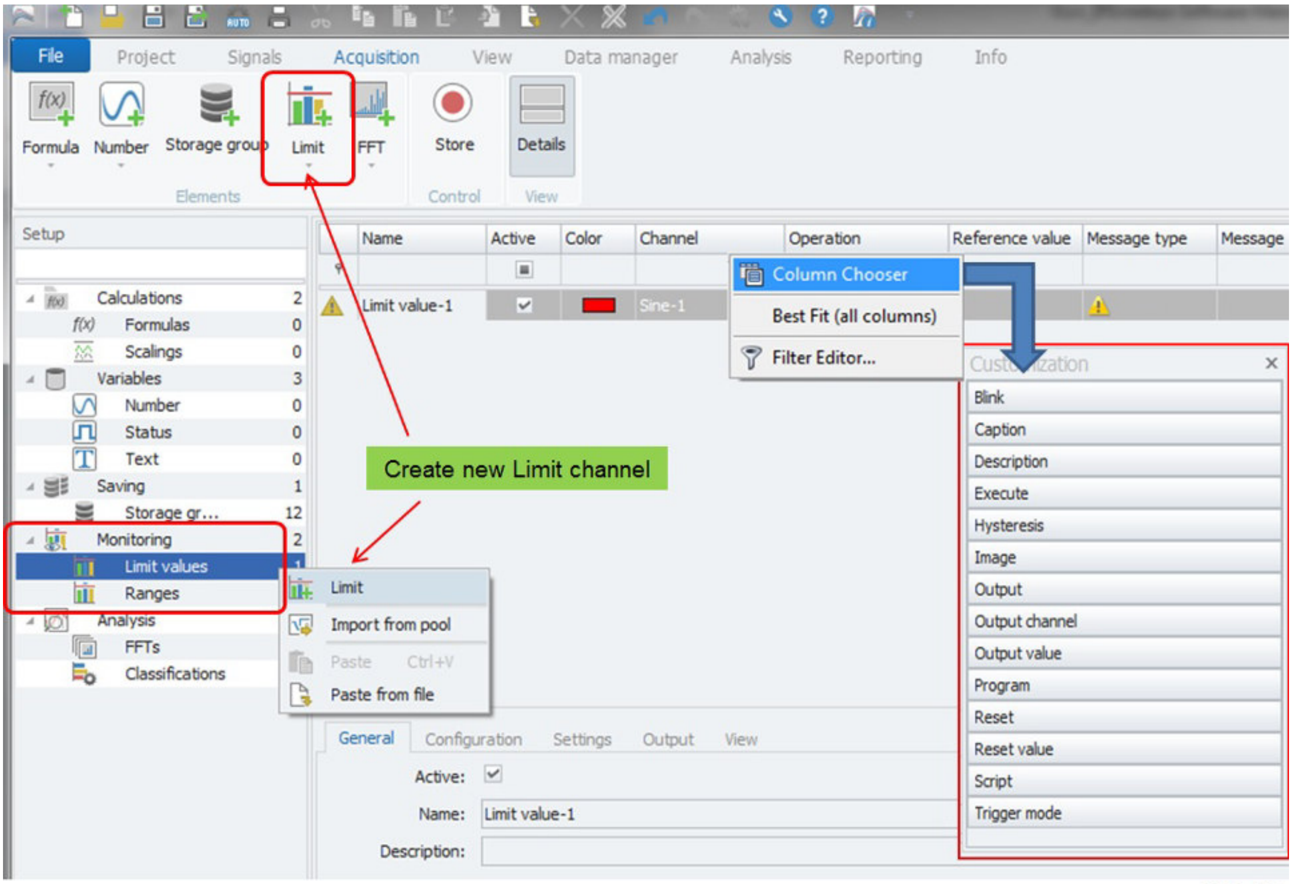

Available channels
Included channels
Format: Excel 2010 XLSX
There is no import for the selected format availabe.
Time_1Hz
Temp 1///57900028/IPETRONIK-CAN-1
Temp 1///57801420/IPETRONIK-CAN-1

[AC_61]

13.10 Monitoring – Limit and Ranges

13.10.1 Creating Limit channel

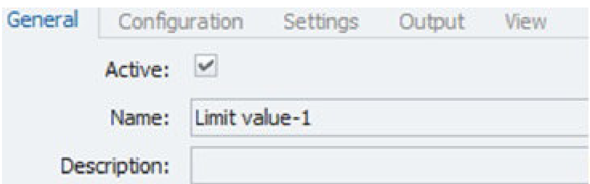
Using the Limit channel, you can monitor a signal for a threshold value. If the Limit condition is met, certain events can be executed. The Limit monitoring function is very important for many measurement applications. Limit and range channels have many functions in common. Therefore the Limit will be discussed in detail. The differences to the Range channel will be discussed in the Range chapter 13.10.8.



[AC_62]

With the column chooser you can add up to 14 additional data columns to the channel grid. Limit has the following configuration tab sheets.

13.10.2 Limit – General tab sheet



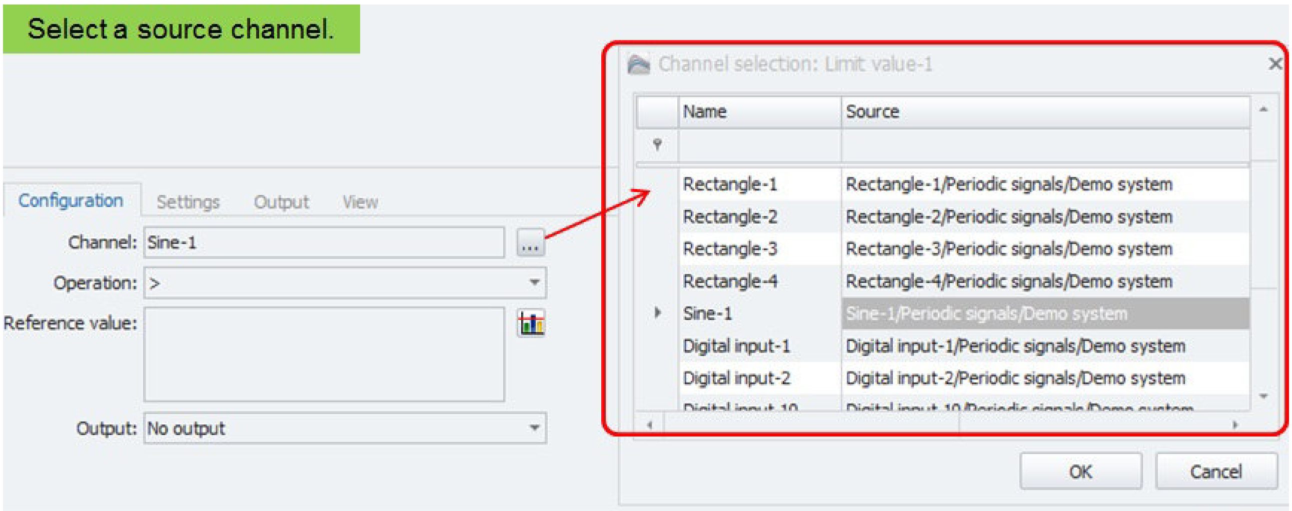
[AC_63]

► Active	In the general tab sheet you define whether a channel is active or inactive. If the channel is inactive (deactivated) the limit monitoring function is disabled
► Name	Is related to the name of the channel
► Description	A space to add additional text information to the channel

13.10.3 Limit – Configuration tab sheet

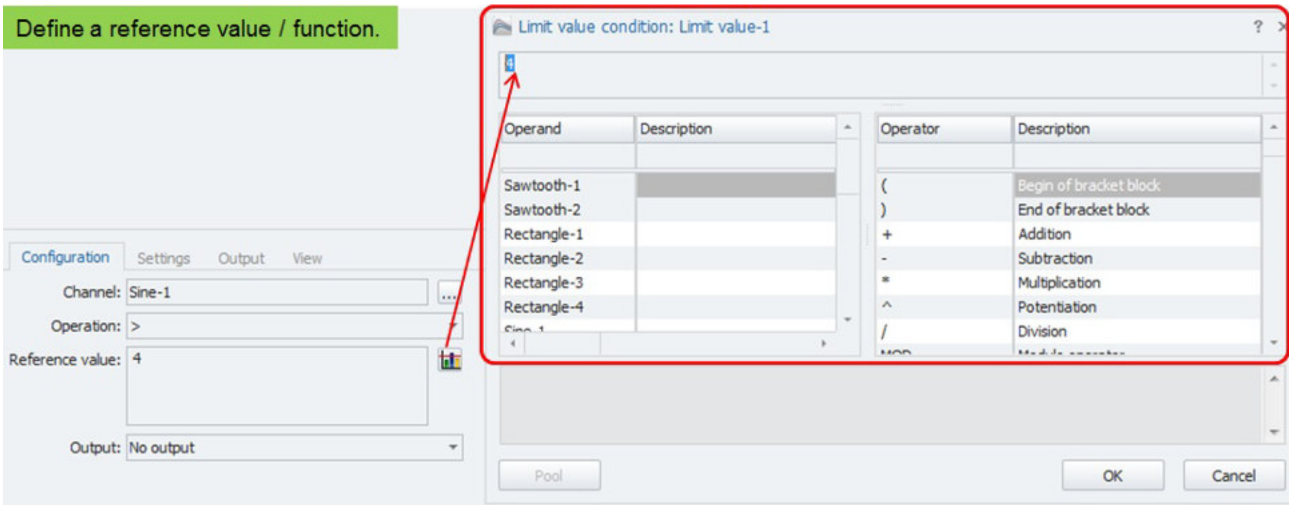
The configuration of a limit consists of two parts. The first one is the definition of the source channel and the threshold condition. The second part is related to the events.

- ► Channel — Select all input channels, variables (number, status, text), any formula and scaling channel here



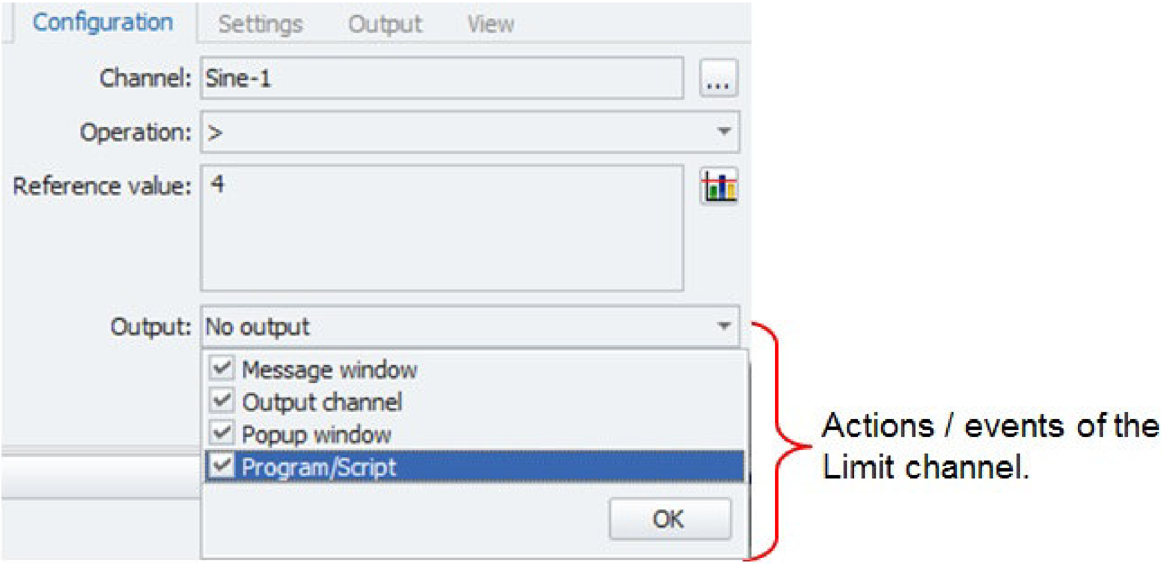
[AC_64]

- ► Operation — Operation covers the type of monitoring function <smaller > larger = equal != unequal <= smaller equal >= larger equal
- ► Reference value — Reference value is the threshold value. It is the value the source channel is permanently compared to. Reference value can be a fixed value like example (4) or a formula or logic operation.



[AC_65]

- ► Output — Output refers to the action associated to the limit. When the limit is met, the defined action is executed. Four actions are supported. Clicking the checkbox, you activate the action

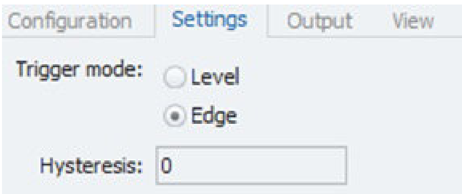


[AC_66]

The Output configuration will be discussed in the Output tab sheet.

13.10.4 Limit – Settings tab sheet

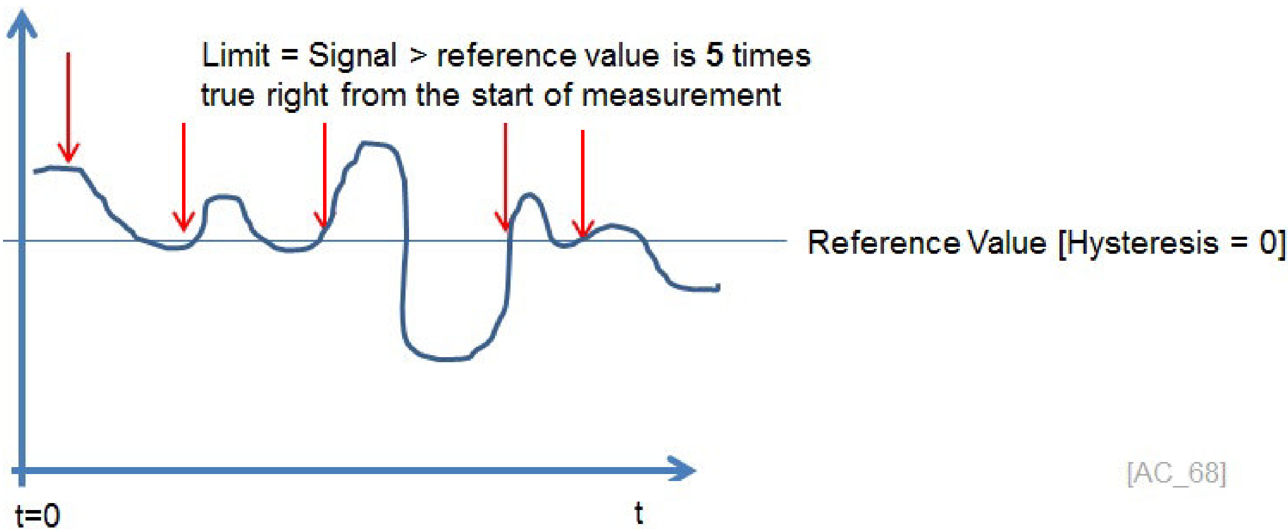
In the settings tab sheet you can define level or edge trigger mode.



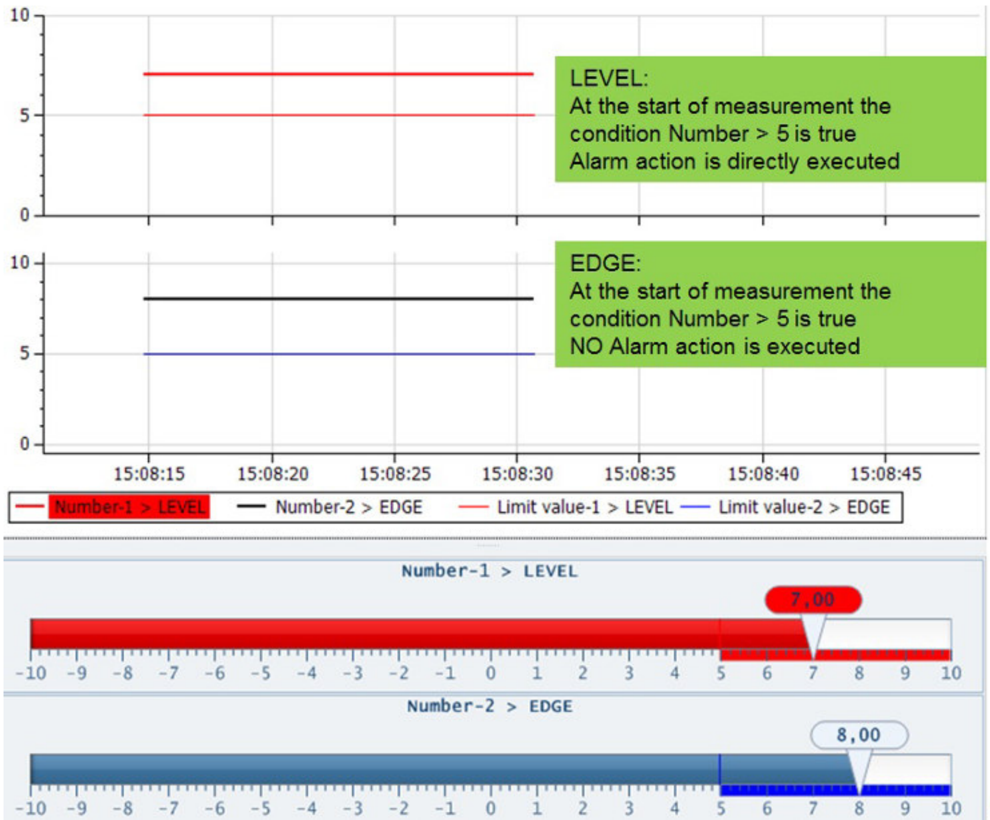
[AC_67]

- ► Level trigger

  This trigger condition will monitor the source channel on the threshold (reference) value and execute the actions if the condition is true right from the beginning of measurement. Every time the reference value is crossed (condition = right), an action is executed.

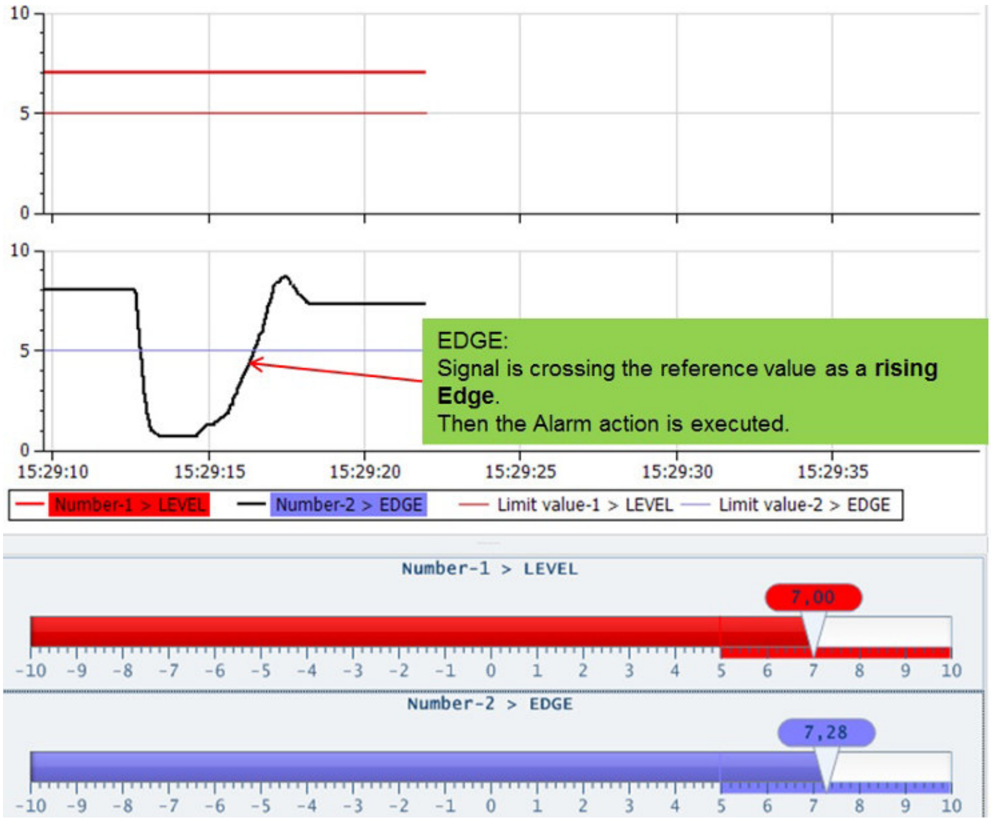


[AC_68]



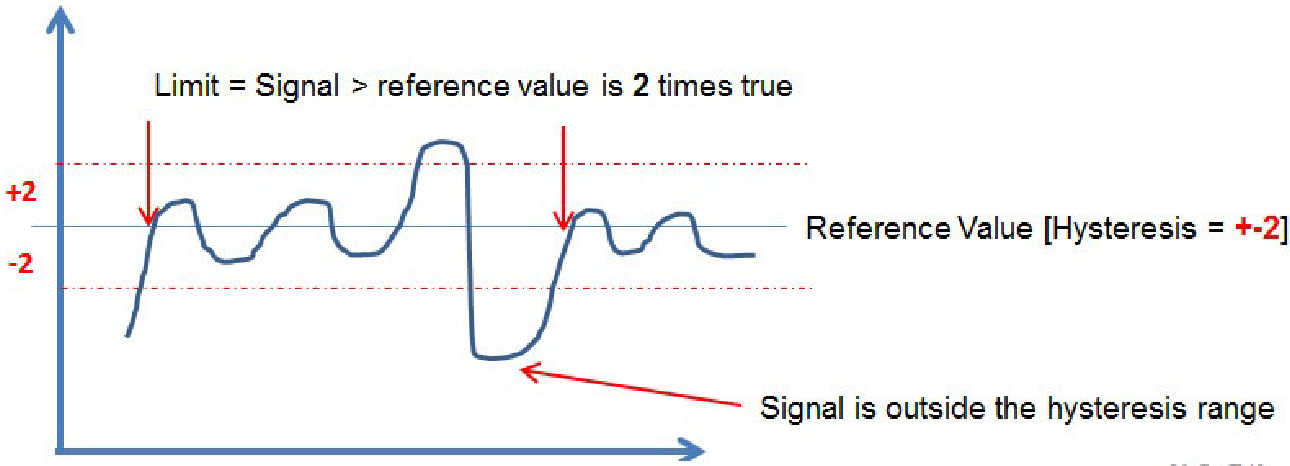
[AC_69]

- Edge trigger
  The edge trigger has a different behavior than the level trigger. In this case the limit channel will define the condition true if the signal has crossed the reference value. That means even if at start of measurement the limit condition is true, no action will be executed.



[AC_70]

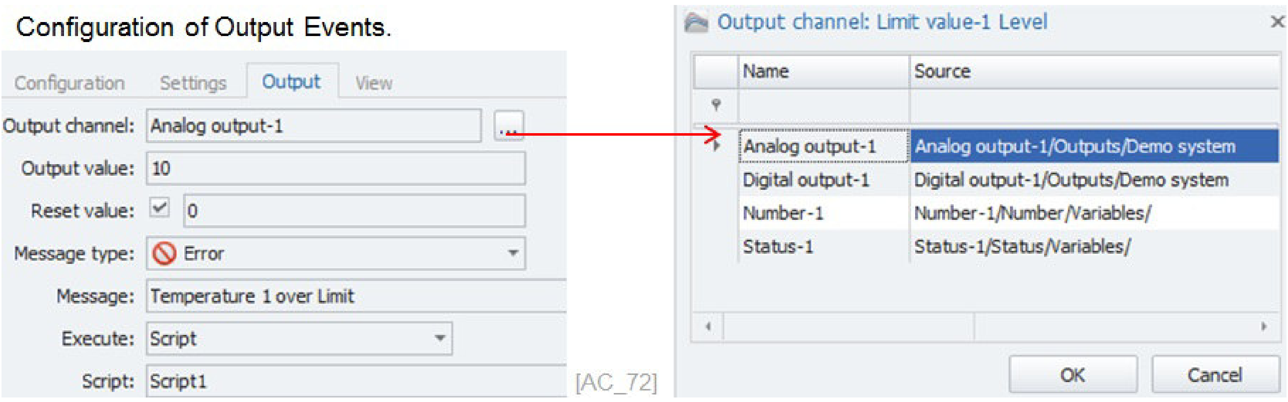
- **Hysteresis** With a hysteresis tolerance / range you are able to reduce the number of limit events provided by the signal which is often nearly over and below the reference value. If the signal jumps between above and below the reference value within the tolerance (hysteresis), the limit action only is executed the first time when the limit condition is met. In order to generate another limit action the signal has to leave the hysteresis band and cross the reference value again.



[AC_71]

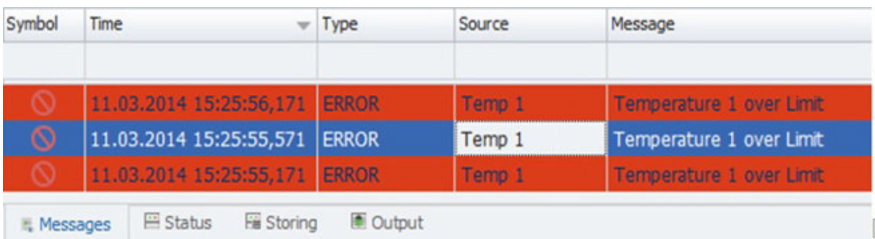
13.10.5 Limit – Output tab sheet

In the output tab sheet you can define the following 3 output events.



[AC_72]

- **Message window** If you like to show a message in the message window you can define the severity Info / Warning / error and a corresponding text here. You can activate the message window in the Application menu as discussed in chapter 6.7.

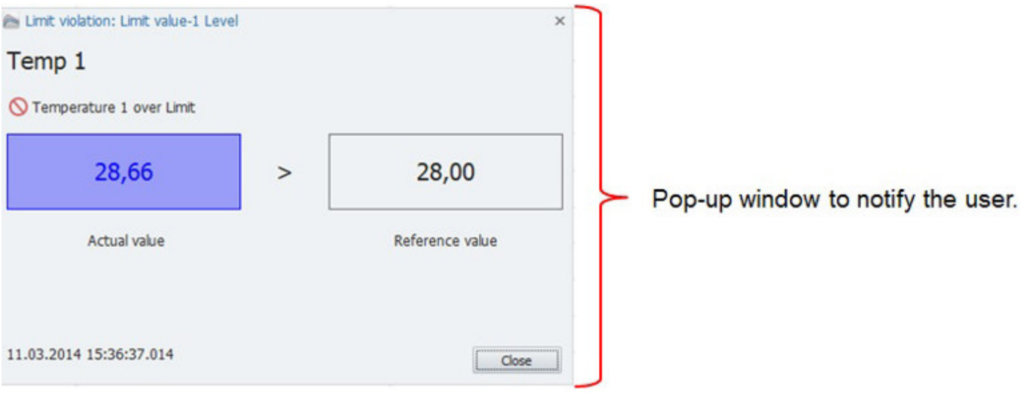


[AC_73]

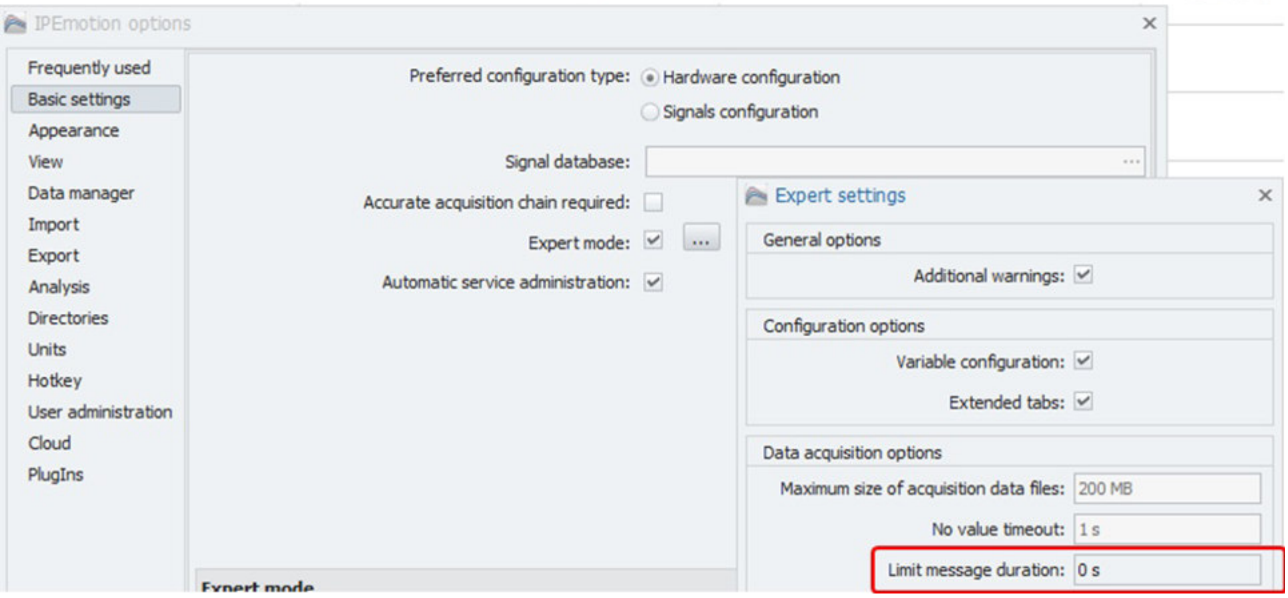
- Output Channel — If you define an output channel (analog, digital, or variable channels like number or status) the output value will be send to this channel. If you enable reset, the output value will be set back to your defined reset value if the limit condition is not met anymore.

- Program/Script — With Program/Script you can execute a Script if the limit condition is met. If you have a Professional license, you have access to the scripting interface and you can manage your VBS and Python scripts as separate functions inside IPEmotion. If you have no scripting tab sheet, you can directly link the Visual basic (VBS) and Python (PY) scripts located on the PC to your event.

- Popup Window — You can configure a pop-up window notifying if the limit condition is met. The duration until the window closes, can be configured in options of the Expert mode. The default configuration is 5 seconds. If you configure a duration of 0s, the pop-up window will stay on the screen as long as it gets closed by the user. It will not disappear automatically after the defined time period.

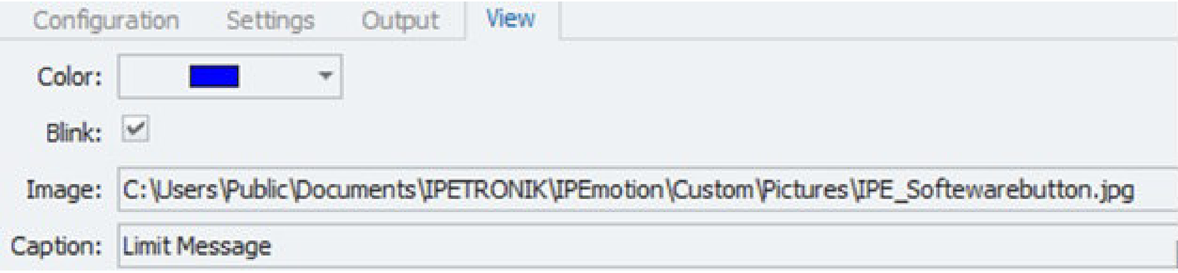


[AC_74]



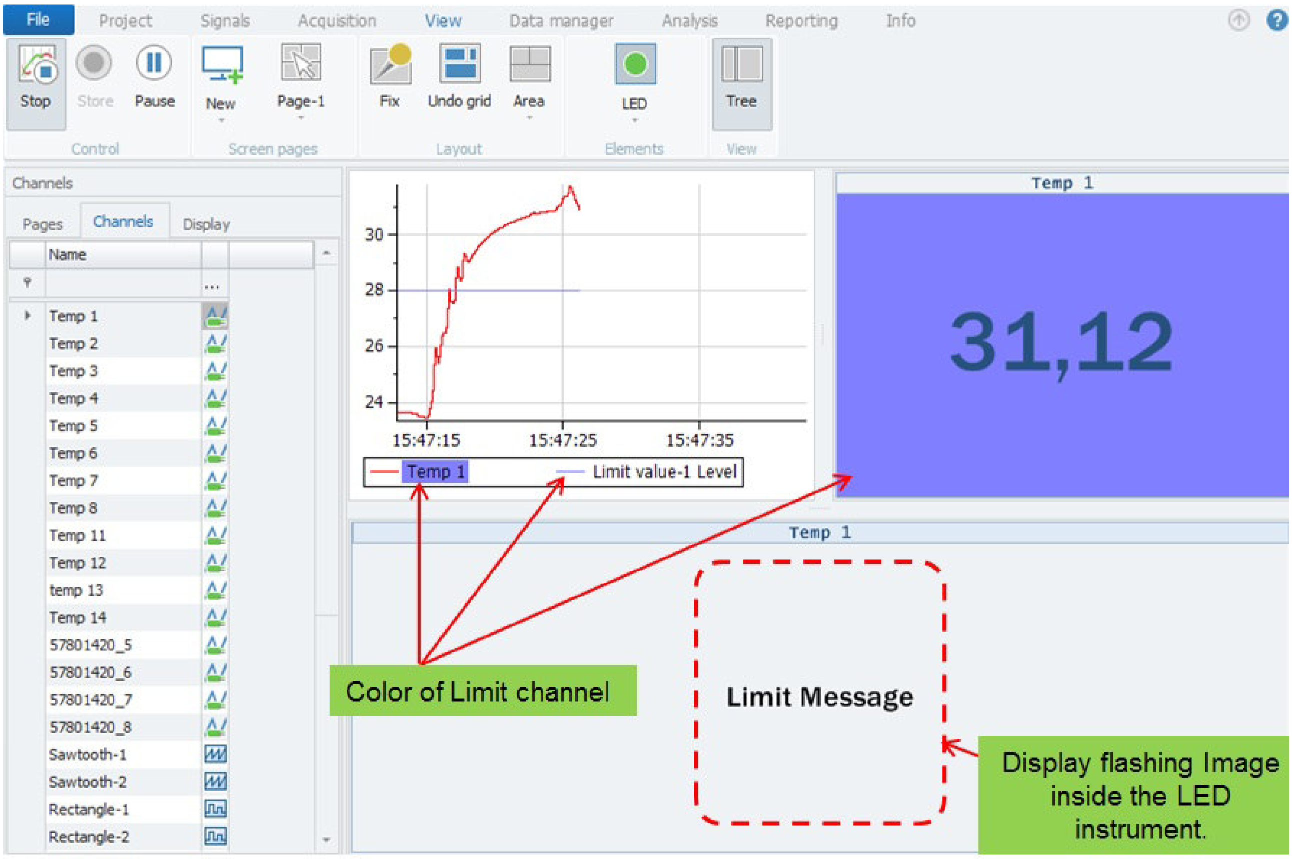
13.10.6 Limit – View tab sheet

In the View tab sheet you can define the appearance of the limit channel.



[AC_75]

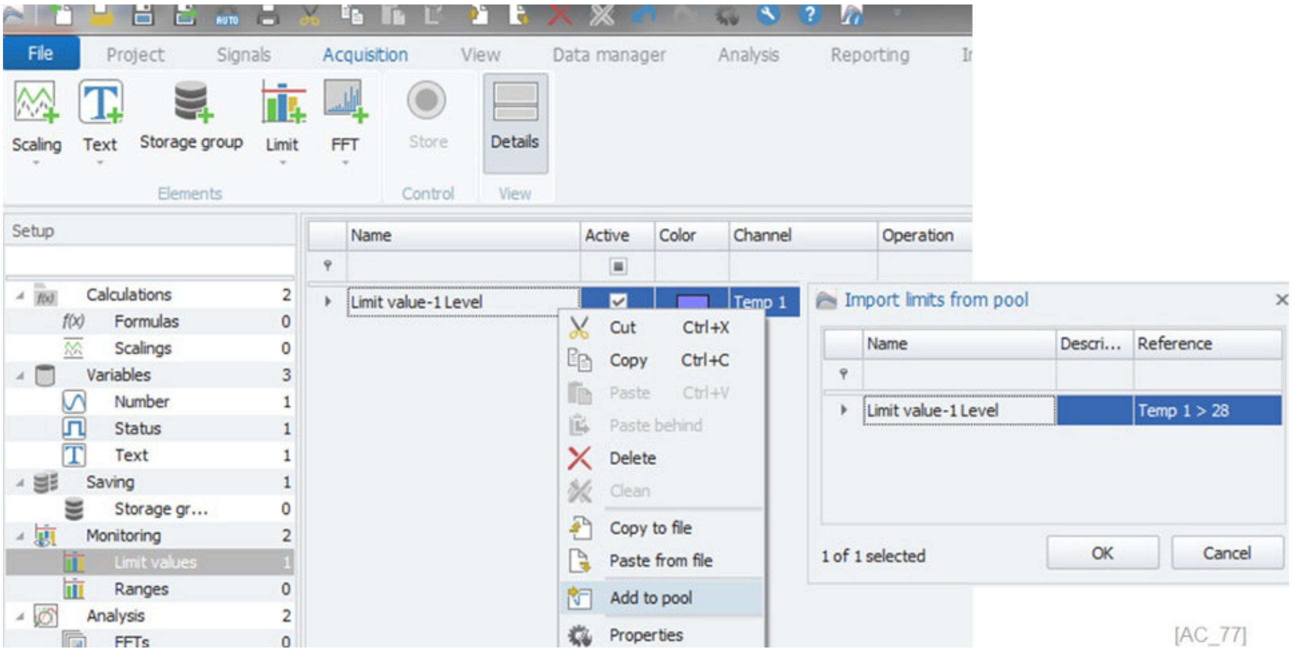
- ► Color — With color you define how the limit channel is visually presented if the condition is true. You can enable the Limit channel in the Yt- chart and in many other instruments and the color you define will be displayed on the instruments.
- ► Blink — If you enable the blink check box, the LED instrument can show a blinking image if one is defined.
- ► Image — Link an image file you would like to be shown on an LED instrument.
- ► Caption — The caption refers to a text message output on the LED instrument. For more details about the LED configuration see VIEW > LED in chapter 17.18.



[AC_76]

13.10.7 Adding and retrieving limit channels from a pool

Limit channels like formulas can be saved to a pool. You can also retrieve limit channels from the pool.

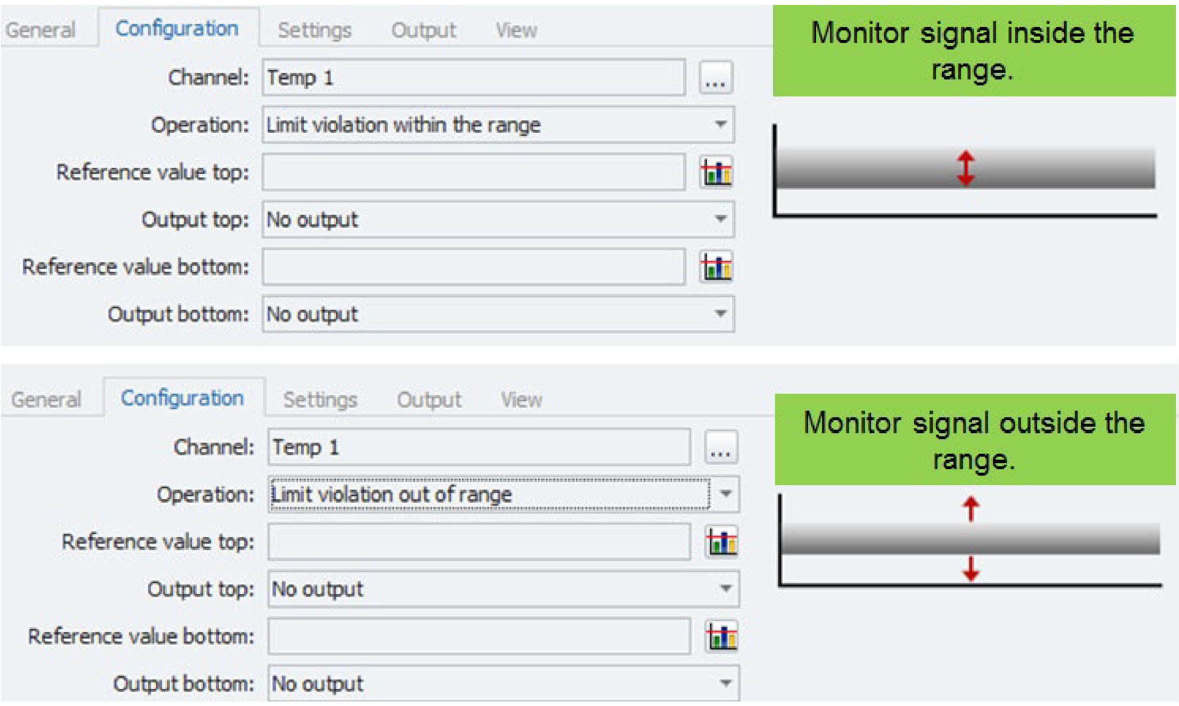


[AC_77]

13.10.8 Range channel

The range channel offers some very convenient functions in order to monitor a source channel to an upper and lower limit. One channel can check whether a signal is leaving or entering a defined range.

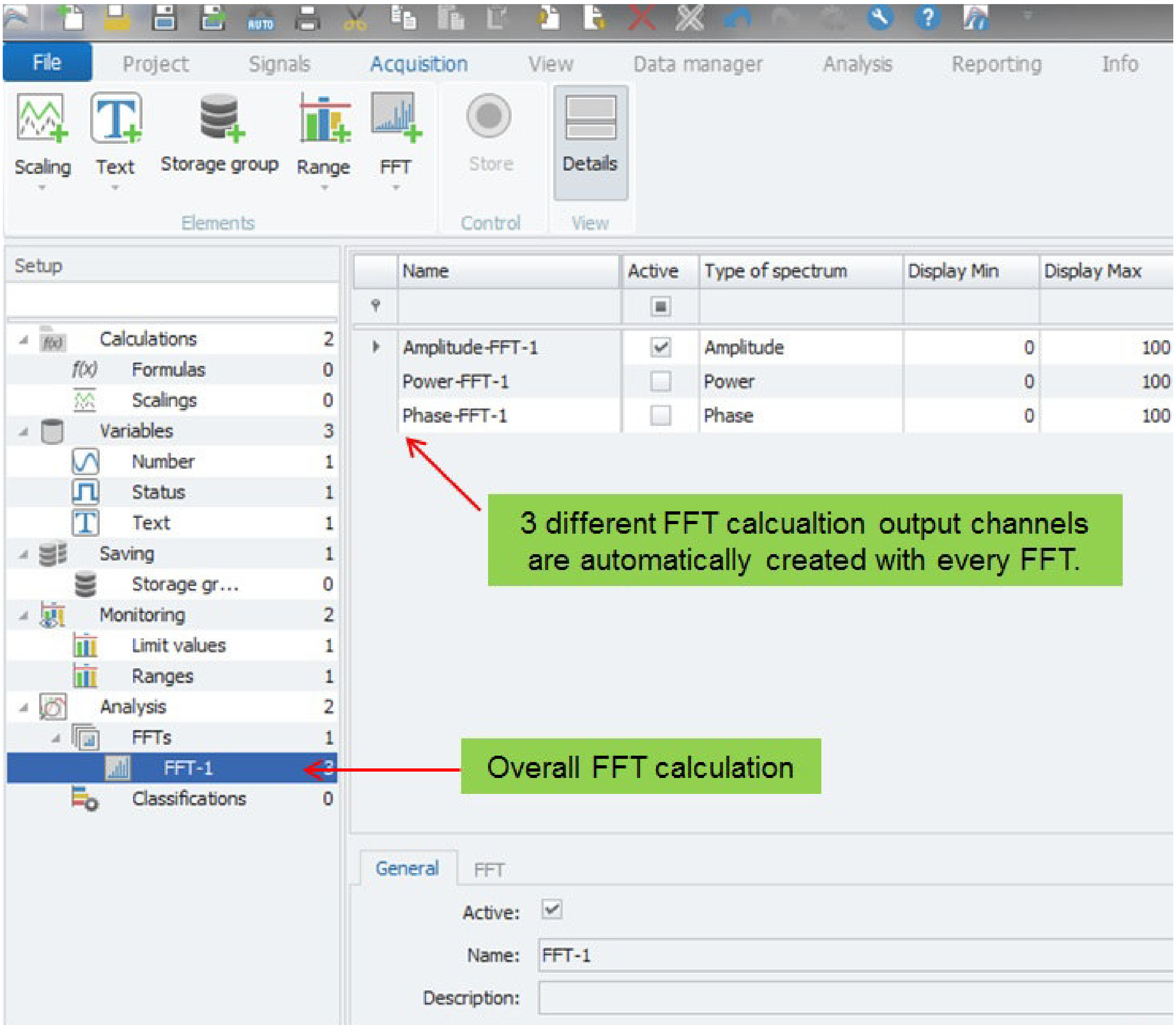
- Color — The monitoring operation defines whether the signal is checked to values inside or outside the upper and lower limit reference.



[AC_78]

13.11 Analysis - FFT

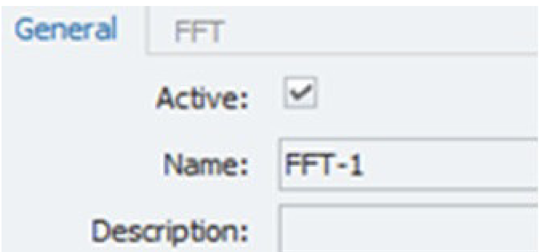
Each license / software edition supports the FFT and classification analysis functions. The FFT analysis is made for dynamic signal analysis where you can find harmonic frequencies and corresponding amplitudes. Creating an FFT channel, the components of Amplitude, Power and Phase are created.



[AC_79]

⚠ ***Attention!*** *The FFT is running only online. The FFT calculation cannot be stored and currently you cannot perform an offline FFT calculation.*

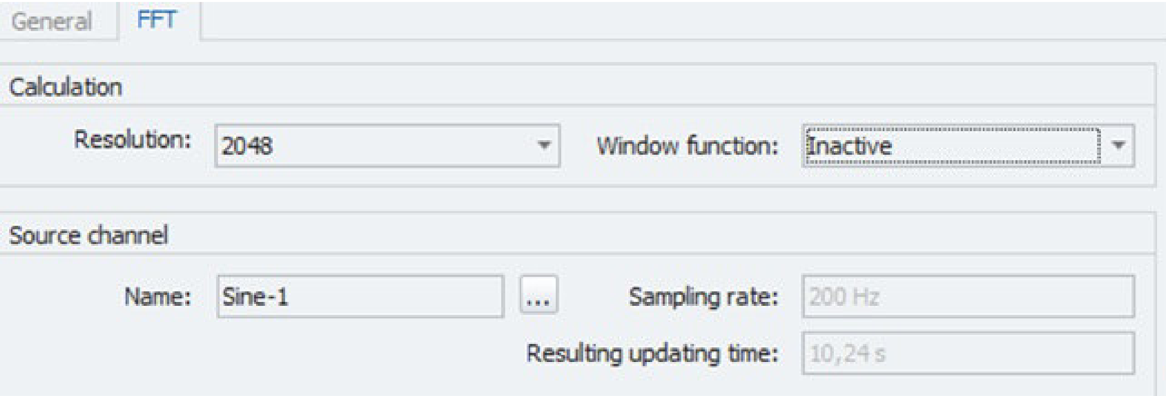
13.11.1 FFT - General tab sheet



[AC_80]

- Active — With this checkbox you activate / deactivate the FFT calculation
- Name — Refers to the name of the FFT
- Description — Here you can add an additional description to the FFT

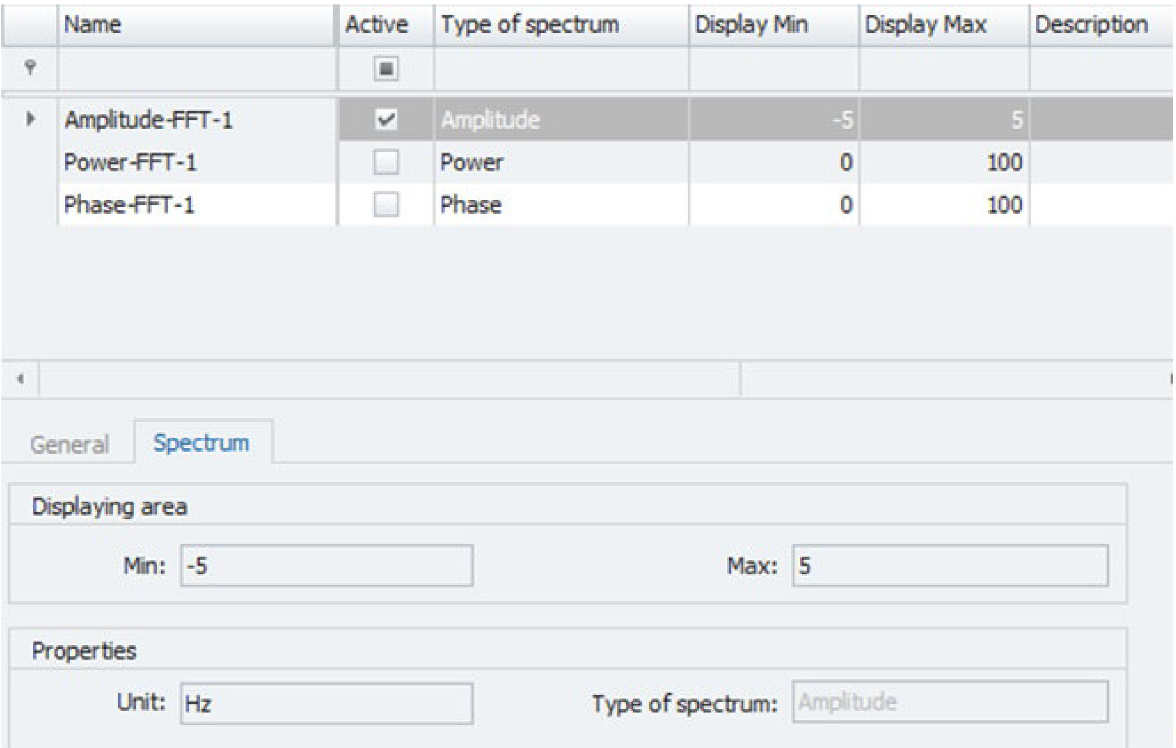
13.11.2 FFT - tab sheet



[AC_81]

- Source channel — This is the signal channel which is subjected to the FFT calculation.
- Resolution — The resolution is related to the number of taken samples to calculate the FFT. The resolution range includes 64, 128, 256, 512, 1024, 2048 and 4096 samples.
- Resulting updating time — Is automatically calculated from signal sample rate and the resolution (number of samples). If you take a resolution of 2048 samples and you have a signal with 200 Hz sample rate, the acquisition time takes about 10,24 seconds before the FFT is presented. (2048 / 200 = 10,24 sec)
- Window function — The window function is particularly important if only very few periods of signals are included in the calculation and the trigger point of the signal recording gets an important impact on the computed result. The following window functions are supported: Hanning, Hamming, Backman, Bartlett.

13.11.3 Channel - tab sheet

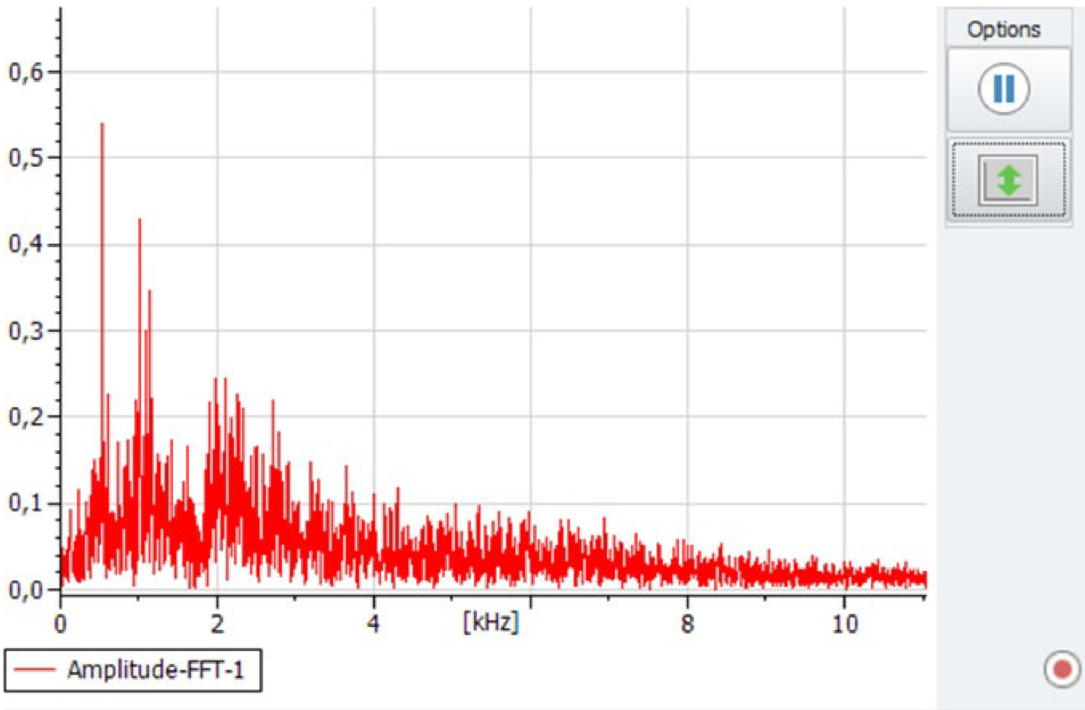


[AC_82]

- Display area MIN / MAX   Defining the Y-axis Min and Max scale
- Unit   Defining unit to be shown on the FFT instrument X-axis

13.11.4 Linking channels to the FFT diagram

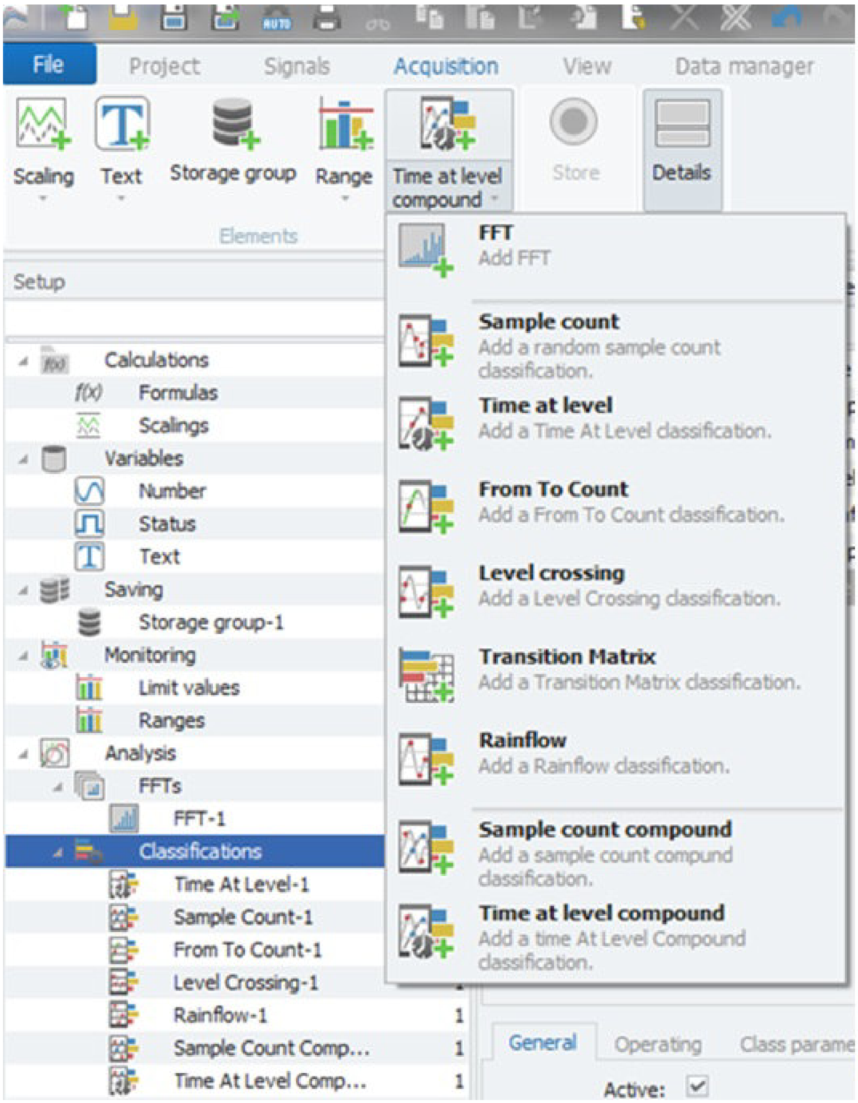
You can simply drag and drop all 3 different types (Amplitude, Power, Phase) into the same FFT diagram. The configuration options of the FFT diagram will be discussed in the chapter 17.10.



[AC_83]

13.12 Analysis - Classification

Classification is a signal analysis method for to get specific information about the signal. You can choose from eight different classification methods. The computed data is presented in the VIEW work area in a histogram or a table instrument. See chapter VIEW > Histogram for more details on the instrument configuration 17.11.



[AC_84]

13.12.1 Sample Count

For a detailed explanation of the classification method see chapter DATA MANAGER > Sample Count 18.22.

13.12.2 Time at Level

For a detailed explanation of the classification method see chapter DATA MANAGER > Time at Level 18.23.

13.12.3 From to count

For a detailed explanation of the classification method see chapter DATA MANAGER > From to Count 18.18.

13.12.4 Level Crossing

For a detailed explanation of the classification method see chapter DATA MANAGER > Level Crossing 18.19.

13.12.5 Transition Matrix

For a detailed explanation of the classification method see chapter DATA MANAGER > Transition Matrix 18.20.

13.12.6 Rainflow

For a detailed explanation of the classification method see chapter DATA MANAGER > Rainflow 18.21.

13.12.7 Sample Count Compound

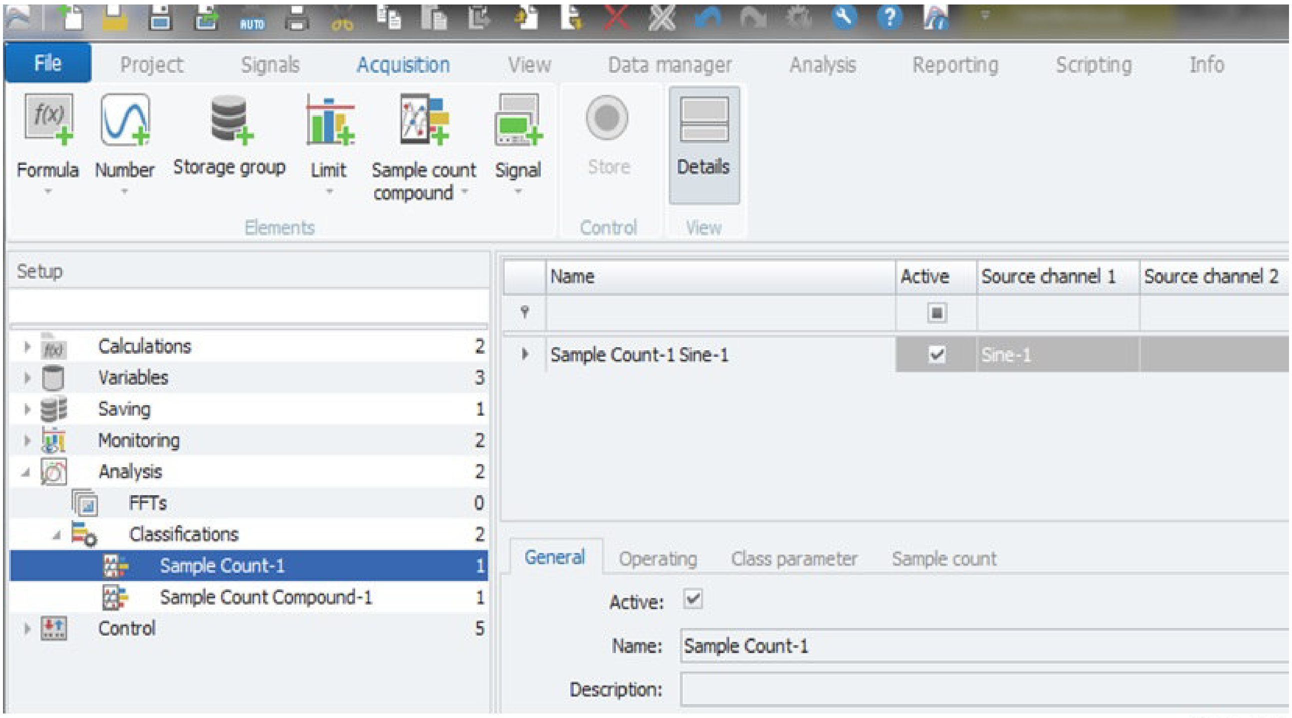
These classification methods require the input of 2 channels to perform the classification algorithm. The results of the 2D classification are displayed in certain instruments called classification table. The configuration options of the online classification table are discussed in VIEW > Classification table in chapter 17.12.

For a detailed explanation of the classification method see chapter DATA MANAGER > Sample count compound classification 18.22.

13.12.8 Time at Level Compound

For a detailed explanation of the classification method see chapter DATA MANAGER > Time at Level Compound Classification 18.18.

13.12.9 Classification – General tab sheet



[AC_85]

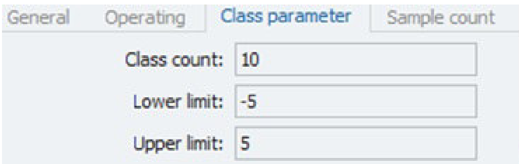
- **Active** — With this checkbox you can activate / deactivate the classification calculation
- **Name** — Refers to the name of the classification
- **Description** — Here you can add an additional description to the classification

13.12.10 Classification – Operating tab sheet

[AC_86]

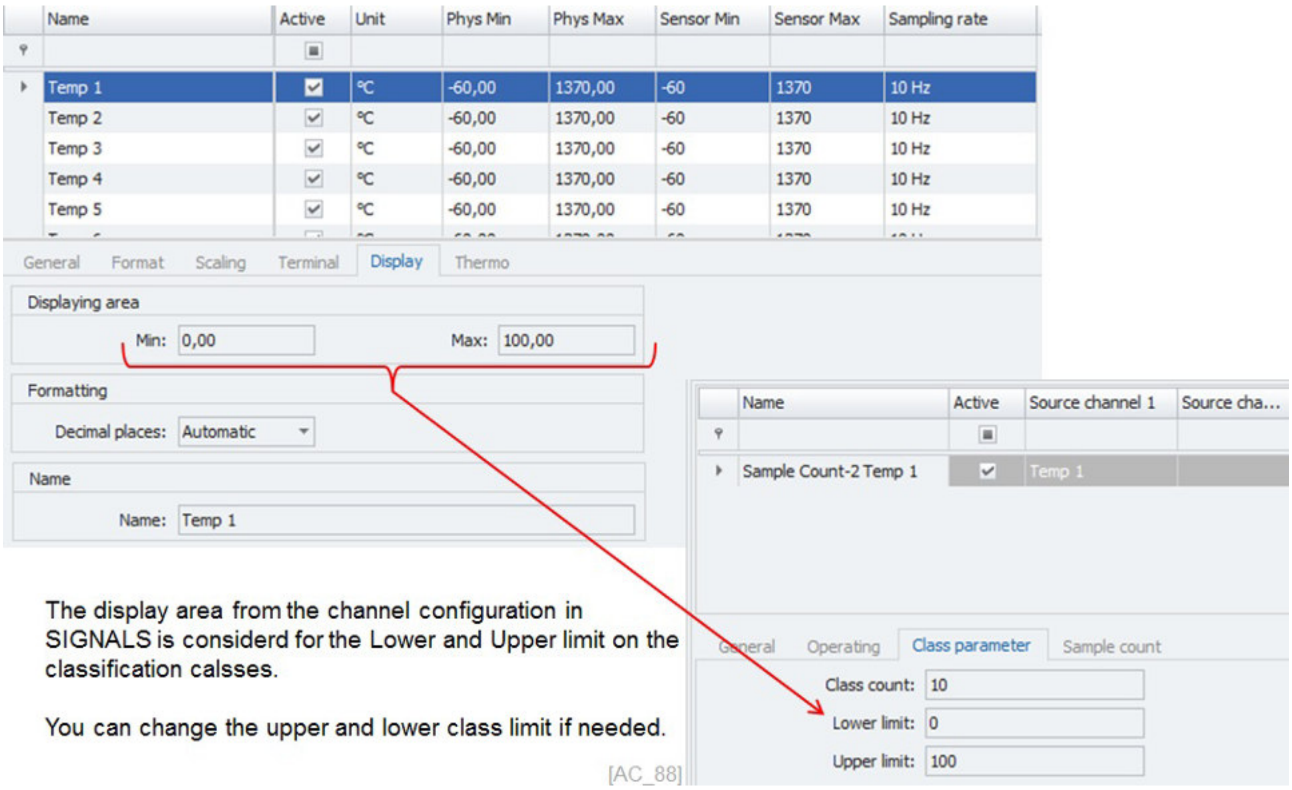
- ► Working frequency — The calculation frequency of the classification should be related to the sample frequency of the signal. The default value in the drop-down list is the frequency of the signal. However, you can reduce the working frequency by another list box entry
- ► Start trigger — This can be a trigger to start the calculation
- ► Stop trigger — This can be a trigger to stop the calculation
- ► Hold trigger — This can be a trigger to hold the calculation

13.12.11 Classification – Class parameter tab sheet



[AC_87]

- ► Class count — Here you can define in how many classes the lower and upper limit
- ► Lower limit — Lower class limit should be split up
- ► Upper limit — Upper class limit. The default values are taken from the display range of the source channel

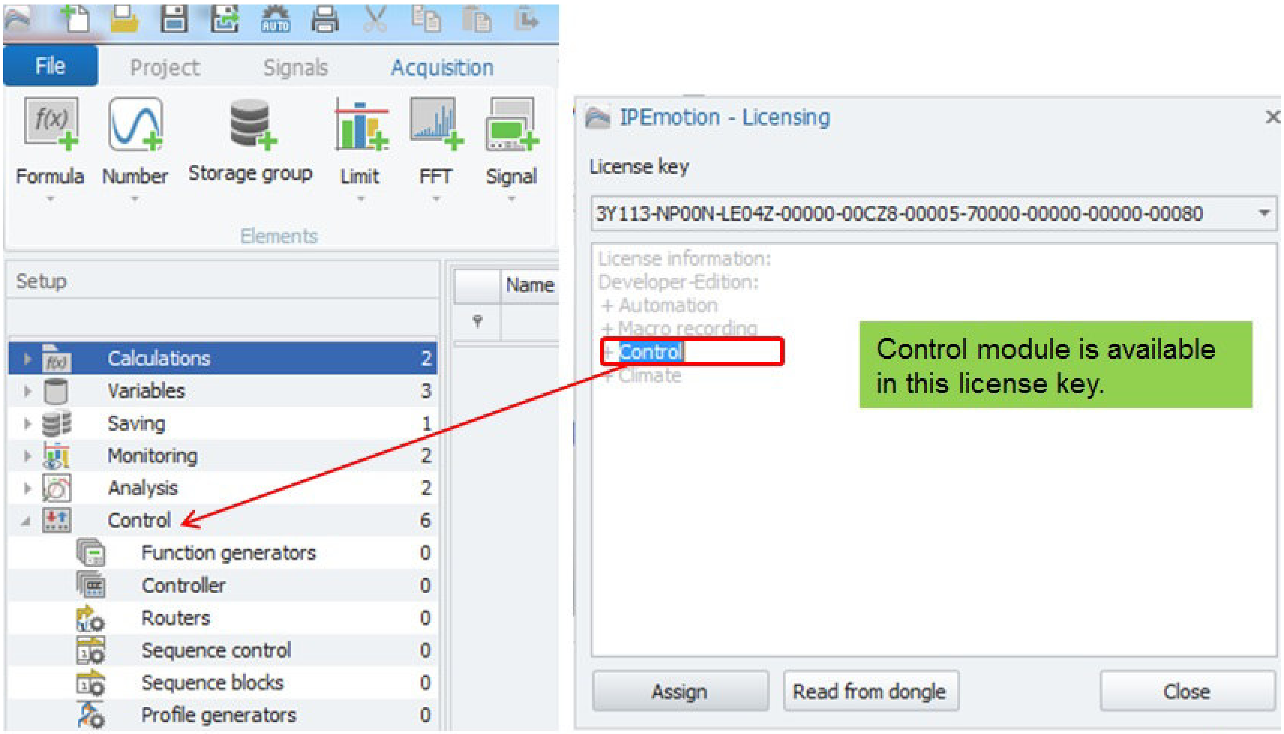


[AC_88]

14 Control Option

14.1 License

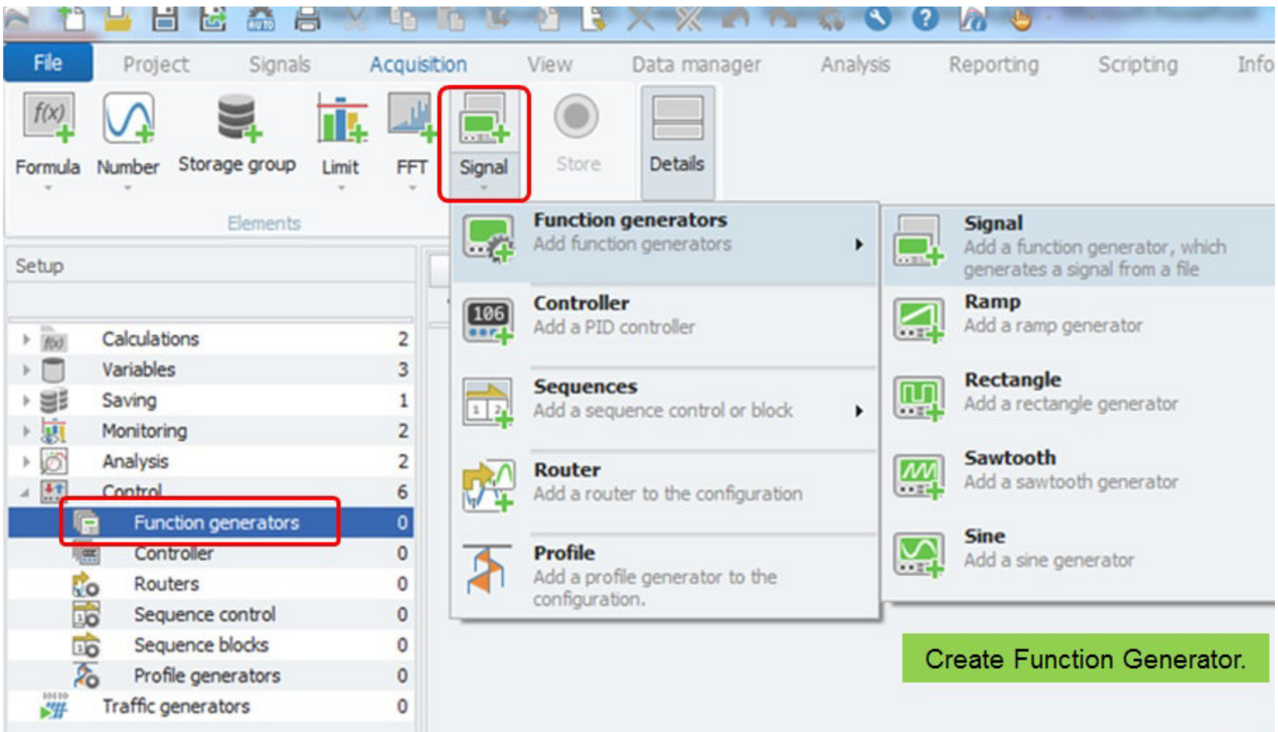
To operate the control module you need to buy a license code which includes the control module.



[CO_1]

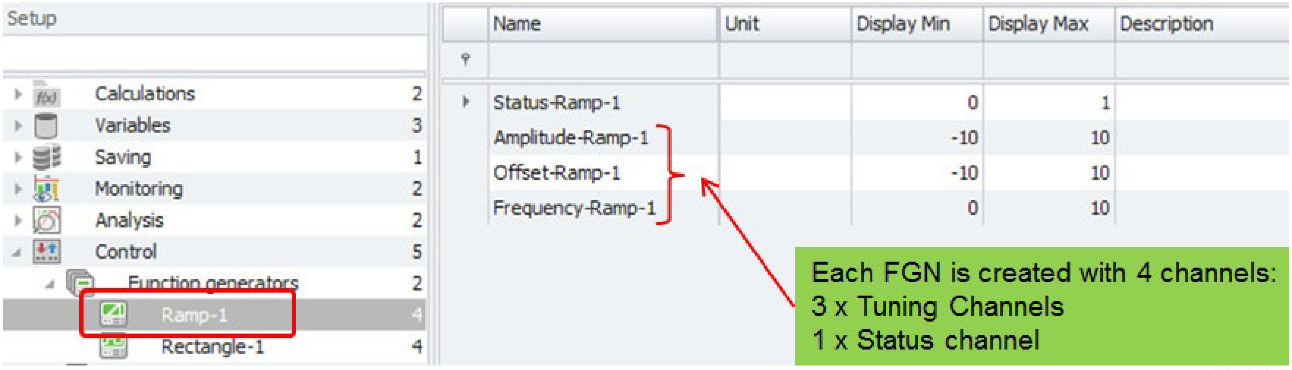
14.2 Configuration of Function Generators (FGN)

With function generators you can create arbitrary wave forms. You can create any function generator from the Ribbon of from the Control module tree.



[CO_2]

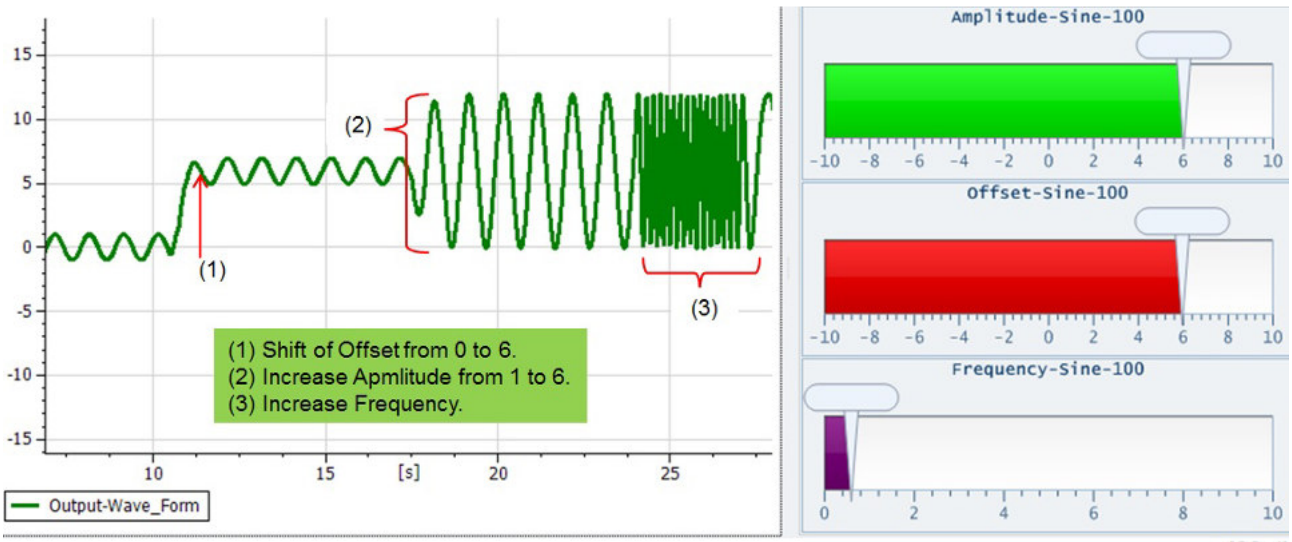
Every Function Generator is created with 4 channels. Three channels are related to the tuning variables which will be discussed below. The status channel is viewing whether the FGN is operating or not.



[CO_3]

Tip *Depending on the settings in the Options you may not see the four channels. To show the tuning and status channels refer to Options > Basic Settings > Expert mode > Variable configuration in chapter 22.3.4.*

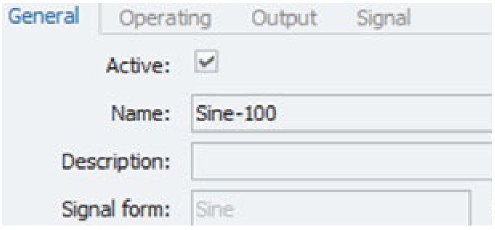
- **Status**: If the status channel shows 1, the FGN is operating. When the status is 0 the FGN is not operating. The status information is convenient e.g. when you use triggers to operate the FGN.
- **Amplitude**: With Amplitude you can change the magnitude of the amplitude of the waveform during operation as the screenshot shows.
- **Offset**: With Offset you can shift online the offset of the zero line during operations as the screenshot shows.
- **Frequency**: With Frequency you can change the frequency of the waveform online as the screenshot shows.



[CO_4]

14.2.1 FGN – General tab sheet

The general tab sheet covers the Status, Name and Description of the FGN.

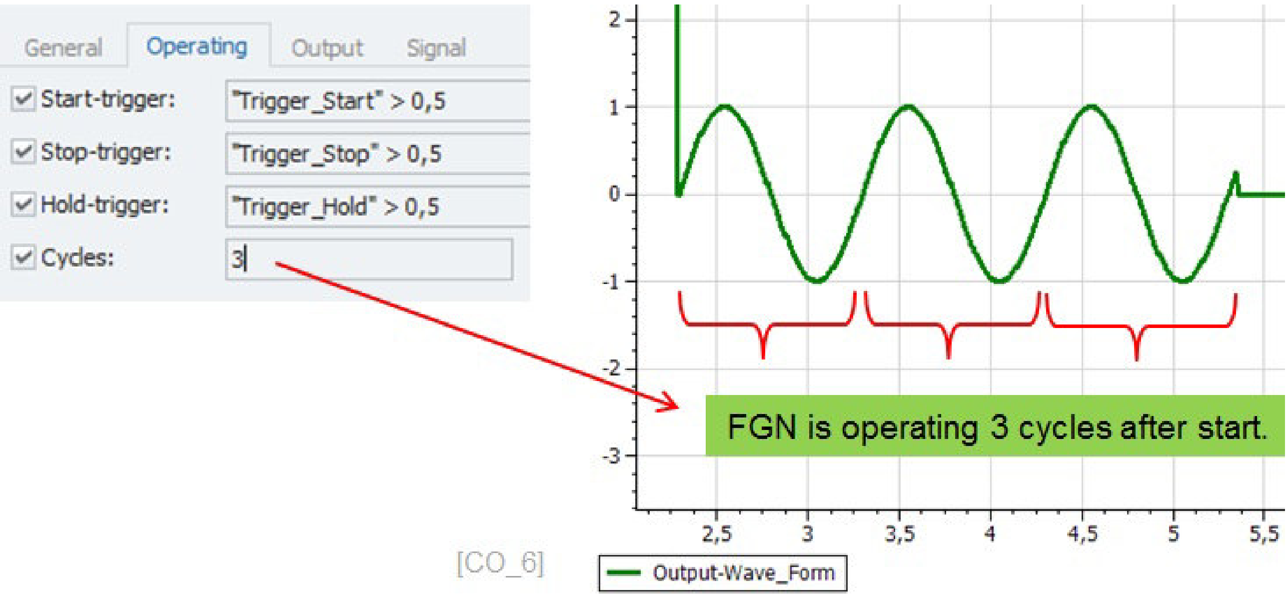


[CO_5]

- Active — With this checkbox you can activate / deactivate the FGN.
- Name — Refers to the name of the FGN controller.
- Description — Here you can add an additional description to the FGN.
- Signal from — Is indicating the basic waveform generated by this FGN.

14.2.2 FGN – Operating tab sheet

In the operating tab sheet you define the triggers for operation and the number of cycles.

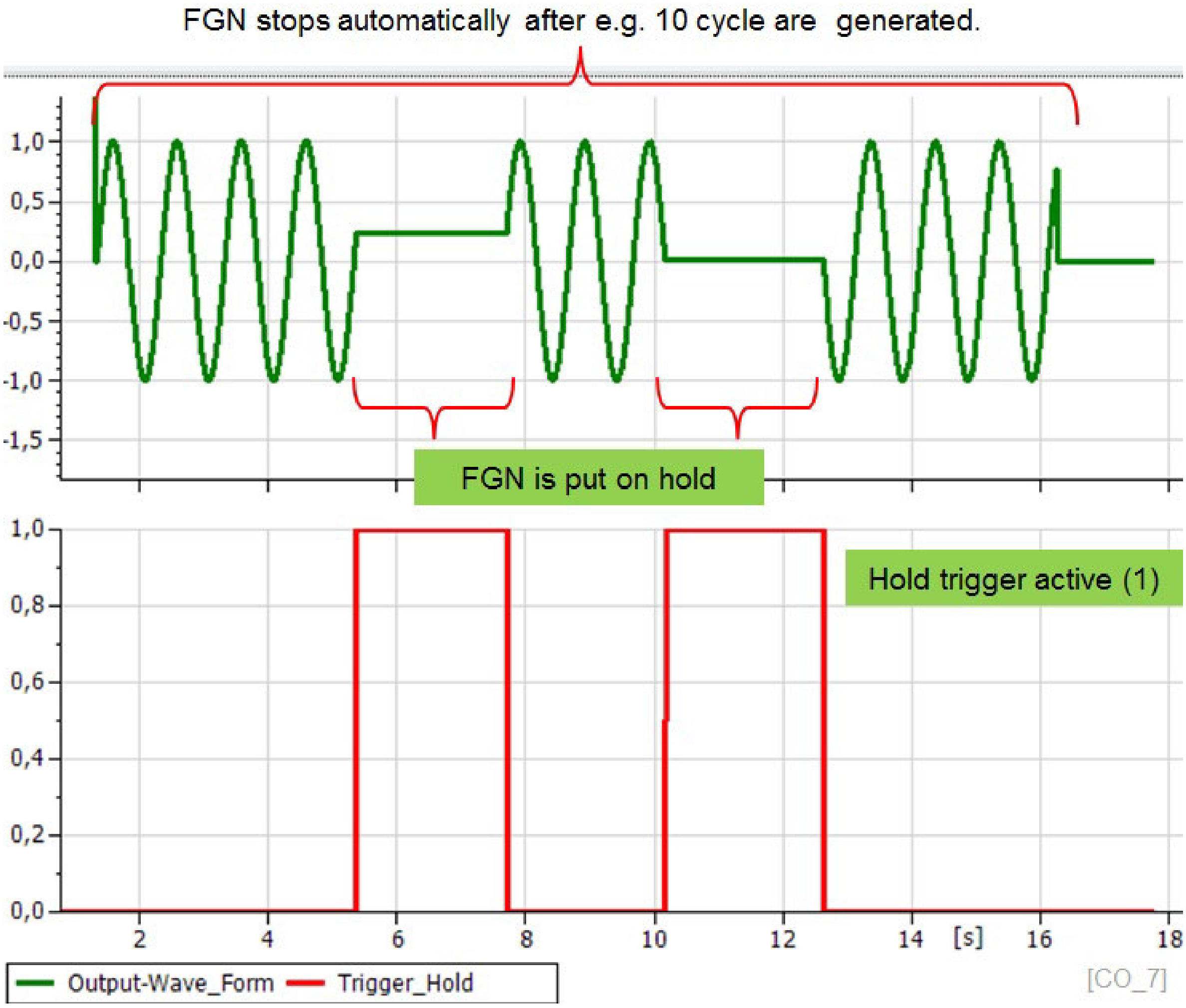


[CO_6]

- Start trigger — This can be a trigger to hold the FGN.
- Stop trigger — This can be a trigger to hold the FGN.
- Hold trigger — This can be a trigger to hold the FGN. If the hold trigger is released the FGN carries in with the operation until the number of cycles is reached.
- Cycles — Here you can define how many cycles the FGN will be operating. When the checkbox is unchecked the FGN is operating in an endless loop.

If you define no trigger condition (of disabled check box), the FGN starts its operation directly when you start the measurement. When the FGN is operating, the status channel is updated from 0 to 1 as discussed above.

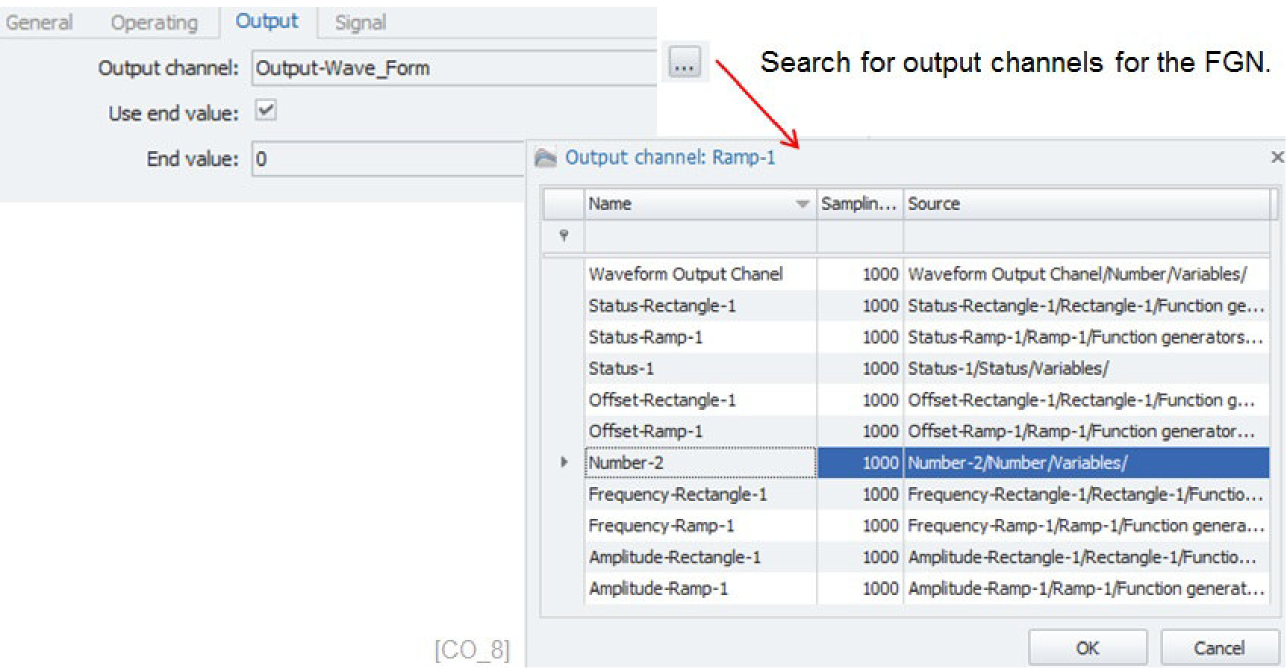
The screenshot shows the impact of the Hold trigger to the FGN operation.



[CO_7]

14.2.3 FGN – Output tab sheet

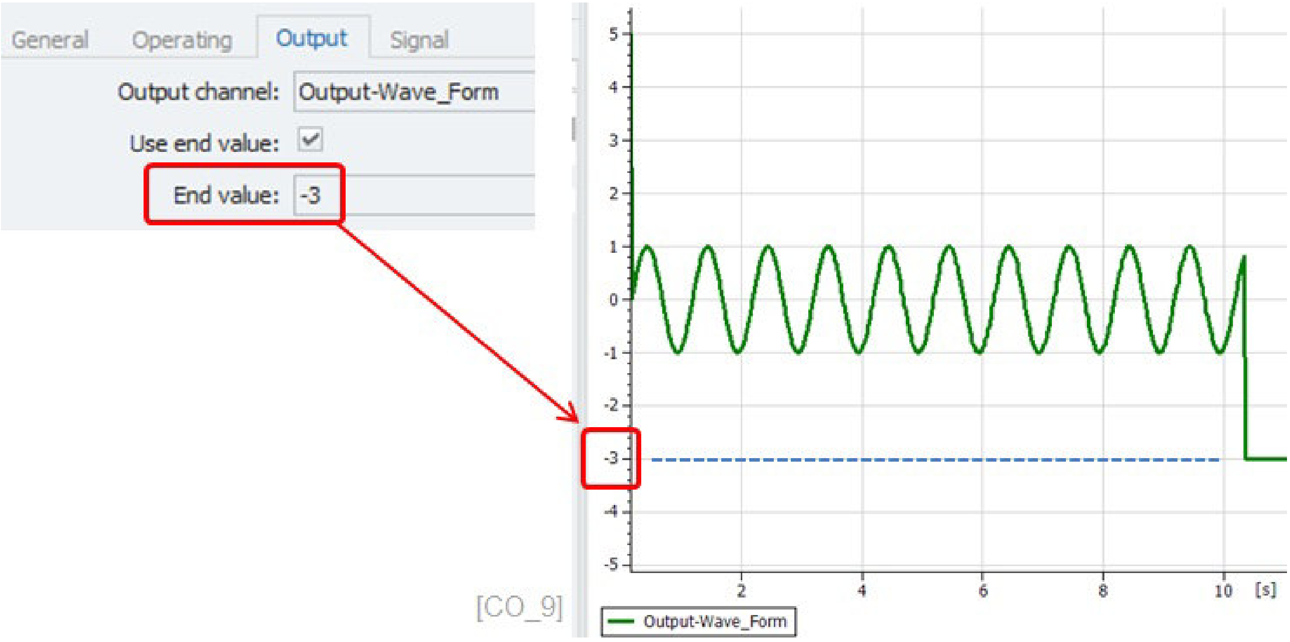
In the Output tab sheet you define the receiving channel of the waveform and the end value.



[CO_8]

- ► Output Channel — You can search in the channel search dialog for an appropriate output channel. The Output can be generated to an analog, digital, variable channel (Number and Status). Text variables and the scaling channel cannot receive waveform signals from the FGN.
- ► Use end value Check box — With this check box you activate the end value of the FGN. With the end value you can define which will be last output value of the FGN when it stops the operation. In the example below, the end value after the 10 cycles is -3.
- ► End value — Define the end value.

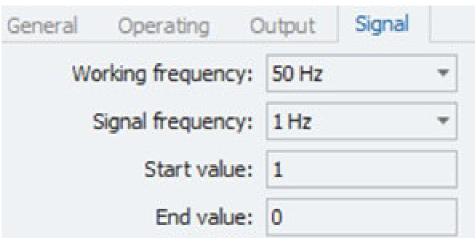
Attention! *The selected output channel should match or exceed the sample rate (Working frequency) of the waveform generator.*



[CO_9]

14.2.4 FGN – Signal tab sheet

In the signal tab sheet you define the standard parameters of the FGN.

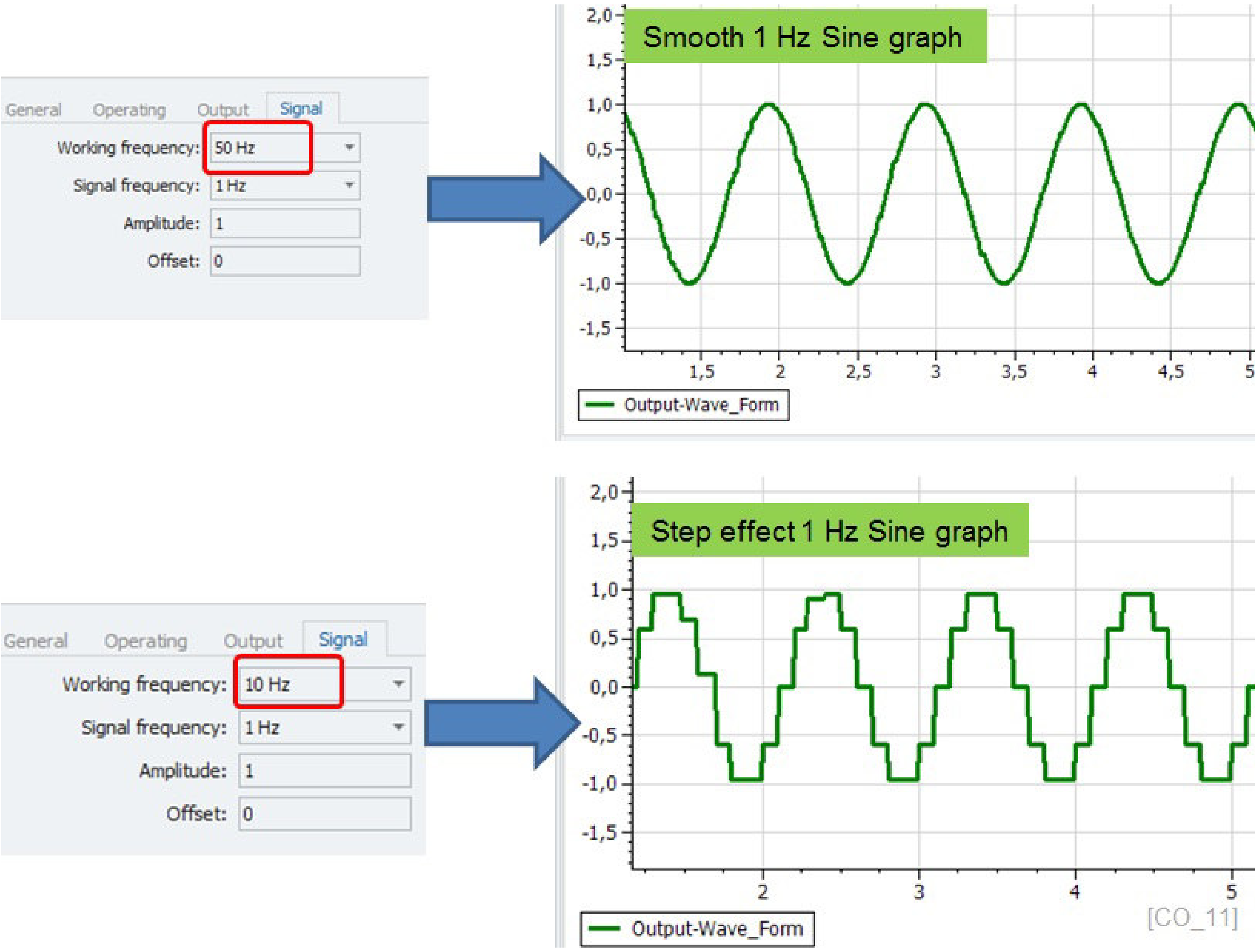


[CO_10]

Attention! *You cannot define a working frequency equal or smaller than the signal frequency.*

- ► Working Frequency — This is the resolution of the signal. This frequency defines how many data points are generated to plot the waveform (signal). The working frequency has a close relation to the Signal frequency. The working frequency should be about a factor 10 higher than the signal frequency.

Example: The screenshot below shows how the working frequency affects the graphical presentation of the waveform.

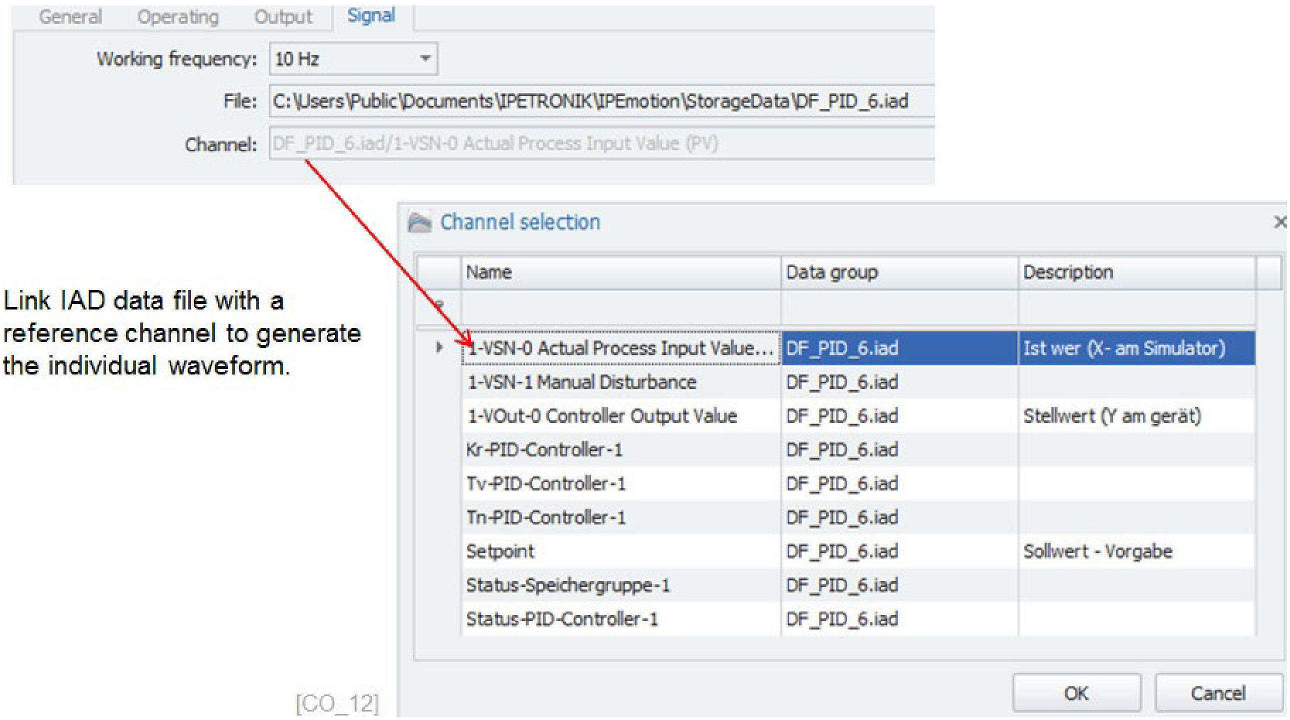


[CO_11]

- **Signal Frequency** This is the default Frequency of the waveform. It can be changed through the tuning parameters discussed in chapter 14.2 above.
- **Amplitude** This is the default Amplitude of the waveform. It can be changed through the tuning parameters discussed in chapter 14.2 above.
- **Offset** This is the default Offset of the waveform. It can be changed through the tuning parameters discussed in chapter 14.2 above.

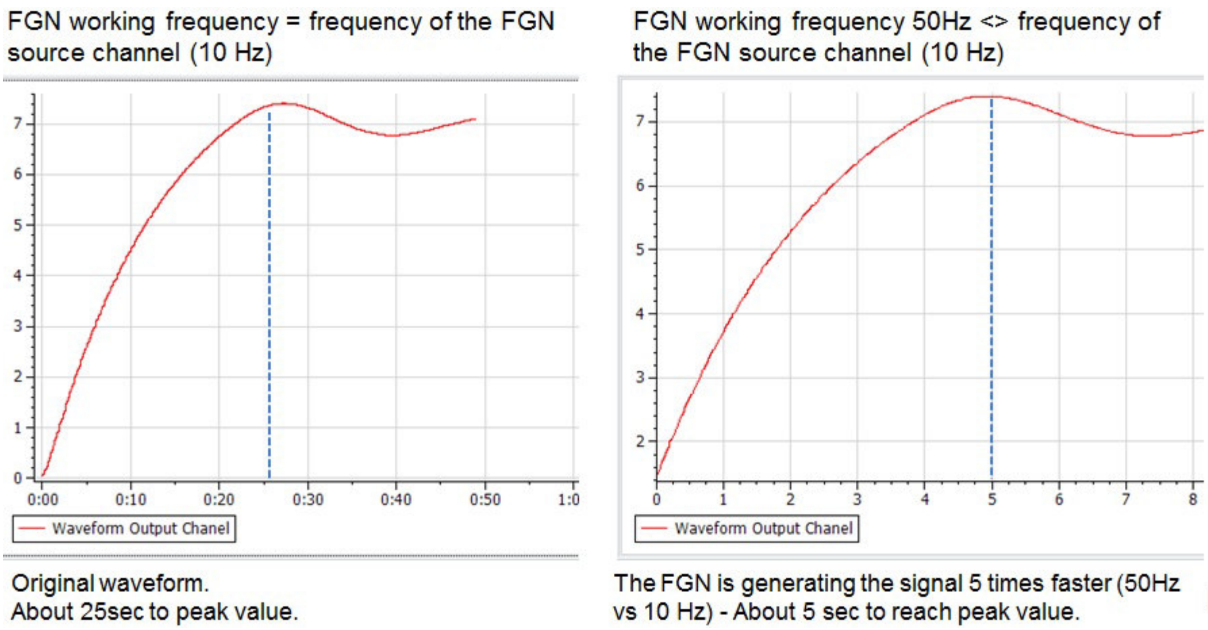
14.2.5 FGN – Signal tab sheet for Arbitrary function generator

The signal tab sheet for the arbitrary function generator has some specific configuration options. You can select an IAD file and a specific channel to generate your individual signal.



[CO_12]

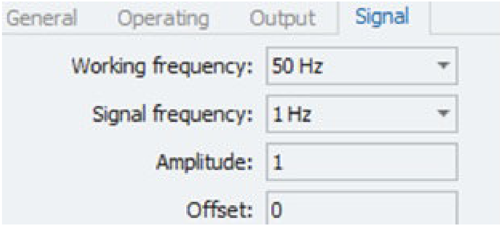
The working frequency has a strong impact on how fast the signal is generated as the example below demonstrates.



[CO_13]

14.3 FGN – Signal tab sheet for Ramp function generator

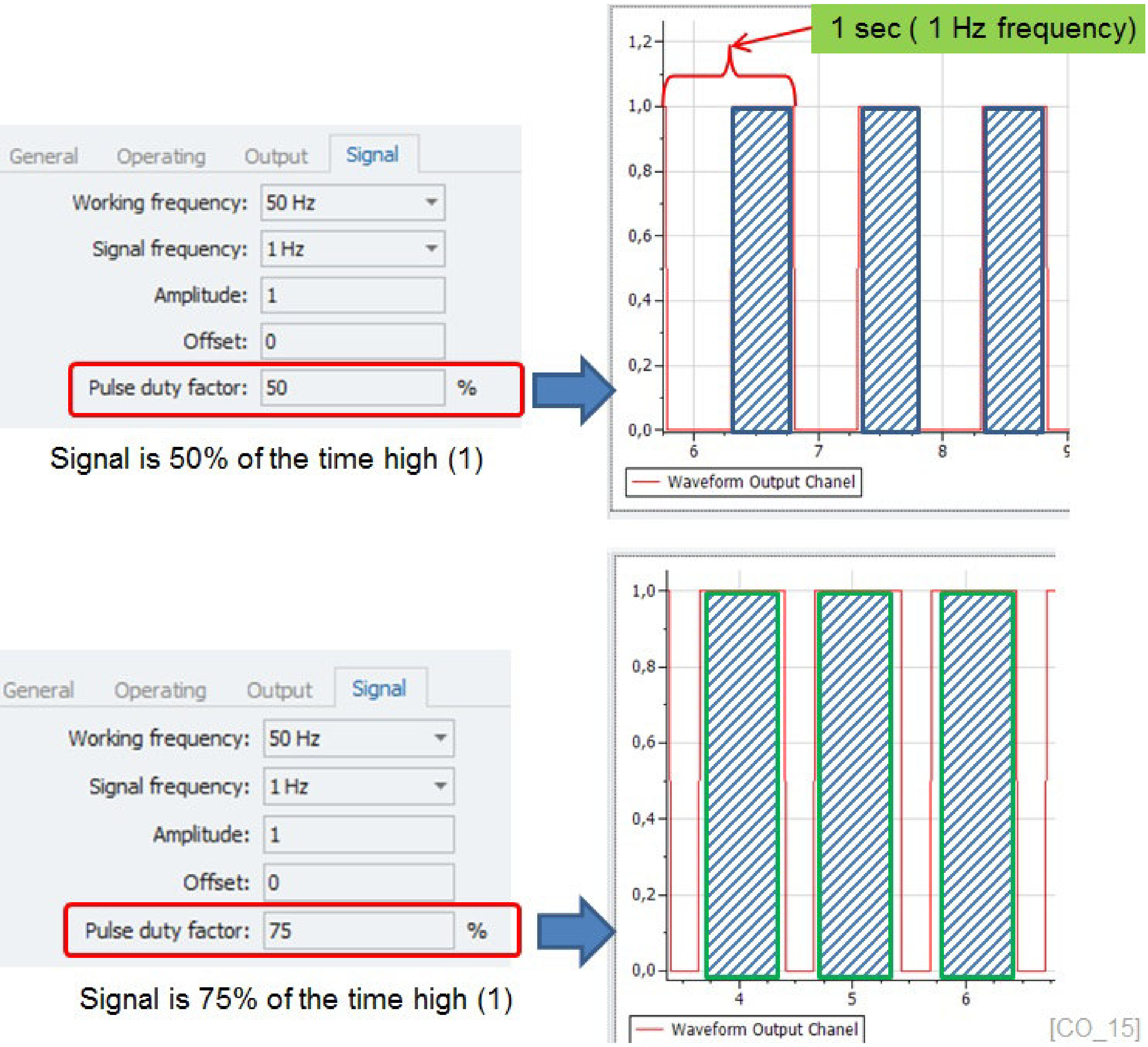
The Ramp generator is generating ramps and the configuration options are the start value and the end value.



[CO_14]

14.4 FGN – Signal tab sheet for Rectangle function generator

The Rectangle function generator has a special configuration setting which is the Pulse duty factor in [%]. The pulse duty factor defines for how long the rectangle signal stays high in one period. You can use the Rectangle FGN generator to generate a static PWM signal. There is no possibility to change the Pulse width factor during operation of this FGN.



[CO_15]

14.5 FGN – Signal tab sheet for Sine/Sawtooth function generator

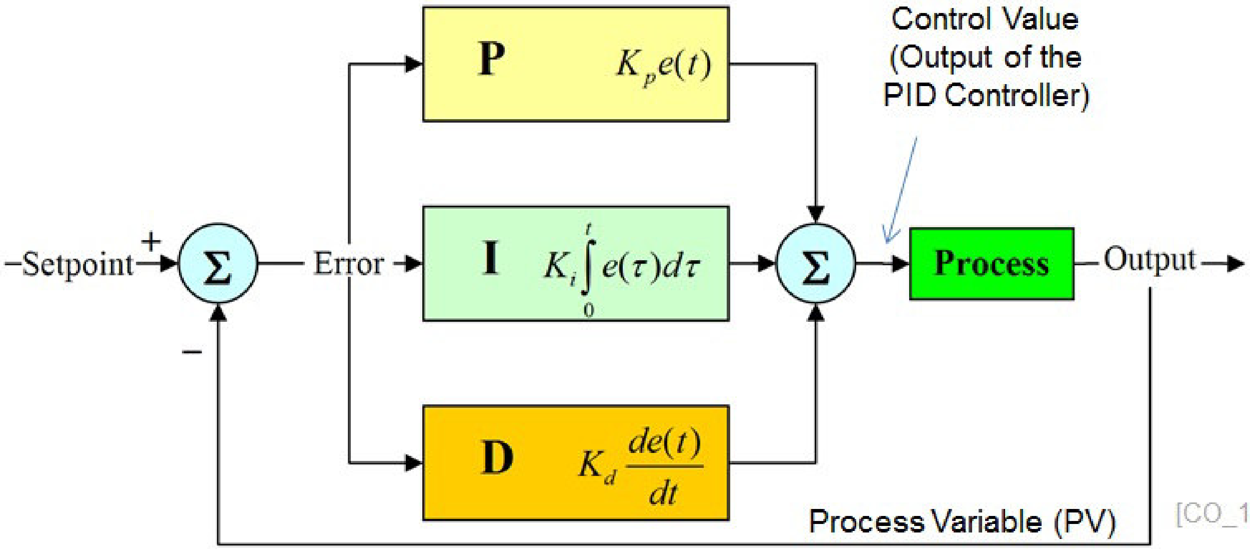
The FGN for Sine and Sawtooth functions have the same configuration settings as the Amplitude and the Offset.

14.6 PID Controller

14.6.1 Introduction and system setup

IPEmotion supports a real PID controller functionality with a maximum update rate of 1 kHz which consist of .

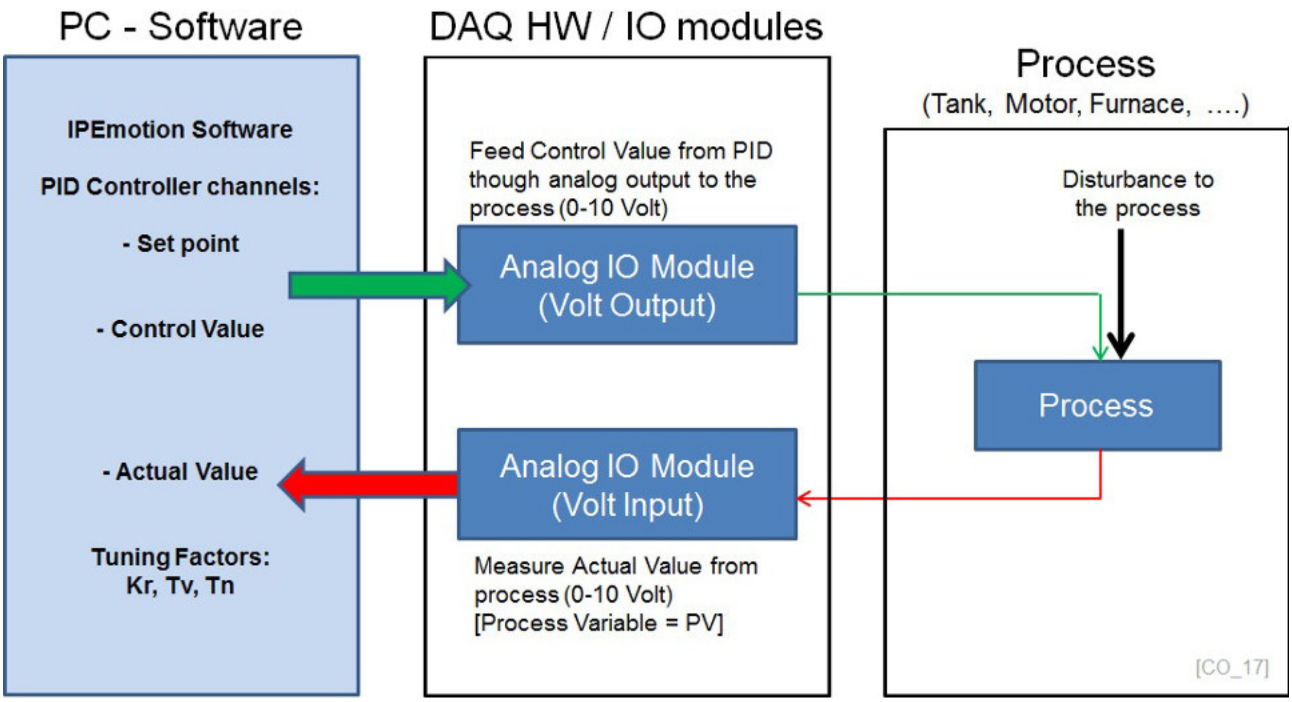
- P = Proportional control
- I = Integral control
- D = Derivative Control



[CO_16]

Information *It is not possible to test and simulate a PID controller functionality with IPEmotion software alone. You need a real process (Tank, Furnace, Engine, etc.) with an output signal feeding back to the PID calculation.*

To demonstrate the PID loop functionality a process simulator specially developed for the IPEmotion PID controller will be used. The process simulator is a small box representing the process and provides an analog output signal from a process and also has an analog input to receive the control value from the PID controller. On a real process the control value e.g. is moving actuators to change the position of a value to change the flow rate into a tank or to control the throttle position of a motor. The following diagram gives you an overview of the software, the analog measurement system with IO modules and the process and how they are interrelated. You will need normally analog input measurement and analog output signals to control the process.

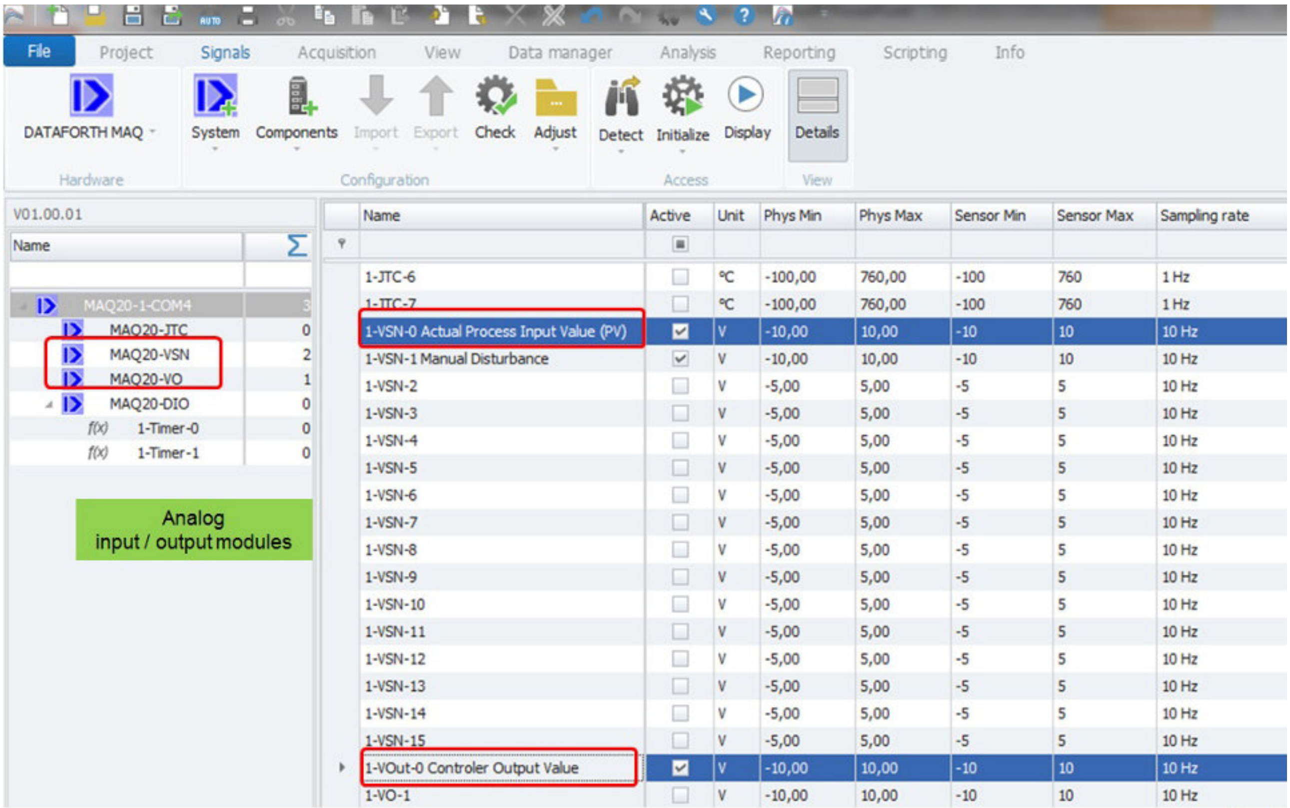


The objective of a PID controller is to keep a process (Oven temperature, engine RPM, Tank fill level etc. . .) to a given set point. Also the PID controller should react to disturbances of the process. For example increase the heating of an oven, when temperature drops or increases throttle position of a motor when the load increases.

14.6.2 Create IO channels

As explained above the PID controller requires an analog input signal from the process (Process Variable) and an analog output channel to feed the control value (CO) from the PID back to the process. In this example the Dataforth MAQ20 IO modules are used. The IO channels are connected to the process which is a pocket size simulator.

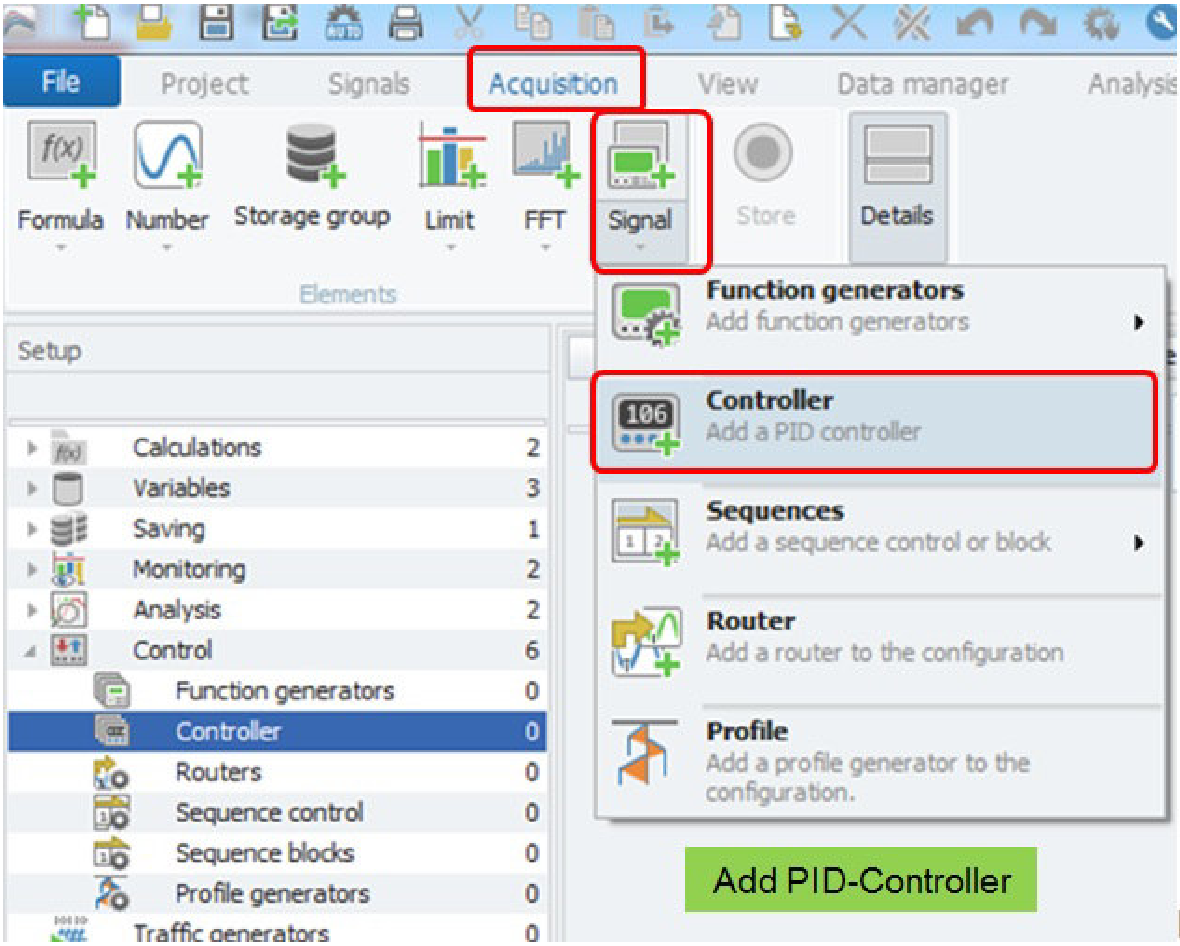
- VSN — Analog input module (single ended)
- VO — Analog output module



[CO_18]

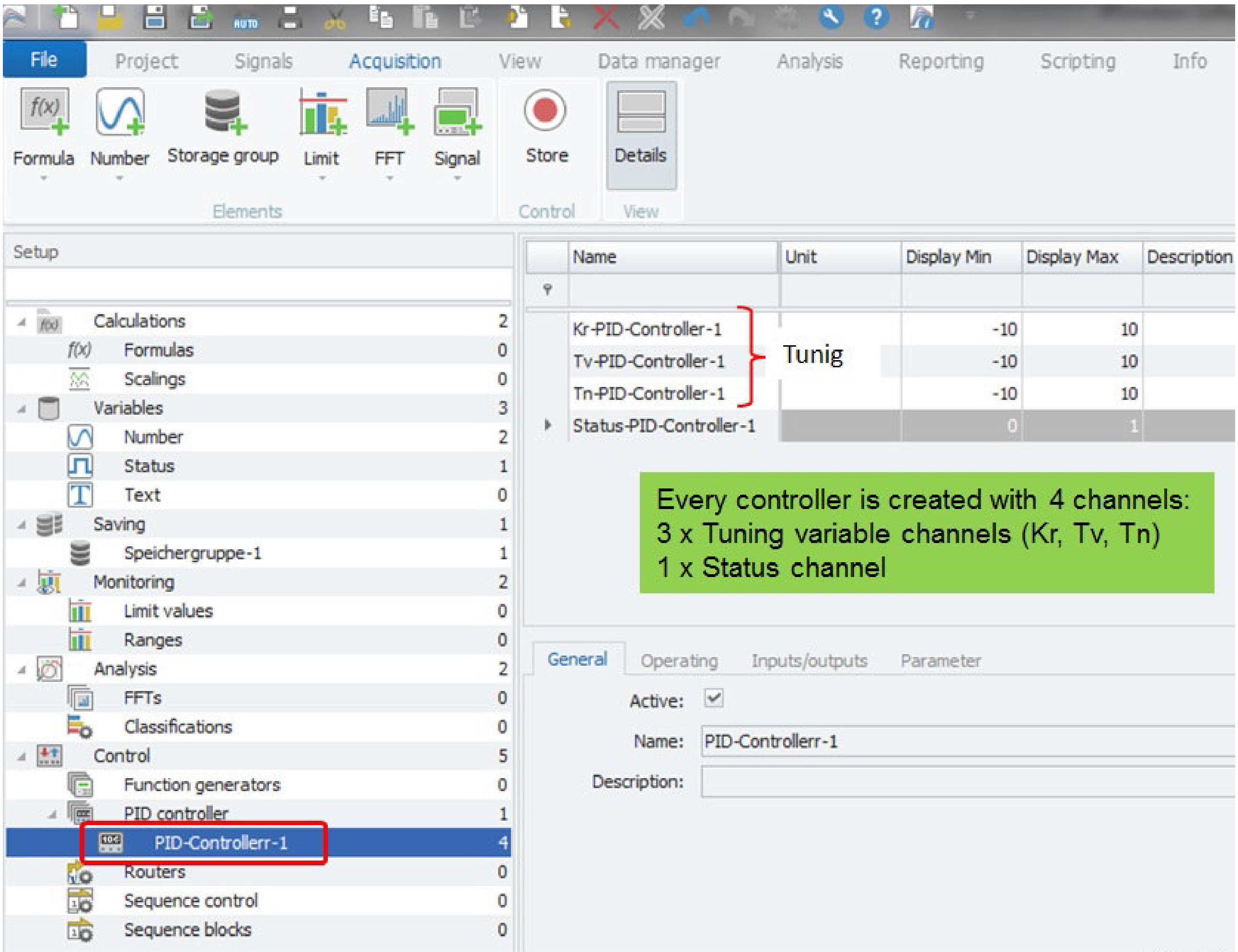
14.6.3 Creating PID controller

You can add the PID controller from the ribbon.



[CO_19]

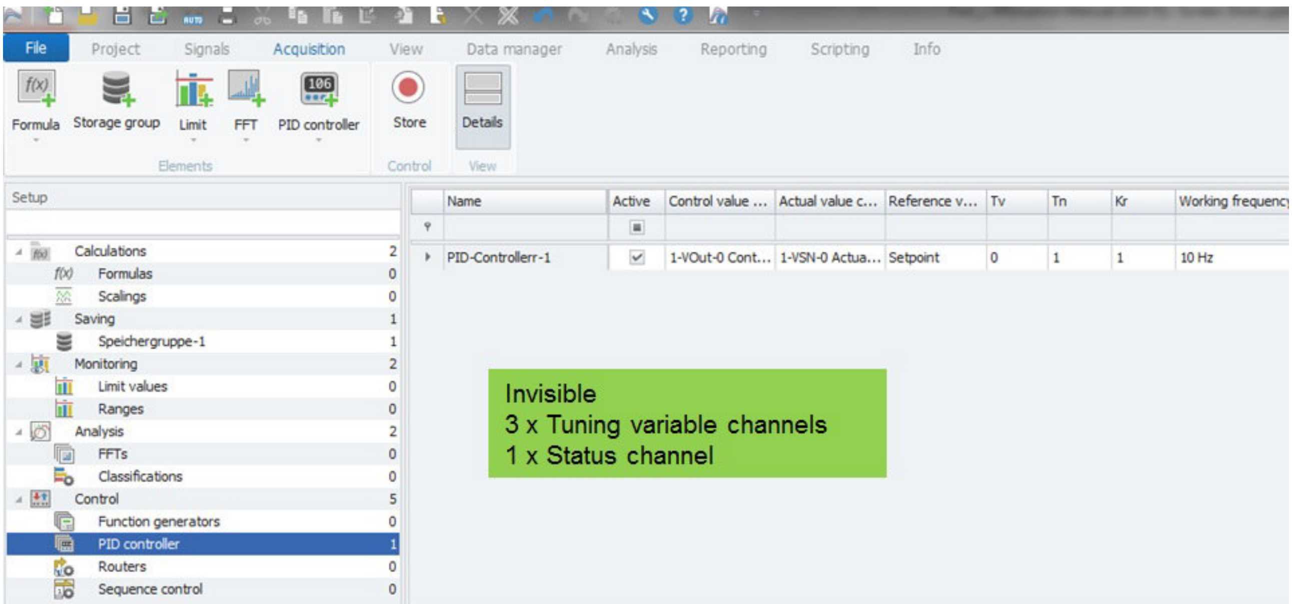
The controller is created and listed in the control module below the PID controller section. Every PID controller is created with 4 channels. Three channels are related to the tuning variable which will be discussed in chapter 14.6.7 below. The status channel is indicating whether the PID controller is operating or not.



[CO_20]

Tip

Depending on the settings in the Options you may not see the three tuning parameter channels as the screenshot below is indicating. To activate the variable channels see Options > Basic Settings > Expert mode > Variable configuration in chapter 22.3.4.



[CO_21]

14.6.4 PID controller - General tab sheet

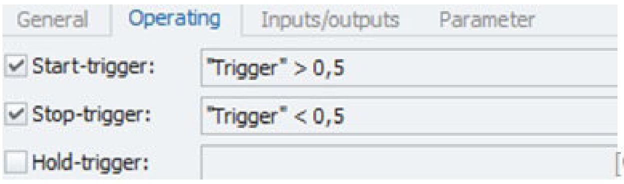
The general tab sheet covers the Status, Name and Description of the PID Controller.

- Active — With this checkbox you can activate / deactivate the PID Controller
- Name — Refers to the name of the PID controller
- Description — Here you can add an additional description to the PID Controller

[CO_22]

14.6.5 PID controller - Operating tab sheet

In the operating tab sheet:



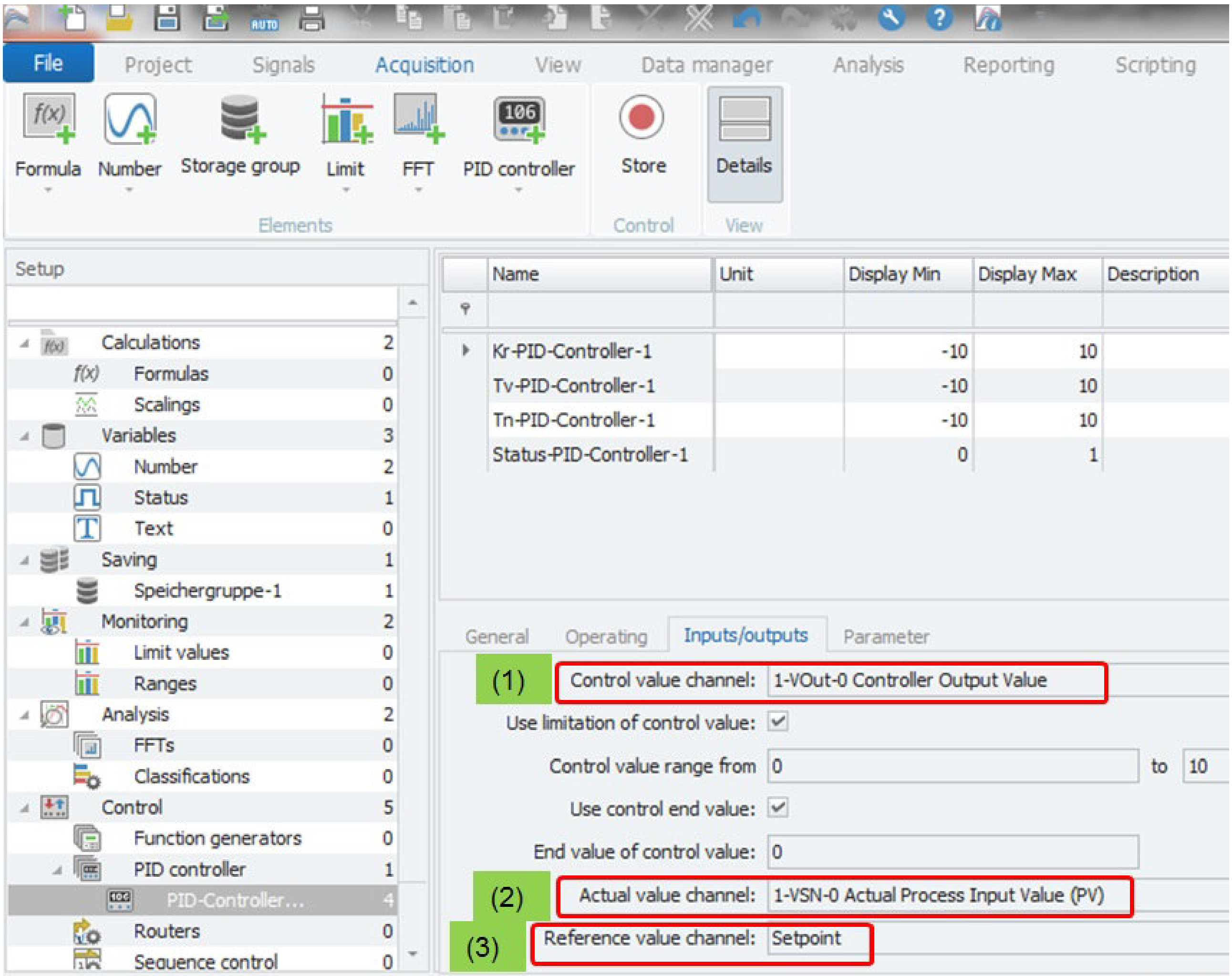
[CO_23]

- Start trigger — This can be a trigger to start the PID Controller
- Stop trigger — This can be a trigger to stop the PID Controller
- Hold trigger — This can be a trigger to hold the PID Controller

If you define no trigger condition (disabled) the PID Controller starts its operation directly when you start the measurement. When the PID Controller is operating the status channel is updated from 0 to 1. The status one is indicating that the PID Controller is operating.

14.6.6 PID controller - Input/Output tab sheet

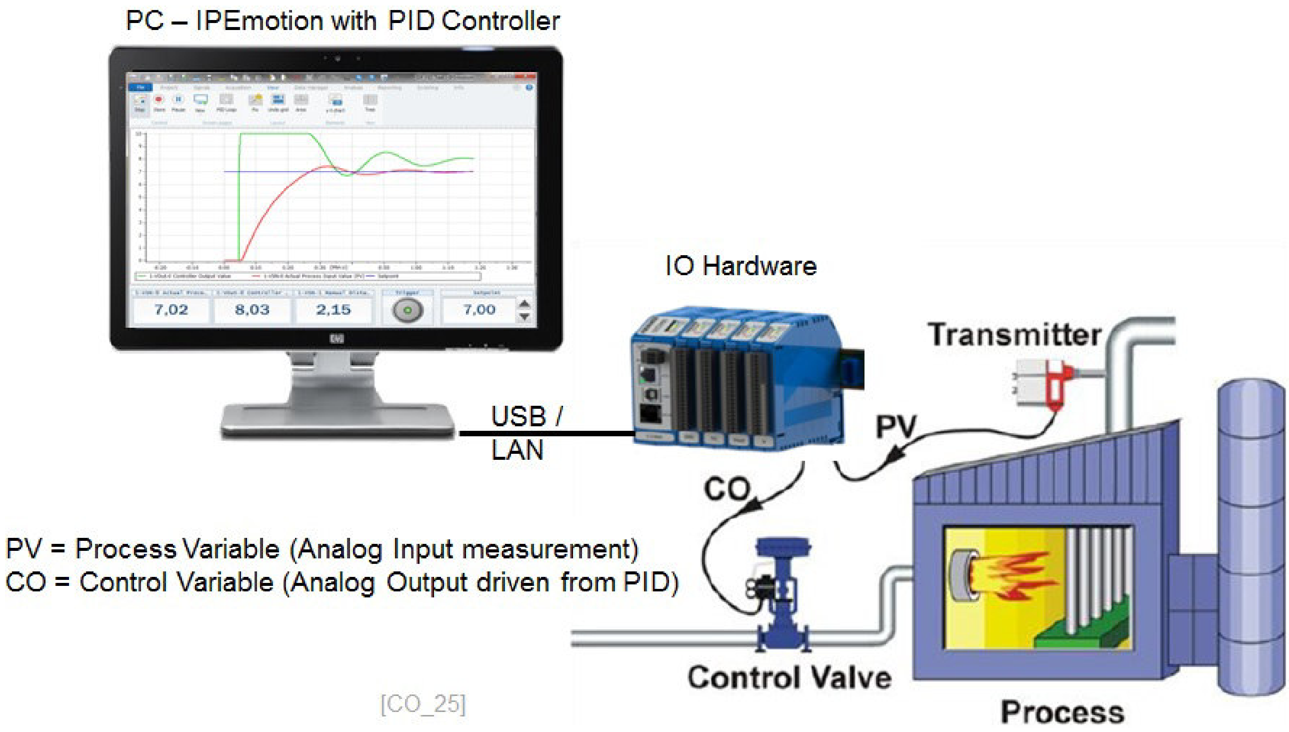
The Input and Output tab sheet is the important tab sheet to make the controller work.



[CO_24]

- **Control value channel** — You have to link a channel with the data direction output. The controller is writing the control value (CO) into this channel. This value is then send to the process thorough an analog output module. This analog output signal is applied to an actuator of the process which could be e.g. a valve to change the flow rate, motor rpm speed, etc. The control value (CO) must update an actuator which has an impact on the actual value channel (Process Variable PV).

- **Actual value channel** — The actual value channel (Process Variable PV) is an analog input channel measuring the current process output signal. This measurement channel could be any type of input e.g. (Volt, Temperature, Strain, RPM, etc.). The PID control loop is only effective when the control value (CO) has an impact on the actual value (PV). Example: If you measure the temperature inside a furnace (PV) the control value (CO) should have for example an impact on the valve releasing more or less natural gas to the burner which will then increase or decrease the furnace temperature. The following diagram shows how the PV and CO are interrelated.



[CO_25]

- Reference value channel (Set Point)

The reference value is also defined as Set Point. The Set Point is a very important point for the process as the PID Controller has to keep the process on this Set Point. The Set Point can be a defined furnace temperature, tank fill level, or engine speed, etc. . . .
The Set Point can be changed by the operator who is adapting the process to his needs. For example the furnace temperature can change depending on the product being process in the furnace.

- Check box: Use limits of control value

This checkbox is activating the control value output range. Control value range

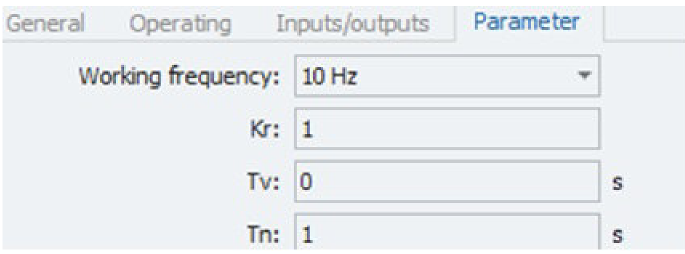
- Check box: Use control end value

In this example the value are set from 0 to 10 as the analog output of the hardware can generate 0 -10 Volt output signal.

- End value of control value As end value when the PID Controller is stopped in his operation 0 is defined. You can define any and value in the given output range.

14.6.7 PID controller – Parameter tab sheet (Tuning Variables)

In the parameter tab sheet the so called tuning variables like amplification factor (Kr), lead time (Tv), and follow-up time (Tn) are defined. The tuning factors are available as separate channels. If needed you can update the parameters during your acquisition process through manual inputs, sliders or function generators.



[CO_26]

- **Working frequency** — Here you define the frequency of how fast the PID loop is calculating. The Working frequency should be pretty much in line with the measurement (PV) and output (CO) frequency. There is no point in having the PID loop running at 1 kHz calculation rate when the inputs and outputs are update at 1 Hz rate.
- **Kr** — Amplification is by default 1. This factor has an impact on the proportional gain.
- **Tv** — Is a time constant for the derivative gain. The default value is 0. When you increase the Tv >0 the noise is increasing.
- **Tn** — Is a time constant for the integral gain. The default value is 1. When this factor increases the system reacts slower.

There are different terminologies used for the tuning factors between European and American standards.

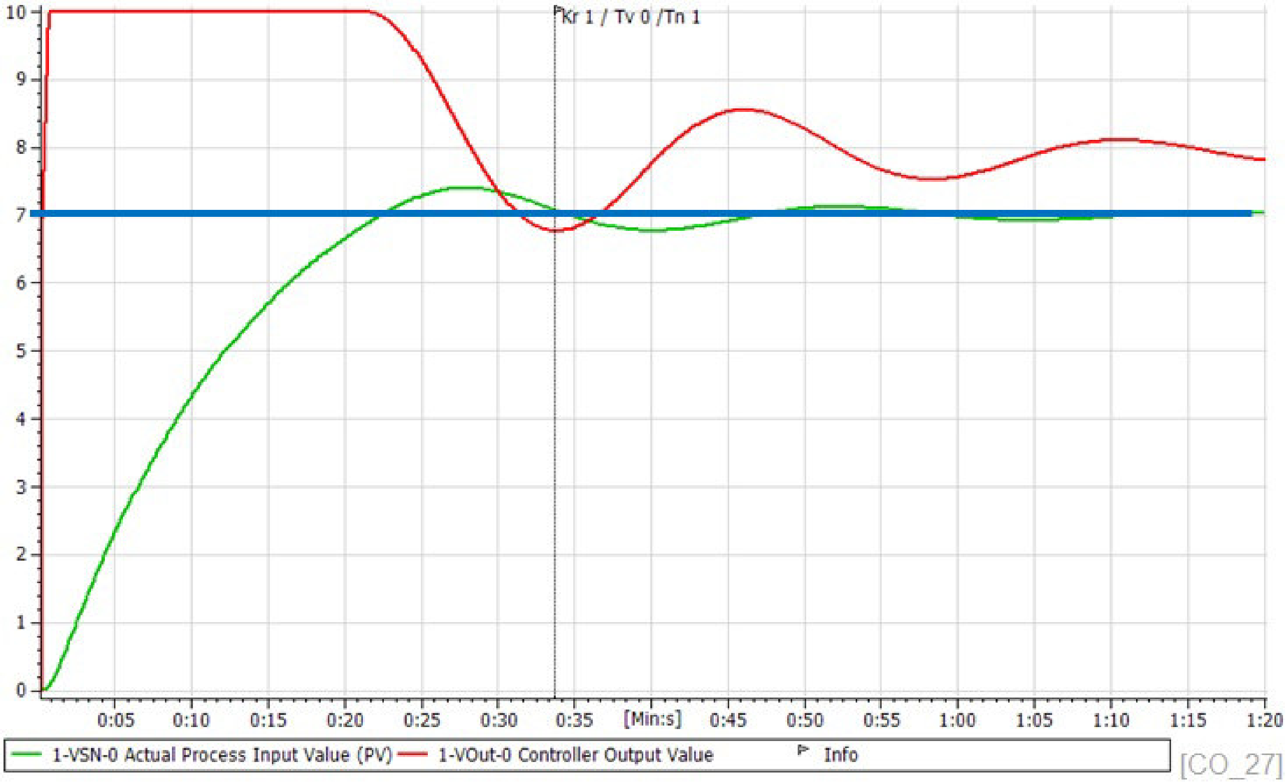
IPEmotion EU - PID Tuning Parameters	US - PID Tuning Parameters
Kr = Amplification	Kp Proportional Gain Kr = Kp
Tv = Lead time	Kd Derivative Gain Tv = Kd / Kp (derivative Gain) Tv = Kd / Kr = Kd / Ki
Tn = Reset time	Ki Integral Gain Tn = Kp / Ki (Integral Gain) Tn = Kr / Ki = Kp / Ki

For more details about the different interpretation of the PID tuning parameters see Wikipedia:
http://de.wikipedia.org/wiki/PID-Regler#PID-Regler
http://en.wikipedia.org/wiki/PID_controller

14.6.8 Examples for the impact of tuning factor settings

Standard tuning factors:

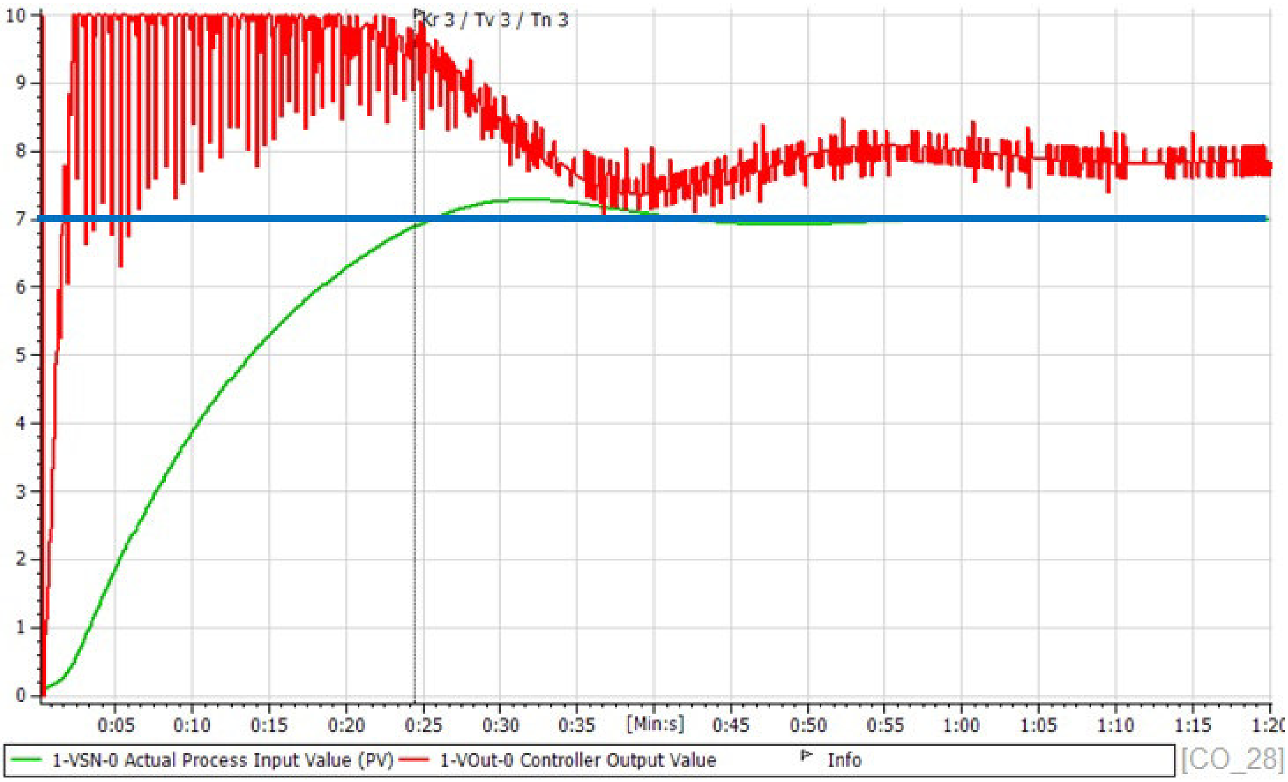
- Kr = 1 / Tv = 0 / Tn = 1



[CO_27]

Increased tuning factors: Here you can see that Tv is increasing the noise a lot.

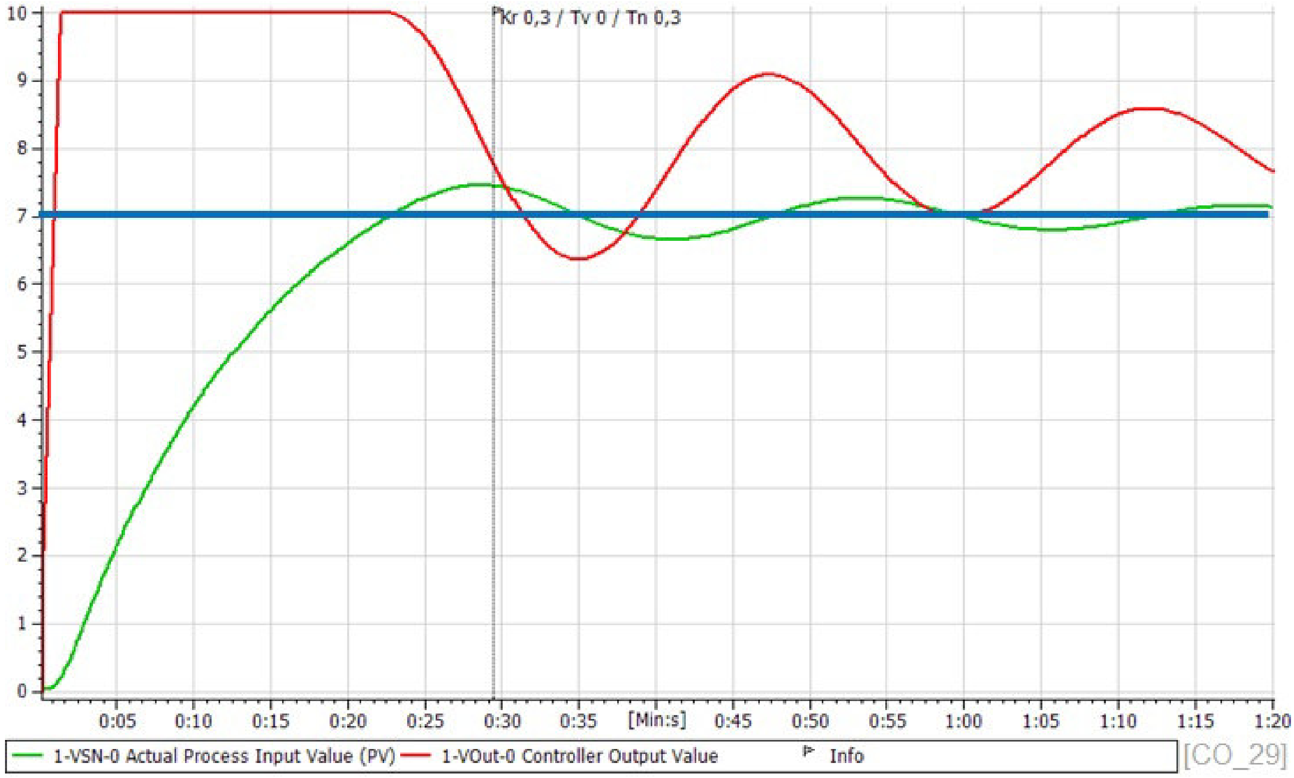
- Kr = 3 / Tv = 3 / Tn = 3



[CO_28]

Decreased tuning factors:

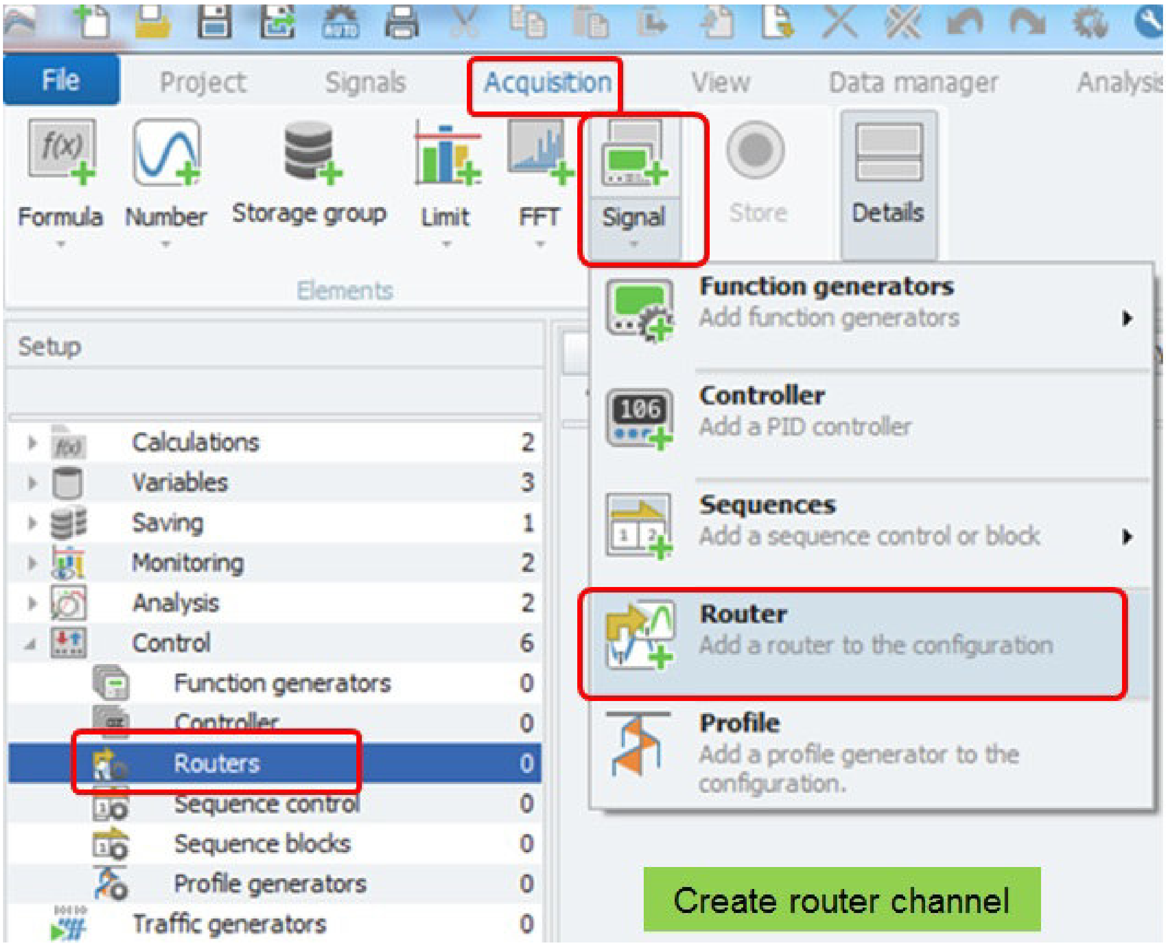
- Kr = 0,3 / Tv = 0 / Tn = 0,3



[CO_29]

14.7 Router channels

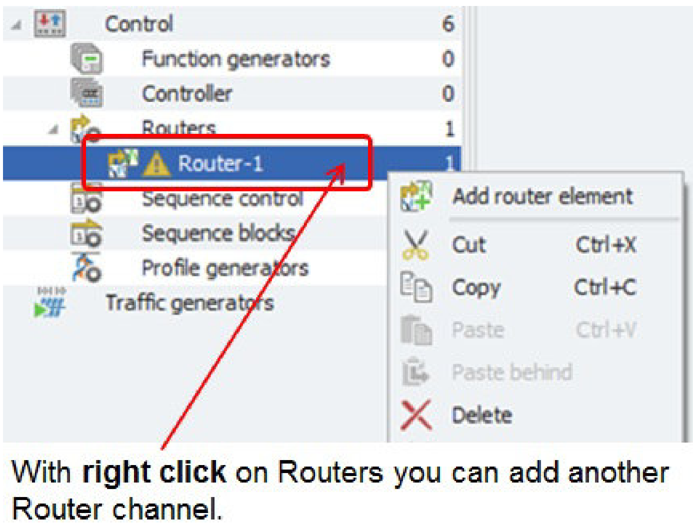
The main function of the router channel is to take a signal (incoming) and return the signal to another channel (output). The router is a turning table for incoming and outgoing data.



[CO_30]

14.7.1 Create Routers

You can create several routers. This is particularly useful if you have several Router elements (channels) which will have different trigger and operating conditions.

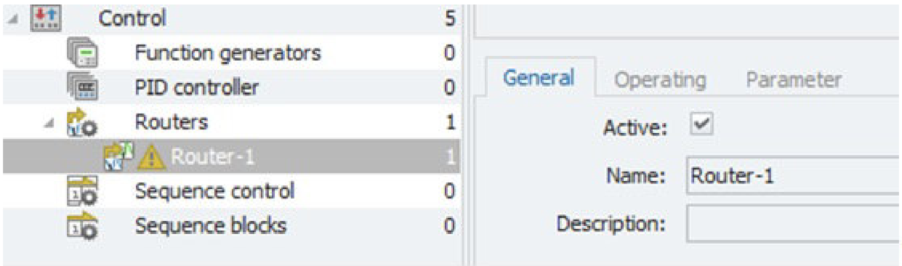


[CO_31]

14.7.2 Router – General tab sheet

The general tab sheet covers the status, name and description of the PID Controller.

Information *All router elements related to one router are subjected to the same overall operating trigger conditions and the cycle time parameters.*

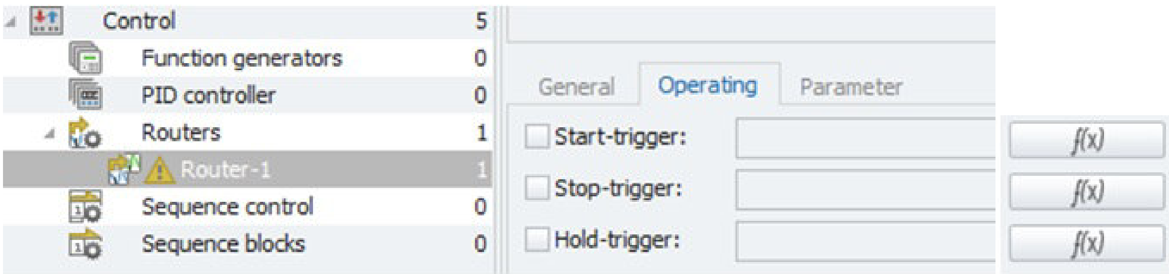


[CO_32]

- ► Active — With this checkbox you can activate / deactivate the router
- ► Name — Refers to the name of the router
- ► Description — Here you can add an additional description to the router

14.7.3 Router – Operating tab sheet

In the operating tab sheet you can define trigger conditions to start, stop and hold the router using the f(x) button.

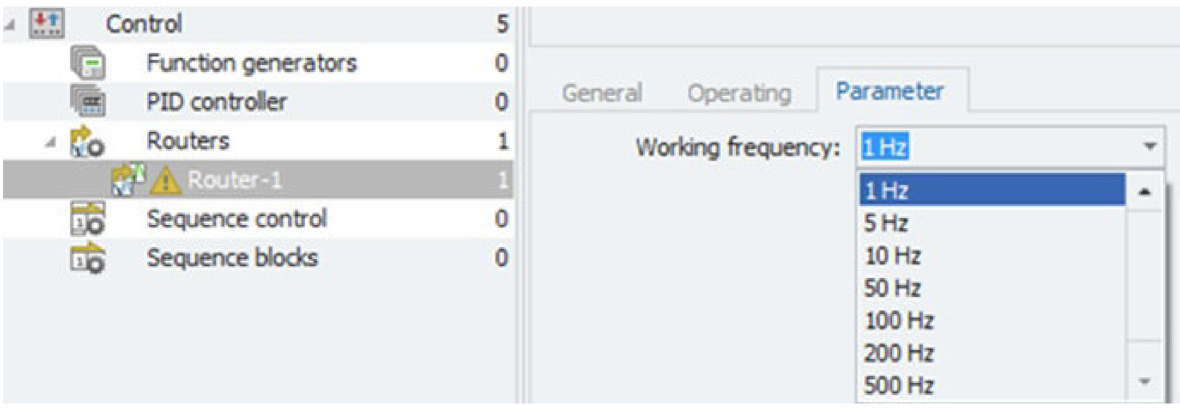


[CO_33]

- ► Start trigger — This can be a trigger to start the Router
- ► Stop trigger — This can be a trigger to stop the Router
- ► Hold trigger — This can be a trigger to hold the Router

14.7.4 Router – Parameter tab sheet

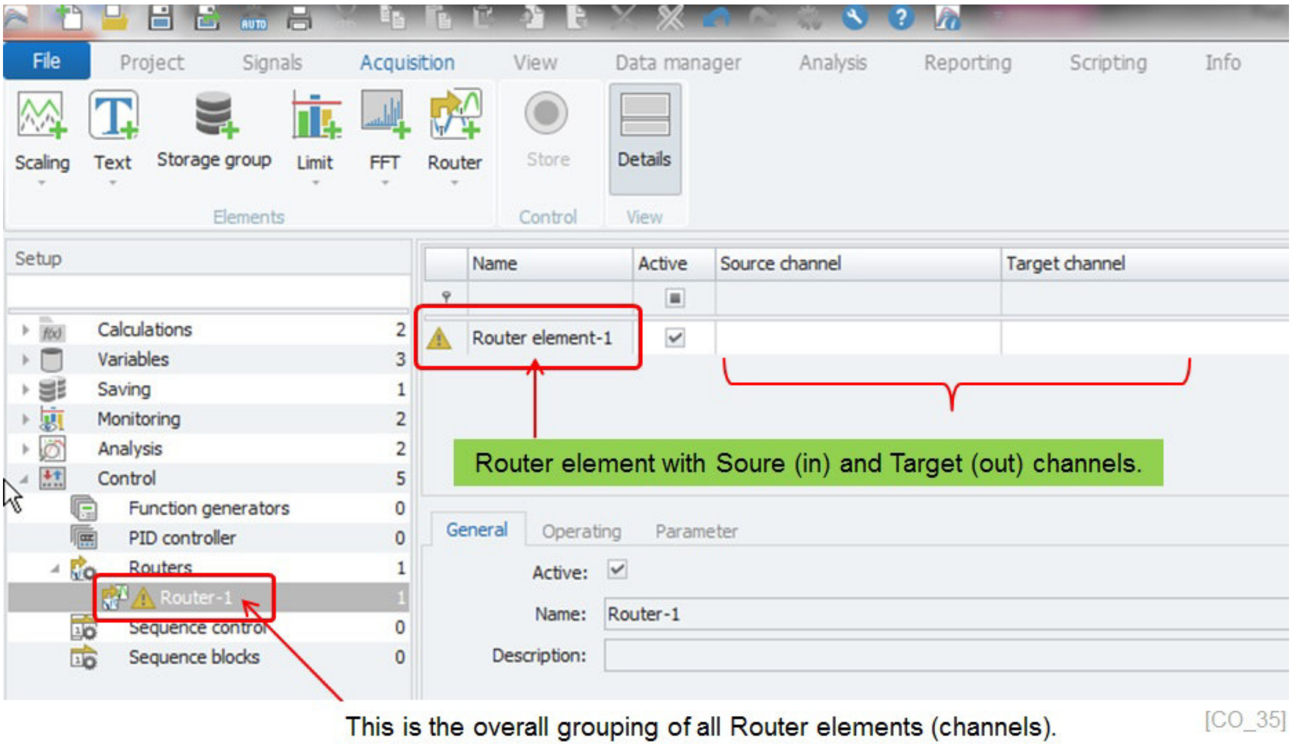
The working frequency can be set to a maximum of 1 kHz. This frequency defines in which interval the router is sending data out.



[CO_34]

14.7.5 Router Element

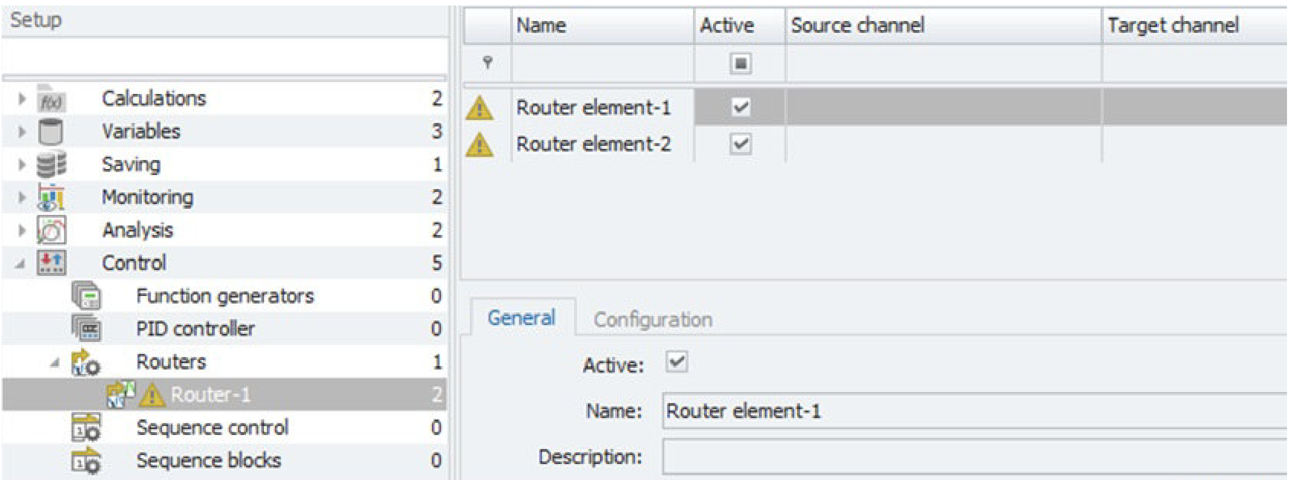
The following screenshot shows a router with one router element (channel).



[CO_35]

14.7.6 Router element - General tab sheet

The general tab sheet covers the Status, Name and Description of the router element.

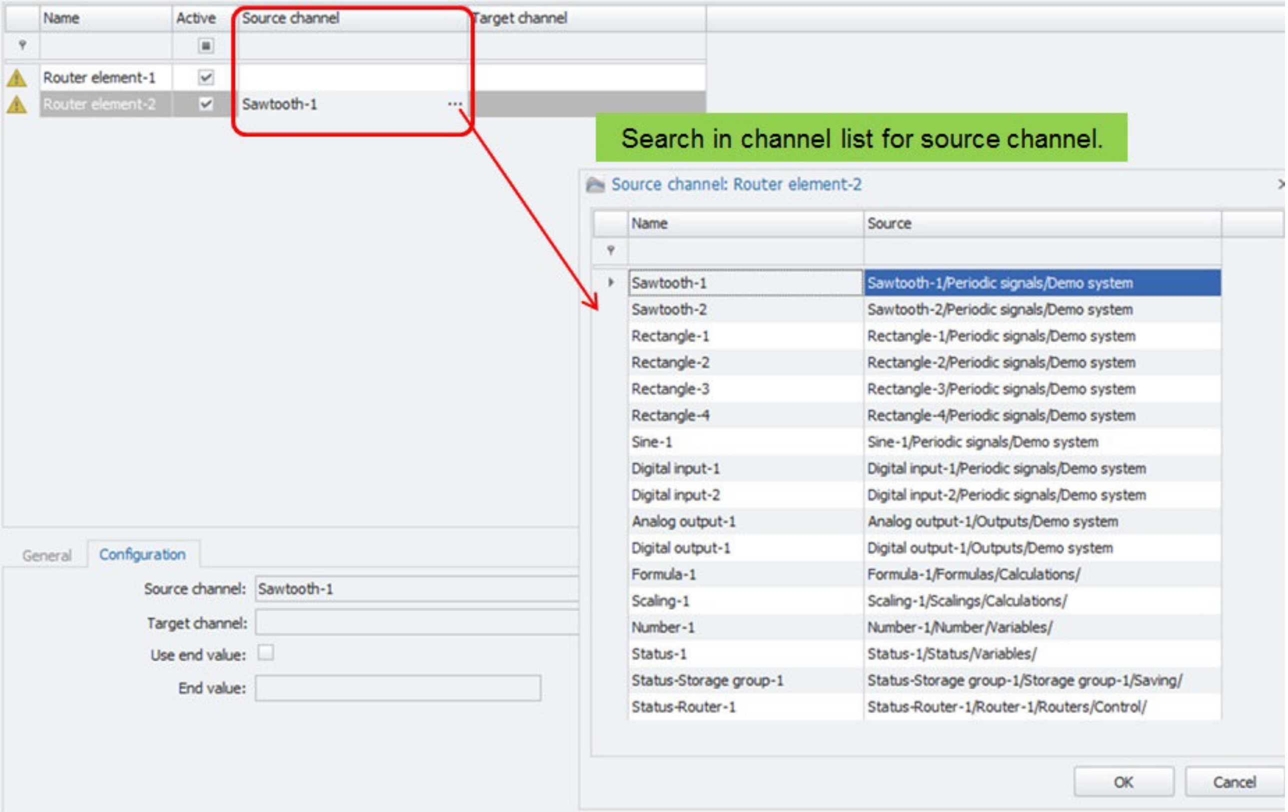


[CO_36]

- **Active** — With this checkbox you can activate / deactivate the router
- **Name** — Refers to the name of the router
- **Description** — Here you can add an additional description to the router

14.7.7 Router element – Configuration tab sheet

On router element level you select the source and target channel.



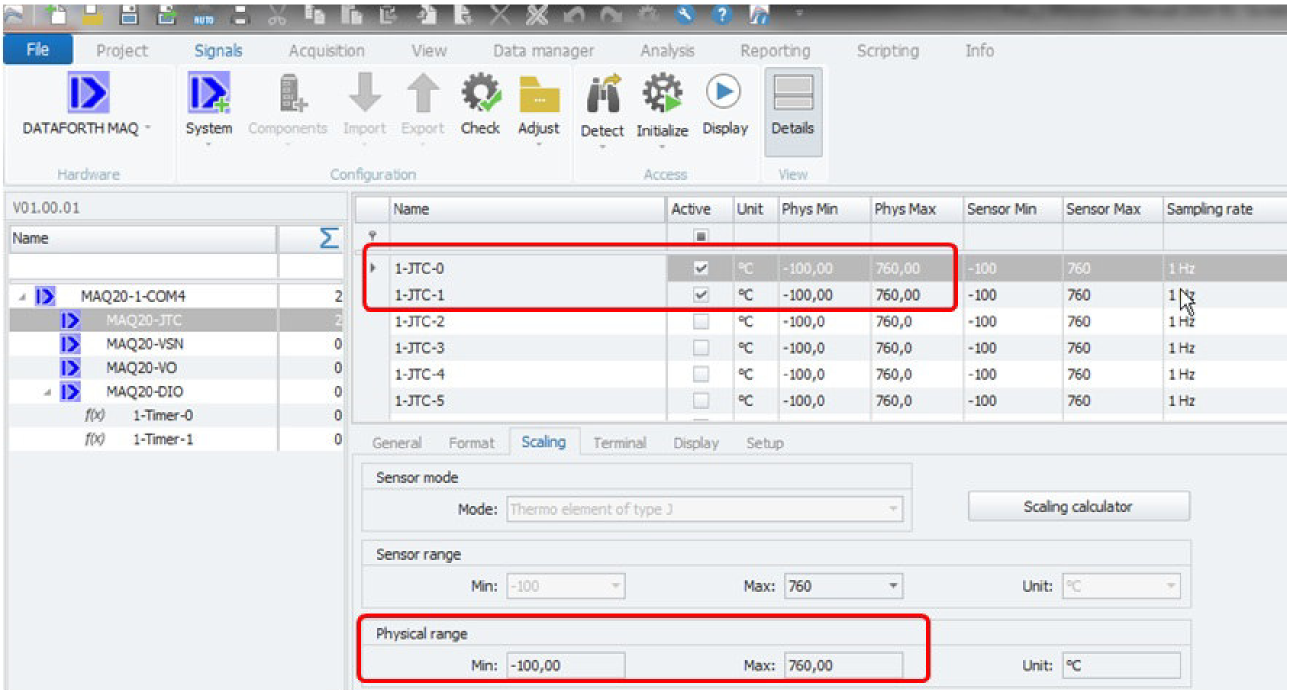
[CO_37]

- **Source channel** — The source channel can be any input or output type channel and variable channels (Number, Status, Text) or Scaling channels can serve as input channels and output channels as well.
- **Target channel** — The target channel is receiving the signals from the source channel and converting it to the output format. Using the router channel you can create a bridge and send data between different PlugIns. This functions works across all signals and supported protocols like: CAN, Ethernet, FlexRay, Profibus, Serial RS232, etc.
- **Used end value** — This is a check box to activate a referred end value. This function becomes effective if you work with trigger conditions to stop the router channel.
- **End value** — Is a defined end value which will be put to the output channel when the trigger condition for Stop is true.

⚠ ***Attention!*** *Video and audio signals cannot be sending via router elements.*

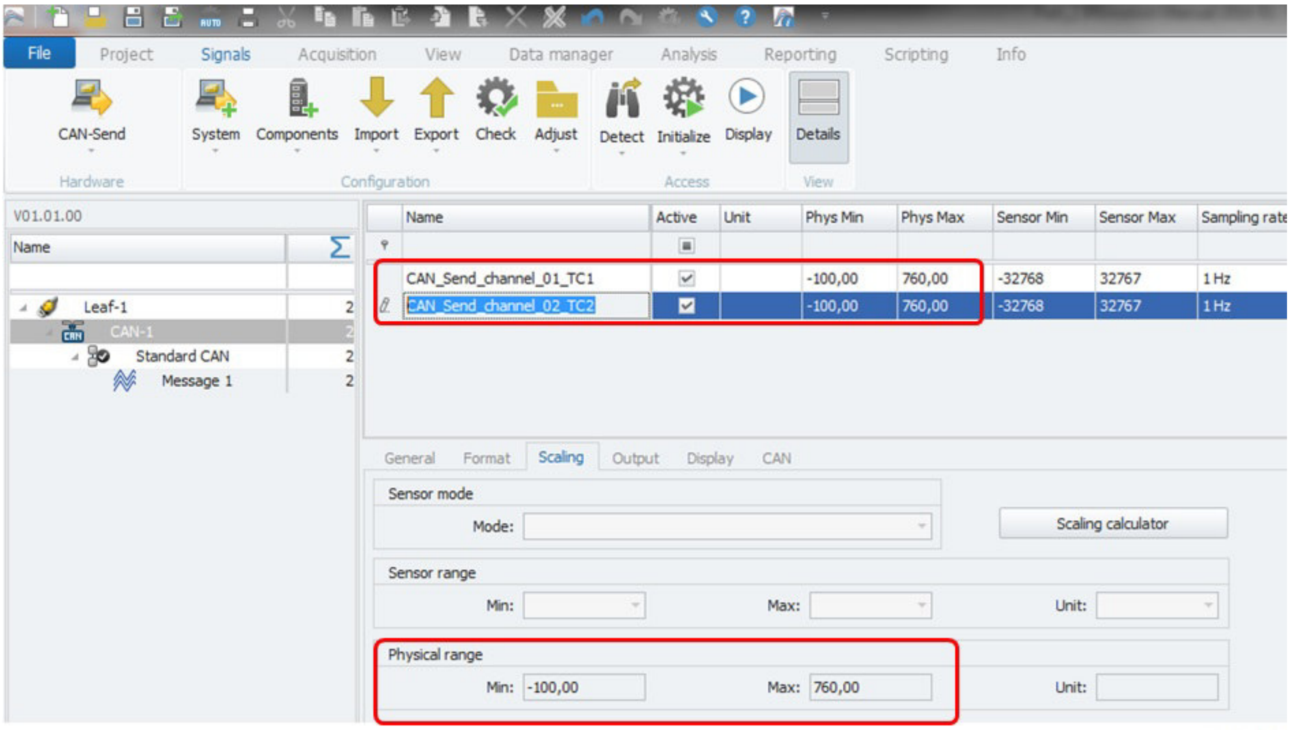
14.7.8 Example Router configuration – Sending over CAN

In the first step you have to check what your source channels and the related scaling is. The target channel should have the same scaling to ensure that that the values are correctly transmitted.



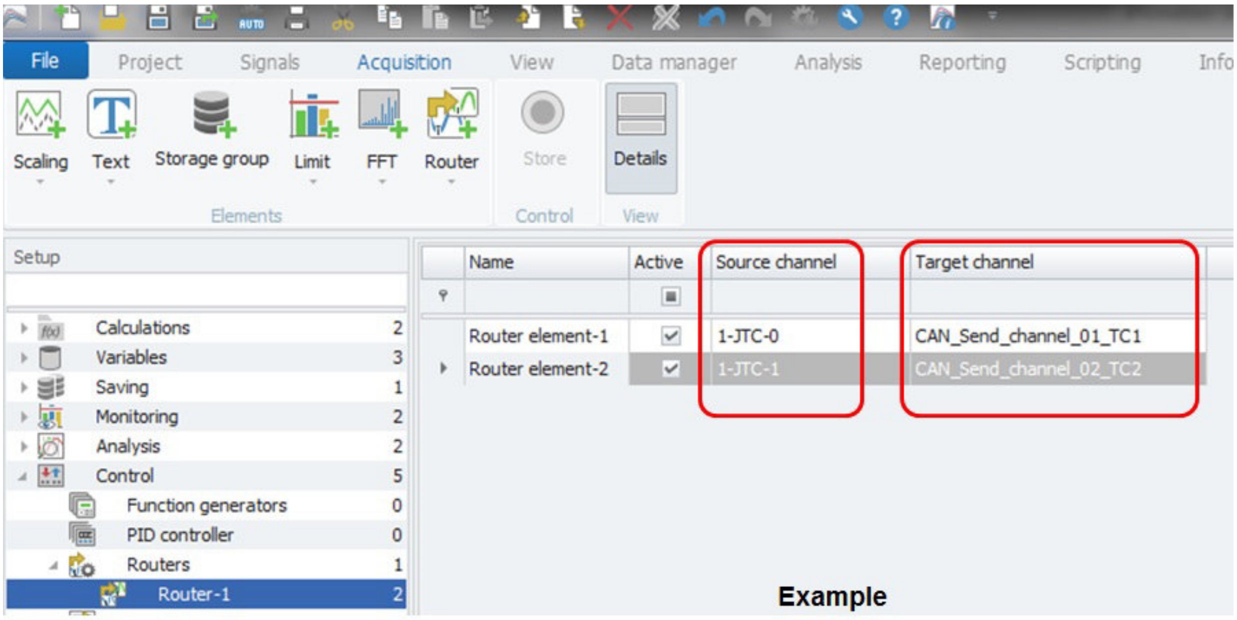
[CO_38]

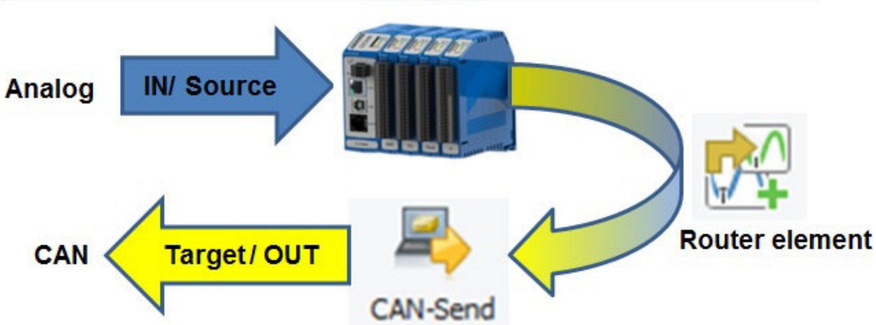
The target system in this example is CAN interface (CAN Send PlugIn) and the analog measurements will be transferred as CAN messages. A CAN interface with 2 CAN channels were created.



[CO_39]

The Router element is now linking both channels together.





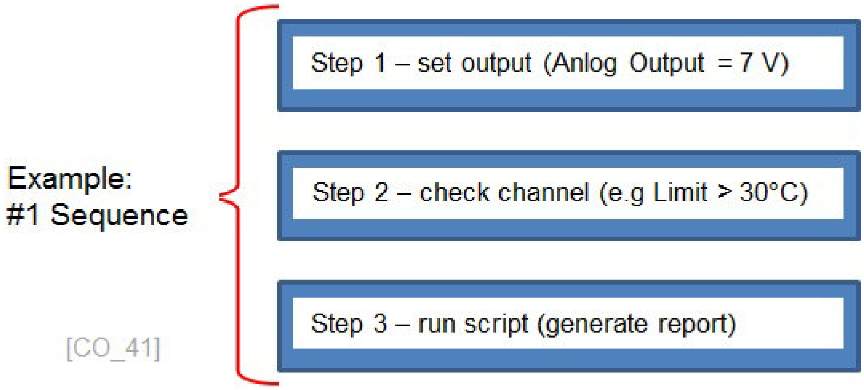
[CO_40]

14.8 Sequences Control

The test sequencing is a very powerful part of the overall Control Module to organize and automate tests. This module is particular practical if you like to automate repetitive test cycles. The main purpose of the module is to organize test steps in a chronological (Time) and logical order.

Within the sequence you can execute or perform 3 different functions which will be discussed in more detail below. Basically you can combine the 4 main functions in any order to cover your application.

- **Set output** — This function is to write a numerical or Text value to a variable or output channel. Example: With a numerical output value you can drive analog or digital outputs to operate actuators like engine speed or valve position.
- **Check channel** — This function is generally used to perform control actions. It is designed to check or monitor if a condition is true. The main idea is that only when the condition is true the next step of the overall sequence is executed. Example: A check condition could be that a certain load is only applied to a motor when a certain engine RPM is reached.
- **Run Script** — This functions is basically a door opener to integrate external applications and more complex programming routines to the test sequence. When you trigger a scrip from the sequence you have plenty possibilities to perform functions inside the script. Example: A script could generate automatically a specific report.

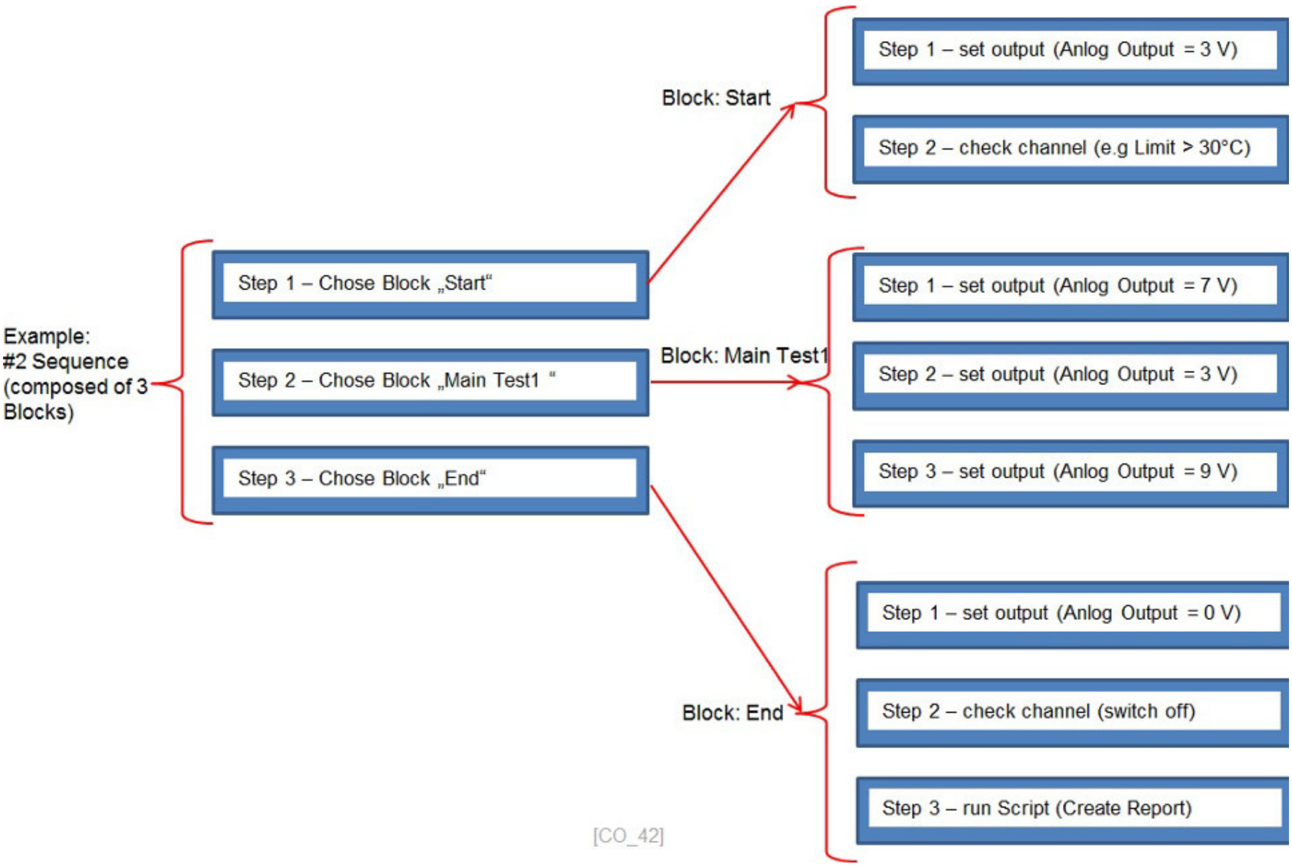


[CO_41]

- **Chose Block**: In larger test applications is useful to break down a large test sequence in separate smaller blocks. You can than define a master test sequence which is consisting of a combination of different blocks. This approach will give you the following advantages:
  1. You program a block only one time and you can use it on several sequences.
  2. You can combine different blocks in different orders as appropriate for a specific test cycle.
  3. If you need to modify a block you need to do it only one time in on place rather to make updates on all test sequence individually.

  Example: You have different test items (e.g. pumps) and for every model you have different test sequences. However for every pump you have the same start and end testing procedure. In this case it is useful to organize the start and end testing sequence in a separate block. See chapter 14.9 for details about how to configure the blocks.

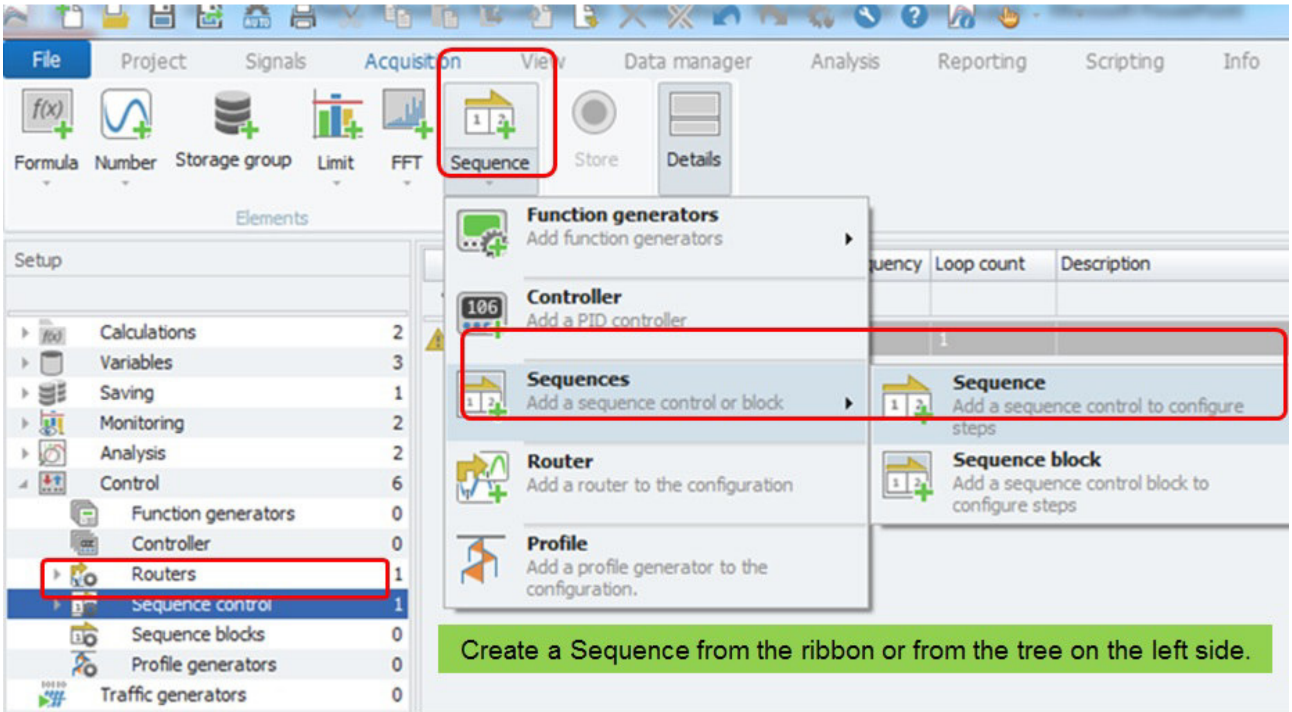
The following diagram gives an example of a test sequence which is composed of 3 blocks.



[CO_42]

14.8.1 Creating a Sequence

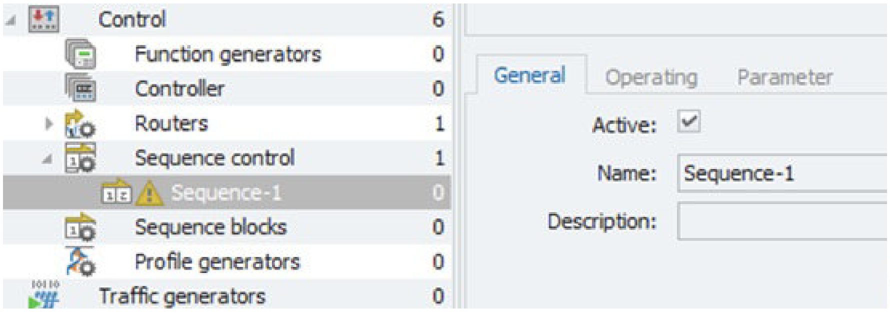
In the first step we need to create a Sequence.



[CO_43]

14.8.2 Sequence – General tab sheet

The general tab sheet covers the Status, Name and Description of the Sequence.

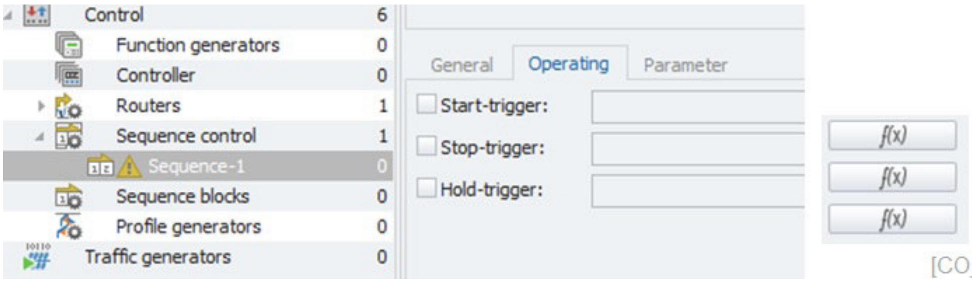


[CO_44]

► Active	With this checkbox you can activate / deactivate the sequence
► Name	Refers to the name of the sequence
► Description	Here you can add an additional description to the sequence

14.8.3 Sequence – Operating tab sheet

In the operating tab sheet you can define trigger conditions to start, stop and hold the sequence using the f(x) button.

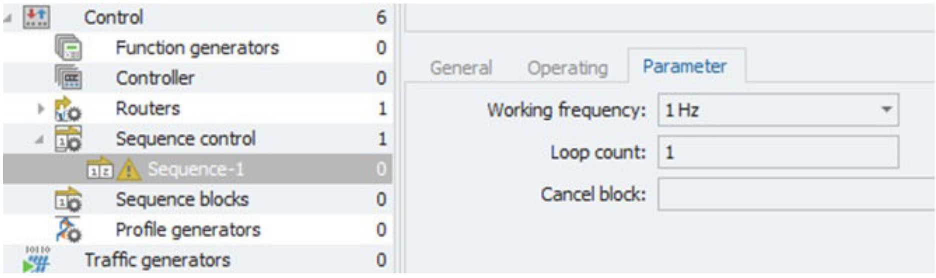


[CO_45]

- Start trigger — This can be a trigger to start the sequence.
- Stop trigger — This can be a trigger to stop the sequence.
- Hold trigger — This can be a trigger to hold the sequence.

14.8.4 Sequence – Parameter tab sheet

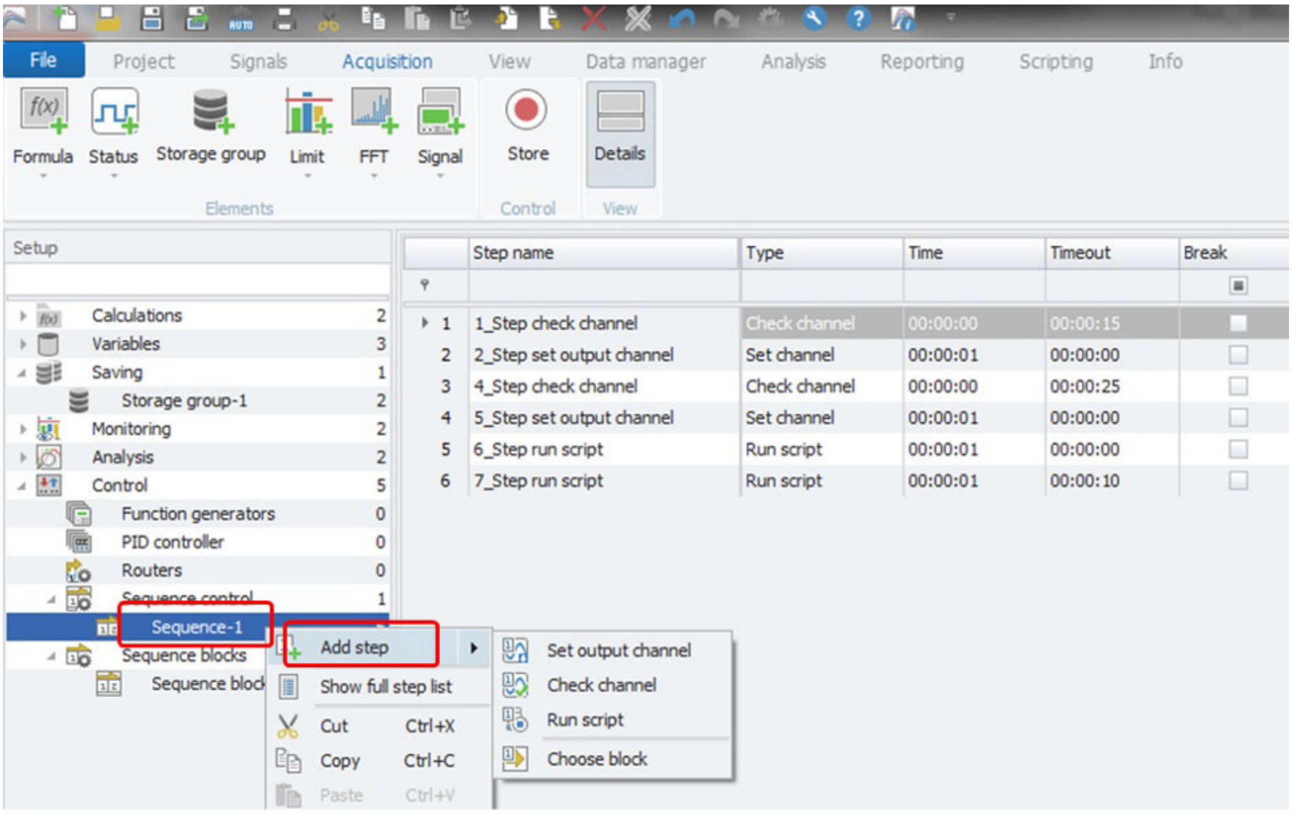
In the sequence parameters you define the sample rate and the loop count.



[CO_46]

- Sample rate — Refers how fast the sequence is executing the different steps
- Loop count — Refers to how often the sequence will be repeated until it will stop automatically.
- Cancel block — On Sequence level you can define a Cancel block. This cancel block will be executed when the sequence is cancelled. With Column chooser you add the column "Cancel block" to the grid.

14.8.5 Create Steps



[CO_47]

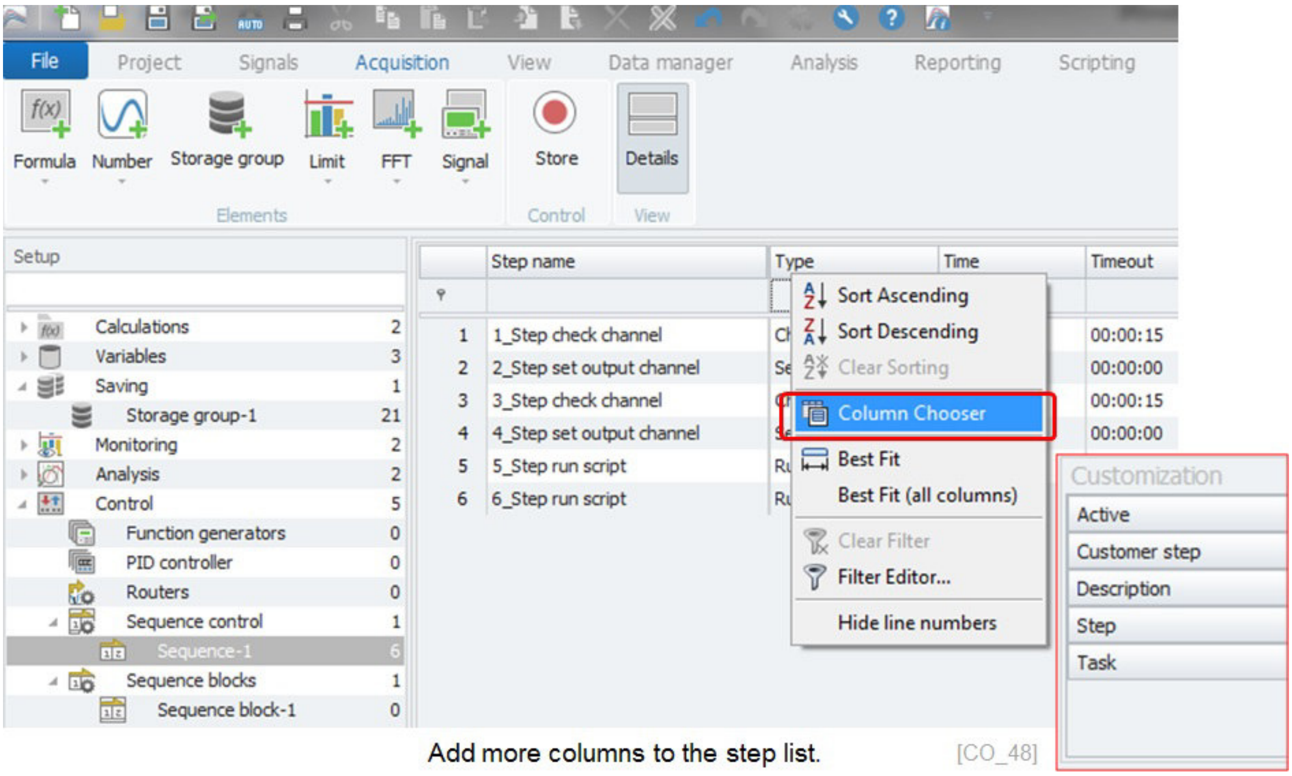
The sequence can be created from the following 4 elements:

- Set output channel — This refers to variable channels and channels with data direction output. With this function you can write a specific output value for the channel.
- Check channel — This function refers to a monitoring function where you can define a threshold condition and when this condition is true the sequence is moving to the next step.
- Run Script — With this function you can execute Visual Basic (VBS) and Iron Python (PY) scripts. This function requires that you have a Professional edition where the Scripting tab sheet in the ribbon is visible.
- Choose Block — Here you select a block which includes a list of output, check or execute script steps. See chapter 14.9 for details about how to configure the blocks.

Each step consists of the following 5 standard columns

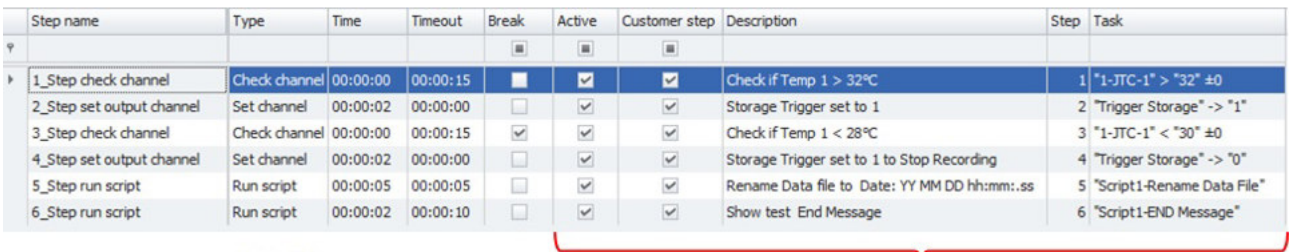
- **Step name** Here you can define the name of the step.
- **Type** Here you will see the type of the step. The type is fixed and related to the function (Check / Set output / Run script)
- **Time** This is the waiting time from step to step. There are sometime time based sequences. Where the steps are executed strictly according to a defined time pattern.
- **Time out** This is a very important time setting to define how long a step will wait at maximum before the next step will start. This is particular relevant for check / monitoring steps. In this case you will define how long the check step shall monitor a channel on the threshold condition before it will move on.
- **Break** If you enable the break check box the whole sequence will be ended when this step is not returning an error or not meeting the check conditions.

With the column chooser you can add more information to the step list.



Add more columns to the step list. [CO_48]

Below you will see an overview of the step list including all additional channels.



Step name	Type	Time	Timeout	Break	Active	Customer step	Description	Step	Task
1_Step check channel	Check channel	00:00:00	00:00:15	☐	☑	☑	Check if Temp 1 > 32°C	1	"1-JTC-1" > "32" ±0
2_Step set output channel	Set channel	00:00:02	00:00:00	☐	☑	☑	Storage Trigger set to 1	2	"Trigger Storage" -> "1"
3_Step check channel	Check channel	00:00:00	00:00:15	☑	☑	☑	Check if Temp 1 < 28°C	3	"1-JTC-1" < "30" ±0
4_Step set output channel	Set channel	00:00:02	00:00:00	☐	☑	☑	Storage Trigger set to 1 to Stop Recording	4	"Trigger Storage" -> "0"
5_Step run script	Run script	00:00:05	00:00:05	☐	☑	☑	Rename Data file to Date: YY MM DD hh:mm:.ss	5	"Script1-Rename Data File"
6_Step run script	Run script	00:00:02	00:00:10	☐	☑	☑	Show test End Message	6	"Script1-END Message"

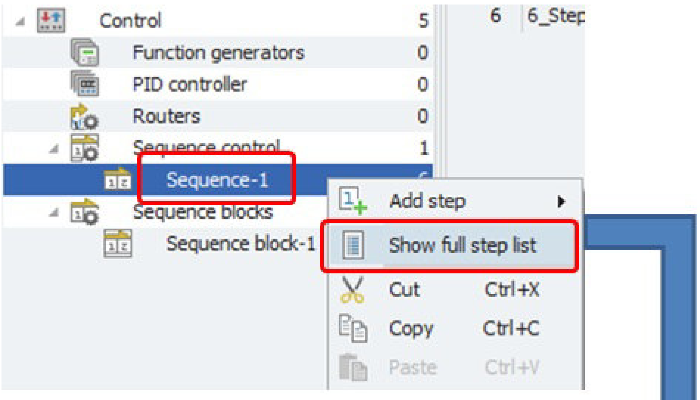
[CO_49]

All additonal columns are added.

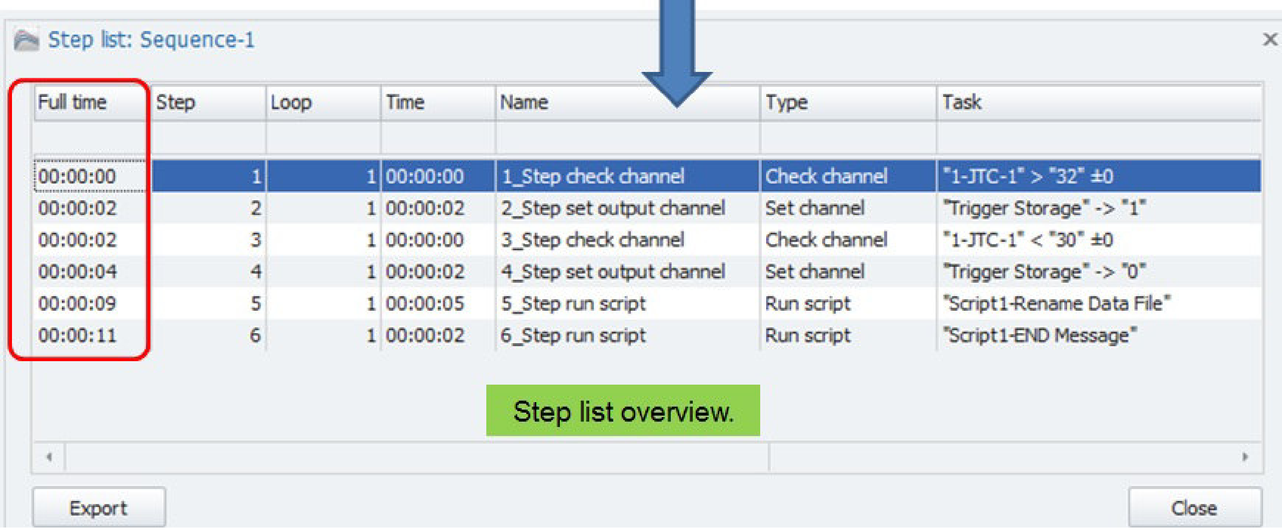
- **Customer Step** With the Customer Step function you can add a grouping hierarchy to the test sequence. With the column chooser you can add the function to the grid. The Customer step is by default activated. In this case every customer step corresponds to a step number in the step sequence list.

14.8.6 Sequence – Display step list overview

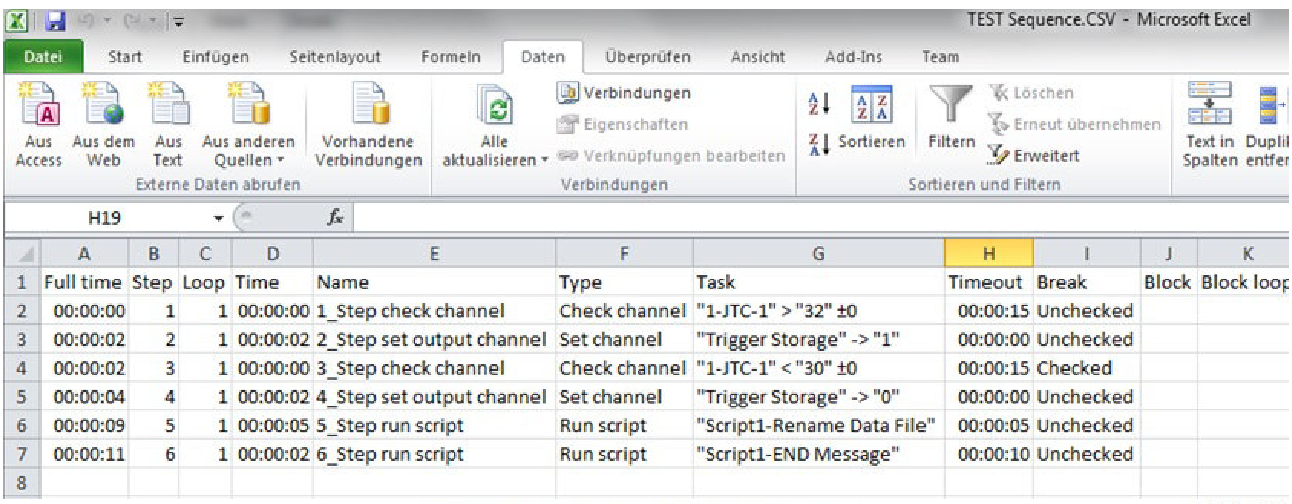
You can get an overview of the complete step list. This is particularly convenient to see the full time of the sequence. The steps have a delay time before they start. The time of each step is defined in the column time. In the column Full Time you can see how all the times add up to the overall sequence time.



[CO_50]

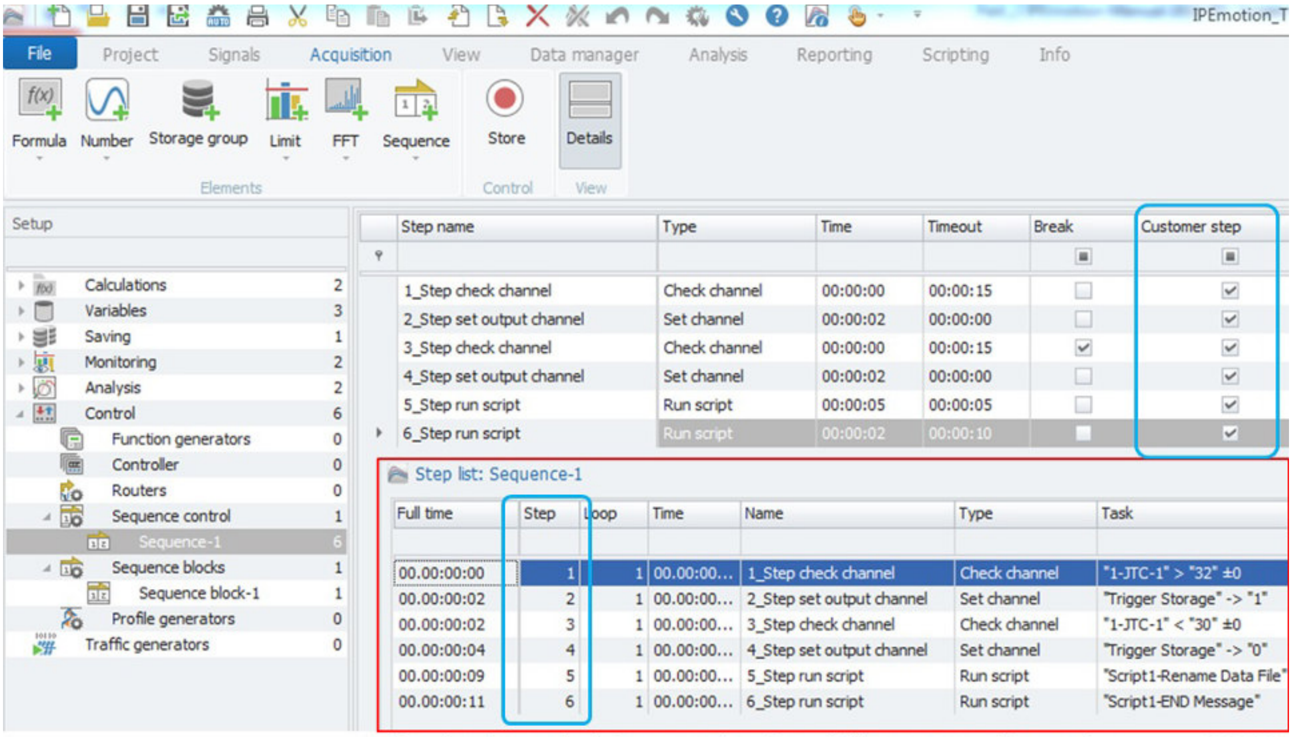


You can also export the sequence to a CSV file.



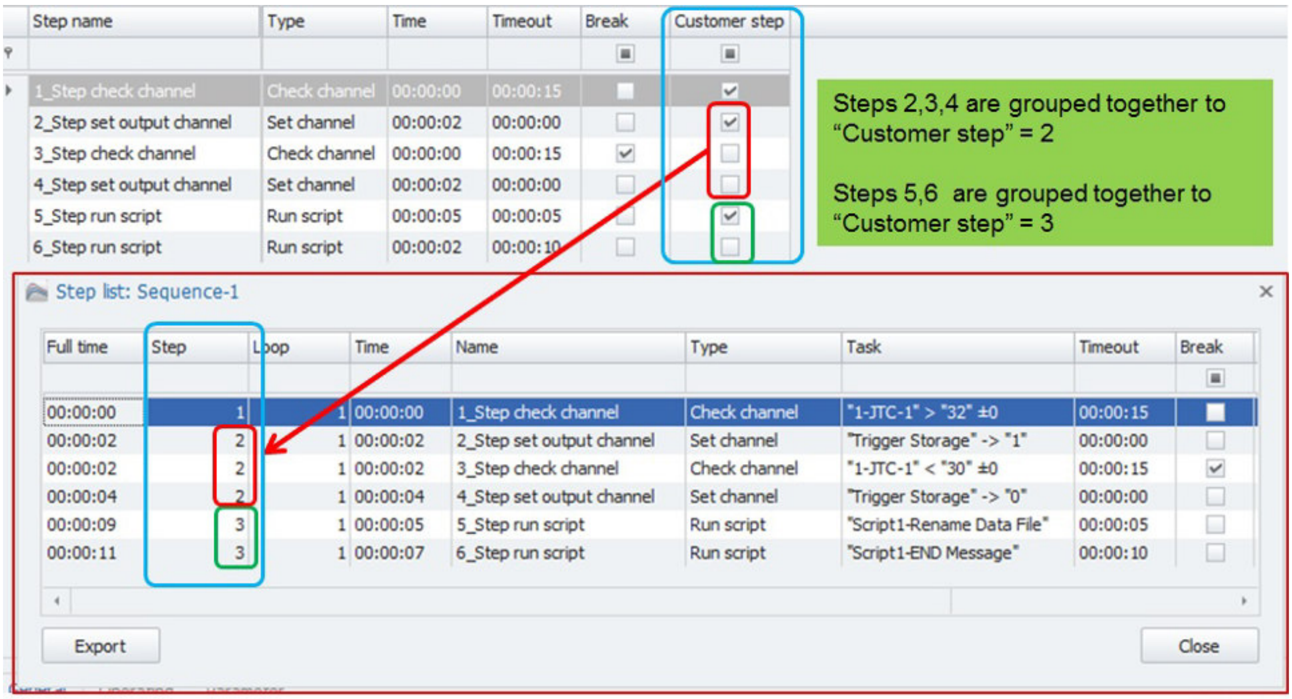
CSV Export of the test sequence.

[CO_51]



Step list: Step order is incrementing when all ”Cutomer steps” are active. [CO_52]

When you disable steps in the **Customer step column** you add a grouping level to the step list as the screenshot below indicates.



[CO_53]

Information *For the overall operation of a test sequence it is **mandatory to enable (activate) the first step as a customer step.***

14.8.7 Example: Configure a Test Sequence

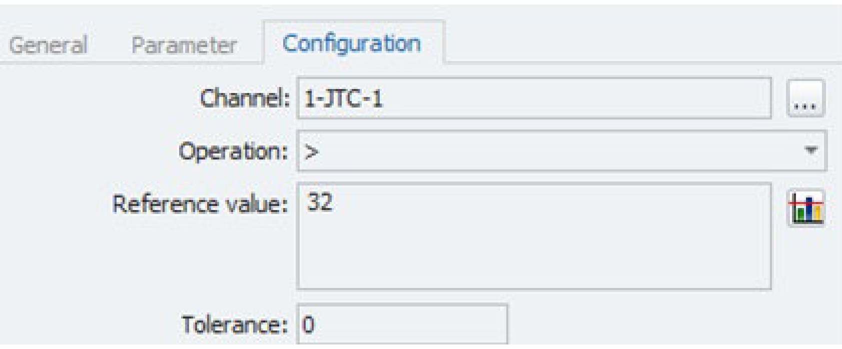
The sequence control function will be explained in a common example for repetitive test measurement where the test item is changing but not the testing process.
The test scenario is the following:

1. Operator is starting the measurement and storage. See chapter for reference 14.8.1.
2. New sequence is started automatically when the measurement starts - no additional triggers.
3. Inside the sequence the following actions take place.
   (a) A temperature is measured and compared to a threshold (limit).
   (b) If a certain temperature limit is reached the data recording is started.
   (c) The recording is stopped when the temperature drops below a certain limit.
4. Data file is renamed to the day and time when the test was ended.
5. Test sequence is finished with a message box.

In the following you will see how a sequence can be set up and how the different settings will affect the results.

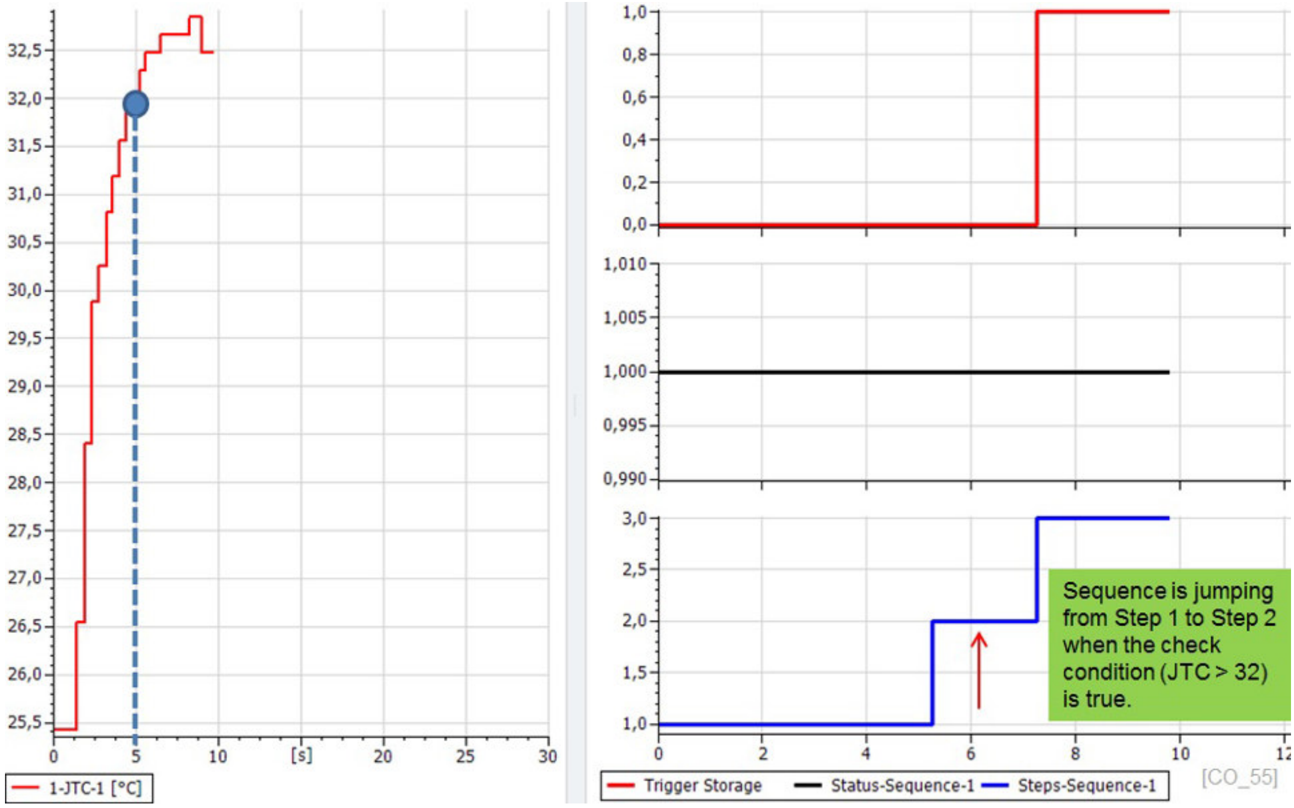
- **1_Step Check Channel** The JTC-1 temperature input channel will be monitored on the threshold of input JTC >32° C. Time: Is set to 00:00:00. This implies that the check function will directly start its operation when the sequence is started. There is no delay in the check operation. Timeout: This time is set to 15 seconds. That implies that the check operation (Monitor JTC >32° C) will run for 15 seconds at maximum. If the condition is true before the time of 15s is elapsed, the sequence will move to the second step. If the condition is not reached after 15s, the test sequence will move to step 2 anyway even if the condition is not true.

	Step name	Type	Time	Timeout	Break
1	1_Step check channel	Check channel	00:00:00	00:00:15	



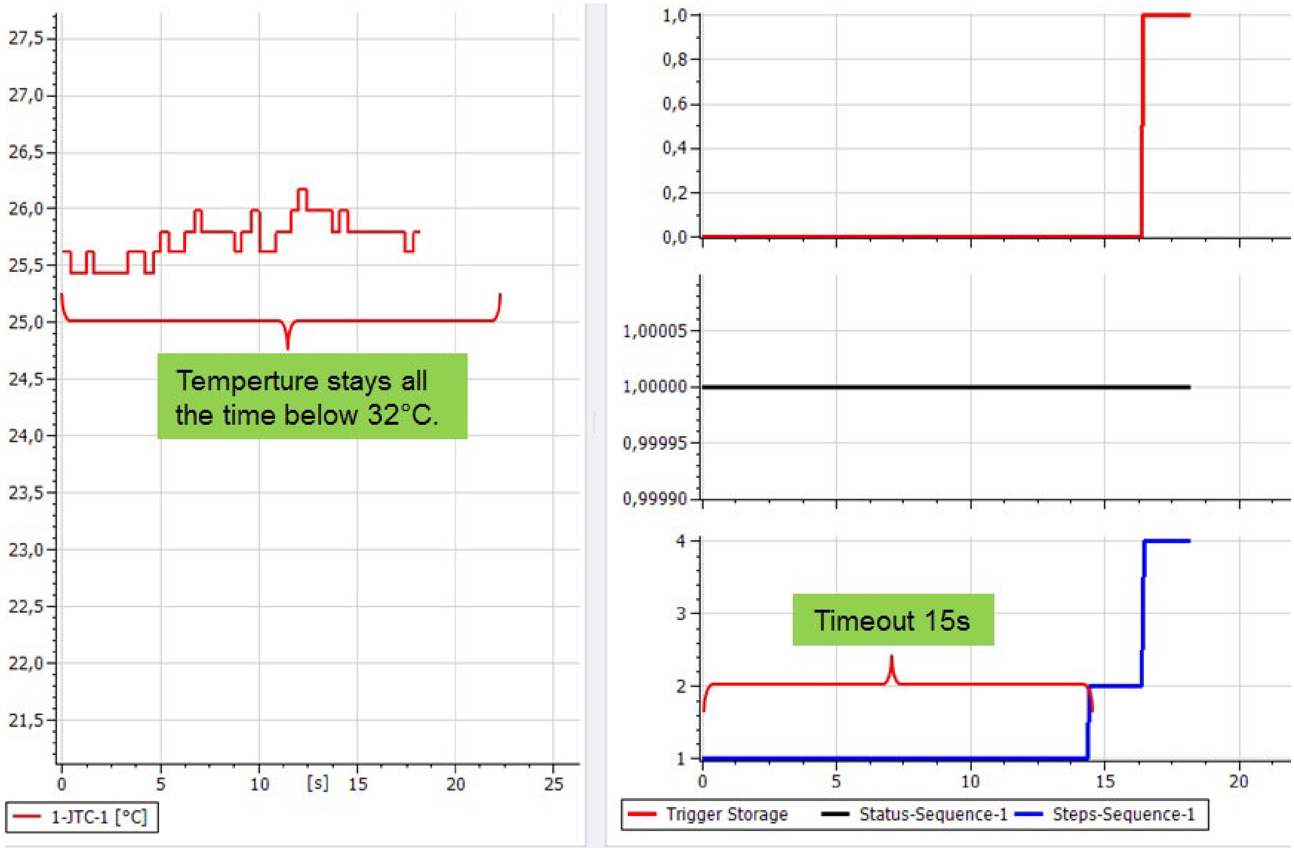
[CO_54]

Graphical presentation of the measurements and the status of the test sequence.



[CO_55]

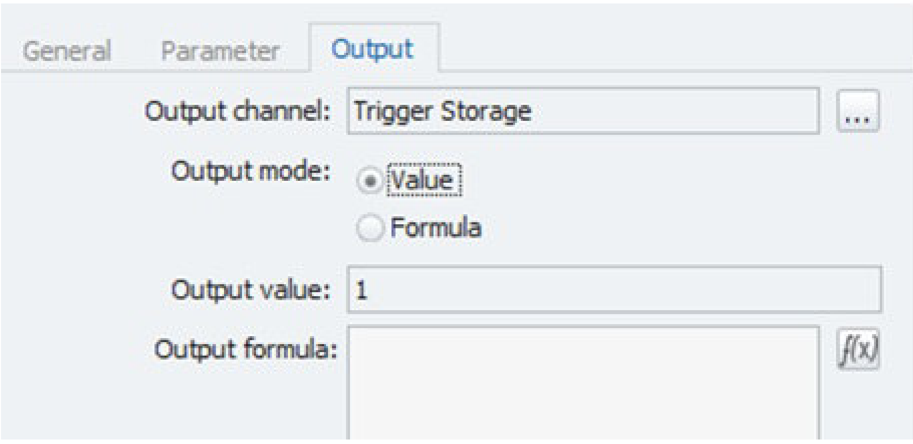
Impact of the Timeout column.



Sequence is jumping to Step 2 after the Timeout of 15s is elapsed. [CO_56]

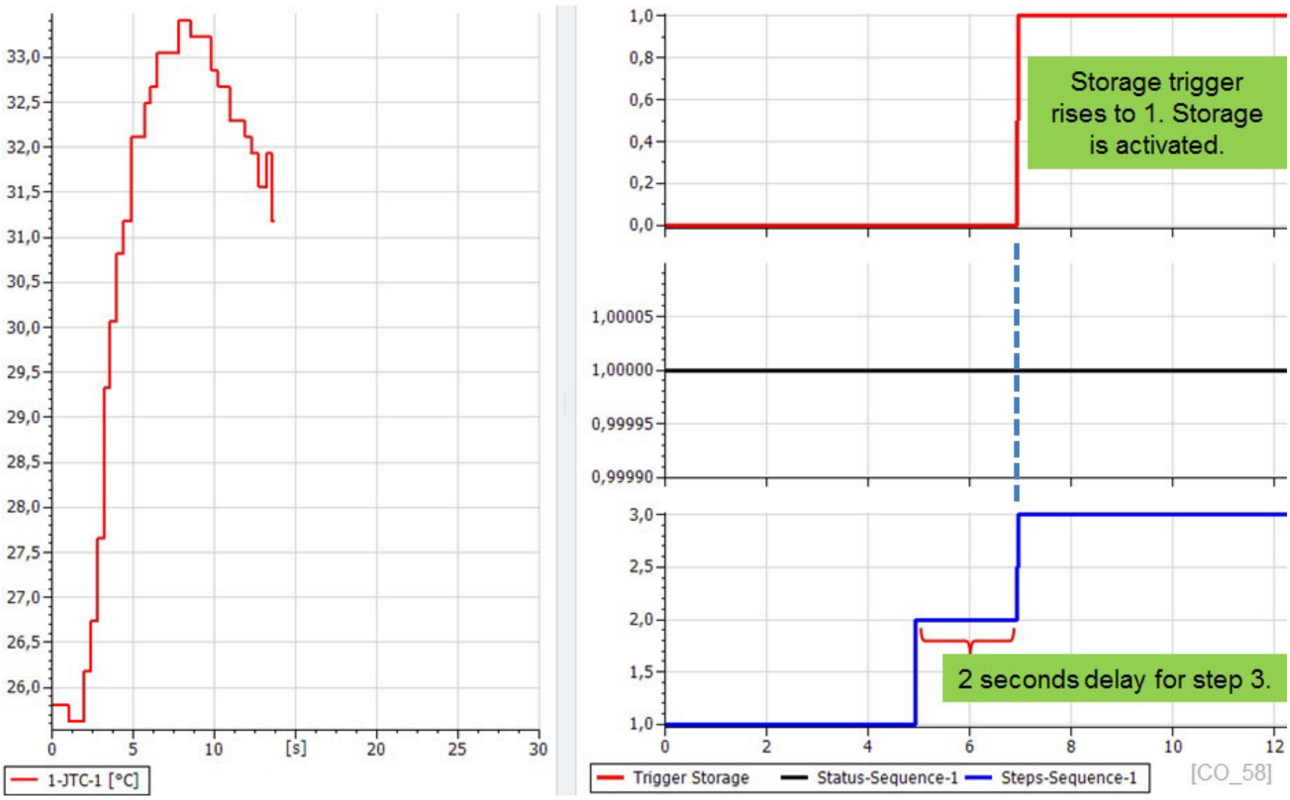
- 2_Step Set Channel — If the temperature condition is true (JTC >32° C) the next step is executed. In this case a variable channel is set to 1. This will then trigger the storage. Time: Is configured to 2 seconds. That implies that the set channel function will be executed with a 2 seconds delay.

	Step name	Type	Time	Timeout	Break
1	1_Step check channel	Check channel	00:00:00	00:00:15	☐
2	2_Step set output channel	Set channel	00:00:02	00:00:00	☐



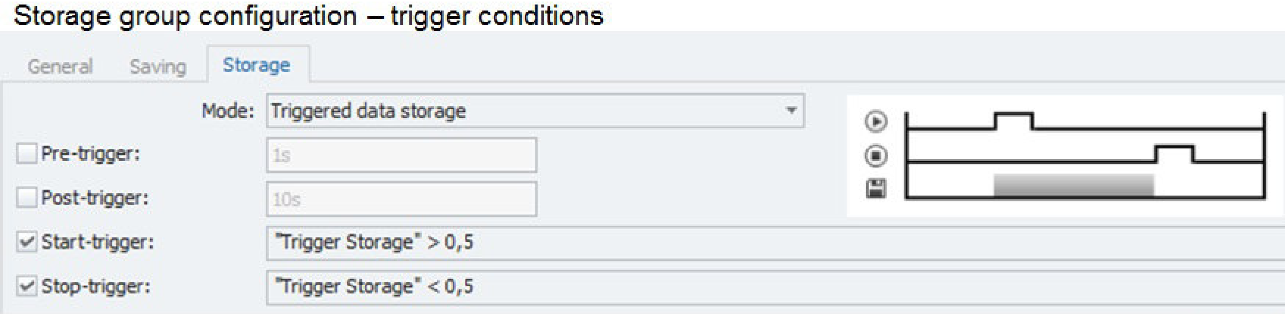
[CO_57]

The Output mode can be switched over a radio button to a fixed output value like the example above or you can build a formula which is calculating an output value from a math or logic function.
Graphical presentation of the measurements and the status of the test sequence.



[CO_58]

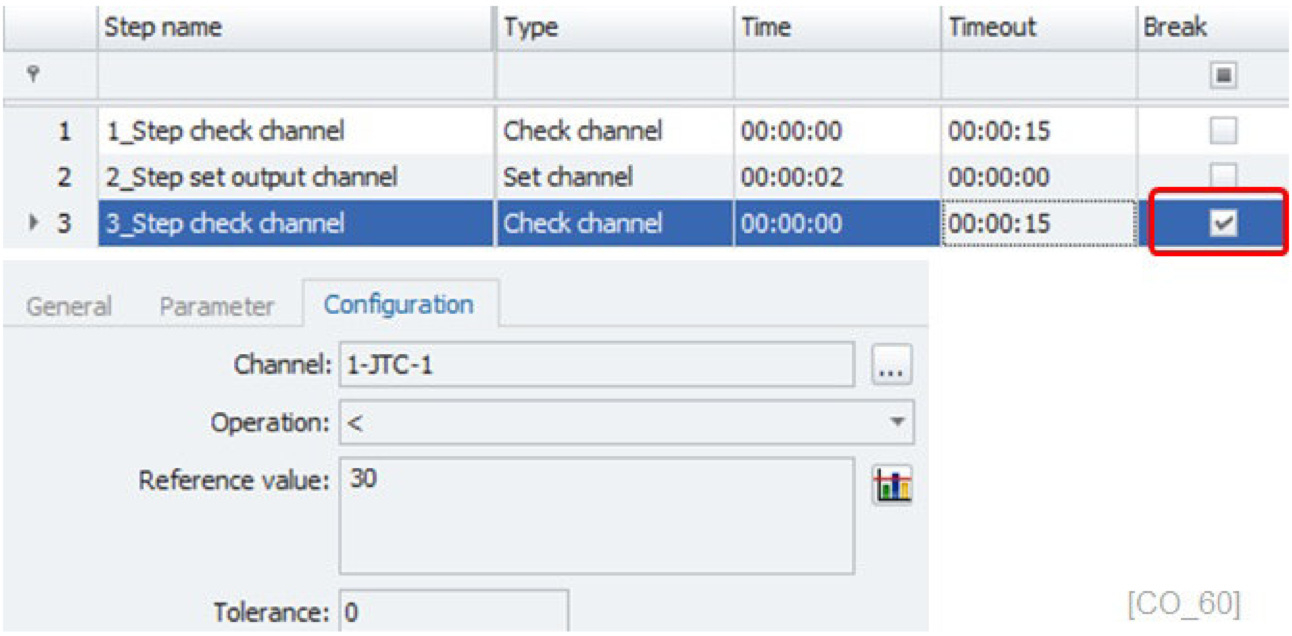
Example of the configuration for the storage trigger condition.



[CO_59]

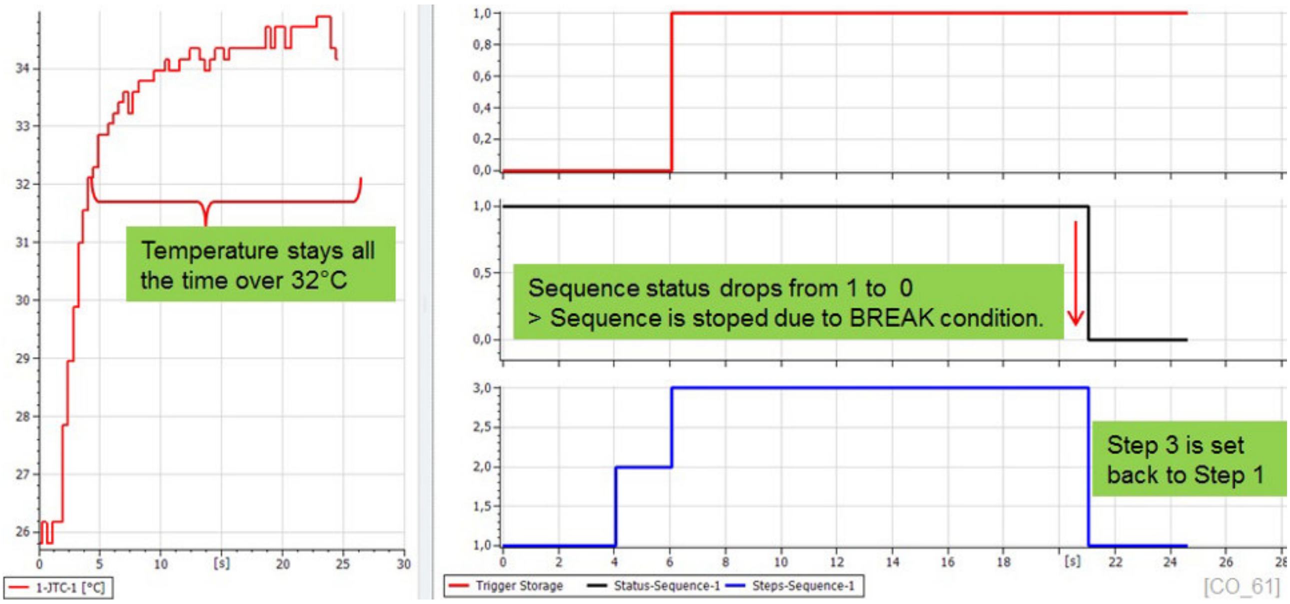
- ► 3_Step Check Channel

The JTC-1 temperature input channel will be monitored on the threshold of input JTC <30° C. Time: Is set to 00:00:00. This implies that the check function will start its operation directly when step 2 (activate data storage) is executed. Timeout: This time is set to 15 seconds. That implies that the check operation (Monitor JTC <30° C) will run for 15 seconds at maximum. If the condition is true before the time of 15s is elapsed, the sequence will stop its operation. Break: The break check box is activated. In this case the whole sequence is stopped when the Timeout of 15s is elapsed.



[CO_60]

Graphical presentation of the measurements and the status of the test sequence.



[CO_61]

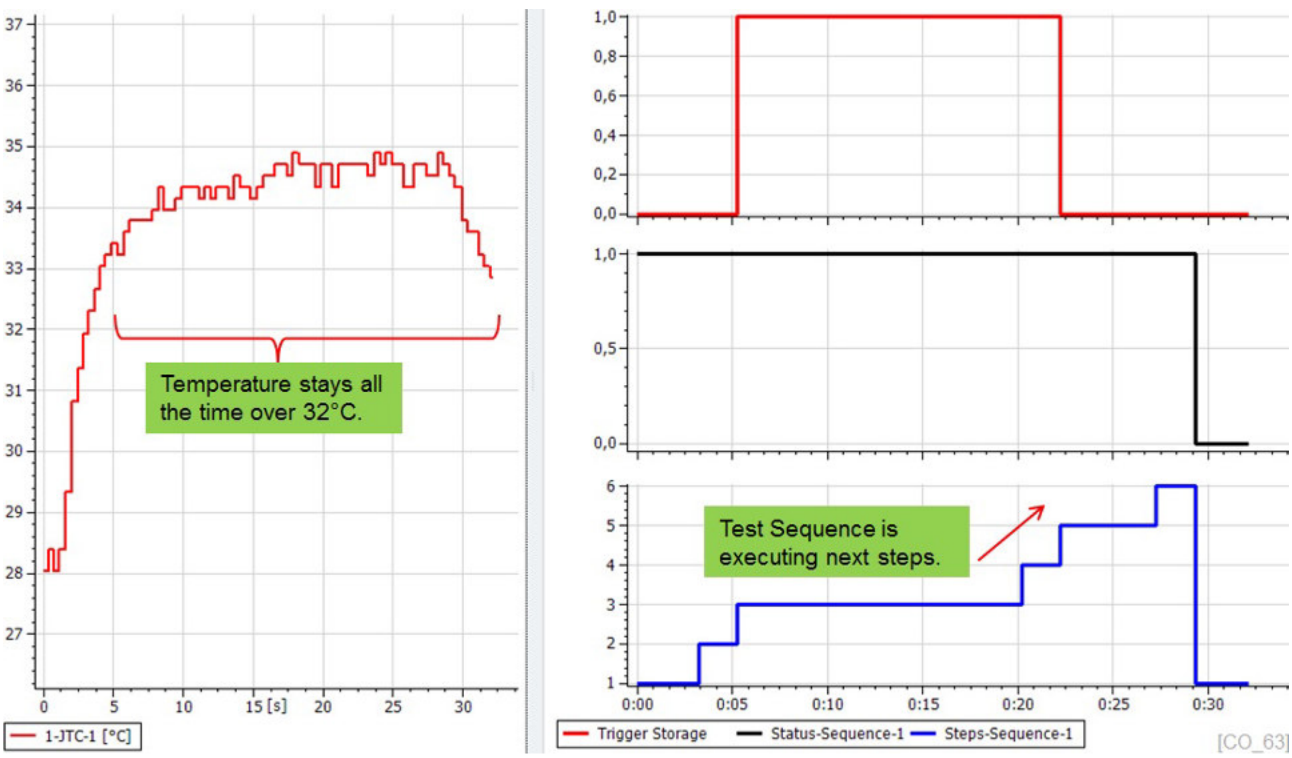
- Impact of Break check box

You can see here if the break check box is not set, the test sequence is moving after the Timeout duration (15s) to the next steps even if the check channel condition (JTC <30) did not become true. As discussed in Step 1.

	Step name	Type	Time	Timeout	Break
1	1_Step check channel	Check channel	00:00:00	00:00:15	
2	2_Step set output channel	Set channel	00:00:02	00:00:00	
3	3_Step check channel	Check channel	00:00:00	00:00:15	

[CO_62]

Graphical presentation of the measurements and the status of the test sequence.



[CO_63]

- **4_Step Set Channel** — If the temperature condition is true (JTC <30° C) the next step is executed. In this case, a variable channel (trigger for storage group) is set back to 0. This will stop the data storage. Time: It is configured to 2 seconds. That implies that the set channel function will be executed with a 2s delay.

	Step name	Type	Time	Timeout	Break
1	1_Step check channel	Check channel	00:00:00	00:00:15	☐
2	2_Step set output channel	Set channel	00:00:02	00:00:00	☐
3	3_Step check channel	Check channel	00:00:00	00:00:15	☑
4	4_Step set output channel	Set channel	00:00:02	00:00:00	☐

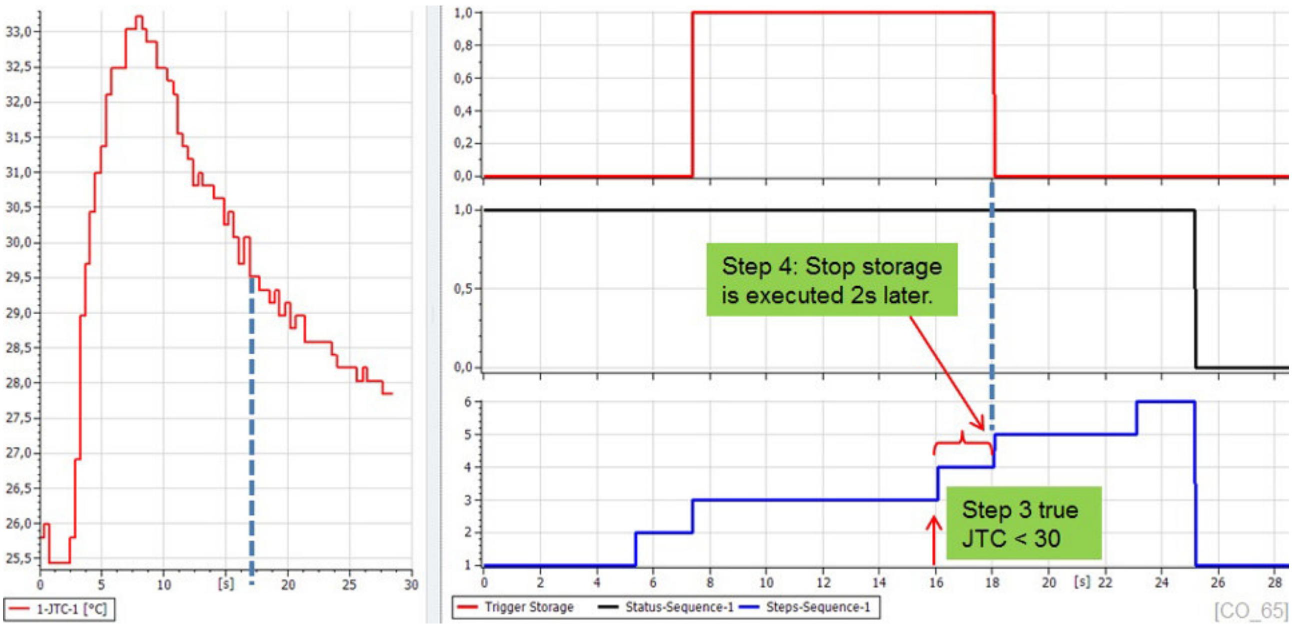
General | Parameter | Output

Output channel: Trigger Storage ...

Output value: 0

[CO_64]

Graphical presentation of the measurements and the status of the test sequence.

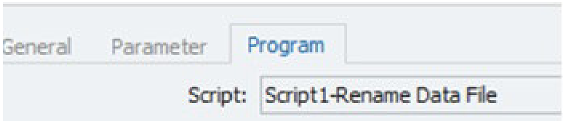


[CO_65]

- ► 5_Run Script

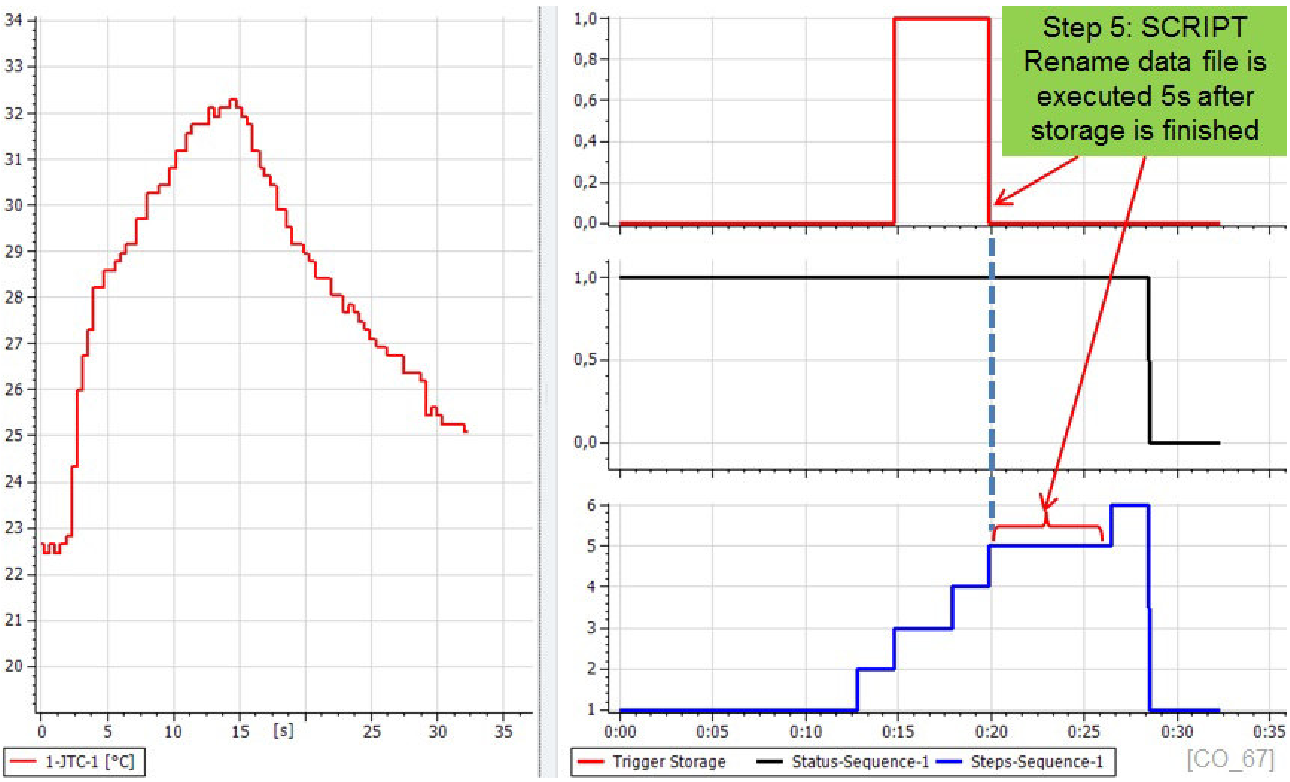
After the storage is finished a script is executed. In this example the script will rename the data file to a given IAD file name of: Date & Time
Time: The Script which is renaming the data file is executed 5s after the storage is finished. A delay time of a few seconds is considered to ensure that the data file is ready for the renaming procedure. Timeout: is defined for 5s. That gives the script 5 seconds to finalize the operation before the next step starts. Some scripts can perform considerable math functions which can take some seconds to finish. Therefore it is important to define an appropriate timeout for the script functions.

	Step name	Type	Time	Timeout	Break
1	1_Step check channel	Check channel	00:00:00	00:00:15	☐
2	2_Step set output channel	Set channel	00:00:02	00:00:00	☐
3	3_Step check channel	Check channel	00:00:00	00:00:15	☑
4	4_Step set output channel	Set channel	00:00:02	00:00:00	☐
5	5_Step run script	Run script	00:00:05	00:00:05	☐
6	6_Step run script	Run script	00:00:02	00:00:10	☐

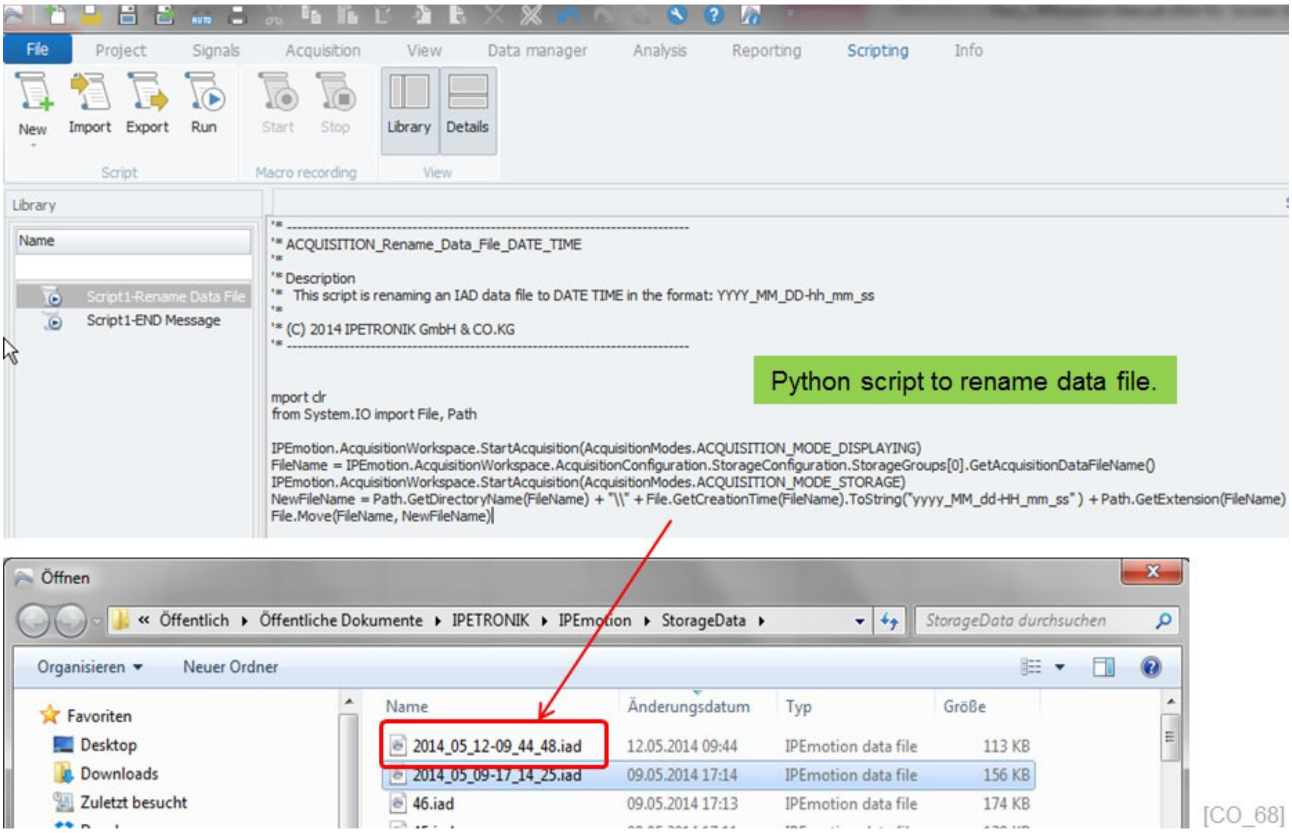


[CO_66]

Graphical presentation of the measurements and the status of the test sequence.

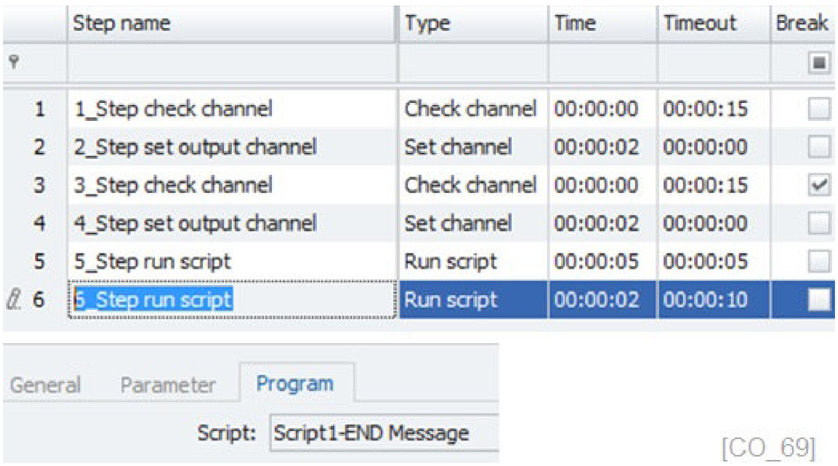


[CO_67]



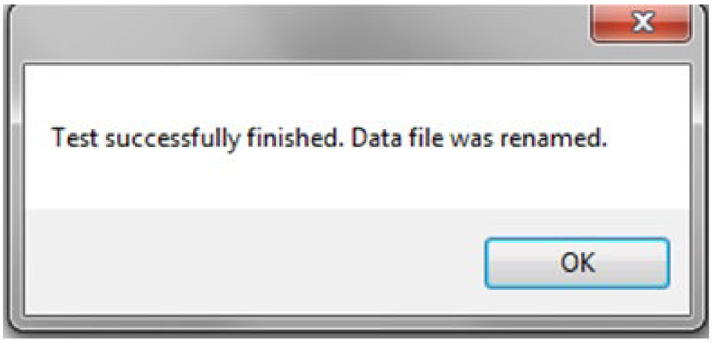
[CO_68]

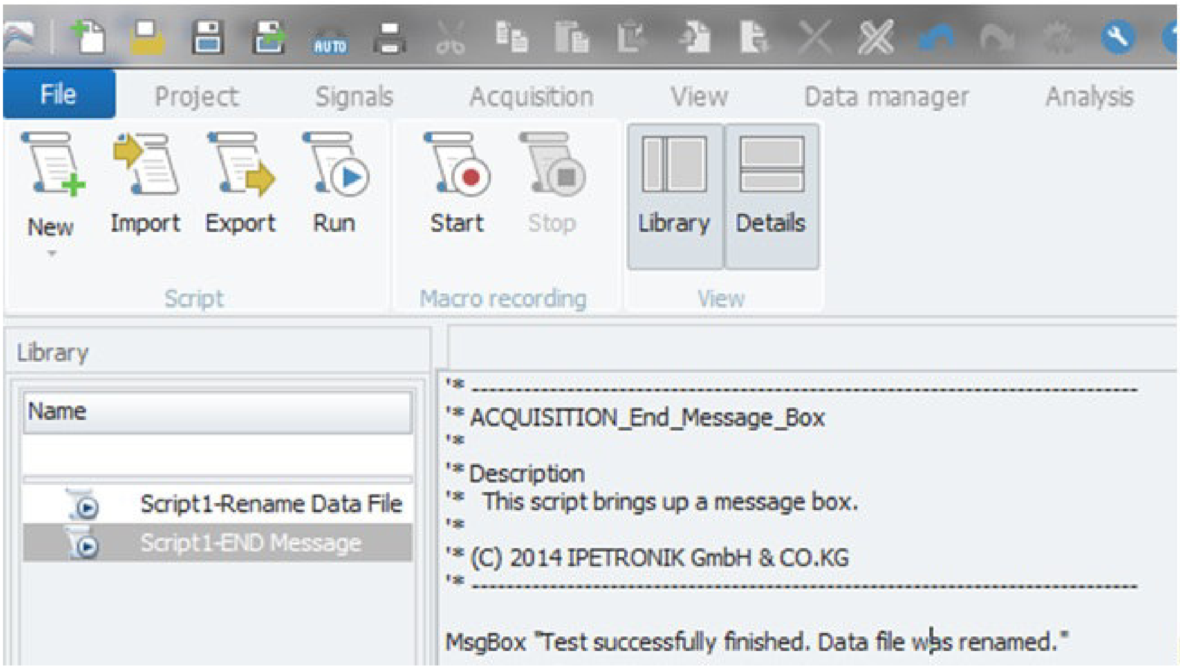
- ► 6_Run Script — The last step is to execute a script to show an end message box that the test was finished successfully.



[CO_69]

Message box with scripting code example below.





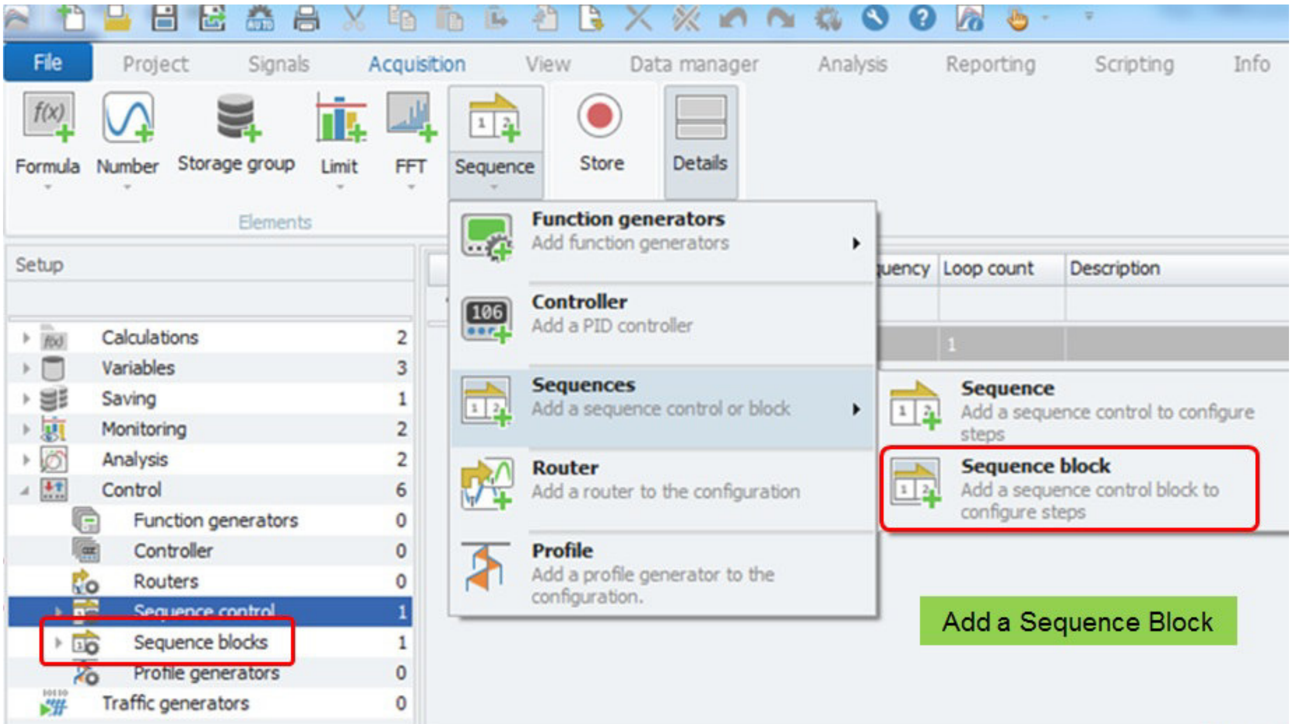
[CO_70]

14.9 Sequence Blocks

If you start to setup larger test sequencing applications with dedicated test phases like the example below, it will be practical to organize each sequence in a separate block.

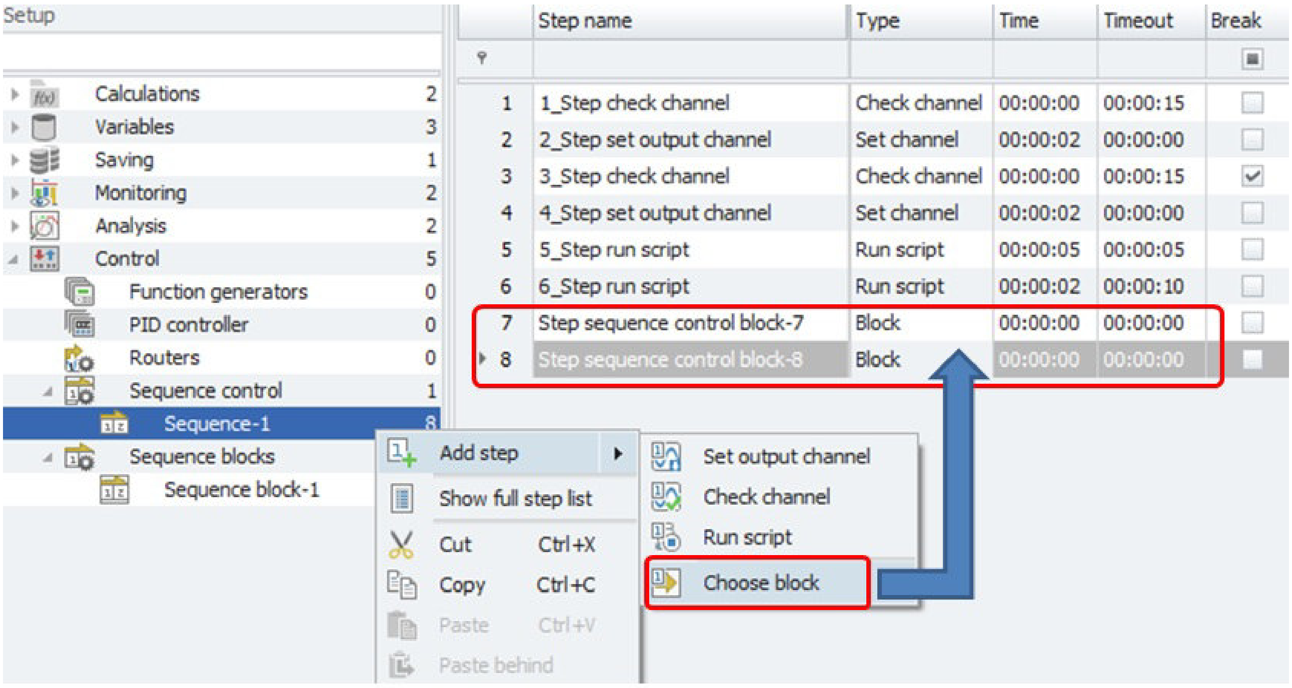
- Initialize System
- Test Sequence 1
- Test Sequence x
- Safety Sequence
- End Sequence

The blocks are created like a sequence with the same functions (Set output, Check Channel, Run Script) but all the steps are in a logical unit called “Sequence Block”.



[CO_71]

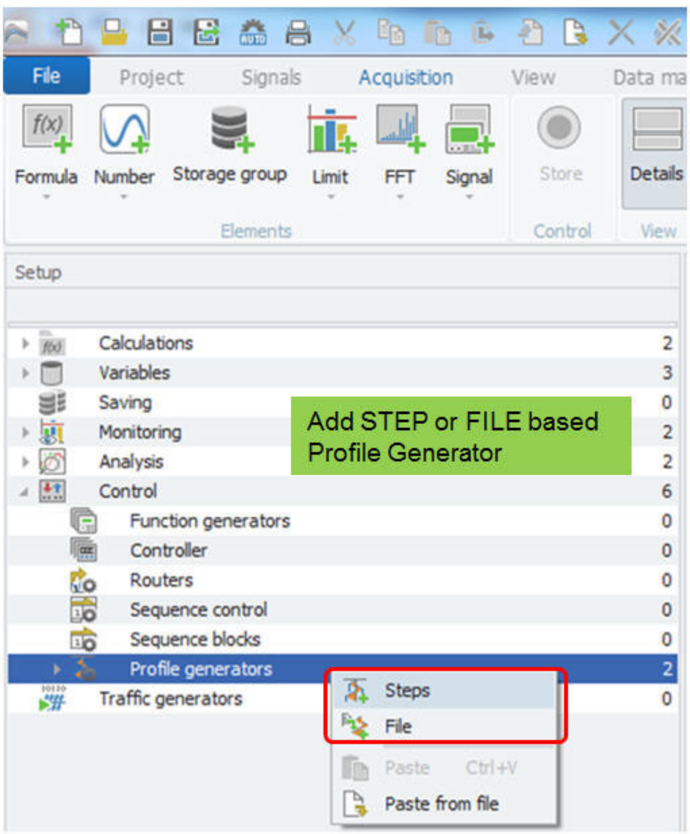
You can then arrange and link different blocks together in the sequence steps as discussed in the example above 14.8.7.

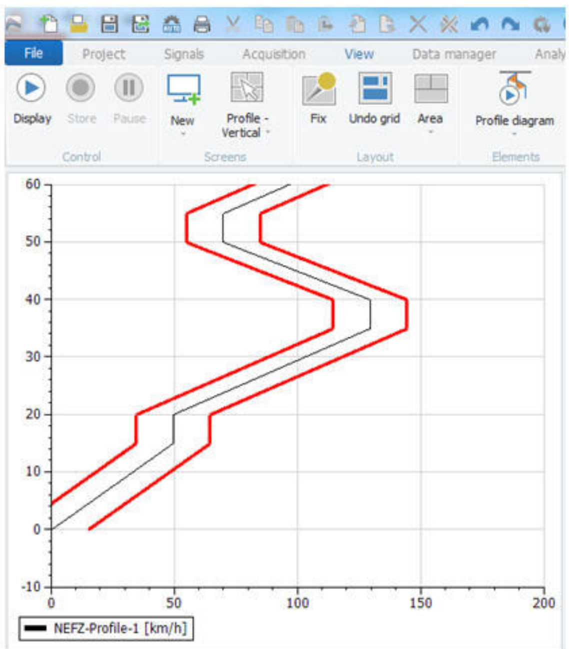


Integrate Blocks to the Sequence Step list. [CO_72]

14.10 Profile Generator

The profile generator is a specific function generator to generate output signals either user defined step based or file based through importing a data file. The output profiles can be graphically displayed online in the VIEW workspace in the Profile Diagram. The configuration of the Diagram instrument is discussed in chapter. 17.28.



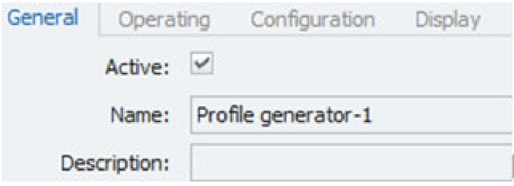


[CO_73]

VIEW: Example of a Profile diagram

14.10.1 Profile Generator – General tab sheet

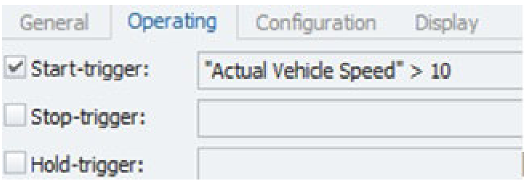
The STEP based and FILE based Profile generator can be configured through 4 tab sheets.
In the General tab sheet you define the status, name and description of the Profile generator channel.



[CO_74]

- **Active**: With this checkbox you can activate / deactivate the Profile generator.
- **Name**: Refers to the name of the Profile generator.
- **Description**: Here you can add an additional description to the Profile generator.

14.10.2 Profil generator – Operating tab sheet

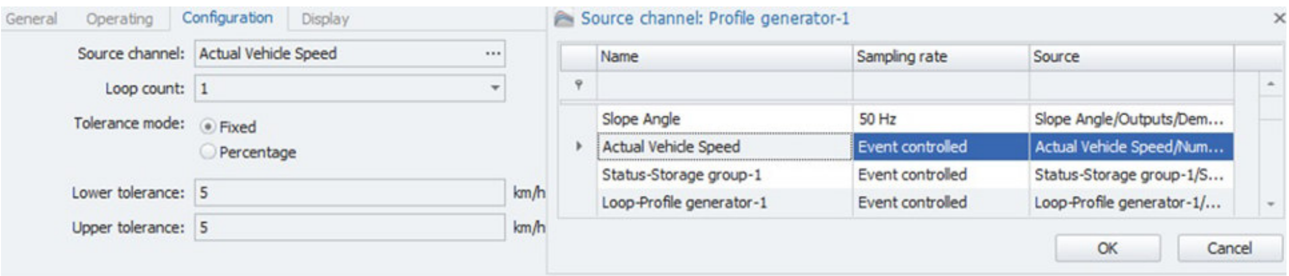


[CO_75]

- **Start trigger**: This can be a trigger to start the Profile generator.
- **Stop trigger**: This can be a trigger to stop the Profile generator.
- **Hold trigger**: This can be a trigger to hold and pause the Profile generator.

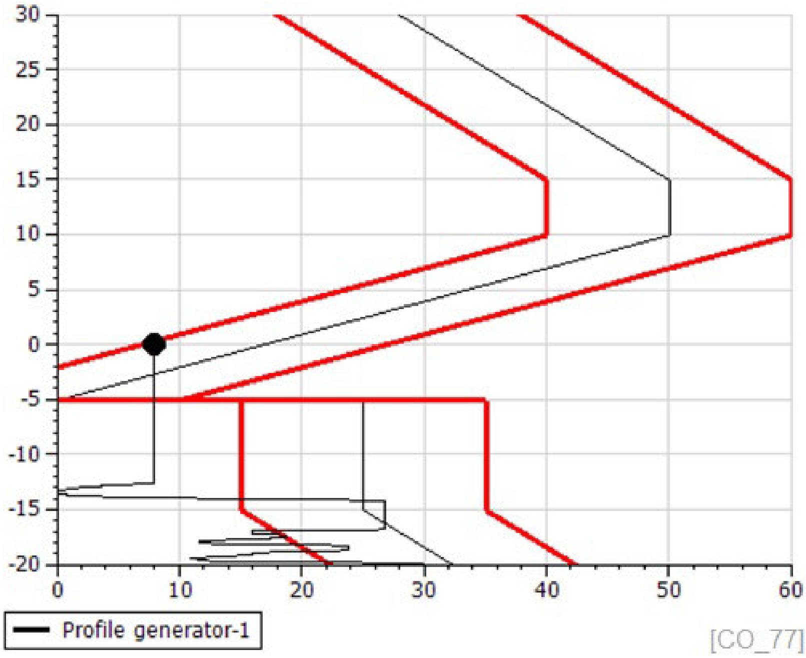
14.10.3 Profile generator – Configuration tab sheet

The settings in the configuration tab sheet have mainly an impact to the Profile diagram appearance.



[CO_76]

- **Source channel**: Here you define a source channel which will be visible in the Profile diagram. This channel is presenting the actual online measurements in the Profile diagram 17.28.4.
- **Loop count (drop edit)**: Here you define how many time the profile is repeated. The drop edit list is providing default entries: Endless, 1, 10, 100, 1000 or user defined numeric inputs. When you select Endless the profile start from the beginning again.

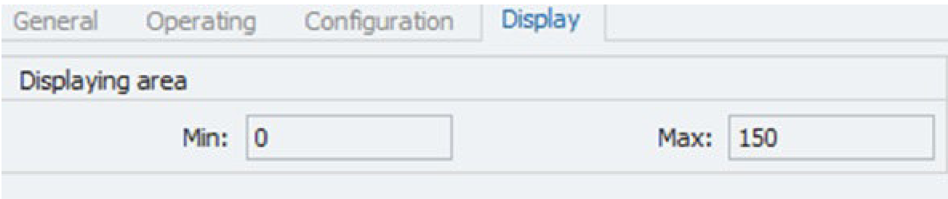


[CO_77]

- Tolerance mode — With this radio button define whether you use absolute or percent tolerance calculation. When you select absolute tolerance the unit of the source channel is displayed. The upper and lower tolerance lines can be presented in the Profile Diagram.
- Lower / upper tolerance — Here you enter the individual values for tolerance band width if needed.

14.10.4 Profile generator – Display tab sheet

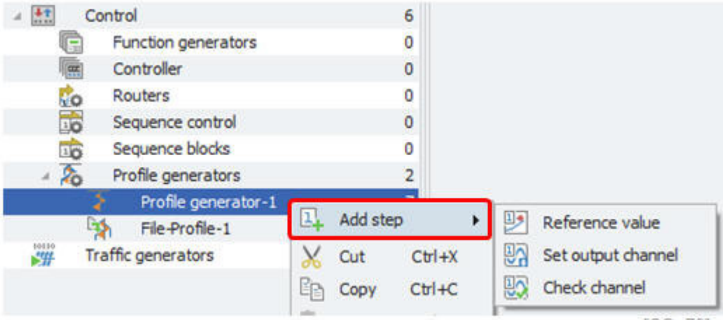
The display tab sheet is related to the reference channel display range in the Profile diagram 17.28.4.



[CO_78]

14.10.5 Add step

The profile Generator is supporting two different step types.

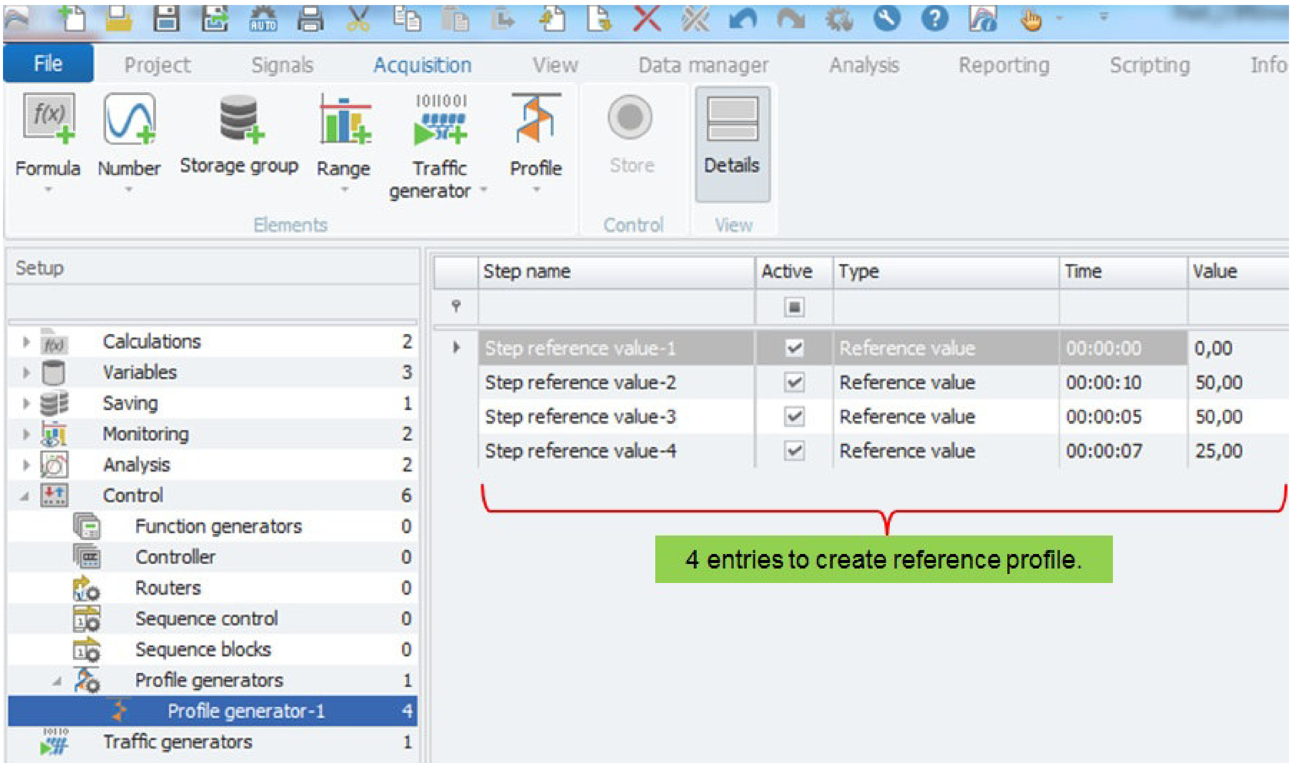


[CO_79]

- **Reference value** — The reference value is designed to create a graphical reference line presentation in the Profile diagram. With this type of steps you can create a graphical profile which serves the driver as a reference profile for his vehicle speed.
- **Set output channel** — The output channel has a different function. With this type of channel you can send output values (numeric or text) to drive actuators or to provide text information messages to the driver. The output channel values are not displayed in the Profile diagram.

14.10.6 Application Example: Time based reference profile

In this simple example 4 reference value steps are defined to create a graphical reference profile in the Profile instrument for the driver.

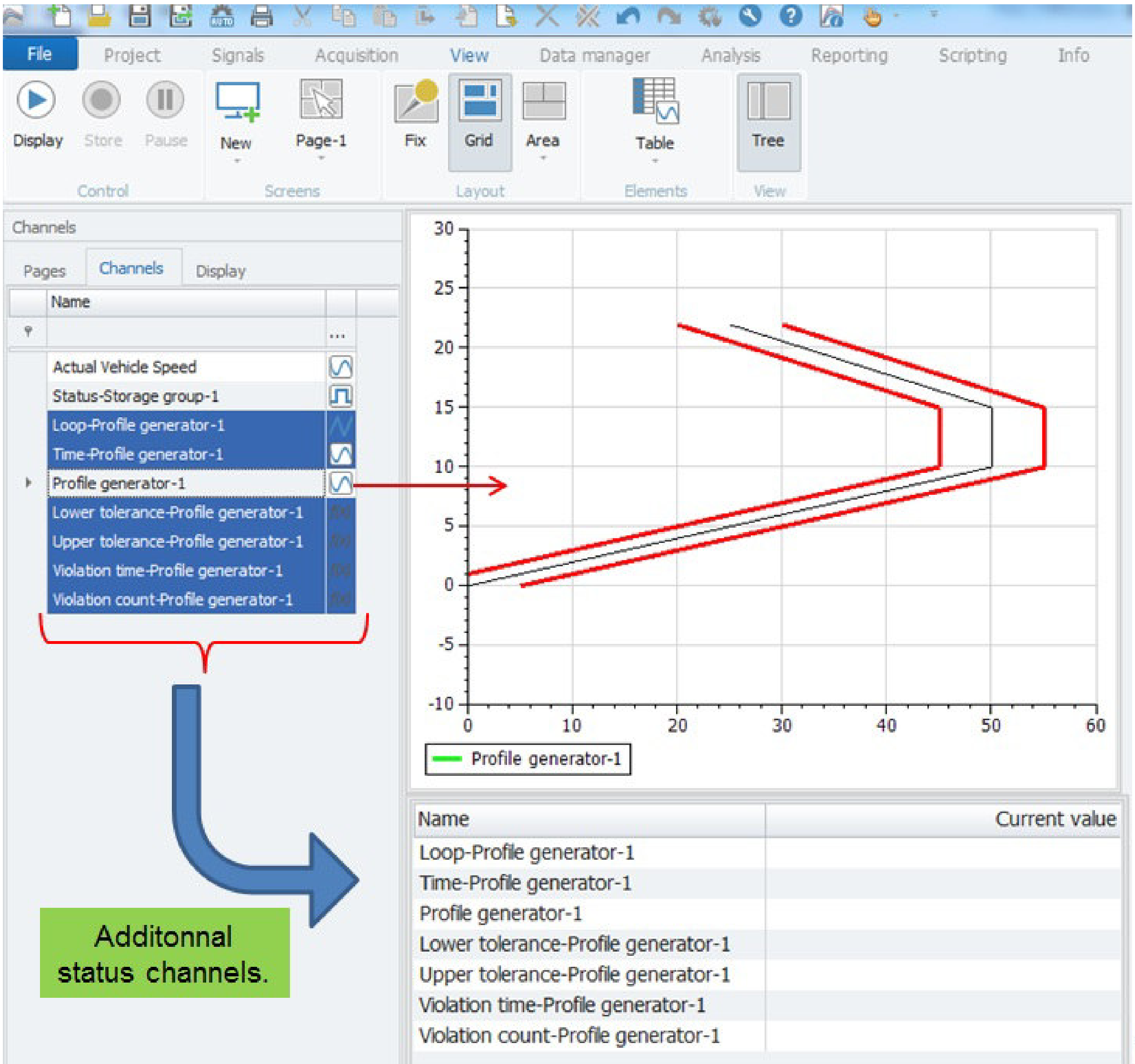


[CO_80]

The reference value steps consist of the following properties allocated to 3 different tab sheets:

- Step name — Refers to an individual name
- Active check box — To enable or disable a step
- Type — Refers to the step type: Reference Value or Output channel
- Time (relative) — This time base is relative and associated to this specific step
- Value — Is the display and output value which is related to this time base

This diagram shows a associated graphical reference profile of the steps defined above. Only the **Profile Generator** channel can be linked to the instrument. The other associated status channels can be linked to other instruments to display other useful information to the driver.

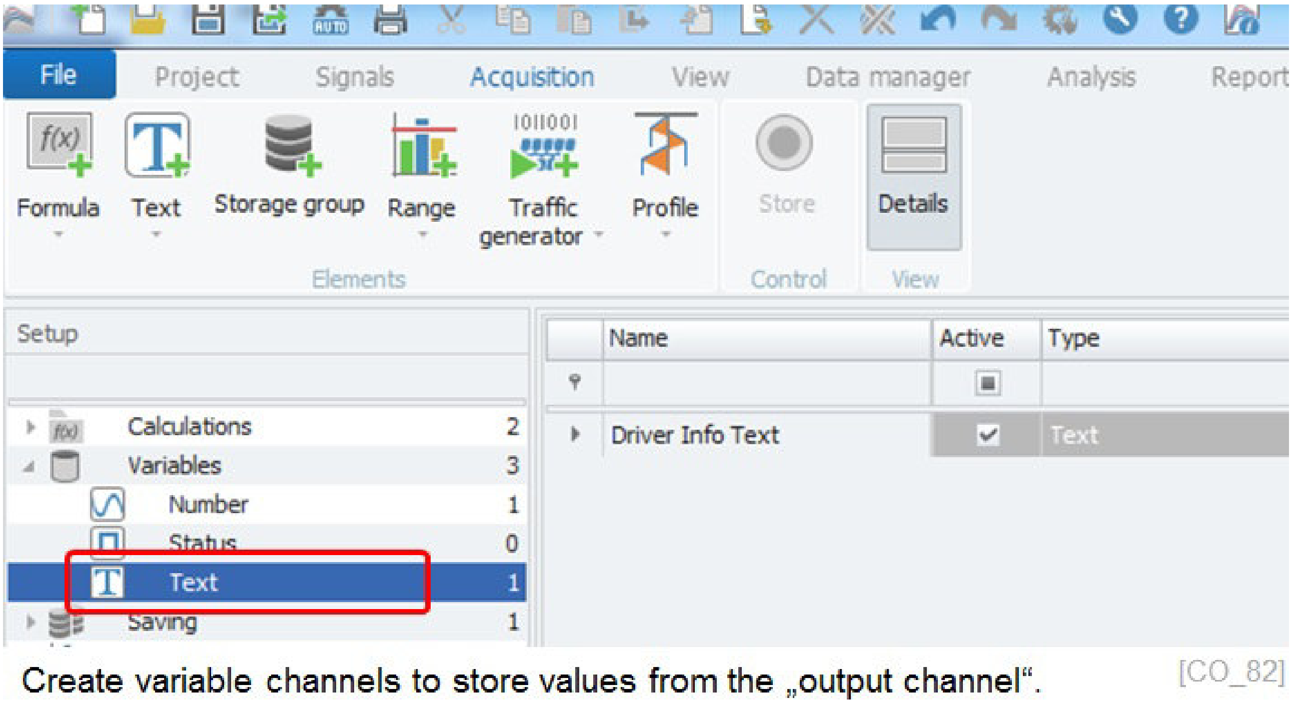


[CO_81]

The configuration of the Profile diagram and the related status channels will be explained in detail in chapter VIEW 17. The status channels of the Profile generator are visible when the EXPERT mode is activated in the OPTIONS. For more details see chapter 22.3.

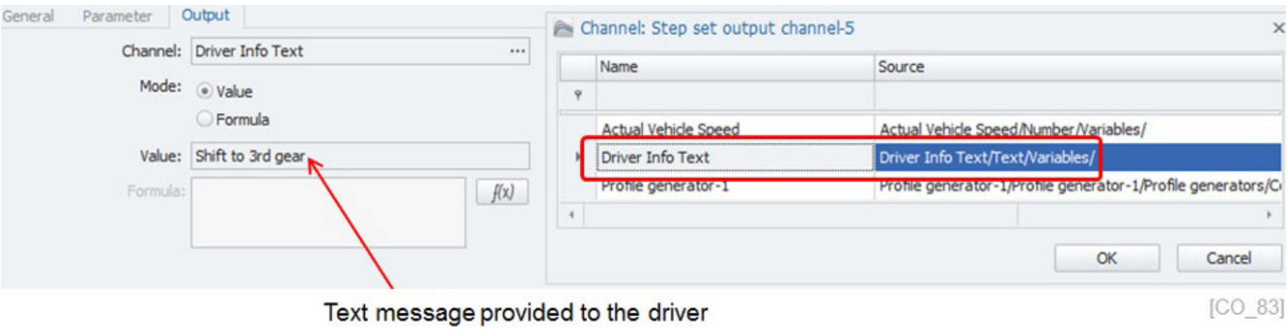
14.10.7 Application Example: Time based reference profile with outputs

The reference profile can include output channels. With output channel you can provide text information to the driver or control physical output channels to communicate with the test bench PLC or other 3^{rd} party hardware. In this example a variable text channel was created to provide text information to the driver.



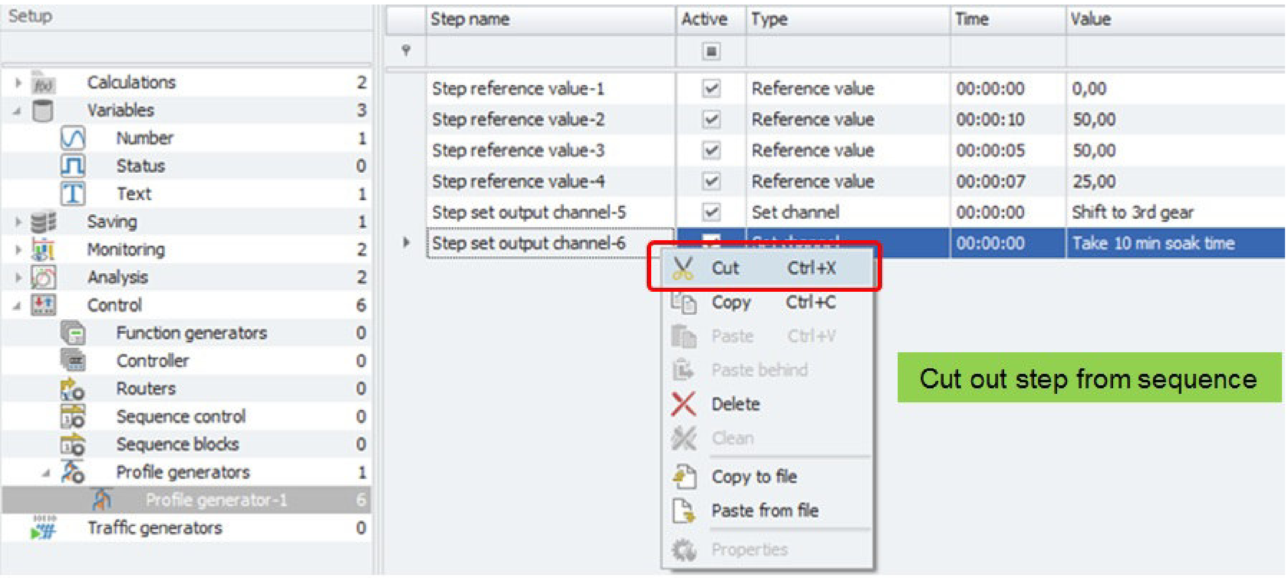
[CO_82]

This output channel “Driver info text” can be included in the profile generator as indicated below. For the display value you either define static text, numbers or output the result of a formula.



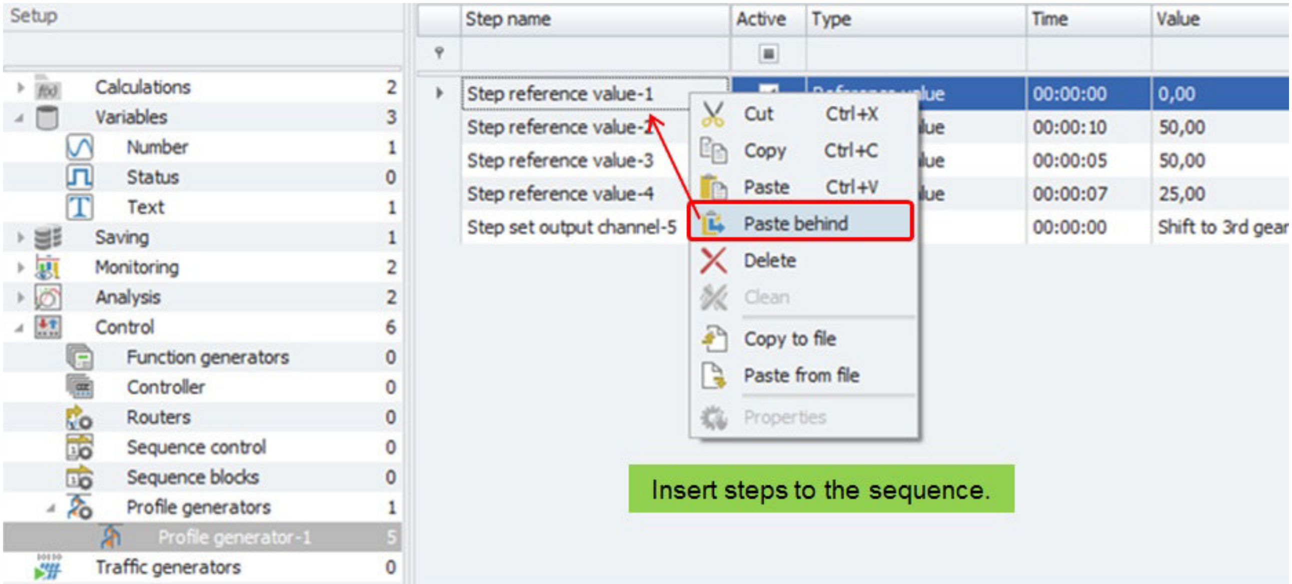
[CO_83]

When you start creating additional channel they are appearing at the end of the sequence. With the right-click on the step you have access to the context menu to cut a step.



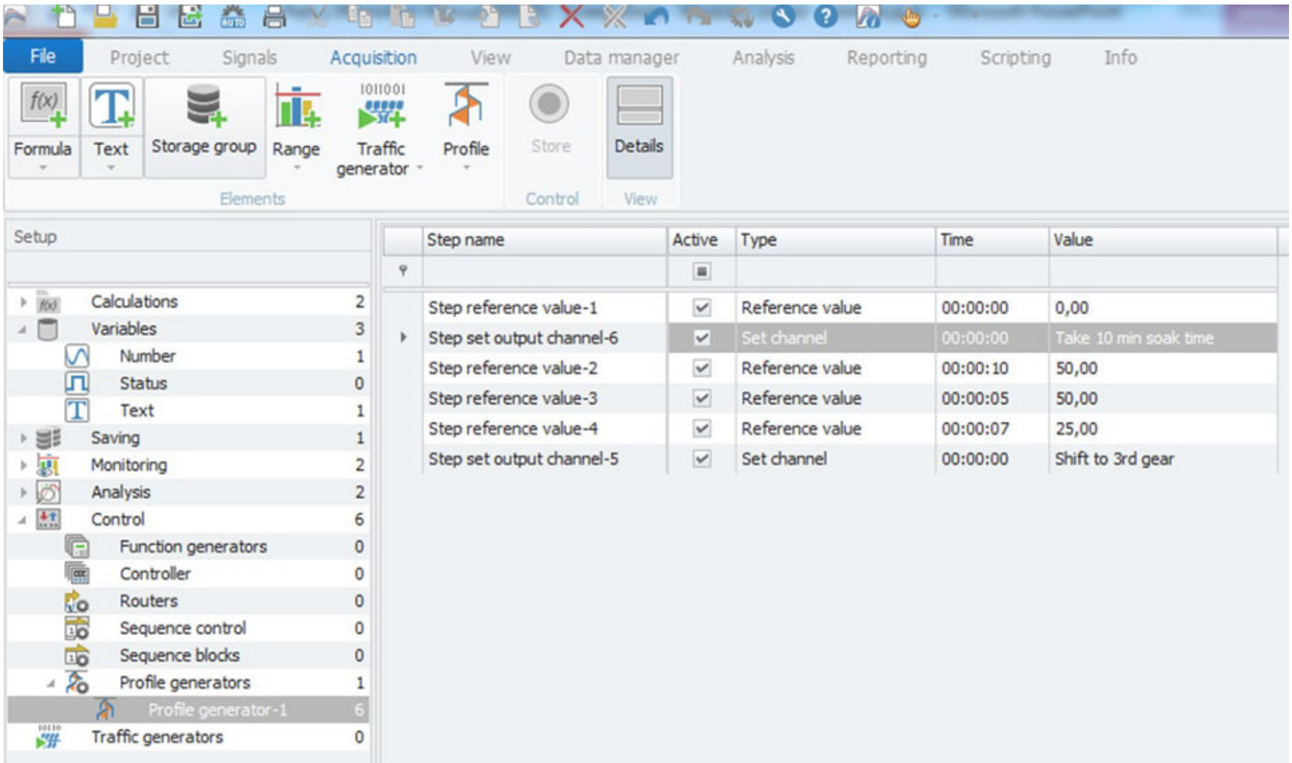
[CO_84]

With the past behind function you insert this step behind the selected step.



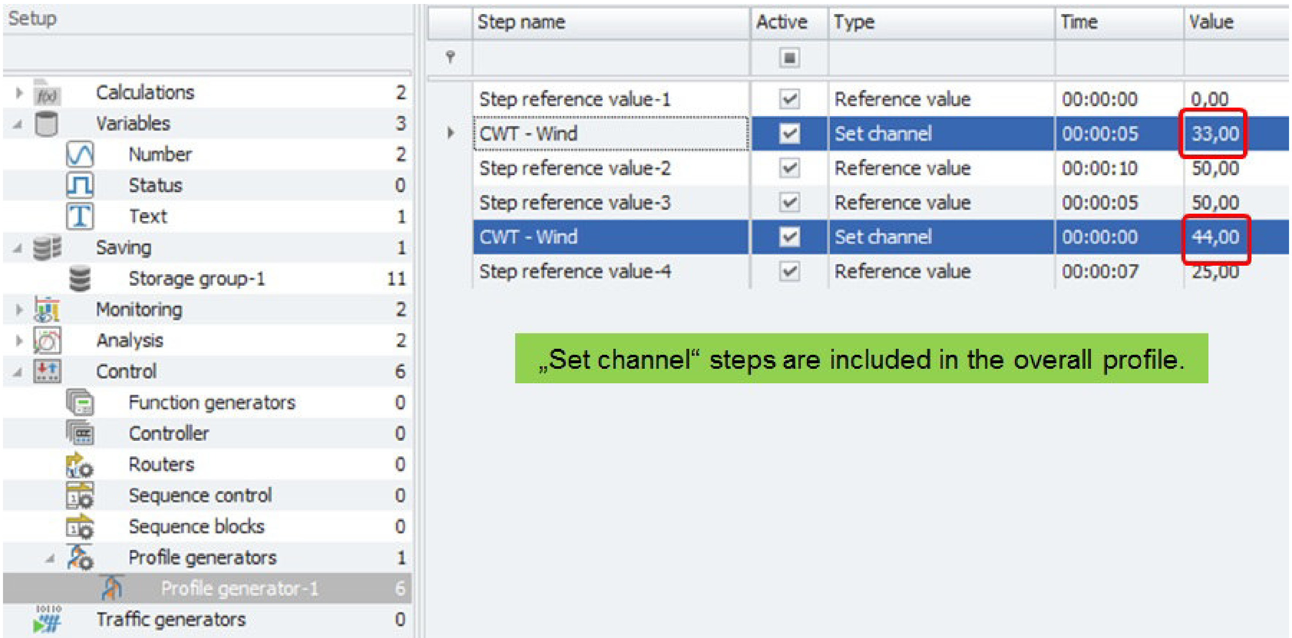
[CO_85]

Updated order of the test sequence, after inserting an output channel.



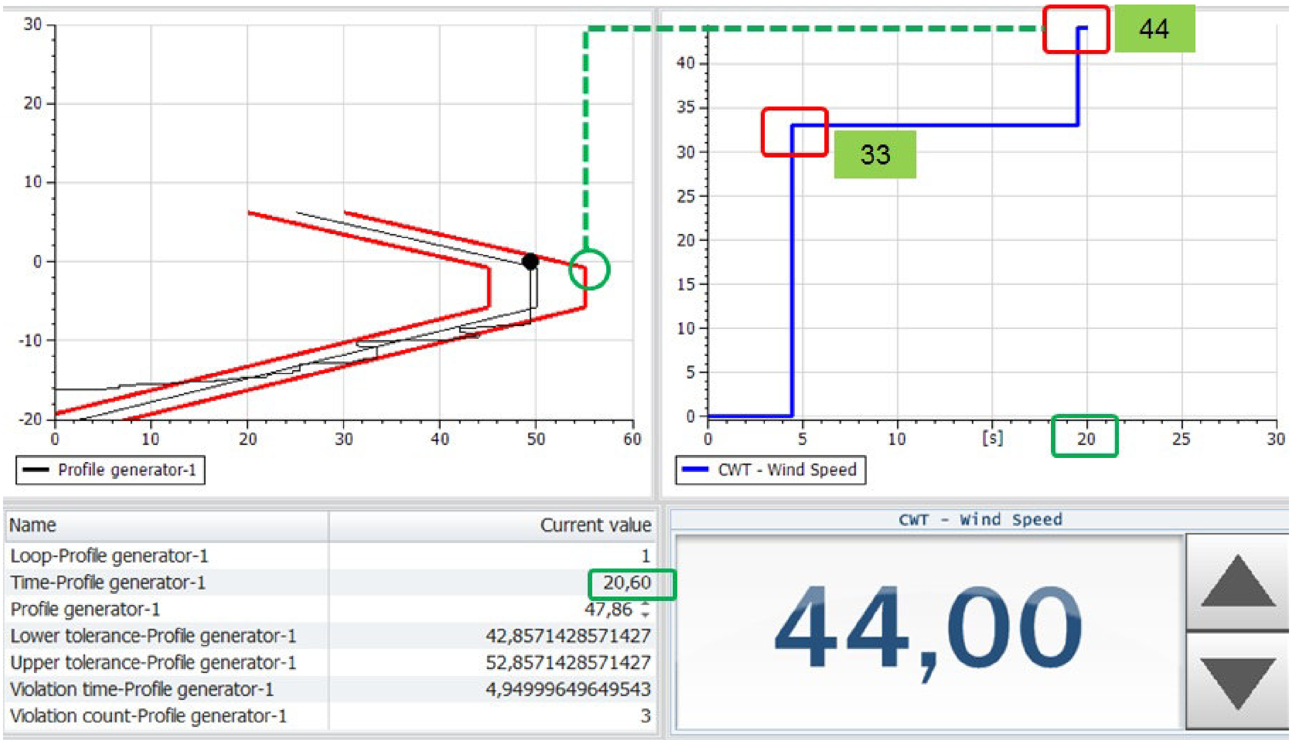
[CO_86]

The following test sequence includes 2 output channels e.g. to set the output channel to control the wind speed “CWT –Wind”.



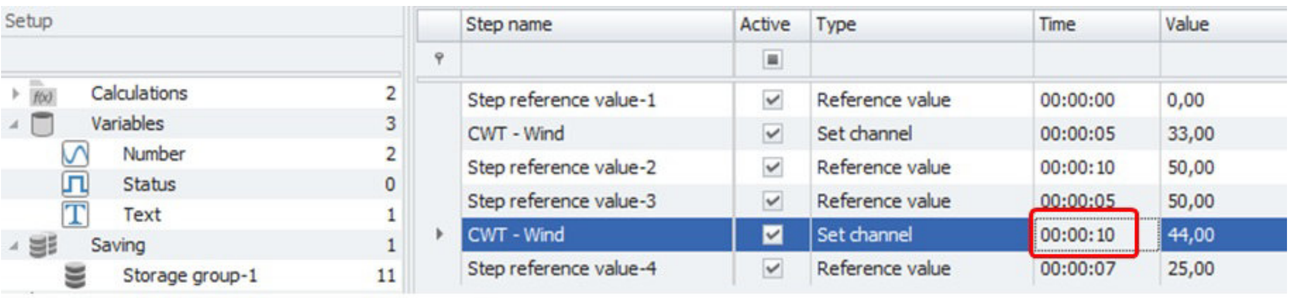
[CO_87]

The output channel are executed along the time base and set the defined value as indicated in the screenshot below.



[CO_88]

The timing operation of the output channels is added to the overall timing to the reference value channels. On this example the output value of 44 is directly set when the reference value step 3 is finished and the slope down profile is starting at 20 seconds elapsed time and will take 7 sec to reach the 25 km/h.
However if you add a time to the set output channel e.g. 10 sec as indicated below, the output channel is operated at 10 sec delay from the previous operation. This time of 10 sec is added to the next reference value step which is in this case a ramp down to 25 km/h. That means the overall ramp down step is (10 sec + 7 sec = 17 sec).



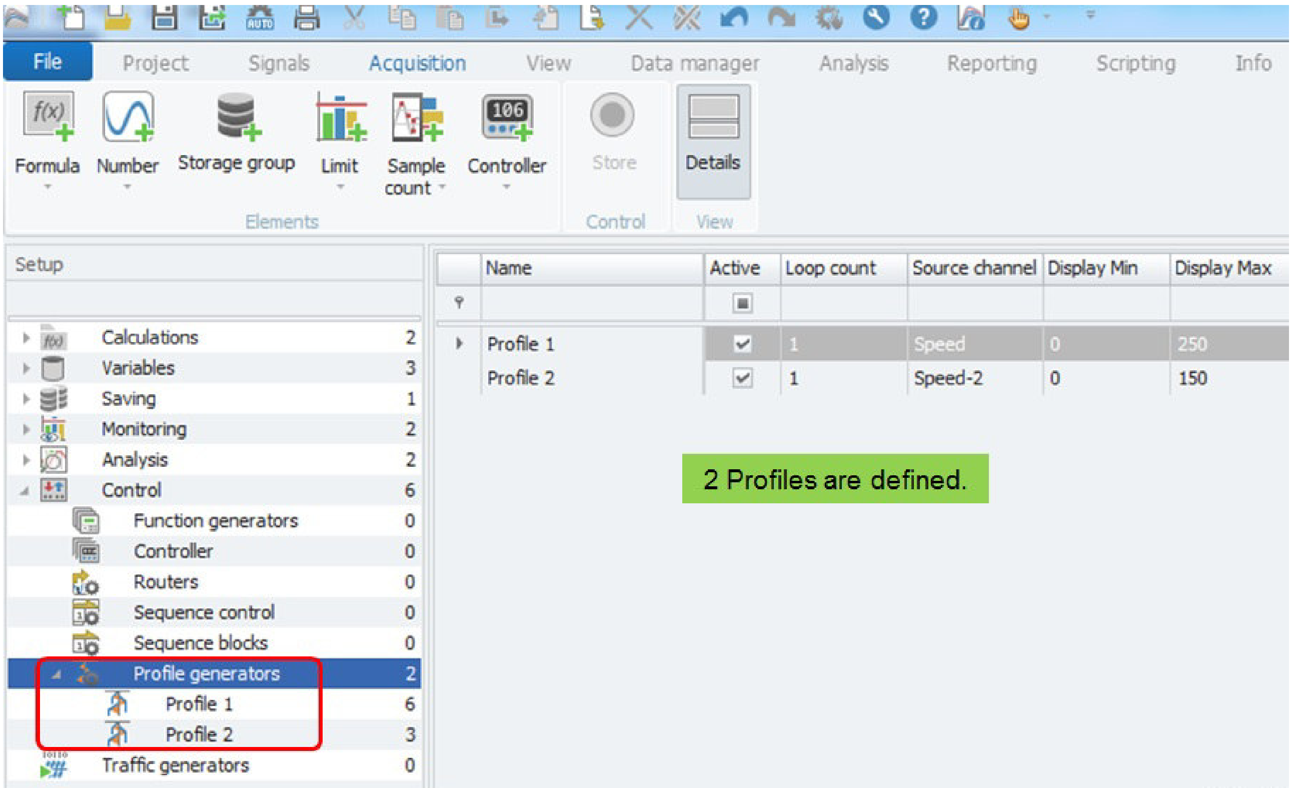
„Set channel" operation is executed 10 sec after the previous step. [CO_89]

The following screenshot is indicating how the 10 sec additional time of the "CWT - Set output channel" is affecting the overall profile presentation. In this case the output channel is set to 44 after 30 seconds total time elapsed and the ramp town to 25km/h is taking a total time of 17 sec.

[CO_90]

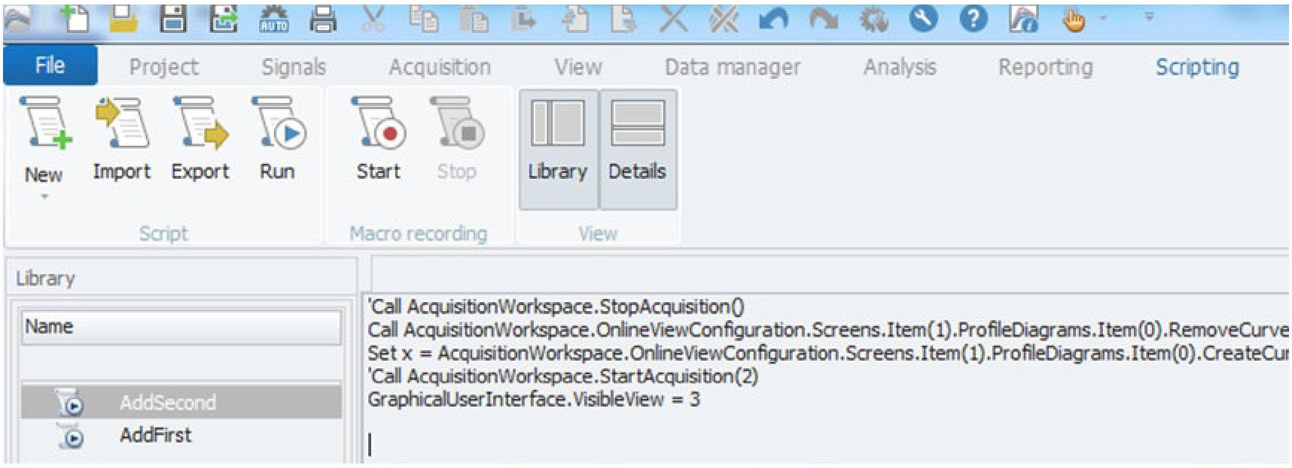
14.10.8 Application Example: Load Different Profiles

Over Com and Scripting interface you can load different Profiles into the Profile diagram. This function is useful if you have a configuration of different profiles and you like to change your test setup within one click. In this example 2 different profiles are created.



[CO_91]

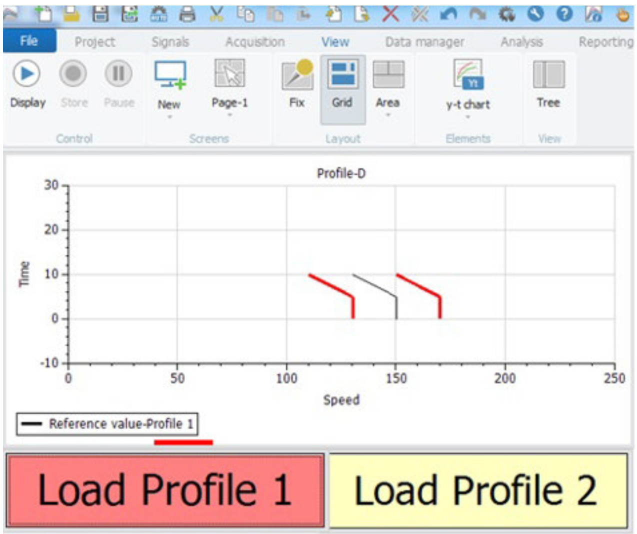
With the following scripting commands you can switch between the profiles through an action button.



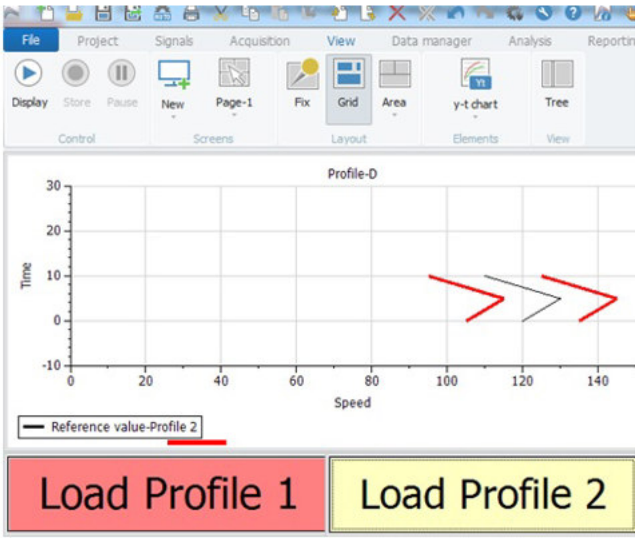
Scrips to change between profile diagrams [CO_92]

Script: Profile 2
'Call AcquisitionWorkspace.StopAcquisition()
Call Acquisition-
Workspace.OnlineViewConfiguration.Screens.Item(1).ProfileDiagrams.Item(0).RemoveCurve(AcquisitionWorkspace.Online
Set x = Acquisition-
Workspace.OnlineViewConfiguration.Screens.Item(1).ProfileDiagrams.Item(0).CreateCurve(AcquisitionWorkspace.Acquisi
'Call AcquisitionWorkspace.StartAcquisition(2)
GraphicalUserInterface.VisibleView = 3
Script: Profile 1
'Call AcquisitionWorkspace.StopAcquisition()
Call Acquisition-
Workspace.OnlineViewConfiguration.Screens.Item(1).ProfileDiagrams.Item(0).RemoveCurve(AcquisitionWorkspace.Online
Set x = Acquisition-
Workspace.OnlineViewConfiguration.Screens.Item(1).ProfileDiagrams.Item(0).CreateCurve(AcquisitionWorkspace.Acquisi
'Call AcquisitionWorkspace.StartAcquisition(2)
The only difference on the scripting commands is the yellow highlighted section where the profile index is different:

- Index = 0 =>Profile 1
- Index = 1 =>Profile 2

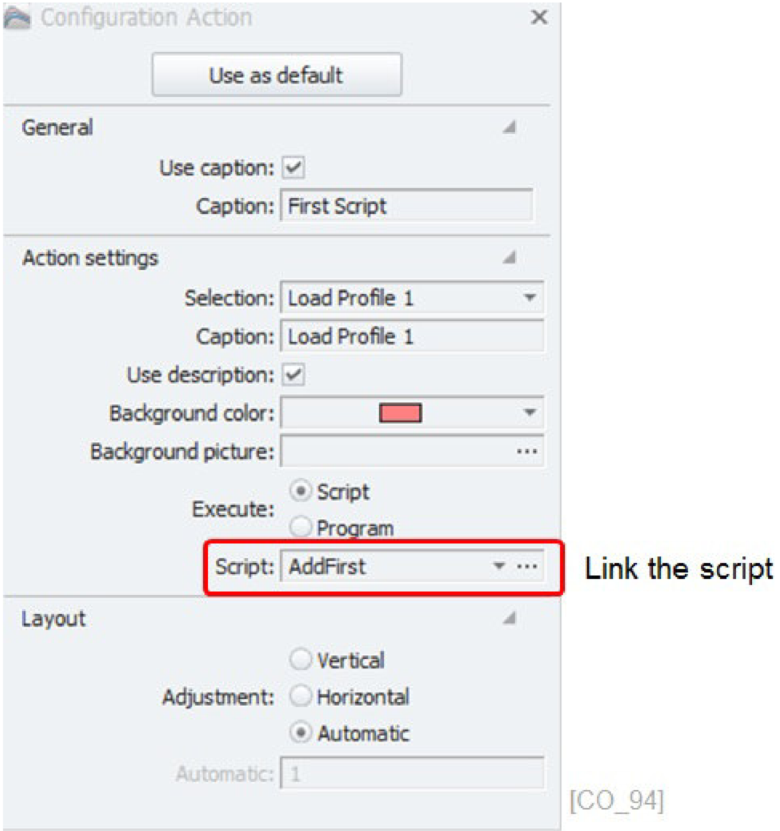


Profile 1 is loaded to the instrument.



Profile 2 is loaded to the instrument. [CO_93]

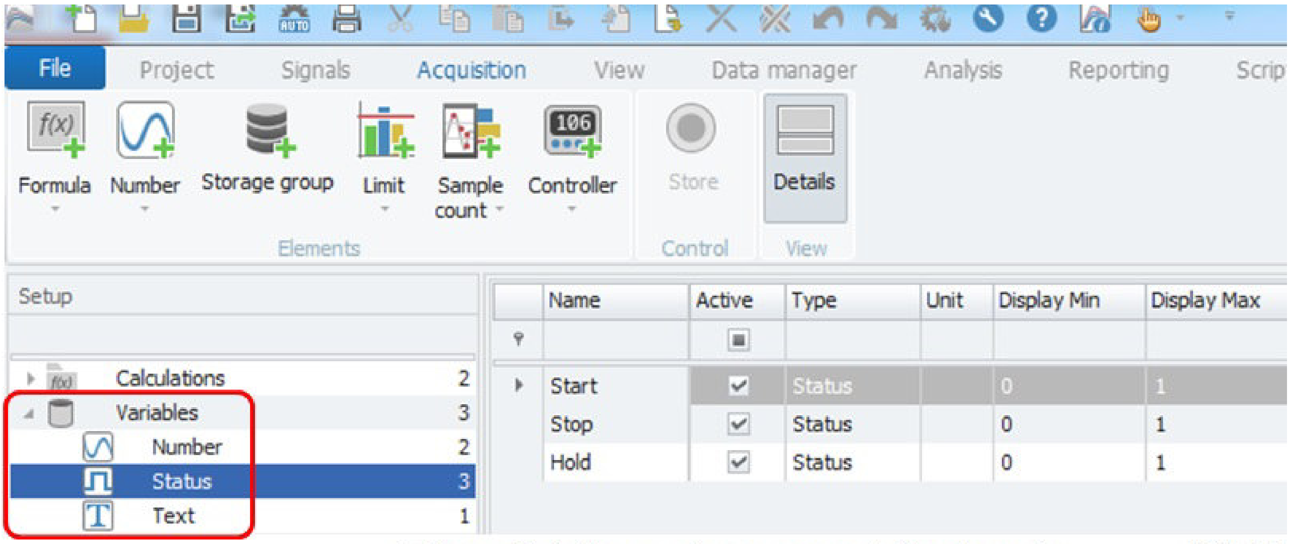
The Action button is configured as following. See for more details chapter VIEW 17.21.



Configuration of Action button.

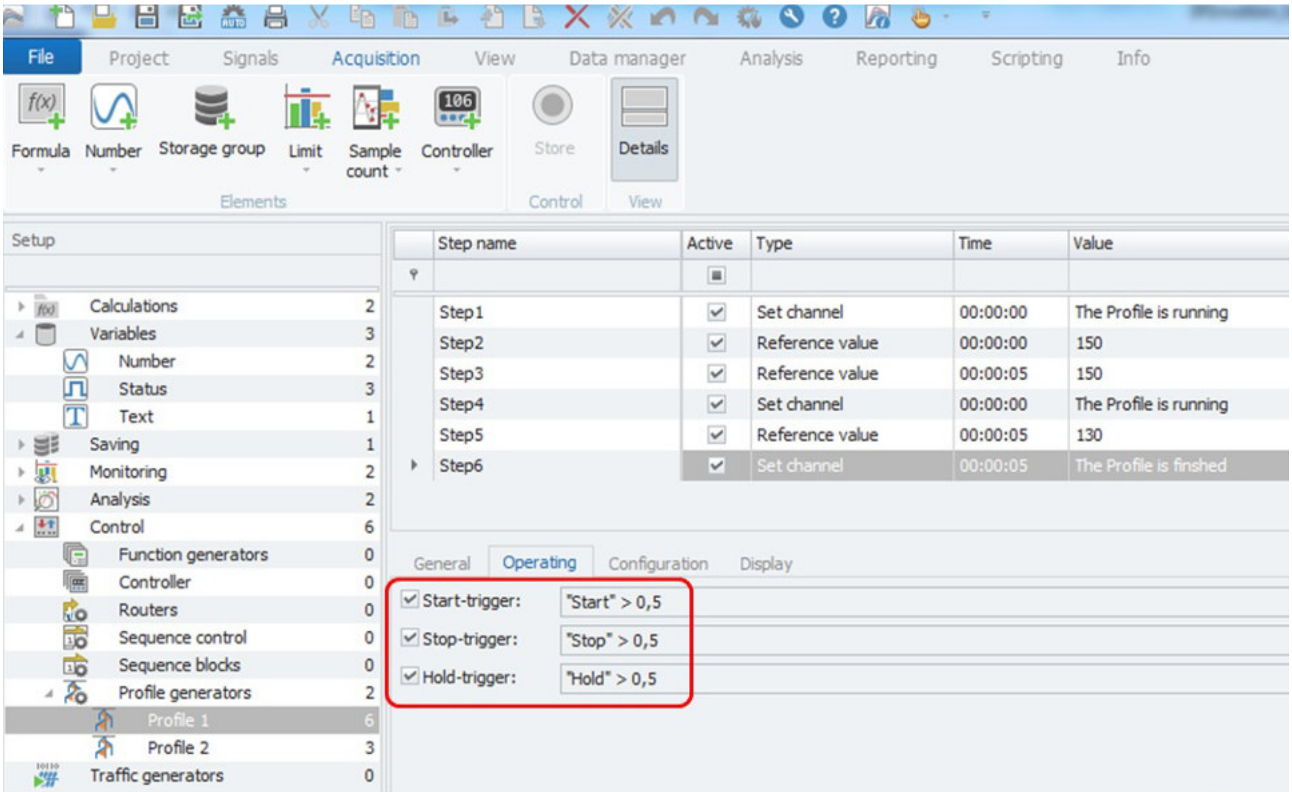
14.10.9 Application Example: Trigger functions in a sequence operation

In the following you will get an example how to use the trigger function to control your Profile generator through 3 Status variables.



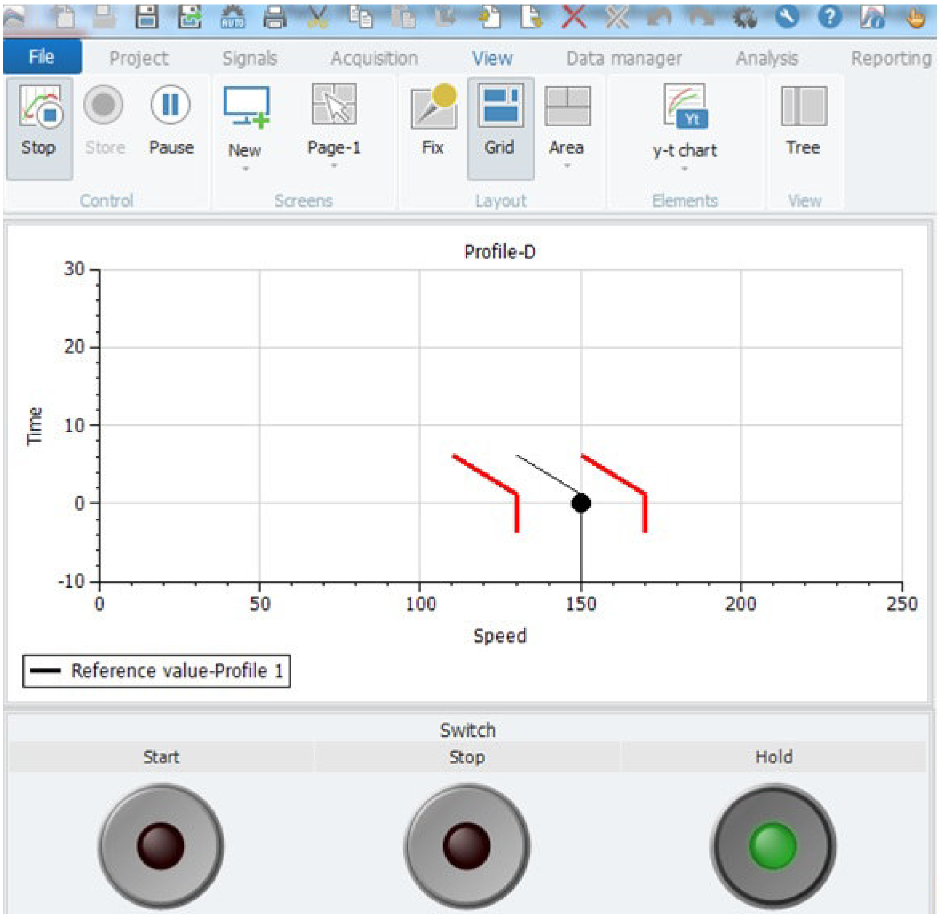
Trigger definition - using status variable channels. [CO_95]

These 3 variables are included in the operating tab sheet of the Profile generator.



[CO_96]

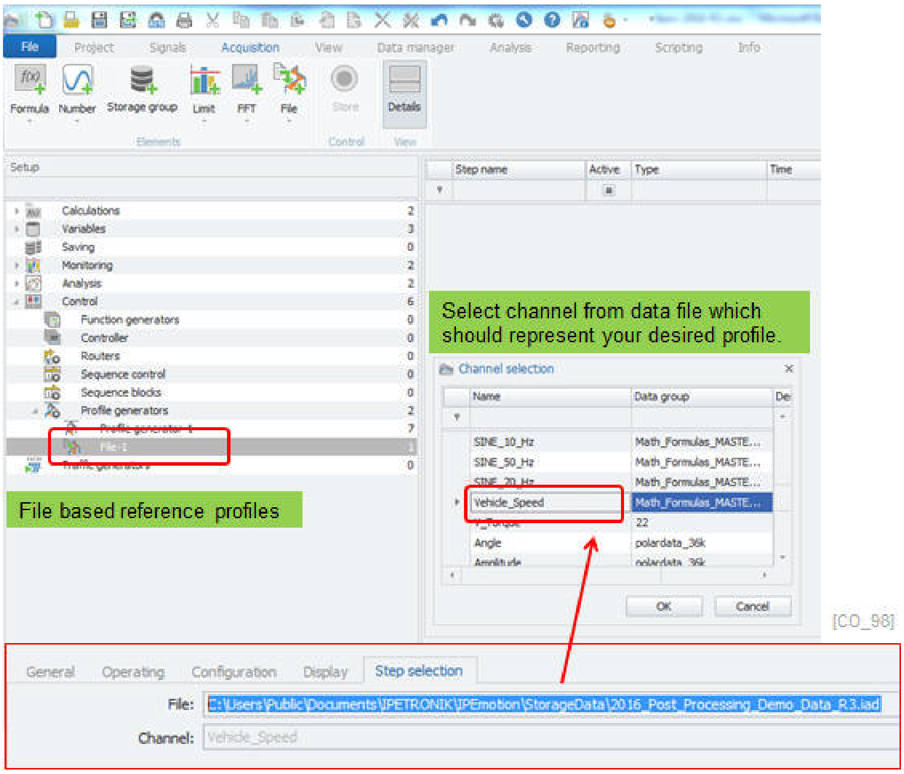
The 3 status variable channels are linked to the Switch instrument in the VIEW work space to give the user the ability to control with one button click the operation of the profile. For more details about the Switch instrument refer to chapter VIEW 17.19.



[CO_97]

14.10.10 File based profile generator

The profile generator is mainly use to indicate drive profiles to the test driver. Rather than setting up a step-by-step list manually, a pre-recorded data file can be imported to display the required drive profile. The main benefit of a file based profile creation is time saving and you have the ability to match a real recorded test drive profile from a on-road test to a test drive on the roller test bench.

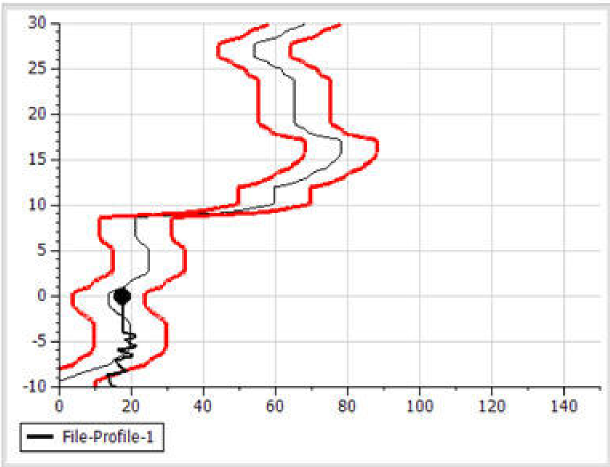


[CO_98]

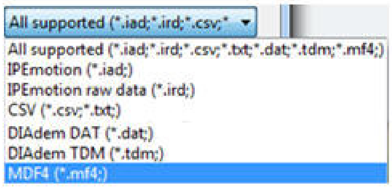
Supported file formats for the import are:

- IPEmotion .IAD
- CSV .CSV, .TXT
- DIAdem .DAT
- DIAdem .TDM
- MDF .MDF4

An example of file based reference profile generation is indicated blow.



Example of a file based reference profile.

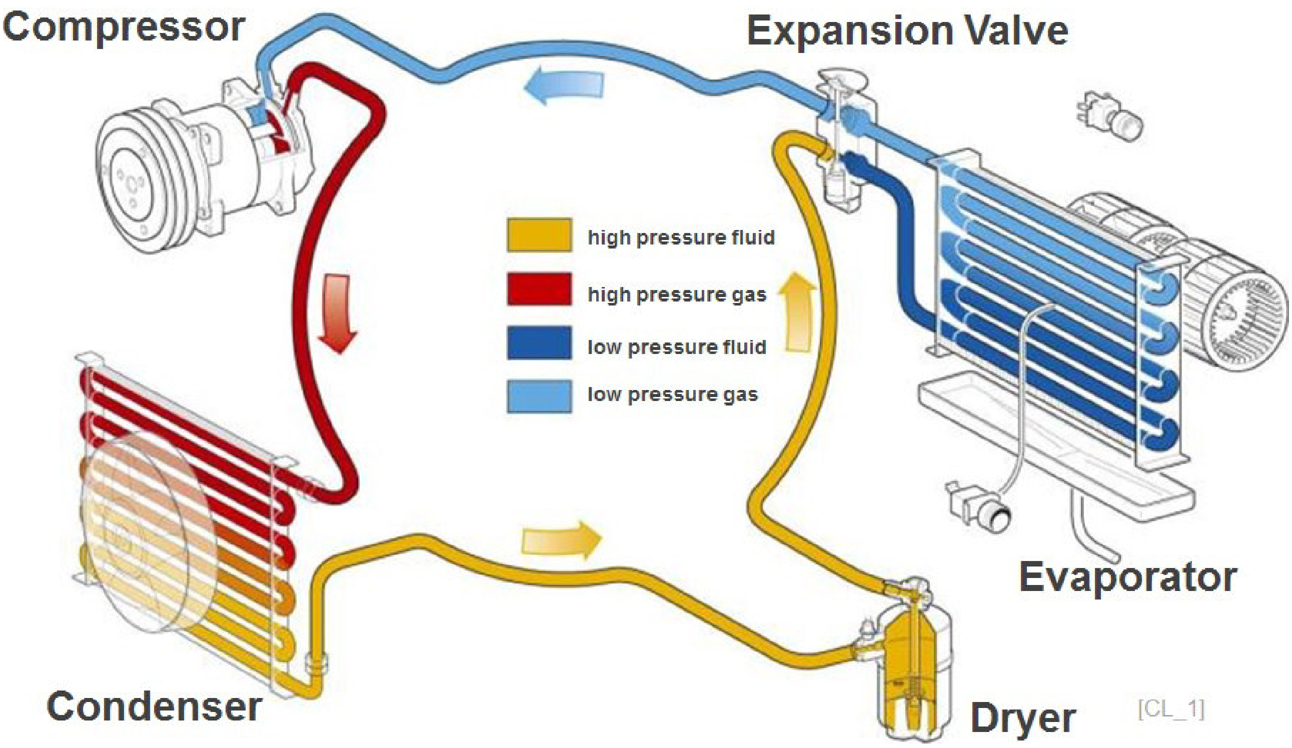


Supported file formats. [CO_99]

15 Climate Option

15.1 Introduction

With the climate option you can calculate thermodynamic cycles using different refrigerants. Thermodynamic cycles basically consist of four main elements as the below graphic shows.

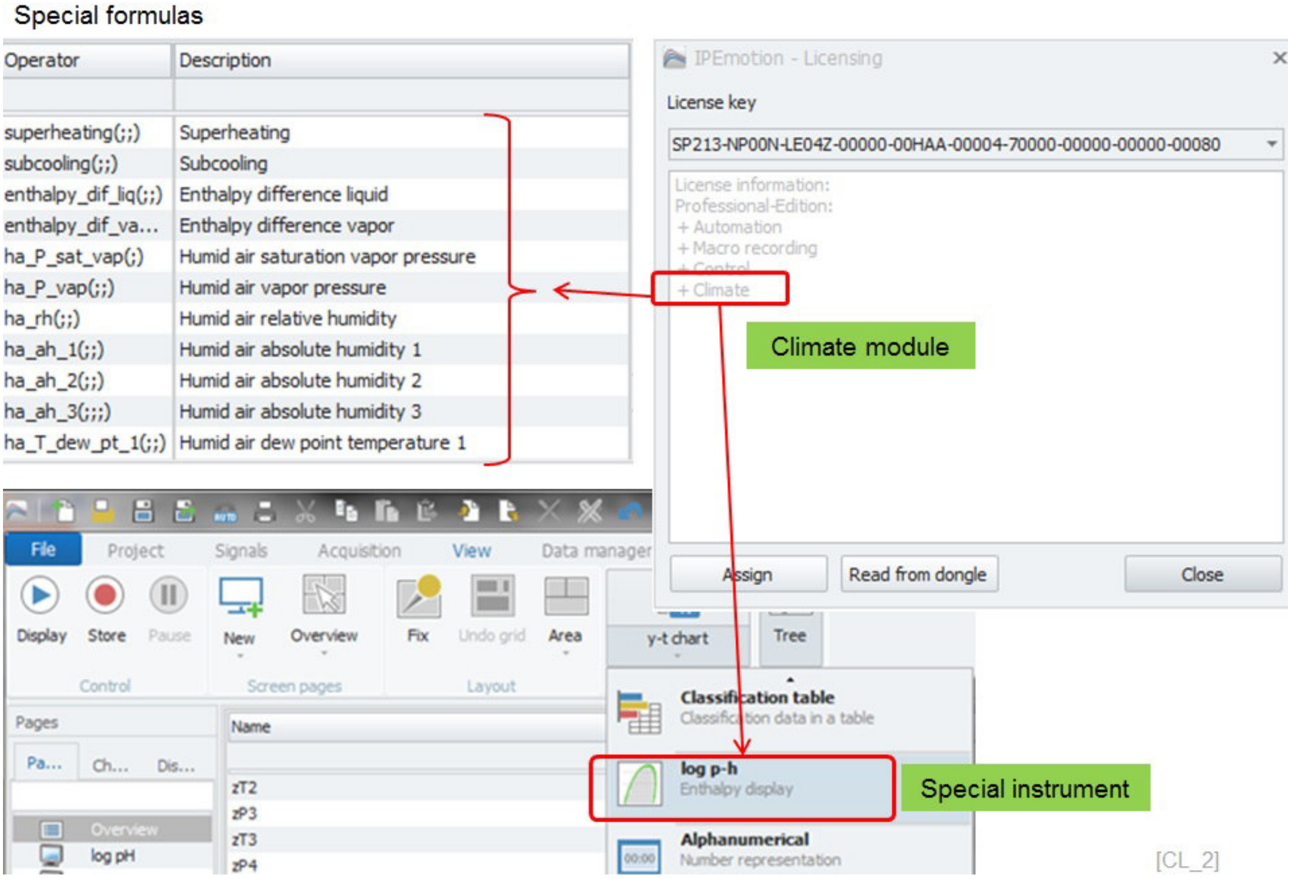


[CL_1]

- Compressor — The compressor is compressing the low pressure gas refrigerant to high pressure gas. The compression process is increasing the temperature of the gas. The refrigerant is getting hot.
- Condenser — The condenser is cooling the hot high pressure gas to a cold liquid fluid.
- Evaporator — The cold low pressure liquid fluid is going through the evaporator and the coolant (refrigerant) is changing from liquid to gas phase.
- Expansion valve — When the liquid is passing through the expansion valve, the pressure is released and it can turn into gas phase. When the liquid changes to the gas phase it causes a heat drift in the evaporator. The evaporator gets cold and extracts the energy from the incoming hot air and cools it down.

15.2 Climate License

With the climate license you get the special Log p-h instrument in the VIEW and ANALYSIS work space and a set of special enthalpy, entropy and humidity formulas.



[CL_2]

15.3 REFPROP database (NIST)

For the climate module you need to install the REFPROP database which includes the thermodynamic properties of different refrigerants. See VIEW >Log p-h instrument for more details in chapter 17.24.1. The REFPROP data base is not included in the IPEmotion standard setup. It is usually purchased together with the Climate module and delivered as a separate setup file. The link to the REFPROP data base can be defined in the OPTIONS 22.11.

15.4 Climate Formulas

The formulas for enthalpy calculations need a corresponding refrigerant. The refrigerants are included in the REFPROP database with their thermodynamic properties indicated.

- Formula Index 1 R134a
- Formula Index 2 R1234yf
- Formula Index 3 R22
- Formula Index 4 R404a
- Formula Index 5 R410a
- Formula Index 6 R507a
- Formula Index 7 R744 (CO2)
- Formula Index 8 R718 (H2O)
- Formula Index 9 R729 (N2+O2+Ar)
- Formula Index 10 R123ze
- Formula Index 11 R290 (Propane)
- Formula Index 12 R600a (Isobutene)
- Formula Index 13 R717 (Ammonia)

- h_std

  h_std calculates the specific enthalpy (unit: kJ/kg) as a function of temperature (unit: ÂřC), pressure (unit: bar) and a fluid. The fluid is defined by an index referring to the following list of supported fluids: R134a, R1234yf, R22, R404a, R410a, R507a, R744 (carbon dioxide), R718 (water), R729 (dry air)
  Syntax: h_std(temperature-operand; pressure-operand; index of fluid)
  Examples:,h_std("ChannelTemperature"; "ChannelPressure"; 1) calculates the specific enthalpy using a temperature channel and a pressure channel for the fluid R134a. h_std(20; 2; 2) calculates the specific enthalpy using fixed values for the pressure and temperature of fluid R1234yf.

- h_vap

  h_vap calculates the specific enthalpy (unit: kJ/kg) as a function of temperature (unit: ÂřC), pressure (unit: bar) and a fluid. This calculation is only suitable for measure points that are in the vapor area. The fluid is defined by an index referring to the following list of supported fluids: R134a, R1234yf, R22, R404a, R410a, R507a, R744 (carbon dioxide), R718 (water), R729 (dry air)
  Syntax: h_vap(temperature-operand; pressure-operand; index of fluid)
  Examples:
  h_vap("ChannelTemperature"; "ChannelPressure"; 1) calculates the specific enthalpy using a temperature channel and a pressure channel for the fluid R134a. h_vap(20; 2; 2) calculates the specific enthalpy using fixed values for the pressure and temperature of fluid R1234yf.

- h_liq

  h_liq calculates the specific enthalpy (unit: kJ/kg) as a function of temperature (unit: ÂřC), pressure (unit: bar) and a fluid. This calculation is only suitable for measure points within the liquid area. The fluid is defined by an index referring to the following list of supported fluids: R134a, R1234yf, R22, R404a, R410a, R507a, R744 (carbon dioxide), R718 (water), R729 (dry air)
  Syntax: h_liq(temperature-operand; pressure-operand; index of fluid)
  Examples:
  h_liq("ChannelTemperature"; "ChannelPressure"; 1) calculates the specific enthalpy using a temperature channel and a pressure channel for the fluid R134a. h_liq(20; 2; 2) calculates the specific enthalpy using fixed values for the pressure and temperature of fluid R1234yf.

- **h_ps** — h_ps calculates the specific enthalpy (unit: kJ/kg) as a function of pressure (unit: bar), entropy (unit: kJ/(kg*K)), and a fluid. The fluid is defined by an index referring to the following list of supported fluids: R134a, , R22, R404a, R410a, R507a, R744 (carbon dioxide), R718 (water), R729 (dry air)
  Syntax: h_ps(pressure-operand; entropy-operand; index of fluid)
  Examples:
  h_ps("ChannelPressure"; "ChannelEntropy"; 1) calculates the specific enthalpy using a pressure channel and an entropy channel for the fluid R134a. h_ps(20; 2; 2) calculates the specific enthalpy using fixed values for pressure and entropy of fluid.
- **h_liq_p** — h_liq_p calculates the specific enthalpy (unit: kJ/kg) as a function of temperature (unit: ÂřC), pressure (unit: bar), and a fluid on the boiling line. The fluid is defined by an index referring to the following list of supported fluids: R134a, R1234yf, R22, R404a, R410a, R507a, R744 (carbon dioxide), R718 (water), R729 (dry air)
  Syntax: h_liq_p(pressure-operand; index of fluid)
  Examples:
  h_liq_p("ChannelPressure"; 1) calculates the specific enthalpy using a pressure channel for the fluid R134a. h_liq_p(2; 2) calculates the specific enthalpy using a fixed value for the pressure of the fluid R1234yf.
- **h_vap_p** — h_vap_p calculates the specific enthalpy (unit: kJ/kg) as a function of temperature (unit: ÂřC), pressure (unit: bar), and a fluid on the dewing line. The fluid is defined by an index referring to the following list of supported fluids: R134a, R1234yf, R22, R404a, R410a, R507a, R744 (carbon dioxide), R718 (water), R729 (dry air)
  Syntax: h_vap_p(pressure-operand; index of fluid)
  Examples:
  h_vap_p("ChannelPressure"; 1) calculates the specific enthalpy using a pressure channel for the fluid R134a. h_vap_p(20; 2; 2) calculates the specific enthalpy using a fixed value for the pressure of the fluid R1234yf.
- **h_liq_t** — h_liq_t calculates the specific enthalpy (unit: kJ/kg) as a function of temperature (unit: ÂřC), pressure (unit: bar), and a fluid on the boiling line. The fluid is defined by an index referring to the following list of supported fluids: R134a, R1234yf, R22, R404a, R410a, R507a, R744 (carbon dioxide), R718 (water), R729 (dry air)
  Syntax: h_liq_t(temperature-operand; index of fluid)
  Examples:
  h_liq_t("ChannelTemperature"; 1) calculates the specific enthalpy using a temperature channel for the fluid R134a. h_liq_t(2; 2) calculates the specific enthalpy using a fixed value for the temperature of the fluid R1234yf.
- **h_vap_t** — h_vap_t calculates the specific enthalpy (unit: kJ/kg) as a function of temperature (unit: ÂřC), pressure (unit: bar), and a fluid on the dewing line. The fluid is defined by an index referring to the following list of supported fluids: R134a, R1234yf, R22, R404a, R410a, R507a, R744 (carbon dioxide), R718 (water), R729 (dry air)
  Syntax: h_vap_t(temperature-operand; index of fluid)
  Examples:
  h_vap_t("ChannelTemperature"; 1) calculates the specific enthalpy using a temperature channel for the fluid R134a. h_vap_t(20; 2) calculates the specific enthalpy using a fixed value for the temperature of the fluid R1234yf.

- h_liqvap_pq

  h_liqvap_pq calculates the specific enthalpy (unit: kJ/kg) as a function of pressure (unit: bar), mixing quality, and a fluid. The mixing quality equals 0 for pure liquids, 1 for vapors, and values in- between for mixes, e.g. 0.25 for 25% liquid and 75% vapor content. The fluid is defined by an index referring to the following list of supported fluids: R134a, R1234yf, R22, R404a, R410a, R507a, R744 (carbon dioxide), R718 (water), R729 (dry air)
  Syntax: h_liqvap_pq(pressure-operand; quality-operand; index of fluid)
  Examples:
  h_liqvap_pq("ChannelPressure"; "ChannelQuality"; 1) calculates the specific enthalpy using a temperature channel or a pressure channel for the fluid R134a. h_liqvap_pq(1.5; 0.75; 2) calculates the specific enthalpy using fixed values for the pressure and mixing quality of the fluid R1234yf.

- h_liqvap_tq

  h_liqvap_tq calculates the specific enthalpy (unit: kJ/kg) as a function of temperature (unit: ÂřC), mixing quality, and a fluid. The mixing quality equals 0 for pure liquids, 1 for vapors, and values in- between for mixes, e.g. 0.25 for 25% liquid and 75% vapor content. The fluid is defined by an index referring to the following list of supported fluids: R134a, R1234yf, R22, R404a, R410a, R507a, R744 (carbon dioxide), R718 (water), R729 (dry air)
  Syntax: h_liqvap_tq(temperature-operand; quality-operand; index of fluid)
  Examples:
  h_liqvap_tq("ChannelTemperature"; "ChannelQuality"; 1) calculates the specific enthalpy using a temperature channel or a pressure channel for the fluid R134a. h_liqvap_tq(20; 0.25; 2) calculates the specific enthalpy using fixed values for the temperature and mixing quality of the fluid R1234yf.

- u_std

  u_std calculates the specific internal energy (unit: kJ/kg) as a function of temperature (unit: ÂřC), pressure (unit: bar) and a fluid. The fluid is defined by an index referring to the following list of supported fluids: R134a, R1234yf, R22, R404a, R410a, R507a, R744 (carbon dioxide), R718 (water), R729 (dry air).
  Syntax: u_std(temperature-operand; pressure-operand; index of fluid)
  Examples:
  u_std("ChannelTemperature"; "ChannelPressure"; 1) calculates the specific internal energy using a temperature channel and a pressure channel for the fluid R134a. u_std(20; 2; 2) calculates the specific internal energy using fixed values for the pressure and temperature of fluid R1234yf.

- s_std

  s_std calculates the specific entropy (unit: kJ/kg) as a function of temperature (unit: ÂřC), pressure (unit: bar) and a fluid. The fluid is defined by an index referring to the following list of supported fluids: R134a, R1234yf, R22, R404a, R410a, R507a, R744 (carbon dioxide), R718 (water), R729 (dry air).
  Syntax: s_std(temperature-operand; pressure-operand; index of fluid)
  Examples:
  s_std("ChannelTemperature"; "ChannelPressure"; 1) calculates the specific entropy using a temperature channel and a pressure channel for the fluid R134a. s_std(20; 2; 2) calculates the specific entropy using fixed values for the pressure and temperature of fluid R1234yf.

- rho_std

  rho_std calculates the density (unit: kg/mÂş) as a function of temperature (unit: ÂřC), pressure (unit: bar) and a fluid. The fluid is defined by an index referring to the following list of supported fluids: R134a, R1234yf, R22, R404a, R410a, R507a, R744 (carbon dioxide), R718 (water), R729 (dry air)
  Syntax: rho_std(temperature-operand; pressure-operand; index of fluid)
  Examples:
  rho_std("ChannelTemperature"; "ChannelPressure"; 1) calculates the density using a temperature channel and a pressure channel for the fluid R134a. rho_std(20; 2; 2) calculates the density using fixed values for the pressure and temperature of fluid R1234yf.

- V_spec

  V_spec calculates the specific volume (unit: mÂş/kg) as a function of temperature (unit: ÂřC), pressure (unit: bar) and a fluid. The fluid is defined by an index referring to the following list of supported fluids: R134a, R1234yf, R22, R404a, R410a, R507a, R744 (carbon dioxide), R718 (water), R729 (dry air)
  Syntax: V_spec(temperature-operand; pressure-operand; index of fluid)
  Examples:
  V_spec("ChannelTemperature"; "ChannelPressure"; 1) calculates the specific volume using a temperature channel and a pressure channel for the fluid R134a. V_spec(20; 2; 2) calculates the specific volume using fixed values for the pressure and temperature of fluid R1234yf.

- c_sound

  c_sound calculates the speed of sound (unit: m/s) as a function of temperature (unit: ÂřC), pressure (unit: bar) and a fluid. The fluid is defined by an index referring to the following list of supported fluids: R134a, R1234yf, R22, R404a, R410a, R507a, R744 (carbon dioxide), R718 (water), R729 (dry air)
  Syntax: c_sound(temperature-operand; pressure-operand; index of fluid)
  Examples:
  c_sound("ChannelTemperature"; "ChannelPressure"; 1) calculates the speed of sound using a temperature channel and a pressure channel for the fluid R134a. c_sound(20; 2; 2) calculates the speed of sound using fixed values for the pressure and temperature of fluid R1234yf.

- c_vol

  c_vol calculates the isochoric heat capacity (unit: kJ/kgK) as a function of temperature (unit: ÂřC), pressure (unit: bar) and a fluid. The fluid is defined by an index referring to the following list of supported fluids: R134a, R1234yf, R22, R404a, R410a, R507a, R744 (carbon dioxide), R718 (water), R729 (dry air)
  Syntax: c_vol(temperature-operand; pressure-operand; index of fluid)
  Examples:
  c_vol("ChannelTemperature"; "ChannelPressure"; 1) calculates the isochoric heat capacity using a temperature channel and a pressure channel for the fluid R134a. c_vol(20; 2; 2) calculates the isochoric heat capacity using fixed values for the pressure and temperature of fluid R1234yf.

- **c_pres** c_pres calculates the isobaric heat capacity (unit: kJ/kgK) as a function of temperature (unit: ÂřC), pressure (unit: bar) and a fluid. The fluid is defined by an index referring to the following list of supported fluids: R134a, R1234yf, R22, R404a, R410a, R507a, R744 (carbon dioxide), R718 (water), R729 (dry air)
  Syntax: c_pres(temperature-operand; pressure-operand; index of fluid)
  Examples:
  c_pres("ChannelTemperature"; "ChannelPressure"; 1) calculates the isobaric heat capacity using a temperature channel and a pressure channel for the fluid R134a. c_pres(20; 2; 2) calculates the isobaric heat capacity using fixed values for the pressure and temperature of fluid R1234yf.
- **T_sat_liq** T_sat_liq calculates the saturation temperature of the boiling line (unit: ÂřC) as a function of pressure (unit: bar) and a fluid. The fluid is defined by an index referring to the following list of supported fluids: R134a, R1234yf, R22, R404a, R410a, R507a, R744 (carbon dioxide), R718 (water), R729 (dry air)
  Syntax: T_sat_liq(pressure-operand; index of fluid)
  Examples:
  T_sat_liq("ChannelPressure"; 1) calculates the saturation temperature of the boiling line using a pressure channel for the fluid R134a. T_sat_liq(1; 2) calculates the saturation temperature of the boiling line using a fixed value for the pressure of fluid R1234yf.
- **T_sat_vap** T_sat_vap calculates the saturation temperature of the dew line (unit: ÂřC) as a function of pressure (unit: bar) and a fluid. The fluid is defined by an index referring to the following list of supported fluids: R134a, R1234yf, R22, R404a, R410a, R507a, R744 (carbon dioxide), R718 (water), R729 (dry air)
  Syntax: T_sat_vap(pressure-operand; index of fluid)
  Examples:
  T_sat_vap("ChannelPressure"; 1) calculates the saturation temperature of the dew line using a pressure channel for the fluid R134a. T_sat_vap(1; 2) calculates the saturation temperature of the dew line using a fixed value for the pressure of fluid R1234yf.
- **superheating** superheating calculates the superheating (unit: ÂřC) as a function of temperature (unit: ÂřC), pressure (unit: bar) and a fluid. The superheating results from the temperature difference between the measuring point and the saturation temperature of the dew line at the same pressure level. Positive values indicate a superheated state. If the fluid is not in a superheated state, the values can also be negative. The fluid is defined by an index referring to the following list of supported fluids: R134a, R1234yf, R22, R404a, R410a, R507a, R744 (carbon dioxide), R718 (water), R729 (dry air)
  Syntax: superheating(temperature-operand; pressure-operand; index of fluid)
  Examples:
  superheating("ChannelTemperature"; "ChannelPressure"; 1) calculates the superheating using a temperature channel and a pressure channel for the fluid R134a. superheating(20; 2; 2) calculates the superheating using fixed values for the pressure and temperature of fluid R1234yf.

- **subcooling** — subcooling calculates the subcooling (unit: ÂřC) as a function of temperature (unit: ÂřC), pressure (unit: bar) and a fluid. The subcooling results from the temperature difference between the measuring point and the saturation temperature of the boiling line at the same pressure level. Positive values indicate a subcooled state. If the fluid is not in a subcooled state, the values can also be negative. The fluid is defined by an index referring to the following list of supported fluids: R134a, R1234yf, R22, R404a, R410a, R507a, R744 (carbon dioxide), R718 (water), R729 (dry air)
  Syntax: subcooling(temperature-operand; pressure-operand; index of fluid)
  Examples:
  subcooling("ChannelTemperature"; "ChannelPressure"; 1) calculates the subcooling using a temperature channel and a pressure channel for the fluid R134a. subcooling(20; 10; 2) calculates the subcooling using fixed values for the pressure and temperature of fluid R1234yf.
- **enthalpy_dif_liq** — enthalpy_dif_liq calculates the enthalpy difference (unit: kJ/kg) between the enthalpy of measuring point and boiling line at the same pressure level as a function of temperature (unit: ÂřC), pressure (unit: bar) and a fluid. The fluid is defined by an index referring to the following list of supported fluids: R134a, R1234yf, R22, R404a, R410a, R507a, R744 (carbon dioxide), R718 (water), R729 (dry air)
  Syntax: enthalpy_dif_liq(temperature-operand; pressure-operand; index of fluid)
  Examples:
  enthalpy_dif_liq("ChannelTemperature"; "ChannelPressure"; 1) calculates the enthalpy difference liquid using a temperature channel and a pressure channel for the fluid R134a. enthalpy_dif_liq(20; 10; 2) calculates the enthalpy difference liquid using fixed values for the pressure and temperature of fluid R1234yf.
- **enthalpy_dif_vap** — enthalpy_dif_vap calculates the enthalpy difference (unit: kJ/kg) between the enthalpy of measuring point and dew line at the same pressure level as a function of temperature (unit: ÂřC), pressure (unit: bar) and a fluid. The fluid is defined by an index referring to the following list of supported fluids: R134a, R1234yf, R22, R404a, R410a, R507a, R744 (carbon dioxide), R718 (water), R729 (dry air)
  Syntax: enthalpy_dif_vap(temperature-operand; pressure-operand; index of fluid)
  Examples:
  enthalpy_dif_vap("ChannelTemperature"; "ChannelPressure"; 1) calculates the enthalpy difference vapor using a temperature channel and a pressure channel for the fluid R134a. enthalpy_dif_vap(20; 2; 2) calculates the enthalpy difference vapor using fixed values for the pressure and temperature of fluid R1234yf.
- **ha_P_sat_vap** — ha_P_sat_vap calculates the saturation vapor pressure of water in humid air (unit: bar) as a function of temperature (unit: ÂřC) and a flag indicating the aggregation state of the non-gaseous mass fraction (0 = over water, 1 = over ice; only relevant if temperatures are below 0 ÂřC).
  Syntax: ha_P_sat_vap(temperature-operand; state-flag)
  Examples:
  ha_P_sat_vap("T1"; 1) calculates the saturation vapor pressure over ice using a temperature channel named "T1". ha_P_sat_vap(8; 0) calculatesthe saturation vapor pressure at a temperature of 8 ÂřC.

- ha_P_vap

  ha_P_vap calculates the vapor pressure of water in humid air (unit: bar) as a function of temperature (unit: ÂřC), relative humidity (unit: %), and a flag indicating the aggregation state of the non-gaseous mass fraction (0 = over water, 1 = over ice; only relevant if temperatures are below 0 ÂřC).
  Syntax: ha_P_vap(temperature-operand; relative-humidity-operand; state-flag)
  Examples:
  ha_P_vap("T1"; "RH1"; 0) calculates the vapor pressure over water using a temperature channel named "T1" and a relative humidity channel named "RH1". ha_P_vap(-10; 45; 1) calculates the vapor pressure over ice at a temperature of -10 ÂřC and a relative humidity of 45%.

- ha_rh

  ha_rh calculates the relative humidity of humid air (unit: %) as a function of temperature (unit: ÂřC), dew point temperature (unit: ÂřC), and a flag indicating the aggregation state of the non-gaseous mass fraction (0 = over water, 1 = over ice; only relevant if temperatures are below 0 ÂřC).
  Syntax: ha_rh(temperature-operand; dew-point-temperature-operand; state-flag)
  Examples:
  ha_rh("T1"; "TD1"; 1) calculates the relative humidity over ice using a temperature channel named "T1" and a dew point temperature channel named "TD1". ha_rh(42; 30; 0) calculates the relative humidity at a temperature of 42 ÂřC and a dew point temperature of 30 ÂřC.

- ha_ah_1

  ha_ah_1 calculates the density of water vapor in humid air (unit: g/mÂş) as a function of temperature (unit: ÂřC), relative humidity (unit: %), and a flag indicating the aggregation state of the non-gaseous mass fraction (0 = over water, 1 = over ice; only relevant if temperature is below 0 ÂřC).
  Syntax: ha_ah_1(temperature-operand; relative-humidity-operand; state-flag)
  Examples:
  ha_ah_1("T1"; 60; 0) calculates the absolute humidity over water using a temperature channel named "T1" at a constant relative humidity of 60%. ha_ah_1(-2; "RH1"; 1) calculates the absolute humidity over ice using a relative humidity channel named "RH1" at a constant temperature of -2 ÂřC.

- ha_ah_2

  ha_ah_2 calculates the density of water vapor in humid air (unit: g/mÂş) as a function of temperature (unit: ÂřC), dew point temperature (unit: ÂřC), and a flag indicating the aggregation state of the non-gaseous mass fraction (0 = over water, 1 = over ice; only relevant if temperature is below 0 ÂřC).
  Syntax: ha_ah_2(temperature-operand; dew-point-temperature-operand; state-flag)
  Examples:
  ha_ah_2("T1"; "TD1"; 1) calculates the absolute humidity over ice using a temperature channel named "T1" and a dew point temperature channel named "TD1". ha_ah_2(15; 5; 0) calculates the absolute humidity at a temperature of 15 ÂřC and a dew point temperature of 5 ÂřC.

- ha_ah_3

  ha_ah_3 calculates the mass ratio between water vapor and dry air in humid air (unit: g/kg) as a function of temperature (unit: ÂřC), barometric pressure (unit: bar), relative humidity (unit: %), and a flag indicating the aggregation state of the non-gaseous mass fraction (0 = over water, 1 = over ice; only relevant if temperature is below 0 ÂřC).
  Syntax: ha_ah_3(temperature-operand; pressure-operand; relative-humidity- operand; state-flag)
  Examples:
  ha_ah_3(42; 1.013; 85; 0) calculates the absolute humidity at a temperature of 42 ÂřC, a barometric reading of 1.013 bar, and a relative humidity of 85%. ha_ah_3("T2"; "P2"; "RH2"; 1) calculates the absolute humidity over ice using a temperature channel named "T2", a pressure channel named "P2", and a relative humidity channel named "RH2".

- ha_T_dew_pt_1

  ha_T_dew_pt_1 calculates the dew point temperature of water in humid air (unit: ÂřC) as a function of temperature (unit: ÂřC), relative humidity (unit: %), and a flag indicating the aggregation state of the non-gaseous mass fraction (0 = over water, 1 = over ice; only relevant if temperature is below 0 ÂřC).
  Syntax: ha_T_dew_pt_1(temperature-operand; relative-humidity-operand; state-flag)
  Examples:
  ha_T_dew_pt_1("T1"; "RH1"; 0) calculates the dew point temperature over water using a temperature channel named "T1" and a relative humidity channel named "RH1". ha_T_dew_pt_1(-20; 33; 1) calculates the dew point temperature over ice at a temperature of -20 ÂřC and a relative humidity of 33%.

- ha_T_de_pt_2

  ha_T_dew_pt_2 calculates the dew point temperature of water in humid air (unit: ÂřC) as a function of absolute humidity (unit: g/kg) and barometric pressure (unit: bar). This calculation is only suitable for temperatures >0.01 ÂřC.
  Syntax: ha_T_dew_pt_2(temperature-operand; pressure-operand)
  Examples:
  ha_T_dew_pt_2(20; 1.013) calculates the dew point temperature at an absolute humidity of 20 g water per kg dry air and a barometric reading of 1.013 bar. ha_T_dew_pt_2("AH0"; "P0") calculates the dew point temperature using an absolute humidity channel named "AH0" and a pressure channel named "P0".

- ha_h

  ha_h calculates the enthalpy of humid air (unit: kJ/kg) as a function of temperature (unit: ÂřC), barometric pressure (unit: bar), relative humidity (unit: %), and a flag indicating the aggregation state of the non-gaseous mass fraction (0 = over water, 1 = over ice; only relevant if temperature is below 0 ÂřC).
  Syntax: ha_h(temperature-operand; pressure-operand; relative-humidity-operand; state-flag)
  Examples:
  ha_h(20; 1.013; 100; 0) calculates the enthalpy at a temperature of 20 ÂřC, a barometric reading of 1.013 bar, and a relative humidity of 100%. ha_h("T2"; "P2"; "RH2"; 1) calculates the enthalpy over ice using a temperature channel named "T2", a pressure channel named "P2", and a relative humidity channel named "RH2".

15.5 Log p-h Diagram

Details on how to configure the Log p-h diagram are explained in the VIEW work area. See chapter 17.24.2.If you like to use the log-pH diagram for data analysis see chapter ANALYSIS 19.16.

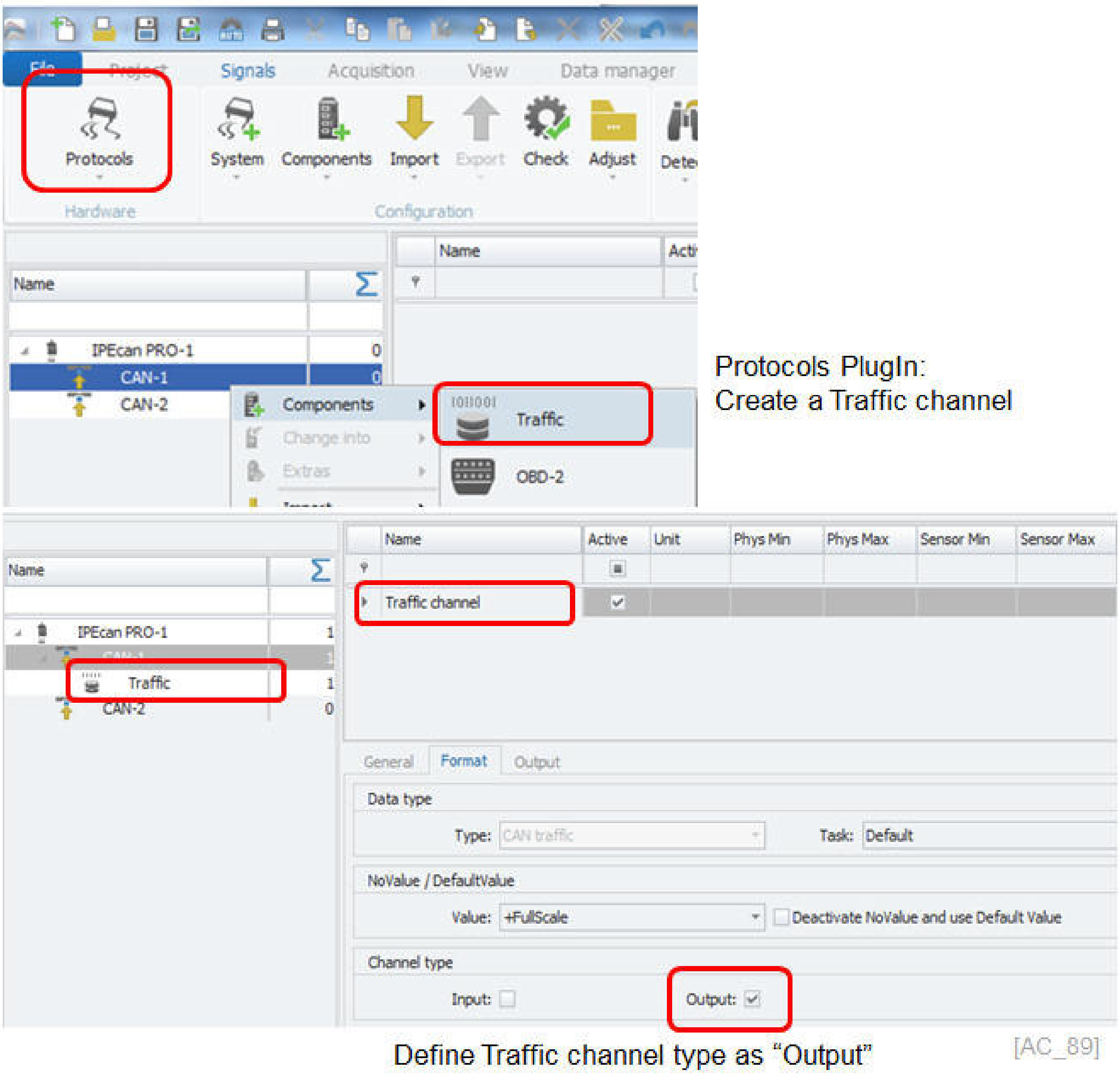
15.5.1 Application Example

The climate calculation formulas pressure, temperature together which the refrigerant index is the input parameter. For the pressure measurement IPETRONIK offers a very accurate product called “CAN pressure”. This transducer is available as relative and absolute pressure measurement device in the range of 1 – 250bar.

For the log p-h calculations you have to use absolute pressure transducers. With absolute pressure transducers you achieve the same measurement results independently where your test bench is located e.g. close to the sea level or in the mountains.

16 CAN bus traffic generator

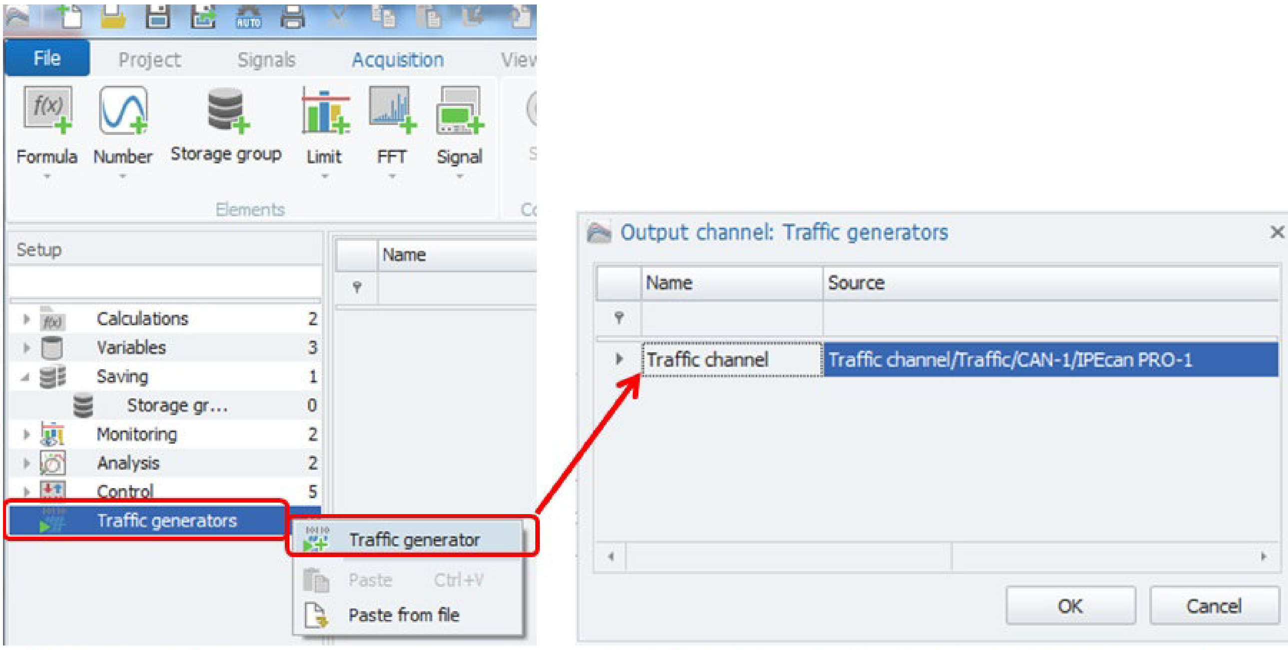
This function is only available if you are the owner of a Professional or Developer Edition. See chapter Editions 4.1.6.When you have a CAN Traffic .ASC file which includes CAN bus traffic messages you can output these message over this traffic generator. If you would like to measure and generate CAN traffic signals you need a traffic channel. It is recommended to use the new **Protocols PlugIn V01.03.00** or higher which includes **Traffic measurement** and **Traffic Send** functions at the same time on the same CAN interface. Alternatively you can use two PlugIns, the **CAN Acquisition** PlugIn for Traffic measurement and the **CAN Send PlugIn** for Traffic sending.
In this document the Protocols PlugIn V01.03.0 is considered.



[AC_89]

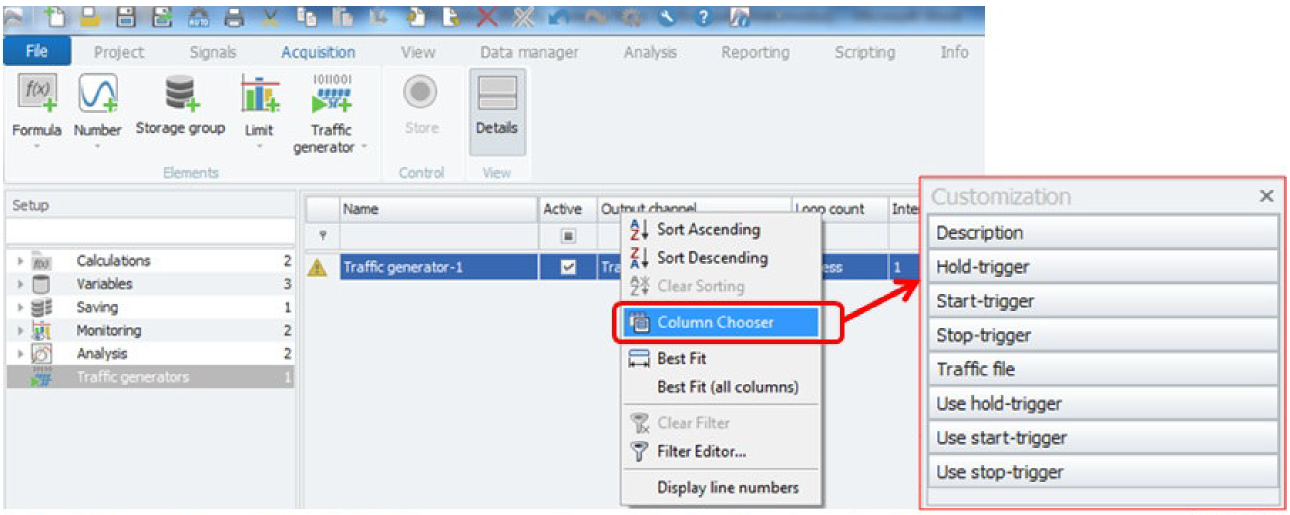
Information *The CAN traffic analyzer instrument and the Traffic generator are only included in the Professional and Developer Edition.*

When you have a Traffic “output” channel in your configuration you can directly configure the Traffic channel correctly. When you create a Traffic generator the dialog is proposing a list of all suitable traffic output channels.



Traffic generator [AC_90] All available Traffic output channels listed for selection.

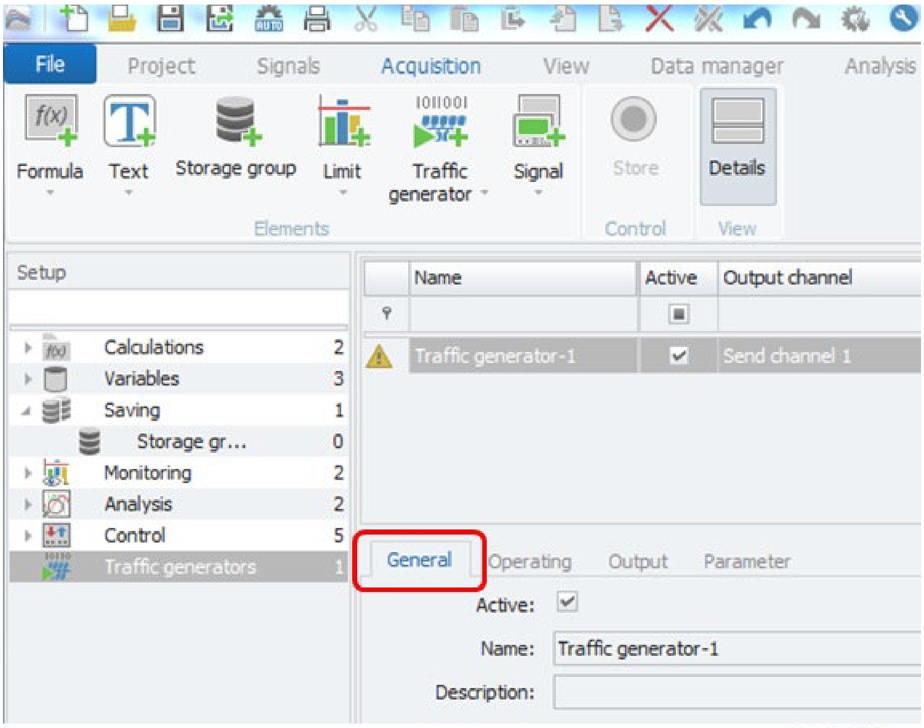
When a Traffic generator channel is created you can use the column chooser to add more parameters into the grid overview. The parameters will be discussed below.



Use Column Cooser to add additonal parameters to the traffic channel grid [AC_91]

16.1 Traffic Generator – General tab sheet

The CAN Traffic generator can be configured through 4 tab sheets.
In the General tab sheet you define the status, name and description of the traffic generator channel.

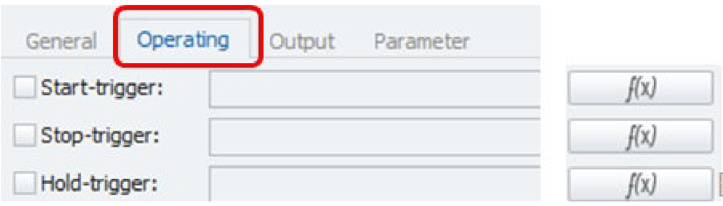


[AC_92]

- **Active** — With this checkbox you can activate / deactivate the Traffic generator
- **Name** — Refers to the name of the Traffic generator
- **Description** — Here you can add an additional description to the Traffic generator

16.2 Traffic Generator – Operating tab sheet

In the operating tab sheet you can define Start, Stop and Hold Trigger conditions to control the traffic signal generation. With the (fx) button you can open the formula interface to configure your trigger condition.



[AC_93]

- **Start trigger** — This can be a trigger to start the Traffic generator.
- **Stop trigger** — This can be a trigger to stop the Traffic generator.
- **Hold trigger** — This can be a trigger to hold the Traffic generator.

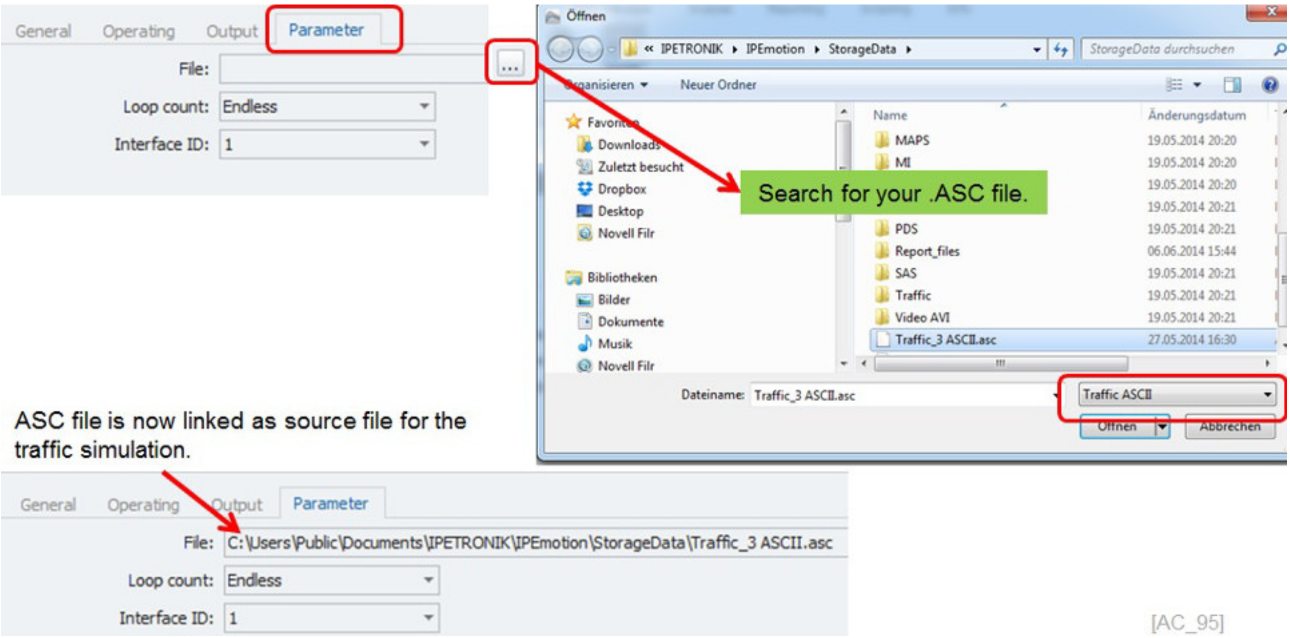
16.3 Traffic Generator – Output tab sheet

In the Output tab sheet you can define the channel which is receiving the CAN traffic messages. This channel must be defined as Output channel suitable for CAN messages.

[AC_94]

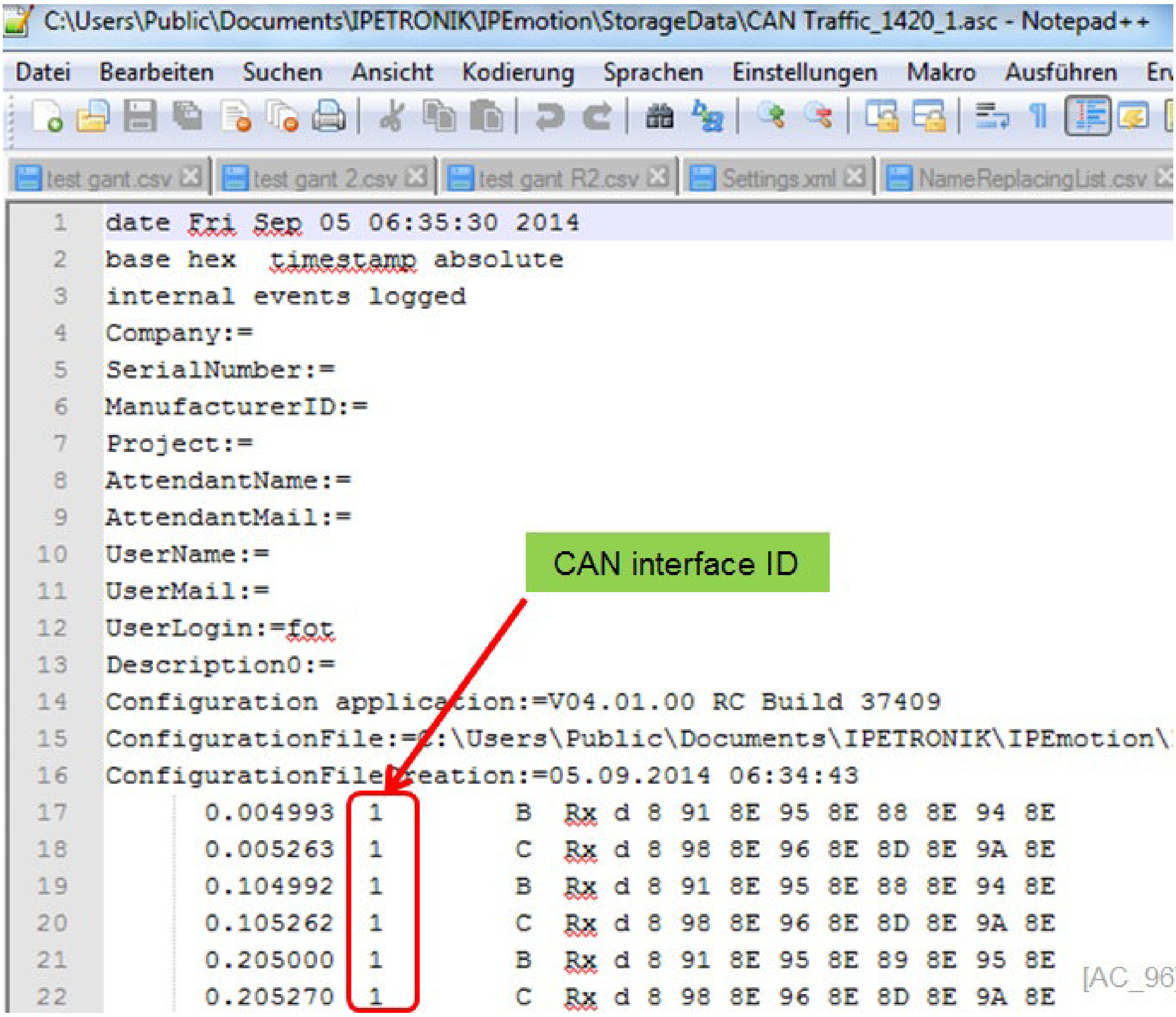
16.4 Traffic Generator – Parameter tab sheet

In the parameter tab sheet you find the ASCII traffic file which includes the signals you would like to generate as an output signal.



[AC_95]

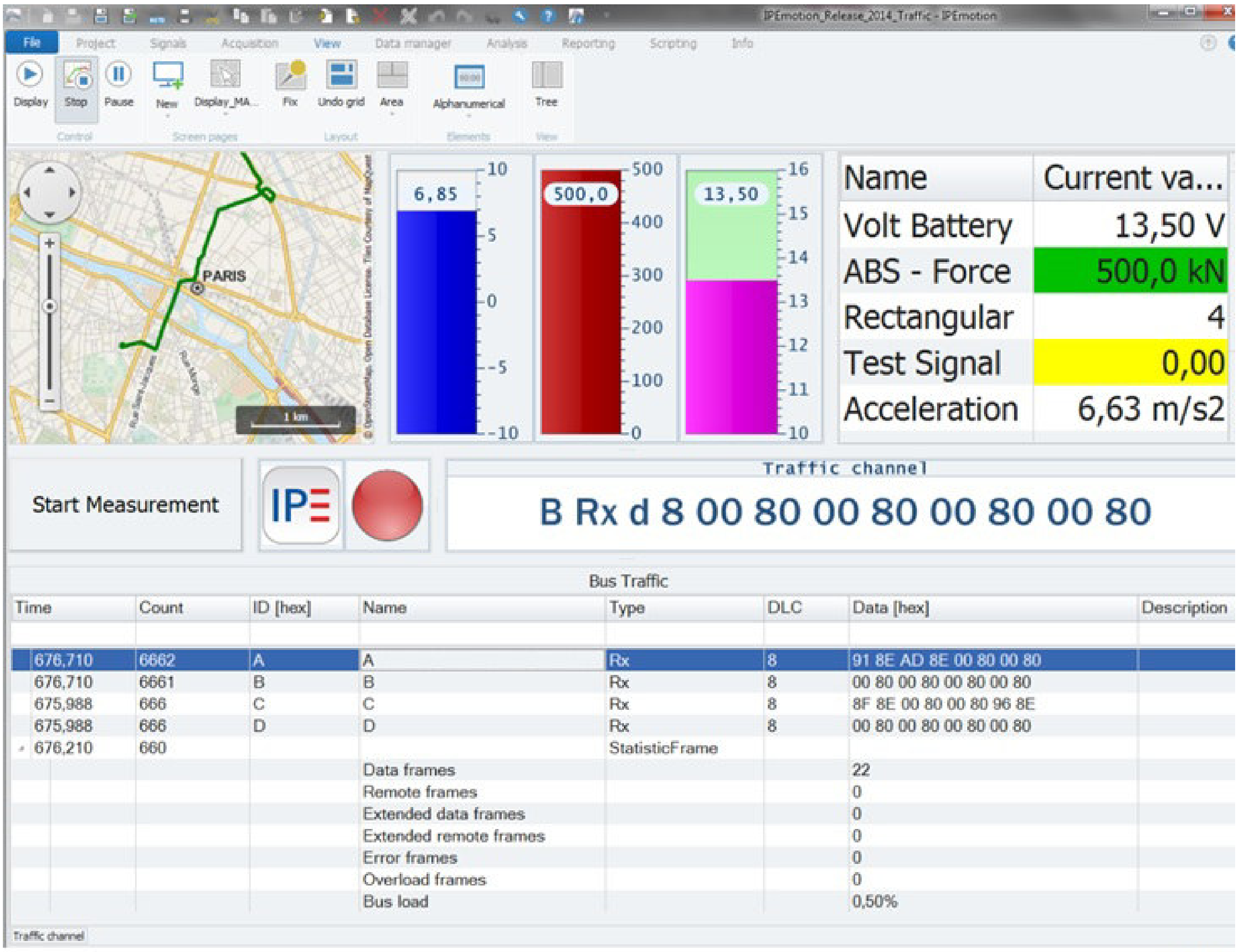
► File	Here you can browse with the file open dialog to search for your ASC file (Traffic ASCII). See next section how to get a Traffic ASC file from IPEmotion. You can load CAN and FlexRay traffic ASCII files
► Loop count	With Loop count you define the number of repeating output loops. When all signals are generated from the data file the signal generation will start as many times as defined in Loop count. Endless will repeat the output generation until you stop the measurement mode of the software.
► Interface ID	Here you can define which of the recorded CAN interface will be considered for signal generation. When you open the ASC file with an Editor you can see the related CAN interface ID of the traffic signals.


C:\Users\Public\Documents\IPETRONIK\IPEmotion\StorageData\CAN Traffic_1420_1.asc - Notepad++
Datei Bearbeiten Suchen Ansicht Kodierung Sprachen Einstellungen Makro Ausführen
test gant.csv
test gant 2.csv
test gant R2.csv
Settings.xml
NameReplacingList.csv
date Fri Sep 05 06:35:30 2014
base hex timestamp absolute
internal events logged
Company:=
SerialNumber:=
ManufacturerID:=
Project:=
AttendantName:=
AttendantMail:=
UserName:=
UserMail:=
UserLogin:=fot
Description0:=
Configuration application:=V04.01.00 RC Build 37409
ConfigurationFile:=C:\Users\Public\Documents\IPETRONIK\IPEmotion\
ConfigurationFileCreation:=05.09.2014 06:34:43
0.004993 1 B Rx d 8 91 8E 95 8E 88 8E 94 8E
0.005263 1 C Rx d 8 98 8E 96 8E 8D 8E 9A 8E
0.104992 1 B Rx d 8 91 8E 95 8E 88 8E 94 8E
0.105262 1 C Rx d 8 98 8E 96 8E 8D 8E 9A 8E
0.205000 1 B Rx d 8 91 8E 95 8E 89 8E 95 8E
0.205270 1 C Rx d 8 98 8E 96 8E 8D 8E 9A 8E
CAN interface ID
[AC_96]

17 VIEW work space

This work space shows live measurement data in a display instrument. You can build your individual graphical interface to operate your test and measurement application.
Example of a VIEW screen consisting of several instruments:

- Map
- Action Button
- LED
- Bar chart
- Table
- Alphanumerical
- Traffic Analyzer



[VI_1]

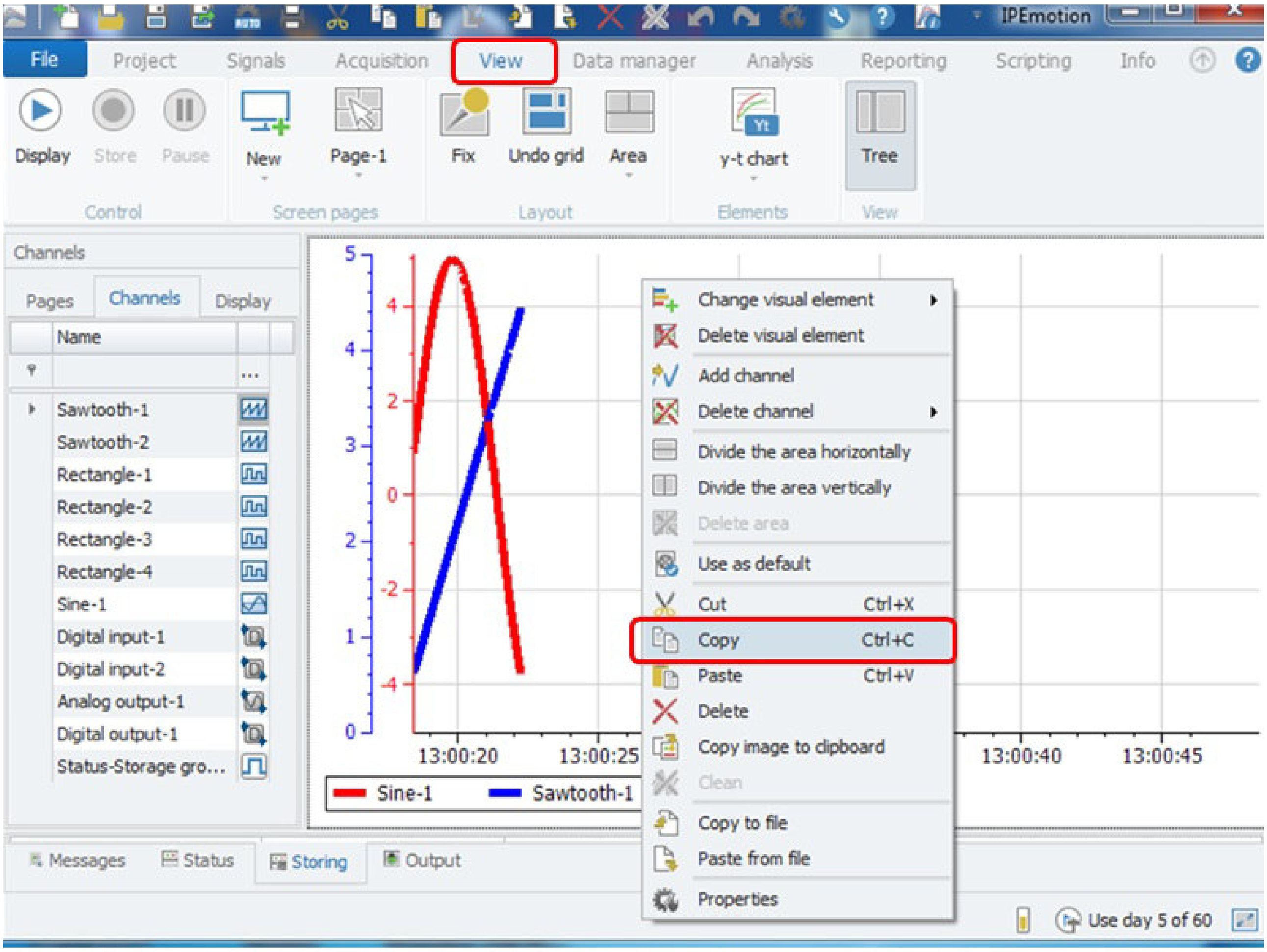
Information

A very convenient feature of IPEmotion is that the instruments and GUI can be created and modified during measurement / data recording process. There is no need to stop the measurement process in order to make changes to the instrument settings.

17.1 Transfer instruments from VIEW to ANALYSIS

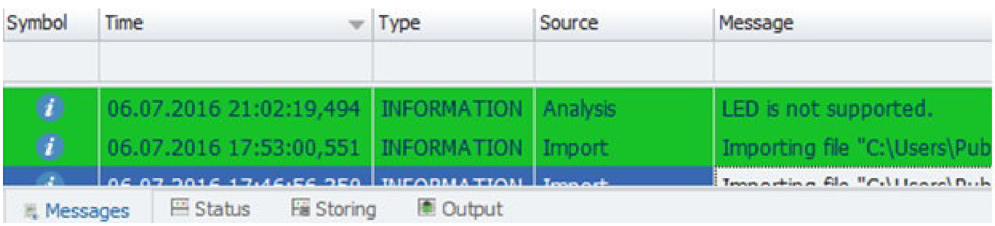
You have the ability to easily copy pages and instruments including the properties from the VIEW work space directly to the ANALYSIS work space. This function is supported by all instruments included in the ANALYSIS work space 19.2.

- Yt-chart
- XY-chart
- Alphanumerical
- Map instrument
- Log p-h Diagram
- Video Instrument
- Action button



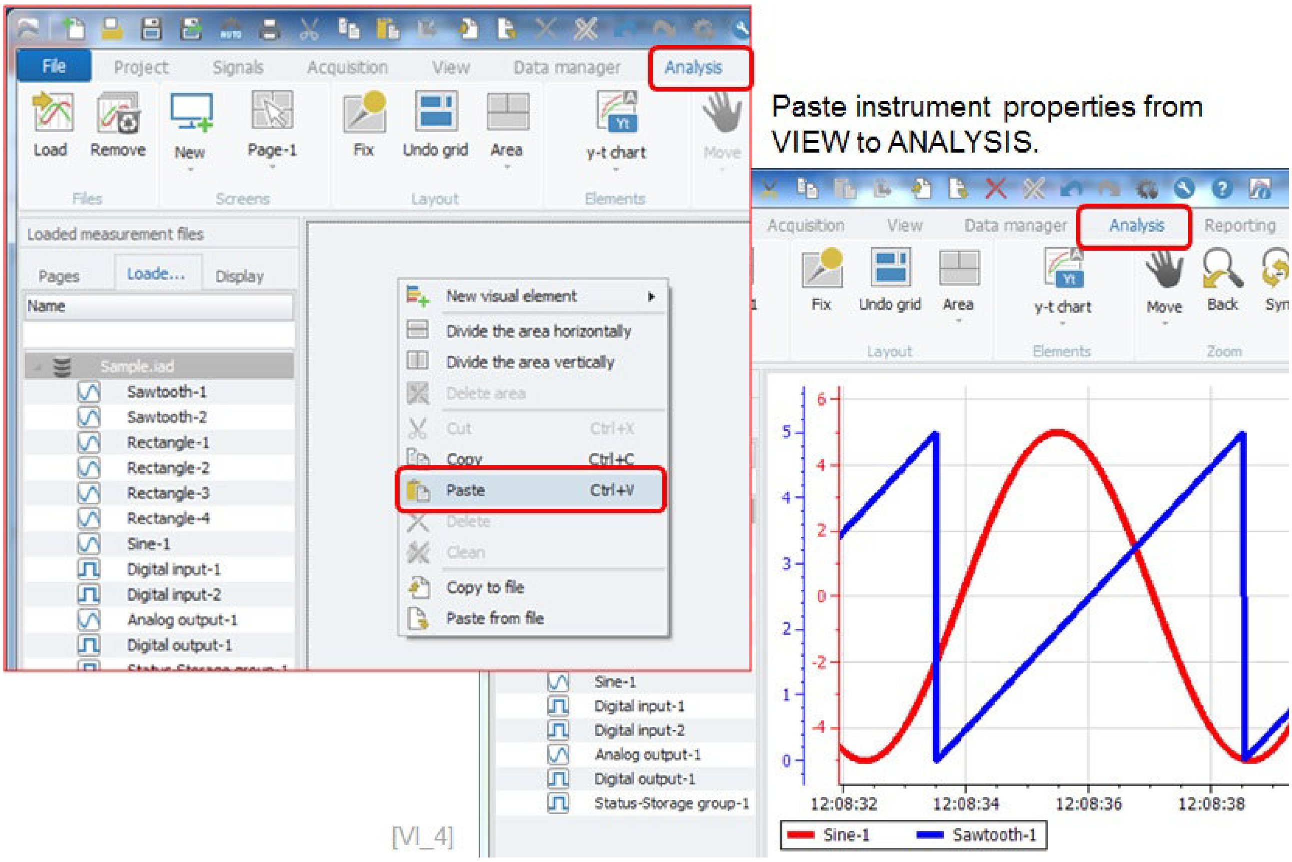
Copy instrument properties from VIEW. [VI_2]

When the copy and paste function is not working to transfer an instrument from VIEW to ANALYSIS an information message is provided. See example: “LED is not supported”

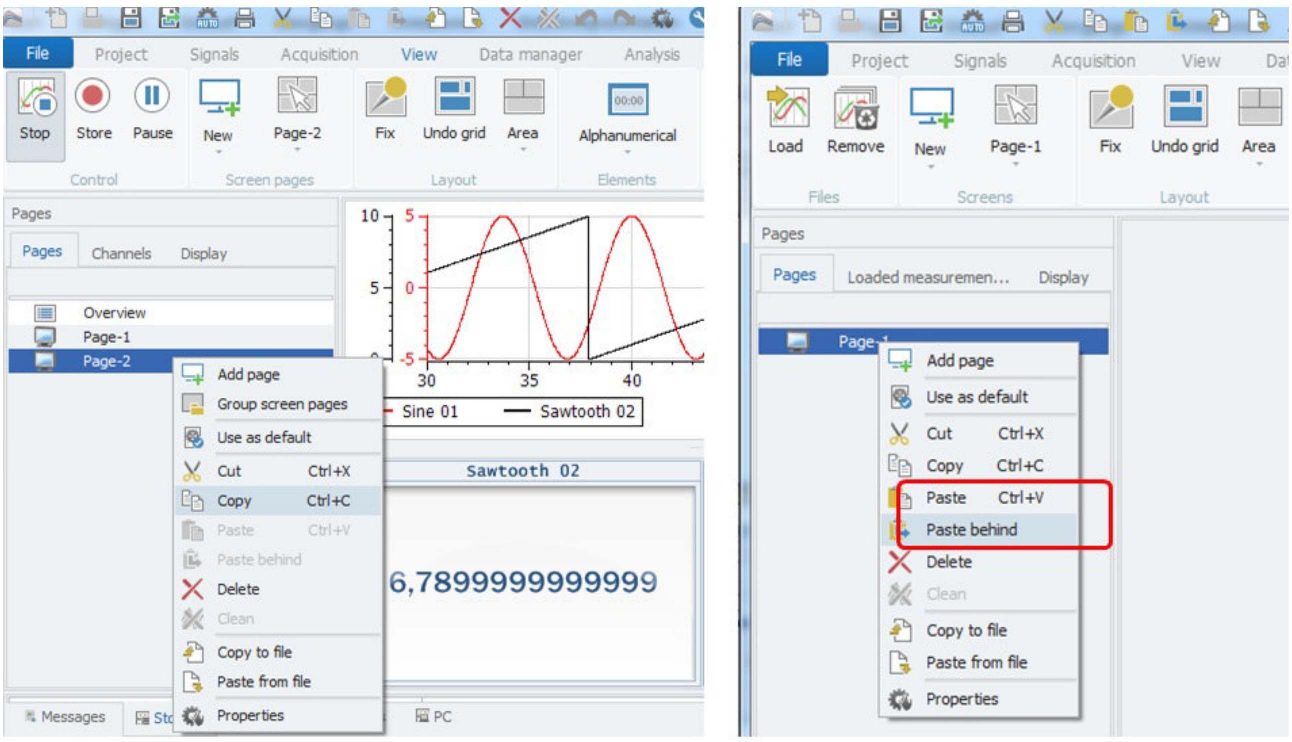


[VI_3]

Paste the instrument including the settings from VIEW to ANALYSIS. When you transfer instruments a page must be created in the ANALYSIS work space.



The copy and paste function is not only working for individual instruments but also for complete pages. You can select several pages and past them with all settings into ANALYSIS.

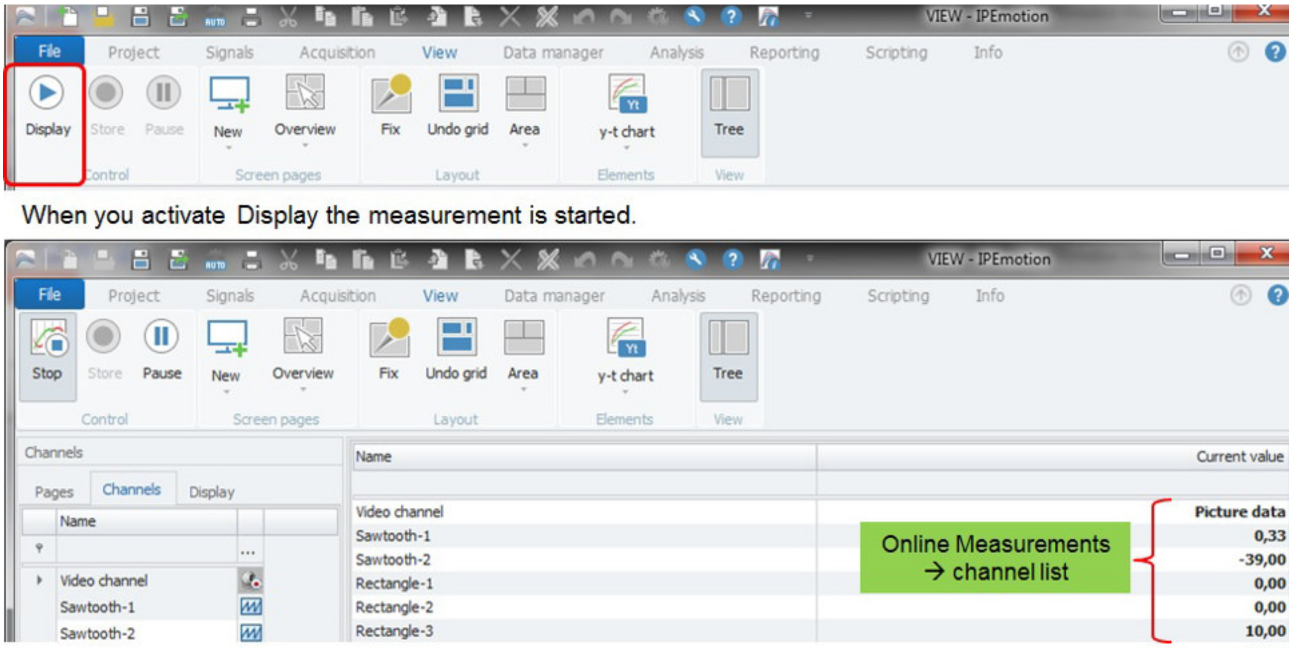


Copy page from VIEW.

Paste complete view page in ANALYSIS. [VI_5]

17.2 Ribbon

17.2.1 Display



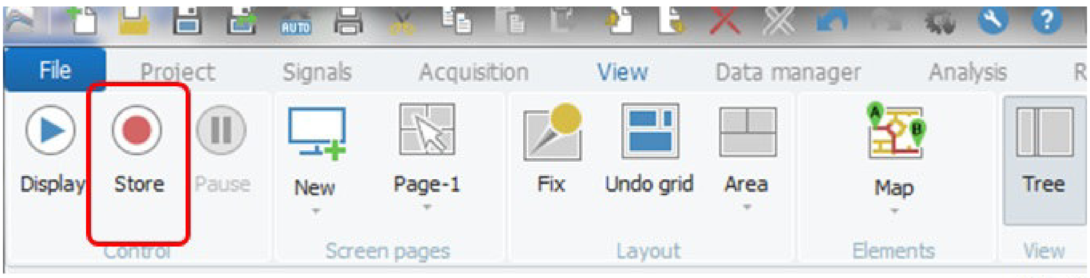
[VI_6]

With the Display button, you activate the data display. The measurement is initialized and online data from the devices / instrument are retrieved.

Information *If you activate the data display, you are not automatically activating data storage. Data storage needs to be activated by a separate button.*

17.2.2 Store

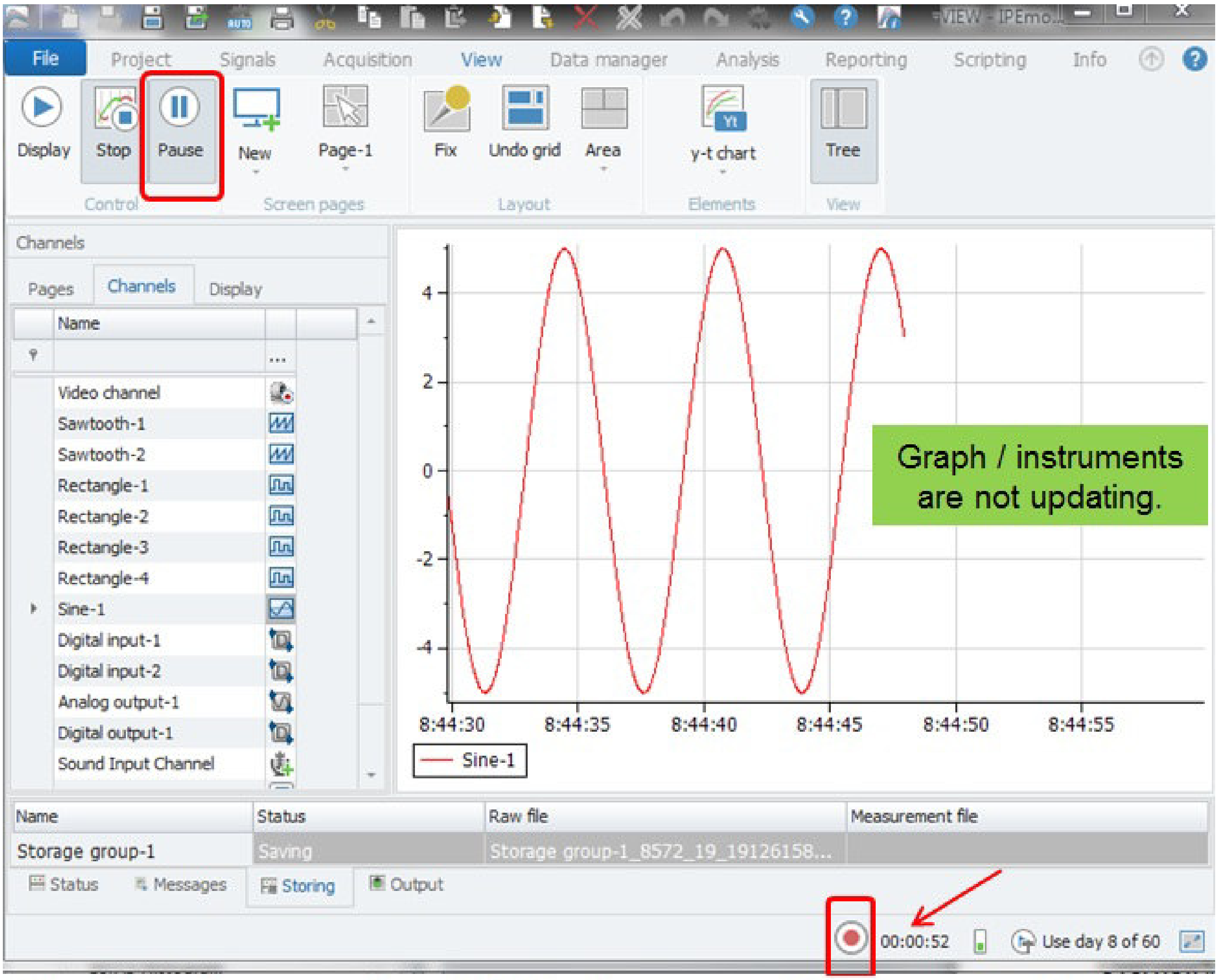
The data store button can only be operated if channels are associated to the store group. An empty storage group returns a grey, disabled store button. See chapter ACQUISITION 13.8 for how to link channels to the store group.



The red dot in the icon is indicating that channels are included in the store group. [VI_7]

17.2.3 Pause

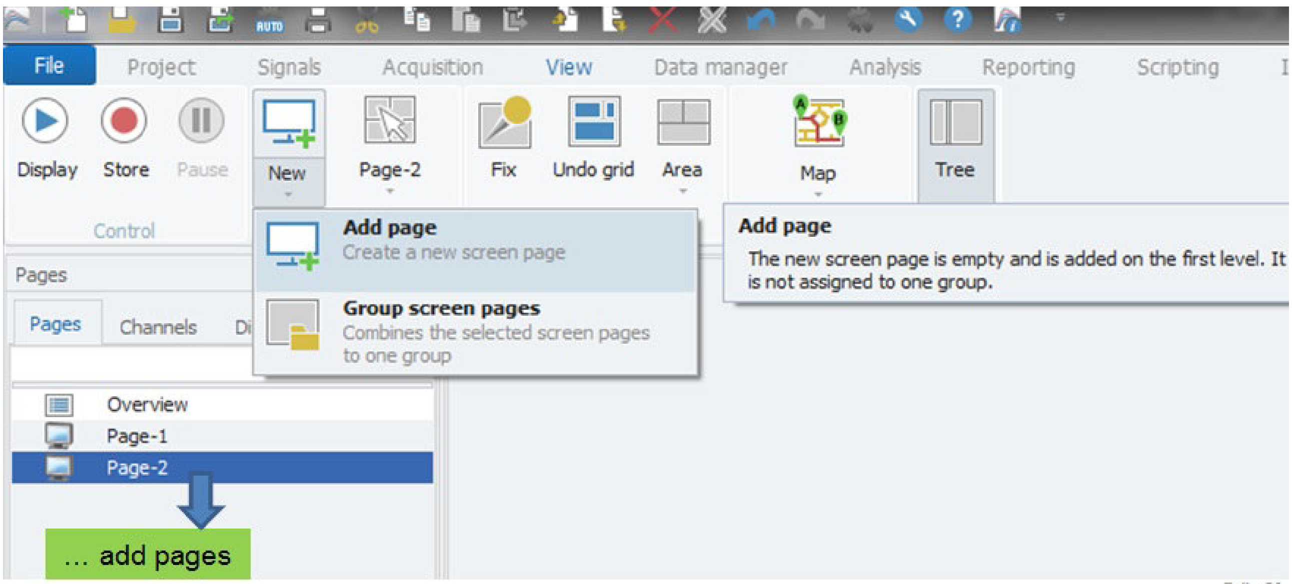
The Pause button is only active if measurement has been started. With this button you can freeze the screen and stop the plotting of graphs and updating of instruments. If you pause the display, the recording is not affected.



The data saving process is not affected-> keeps working in pause mode. [VI_8]
The red flashing dod is indiacting that data recording is in progress.

17.2.4 New

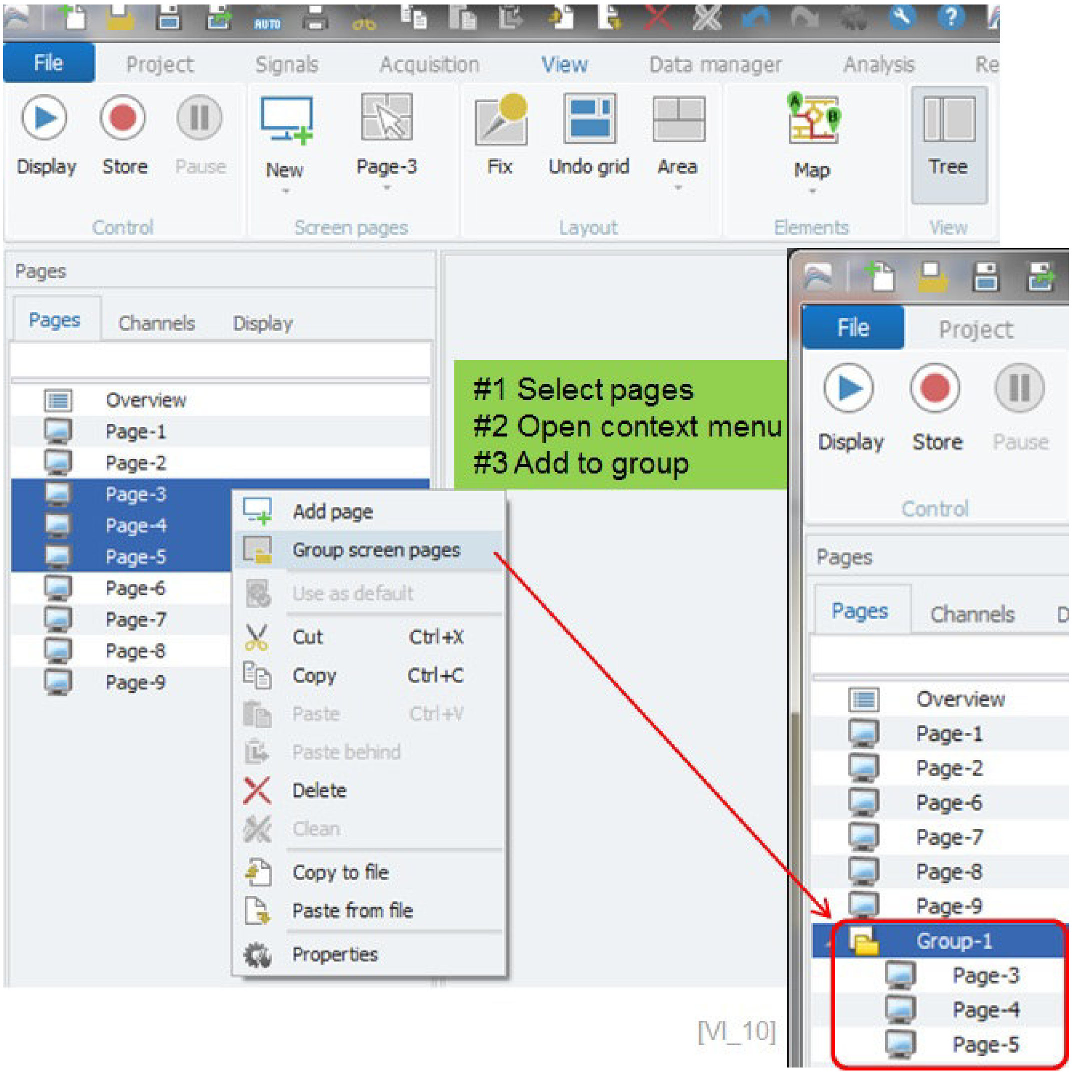
With the New button you can add pages to fill your GUI (Graphical user Interface) with instruments.



[VI_9]

Information *The number of display pages is restricted by the different editions. See the overview table of chapter Software Editions 4.1 for more details. If you exceed the number of permitted pages you will get a warning message.*

You can also group pages to one logical unit. This is particular interesting for users who have many pages and who need to structure the pages in a suitable way.

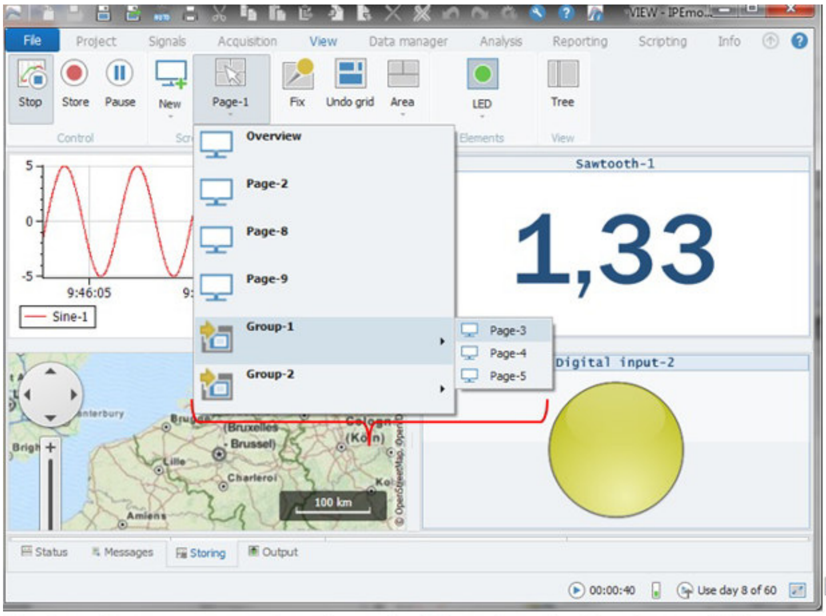


[VI_10]

The detailed configuration functions will be discussed in the section Tree below.

17.2.5 Overview page – switching between pages

The Page icon navigates between different screen pages even if the Tree on the left hand side is not visible. The detailed configuration functions of the Tree are discussed in chapter 17.3. As you can see, all pages and groups are listed in a drop-down list and can be selected to switch to this page.

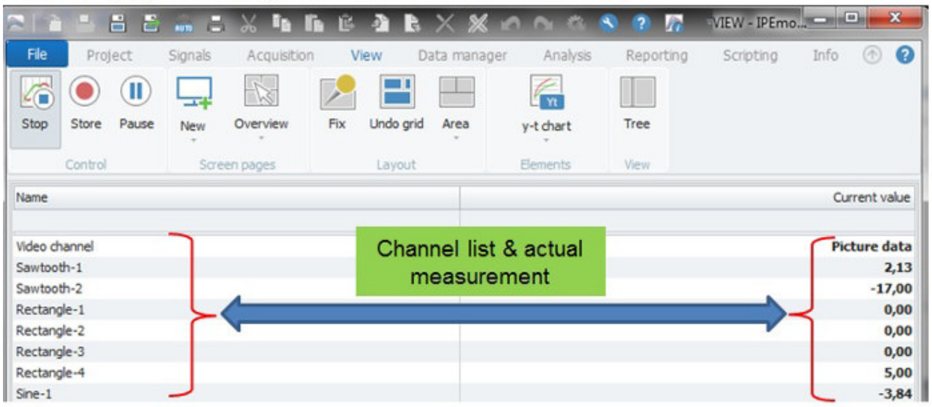


[VI_11]

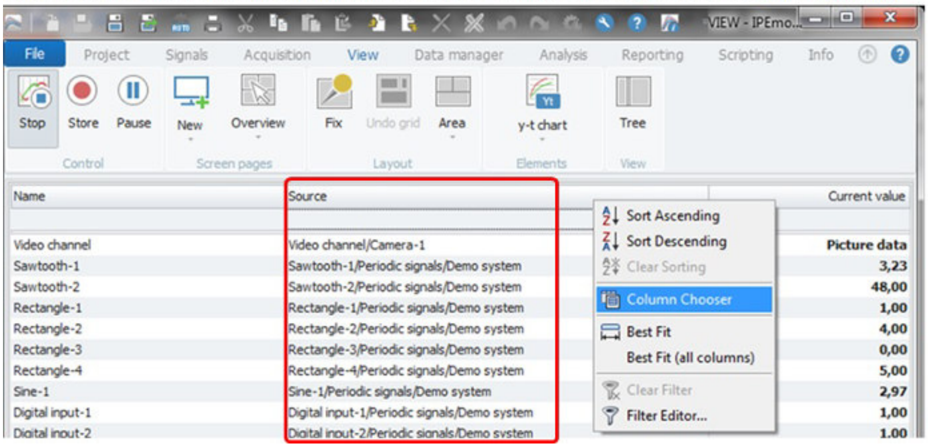
Navigate between pages from the main ribbon when the Tree is not visible.

The Overview page is a default page which lists all channels and measurement signals. The channel list includes measurement channels from SIGNALS work space but also all variables (number, text and status channels), formulas, scaling and status channels from FFTs, function generators, storage groups.

Overview page is a factory standard and cannot be removed.



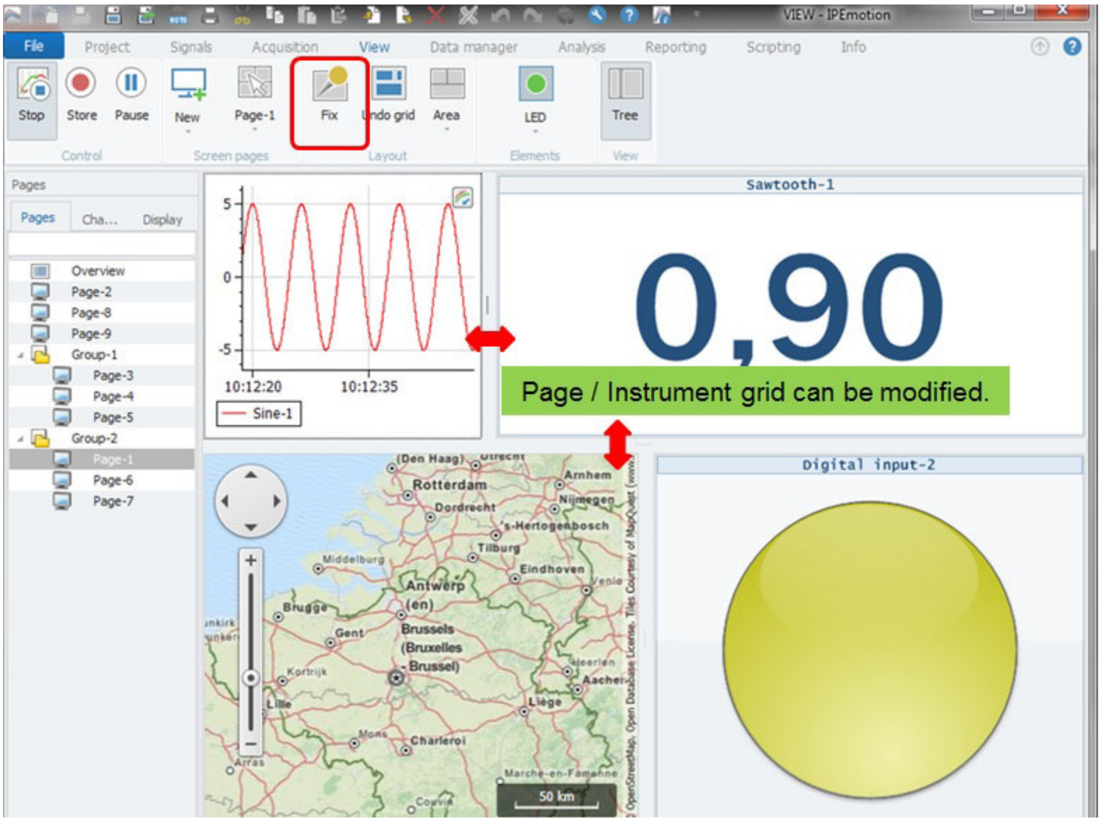
Add Source channel from column chooser to see where the signals are originating from.



[VI_12]

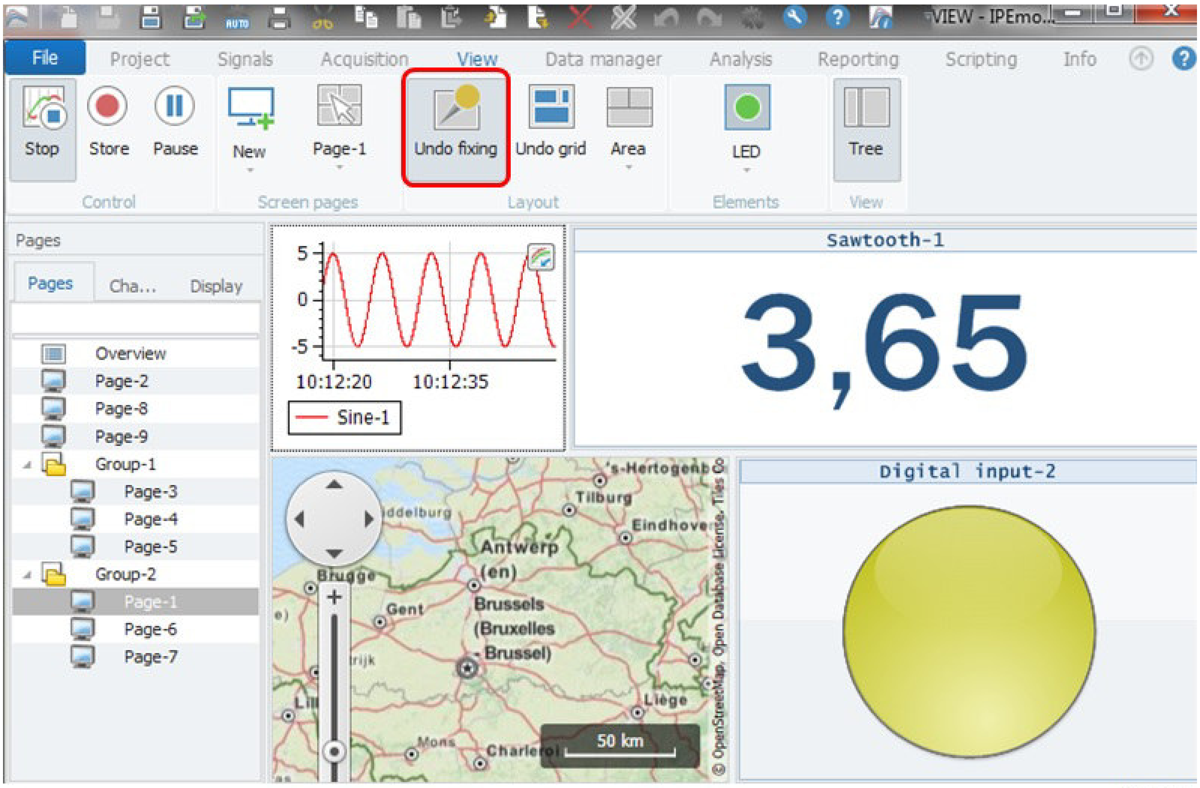
17.2.6 Fix / Undo fixing

The Fixing function is related to the modification of the page and instrument grid. You can change the size of the instrument grid horizontally and vertically.



[VI_13]

If you activate the Fixing function, the handles are removed and the size of the instruments cannot be changed. In both options the instrument keeps the proportional size if you change the overall screen size of the application window.

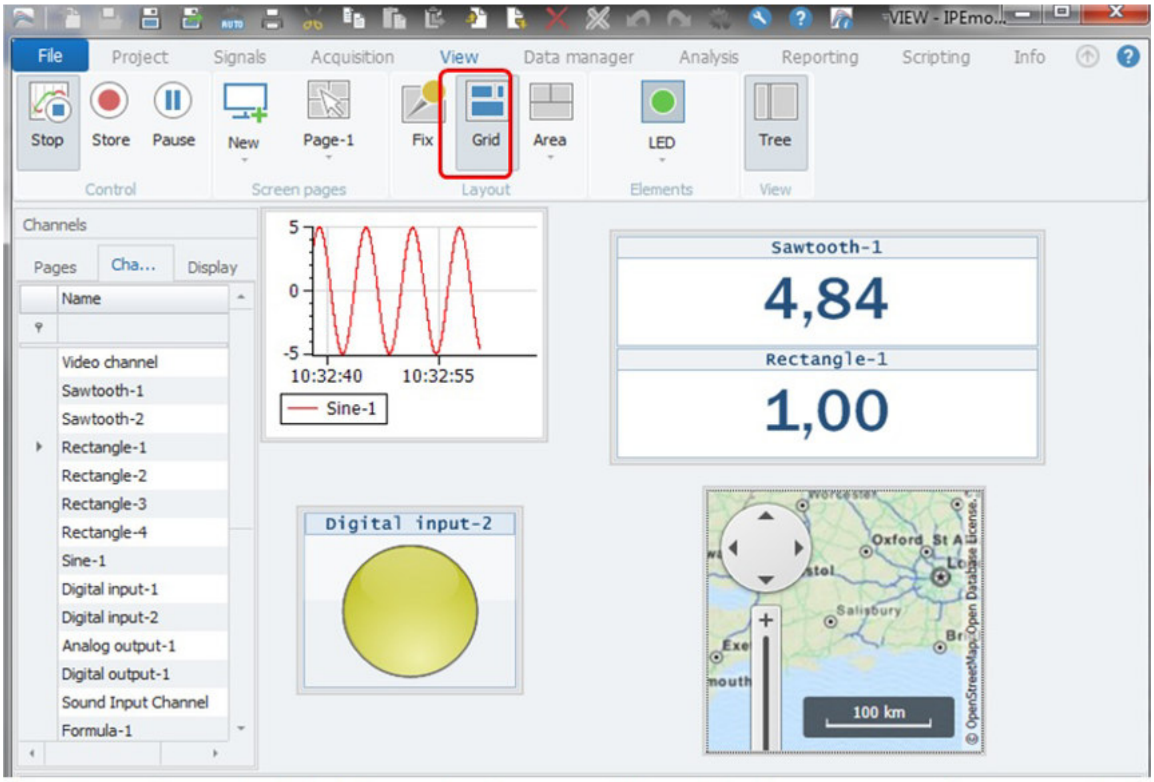


Page / Instrument grid is fixed. No handles to move or change size of the instruments. [VI_14]

17.2.7 Undo grid

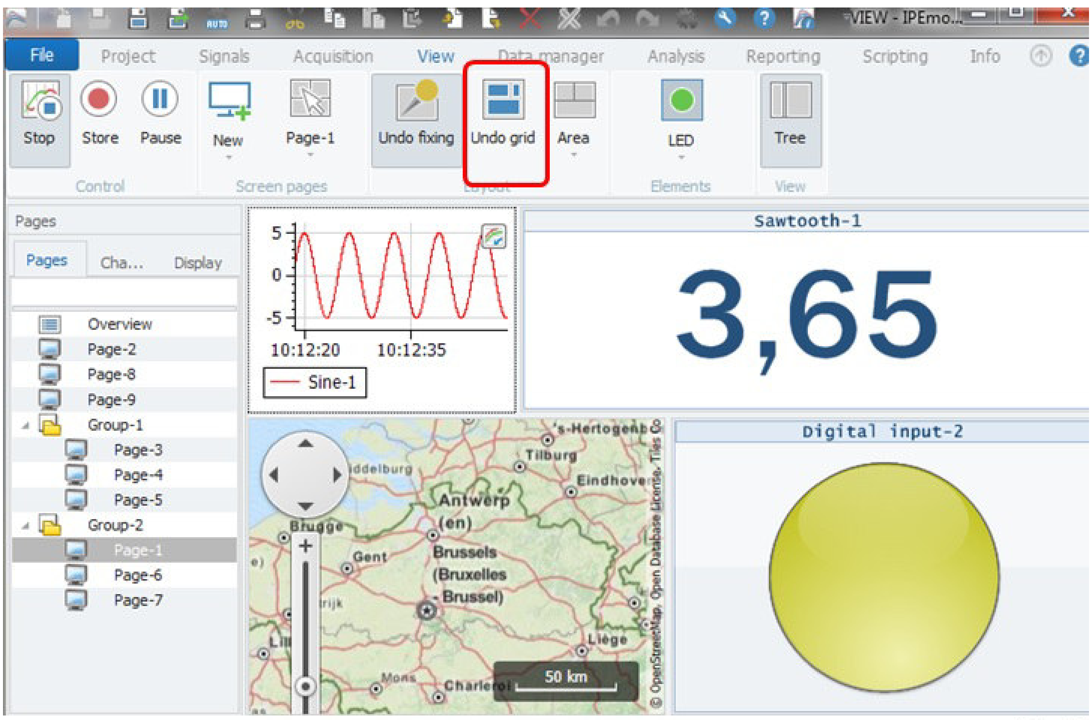
The instruments are arranged automatically on the page by the software, considering the order of creation. If you resolve (undo) the grid you can allocate and position the instruments at any place.

Information *When the screen page is still in the fixed mode the undo grid function is ineffective.*



When the grid is resolved the instrument containers can be positioned on any place of the page. [VI_15]

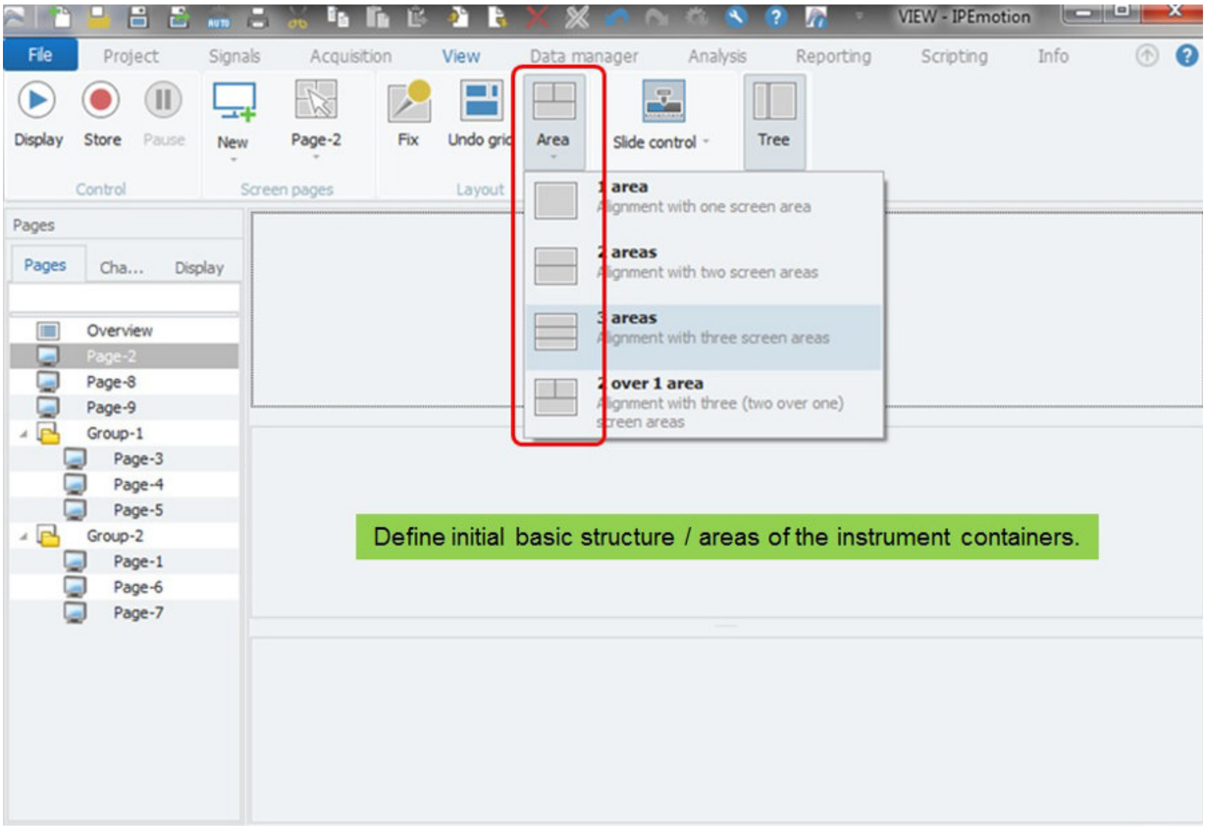
If you activate the grid again, the software is switching back to the automatic arranging function.



When you activate the grid the instruments are again arranged automatically. [VI_16]

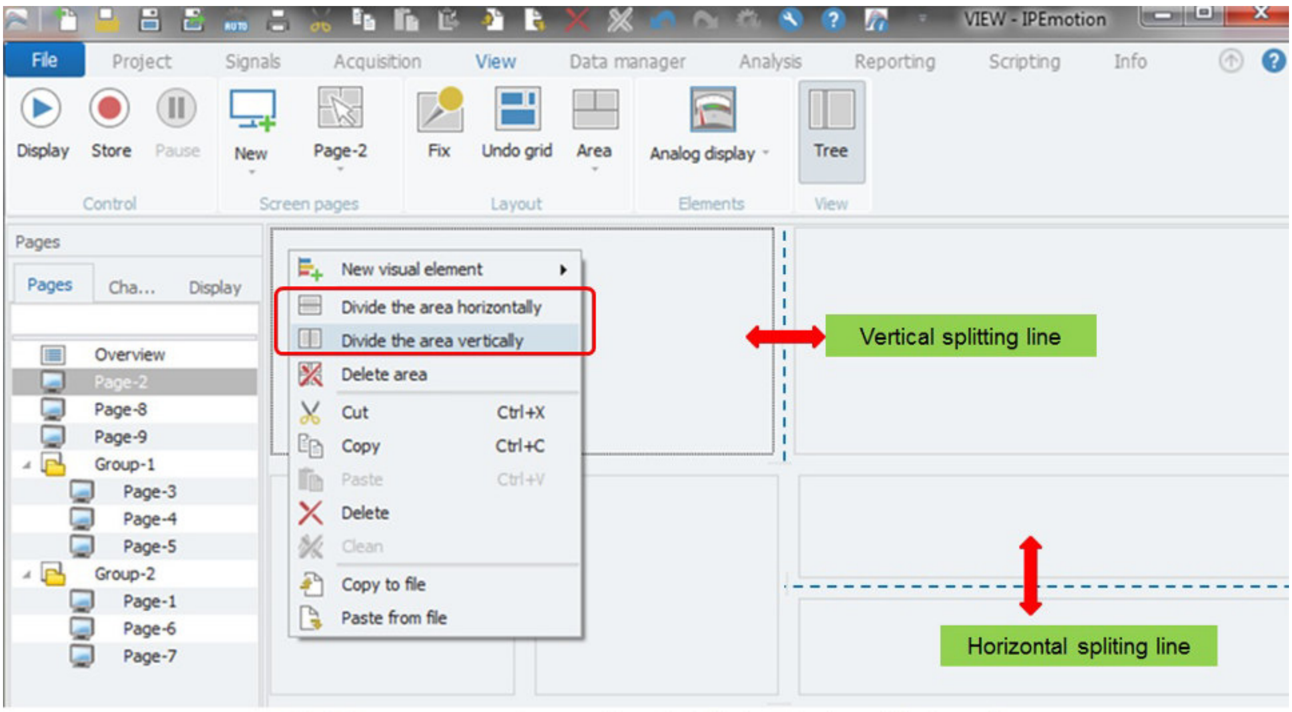
17.2.8 Area

With the Area function you can split the view page in a basic structure of the instrument containers before you start adding instruments. Each area is considered as a container for one instrument type. The same function is available in the ANALYSIS work space in chapter 19.2.3.



[VI_17]

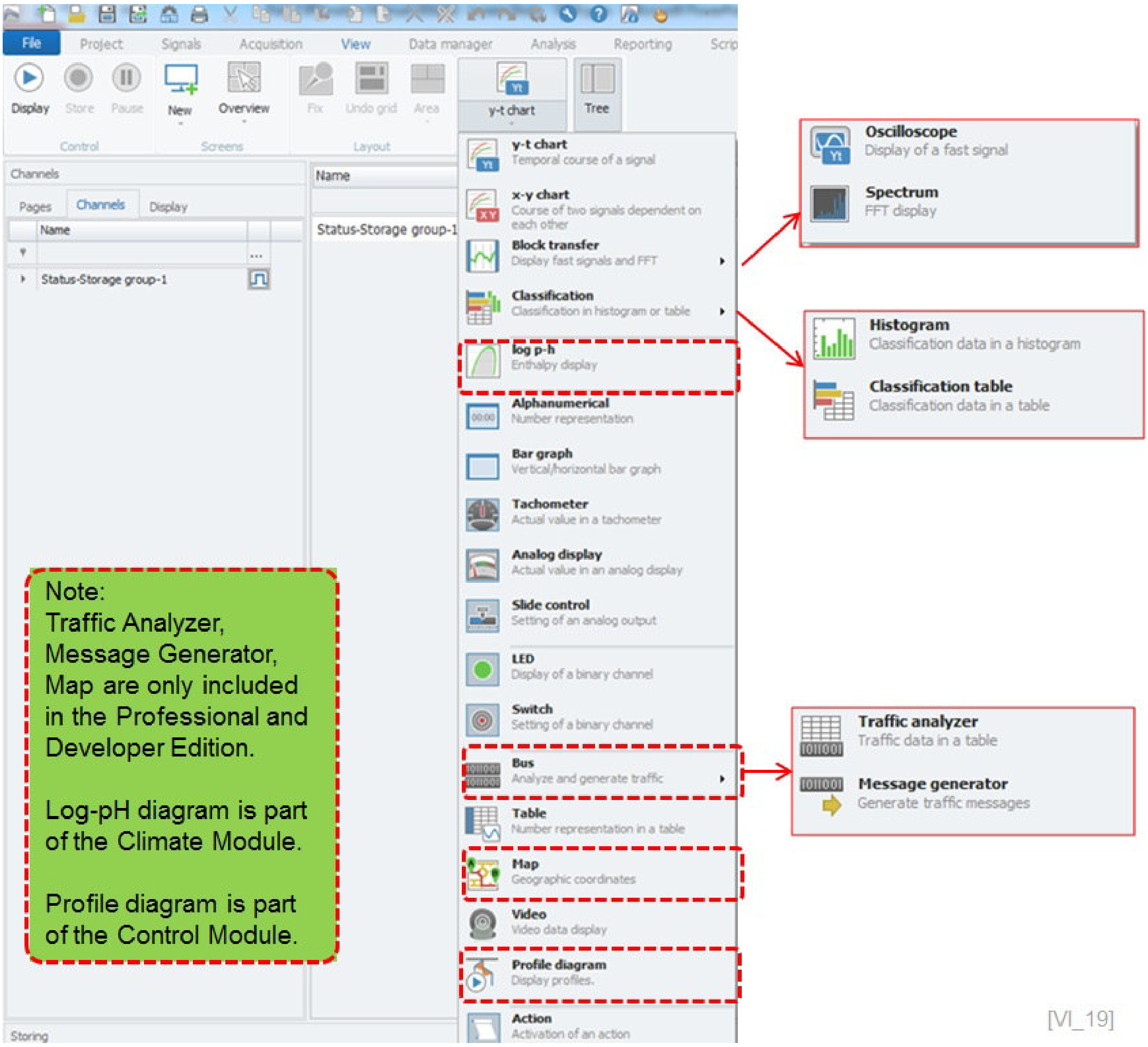
For each container you can open the context menu to divide the instrument container vertically and horizontally.



Each instrument container can be subdivided vertically and horizontally. [VI_18]

17.2.9 Instrument Overview

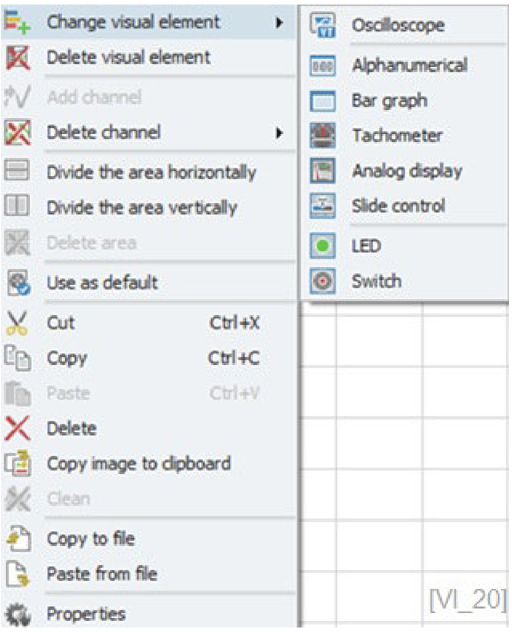
The software is currently supporting 21 different instruments. You can add instruments directly from the ribbon to the view page.



[VI_19]

The following 16 instruments are supported by all IPEmotion editions, regardless of which license you have activated.

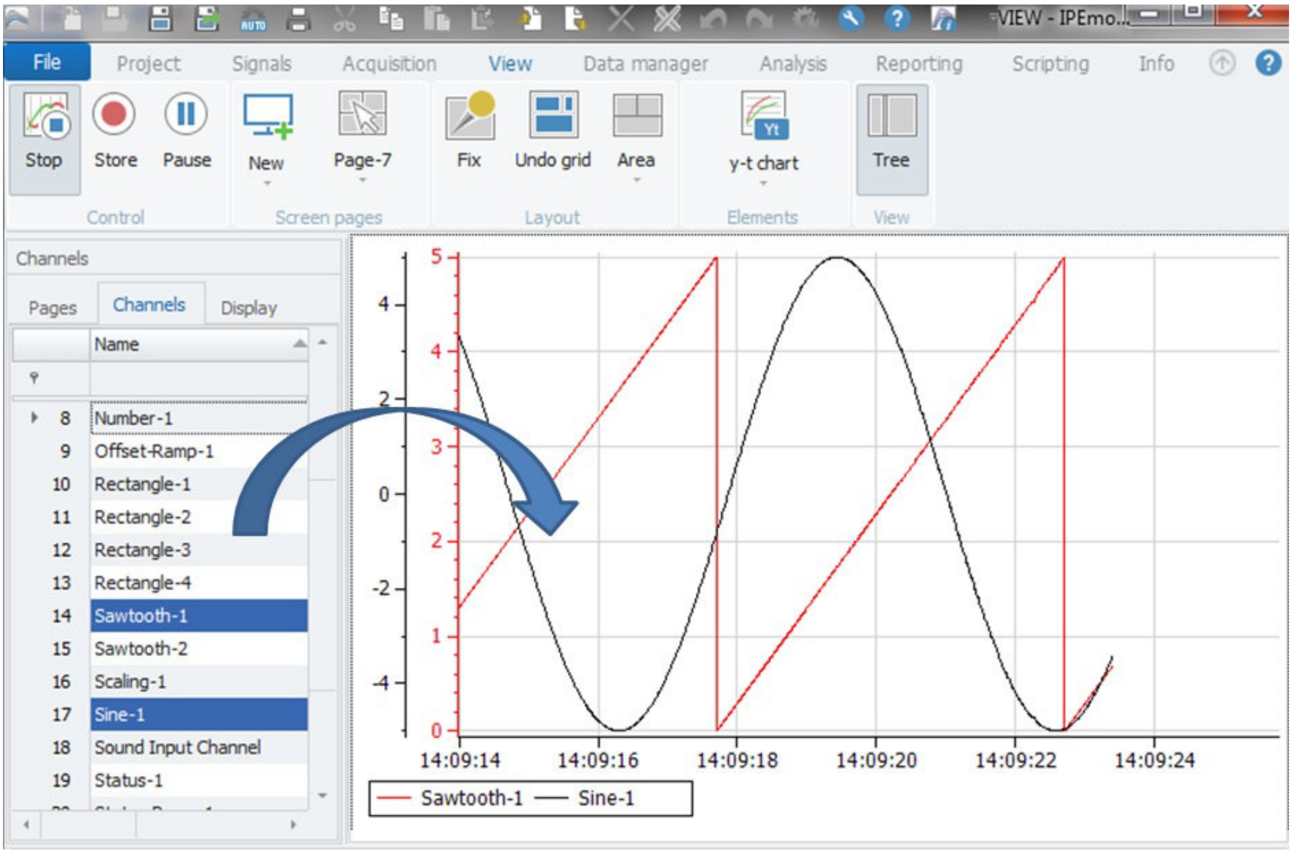
Instrument name	Change-to function
Yt-chart	**Yes**
XY-chart	No
Oscilloscope	**Yes**
Spectrum	No
Histogram	No
Classification table	No
Alphanumerical	**Yes**
Bar graph	**Yes**
Tachometer	**Yes**
Analog display	**Yes**
Slide control	**Yes**
LED	**Yes**
Switch	**Yes**
Table	No
Video	No
Action	No



The change-to function refers to the context menu of the instruments where you can change an instrument from e.g. a Yt-chart into an alphanumeric display. See chapter 17.6 to find more details about the context menu.
Each instrument will be discussed in detail below.

17.2.10 Dragging channels to the instrument

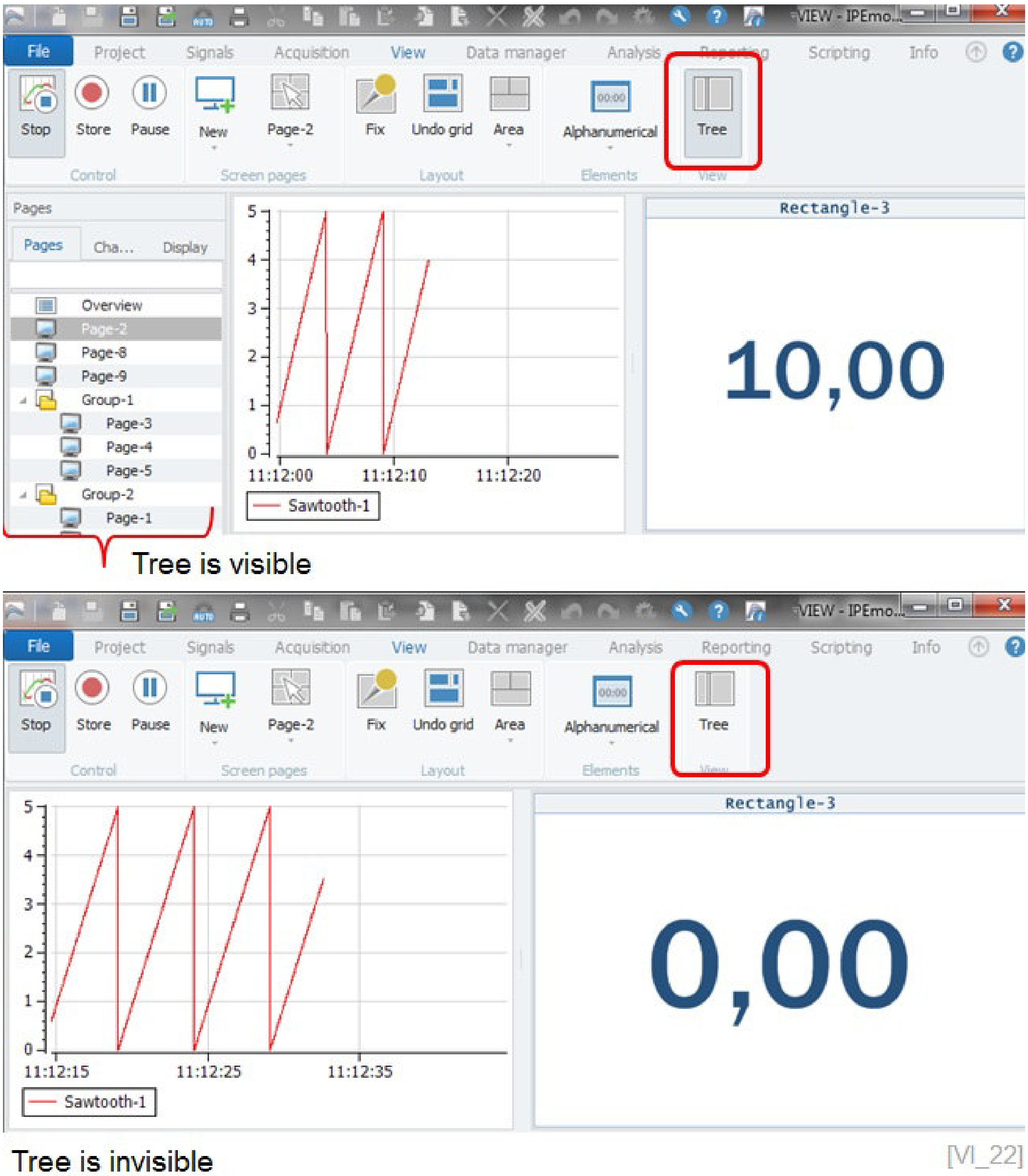
There are different possibilities of how to get a channel associated to an instrument. One way is to select channels from the channel tab sheet from the Tree box and to drag and drop channels to the instrument. The software automatically takes the instrument which is selected in the ribbon. In this example, a Yt- chart is created for the selected channels.



Drag and drop channels to instruments. Multiple channel selection is supported. [VI_21]

17.3 Tree window - for pages, channels, display instruments

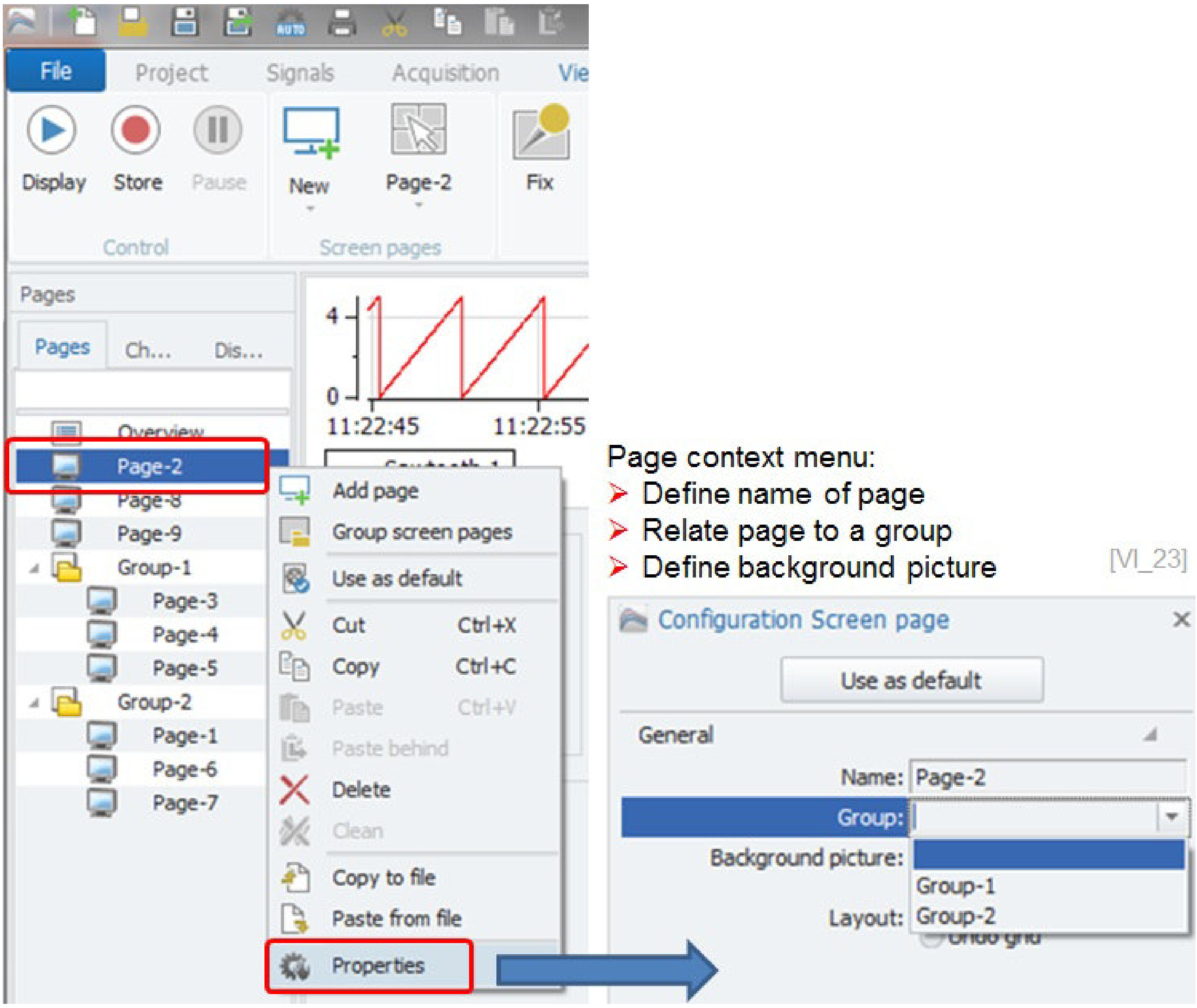
With the tree function you can show or hide the tree of pages, channels and instruments. You can build your application without using the tree function. You can create pages, add instruments and link channels through the context menus. If the tree is removed, you gain more screen page space for the instrument display.



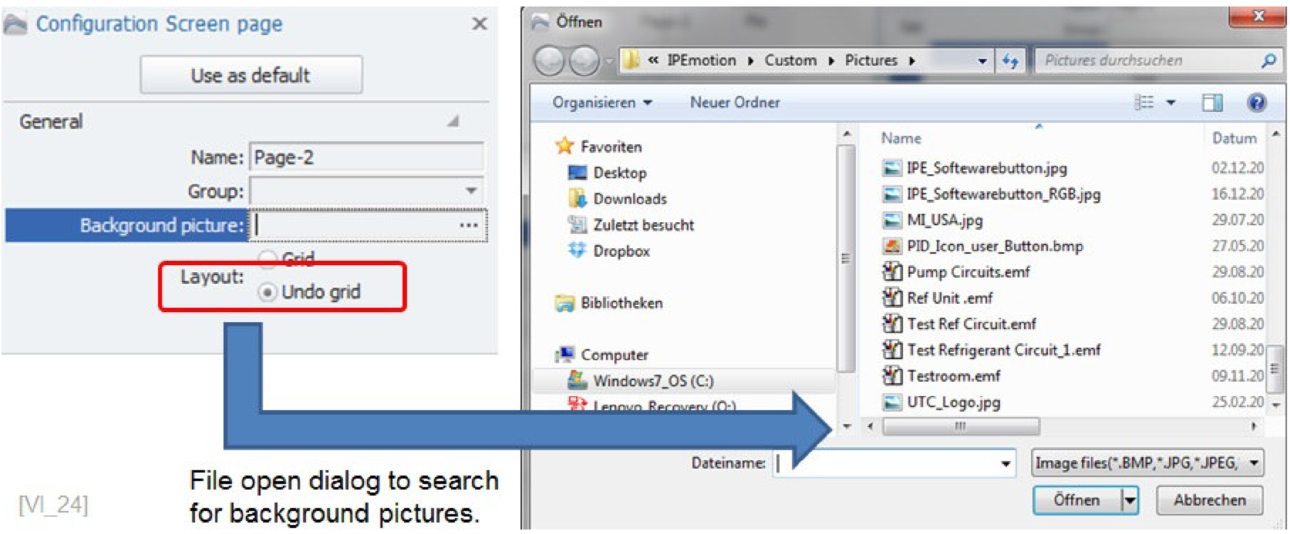
[VI_22]

17.3.1 Tree – Page tab sheet

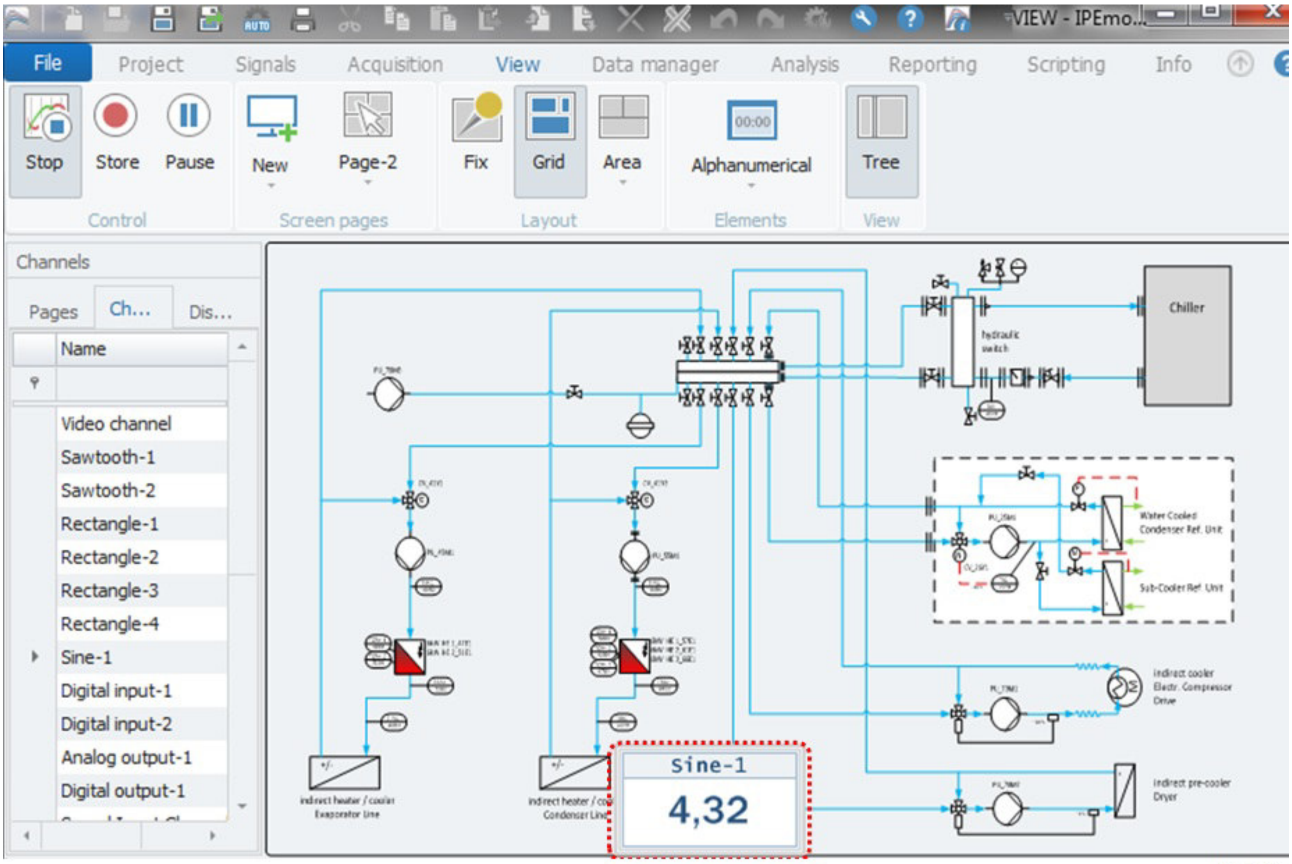
The tree provides direct access to three tab sheets. The page tab sheet configures the page. It was discussed in section 17.2.5 - how to create a page group and how to link a page to a group.



If you like to add a background picture for the complete screen page, you have to resolve / undo the grid. Then you can search for a picture file. The default directory for pictures is:
Win 7 C:\Users\Public\Documents\IPETRONIK\IPEmotion\Custom\Pictures

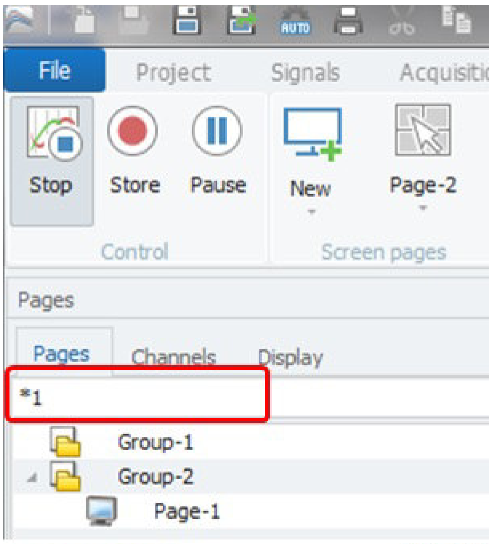


You can change the default directory for all custom files (Map database, UserOperations and Pictures) in the options. See chapter OPTIONS >Directories 22.11.
You can place instruments on the background picture wherever you like. The instruments are not transparent. They are hiding / overlaying parts of the background picture.



Example of a background picture with one alphanumerical instrument. [VI_25]

Background pictures can be integrated to the IWF project file. This function can be activated in OPTIONS >Frequently used, as discussed in chapter 22.1.2.
The Tree tab sheet also has a search field to search for and filter specific page names.

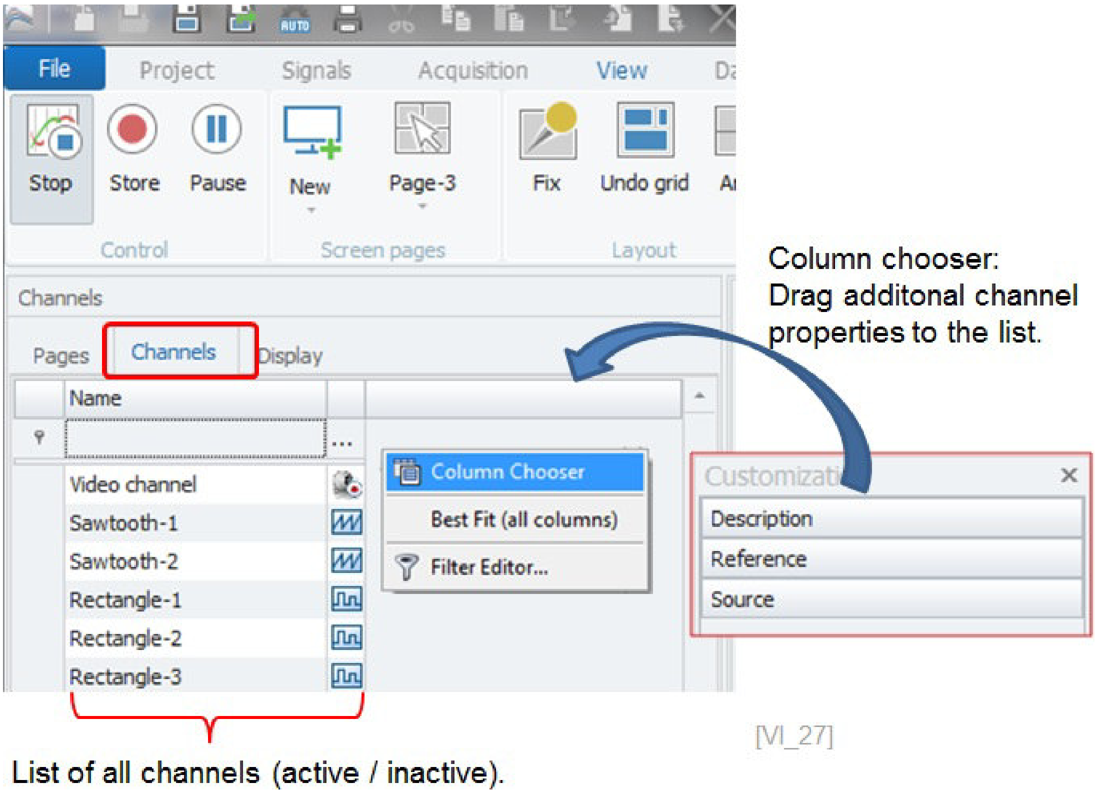


Search field. [VI_26]

17.3.2 Tree – Channels tab sheet

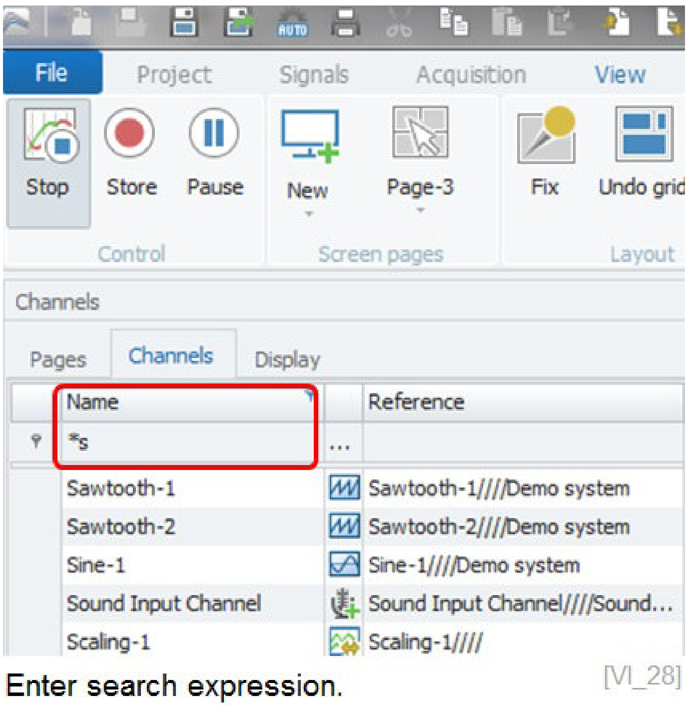
Another useful function of the tree element is the channel tab sheet that is used to select, drag and drop the channels into the instruments as discussed in section 17.2.10.

With the column chooser you can drag additional channels into the channel grid. The description and source field are particularly useful if you need this field to clearly identify which channel is the right one.



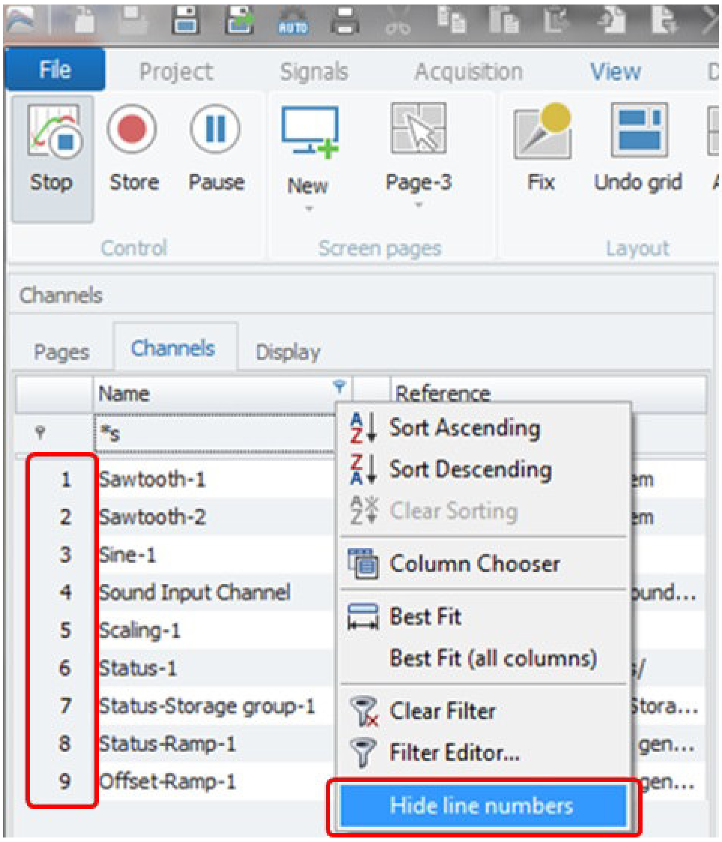
[VI_27]

Using the search field below the Name column to filter for your channels.



[VI_28]

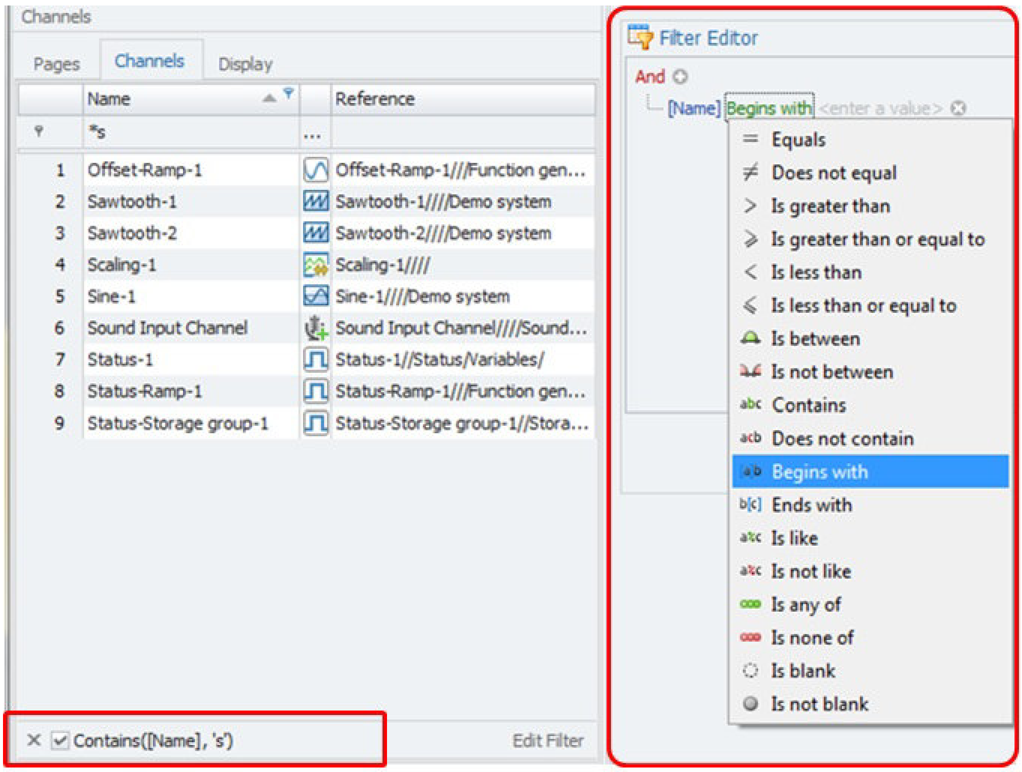
Within the context menu of the channel tab sheet you can show the line numbers.



[VI_29]

Additional functions in the context menu:

- sorting in ascending and descending order
- ability to build filter expressions

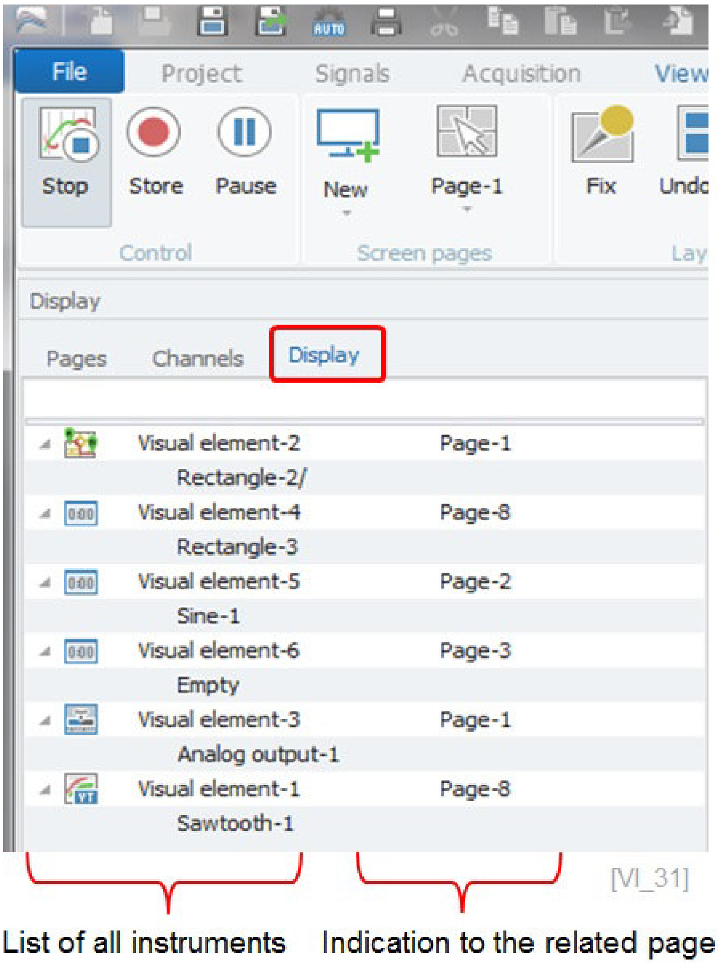


Active filter expression is indicated. Filter Editor

[VI_30]

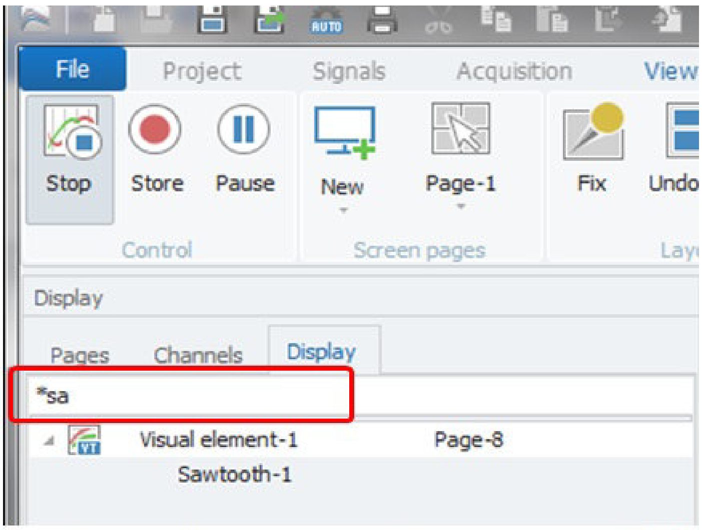
17.3.3 Tree - Display tab sheet

The display tab sheet is destined for working, searching and customizing display instruments. One function is to directly spot on which pages the instruments are located.



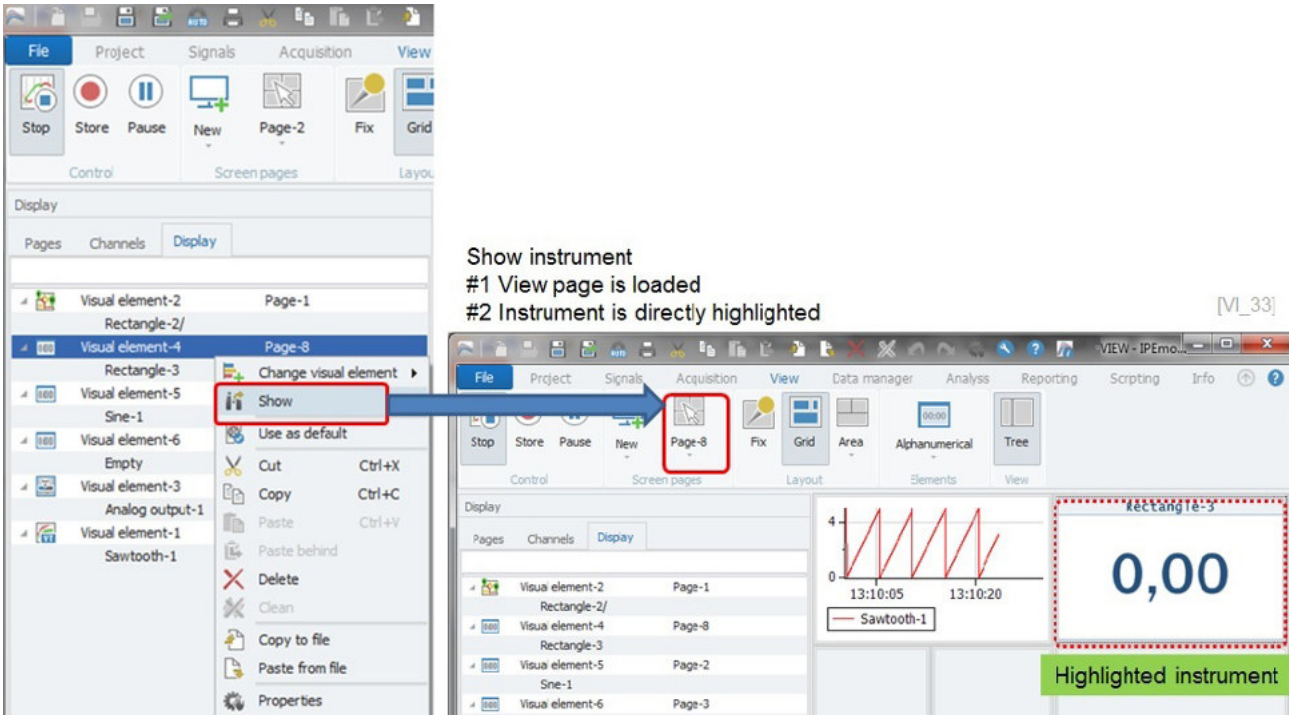
[VI_31]

In the search box you can search across instrument names and channel names.



Search across instrument name & channel name. [VI_32]

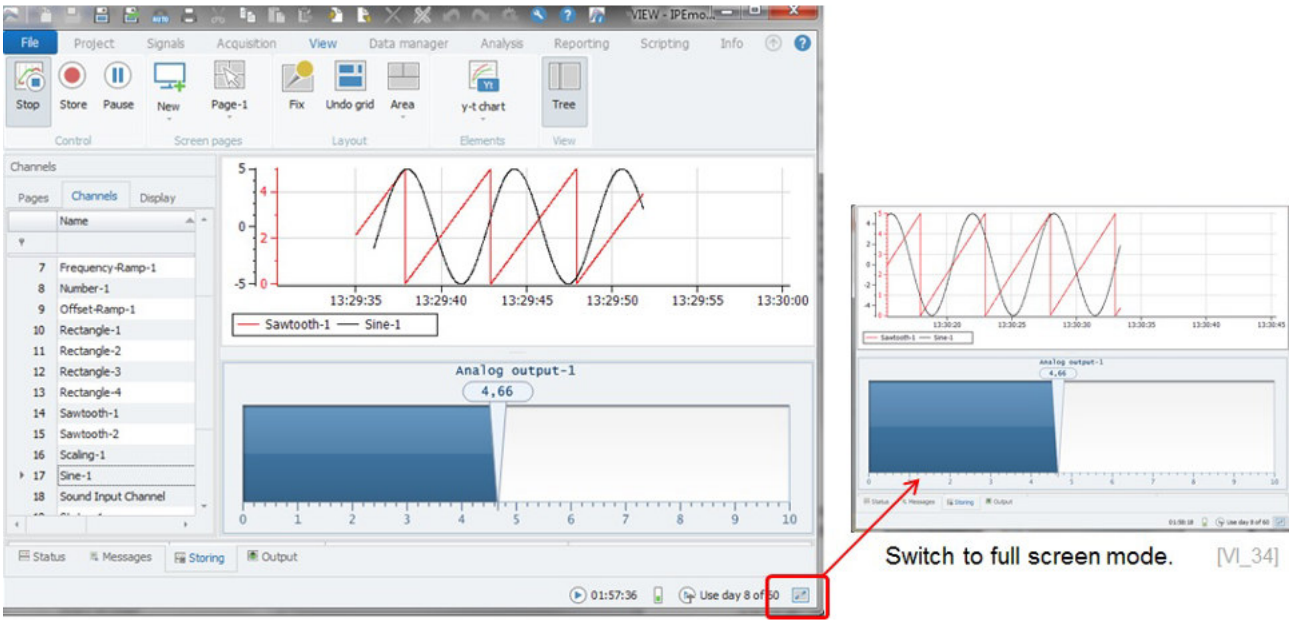
With the context menu of the instrument you can easily search on which page and on what page section the instrument is located. This function is particularly useful if you maintain large applications with many channels, instruments and view pages.



The instrument context menu and the configuration head-up displays will be discussed in the chapter of the detailed instrument overview below.

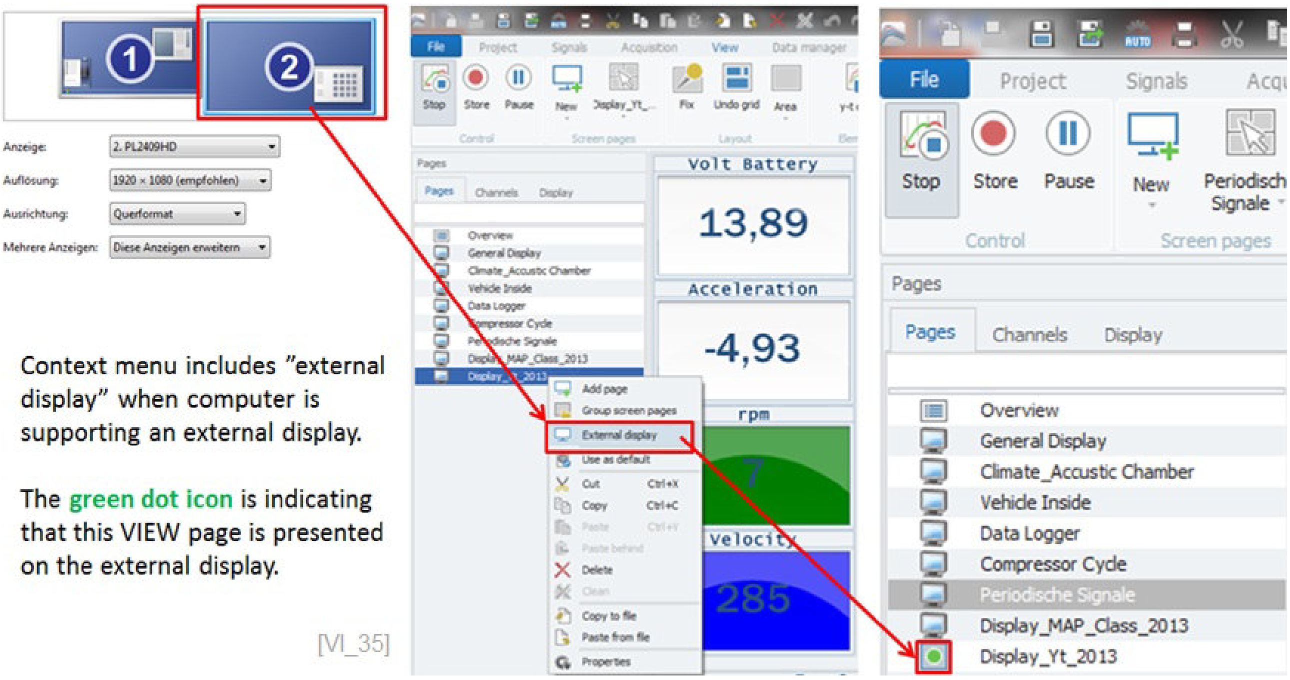
17.4 Showing VIEW pages in full screen mode

With the icon at the lower bottom right hand corner you can hide the complete ribbon to show the instrument page in full screen mode. In this mode, you need to define your own action buttons to navigate between screen view pages



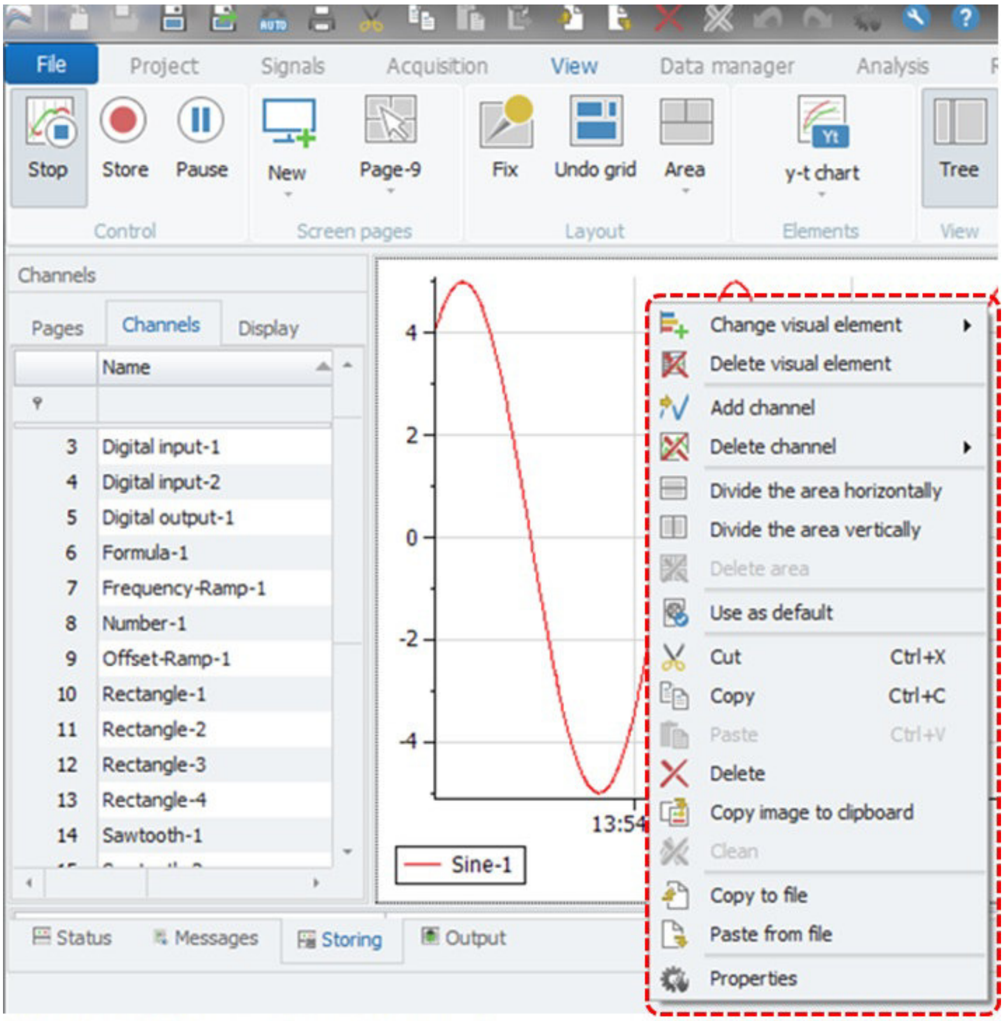
17.5 Displaying VIEW page on a second computer screen

If the computer is configured for two display screens, you can define one VIEW page to be shown on the second computer screen. The external display option is only available if two screens are supported by the computer. A green icon shows that this view page is presented on a second computer screen.



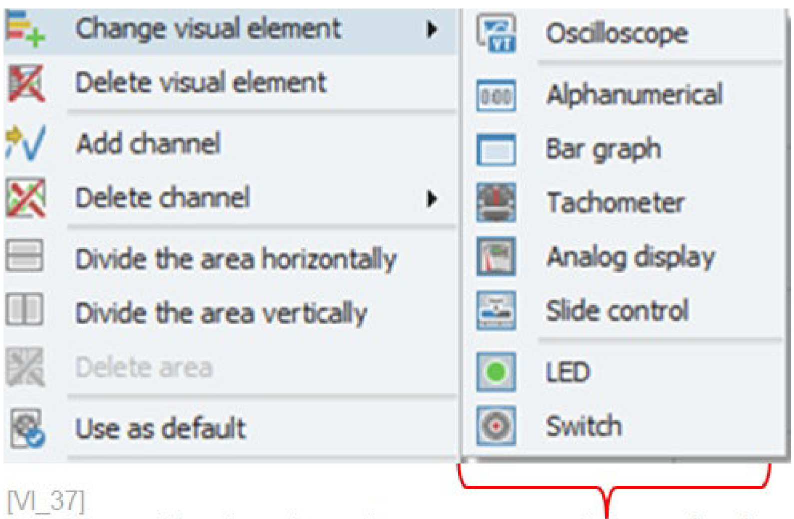
17.6 Standard context menu all instruments share

All instruments have the same common context menu. Some instruments support special features like map download which will be discussed in detail on instrument level.



Default context menu of every instrument. [VI_36]

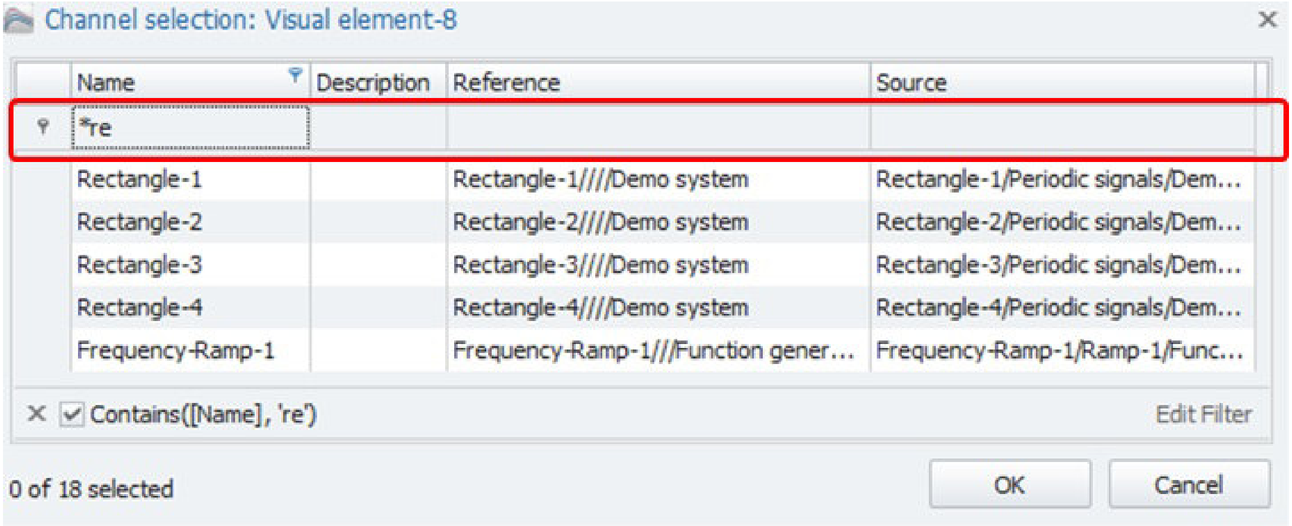
- ► Change visual element — This function gives you the ability to exchange one instrument with another instrument directly. no need to delete the instrument used before.



[VI_37]

Replace these instruments against each other.

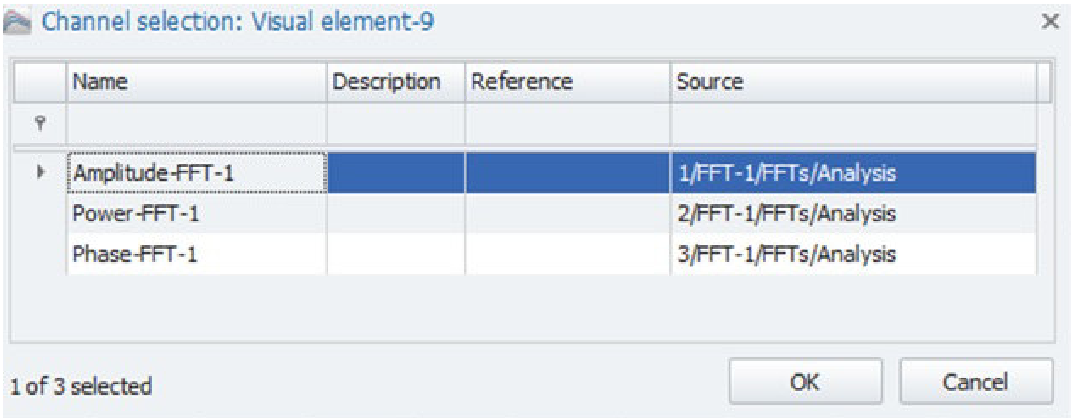
- **Delete visual element** — Using the deleting function you remove an instrument from the instrument container. Each instrument maintains a container for the instrument. Only if you delete the instrument and the container, the page layout is changed.
- **Add channel** — This function opens a channel search dialog to add channels to the instrument. In the first row you can add filter criteria for each column.



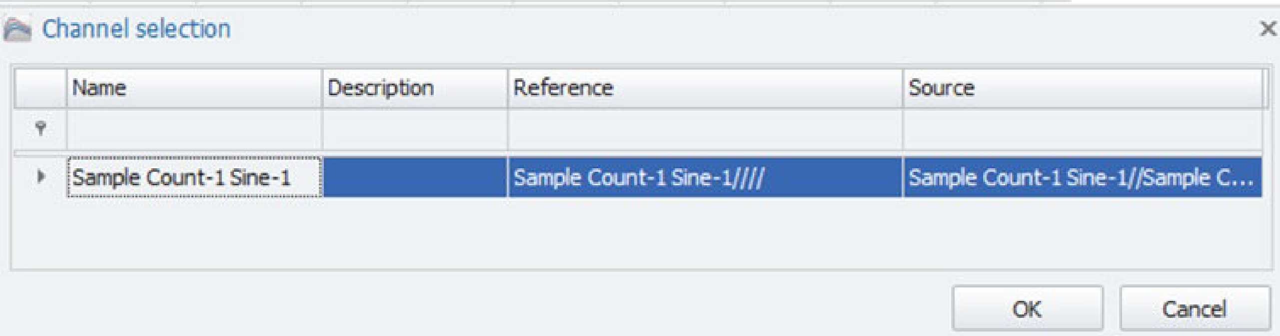
Channel search window

[VI_38]

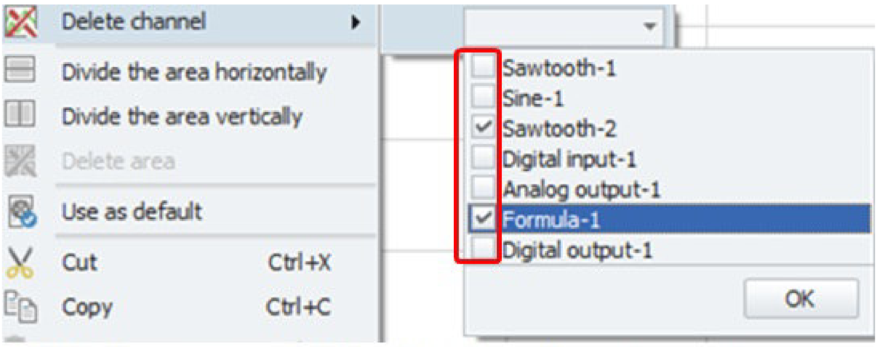
This is an intelligent channel search dialog. If you open it in the context of an FFT instrument or in the context of a Histogram / Classification instrument, only the channels supported by the instrument are provided for selection. This prevents from linking misleading channels to an instrument.



[VI_39]

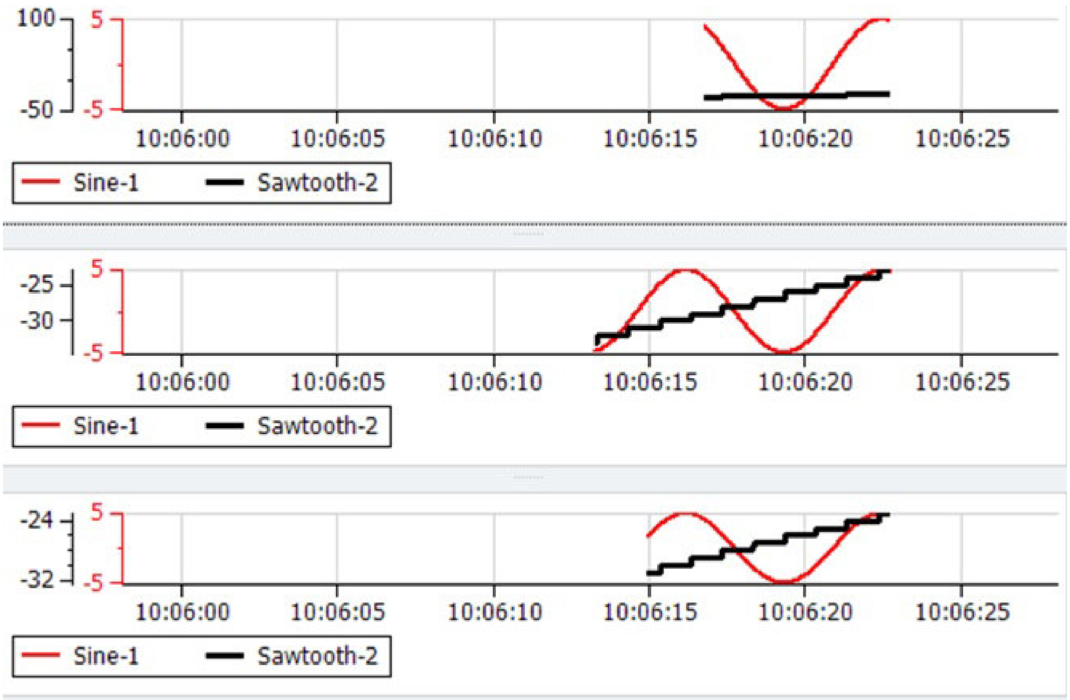


- Delete channel — This function removes channels from the instrument. Select the checkboxes to delete the channels.



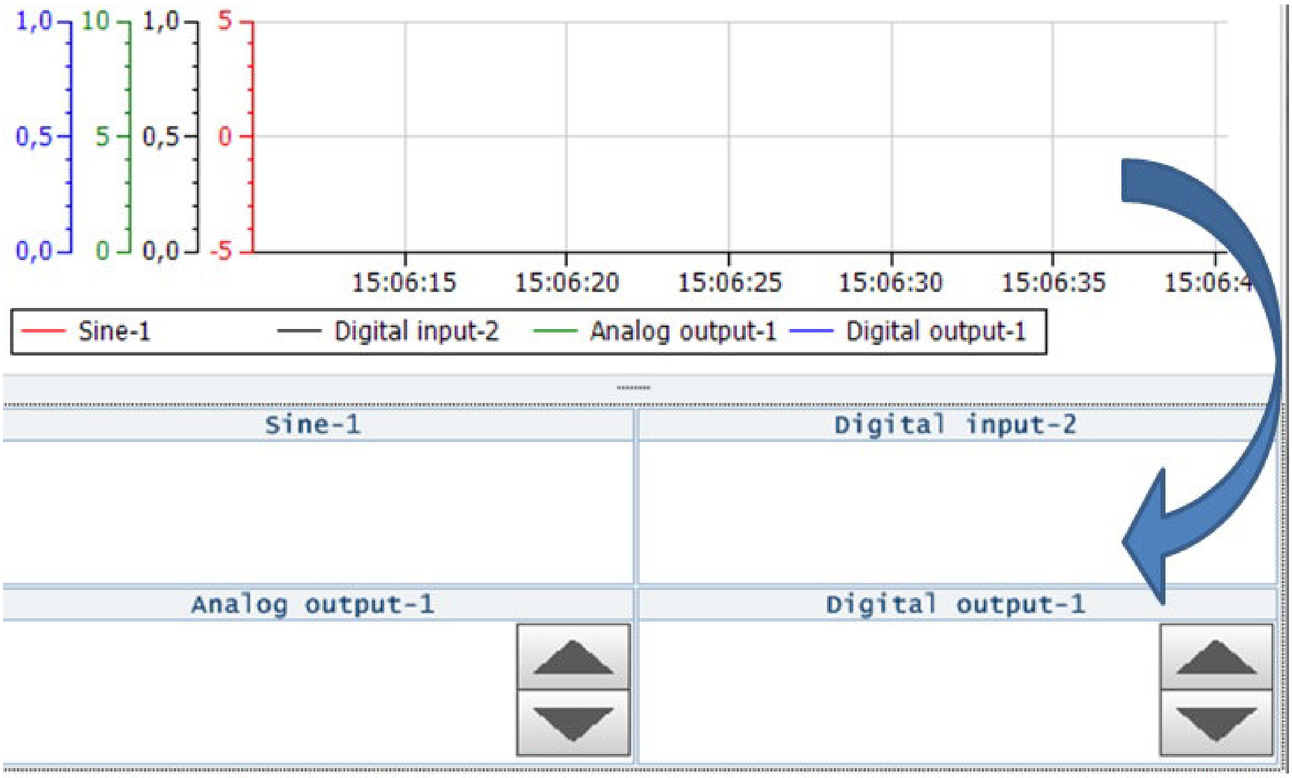
Select channels you like to delete from the instrument. [VI_40]

- Divide area horizontally — Was discussed above in chapter Area 17.2.8
- Divide area vertically — see above
- Delete area — This function is only active if an area / instrument container is selected on the VIEW page.
- Use as default — The customizing settings of the instrument can be saved to a default configuration. If you hit the Use as default button you save the instrument configuration to a data base file and all instruments you create are shown in the same format. The instruments are configured in the properties dialog discussed below for example for the Yt- chart 17.7. If you like to see a list of all instruments with a default configuration see chapter Application Menu >Administration >Reset templates 6.8
- Cut/Paste — Using cut (Ctrl+x) you remove the instrument from this instrument container and you can insert it to another instrument container. You can use this function e.g. to rearrange the order of your instruments on your screen area or to replicate an instrument with all properties and related channels for any times.



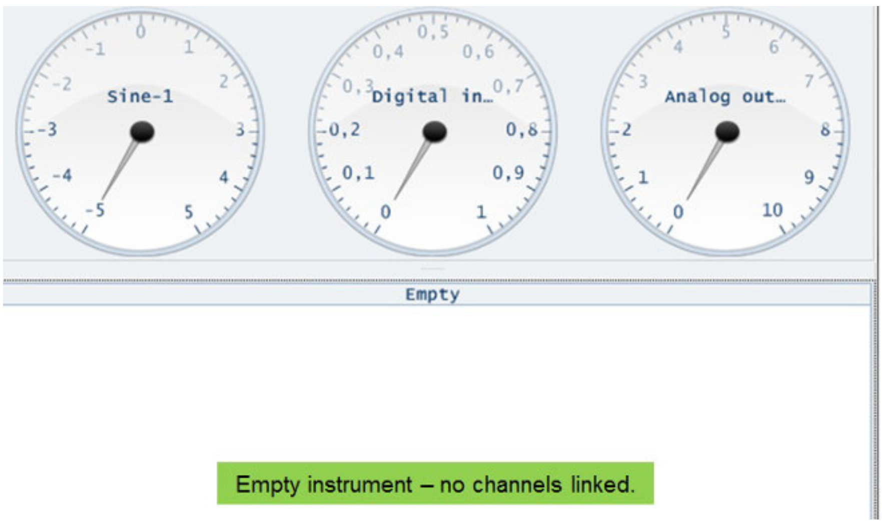
Cut & Paste > one instrument is easily replicated many times. [VI_41]

- **Copy / Paste** — This function will copy and paste the channels of one instrument to another instrument. The copy and paste function works on channel level and on instrument container level. In the example below, all the channels of the Yt- chart are copied over to an empty alphanumerical instrument.



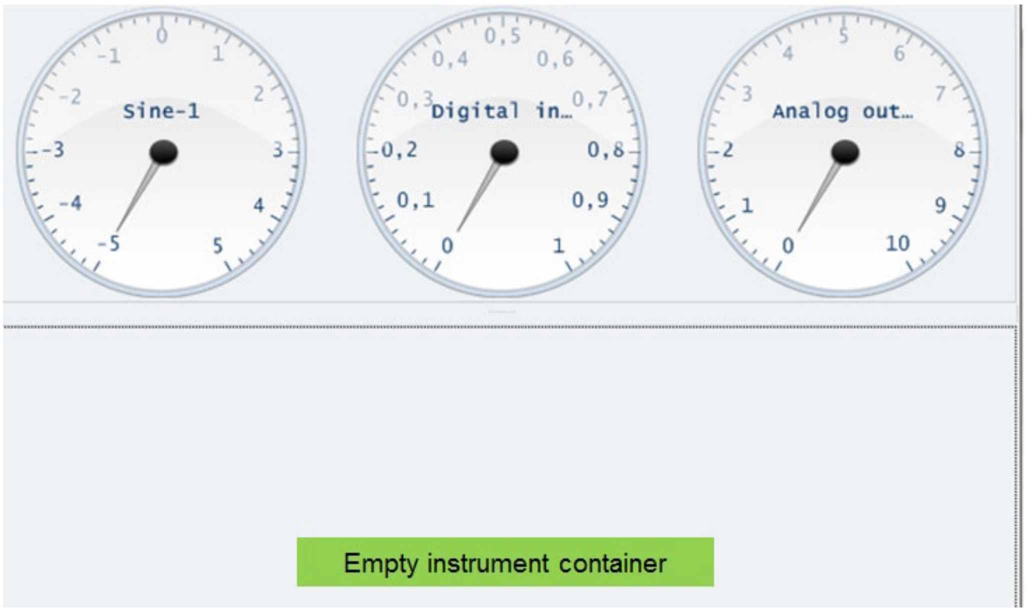
Copy channels from one instrument container to another one. [VI_42]

- **Paste to overwrite** — You can select only one channel from one instrument and paste it over another channel of another instrument if a specific channel was selected.
- **Paste to add channel** — Another functionality is to copy a channel from one instrument and to insert this channel to another instrument. That function works only if you select the complete container of the target instrument.
- **Delete** — With the delete function you can remove channels from instruments. Below, you see an empty alphanumerical instrument.



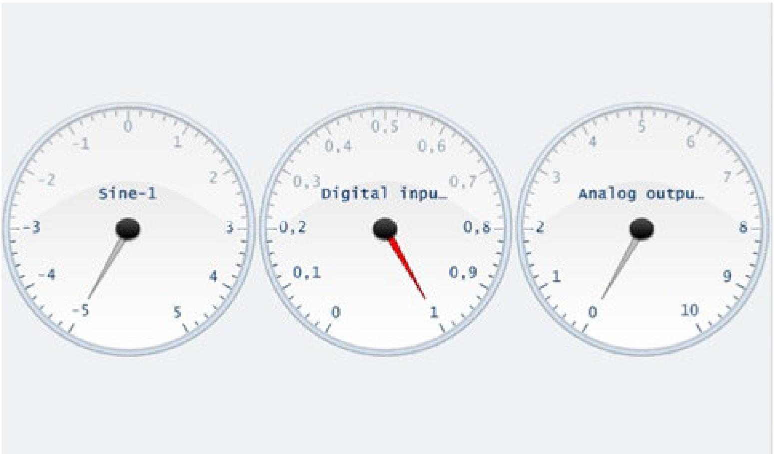
[VI_43]

If the last channel is removed, you will delete the instrument itself in the next step. The screenshot below shows an empty instrument container.



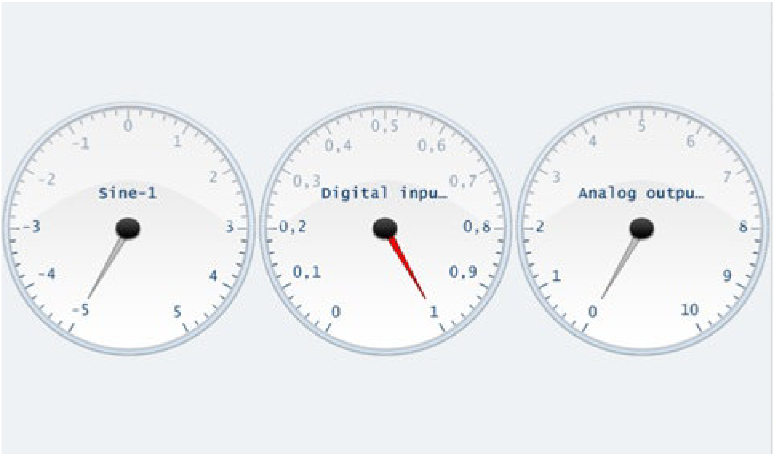
[VI_44]

Finally, the container is deleted and more space is gained for other instruments.



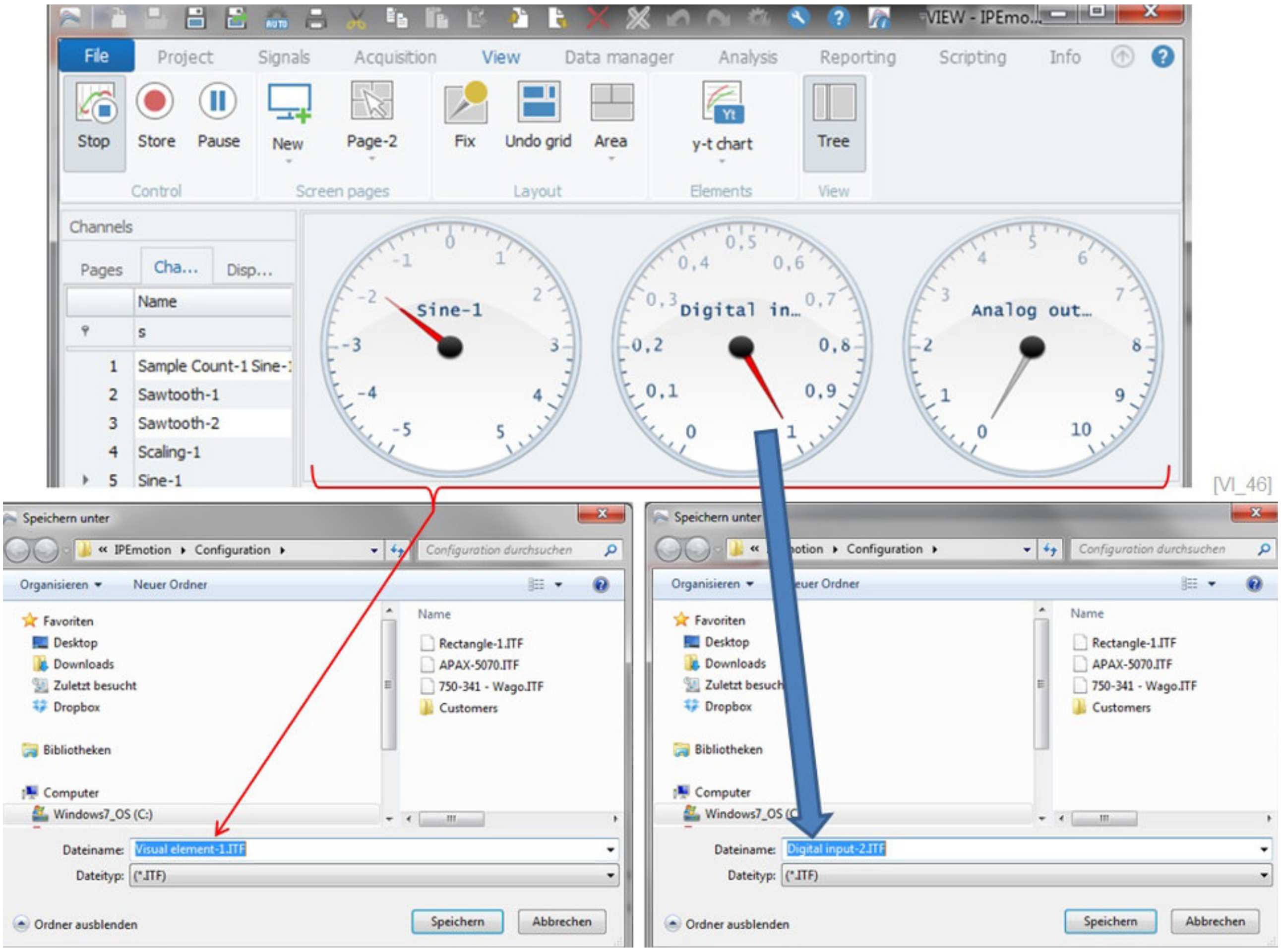
[VI_45]

► Copy image to clipboard — Using the copy function, you will copy the selected channel, instrument or complete instrument container into your clip board. You can paste the image to other Microsoft Office applications.



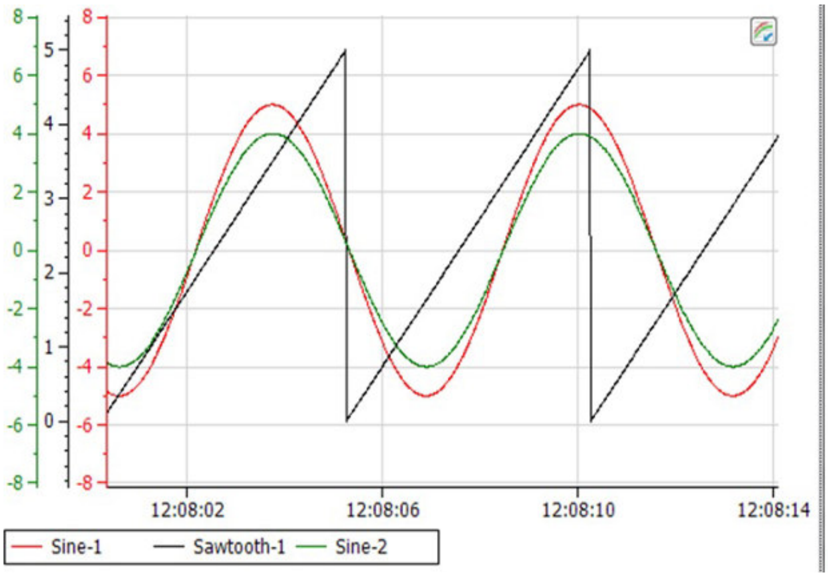
[VI_45]

► Clean	The instruments in VIEW do not support any Clean function. The Clean function is implemented in the SIGNALS workspace.
► Copy to file	With this function you can save the container/instrument configuration to a ITF file. This file can be retrieved and pasted over other instruments.
► Paste from file	Using the paste function you can load an ITF file and create an instrument in an empty instrument container.



[VI_46]

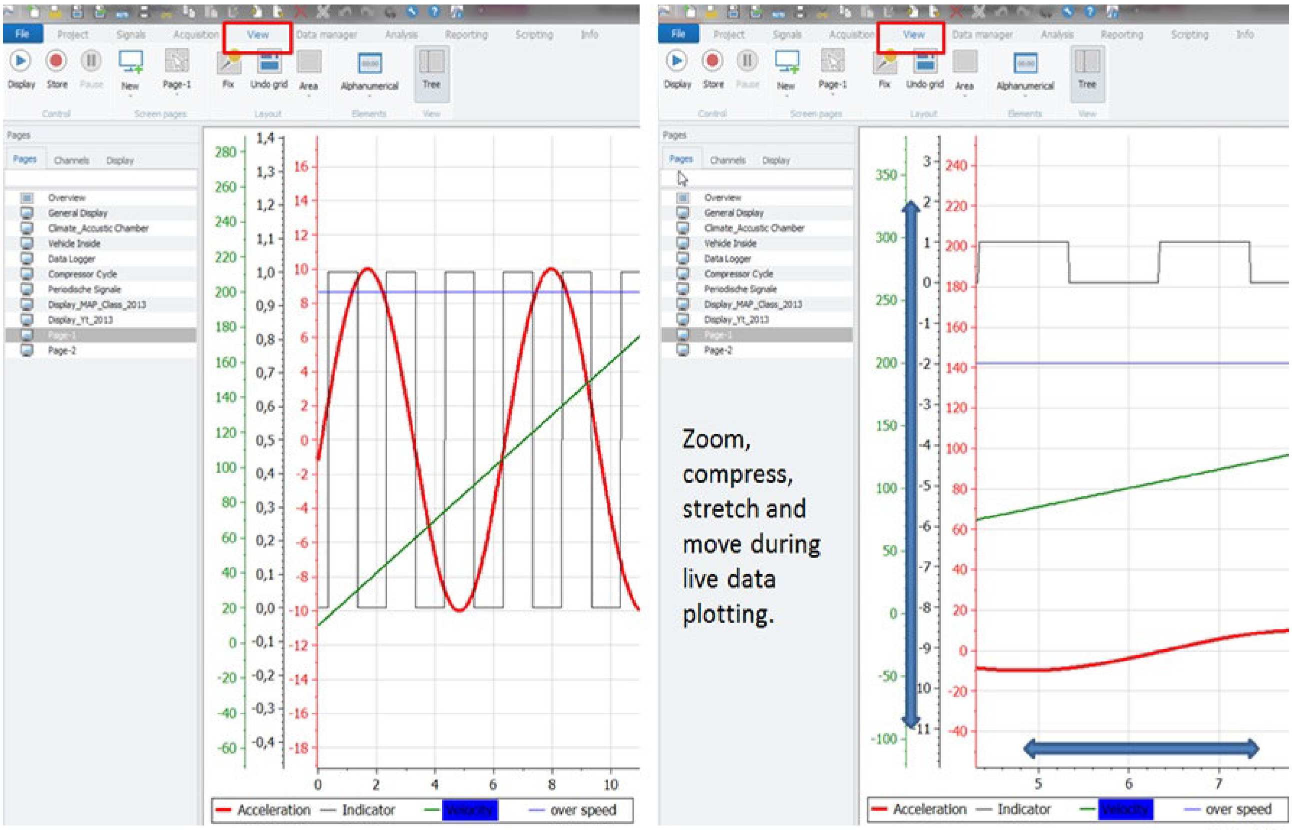
17.7 Yt-chart



[VI_47]

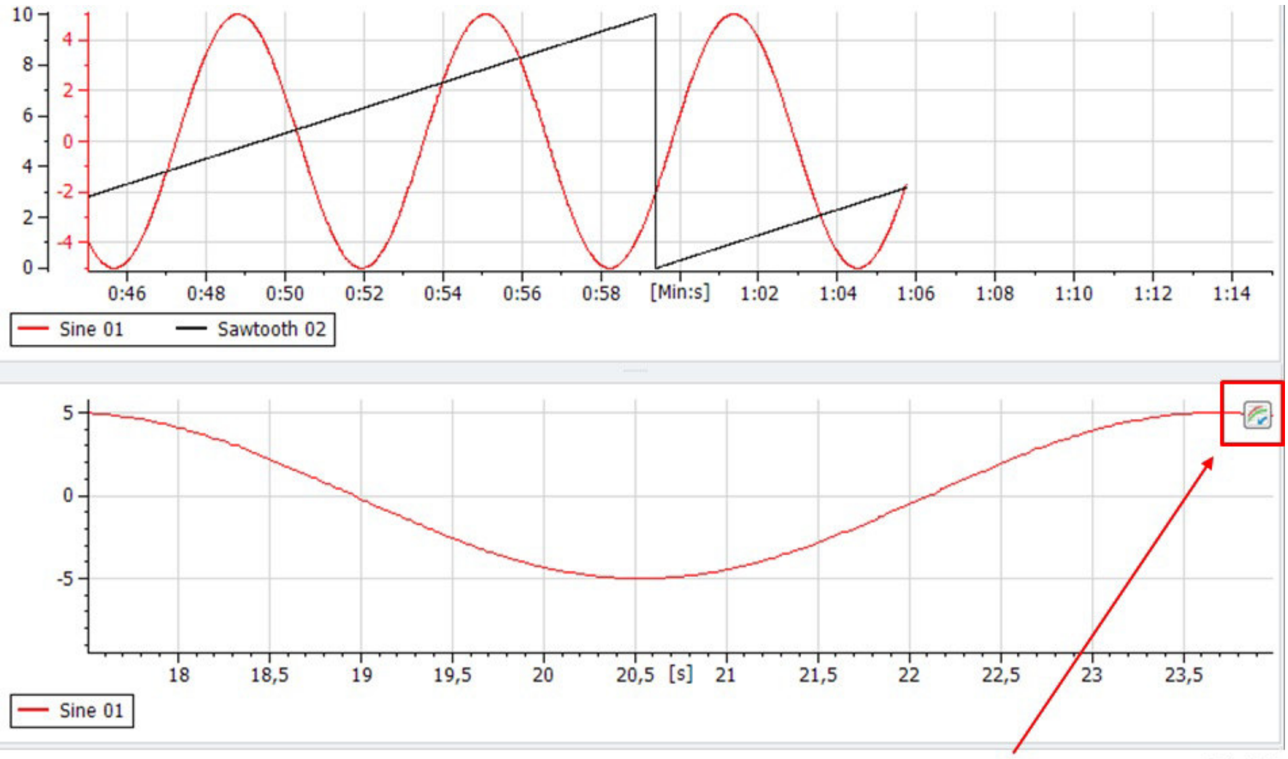
17.7.1 Chart analysis - zoom and stretch functions

The Yt- chart in the online view supports chart analysis functions during live data plotting. It is possible to squeeze & stretch along the X- and Y-axis. The buffer size settings are defined in the OPTIONS >History Buffer chapter 22.5.1. The zooming functionality does not require any active data storage. The data is stored independently from the normal data storage function discussed in the ACQUISITION >Storage chapter 13.8. For users it is very convenient that they can use these zoom and stretch functions along all axes to optimize the data presentation of the online view. The easiest way to zoom and stretch the graphs and axes is to use the CONTROL key and the left mouse button.



[VI_48]

After zooming into the graph a small Icon appears to reset the zoom.

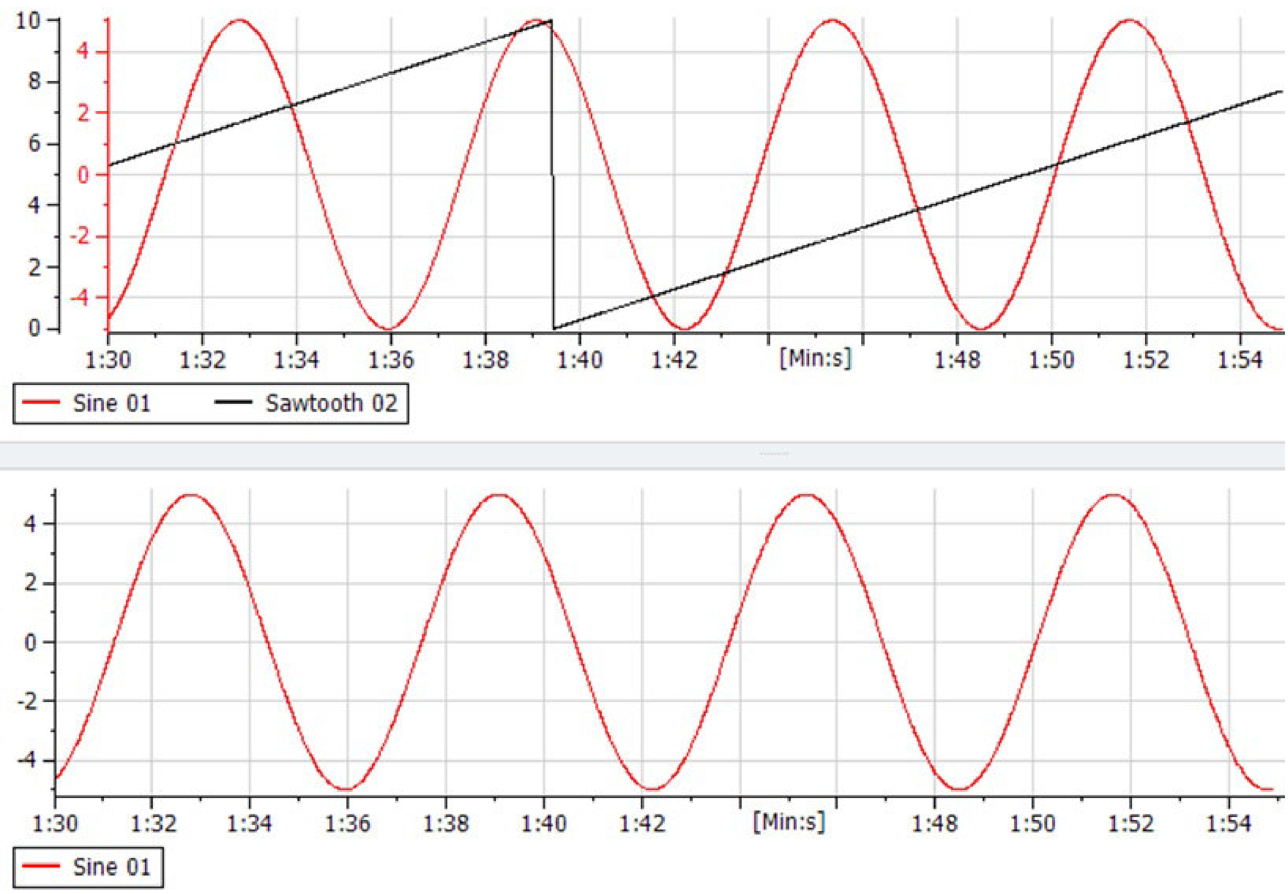


Zoom into the online Yt-chart

Button to reset zoom to original axis settings

[VI_49]

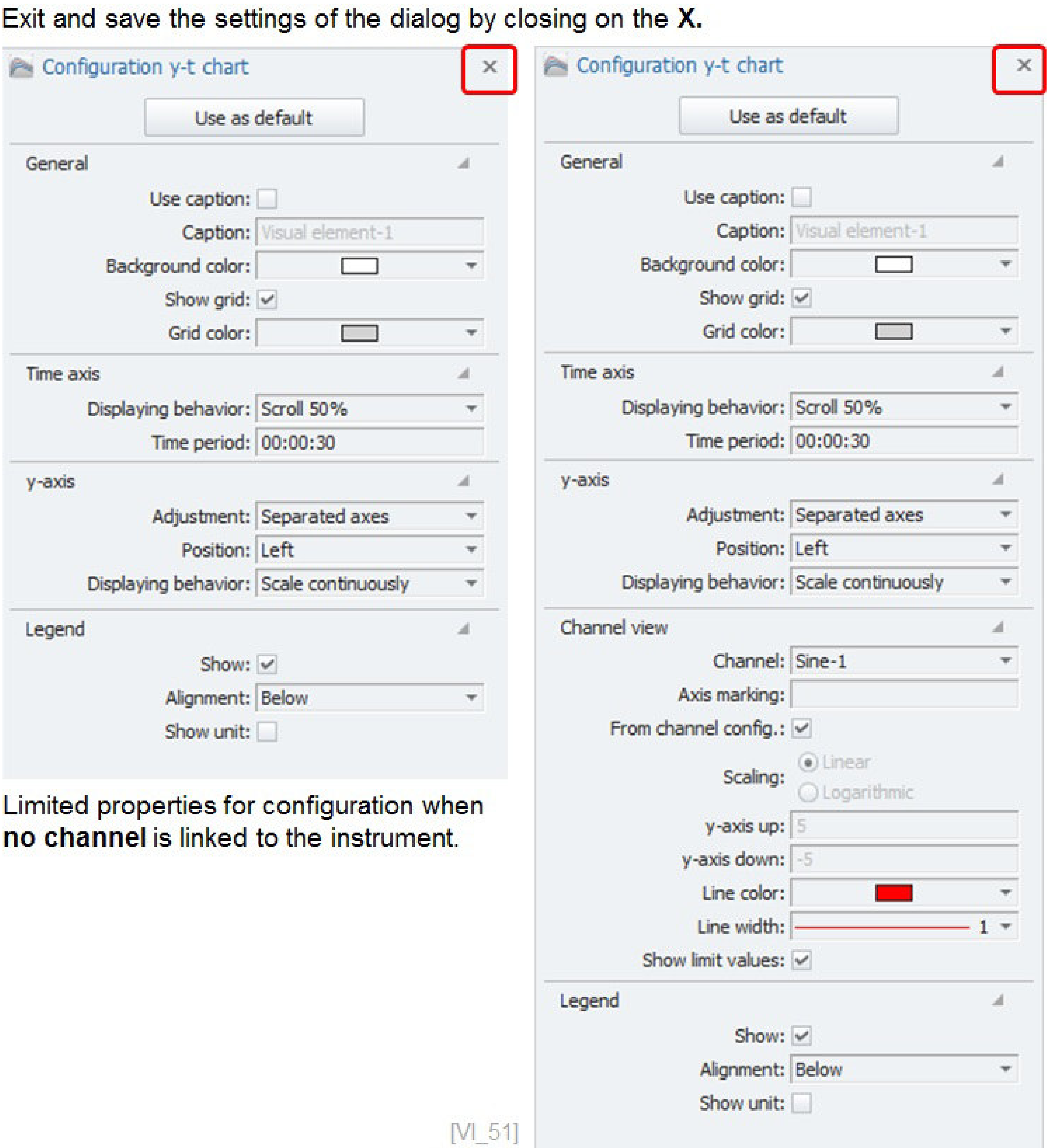
After reset the diagram axis are are changed back to the standard settings.



After reset diagrams set back to standard x- and y-axis scaling.

[VI_50]

17.7.2 Yt-chart head-up display



[VI_51]

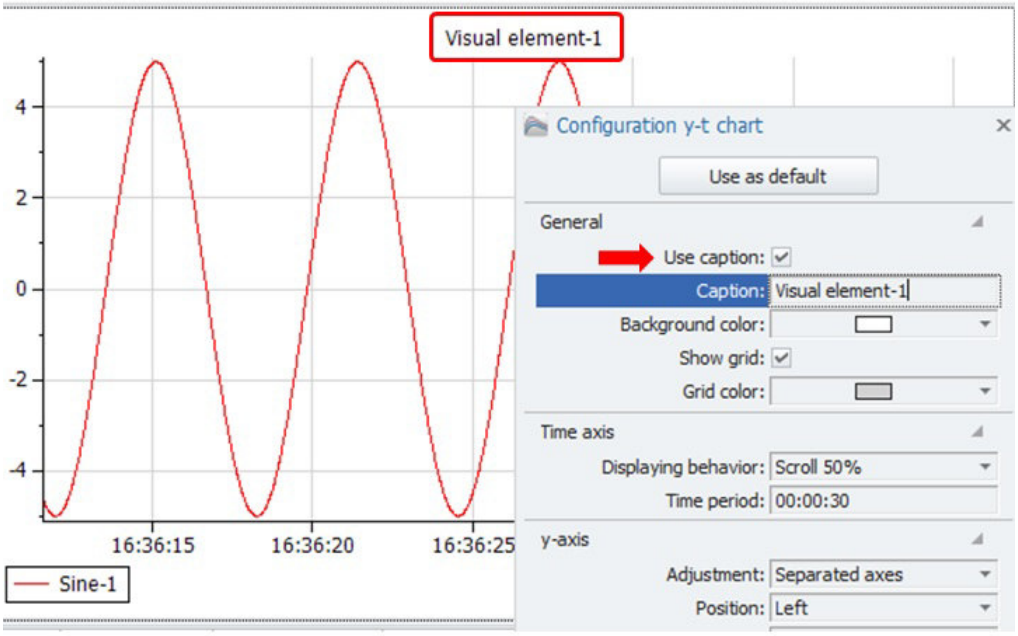
17.7.3 Use as default

As discussed above, you can save all configurations of an instrument by hitting the default button. In this case, the software creates a template file and every new instrument you create will comply with this template. The templates are managed under Application Menu >Administration. For more details see chapter 6.8.

17.7.4 General

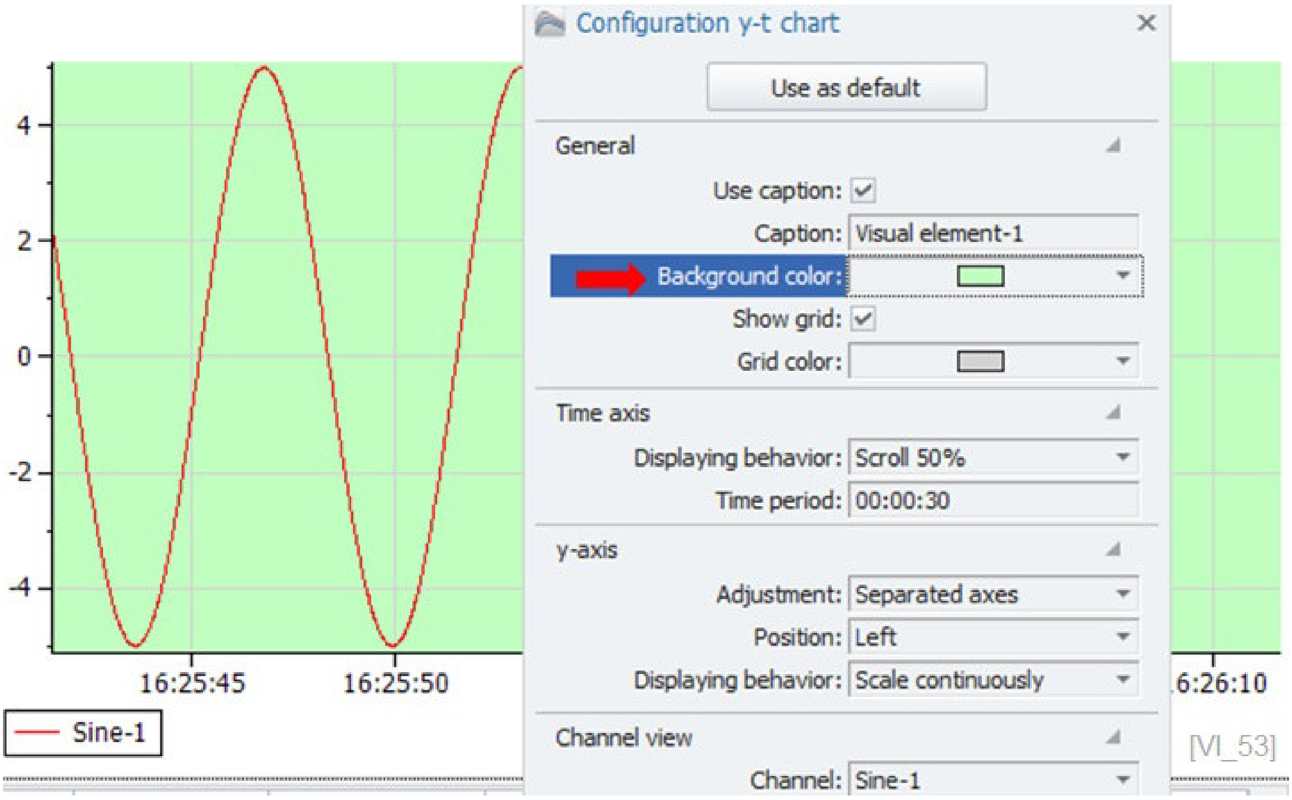
- Use Caption — Checkbox to show the name defined in caption
- Caption — Refers to the name of the instrument container

Caption enabled



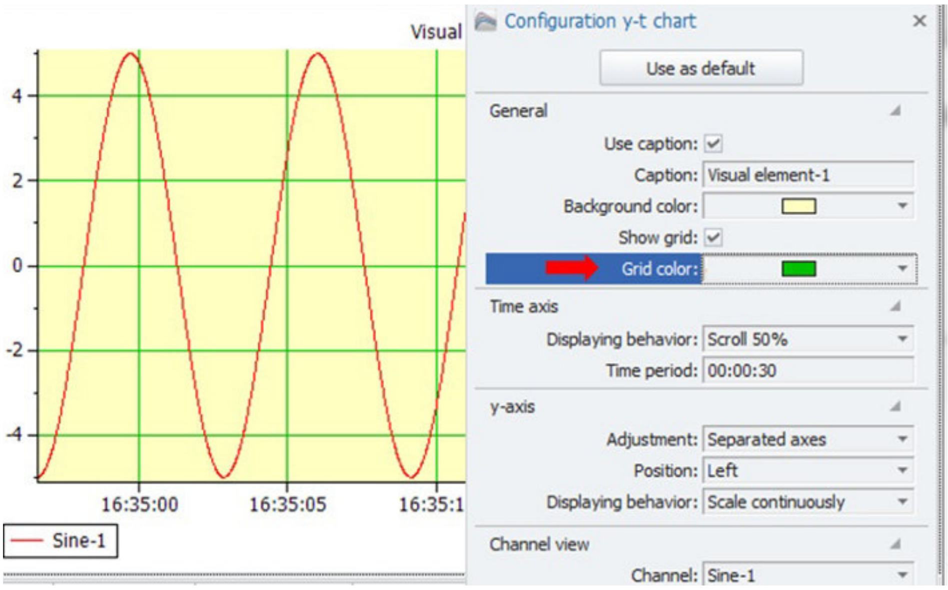
[VI_52]

- Background color — The background color can be selected from three different color systems and is directly applied to the instrument even before the dialog is closed.



[VI_53]

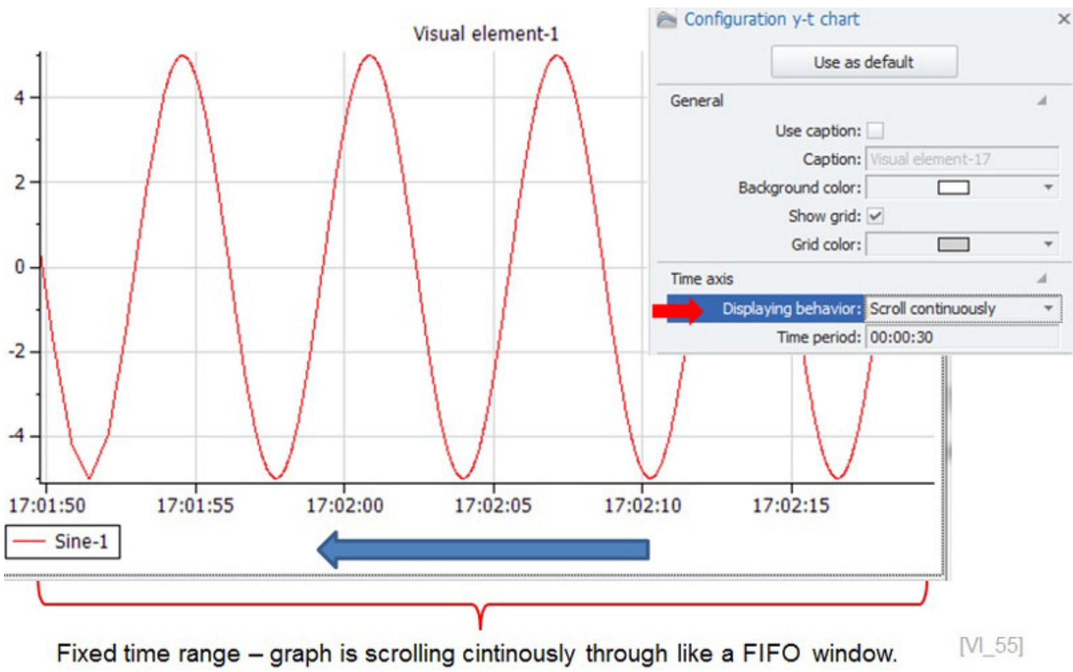
- Grid — The checkbox activates the grid
- Grid color — Here you can select from three different color systems to define your grid color



[VI_54]

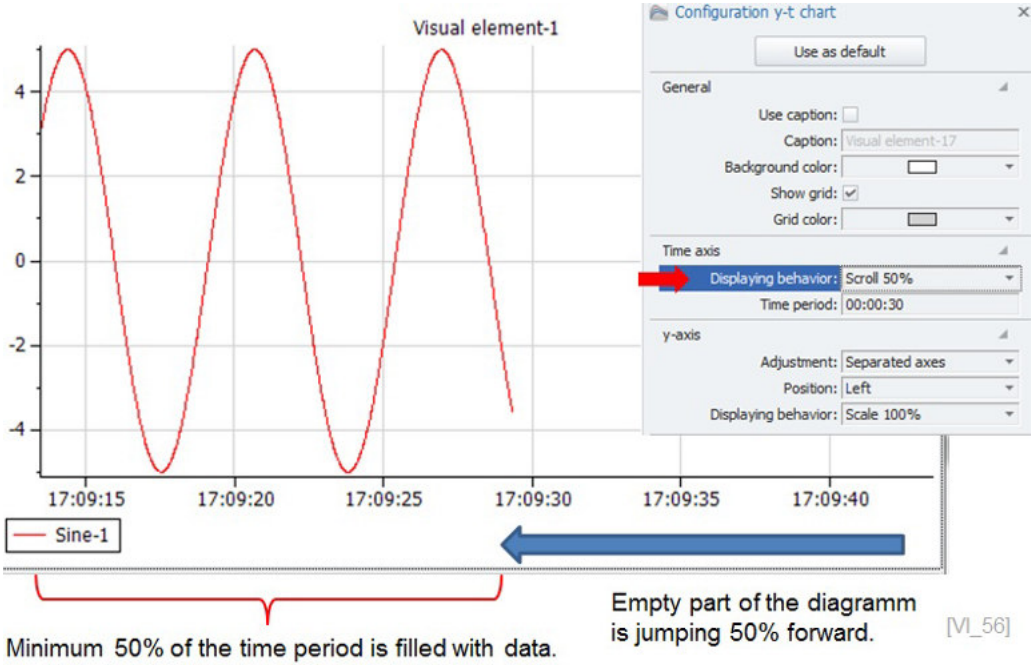
17.7.5 Time axis

- Time period — Refers to the default time axis of the diagram defined in hours. You can define the time period you will use to show the plotted diagram. This setting has an immediate effect on the displaying/scrolling behavior. If you select a large time axis it will take accordingly longer until the scroll mechanism will start its operation. If appropriate for the application, you can define hours and days as time period.
- Display behavior — Here you define how the time (x-axis) is updated. There are different scrolling and scaling modes available which are discussed below.
- Scroll continuously — You will see a complete graph in the chart if the time window is filled with data. The axis is then scrolling through.



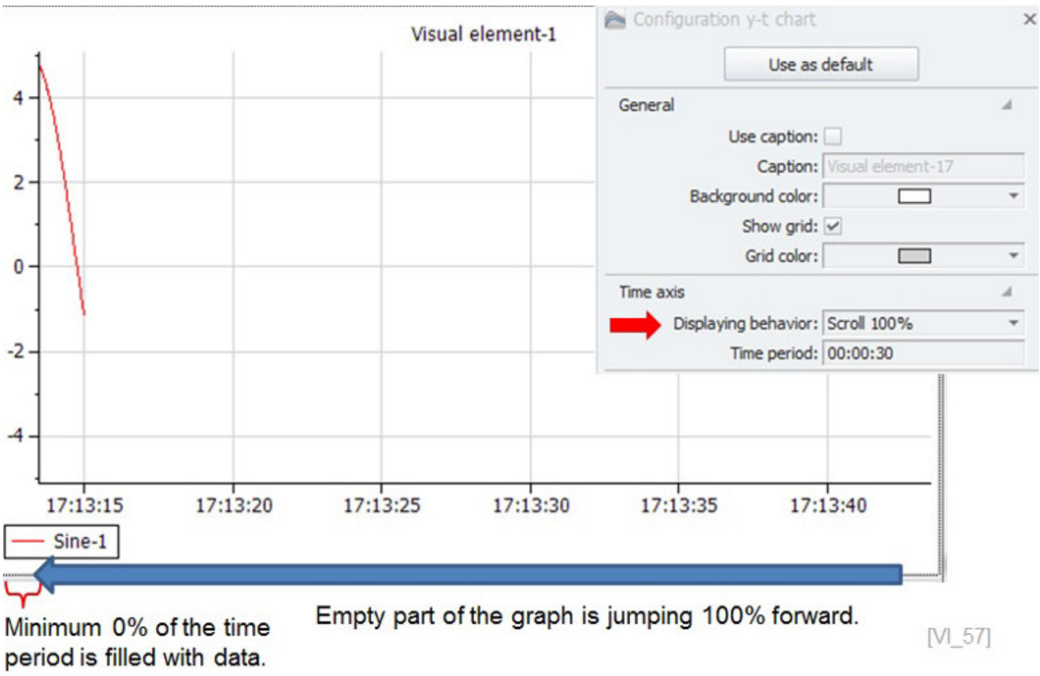
[VI_55]

- Scroll 50 % — Here the graph is covering only 50% of the time window. If 100% are filled with data, the graph jumps forward by 50% which is the empty part, then. If the empty part is filled up with data, it again jumps 50% forward.



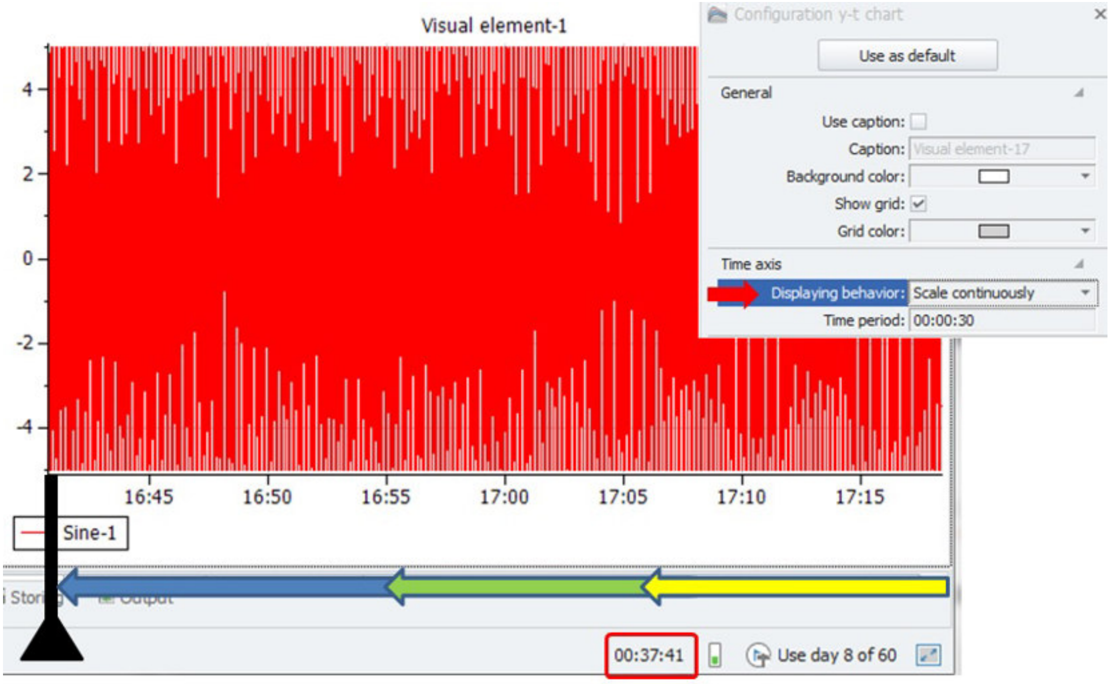
[VI_56]

- Scroll 100 % — In this configuration the graph jumps the full time axis (100%) forward if the diagram is full of data.



[VI_57]

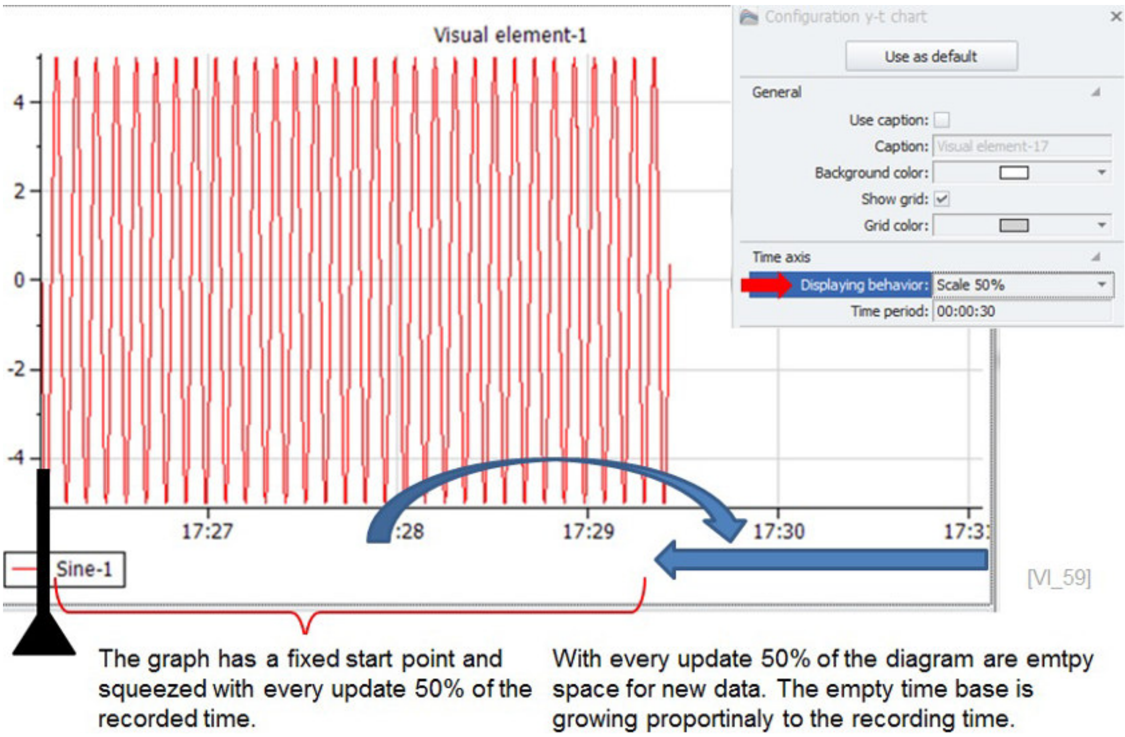
- **Scale continuously** — In this scaling mode, if the measurement started, a fixed starting point is defined in the diagram and all incoming data is squeezed into the diagram.



The signals and time axis is squieezed in. There is a fixed start point and the axis is compressed. In this example 37 minuts are accumulated for the time axis.

[VI_58]

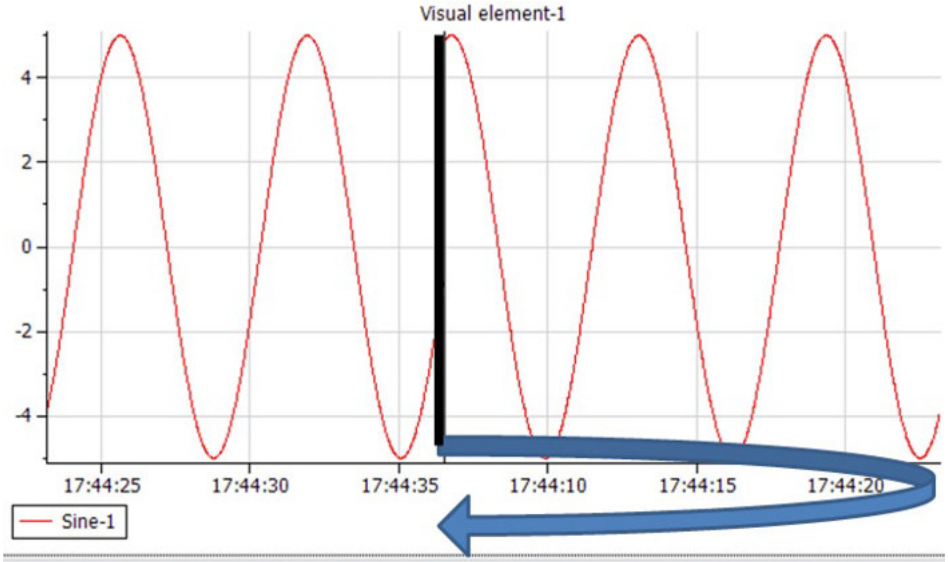
- **Scale 50 %** — The graph has a fixed starting point. If the diagram is full of data the time axis of the recorded data is squeezed together by 50% so that there is space for new incoming data.



[VI_59]

- **Scale 100 %** — The difference between 50% and 100% scaling needs to be clarified.

- **Wiper** — This is a special display mode where a horizontal bar moves along the time axis. The wiper is the dividing line between online data and historic data. The wiper overwrites the historic data in the chart.

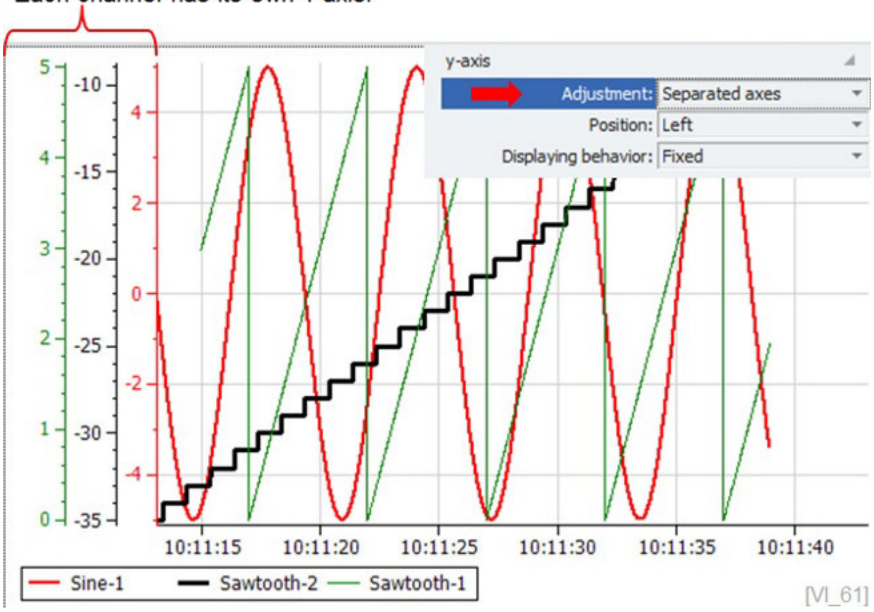


A vertical bar is moving along the x-axis and is overwriting old data by new incoming data from left to right.
[VI_60]

17.7.6 Y-axis

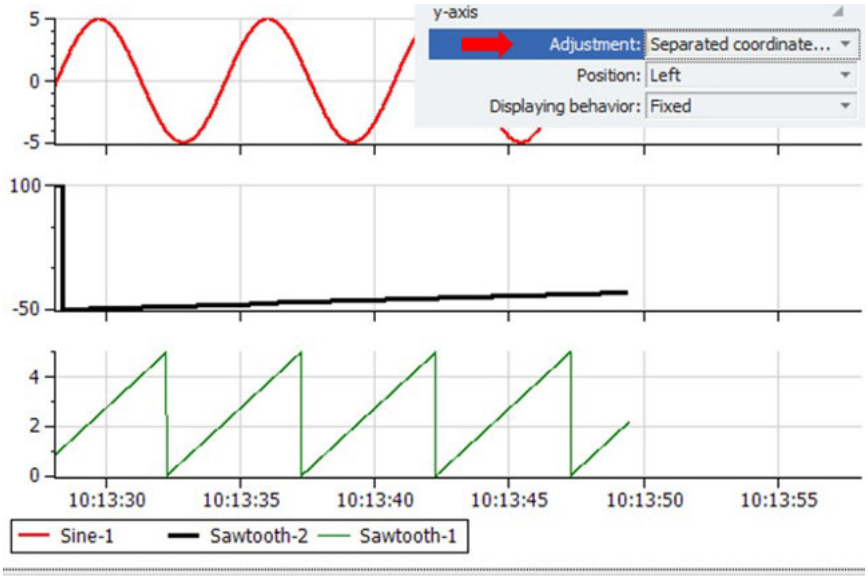
- **Adjustment** Covers the properties of the y-axis
- **Separate axis** In this configuration, each channel has its own y-axis

Each channel has its own Y-axis.



[VI_61]

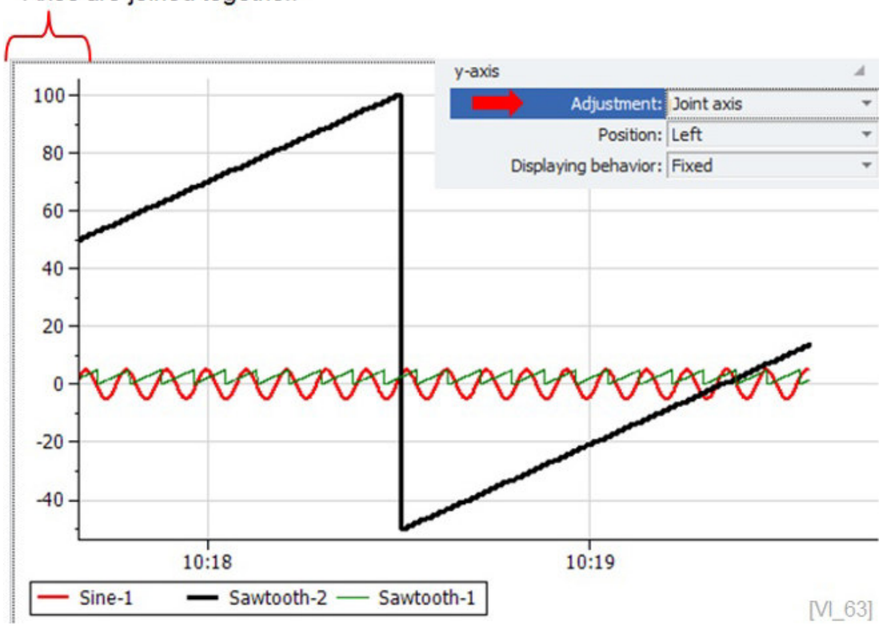
- Separate coordinate systems — The diagram will be split into separate coordinate systems for each channel



Each channel has its own coordinate system. [VI_62]

- Join axis — The join function is merging all y-axes together. The common y-axis scale is determined by the channel with the MAX positive scale and the channel with the MIN negative scale. Two separate channels can define the upper and lower end of the scale. In the example below, one channel alone is defining MAX and MIN end of the y-axis scale.

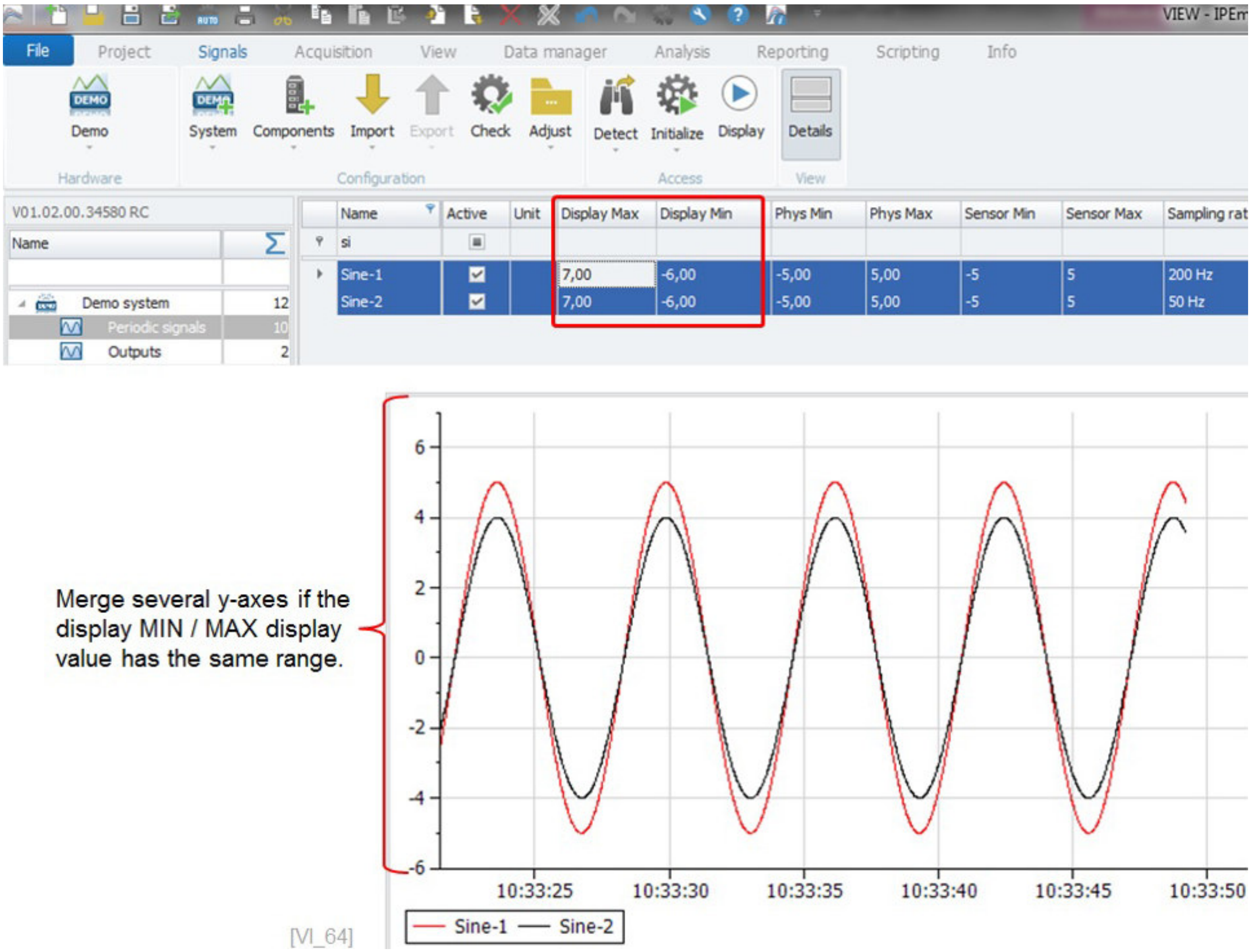
Axes are joined together.



[VI_63]

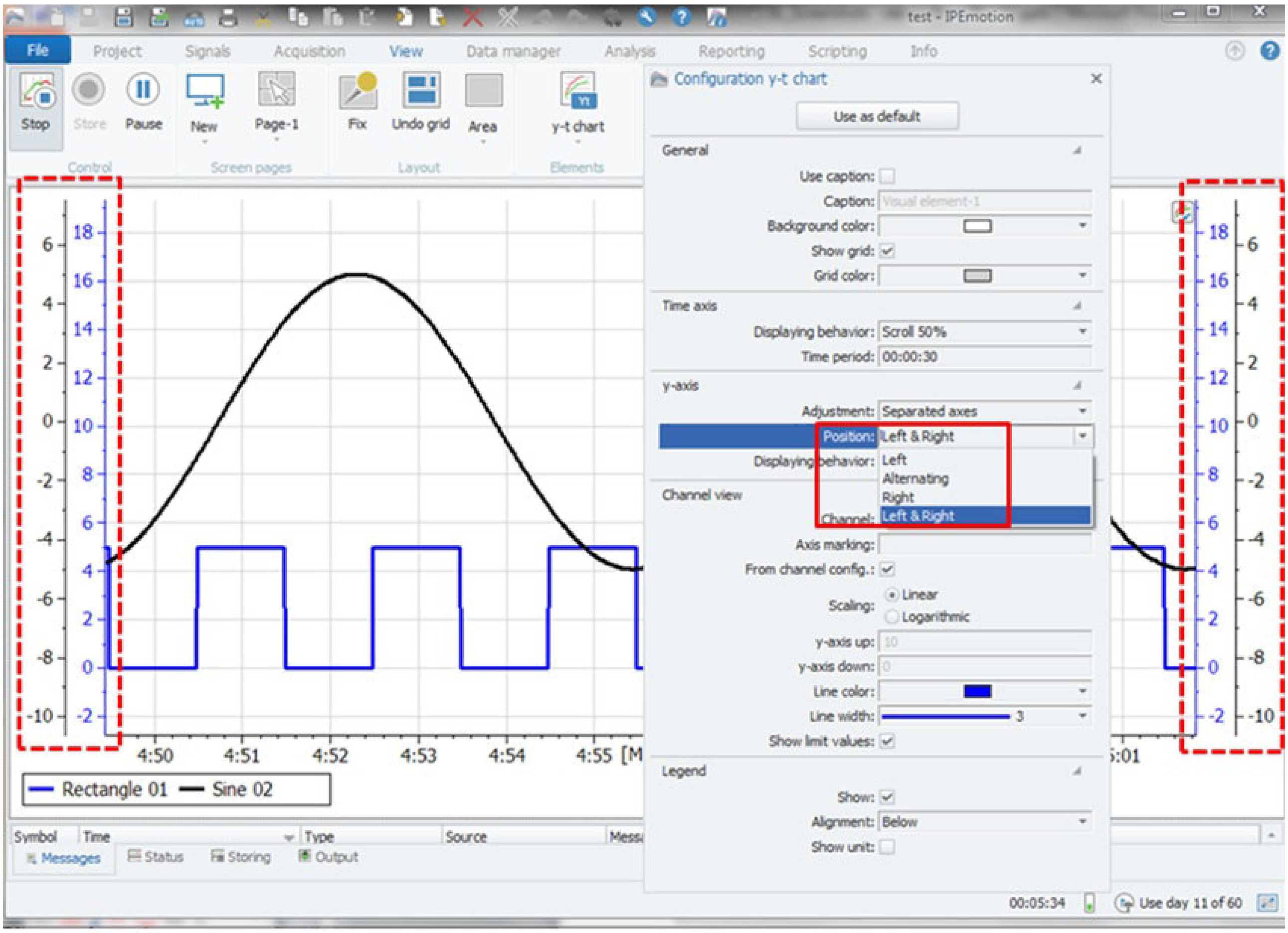
- **Merge equal axes**

  Using the merge function you can consolidate the number of y-axes and group all channels that use the same MIN / MAX scale. You can only merge y-axes, provided the channels have the same display MIN / MAX scaling defined e.g. in the SIGNALS work space. See also chapter 11.8.1.



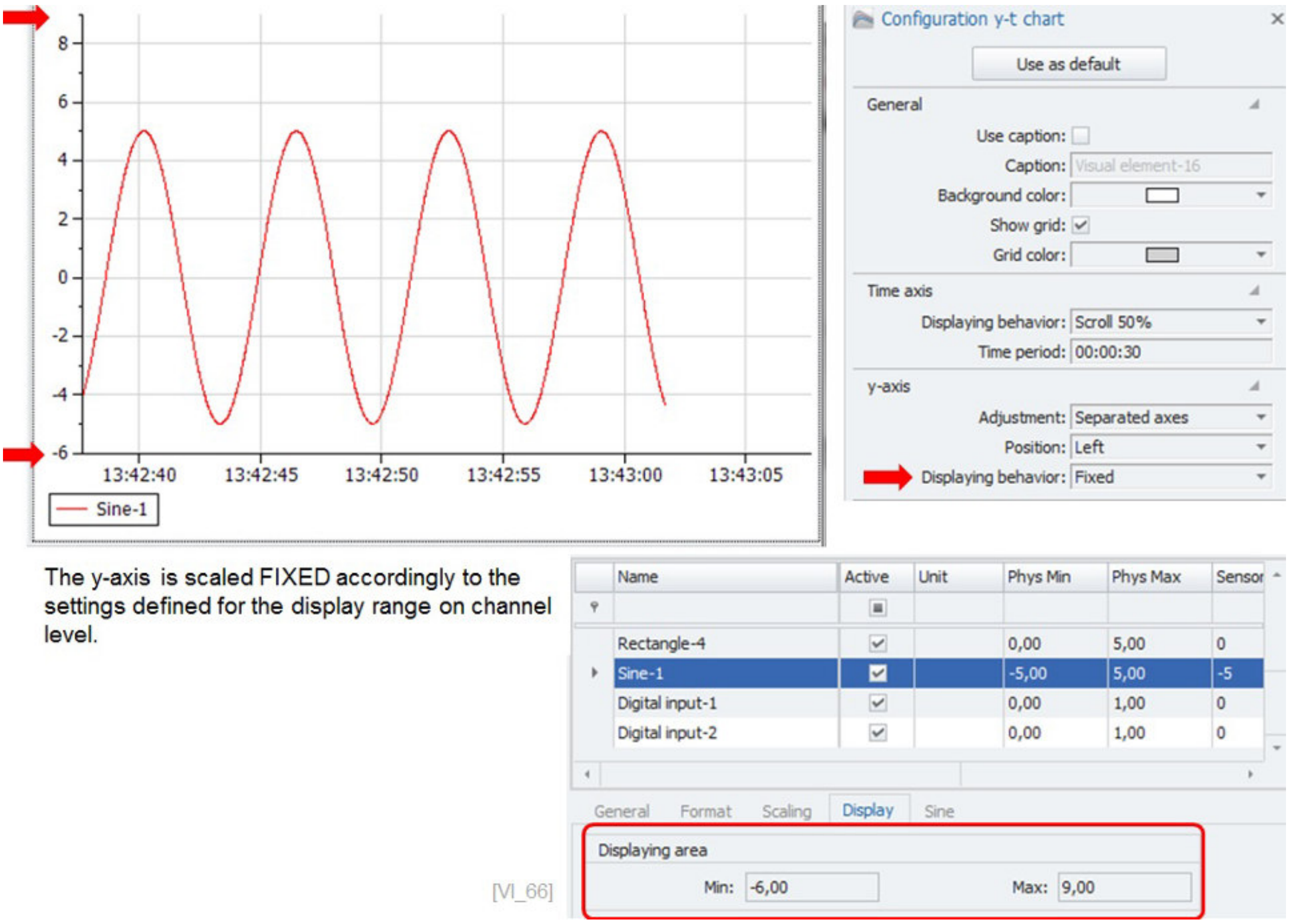
[VI_64]

- **Position** — With position you can define the location of the y-axes (left, right, alternating or both sides) for the Yt- chart. The screenshot below shows the display of the Y-axis' location on both sides of the diagram.



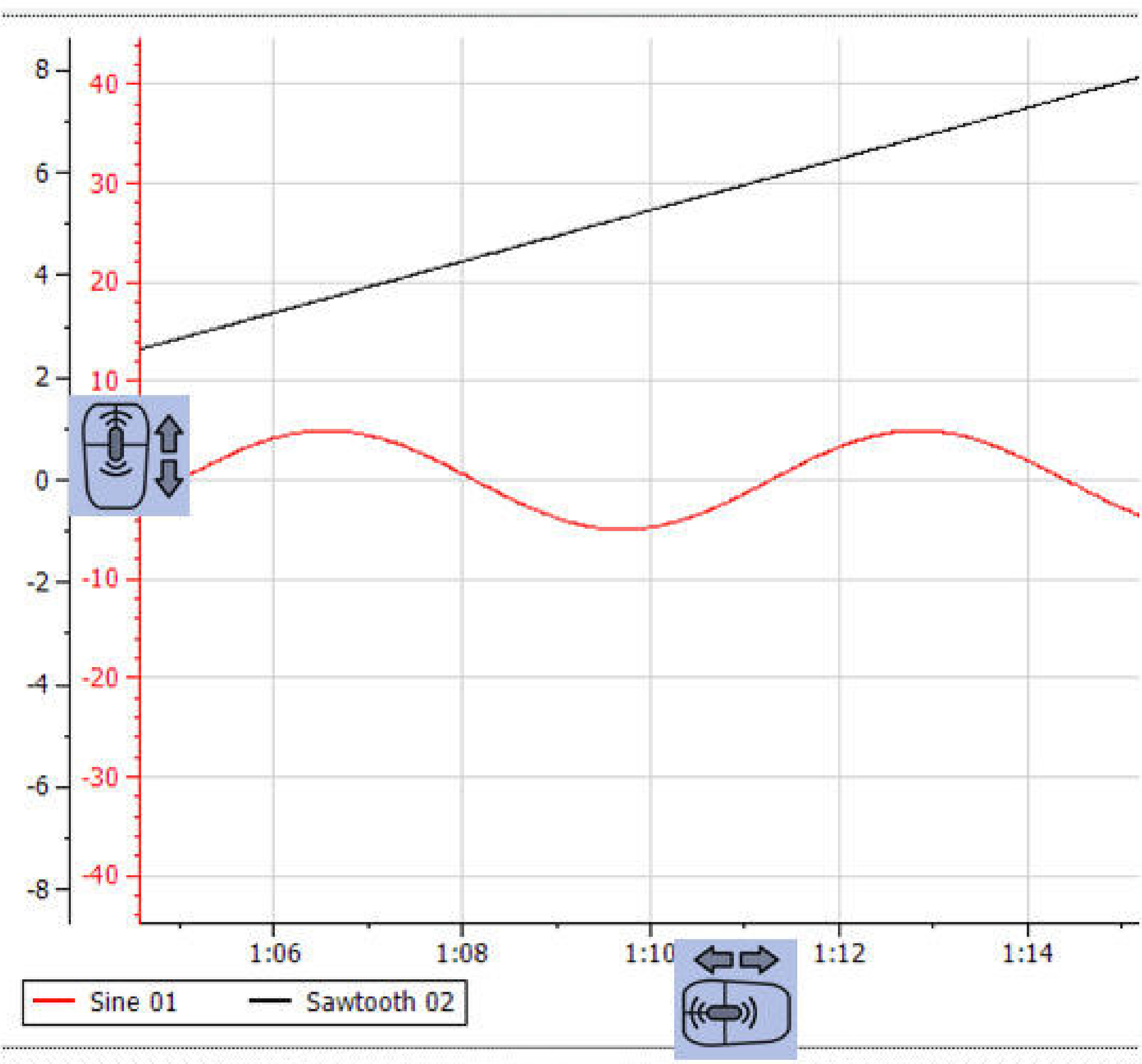
[VI_65]

- **Display behavior** — The display behavior of the y-axis can be configured similar to the display properties of the x-axis (time axis) discussed above.
- **Scroll continually** — refer to x-axis
- **Scroll 50 %** — refer to x-axis
- **Scroll 100 %** — refer to x-axis
- **Scale continuously** — refer to x-axis
- **Scale 50 %** — refer to x-axis
- **Scale 100 %** — refer to x-axis
- **Scale fixed** — The Y-axis is set fixed to the MIN / MAX display values as defined on channel level in the SIGNALS work space or as defined for variables or formulas in the ACQUISITION work space. Even if the signal goes beyond the MIN / MAX display range, the axes are not updated.



[VI_66]

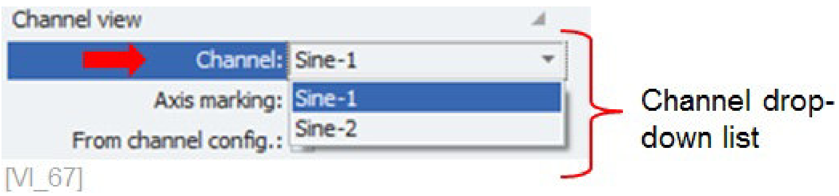
The Yt chart is supporting a mouse wheel scroll function for X- and Y-axis. You need to click on the axis to select the axis and then you can use the mouse wheel to change the axis display range.



Scroll X- and Y-axis with mouse wheel [VI_66_1]

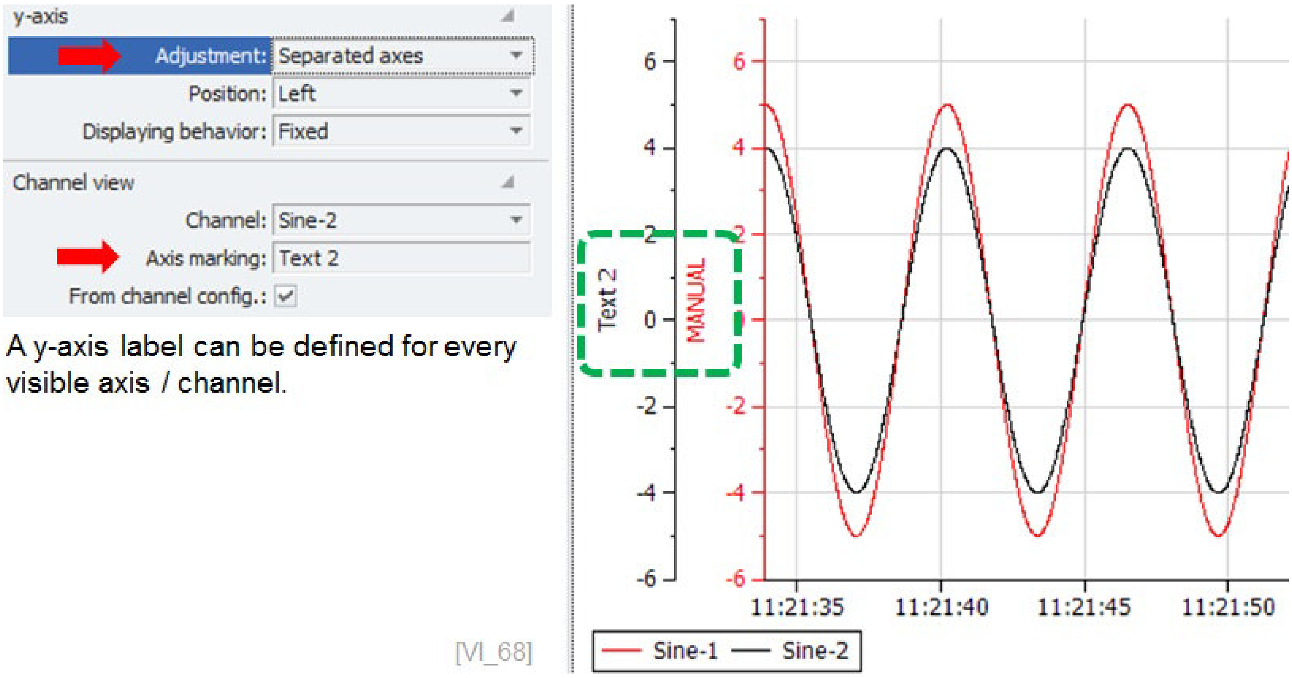
17.7.7 Channel view

- ► Channel — In this drop-down list you can select the channel subjected to the different configurations which will be discussed below.



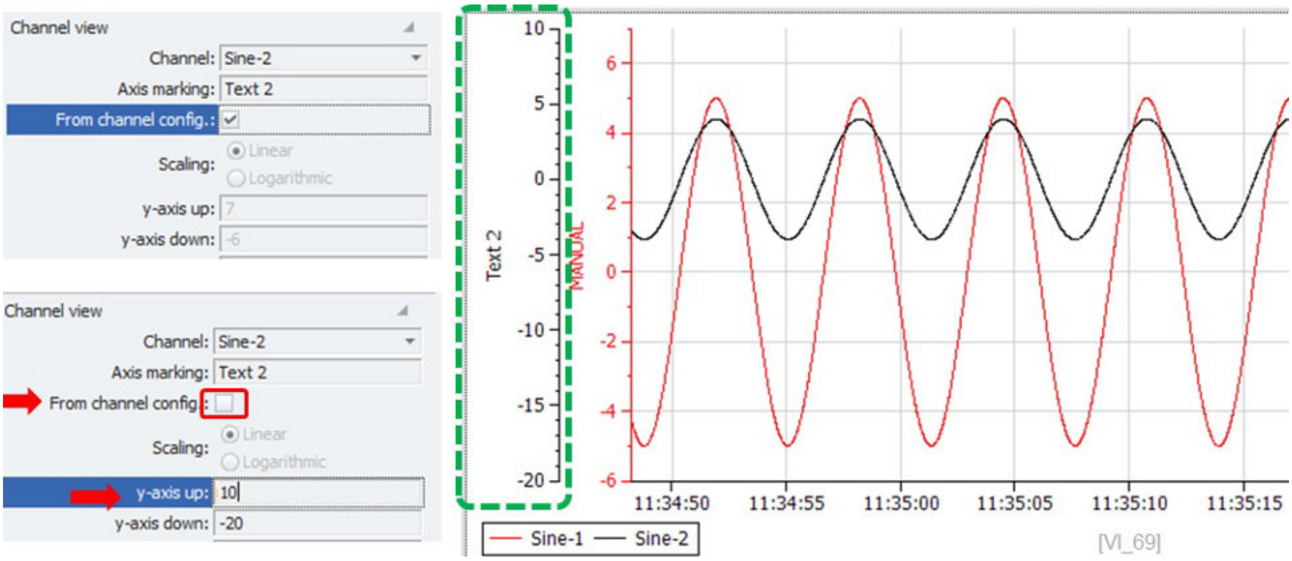
[VI_67]

- **Axis marking** — Define a label/description for the y-axis. If each channel has its own y-axis you can have a separate label on each axis. You can show the y-axes' labels if you change the display mode to separate coordinate systems, as well.



[VI_68]

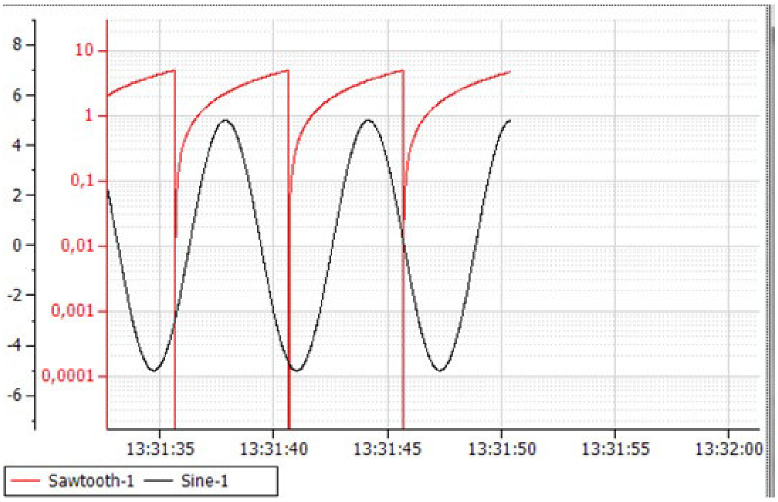
- **From channel config** — This checkbox relates the y-axis MIN / MAX scaling either to the channel display scaling discussed above or to a specific scaling individually defined in this specific diagram. If you disable the check box you can define the MIN / MAX scaling for the channel selected in the list box. In the screenshot below, the channel SINE-2 was individually scaled from -20 to 10. The diagram is directly updated to the new scaling values.

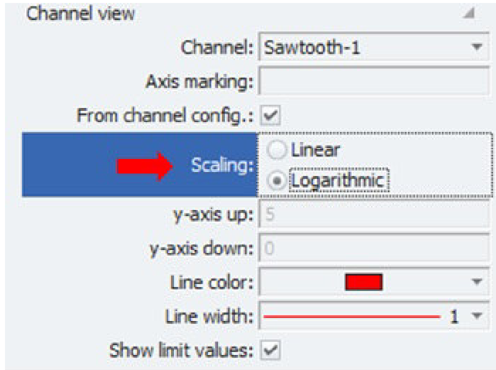


[VI_69]

- **Scaling**

  Logarithmic scaling can only be configured if the signal display range is within the MIN value in the positive number range. The scaling mode Linear / logarithmic can be defined on channel level.



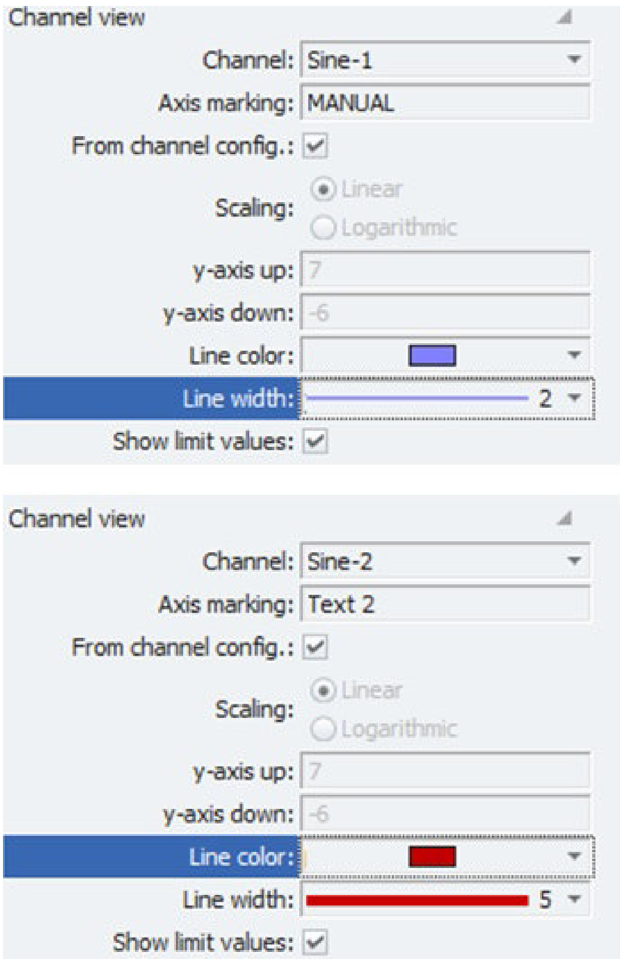


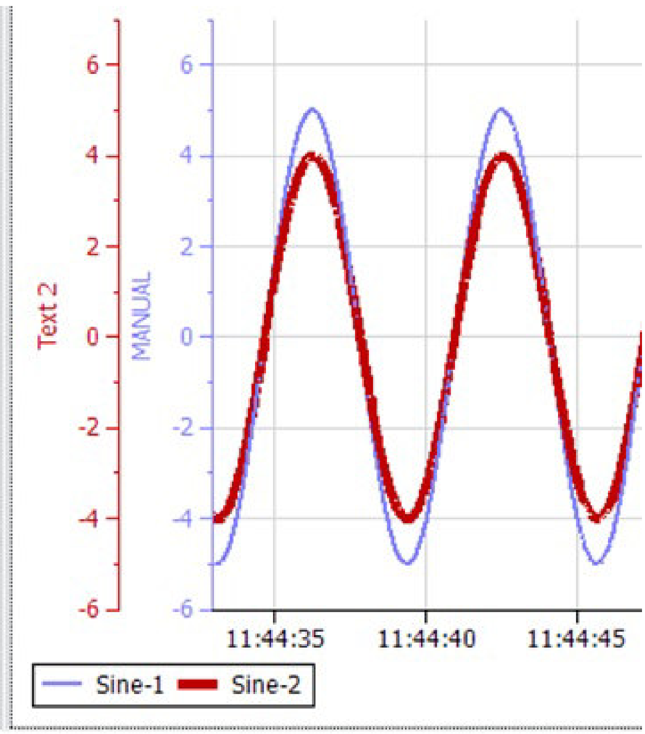
Logarithmic scaling of y-axis. The scaling mode is defined on channel level.

[VI_70]

- **Line color / width**

  For each channel, an individual line color and width can be defined. The settings are directly visible on the diagram.

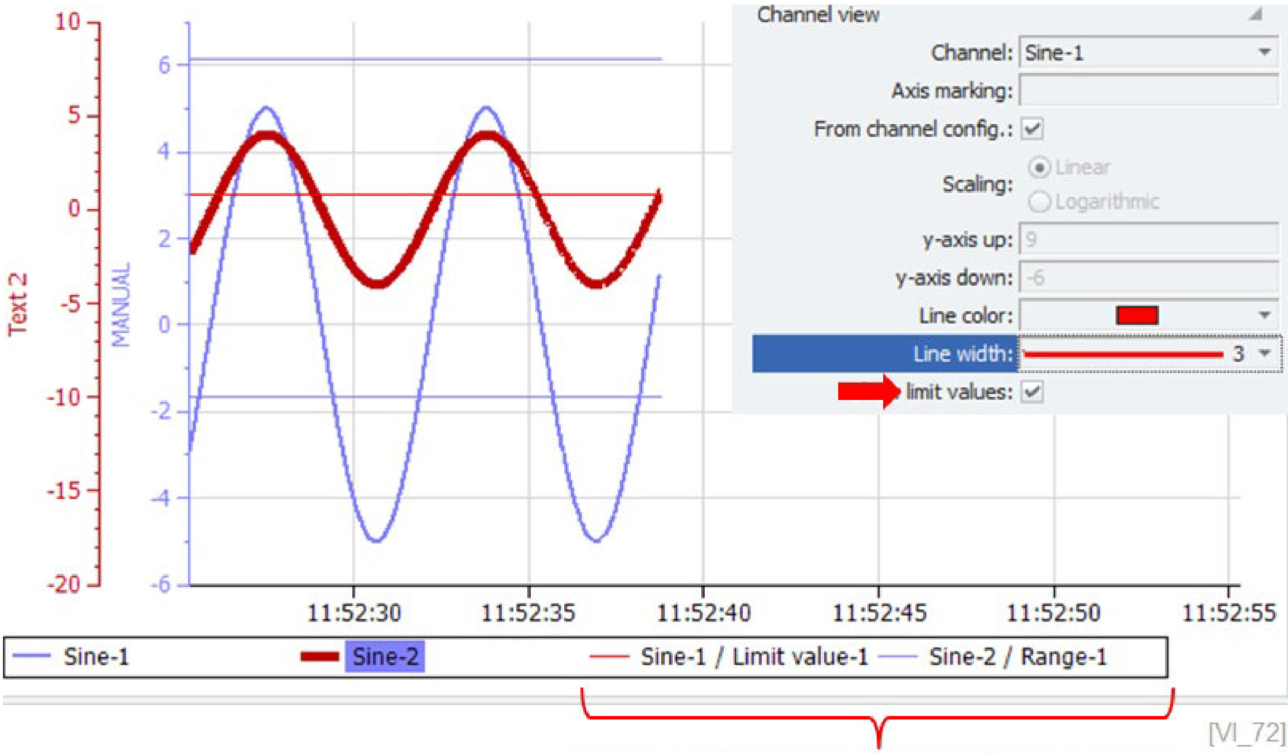




Define graph color and and line width on channel level.

[VI_71]

- **Show limit value** — If a limit channel is associated to the channel in the graph, you can show the limit / threshold line in the diagram. This is applied to the limit channel and the range channel. To see how to configure limit and range channels refer to ACQUISITION >Monitoring in chapter 13.10.

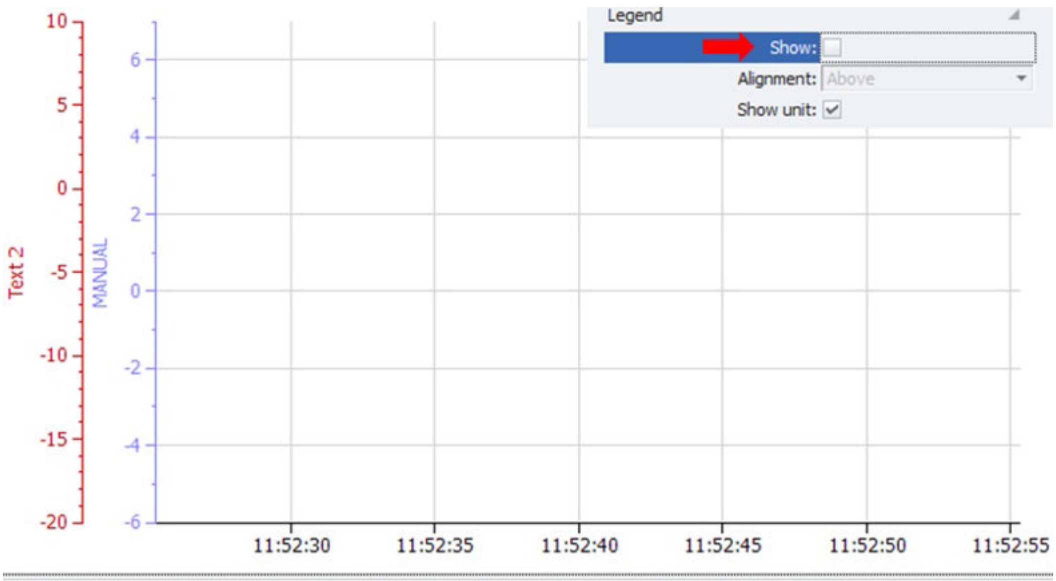


[VI_72]

Limit and Ranges are indicated on the graph.

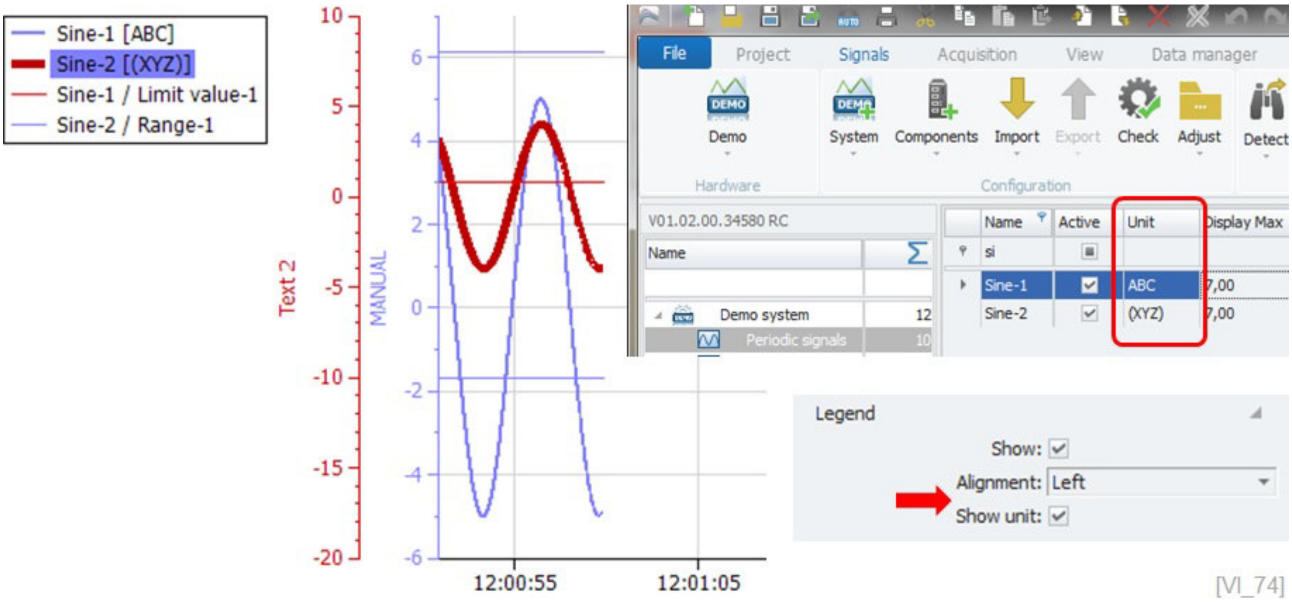
17.7.8 Legend

- **Show** — With this checkbox you enable / disable the visibility of the legend.



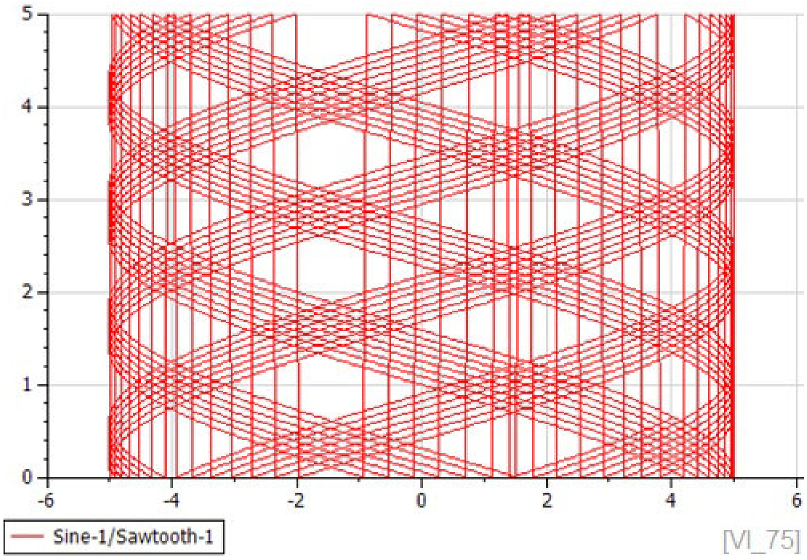
No legend visible. [VI_73]

- **Position** — With position you define the location of the legend: below, above, left, right.
- **Unit** — Units defined in SIGNALS on channel level or in ACQUISITION for calculation channels, variables or scaling channels can be integrated to the legend.



[VI_74]

17.8 x-y chart

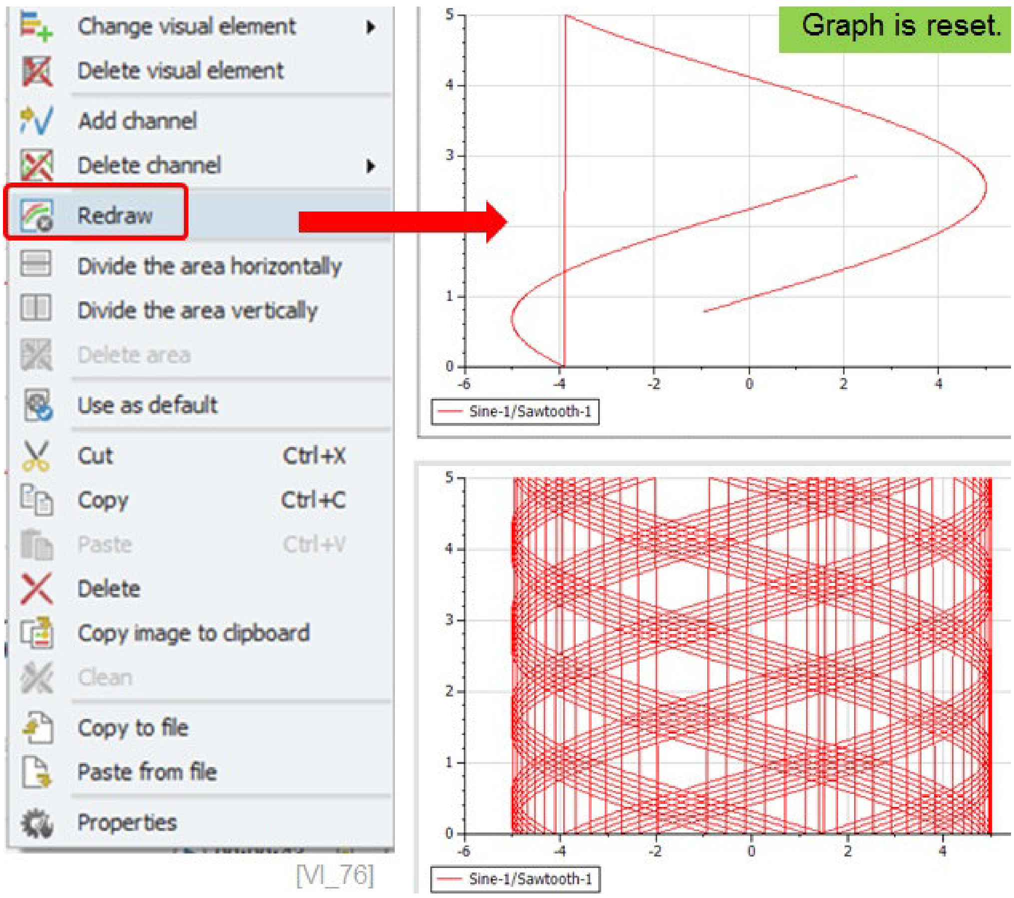


[VI_75]

Information *For details see chapter 17.6.*

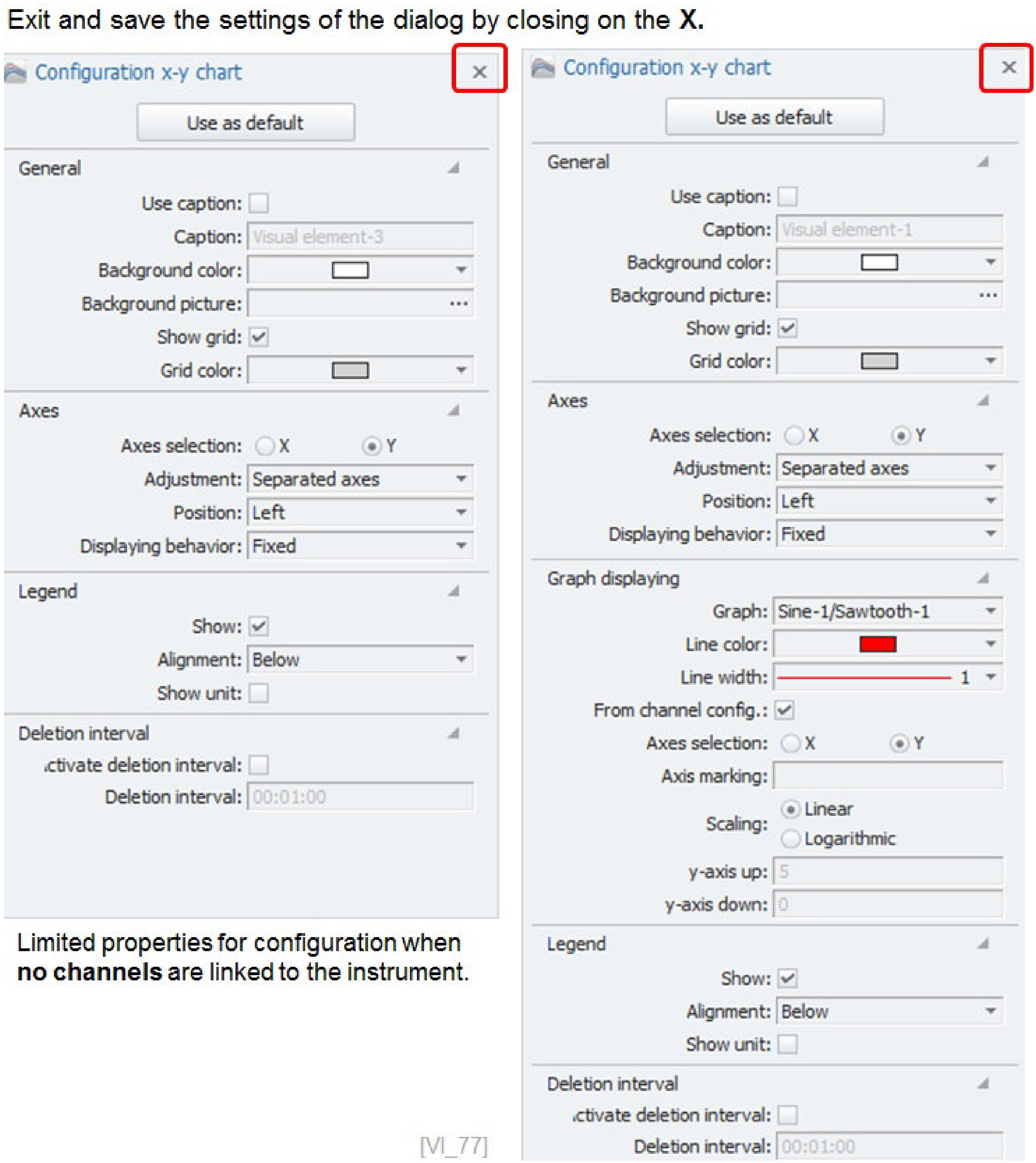
17.8.1 Context menu - Redraw

With the redraw function you can clean up the diagram and remove all lines.



[VI_76]

17.8.2 x-y chart head-up display

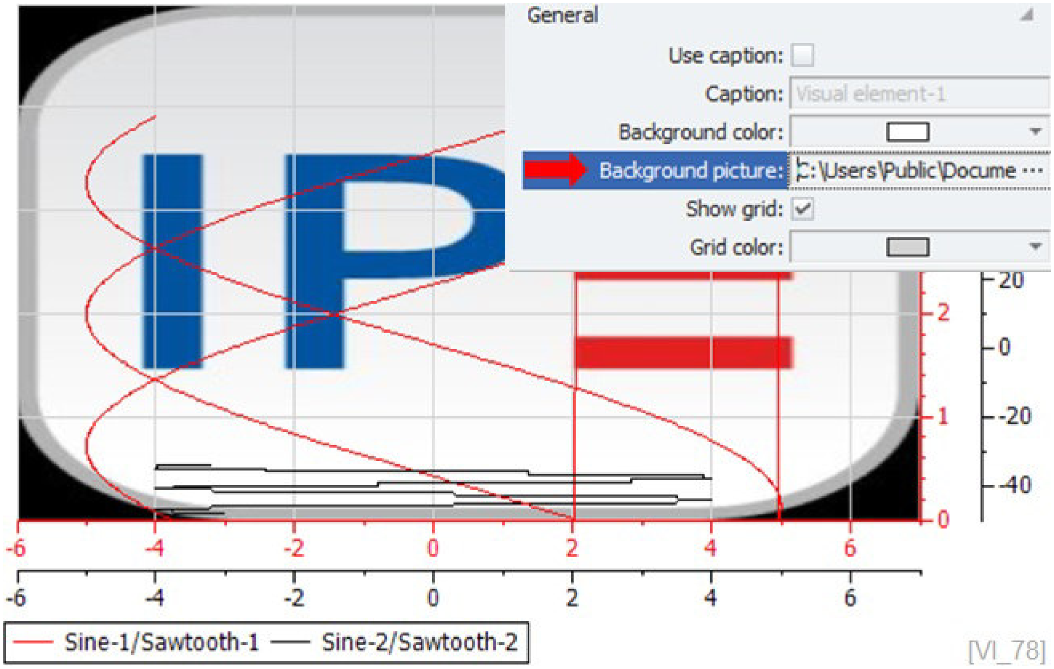


This diagram requires a pair of channels. You need to drag and drop the channels into the diagram in the required order (X >Y). If you like to show force above displacement, you need to drag force (x-channel) and displacement (y-channel) into this order to the diagram.
The first channel is related to the x-axis and the second channel to the y-axis.
You can add several pair (x/y) channel combinations to the diagram.

17.8.3 General

► Background picture

You can relate a background picture to the instrument. Background pictures can be included in the IWF configuration file when activated. See chapter OPTIONS >Frequently used 22.1.2.

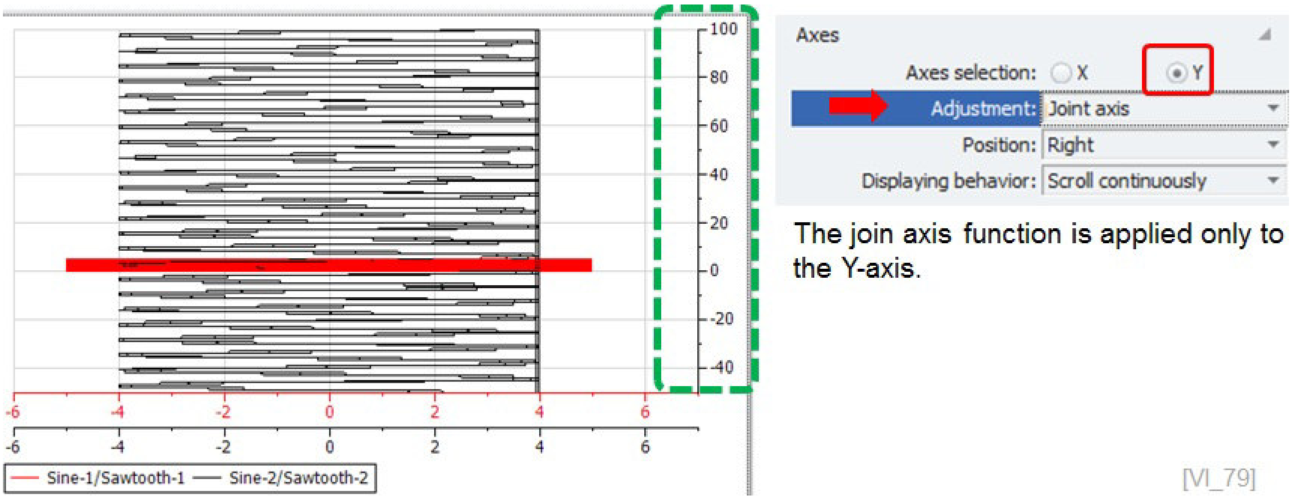


[VI_78]

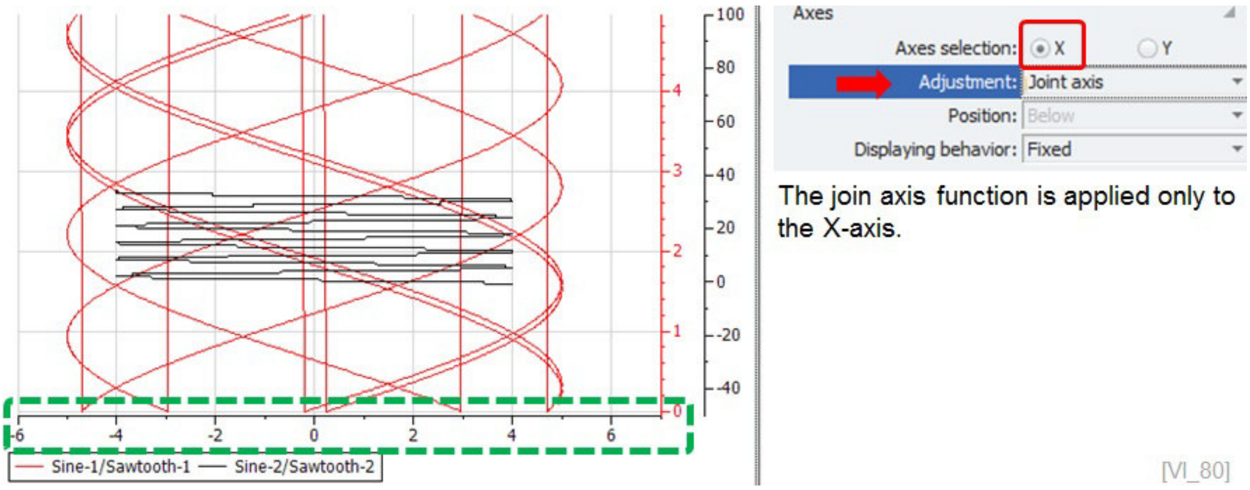
17.8.4 Axes

► X-axis

With the radio button X / Y you can decide which axis is configured. The radio button has an impact on all axes-related settings in this group.

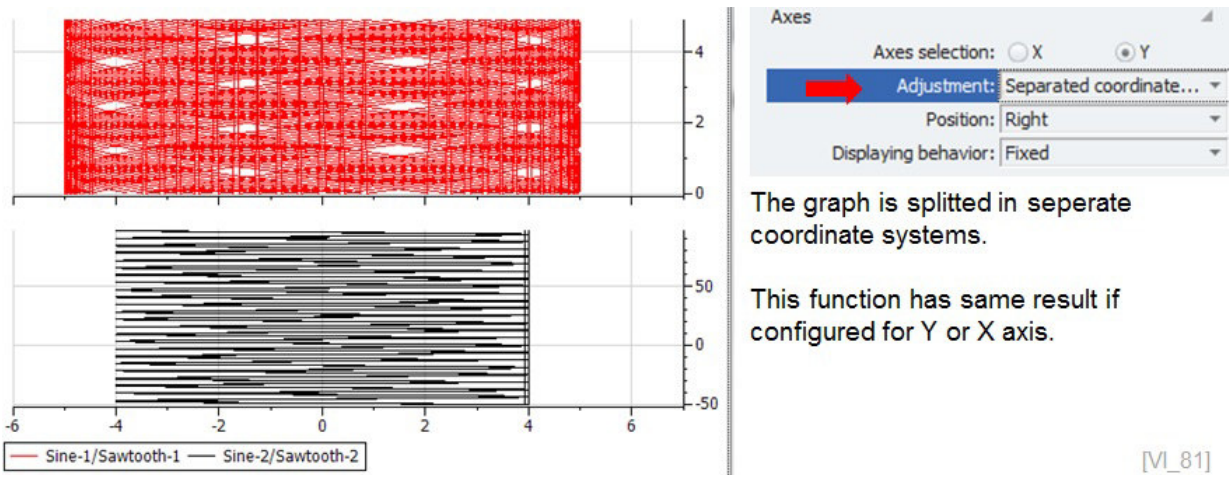


[VI_79]



The join axis function is applied only to the X-axis.

[VI_80]



The graph is splitted in seperate coordinate systems.

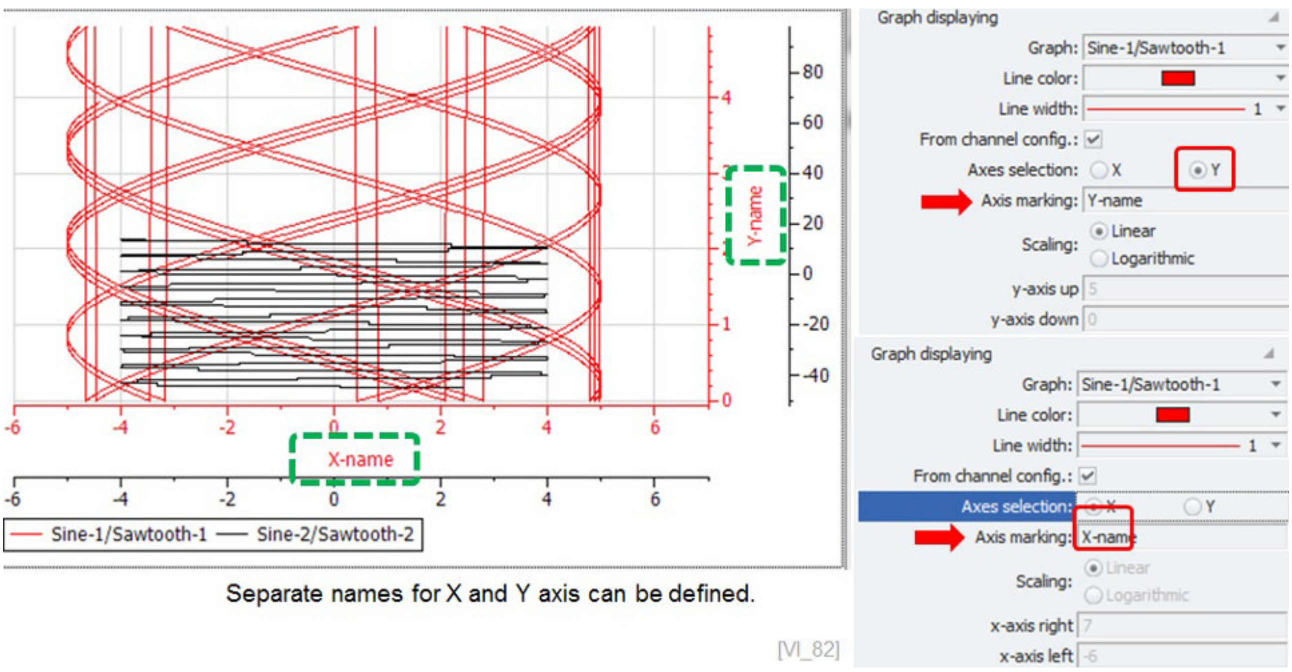
This function has same result if configured for Y or X axis.

[VI_81]

17.8.5 Graph displaying

- Axis selection

With radio button you define the configuration properties of this instrument concerning axis marking, scaling, and the MIN / MAX display. In the screenshot below, the axis marking (name) is demonstrated.



Separate names for X and Y axis can be defined.

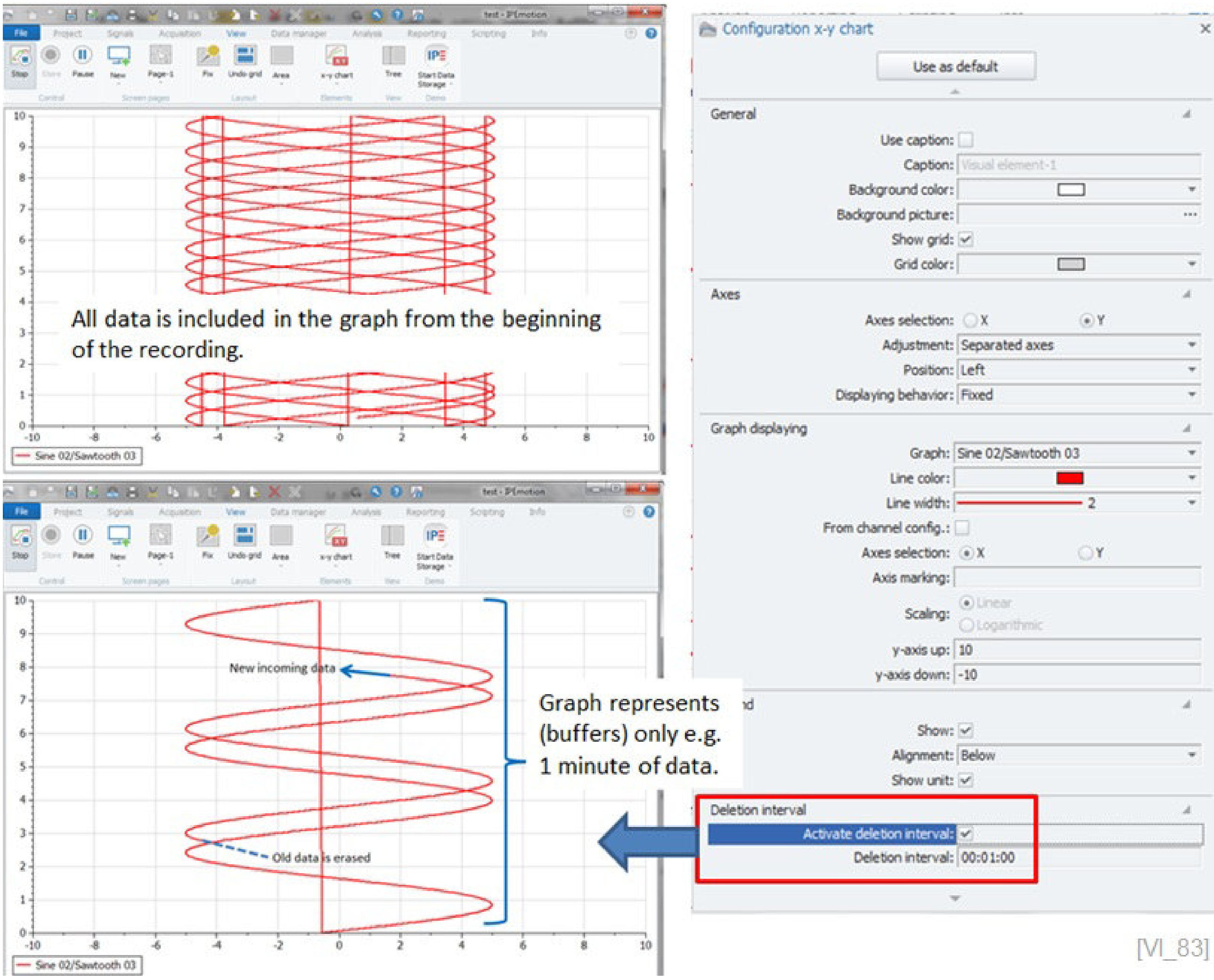
[VI_82]

17.8.6 Legend

See chapter VIEW >Yt-chart [16.7.8]

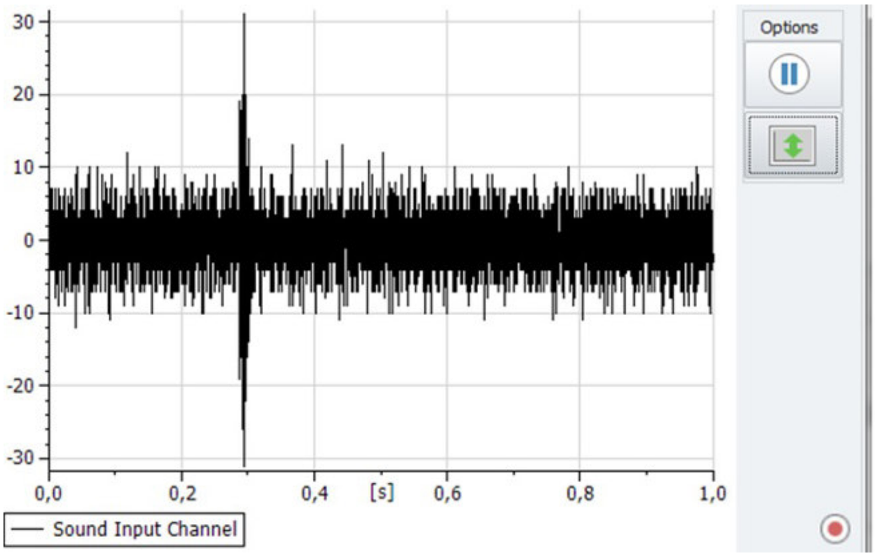
17.8.7 Deletion interval

Over time, plotting Y-X charts leads to graphically overloaded graphs where it is nearly impossible to see the incoming signal. Therefore, a time buffer (deletion interval) can be specified for the period of time in which the data should be displayed. As the screenshot below shows, the lower Y-X chart only shows 1 minute of the latest incoming data. The diagram operates in the LIFO mode where basically the latest incoming data is plotted and at the same time the oldest data is removed. In essence, only one minute of data is displayed in the diagram.



[VI_83]

17.9 Oscilloscope

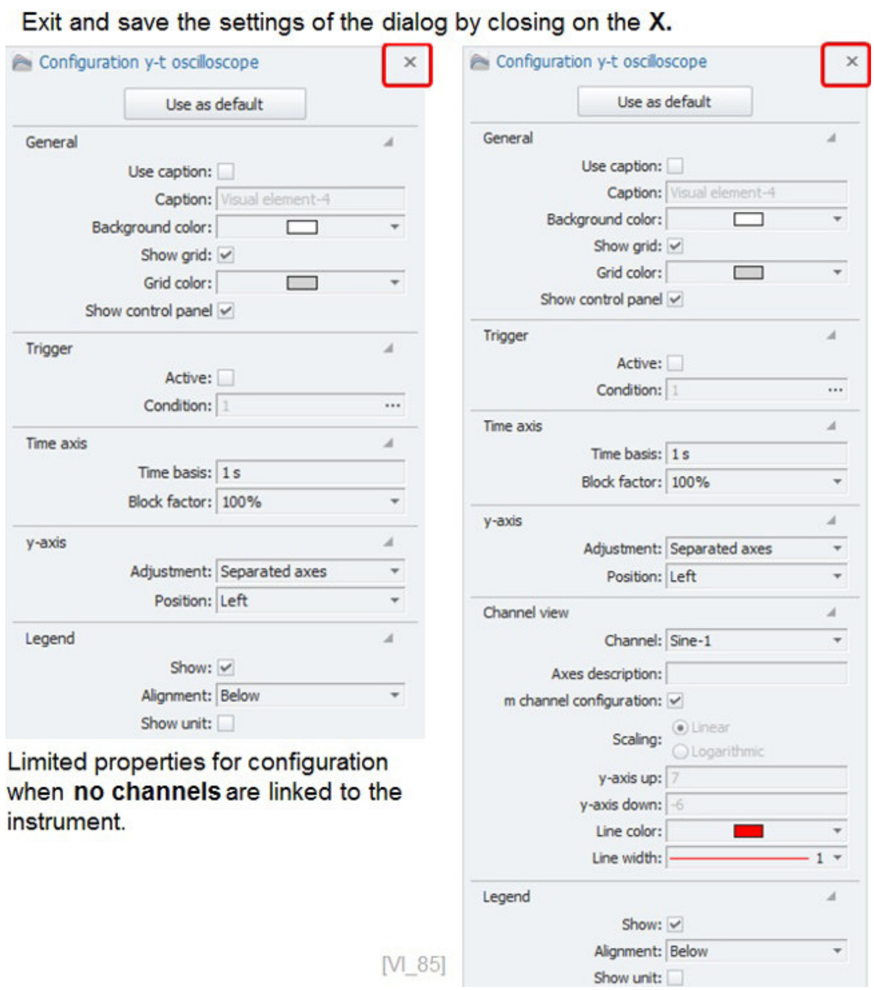


[VI_84]

Information

Only functions differing from the functions of the Yt- chart and the standard context menu, which all instruments share, are explained. For details, see chapter 17.6.

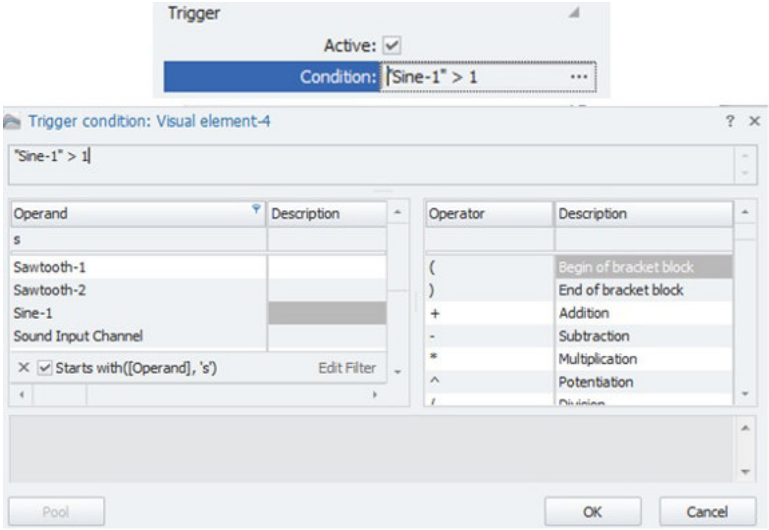
17.9.1 Oscilloscope chart head-up display



[VI_85]

17.9.2 Trigger

If you activate the trigger function, you start the recording of the chart, in case the trigger condition is true.

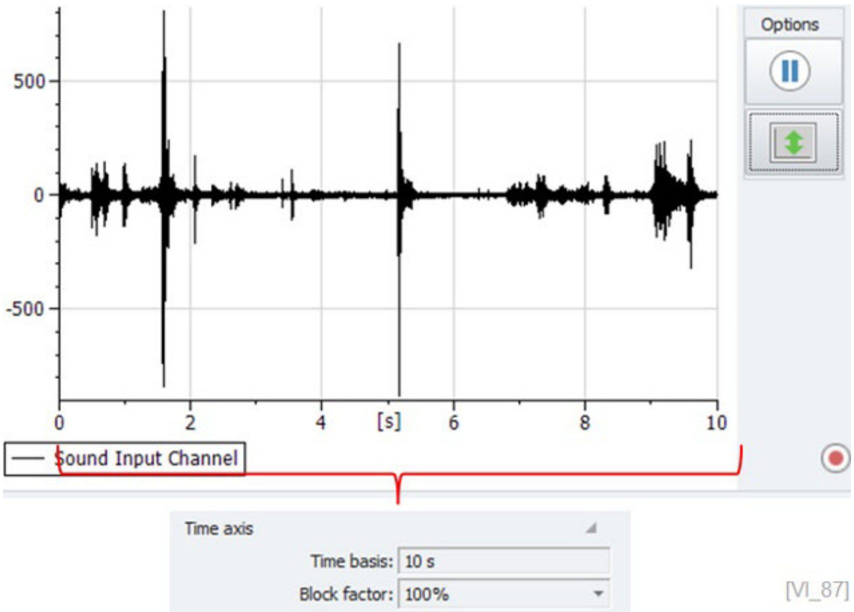


[VI_86]

If the trigger is inactive, the diagram is retriggering itself automatically, based on the time axis setting discussed below.

17.9.3 Time axis

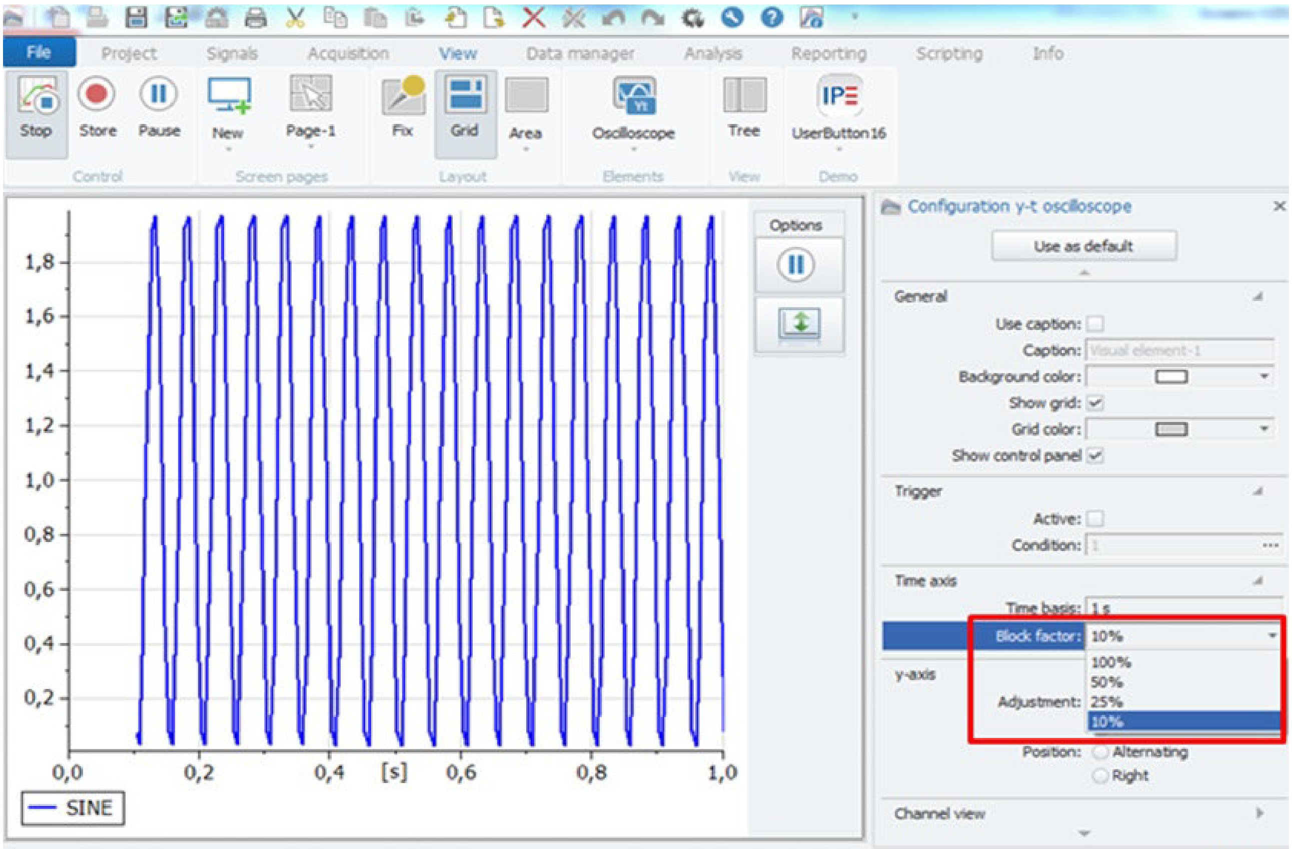
- **Time base** The time base defines the size of the x-axis. The time base has impact on the update refreshing rate. If no trigger condition is defined, the diagram is refreshed according to the time base. In conclusion, large time bases will slow down the update rate because the time has to elapse before the graph can be plotted.



[VI_87]

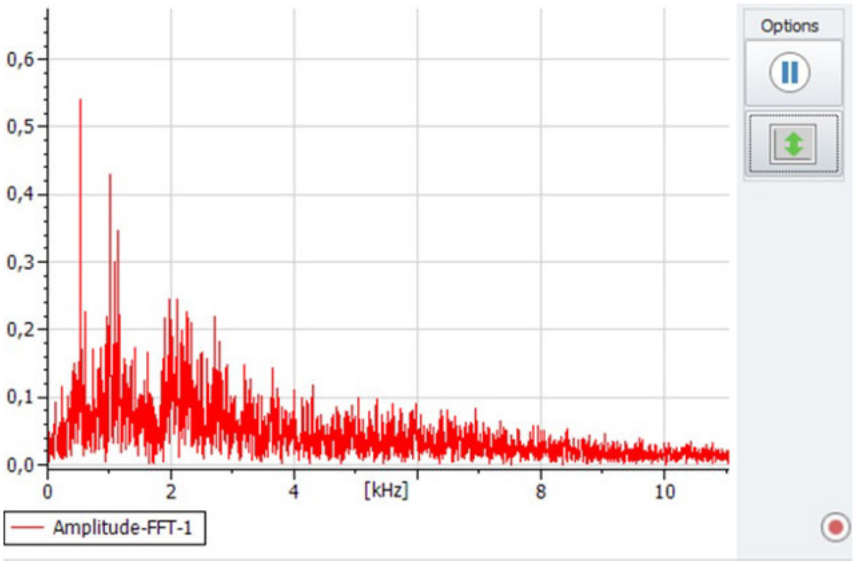
► Block factor

With the block factor setting it is possible to show continuously dynamic signals in the Oscilloscope diagram. Any block factor setting smaller than 100% increases the update rate of the Oscilloscope. For example, if you select a block factor of 10% the oscilloscope will be refreshed 10 times. For example, if the time axis unit is 1 second, every 100 ms a new set of data is loaded into the diagram and the oldest data block is removed.



[VI_88]

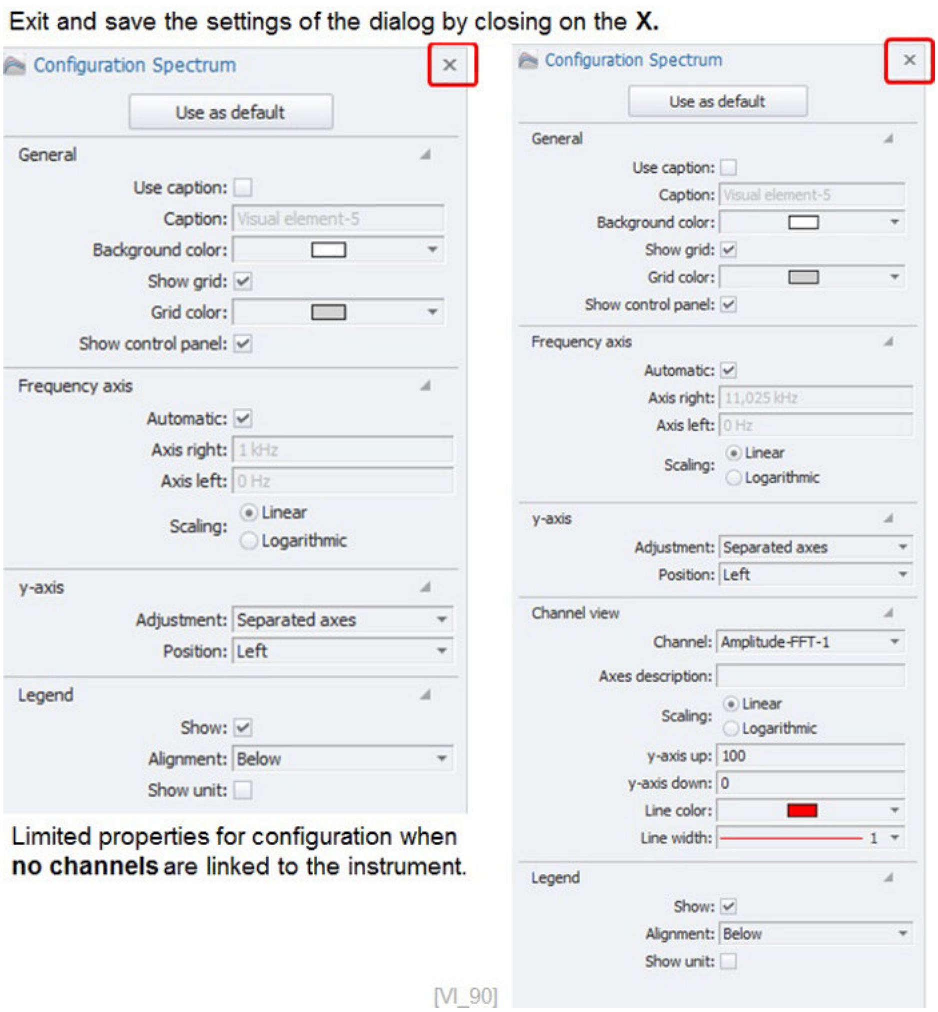
17.10 Spectrum



[VI_89]

Information *Only functions differing from the functions of the Yt- chart and the standard context menu, which all instruments share, are explained. For details, see chapter 17.6.*

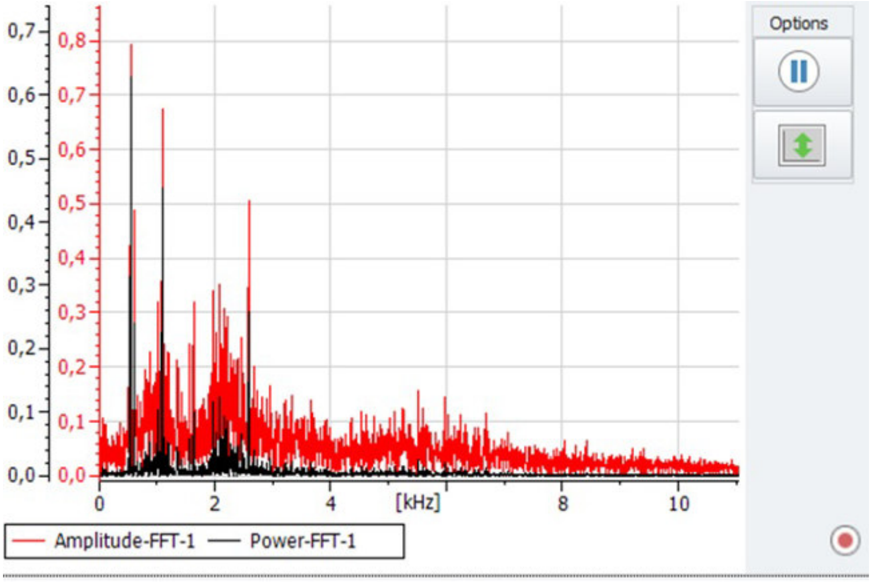
17.10.1 Spectrum head-up display



[VI_90]

17.10.2 FFT Source signal

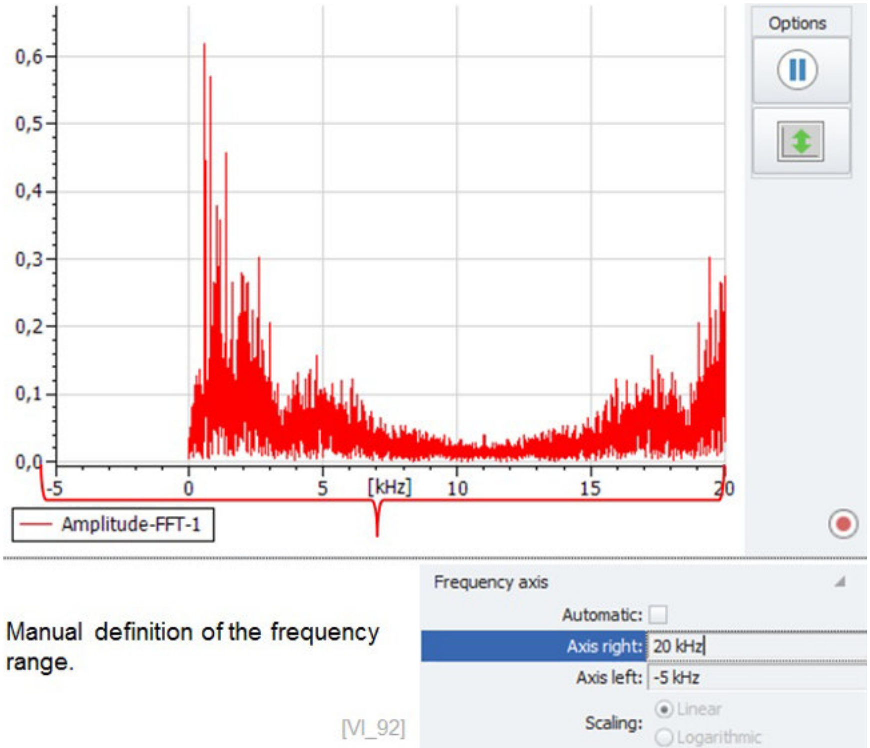
The signal for the FFT is calculated in the ACQUISITION work space. Details about the FFT configuration are discussed in chapter 13.11. You can link several spectrum channels from the same FFT components like (Amplitude, Phase, or Power) to one FFT diagram.



[VI_91]

17.10.3 Frequency axis

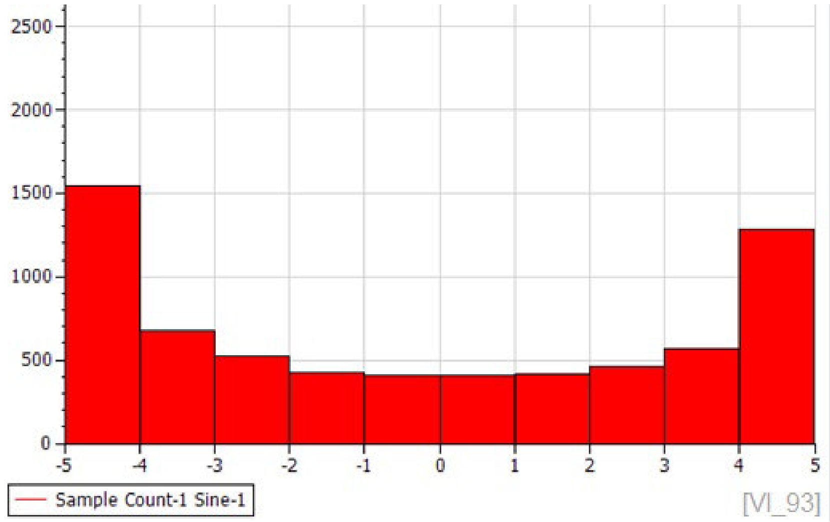
► Autmoatic / manual — If this checkbox is disabled, you can define manual frequency ranges for the x-axis.



Manual definition of the frequency range.

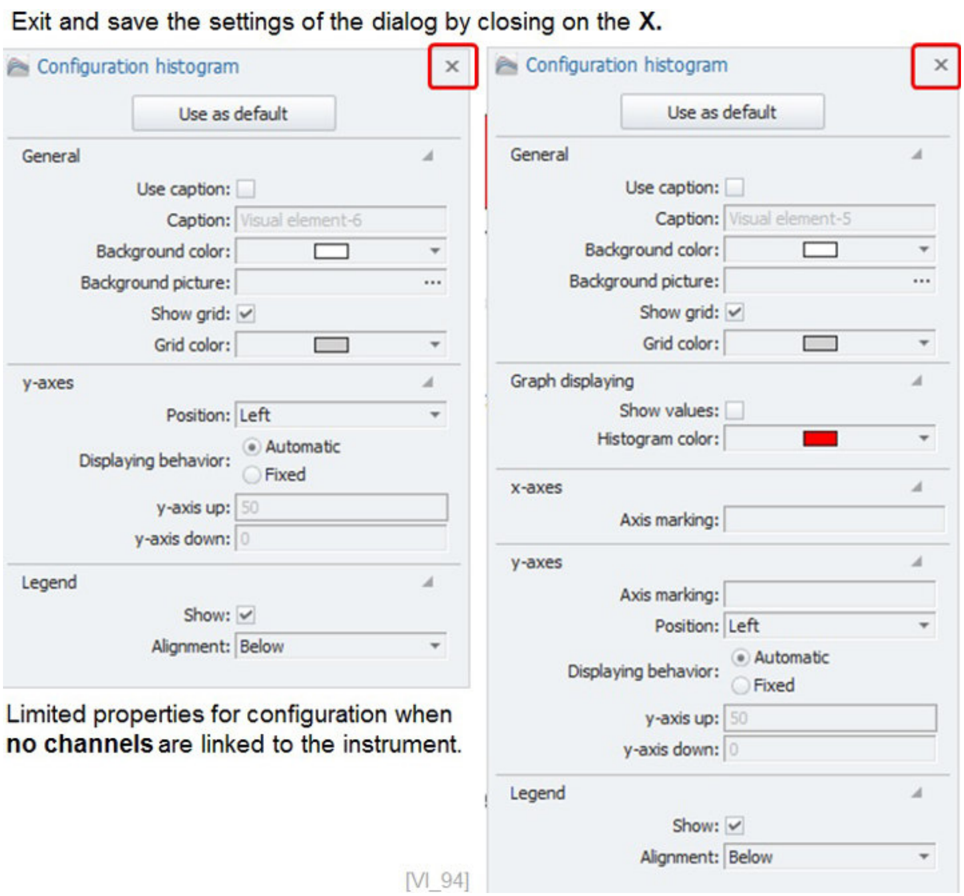
[VI_92]

17.11 Histogram



Information *Only functions differing from the functions of the Yt- chart and the standard context menu, which all instruments share, are explained. For details see chapter 17.6.*

17.11.1 Histogram head-up display

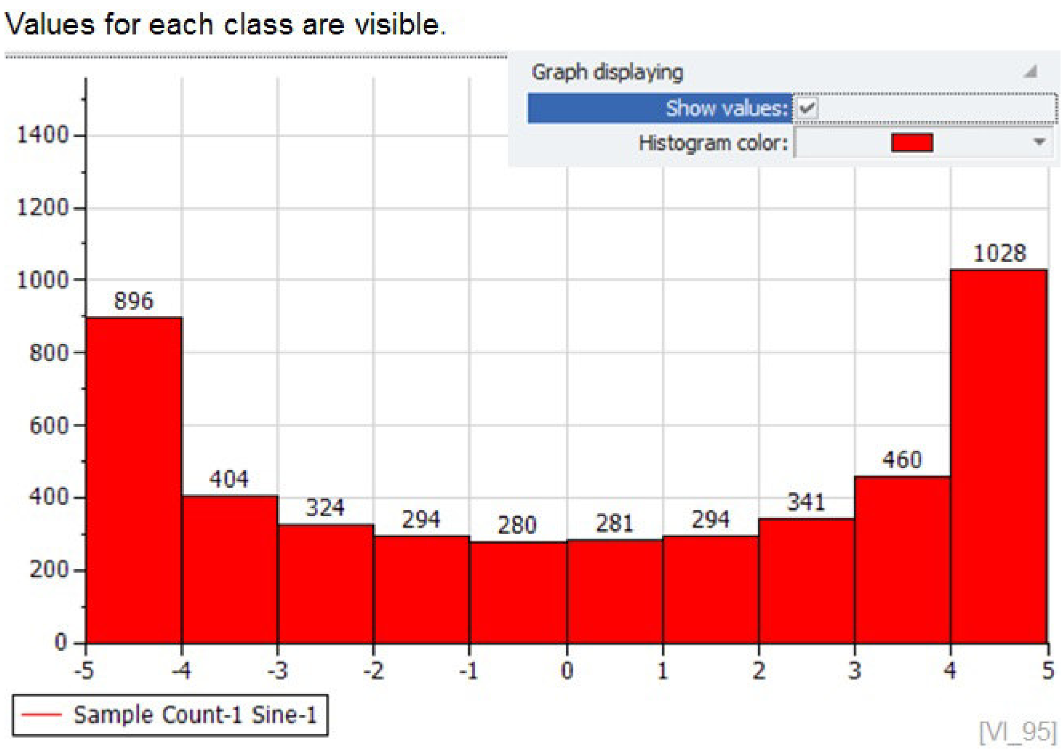


17.11.2 Histogram source signal

The source signal for the classification is calculated in ACQUISITION >Analysis - Classification in chapter 13.12. You can only link one classification channel to one diagram.

17.11.3 Graph displaying

- Show value — If you activate this checkbox, the actual values of each class are displayed
- Color — Here you can define the color of the bars



[VI_95]

17.12 Classification table

17.12.1 1D-Classification

Name	Value
-5 ... -4	1546
-4 ... -3	680
-3 ... -2	553
-2 ... -1	505
-1 ... 0	519
0 ... 1	526
1 ... 2	544
2 ... 3	602
3 ... 4	740
4 ... 5	1692

Sample Count-1 Sine-1

[VI_96]

17.12.2 2D-Classification

	-5	-4	-3	-2	-1 ... 0	0 ... 1	1 ... 2	2 ... 3	3 ... 4	4 ... 5
-5 ... -4	0	0	0	0	0	58	0	0	0	200
-4 ... -3	0	0	0	0	0	114	0	0	0	0
-3 ... -2	0	0	0	0	0	92	0	0	0	0
-2 ... -1	0	0	0	0	0	85	0	0	0	0
-1 ... 0	0	0	0	0	0	42	0	0	0	38
0 ... 1	0	0	0	0	0	13	0	0	0	92
1 ... 2	0	0	0	0	0	0	0	0	0	126
2 ... 3	0	0	0	0	0	0	0	0	0	138
3 ... 4	0	0	0	0	0	24	0	0	0	150
4 ... 5	0	0	0	0	0	376	0	0	0	94

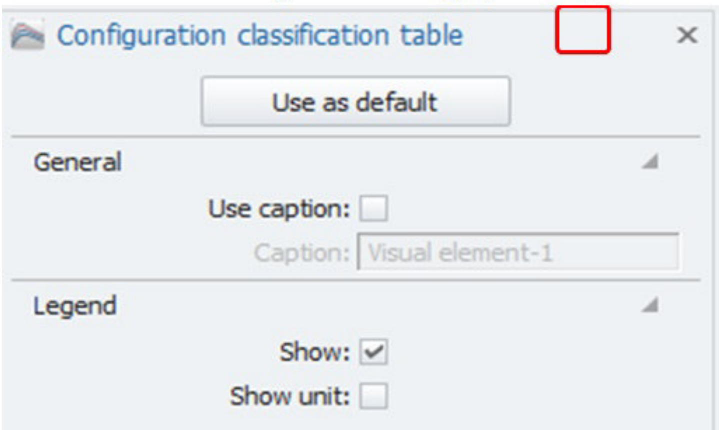
Sample Count Compound-1 channel-1

[VI_97]

Information *Only functions differing from the functions of the Yt- chart and the standard context menu, which all instruments share, are explained. For details, see chapter 17.6.*

17.12.3 Classification table head-up display

Exit and save the settings of the dialog by closing on the **X.**

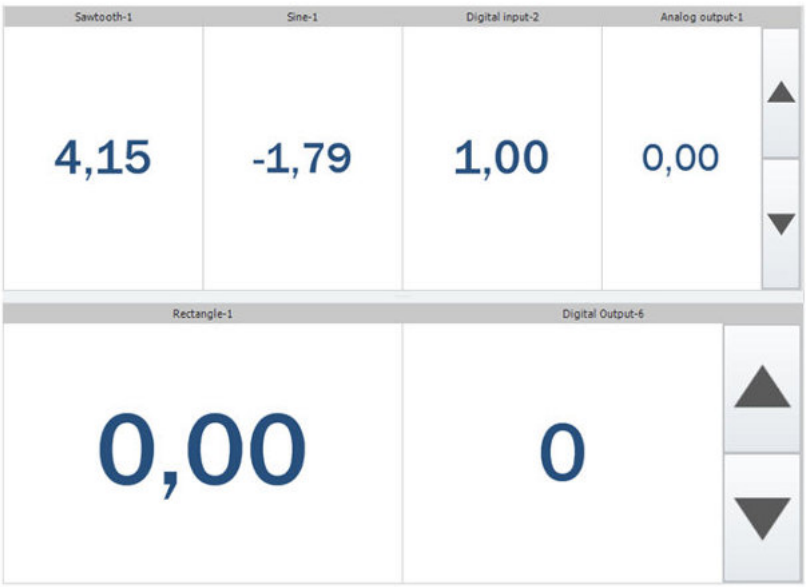


[VI_98]

17.12.4 Classification table source signal

The source signal for the classification table is calculated in ACQUISITION >Analysis - Classification in chapter 13.12. You can only link one classification channel to one diagram. The table instrument is relevant for 2D classification methods where the classification is applied to channels. 2D classification results cannot be displayed in a Histogram instrument.

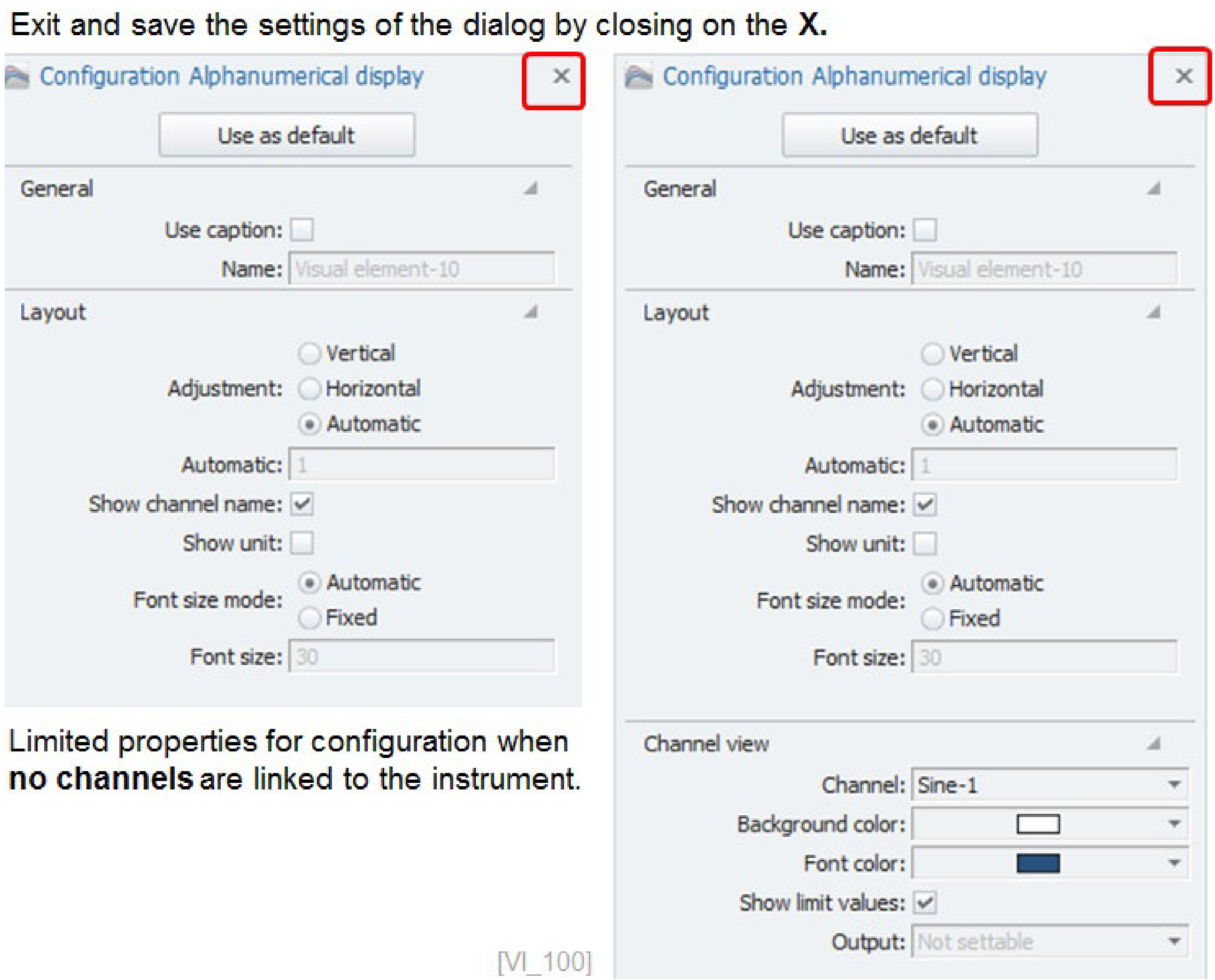
17.13 Alphanumerical



[VI_99]

Information *Only functions differing from the functions of the Yt- chart and the standard context menu, which all instruments share, are explained. For detail,s see chapter 17.6.*

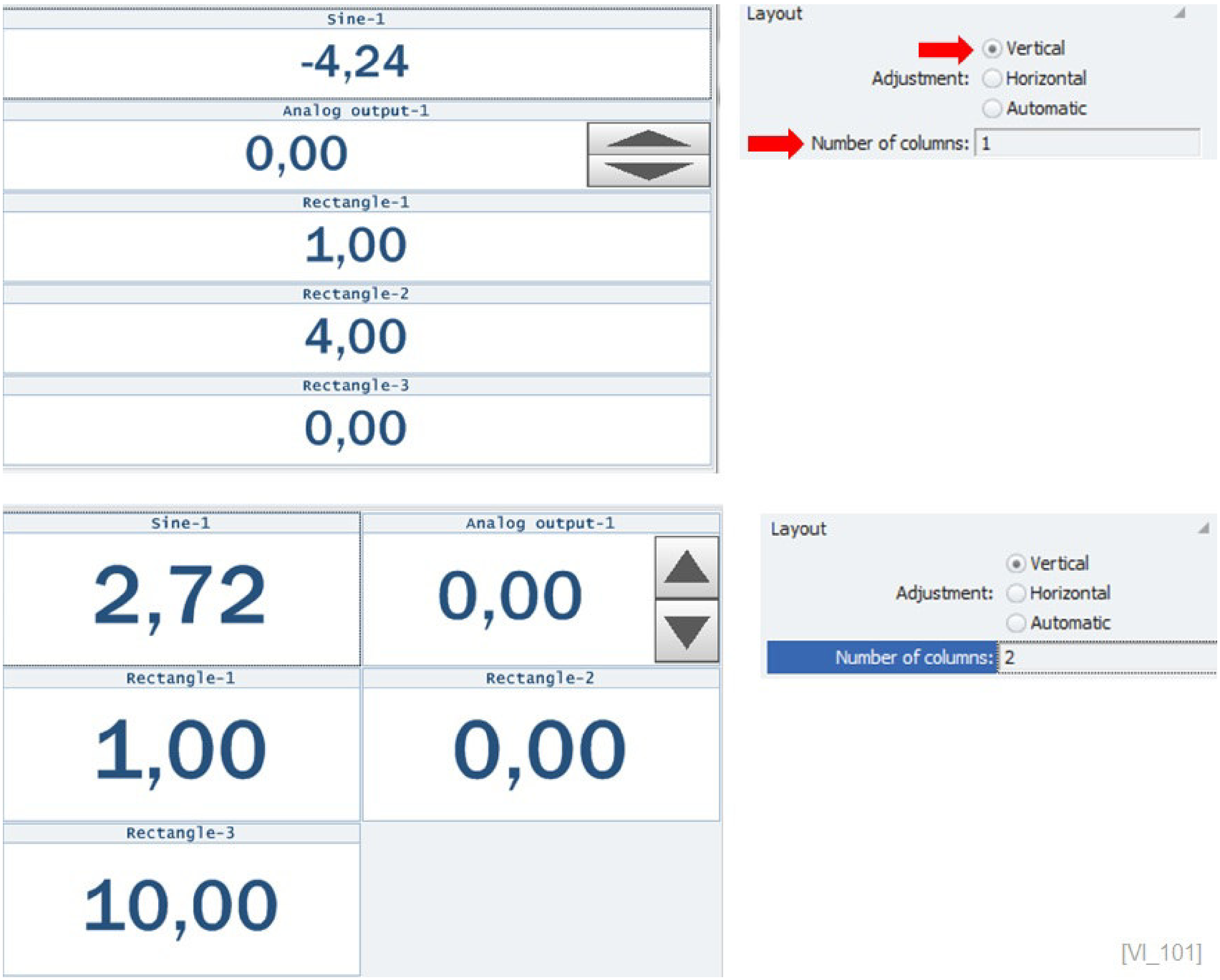
17.13.1 Alphanumerical head-up display



[VI_100]

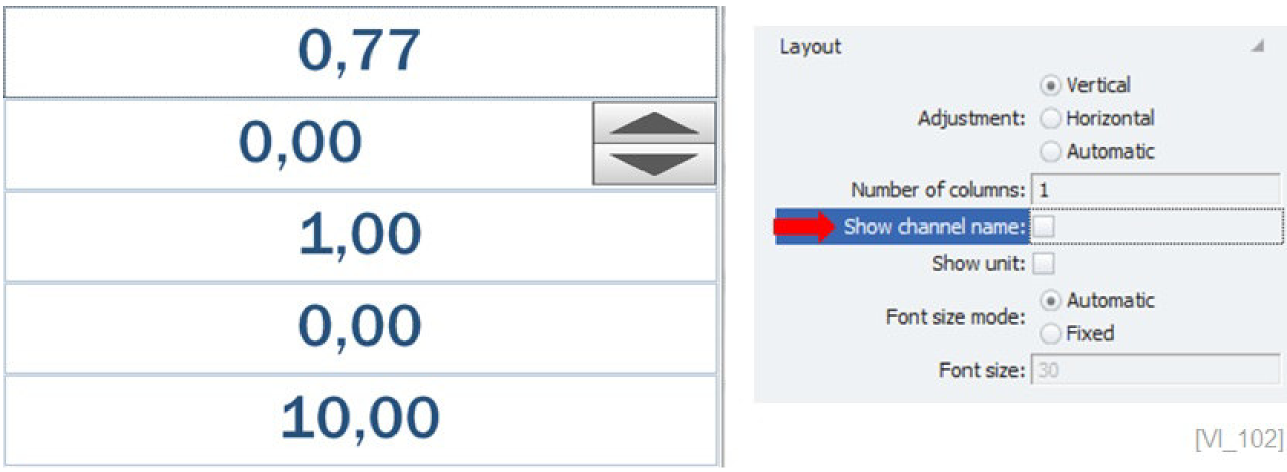
17.13.2 Layout

- ► Adjustment Horizontal — Arranging instruments in a horizontal order. With the number of columns you can influence the vertical column arrangement of the horizontal row arrangement
- ► Vertical — Arranging instruments in a vertical order.



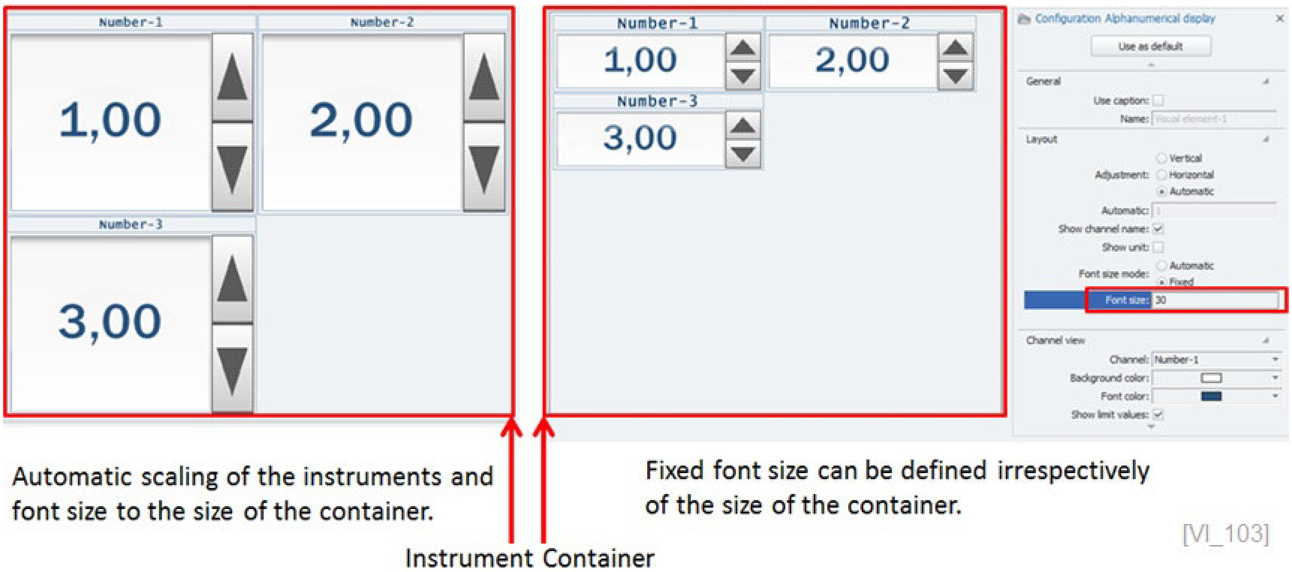
[VI_101]

- ► Automatic — Automatic arranging of the instruments
- ► Channel name — If you deactivate this checkbox, the channel name is removed



[VI_102]

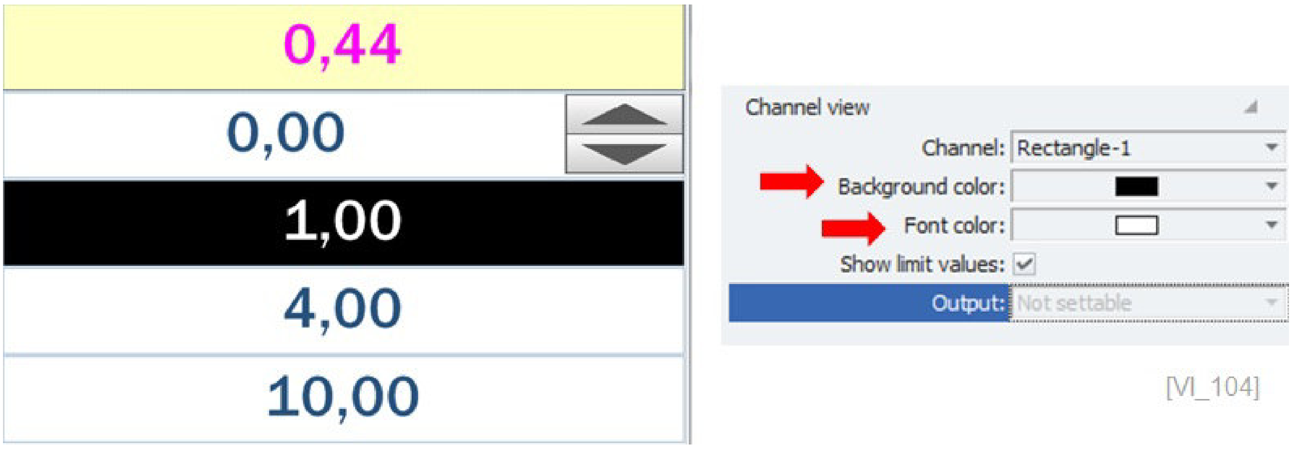
- **Font size mode** The alphanumerical display gives users more flexibility to build their GUI interfaces with defined font sizes. This function is very convenient for large applications which use many alphanumerical display instruments because they can be implied in a small instrument container and even show the values (text or number) in large font size. If the container is smaller than the instrument, scroll bars will appear.



[VI_103]

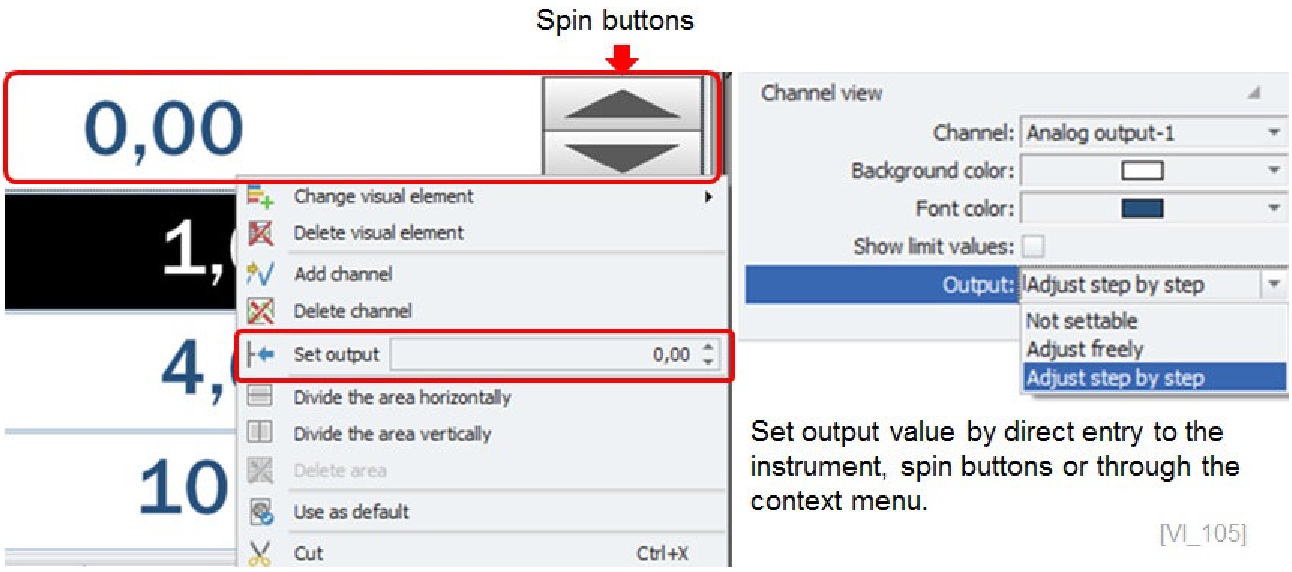
17.13.3 Channel view

- ► Background color — You can define an individual background color for each channel.
- ► Font color — You can define an individual font color for each channel.



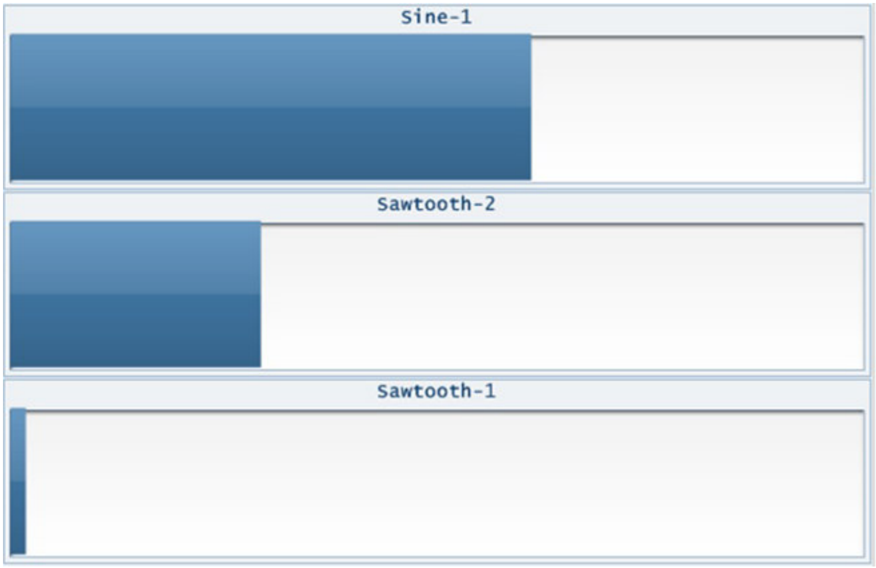
[VI_104]

- ► Output — If you link an output channel or a variable channel to the alphanumerical instrument, spin buttons will appear. For output channels, three configuration options are available: No input (blocked) / free entry / use spin buttons for up / down setting. You can see the data direction Input / Output in the SIGNALS work space >Channel >Format tab sheet in chapter 11.6.4.



[VI_105]

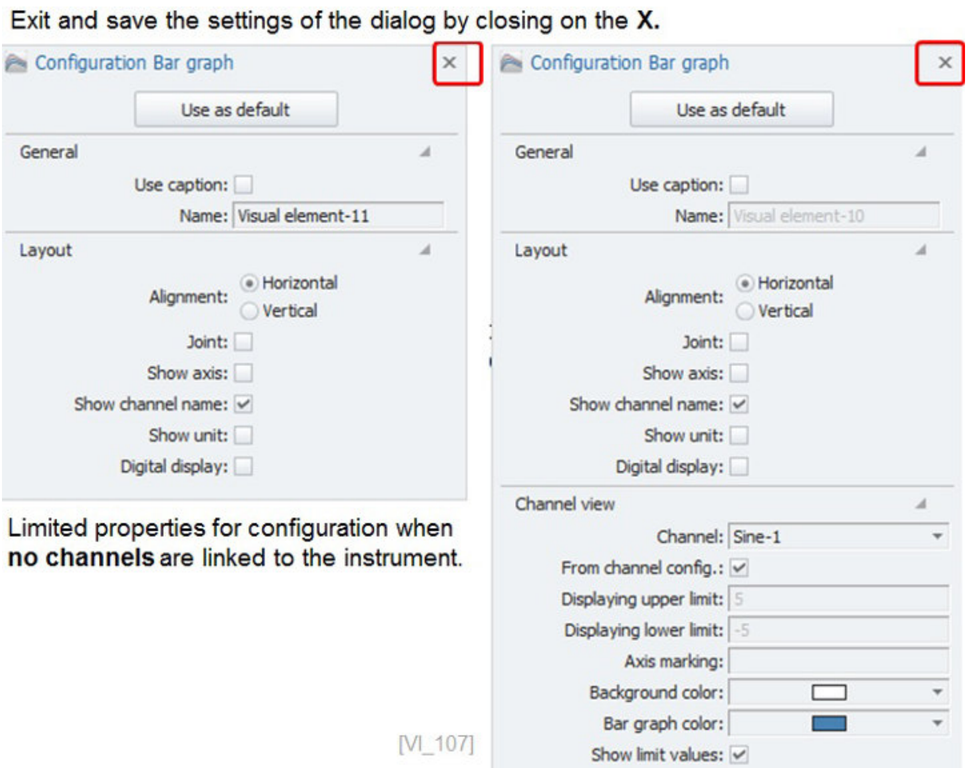
17.14 Bar graph



[VI_106]

Information *Only functions differing from the functions of the Yt- chart and the standard context menu, which all instruments share, are explained. For detail,s see chapter 17.6.*

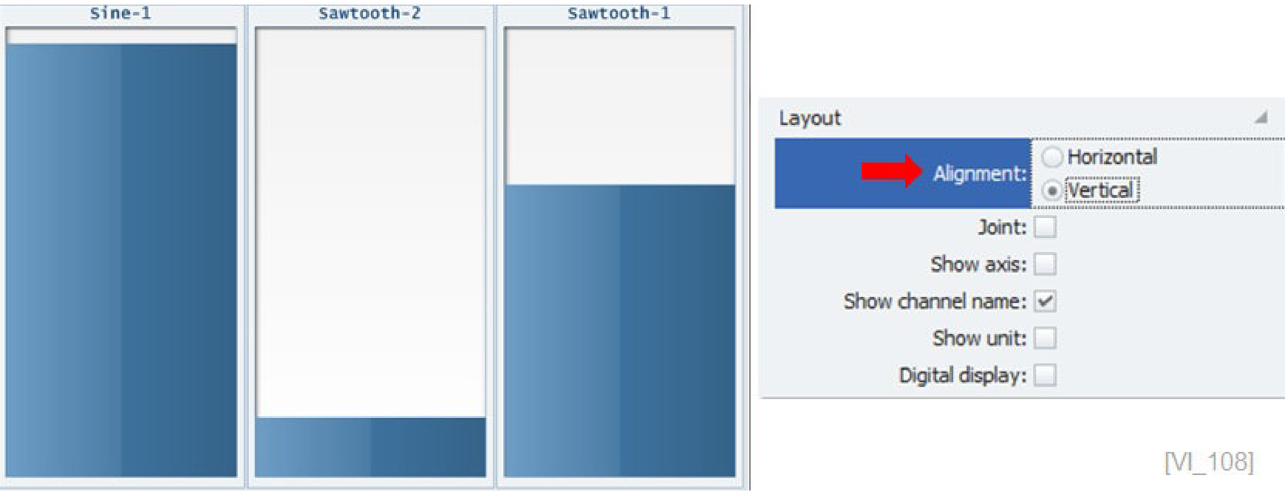
17.14.1 Bar graph head-up display



[VI_107]

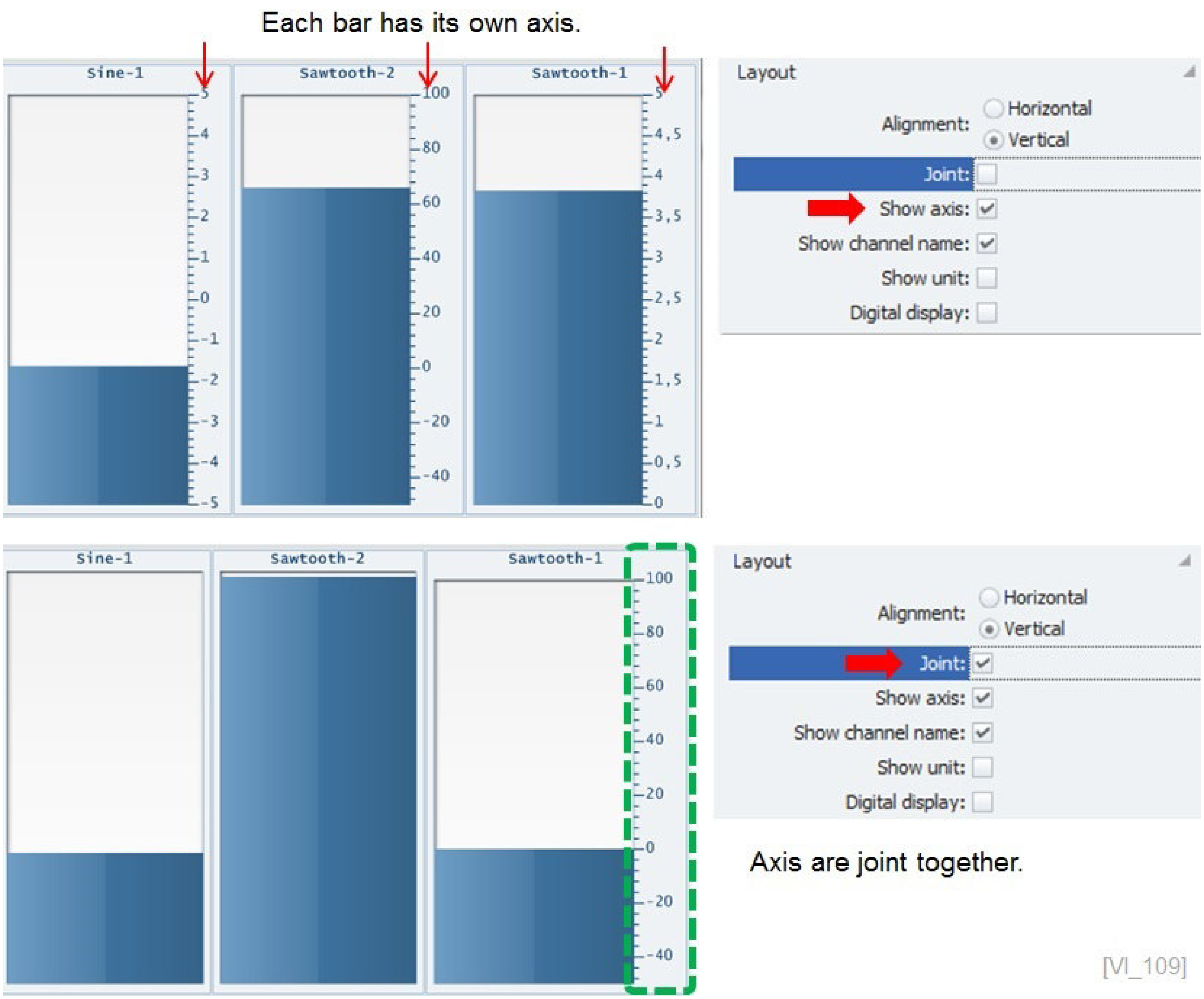
17.14.2 Layout

- Alignment — With alignment, you can change the orientation of the bars from horizontal to vertical.



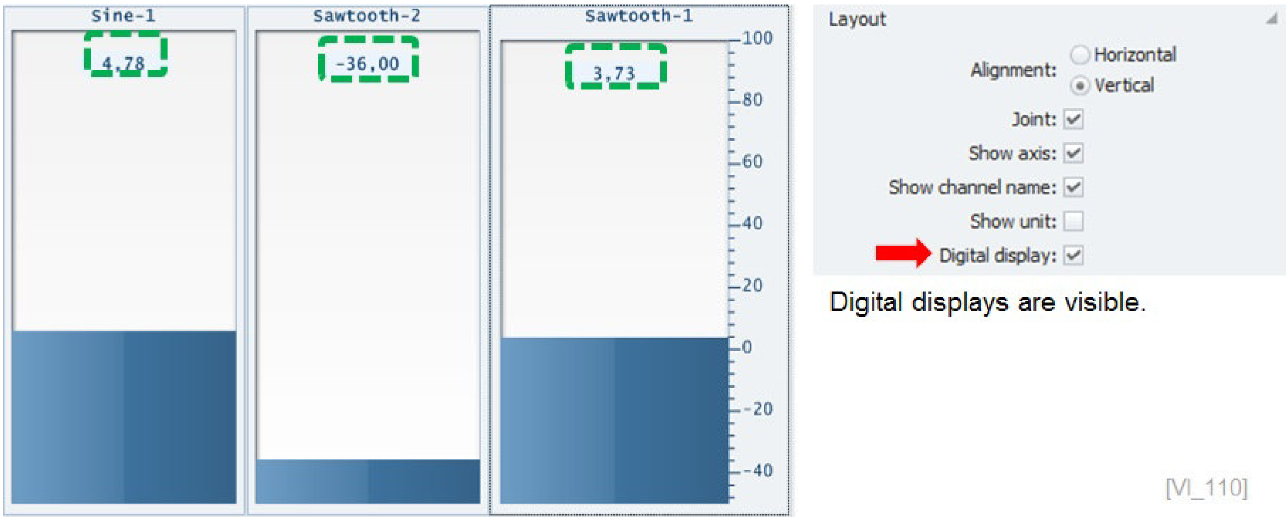
[VI_108]

- **Joint** — The joint checkbox is related to the axis and becomes effective as soon as the show axis checkbox is activated
- **Show axis** — This checkbox will show the display MIN / MAX range defined on channel level in the SIGNALS work space and to formula channels or variables channels.



[VI_109]

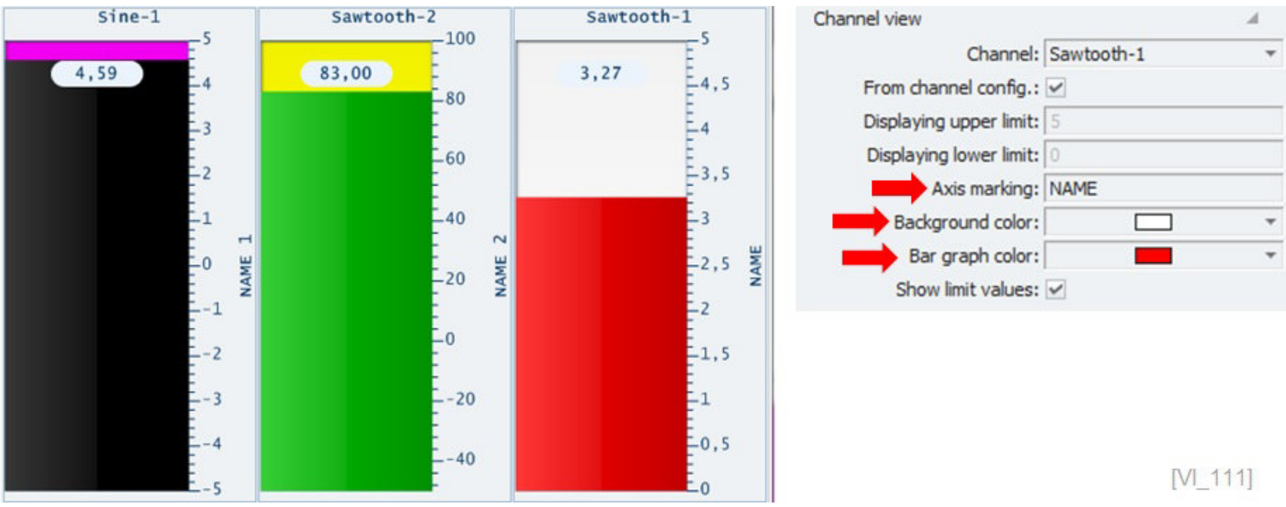
- Show channel name — With this checkbox you can remove the channel name as discussed in the chapter about the alphanumerical instrument 17.13.2.
- Digital displays — With this checkbox you can activate digital displays in the instrument for each bar.



[VI_110]

17.14.3 Channel view

- Axis marking — Refers to the name of the axis. A name can be defined for each bar.
- Background color — Refers to the background color. A background color can be defined for each bar.
- Bar graph color — Refers to the bar color which can be defined on bar / channel level.



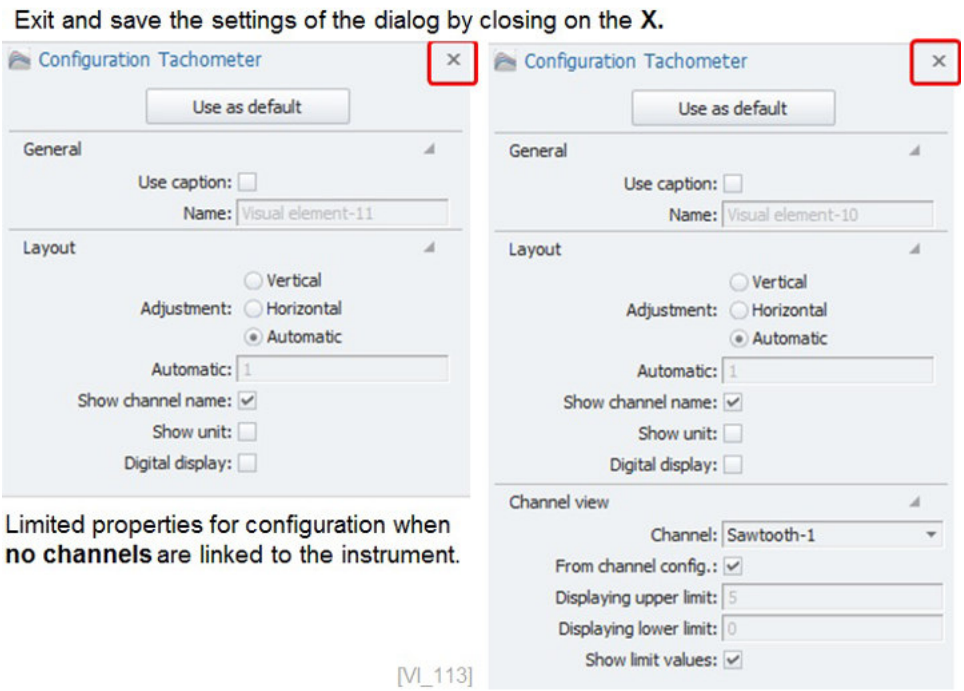
[VI_111]

17.15 Tachometer

[VI_112]

Information *Only functions differing from the functions of the Yt- chart and the standard context menu, which all instruments share, are explained. For details see chapter 17.6.*

17.15.1 Tachometer head-up display



[VI_113]

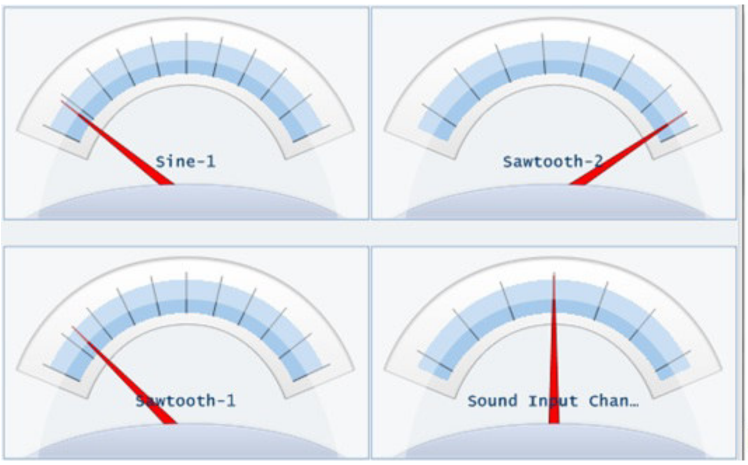
17.15.2 Layout

See alphanumerical instrument 17.13.2.

17.15.3 Channel view

Has already been discussed.

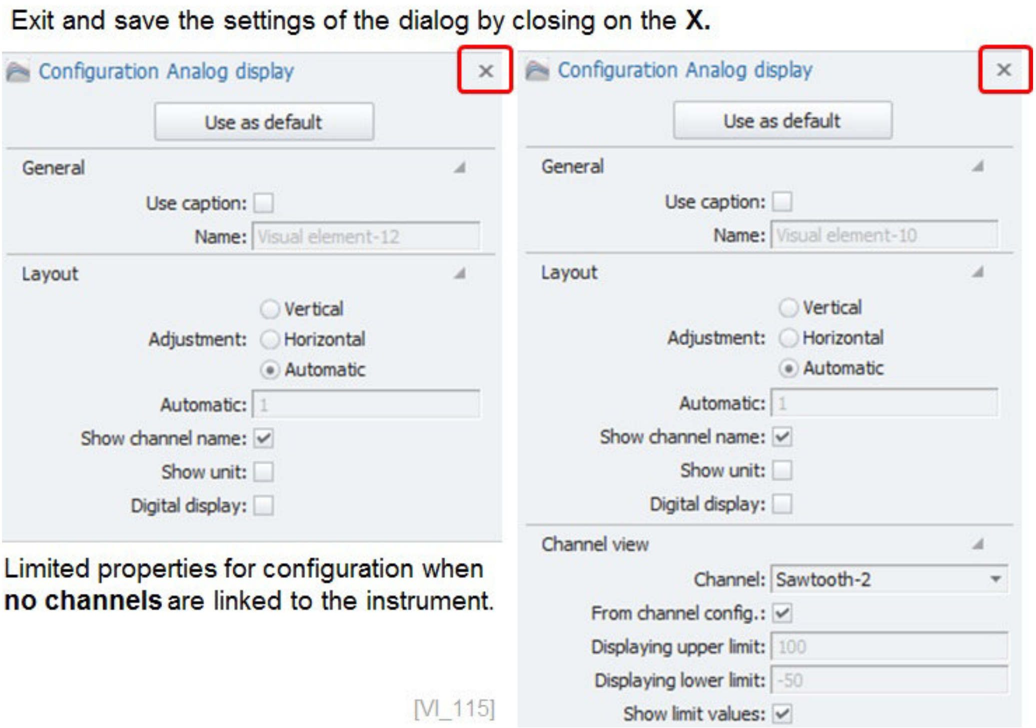
17.16 Analog



[VI_114]

Information	*Only functions differing from the functions of the Yt- chart and the standard context menu, which all instruments share, are explained. For details see chapter 17.6.*

17.16.1 Analog head-up display



[VI_115]

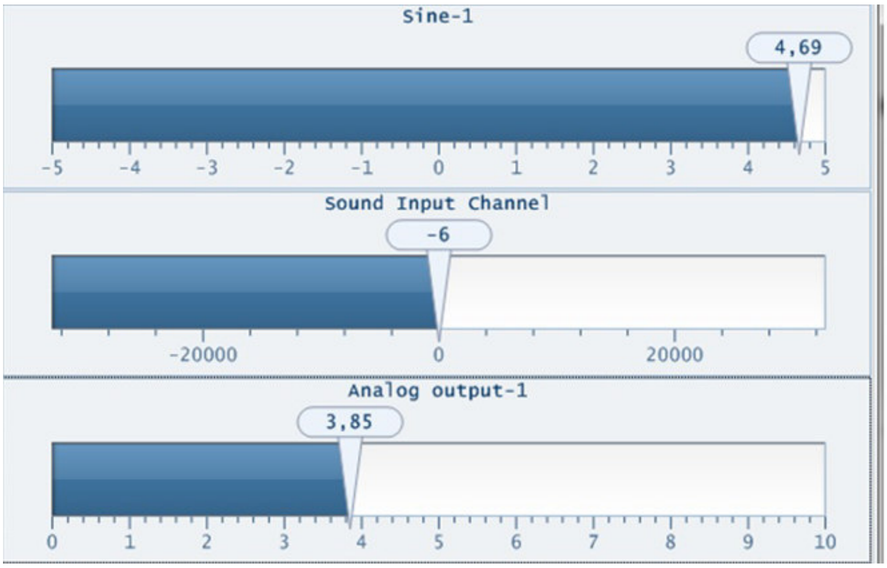
17.16.2 Layout

See tachometer instrument 17.15.

17.16.3 Channel view

Has already been discussed.

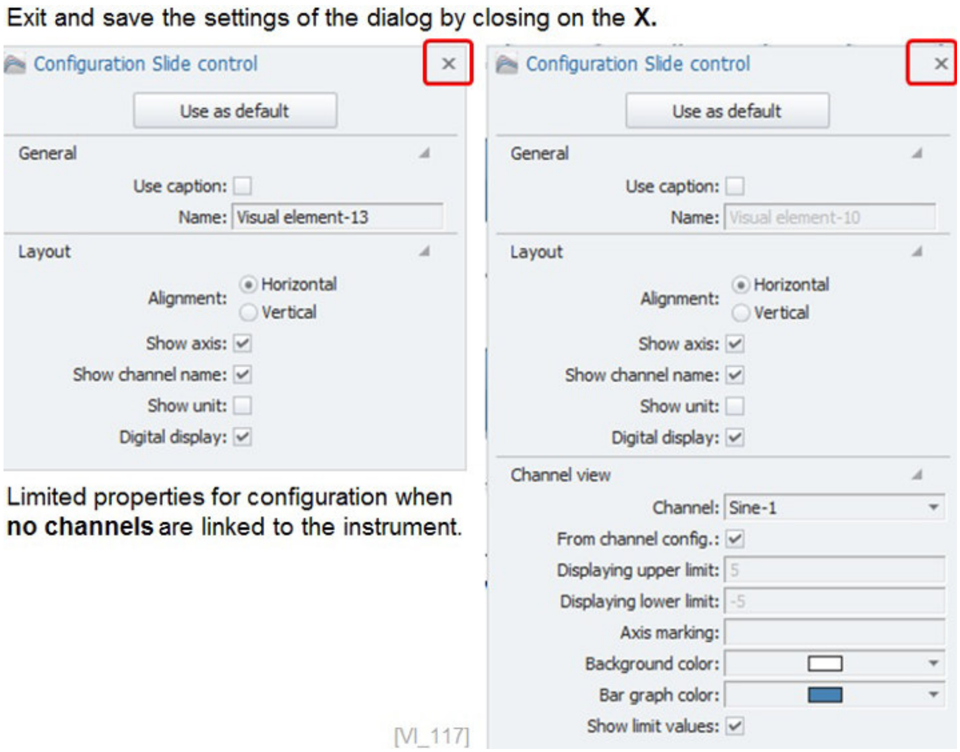
17.17 Slide Controller



[VI_116]

Information *Only functions differing from the functions of the Yt- chart and the standard context menu, which all instruments share, are explained. For details see chapter 17.6.*

17.17.1 Slide controller head-up display



[VI_117]

17.17.2 Layout

See bar graph instrument 17.14.2.

17.17.3 Channel view

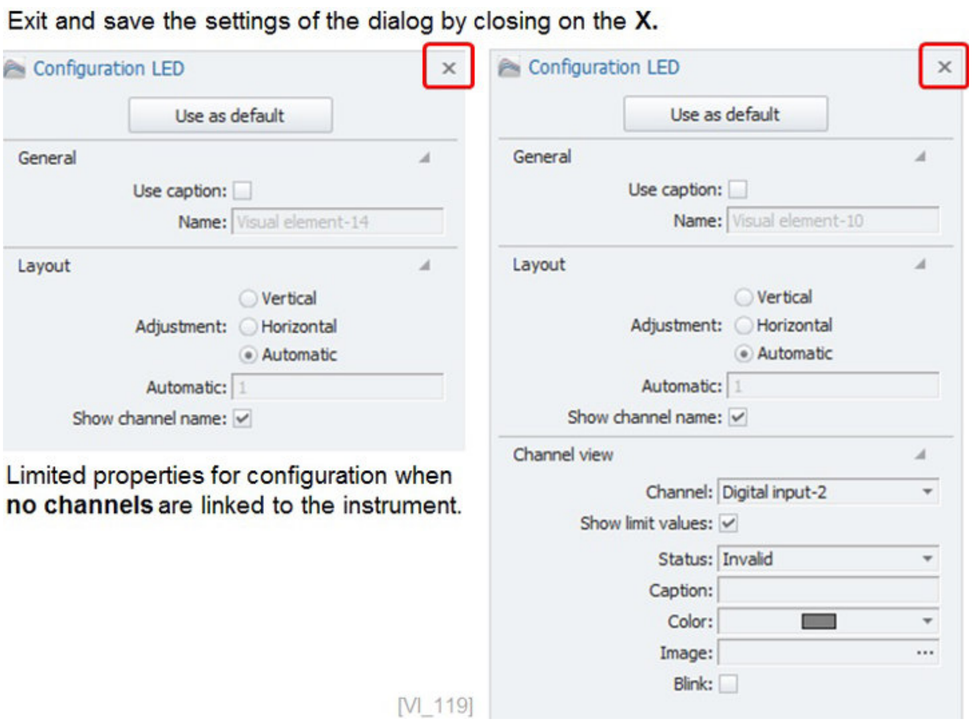
See bar graph instrument 17.14.2.

17.18 LED

[VI_118]

	Information	*Only functions differing from the functions of the Yt- chart and the standard context menu, which all instruments share, are explained. For details see chapter 17.6.*

17.18.1 LED head-up display



[VI_119]

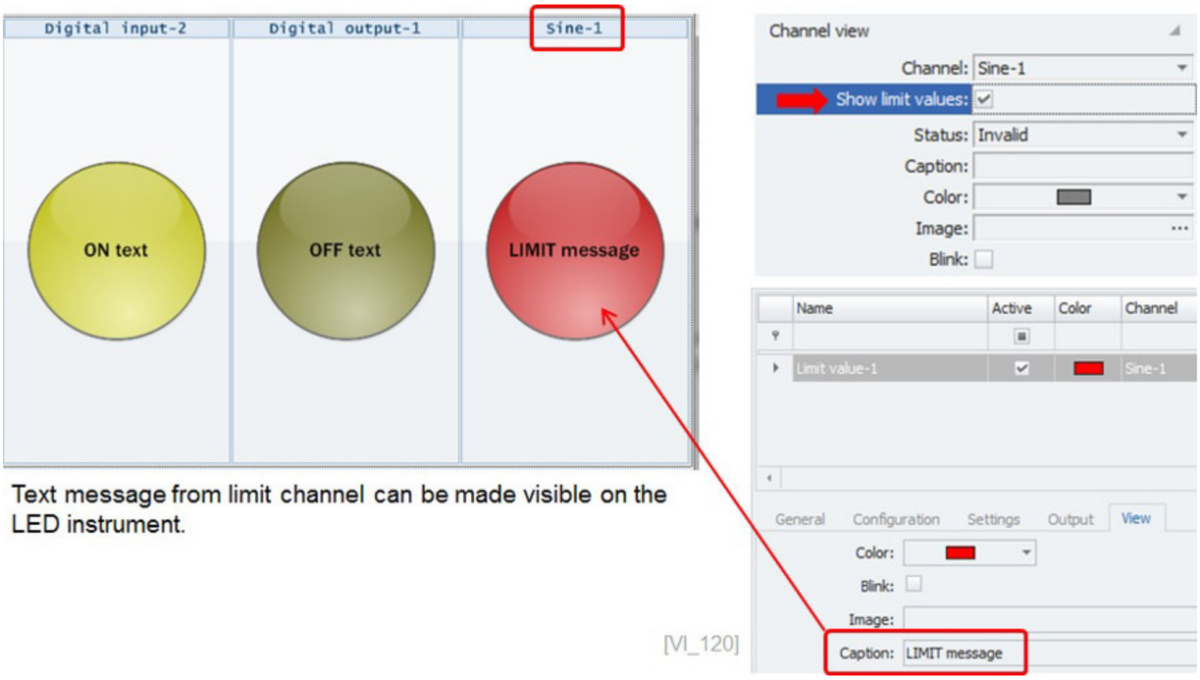
17.18.2 Layout

See bar alphanumerical instrument 17.13.2, for example.

17.18.3 Channel View

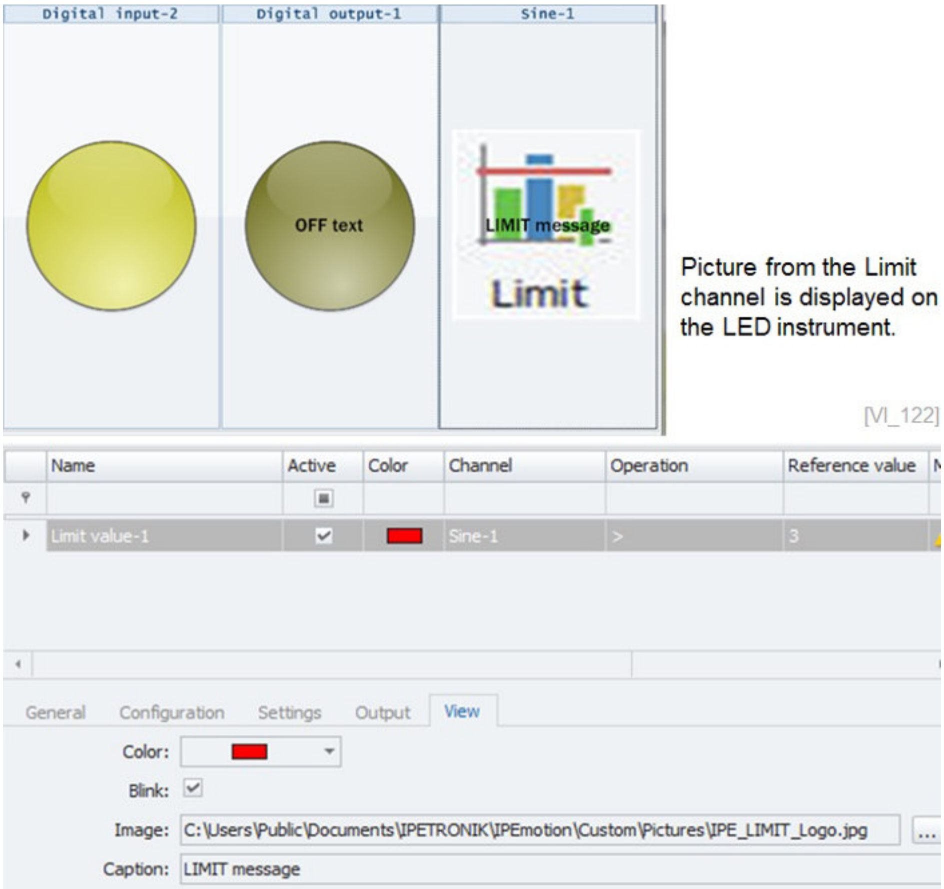
The LED instrument is also related to configuration settings defined on the limit channels discussed in ACQUISISTION >Monitoring >Limit >View tab sheet in chapter 13.10.6.

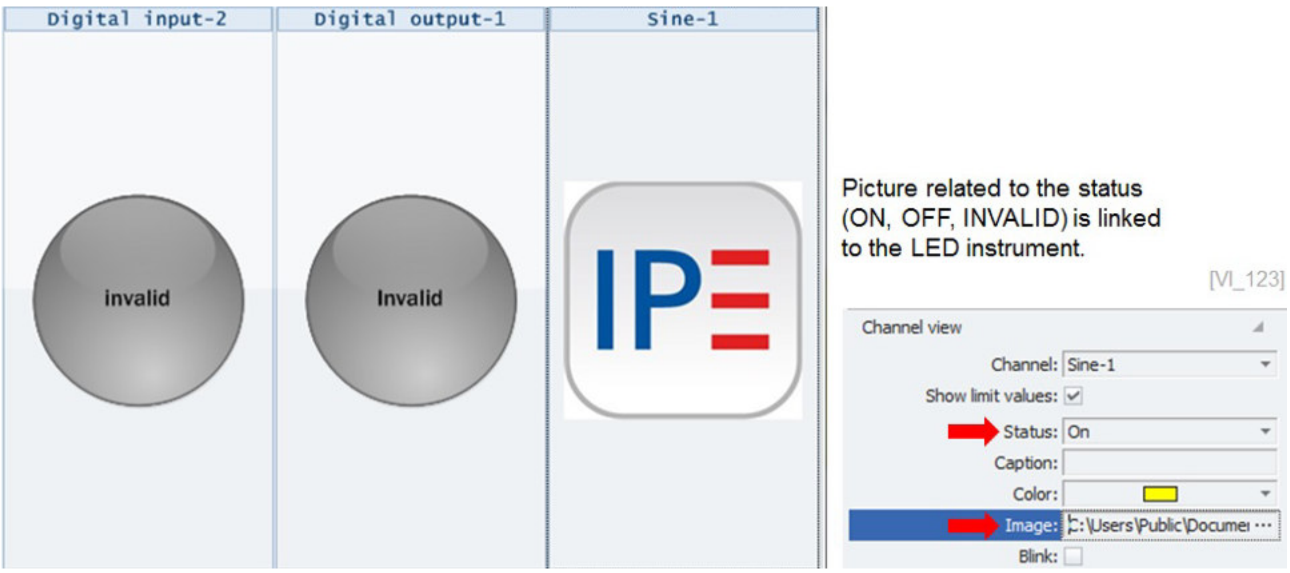
- Show limit values — If you relate a channel to the LED which has a limit channel defined, an output text can be made visible on the LED if the condition is true. The LED is also changing the color according to the defined color on the limit channel.



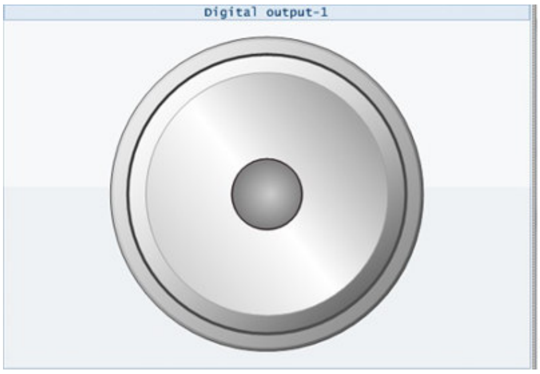
- Status — The status refers to the status of the signal coming into the LED. The status can be ON, OFF or Invalid. Each status can be associated with a color and a caption (text display inside the instrument).

- Caption — Is shown on the LED instrument
- Color — Can be defined for each status individually.
- Image — Here you can link an individual picture to each status. Alternatively, you can show an image which is defined on the limit channel. If you link an image on LED level, the picture of the LIMIT channel for the Status ON, OFF will be overruled and will not be displayed if the condition is true. The stats pictures can be included in the IWF configuration file when activated. See chapter OPTIONS >Frequently used 22.1.2.
- Blink — The instrument background picture is blinking if the limit condition of the source channel is true.





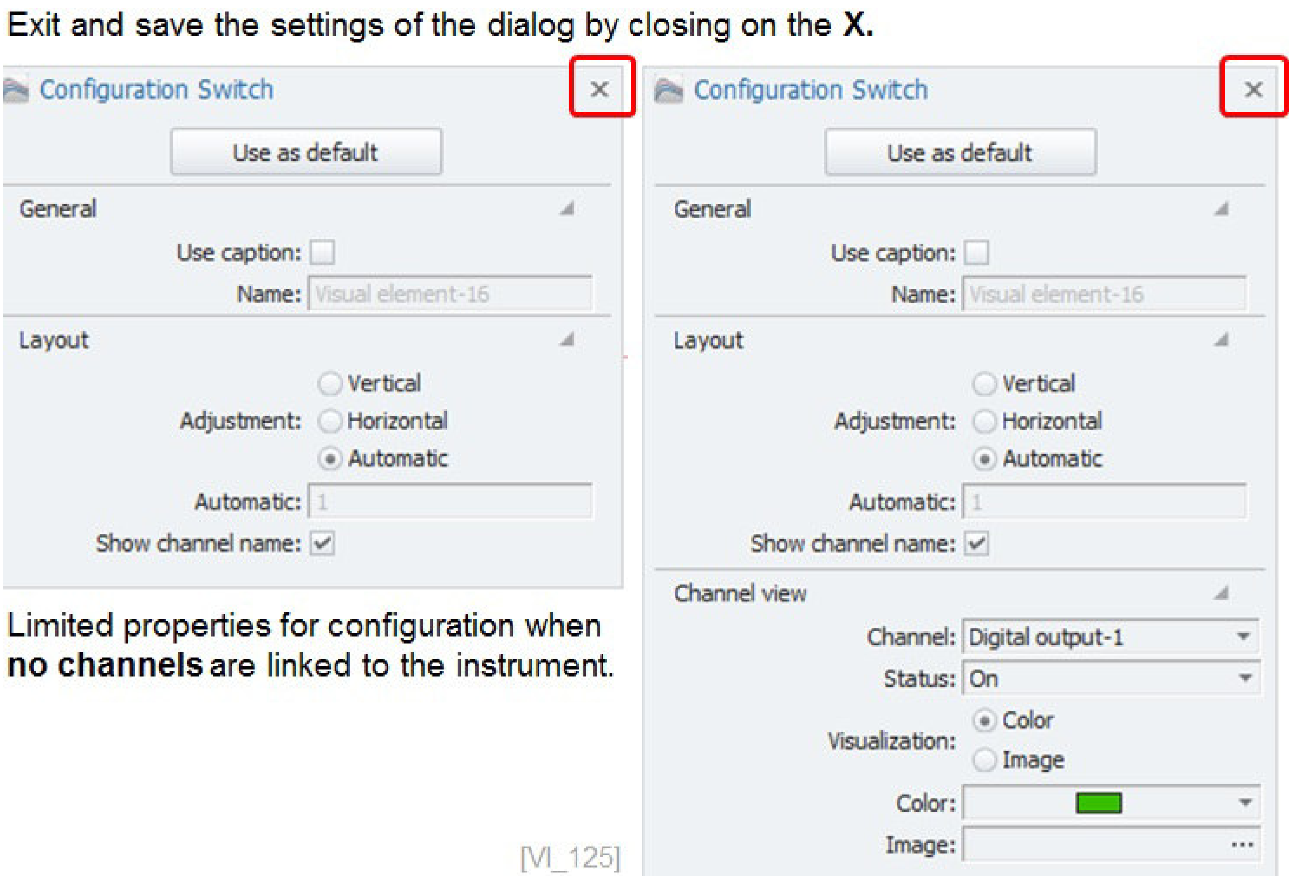
17.19 Switch



[VI_124]

Information — *Only functions differing from the functions of the Yt- chart and the standard context menu, which all instruments share, are explained. For details see chapter 17.6.*

17.19.1 Switch head-up display



[VI_125]

17.19.2 Layout

See for example LED instrument 17.18.2

17.19.3 Channel View

See for example LED instrument 17.18.3

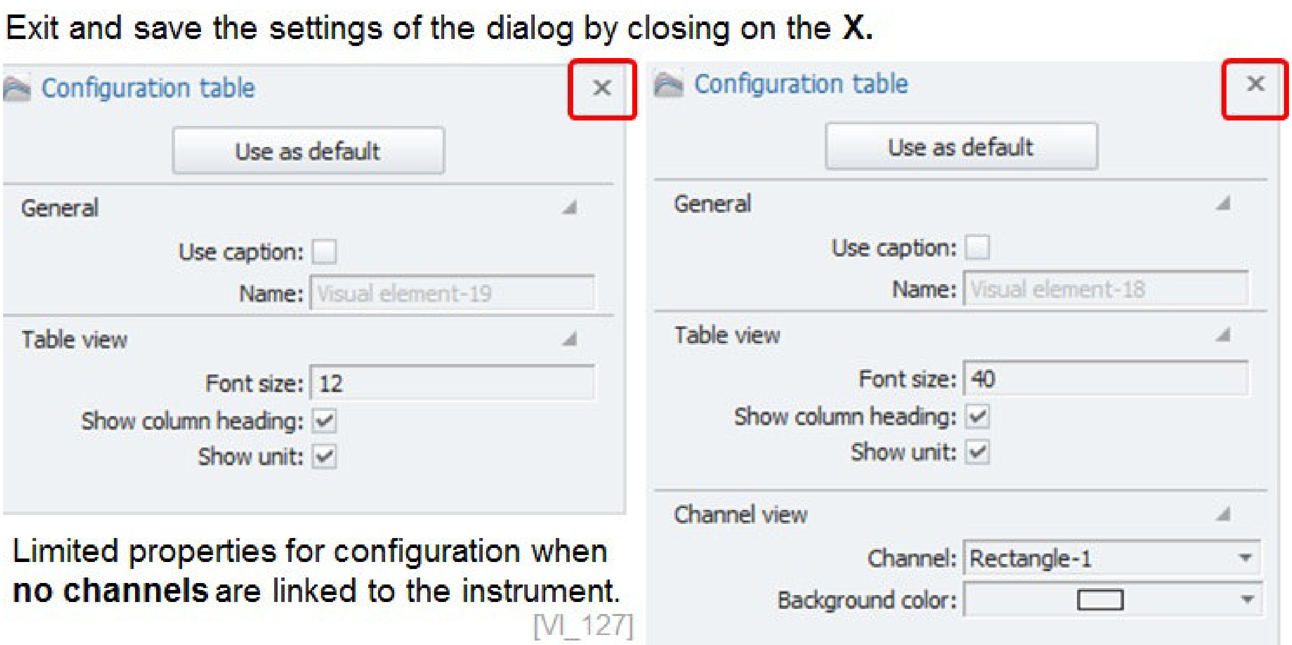
17.20 Table

Name	Current value
Analog output-1	9,2096
Digital output-1	1
Sawtooth-1	0,72
Sawtooth-2	-30
Rectangle-1	1
Rectangle-2	4
Rectangle-3	0

[VI_126]

Information *Only functions differing from the functions of the Yt- chart and the standard context menu, which all instruments share, are explained. For details see chapter 17.6.*

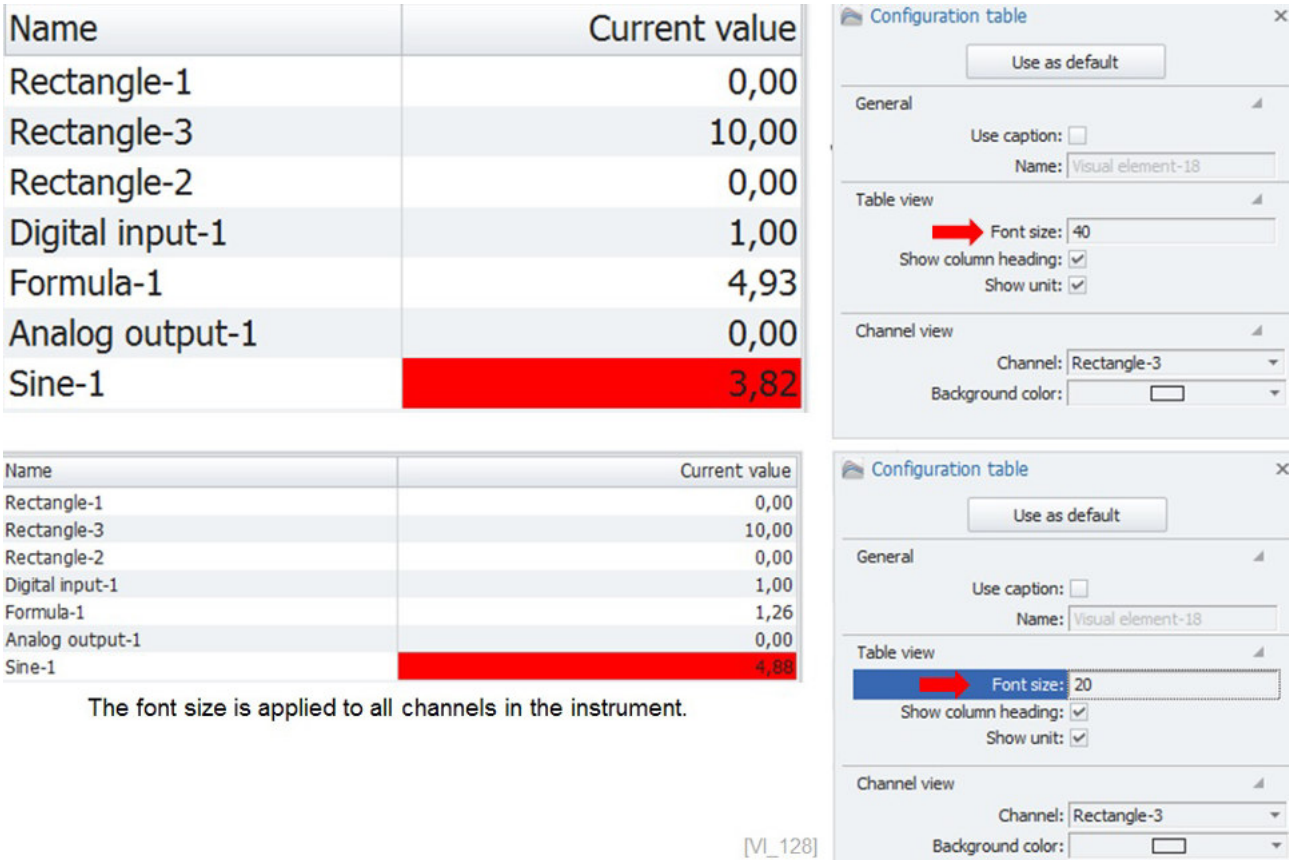
17.20.1 Table head-up display



[VI_127]

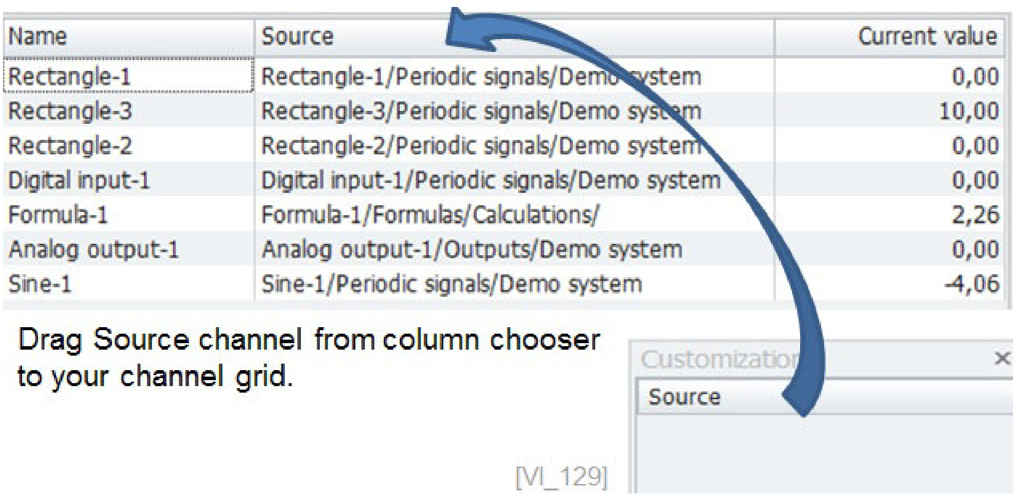
17.20.2 Table View

- **Font Size** — Defining font size. Default is 12pt. The Entry can range from 1 up to the size of a Single (32 bit) number format.



[VI_128]

- **Column chooser** — With the column chooser function you can add the source to the table grid.



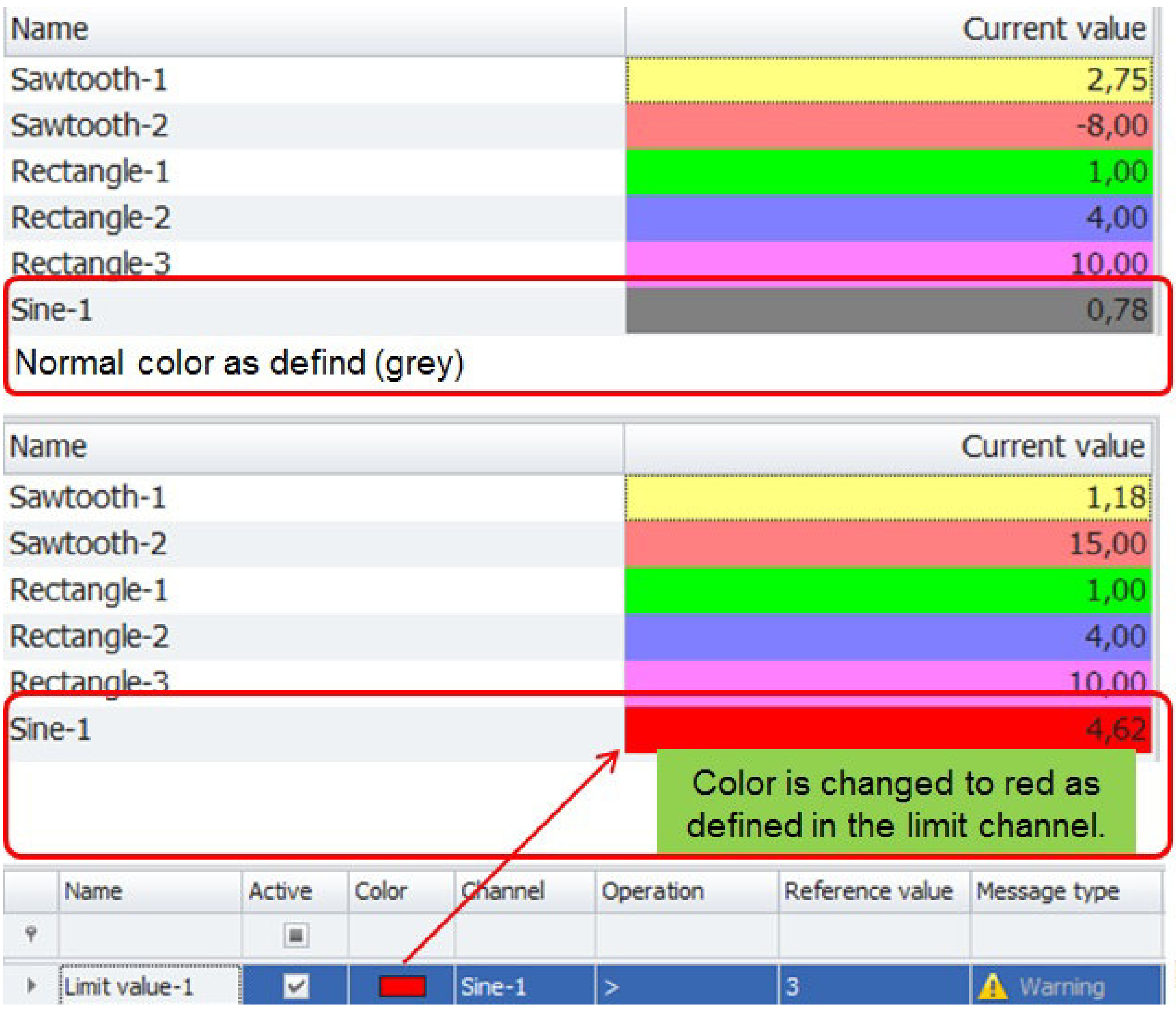
[VI_129]

- Column headings — Activate / deactivate the column headline

[VI_130]

17.20.3 Channel View

- Background color — Defining individual background colors for all channels. See example above
- Limit channel — If a limit channel is associated to a channel included in the table instrument, the color of the limit channel is visible in the instrument if the limit condition is true. See ACQUISITION >Limit Monitoring in chapter 13.10.6.



[VI_131]

- Spin buttons — When output channels included in the table instrument you can enter output values to the instrument or use the spin buttons

Name	Current value
E_4_HV_Therm_Eng_Oil	20,91 °C
DigitalOut 02	1
AnalogOut 01	4,23

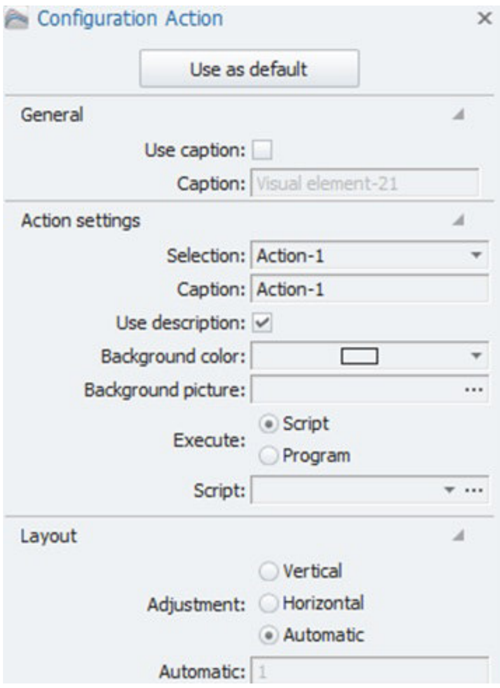
Operate outputs from table instrument. [VI_132]

17.21 Action button

[VI_133]

Information — *Only functions differing from the functions of the Yt- chart and the standard context menu, which all instruments share, are explained. For details see chapter 17.6.*

17.21.1 Action button head-up display

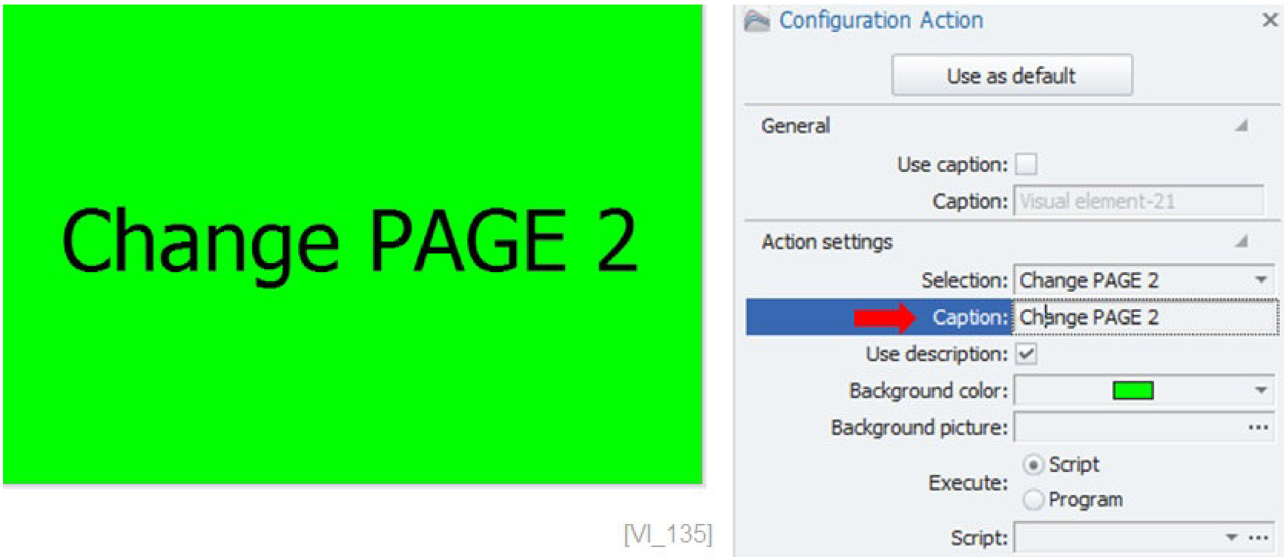


[VI_134]

The action button does not have channel relations. Only VBS (Visual Basic), PY (Iron Python) scripts or program executables (.EXE) can be linked to the action button.

17.21.2 Action Settings

- Caption — Using the Caption function, you can define a text visible on the action button.

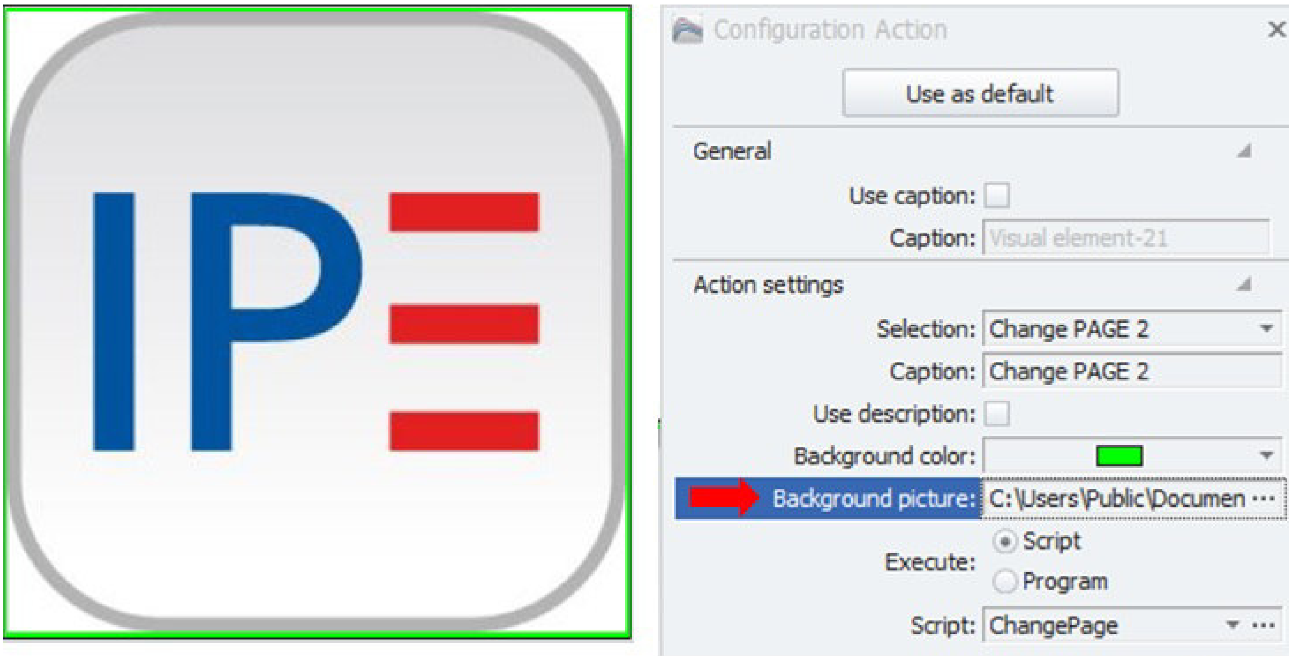


[VI_135]

- Background color — Defining individual background colors for the button.

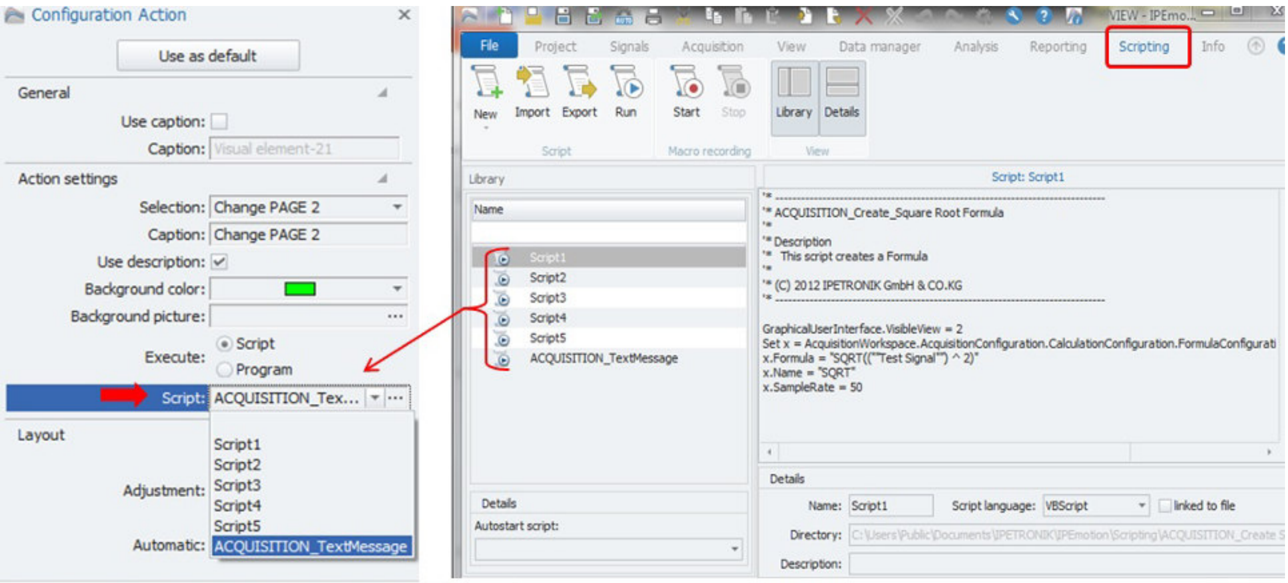
[VI_136]

- **Background picture** — Defining individual background picture. Default directory is defined in OPTIONS.



[VI_137]

- **Execute** — With the Execute radio button, you can define where you like to start a program (.EXE) file or if you like to run a script (VBA or PYTHON). The script can be an internal script managed in the SCRIPTING work space or can be a script file located from somewhere on the PC.



Drop down list of scripts from the SCRIPTING work space.

[VI_138]

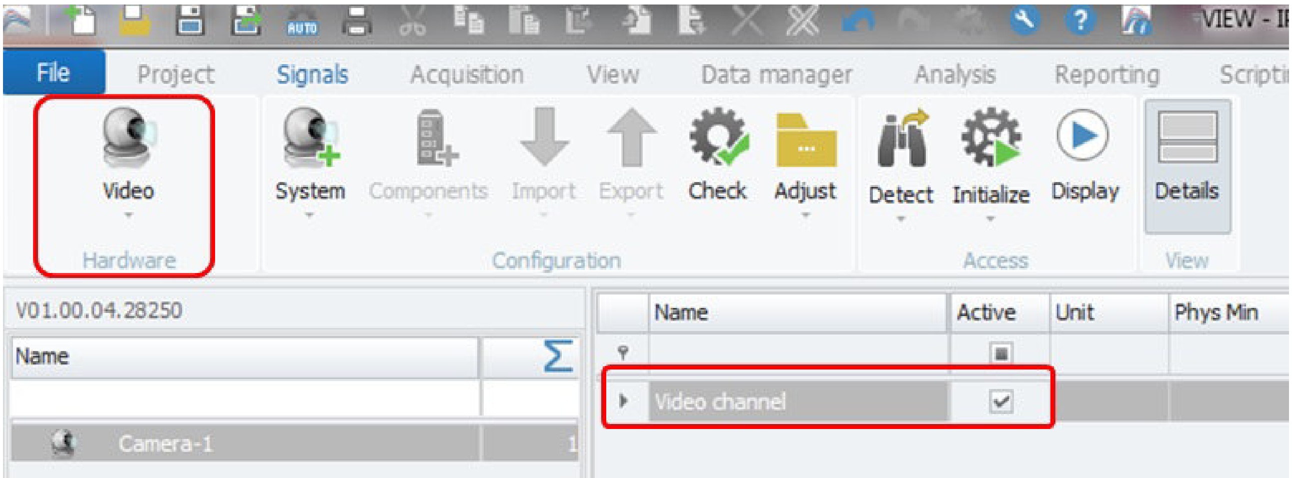
Information — *The Action button is fully operational even if you have no Professional license which supports the SCRIPTING tab sheet.*

17.22 Video

[VI_139]

17.22.1 Required PlugIn

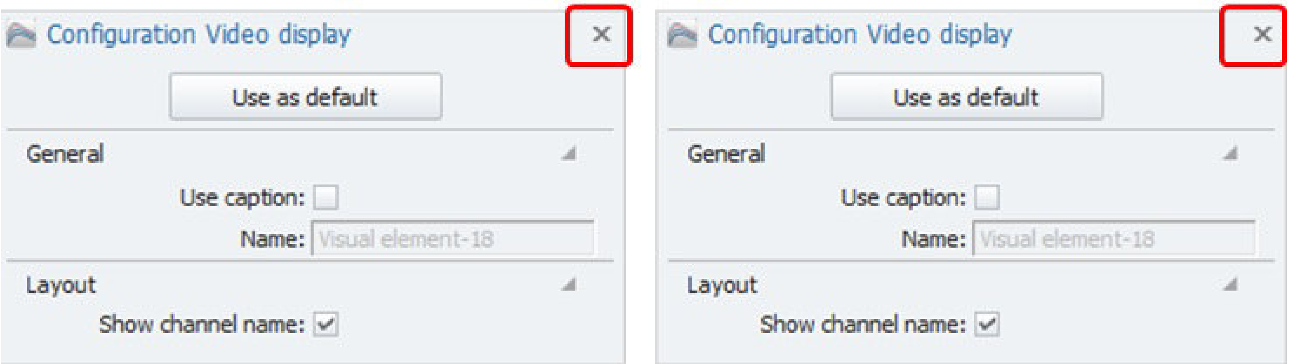
The video instrument requires the video PlugIn. USB Webcams (computer integrated or external) based on the WDM driver are supported by the Video PlugIn. The latest version of the Video PlugIn (V01.02.00) is supporting ethernet IP cameras based on the Realtime Streming Protocol and the IPETRONIK Video Externder. For more details see the manual of the Video PlugIn.



[VI_140]

17.22.2 Video instrument head-up display

Exit and save the settings of the dialog by closing on the **X**.

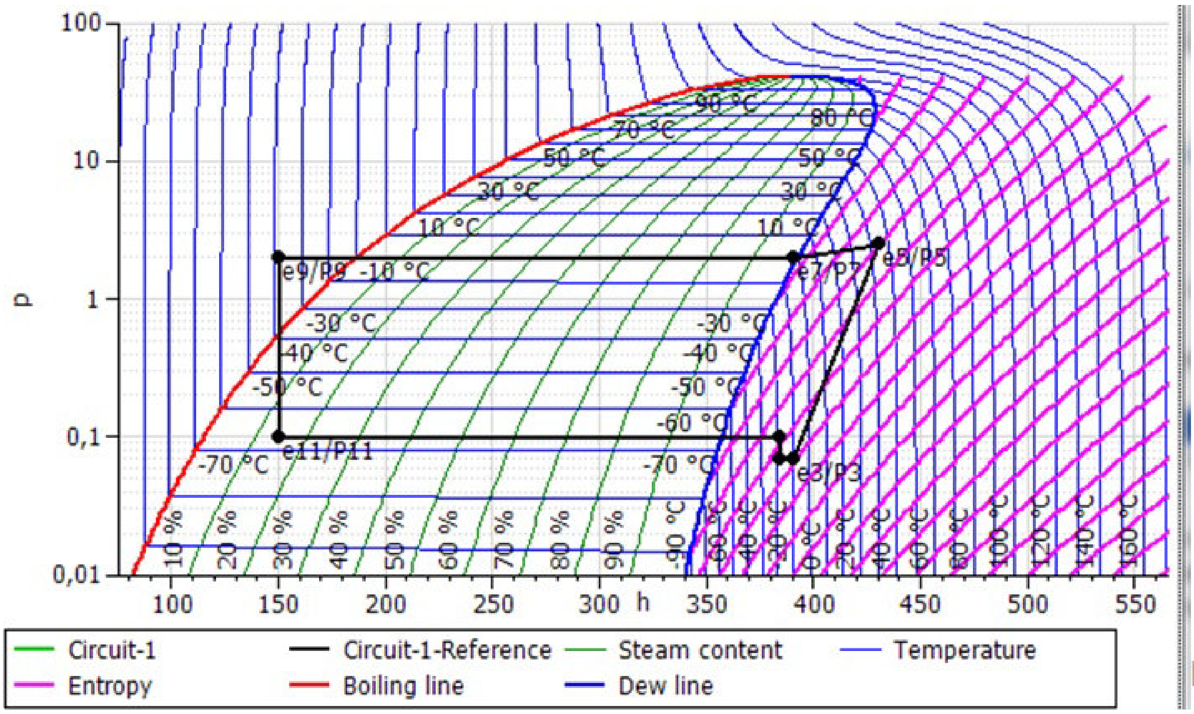


The video instrument has no channel related configuration options.

[VI_141]

17.23 Instruments for Professional, Developer, Analysis Edition

17.24 Log p-h

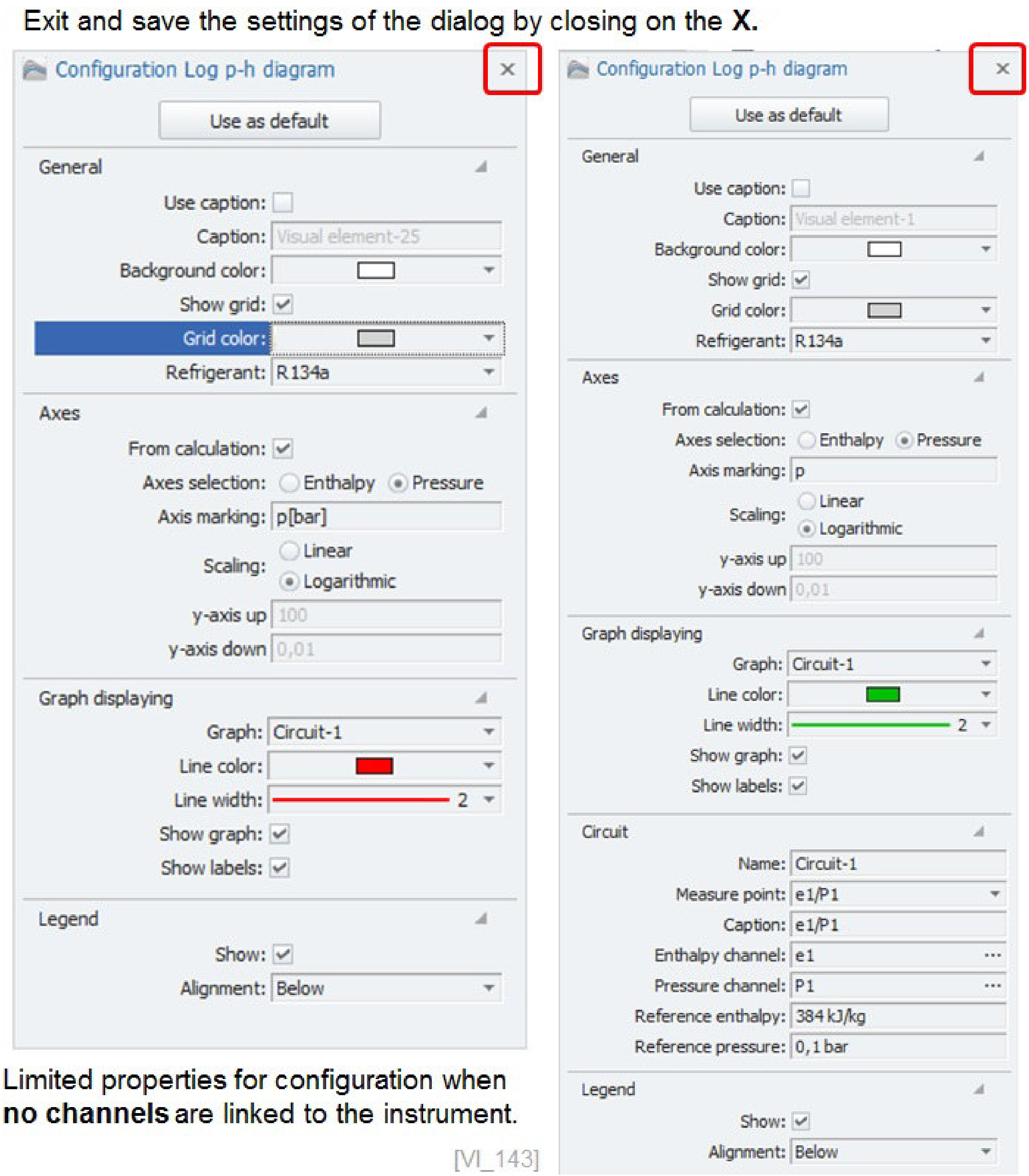


[VI_142]

17.24.1 REFPROP database requirement

In order to use the Log p-h diagram, you need to install the REFPROP (NIST - Reference Fluid Thermodynamic and Transport Properties Database) on your computer. The database is provided by NIST (National Institute of Standards and Technology, see http://www.nist.gov/srd/nist23.cfm). If you start IPEmotion with a climate license, you need to link the REFPROP dll to the application, initially. The default installation directory of the RFPROP database is:
Win7: C:\Program Files (x86)\REFPROP**refprop.dll**
The Log p-h instrument is included in the Climate Module 4.2.2.

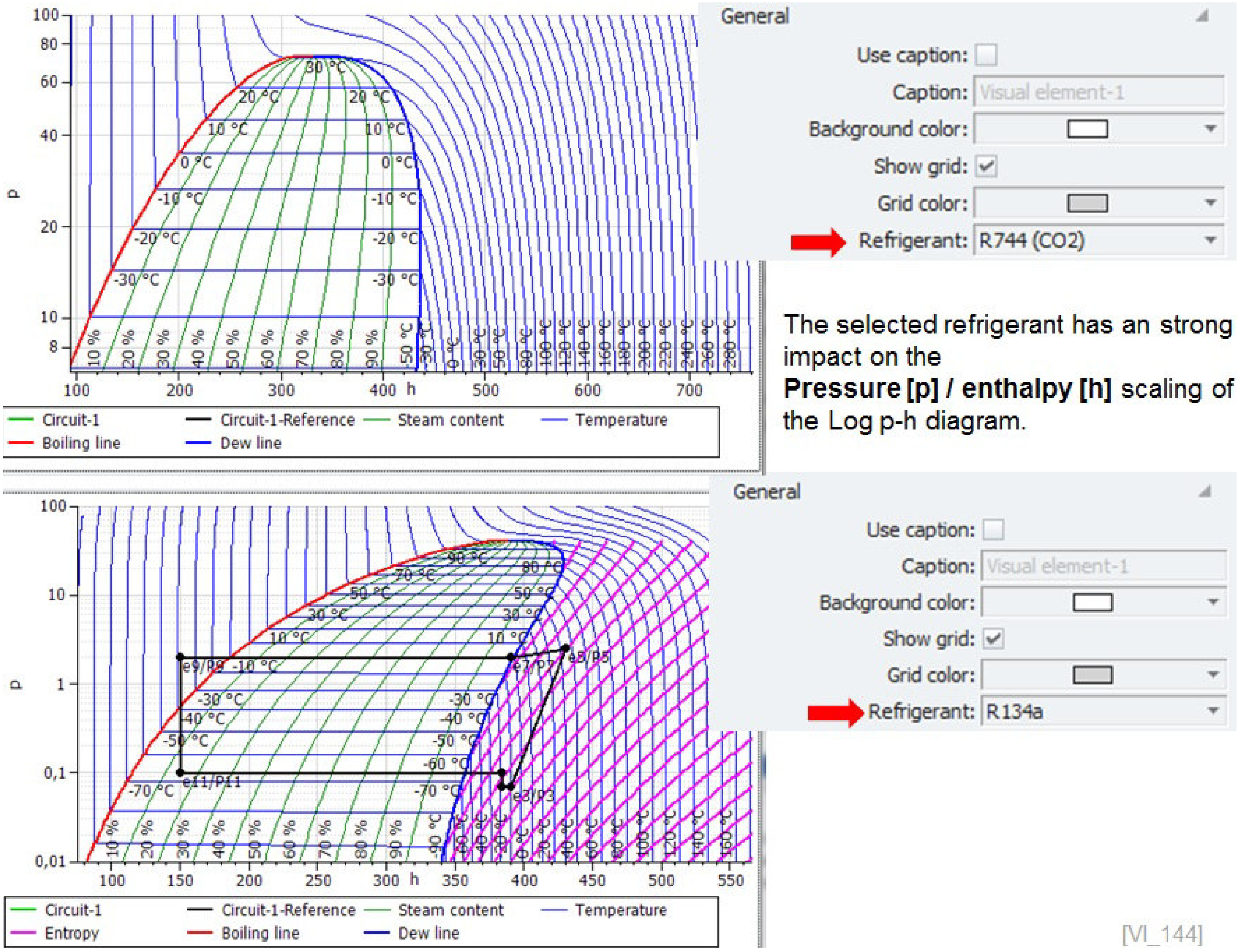
17.24.2 Log p-h head-up display



[VI_143]

17.24.3 General

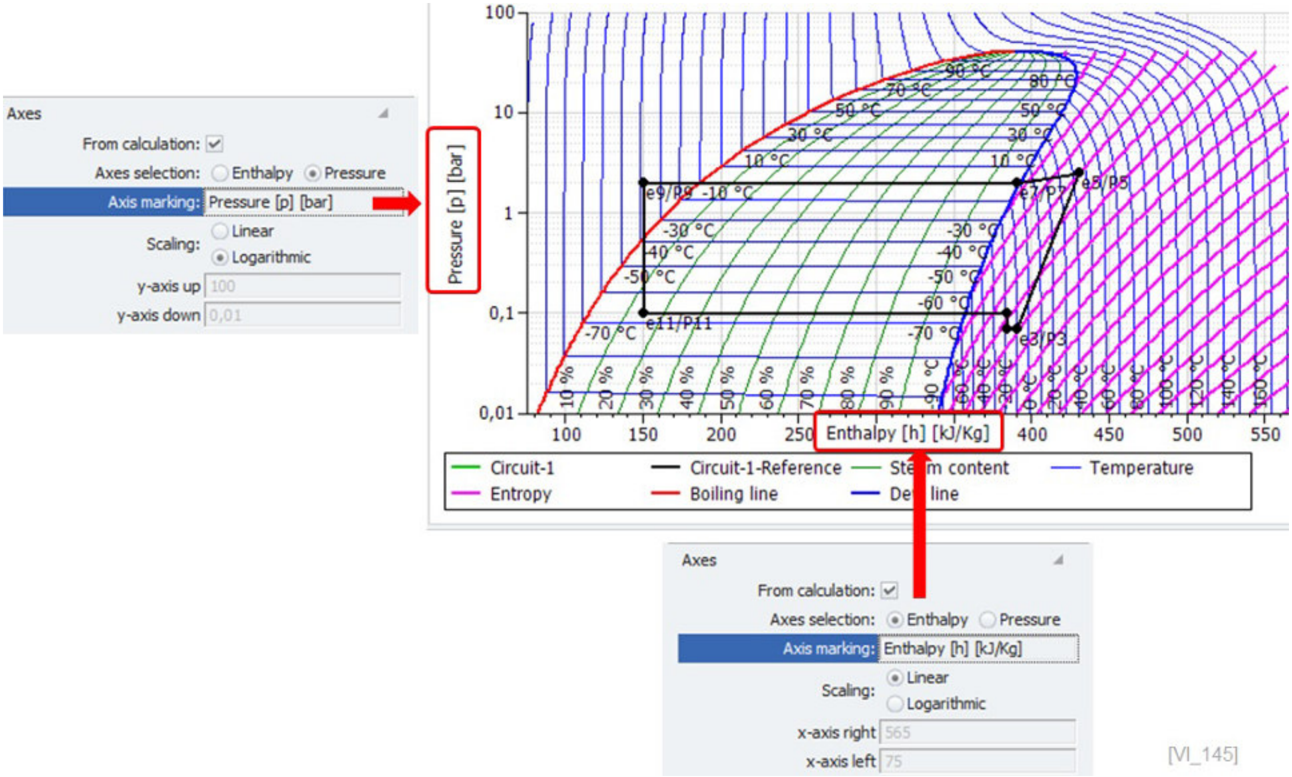
► Refrigerant	Here you can select the coolant used in your thermodynamic system. The type of coolant has an impact on the layout of the log p-h diagram. It is important that the Enthalpy calculations defined in the ACQUISITION use the same coolant as defined for the log p-h diagram. See chapter 15.4 for the formulas. The following coolants from the REFPROP database are supported in the log p-h diagram.
► Formula Index 1	R134a
► Formula Index 2	R134yf
► Formula Index 3	R22
► Formula Index 4	R404a
► Formula Index 5	R410a
► Formula Index 6	R507a
► Formula Index 7	R744 (CO2)
► Formula Index 8	R718 (H2O)
► Formula Index 9	R729 (N2+O2+Ar)



[VI_144]

17.24.4 Axes

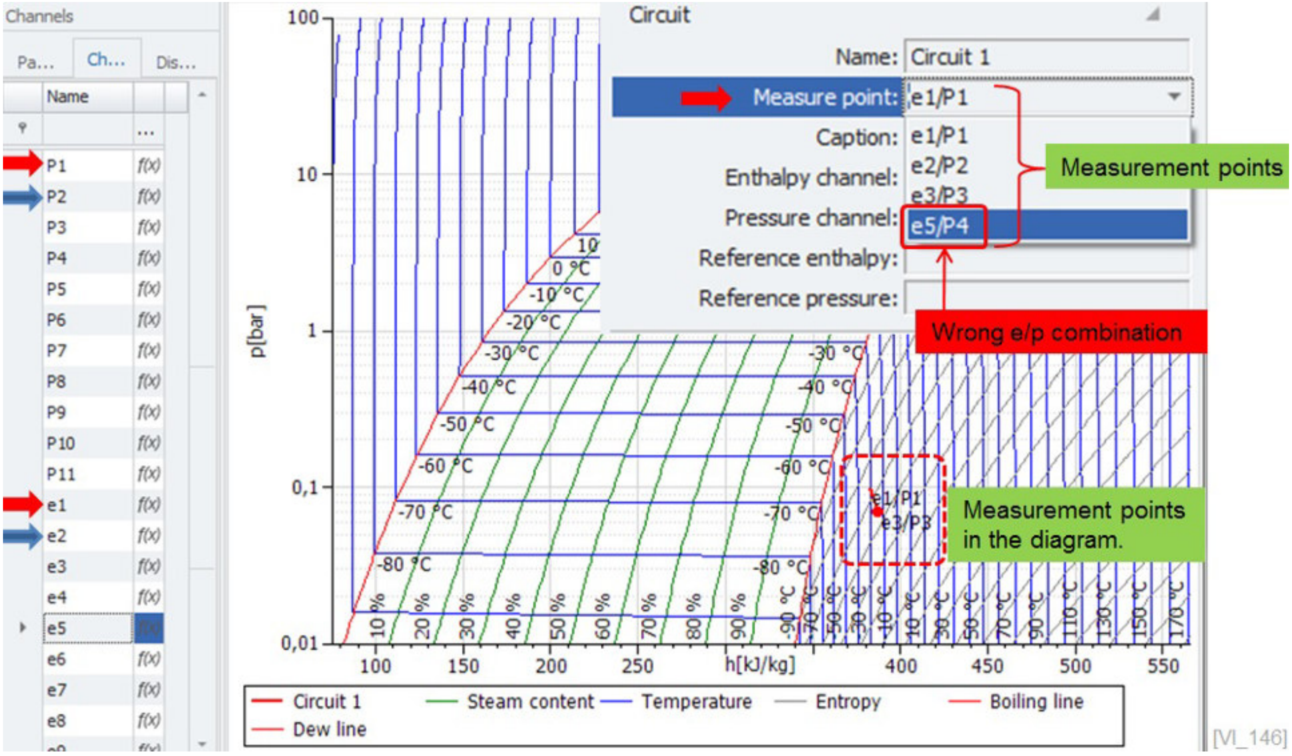
- **x-axis Enthalpy** — With the radio button you can switch between the different axes, just as discussed with the y-x chart. The x-axis is defined for enthalpy [kJ/kg] which is linear-scaled by default.
- **y-axis Pressure** — The y-axis is defined for the pressure [p] scale which is logarithmic-scaled by default.



[VI_145]

17.24.5 Circuit

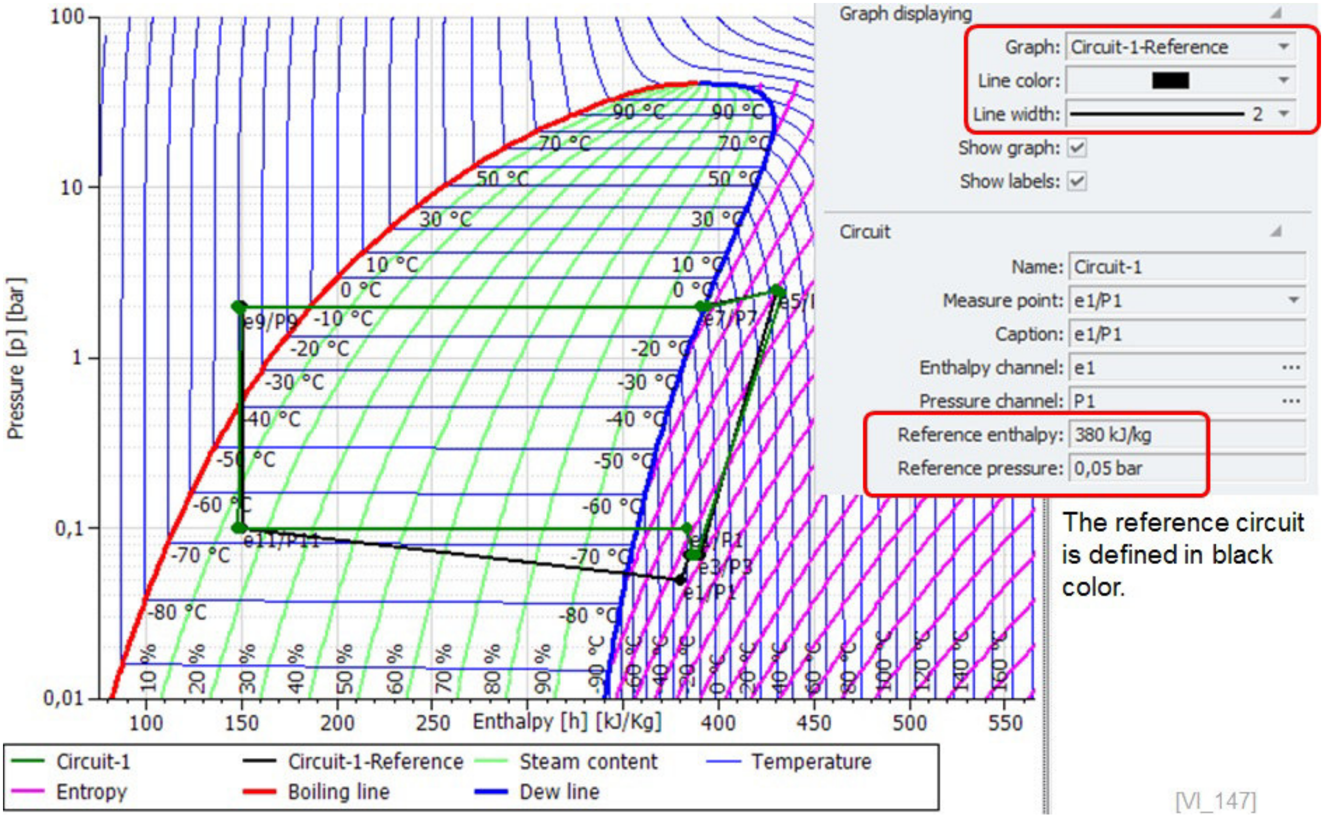
- **Circuit 1** — You can show one thermodynamic cycle in the log p-h instrument.
- **Measure points** — You need to link the enthalpy / pressure channels of the corresponding measurement point to the diagram as pairs. The pressure measurement and the enthalpy calculation are related to one measurement point of your thermodynamic circuit. First, drag the enthalpy channel and then the pressure channel of the measurement point to the diagram. You need at least four measurement points to get a reasonable circuit diagram.



[VI_146]

► Circuit 1 - Reference

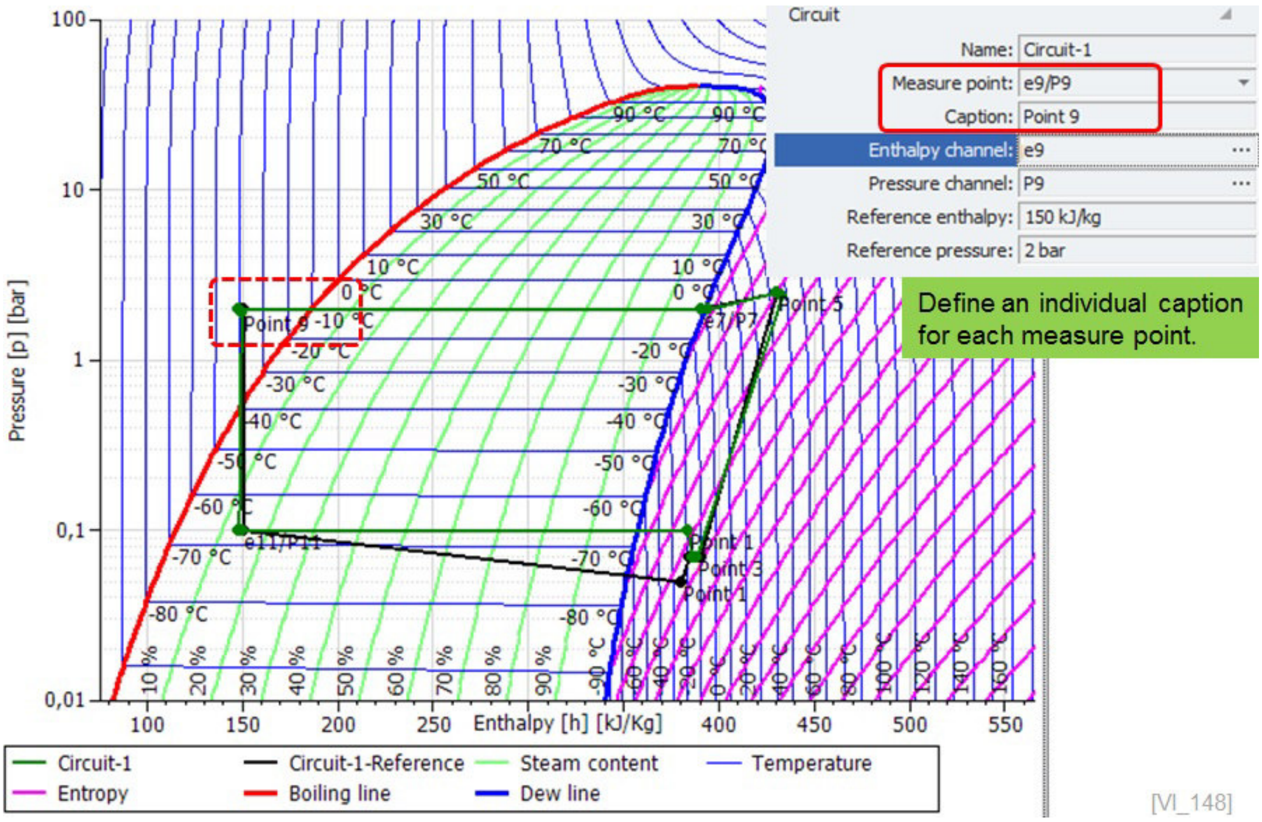
The reference circuit is a simulated circuit based on the main circuit where you can define a reference cycle with its own constant pressure and enthalpy.



[VI_147]

► Caption (measure point)

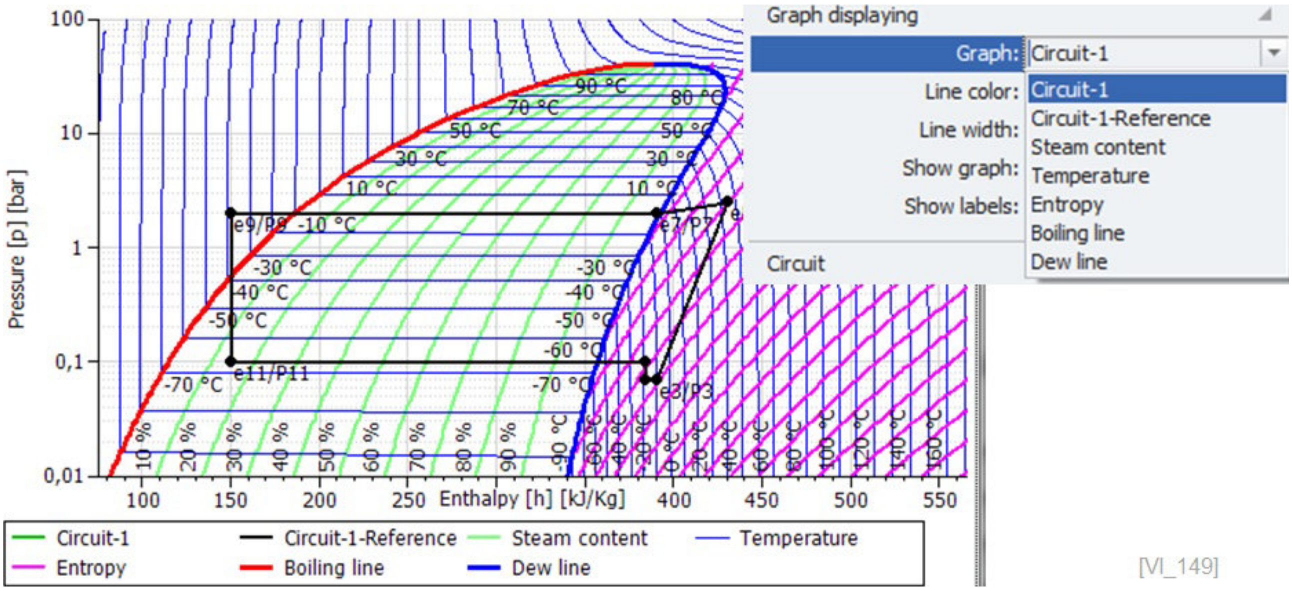
The default caption is created from the name of the enthalpy calculation channel and the pressure measurement channel. However, you can define your own specific name for each measurement point.



[VI_148]

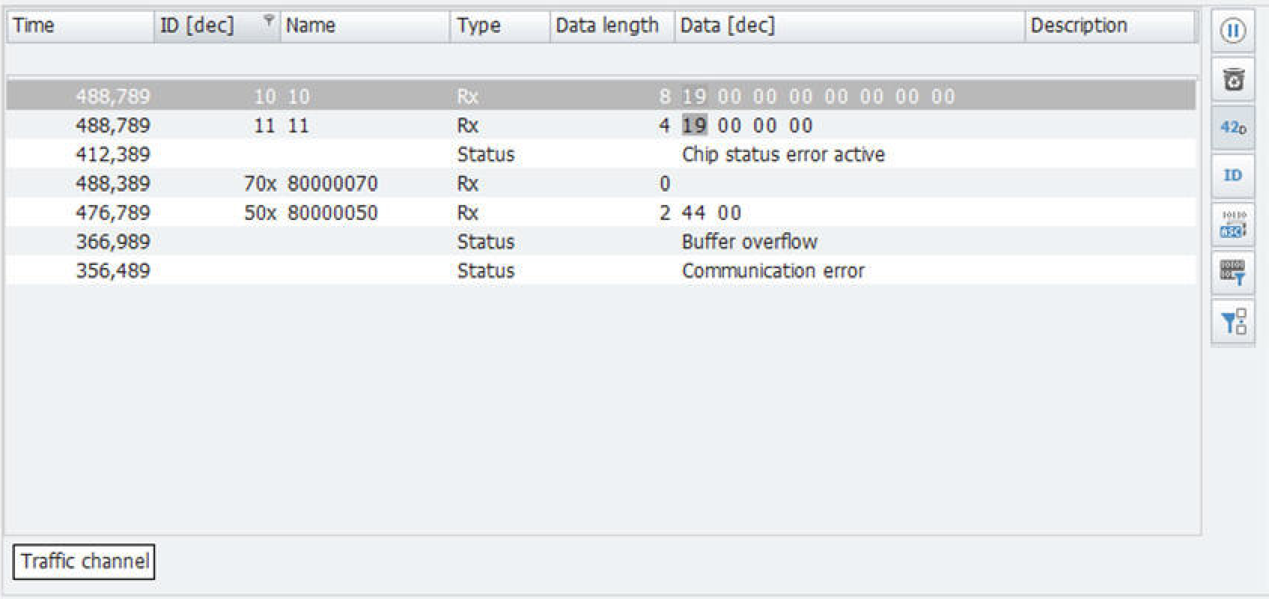
17.24.6 Graph display

- Circuit 1 — Define individual line color and thickness.
- Circuit - Reference — Define individual line color and thickness.
- Steam Content — Define individual line color and thickness.
- Temperature — Define individual line color and thickness.
- Entropy — Define individual line color and thickness.
- Boiling Line — Define individual line color and thickness.
- Dew Line — Define individual line color and thickness.



[VI_149]

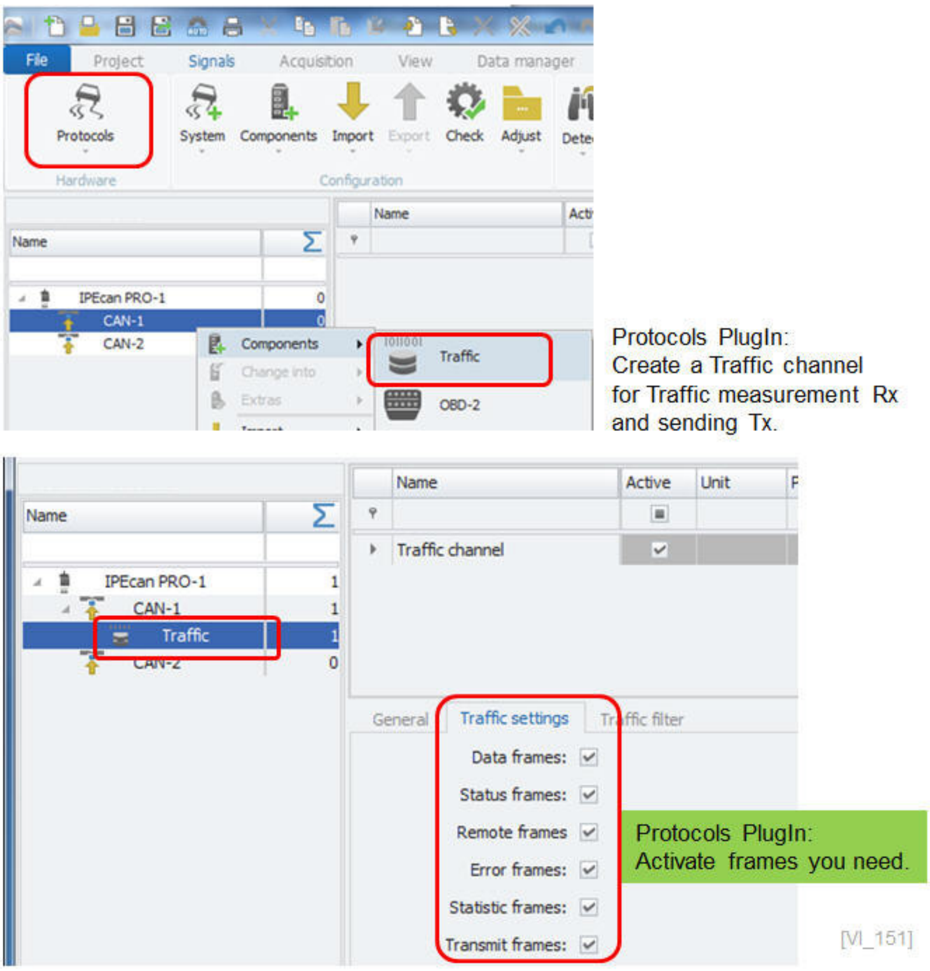
17.25 Traffic analyzer



[VI_150]

17.25.1 PlugIn for traffic measurement

With the Protocols PlugIn you can perform traffic measurements Rx and you can send Tx traffic signals.



[VI_151]

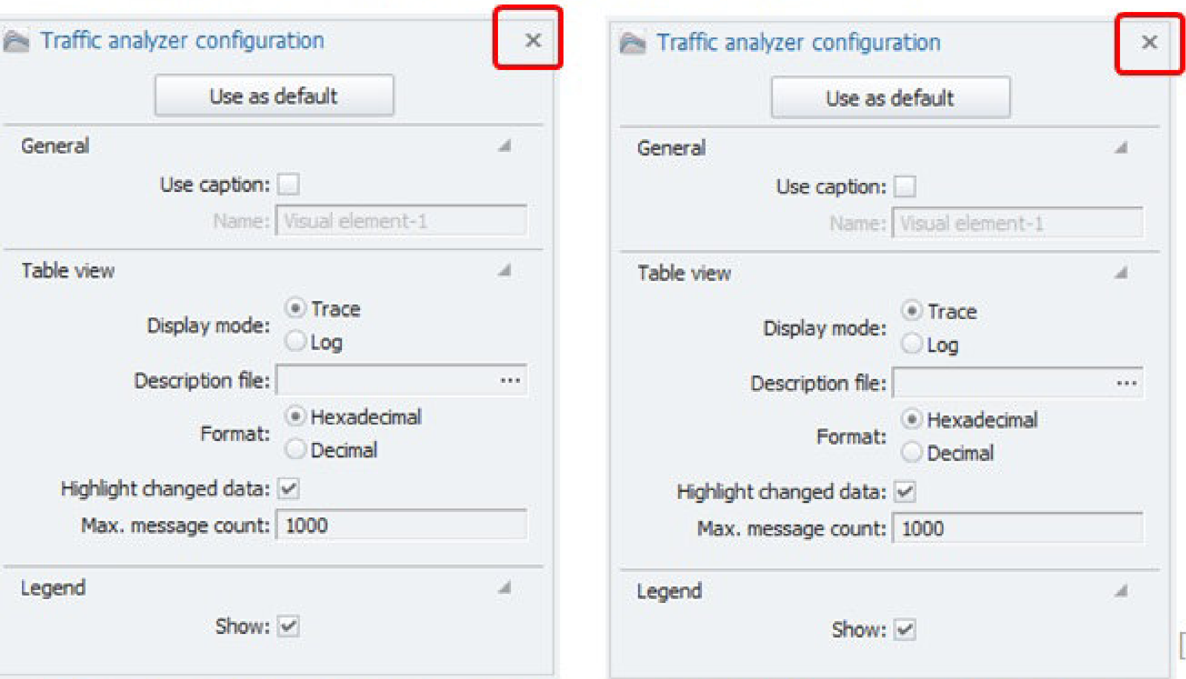
Data display in the instrument depends on the functions selected on the traffic channel. The following frames are supported:

► Data frames	Includes signal data received from a CAN interface / device.
► Status frames	This frame is not measured on the CAN bus. Rather it is generated by the IPEmotion CAN server integrted to CAN interface of the PlugIns. The status frames include an error counter for received Rx and transmitted Tx frames and can report the following status changes when a certain limit is crossed: CAN_SERVER_STATE_BUS_ACTIVE >changed to status active CAN_SERVER_STATE_BUS_WARNING >changed to status warning CAN_SERVER_STATE_BUS_PASSIVE >changed to status passive CAN_SERVER_STATE_BUS_OFFLINE >changed to status offline CAN_SERVER_STATE_HARDWARE_BUFFER_OVERFLOW CAN_SERVER_STATE_SOFTWARE_BUFFER_OVERFLOW CAN_SERVER_STATE_BUFFER_OVERFLOW
► Remote frames	This is a request telegram to ask a passive CAN device to provide data.
► Error frames	A CAN device is sending an error message.
► Statistic frames	This frame is not a frame measured on the CAN bus. Rather it is a software switch to display the static information in the traffic analyzer instrument 17.25.
► Transmit frames	This are frames sent from the PlugIn and the installed CAN card.

Information *You can store CAN traffic messages and analyze them with a suitable DBC file in the data manager. See chapter DATA MANAGER 18.11.2.*

17.25.2 Traffic analyzer head-up display

Exit and save the settings of the dialog by closing on the **X.**

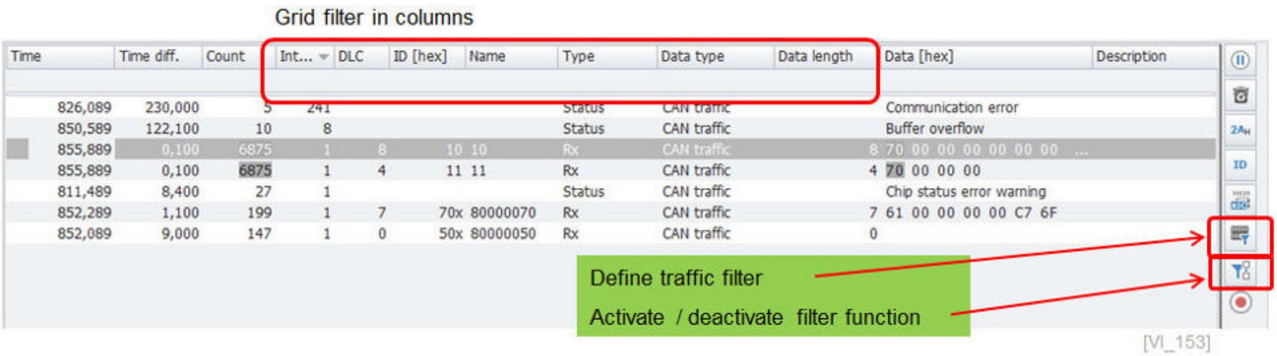


[VI_152]

The Traffic analyzer instrument has no channel related configuration options.

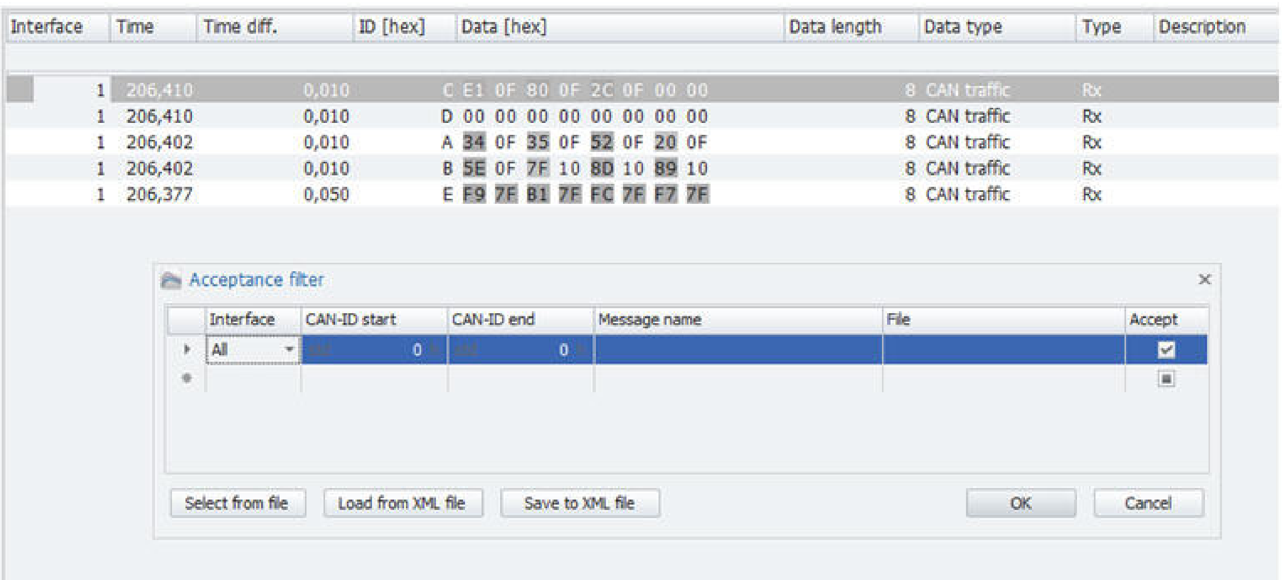
17.25.3 Column filter functions

You can filter in the following columns:



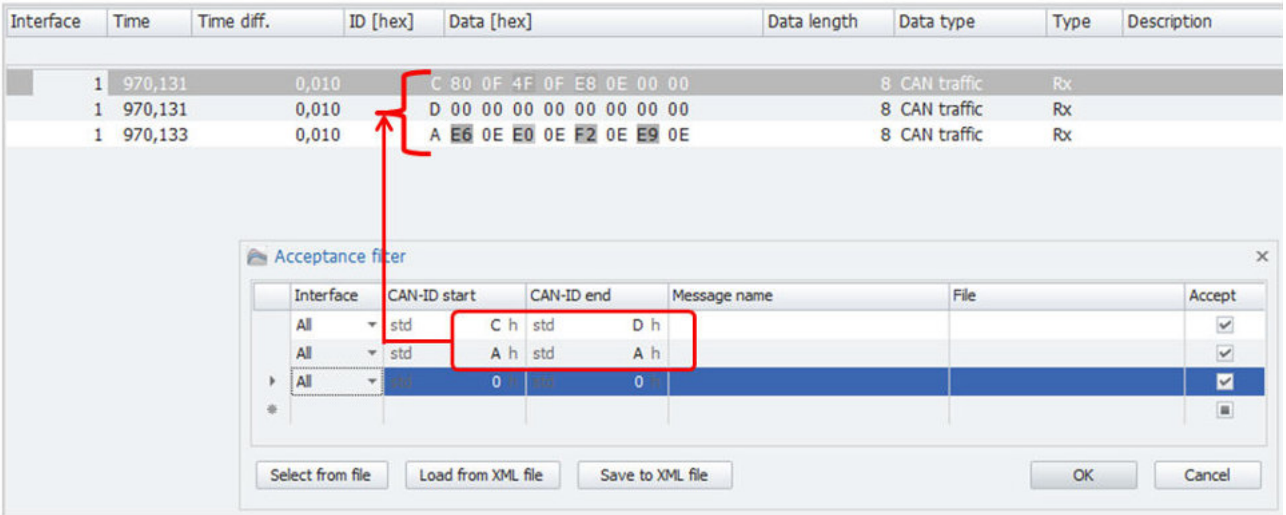
- DLC — Data length byte (activated over column chooser) 17.25.14
- ID — CAN ID
- Name — Name of message when DBC is linked
- Type — Rx – received frames or Tx – transmit fames
- Data length — Message length in byte. Since CAN FD implementation length can reach up to 64 byte.
- Data type — Is indicating standard 8 byte CAN traffic from up to 64 byte CAN FD, traffic and FlexRay traffic.

The online traffic analyzer instrument is supporting an extended filter function. You can define filters for individual and multiple CAN IDs and CAN ID ranges. The CAN IDs defined in the filter are those ID which pass and will be presented in the instrument. Filtering of FlexRay traffic is not jet supported



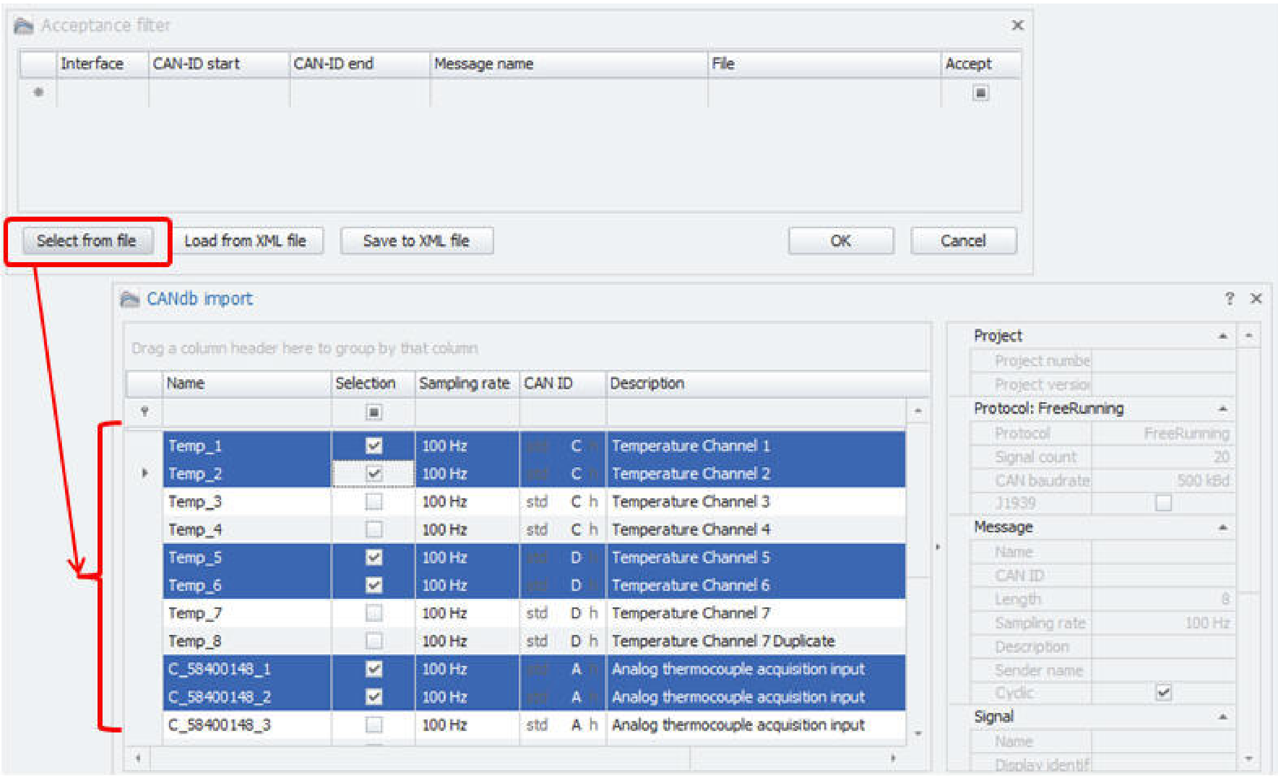
Traffic filter configuration [VI_153_1]

In the example blow the CAN IDs are defined by entering directly the Start and End ID range. The filter of displayed CAN ID is updated accordingly. You can see that the ID B and E are suppressed.



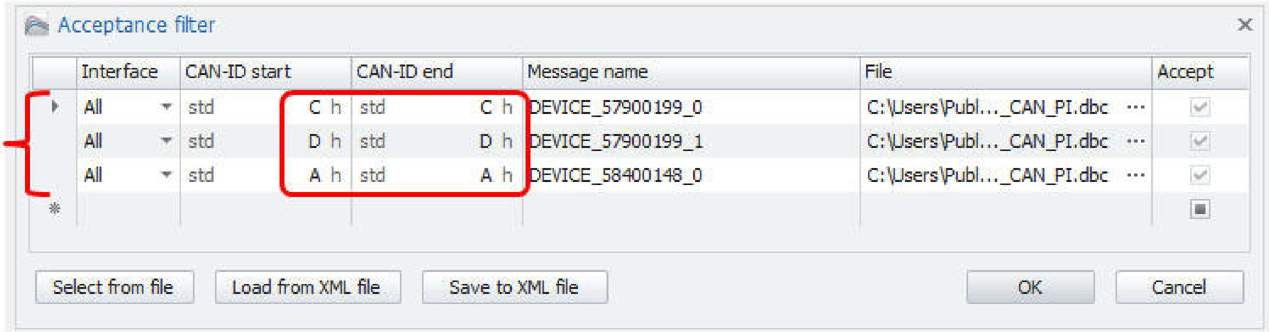
Example of CAN ID filter settings for A and range C - D [VI_153_2]

If you do not know the CAN IDs you like to filter you can import a DBC description file to create your filter definition. As indicated below you select the channels you like to see in the traffic analyzer and the corresponding CAN IDs from the selected channels are automatically integrated to the traffic filter.



Select channels from DBC file to define CAN ID filter settings. [VI_153_3]

When you confirm the selection dialog the CAN ID filter settings are displayed. You can see that only 3 filter definitions for CAN ID A, C, D included. Even tough that 6 channels where selected in the DBC channel list



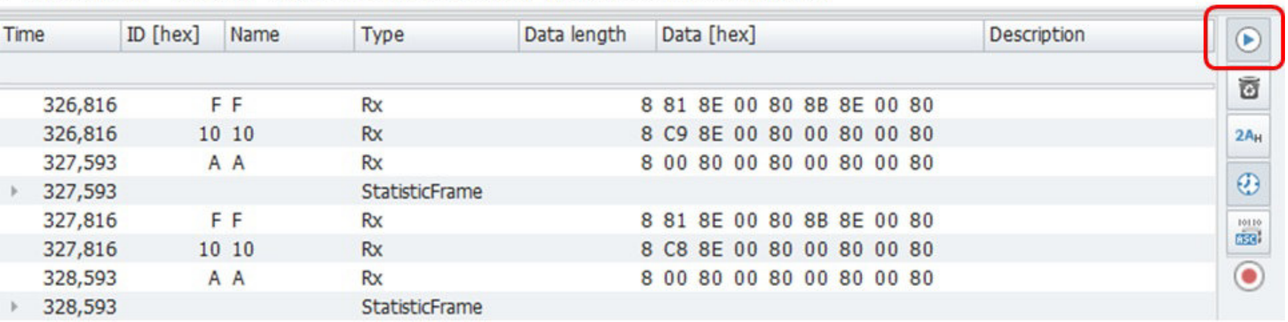
CAN ID filter definition selected from channels in the DBC file. [VI_153_4]

The reason for this behavior is that only one channel is considered as relevant to identify which CAN ID has to be integrated in the filter definition. In other words you need only to select one channel which is part of the CAN ID you like to filter.

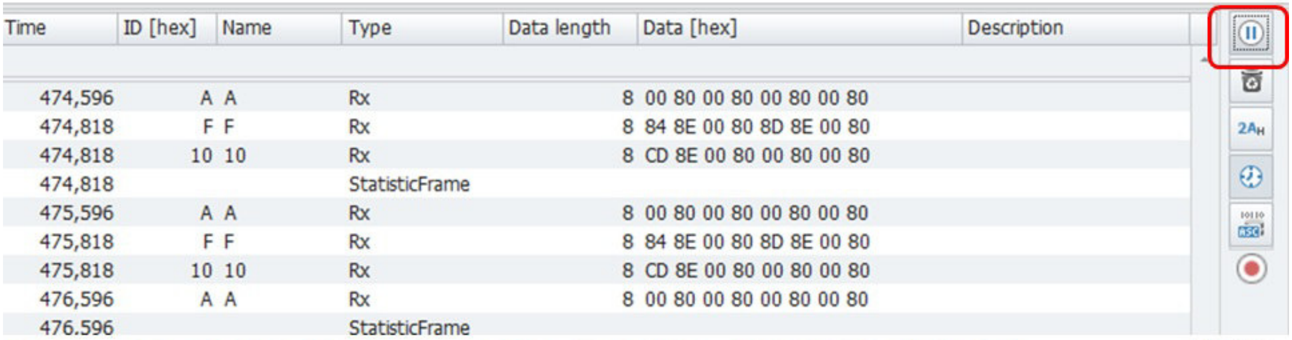
17.25.4 Instrument button for play/pause

With the display / Pause button you can switch the instrument from measurement mode with updated readings to a freezing mode where the values stay constant which gives the ability to filter and analyze the data.

Pause mode – no new values are received and updated in the instrument.



Time	ID [hex]	Name	Type	Data length	Data [hex]	Description
326,816	F	F	Rx	8	81 8E 00 80 8B 8E 00 80	
326,816	10	10	Rx	8	C9 8E 00 80 00 80 00 80	
327,593	A	A	Rx	8	00 80 00 80 00 80 00 80	
327,593			StatisticFrame			
327,816	F	F	Rx	8	81 8E 00 80 8B 8E 00 80	
327,816	10	10	Rx	8	C8 8E 00 80 00 80 00 80	
328,593	A	A	Rx	8	00 80 00 80 00 80 00 80	
328,593			StatisticFrame			



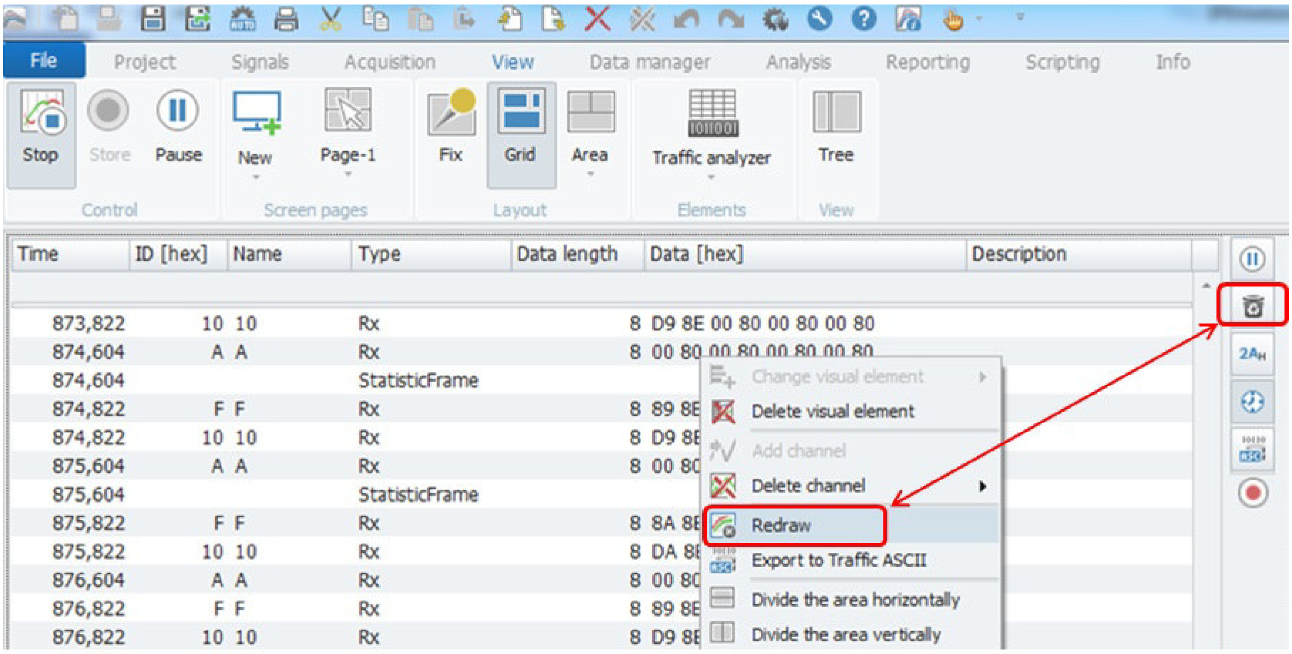
Time	ID [hex]	Name	Type	Data length	Data [hex]	Description
474,596	A	A	Rx	8	00 80 00 80 00 80 00 80	
474,818	F	F	Rx	8	84 8E 00 80 8D 8E 00 80	
474,818	10	10	Rx	8	CD 8E 00 80 00 80 00 80	
474,818			StatisticFrame			
475,596	A	A	Rx	8	00 80 00 80 00 80 00 80	
475,818	F	F	Rx	8	84 8E 00 80 8D 8E 00 80	
475,818	10	10	Rx	8	CD 8E 00 80 00 80 00 80	
476,596	A	A	Rx	8	00 80 00 80 00 80 00 80	
476,596			StatisticFrame			

Display mode – display red LED is blinking and new measurement are updated in the table.

[VI_154]

17.25.5 Instrument button to redraw table data

With the redraw function you can delete all entries from the table.



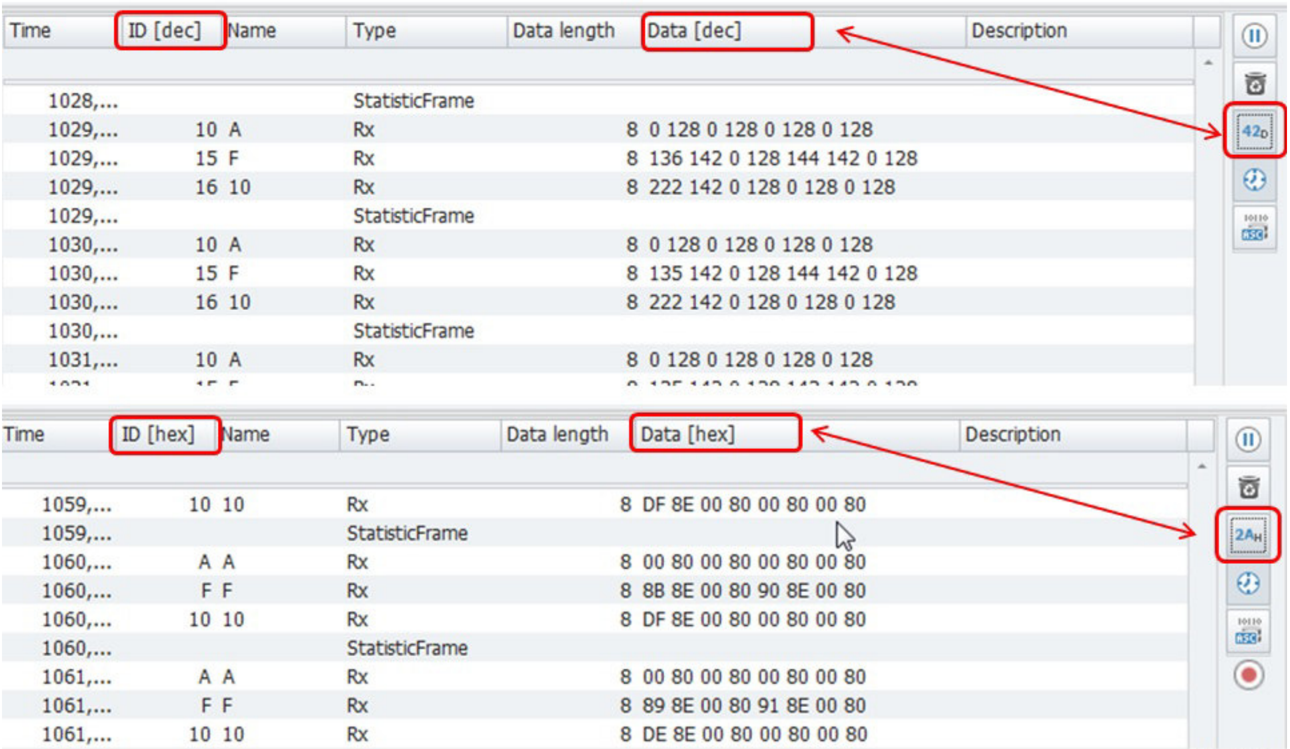
Redraw table and delete all entries.

[VI_155]

17.25.6 Instrument button to switch between Hex and Dec data

With this button you switch ID and data presentation between hexadecimal and decimal presentation.

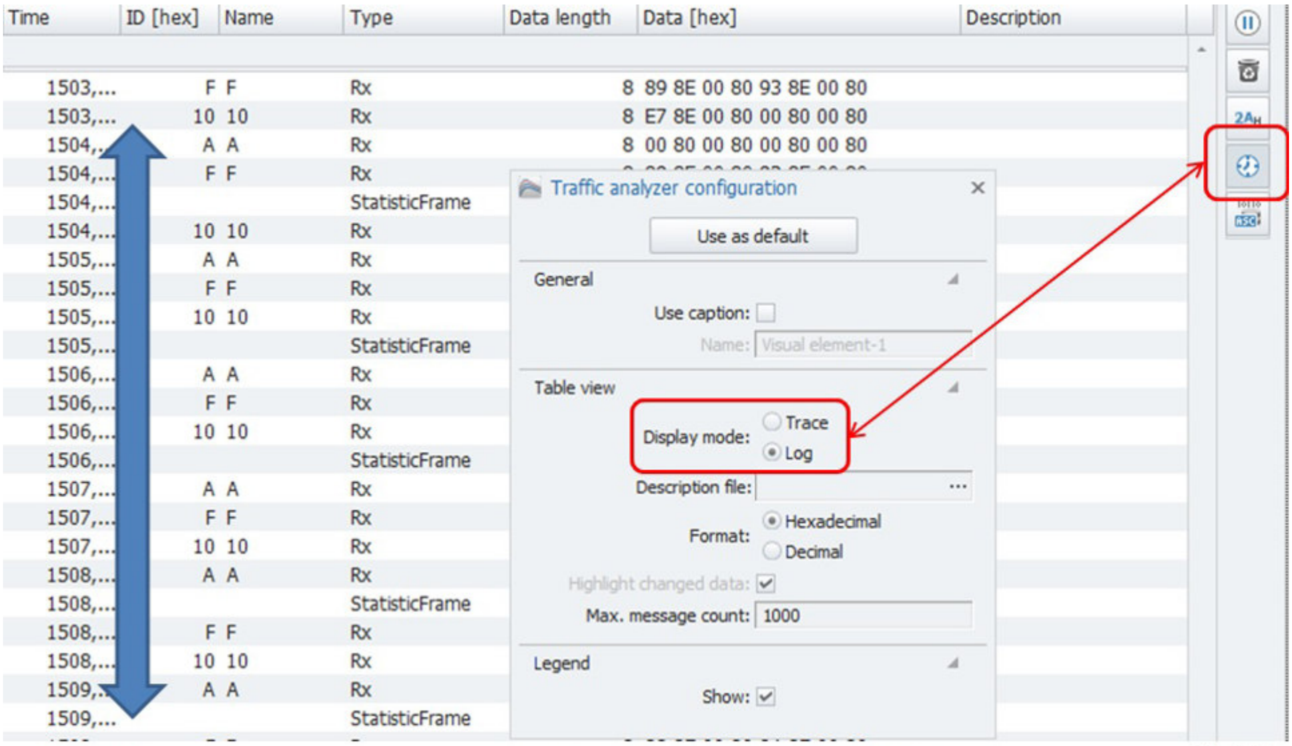
Switch between Decimal and Hexadecimal data and ID presentation.



[VI_156]

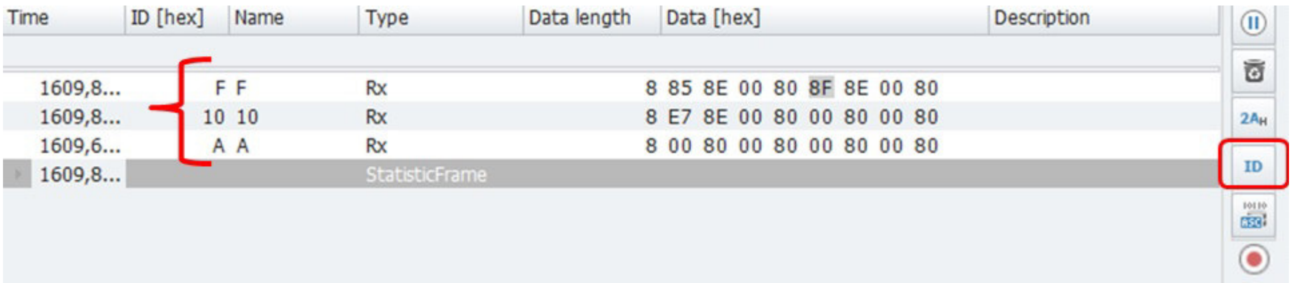
17.25.7 Instrument button to switch between Log and Trace mode

In the Log mode you see all incoming message with the most resent messages at the end of the table.



Log mode Switch between Log or Trace display mode. [VI_157]

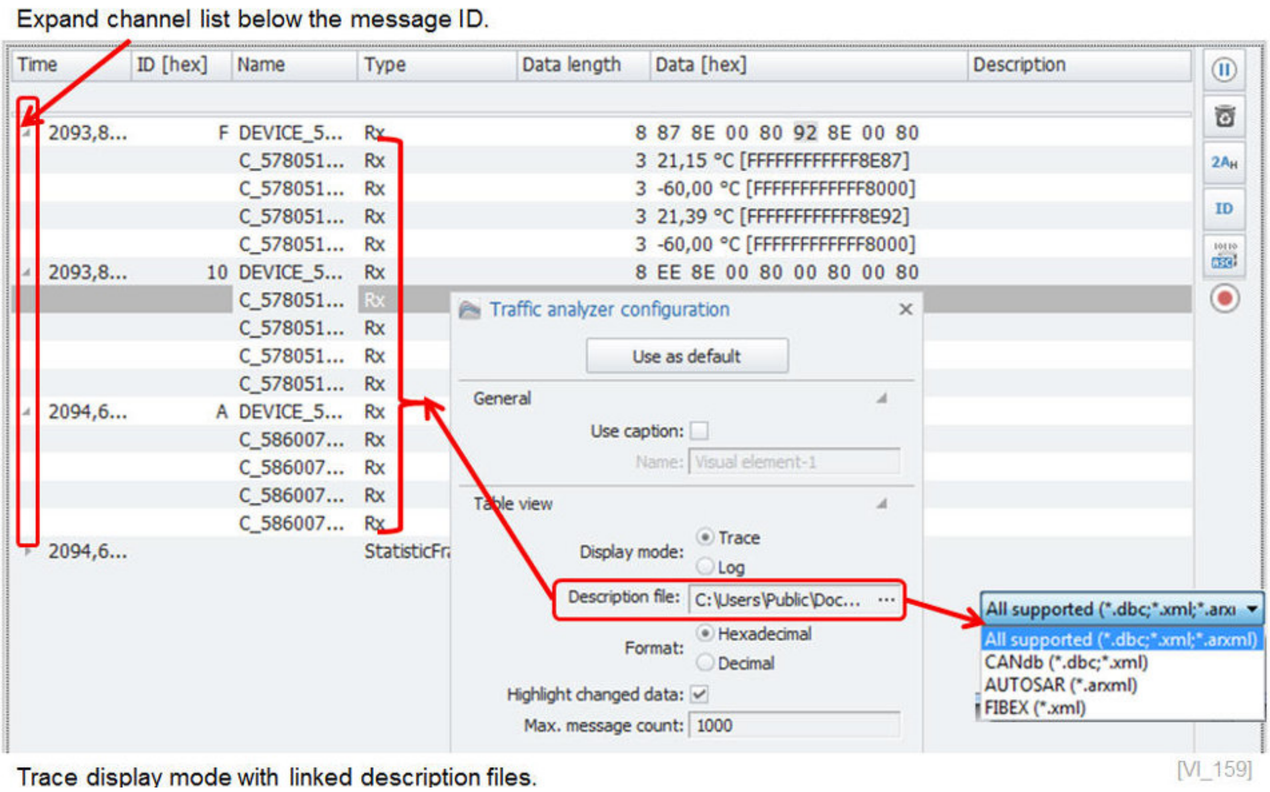
You can set the Log display mode from the head-up display or from the instrument button directly.
In the display trace view you get a static presentation of the message IDs and only the time stamp and the data column is updated.



Trace mode: Static display of message IDs. [VI_158]

17.25.8 Link description files to trace display mode

When you link a corresponding description file (DBC, Fibex, AUTOSAR) file to your traffic the instrument can directly convert the data frames received directly in signal names together with actual physical measurements.

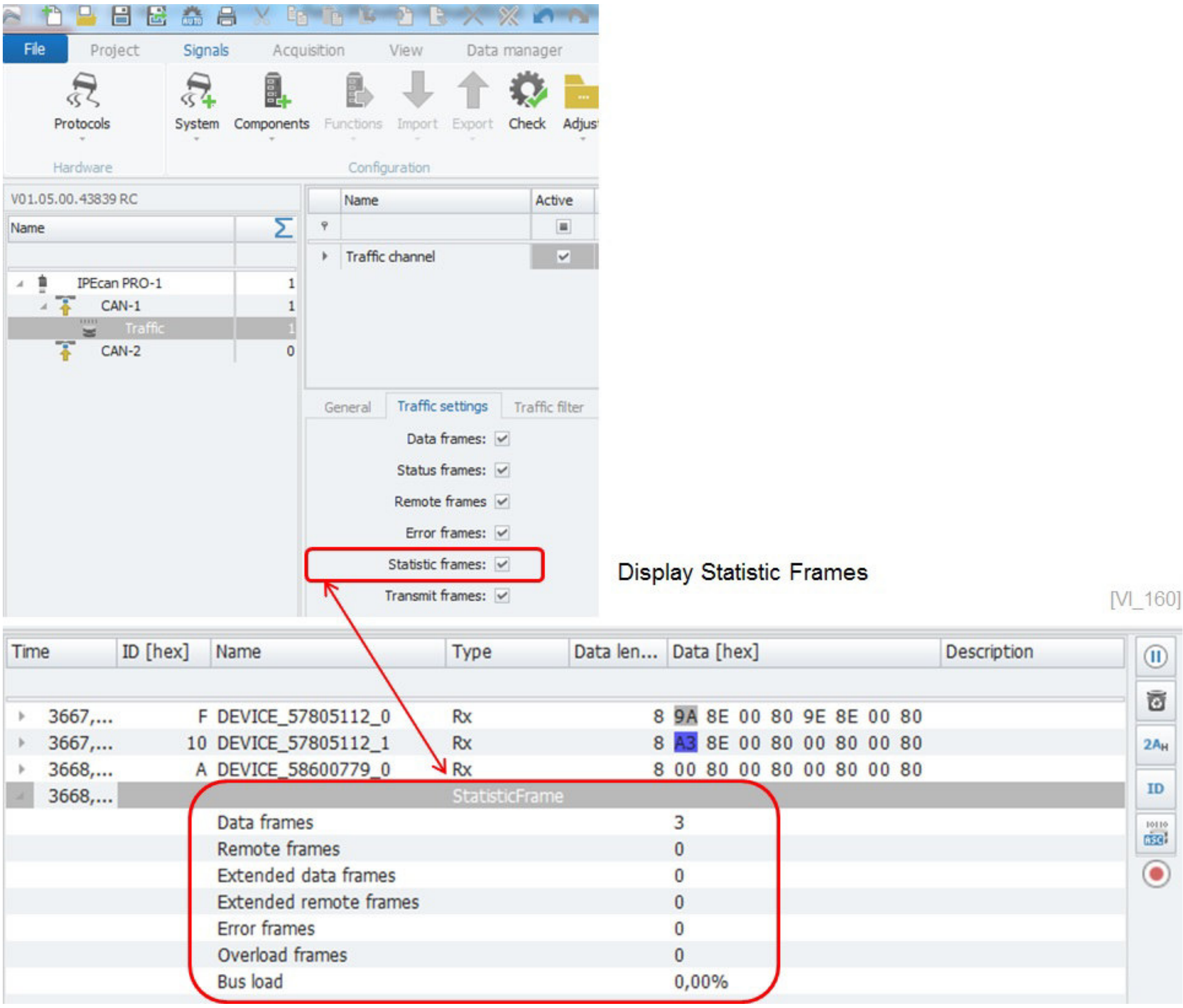


Information

The description files linked to the traffic analyzer instrument are not included in the .IWF file when you activate in the OPTIONS > Frequently used > the function include External files. This is a safety measure to ensure that confidential description files are not transferred between users through the exchange of IPEmotion .IWF measurement configuration files. 22.1.2.

17.25.9 Expand statistic frames

To display of the statistic frame in the traffic analyzer instrument you have to activate the static channel in the corresponding Protocols PlugIn in the traffic channel level. For more information about the different static channels see 17.25.1.

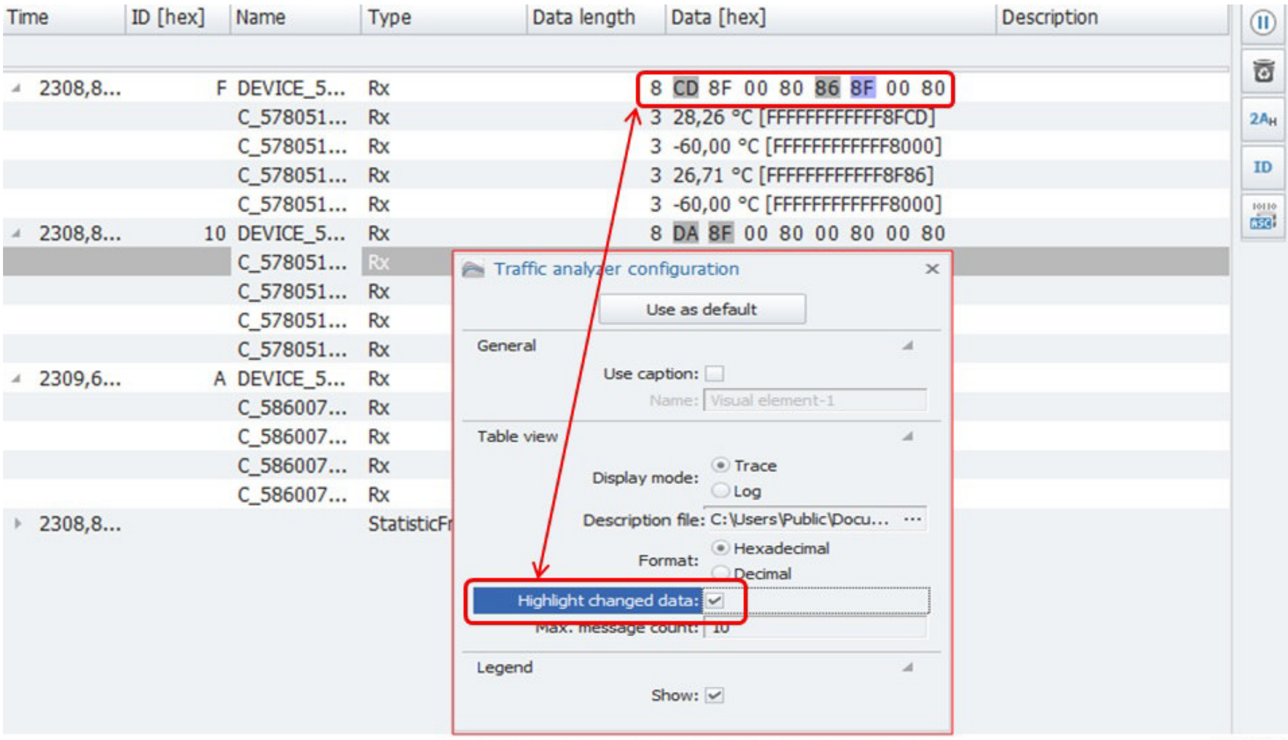


Display Statistic Frames

[VI_160]

17.25.10 Highlight changed byte data

The instrument supports a visual aid to spot changing bytes directly. By default the highlighting function is enabled. When bytes are changing the related background color of this byte is changing the color. The traffic instrument has an online update rate for the readings and the color changes of 10 Hz.



Show background color of changing data bytes. [VI_161]

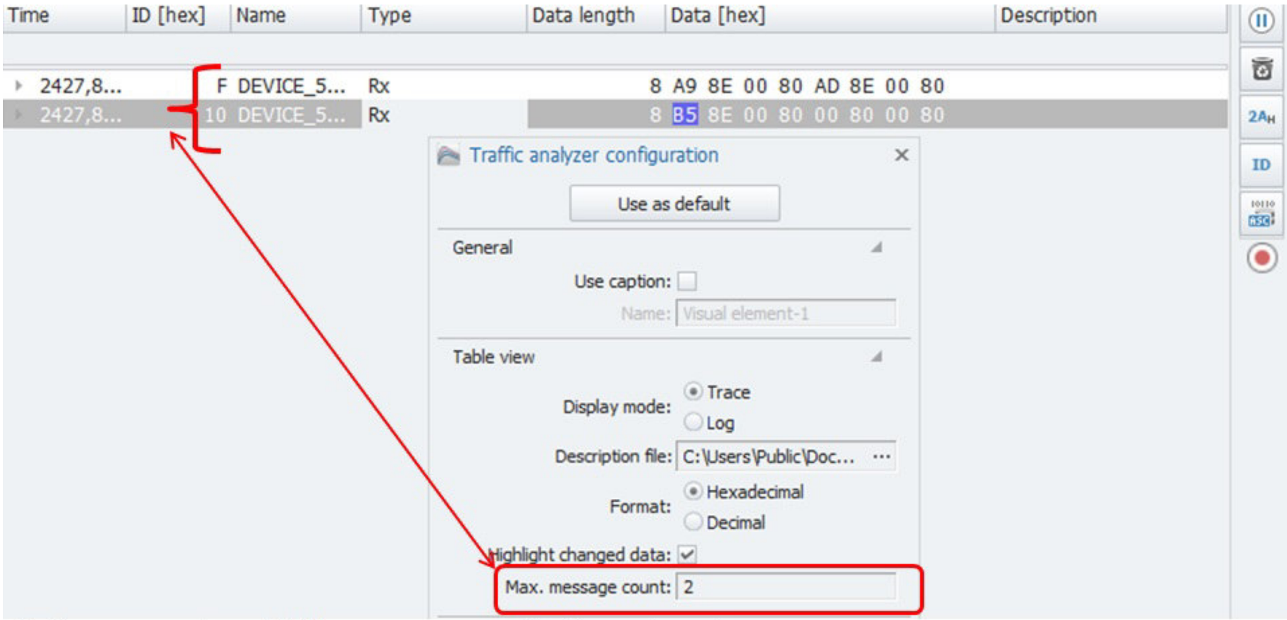
The background color coding is defined as following:

- ► Dark Blue — When a byte is changing the value in a time period of every 5 seconds or slower, it is indicated with blue back ground color. When no new value is received within the next 5 seconds the blue is fading away.
- ► Dark Grey — Dark grey is indicating frequently updated data bytes. When a byte is changing the value every 5 seconds or at shorter time periods the background color is dark grey.
- ► White — When a byte is static and not changing at all the background color turns to white color.

The sample rate has only a limited impact on the color code. When you apply a high measurement rate but the byte value is not changing the background color is not affected. The background color is affect by updated / new values. However is the sample rate slow e.g. every 10 seconds or 1 reading per minute, every new reading is considered as new data and the instrument will show all bytes with blue background color. In this constellation the instrument will never be able to show grey background color as the measurement rate is slower than needed for grey back ground color.

17.25.11 Message Count

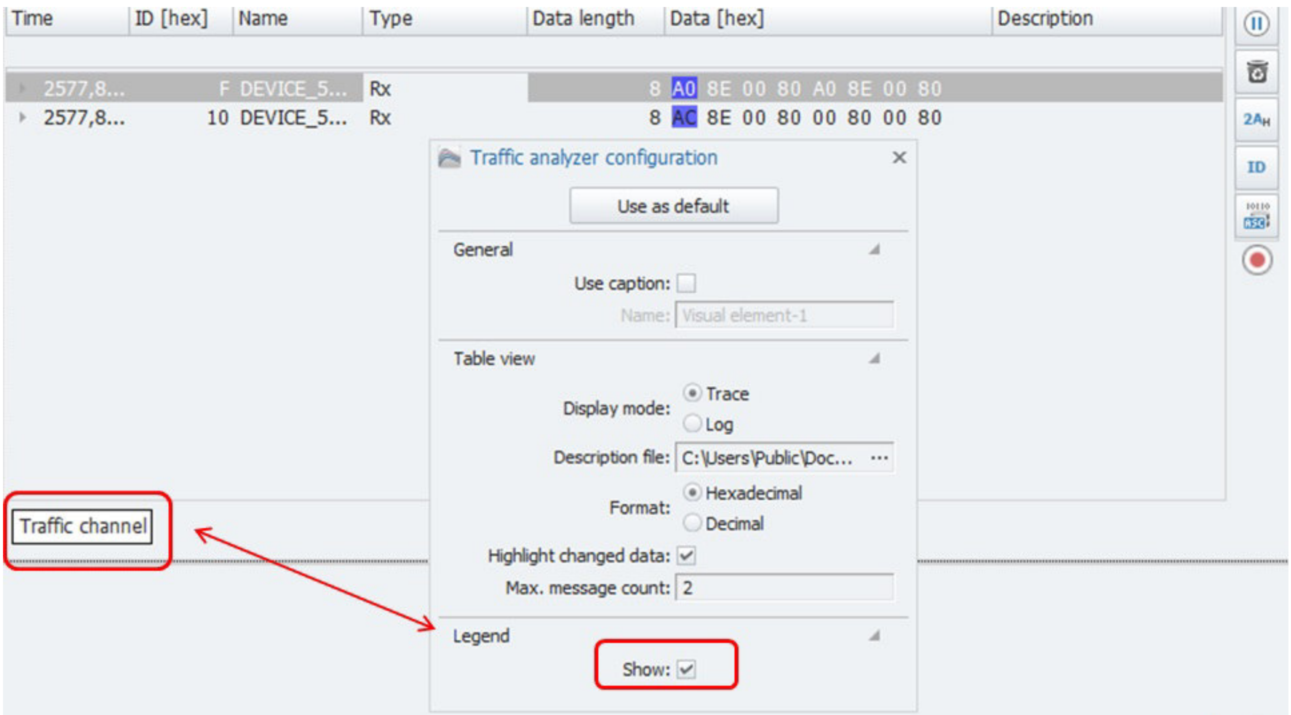
Here you define how many messages are stored in the instrument. The maximum number of messages which can be displayed in the instrument is 2000.



Define max number of CAN messages stored in the analyzer instrument. [VI_162]

17.25.12 Legend

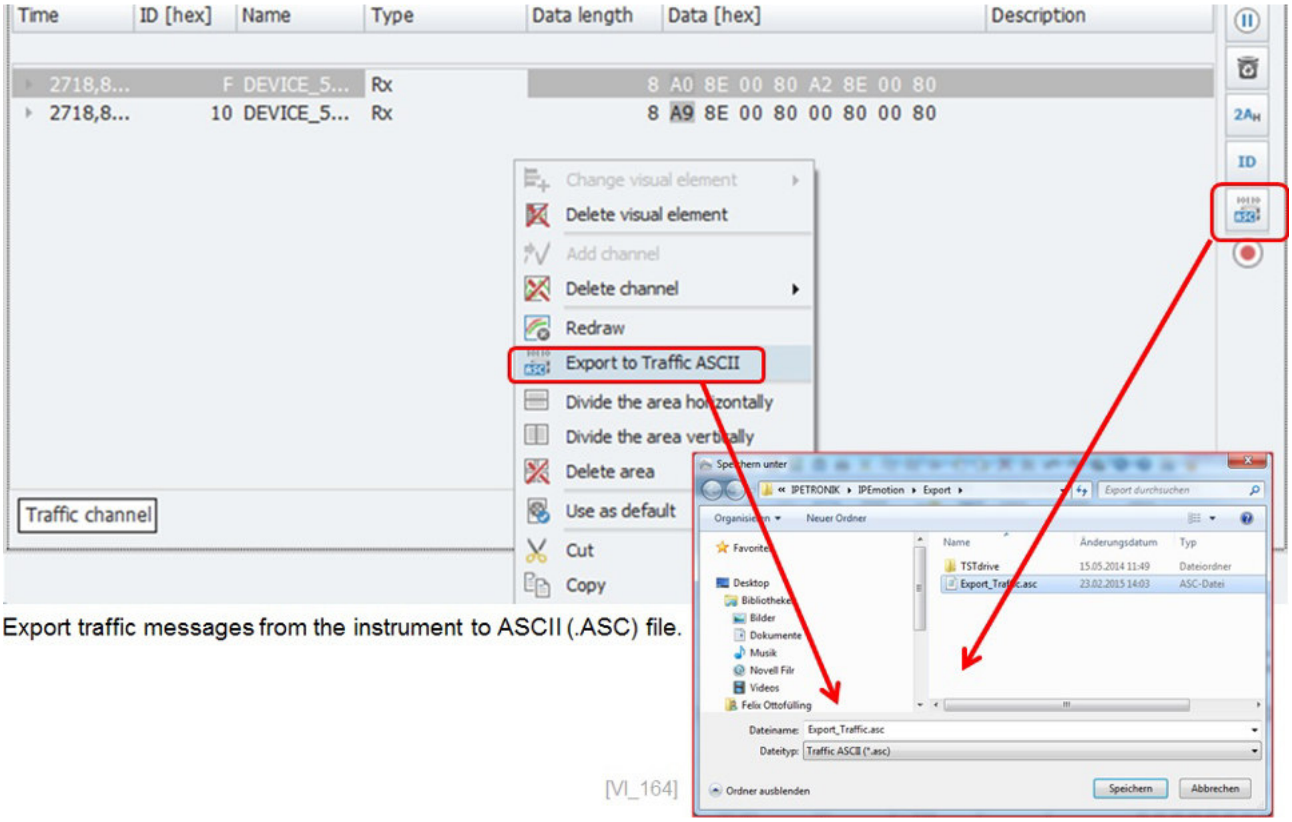
With this checkbox you can show or hide the “Traffic Channel” in the lower left corner of the instrument.



[VI_163]

17.25.13 Context menu – ASCII export

The data recorded in the Traffic Analyzer instrument can be exported from the context menu to ASCII (:ASC) files. These ASCII files can be used for traffic generation as discussed in chapter **??**.

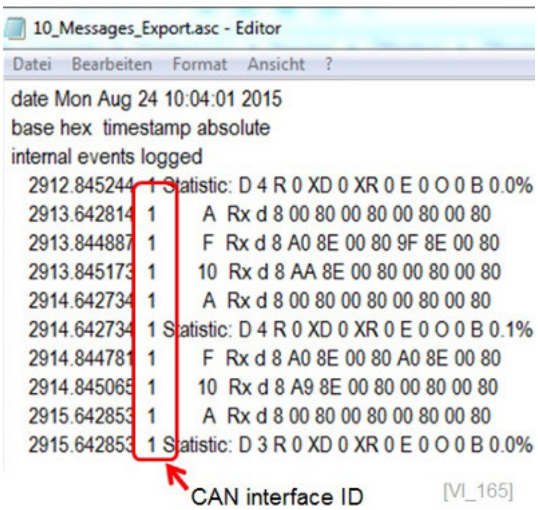


Export traffic messages from the instrument to ASCII (.ASC) file.

[VI_164]

Information *The ASCII data file export is always in hexadecimal format even if the display in the instrument is configured to decimal format. The ASCII export will include only the most resent values stored in the instrument.*

Traffic ASCII file.



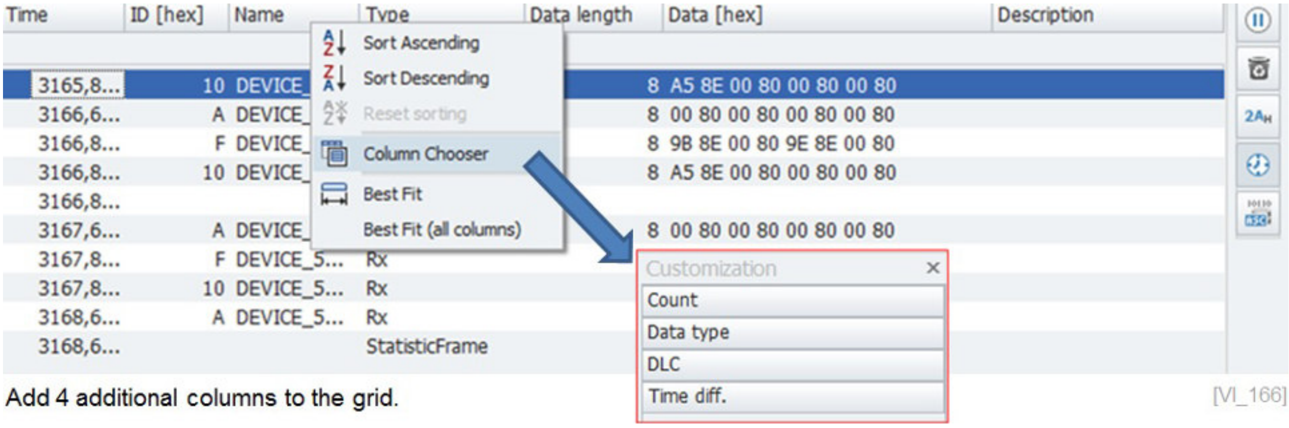
```
10_Messages_Export.asc - Editor
Datei  Bearbeiten  Format  Ansicht  ?
date Mon Aug 24 10:04:01 2015
base hex  timestamp absolute
internal events logged
   2912.845244 1 Statistic: D 4 R 0 XD 0 XR 0 E 0 O 0 B 0.0%
   2913.642814 1     A  Rx d 8 00 80 00 80 00 80 00 80
   2913.844887 1     F  Rx d 8 A0 8E 00 80 9F 8E 00 80
   2913.845173 1    10  Rx d 8 AA 8E 00 80 00 80 00 80
   2914.642734 1     A  Rx d 8 00 80 00 80 00 80 00 80
   2914.642734 1 Statistic: D 4 R 0 XD 0 XR 0 E 0 O 0 B 0.1%
   2914.844781 1     F  Rx d 8 A0 8E 00 80 A0 8E 00 80
   2914.845065 1    10  Rx d 8 A9 8E 00 80 00 80 00 80
   2915.642853 1     A  Rx d 8 00 80 00 80 00 80 00 80
   2915.642853 1 Statistic: D 3 R 0 XD 0 XR 0 E 0 O 0 B 0.0%
```


[VI_165]

The number of exported message to ASCII file is corresponding to the defined number of max message displayed in the instrument. When you define and display 10 messages in the instrument these 10 messages are exported to ASCII file.

17.25.14 Instrument grid columns and column chooser

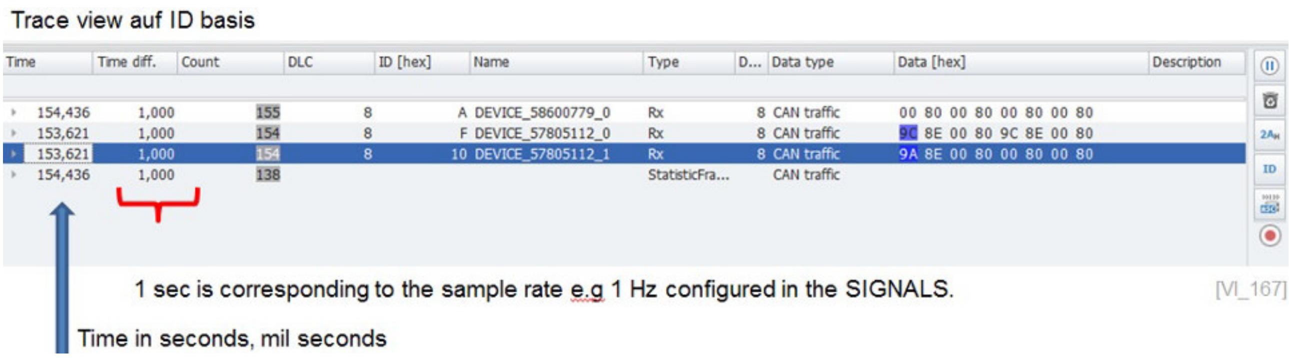
With the Column chooser you can add additional columns to the instrument grid.



[VI_166]

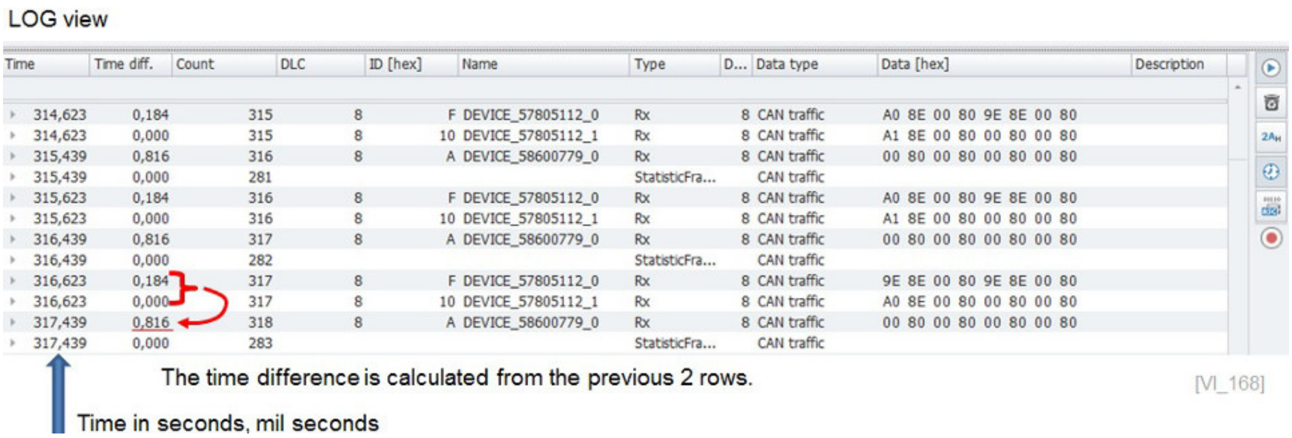
The following columns are available in the instrument:

- Time — Relative time in seconds. Starting with zero seconds if you press the acquisition button.
- Time diff. — Shows the time difference between the incoming messages. In the screen below, in the ID trace view the time difference between the incoming messages is 1 second.



[VI_167]

If you switch into LOG view the time difference is calculated between the previous incoming messages.

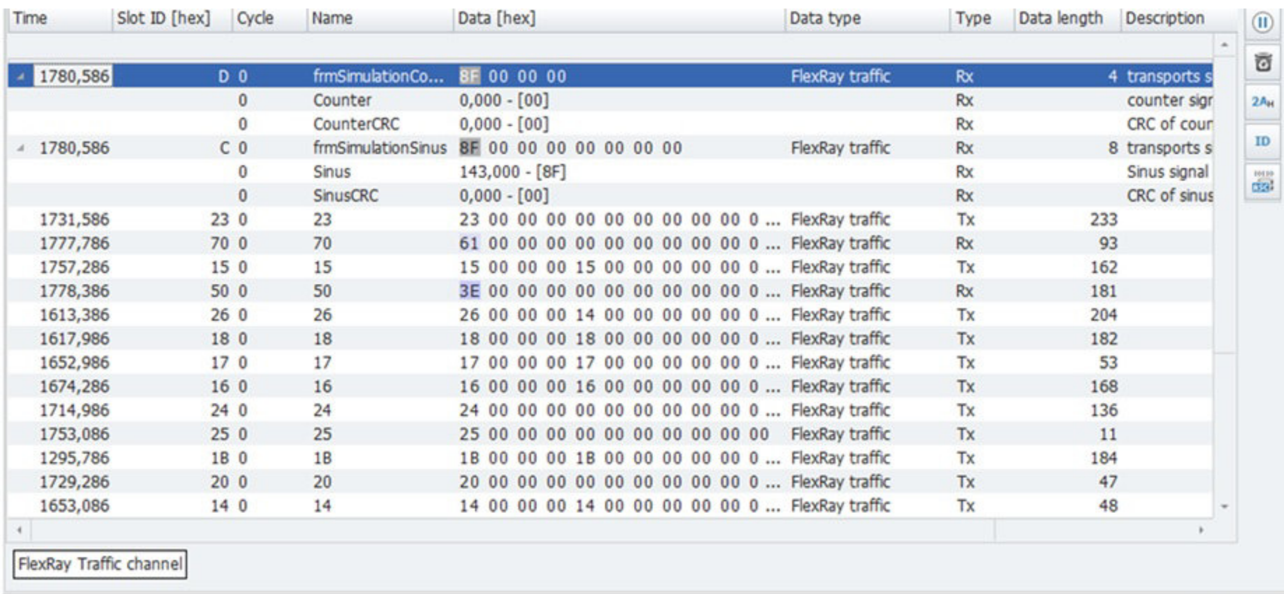


[VI_168]

- Count — Counting the number of messages from the display starting point
- ID — ID of the message.
- Name — Name of the message when description file islinked.
- Data type — Is differentiating CAN, CAN FD or FlexRay traffic.
- Data length — Is corresponding to the byte length of the message.
- DLC (Data Length Count) — Is indicating the byte length of the messages received. DLC is ranging from CAN: 0 – 8, CAN FD: 0 – 15 and FlexRay: 0 – 254. In the range count 0 – 8 the DLC is corresponding to the byte length of the message indicated in the column Data length. In the range 9 – 15 the DLC number needs to be converted into the byte length. The conversion is defined in the following table.
  DLC 9 ->12 Byte Data
  DLC 10 ->16 Byte Data
  DLC 11 ->20 Byte Data
  DLC 12 ->24 Byte Data
  DLC 13 ->32 Byte Data
  DLC 14 ->48 Byte Data
  DLC 15 ->64 Byte Data
- Type — Type of message, Rx - receive, Tx - transmit, Error, Statistic. The available message types are depending on the functions selected in the Protocols PlugIn discussed above 17.25.1.
- Data — Data of the message display hexadecimal or decimal.
- Description — This field is only filled with a value if you have a channel / message description included in the DBC or Fibex XML file.

17.25.15 FlexRay traffic analysis

The traffic analyzer instrument is supporting FlexRay traffic also. When a FlexRay traffic channel is linked to the instrument the instrument columns are adapted to the FlexRay format.



Time	Slot ID [hex]	Cycle	Name	Data [hex]	Data type	Type	Data length	Description
1780,586	D	0	frmSimulationCo...	8F 00 00 00	FlexRay traffic	Rx	4	transports s
		0	Counter	0,000 - [00]		Rx		counter sigr
		0	CounterCRC	0,000 - [00]		Rx		CRC of cour
1780,586	C	0	frmSimulationSinus	8F 00 00 00 00 00 00 00	FlexRay traffic	Rx	8	transports s
		0	Sinus	143,000 - [8F]		Rx		Sinus signal
		0	SinusCRC	0,000 - [00]		Rx		CRC of sinus
1731,586	23	0	23	23 00 00 00 00 00 00 00 00 00 0 ...	FlexRay traffic	Tx	233	
1777,786	70	0	70	61 00 00 00 00 00 00 00 00 00 0 ...	FlexRay traffic	Rx	93	
1757,286	15	0	15	15 00 00 00 15 00 00 00 00 00 0 ...	FlexRay traffic	Tx	162	
1778,386	50	0	50	3E 00 00 00 00 00 00 00 00 00 0 ...	FlexRay traffic	Rx	181	
1613,386	26	0	26	26 00 00 00 14 00 00 00 00 00 0 ...	FlexRay traffic	Tx	204	
1617,986	18	0	18	18 00 00 00 18 00 00 00 00 00 0 ...	FlexRay traffic	Tx	182	
1652,986	17	0	17	17 00 00 00 17 00 00 00 00 00 0 ...	FlexRay traffic	Tx	53	
1674,286	16	0	16	16 00 00 00 16 00 00 00 00 00 0 ...	FlexRay traffic	Tx	168	
1714,986	24	0	24	24 00 00 00 00 00 00 00 00 00 0 ...	FlexRay traffic	Tx	136	
1753,086	25	0	25	25 00 00 00 00 00 00 00 00 00 00	FlexRay traffic	Tx	11	
1295,786	1B	0	1B	1B 00 00 00 1B 00 00 00 00 00 0 ...	FlexRay traffic	Tx	184	
1729,286	20	0	20	20 00 00 00 00 00 00 00 00 00 0 ...	FlexRay traffic	Tx	47	
1653,086	14	0	14	14 00 00 00 14 00 00 00 00 00 0 ...	FlexRay traffic	Tx	48	

FlexRay Traffic channel

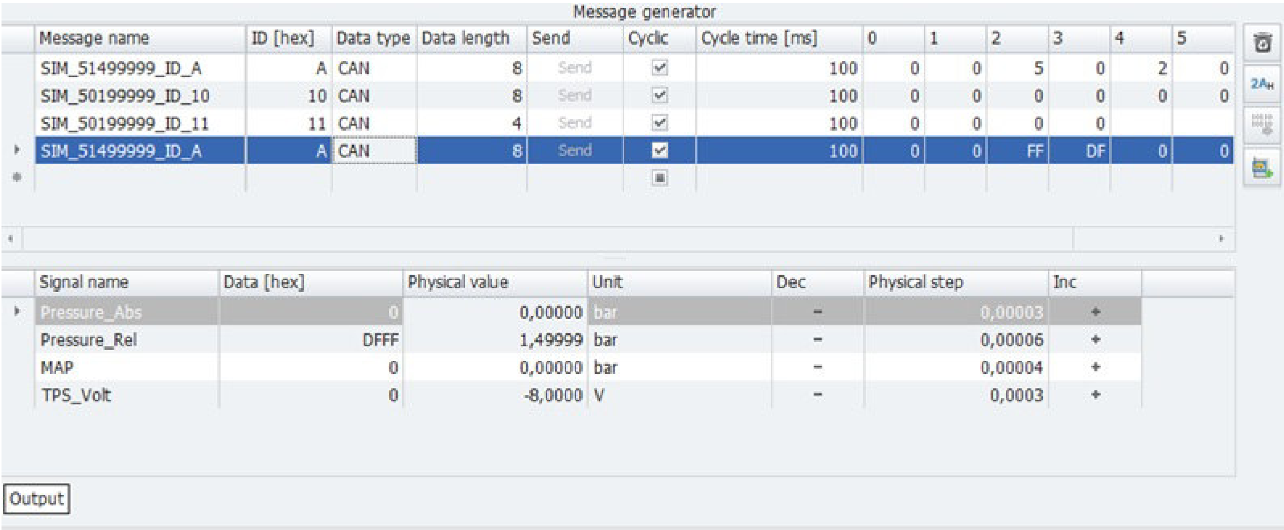
Traffic analyzer with FlexRay signals. [VI_169]

- Slot ID — Message ID
- Cycle — Transfer cycle

17.26 Message Generator

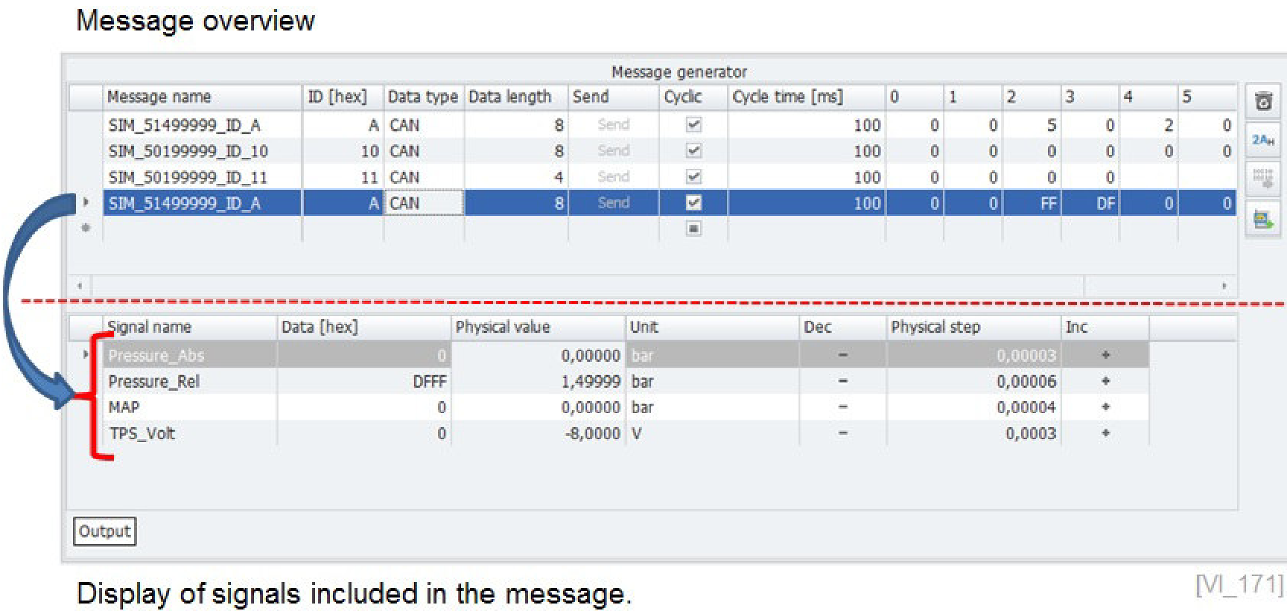
17.26.1 YouTube resources

IPEmotion - Online Instrument - Message Generator: http://youtu.be/Hi8LyfnKCu0



[VI_170]

With the message generator you can edit output values and send messages from a reference DBC file. When you have loaded a DBC file you see that the instrument is divided in 2 main sections. In the upper part you see the CAN IDs and the related message data properties like CAN or CAN FD type, message length etc. . .

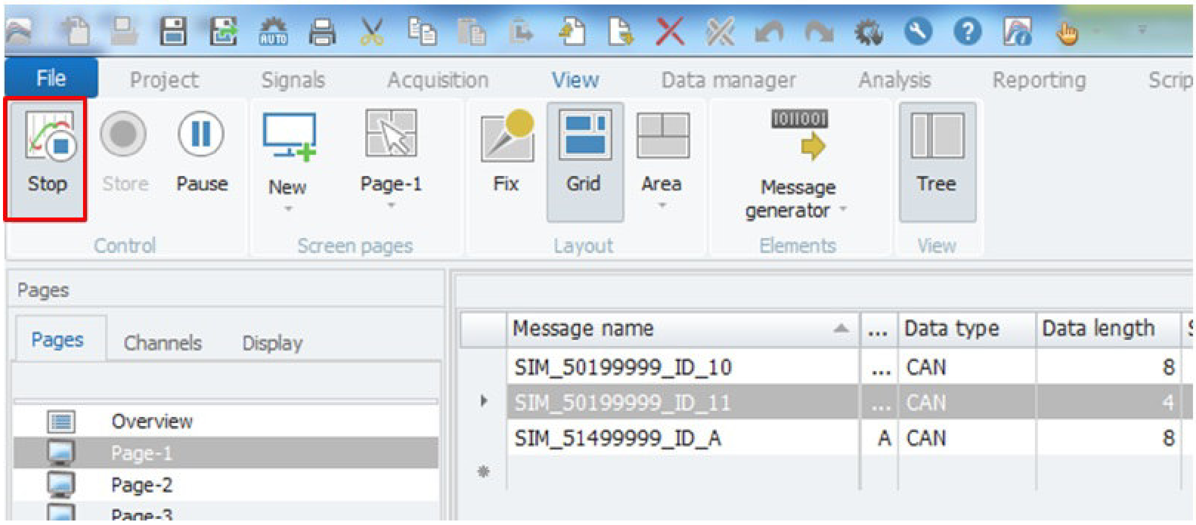


[VI_171]

In the lower part of the instrument you see the channels / labels included in the message. When you select a message ID from the top you see the related channels included in this specific ID below.

Information	*You have to start the measurement mode of IPEmotion in order to send the messages over the CAN interface. The instrument configuration and data values are always updated inside the instrument but they are only effectively transferred, when you are in the measurement mode.*

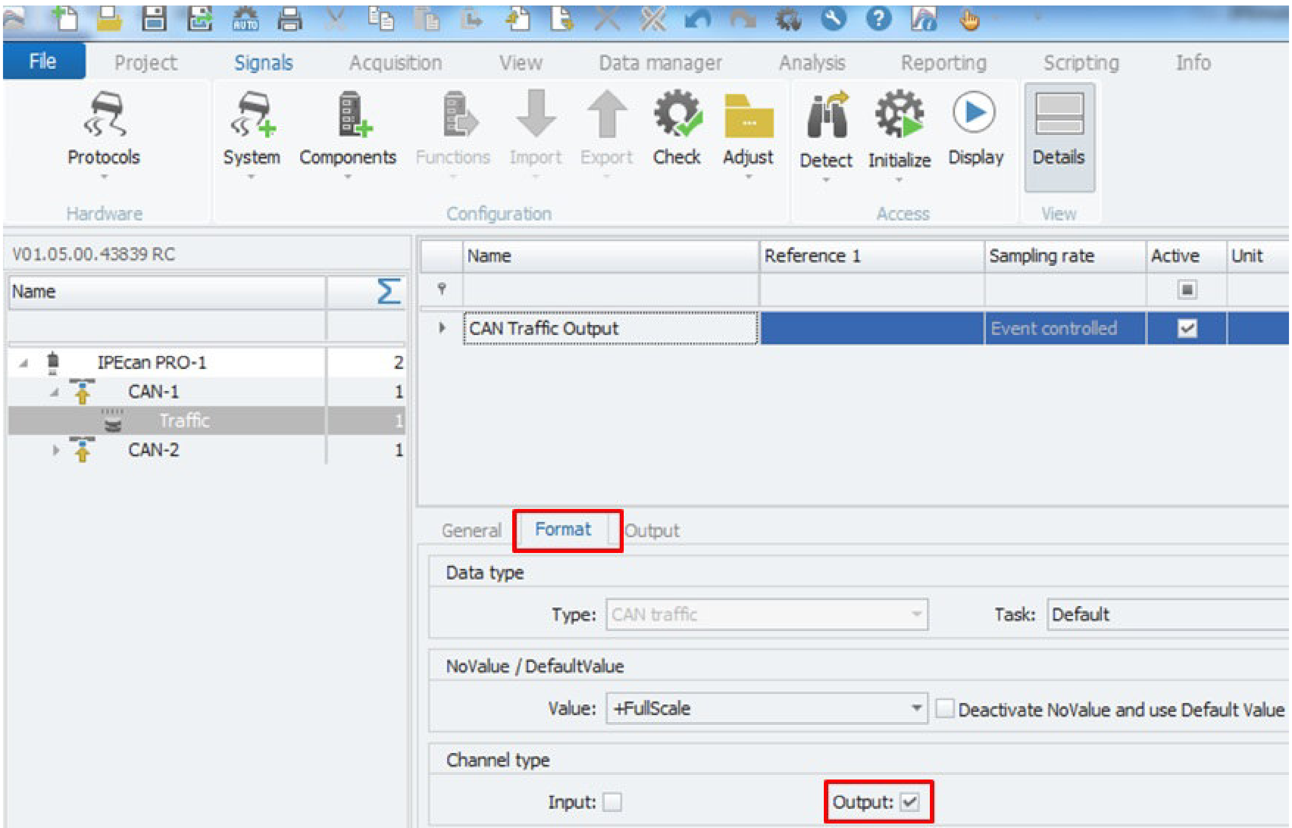
Start measurement to send data out.



[VI_172]

17.26.2 Required PlugIn for traffic output generation

To operate the message generator you need a corresponding PlugIn supporting traffic sending functions. In this example Protocols PlugIn is used. Select a CAN interface and create on the CAN interface a traffic channel. The default configuration is traffic input measurement. If you like to send CAN messages you need to change the data direction in the Format tab sheet to output.

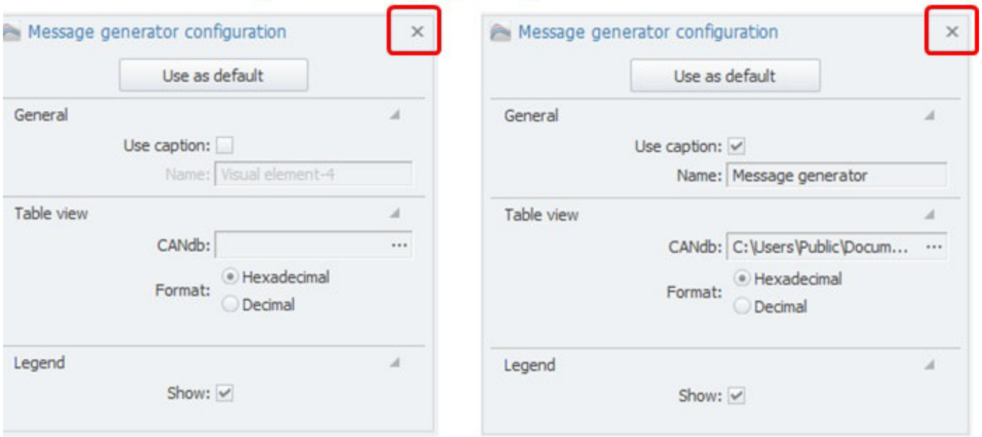


[VI_173]

If you cannot see the format tab sheet activate in OPTION >Basic settings >Expert mode the check box extended tabs sheets. For more details see 22.3.1. When the traffic channel is set to output can send and measure traffic on the same CAN interface at the same time.

17.26.3 Message generator head-up display

Exit and save the settings of the dialog by closing on the **X**.

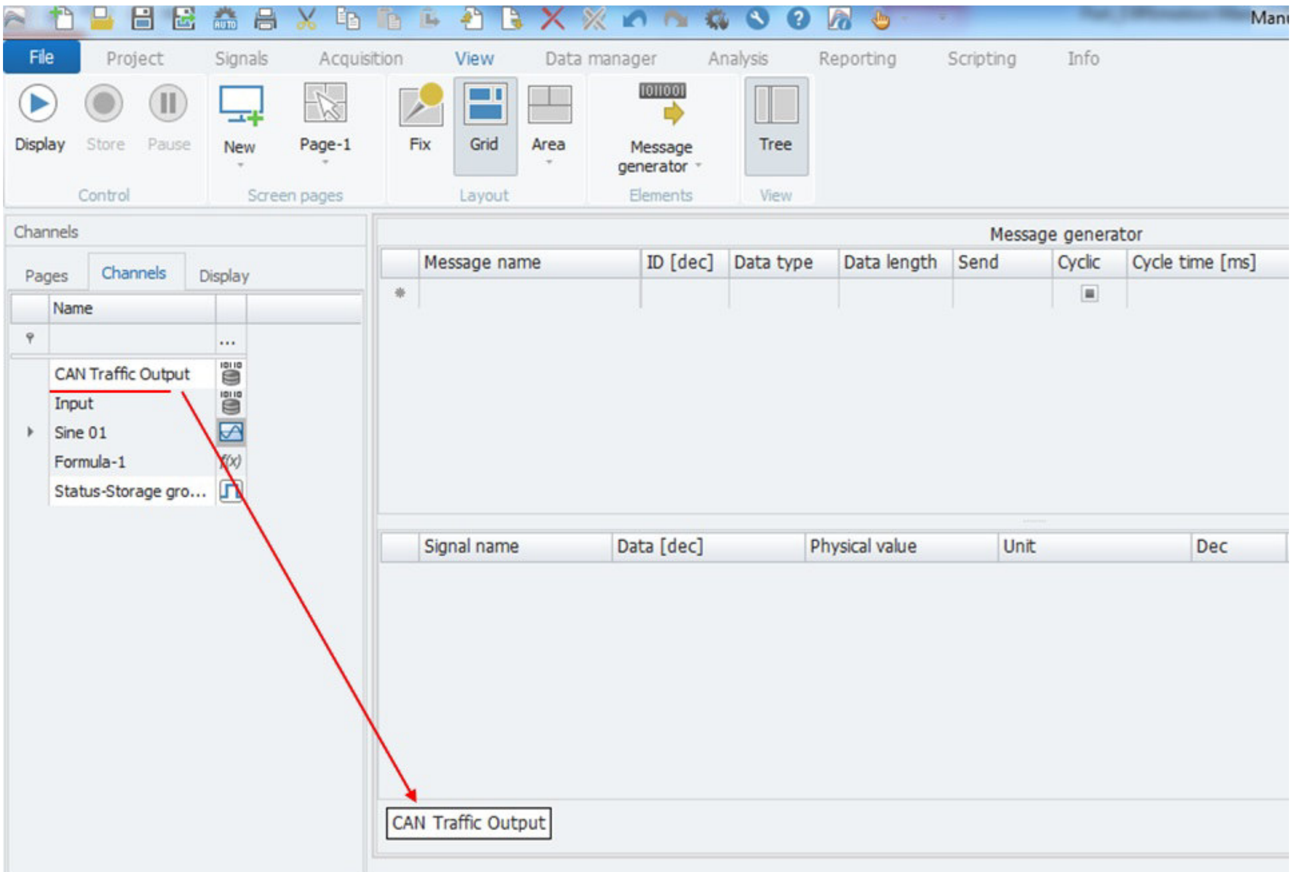


Same configuration properties with and without linked output channel to the instrument. [VI_174]

In the head up displays you can load the CANdb to select the message you like to send. Also you can change the data format from hexadecimal to decimal. The functions are also available through the instrument buttons which will be discussed below.

17.26.4 Link traffic output channel to instrument

In order to put the instrument into operation you need to link an traffic output channel which is configured in the SIGNALS workspace to the instrument.

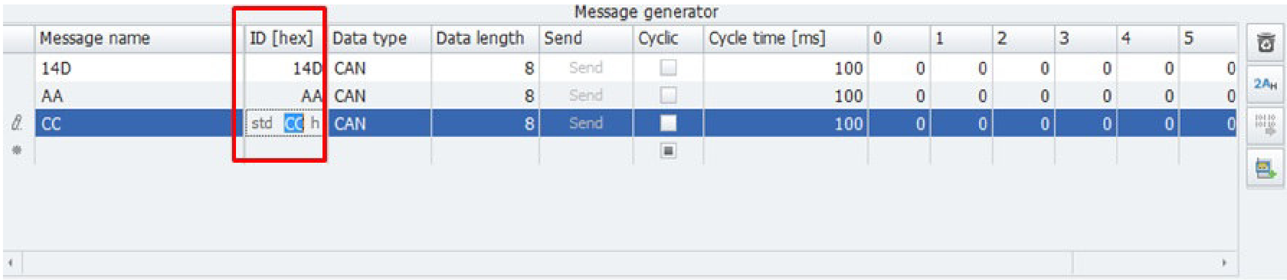


Link traffic output channel to the message generator instrument. [VI_175]

You can only link one traffic output channel by instrument.

17.26.5 Import CANdb and select CAN messages for output generation

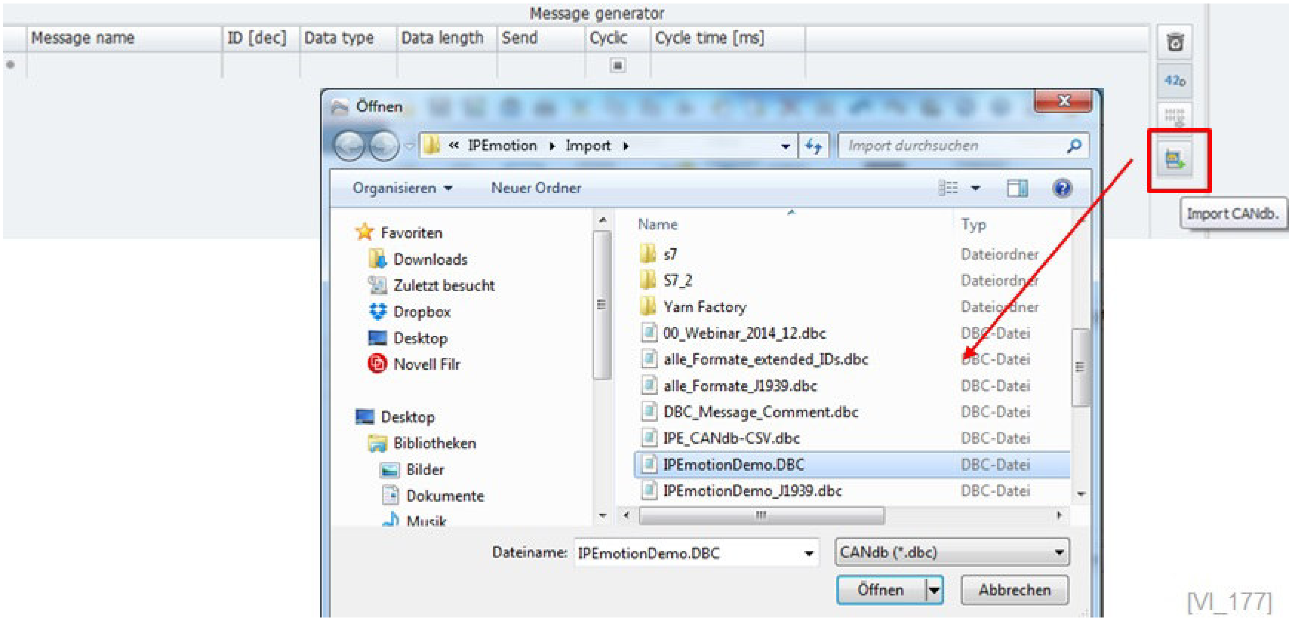
To put the instrument into operation you can either enter individual message IDs or you load a DBC reference file. To enter messages manually you access the ID column and type the values in the HEX value range 0 - FF.



In the column ID you can enter individual messages IDs.

[M_176]

The message name cannot be edited.
The other possibility is to load a DBC file and select from the DBC file the messages manually.



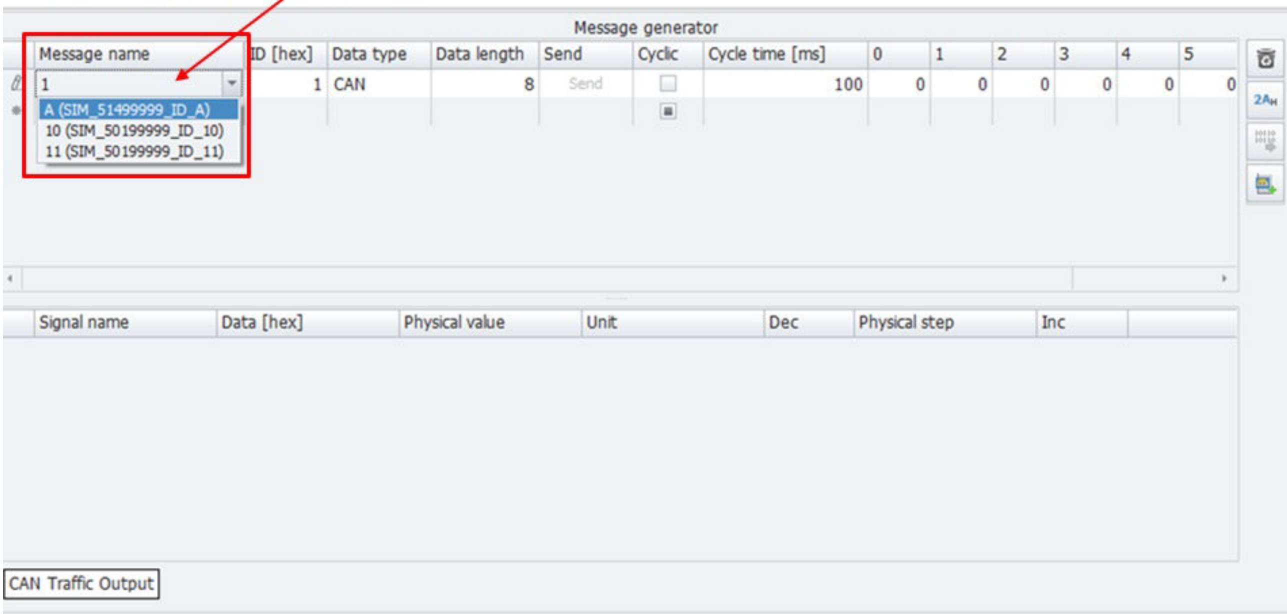
[M_177]

Information

You can load only one DBC file to select messages. However if you like to have messages from several DBC files in the message generator, load one DBC after another and select the channels needed from the channel name column.

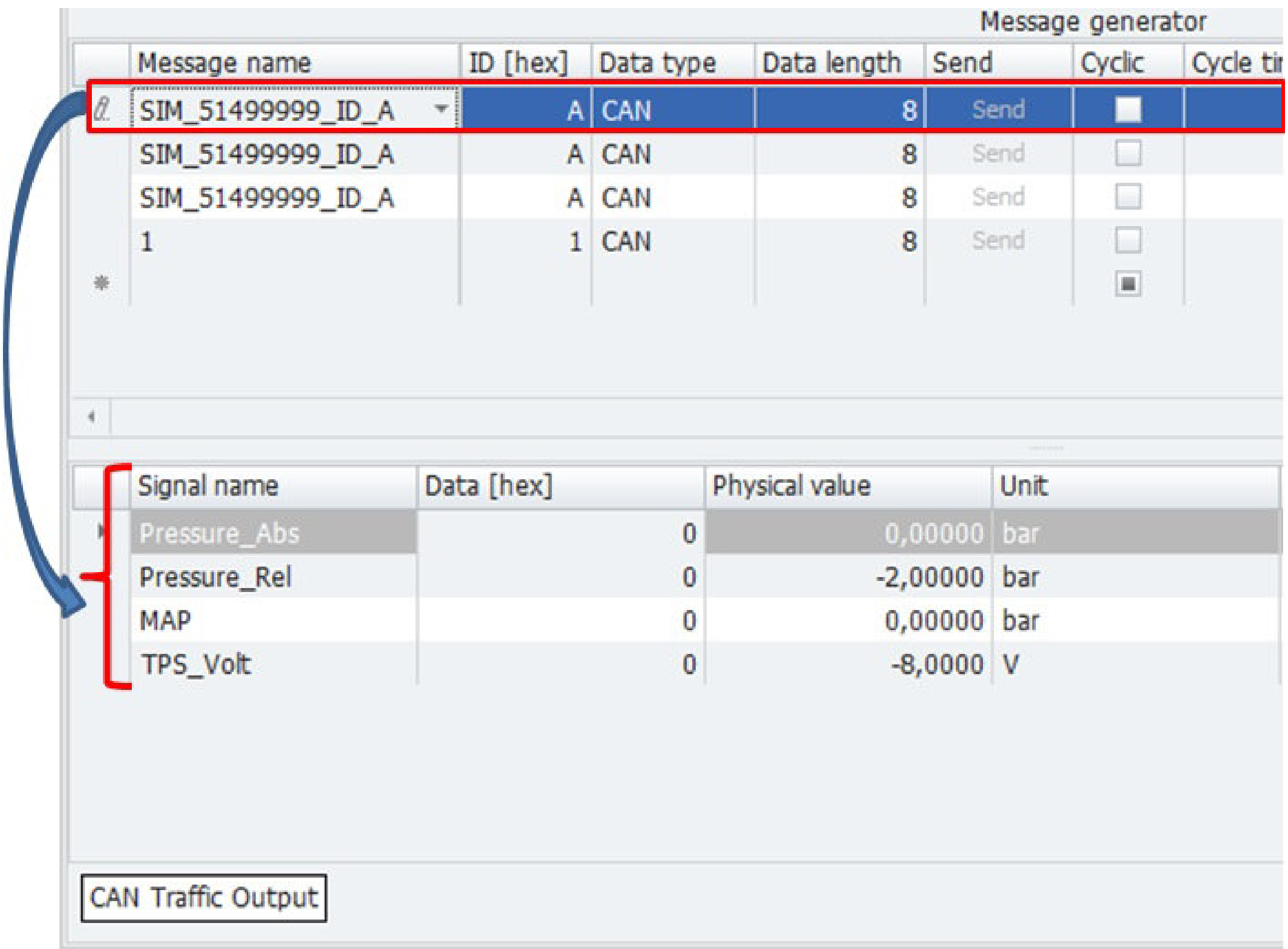
After loading the DBC file you can select the messages in the column message name from the pull down list. In the pulldown list all messages included in the DBC are available.

Select messages from pull down list.



[VI_178]

When you highlight and select one message the signals included in the message are displayed in the lower part of the instrument. The same message from the DBC can be selected multiple times too.

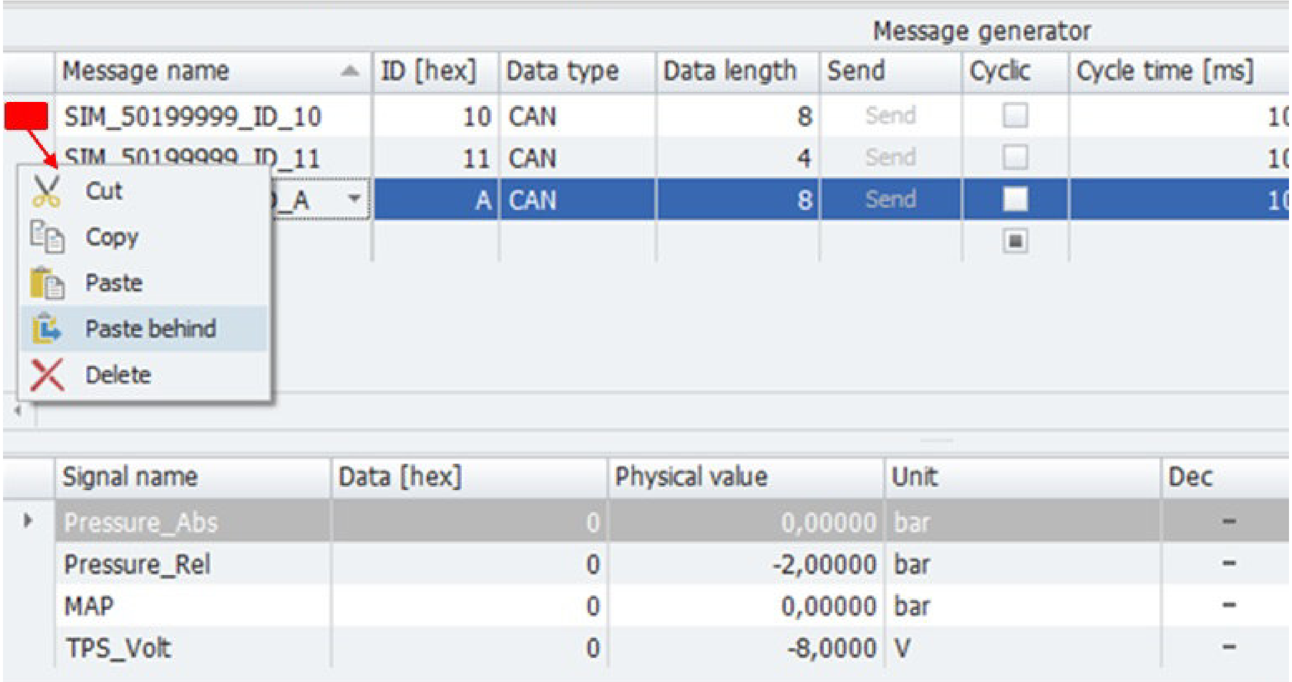


Select message and display signals of the message.

[VI_179]

With a right click in the very first column you can access a context menu to change the order of message IDs by using the cut, copy, past and past behind or delete function.

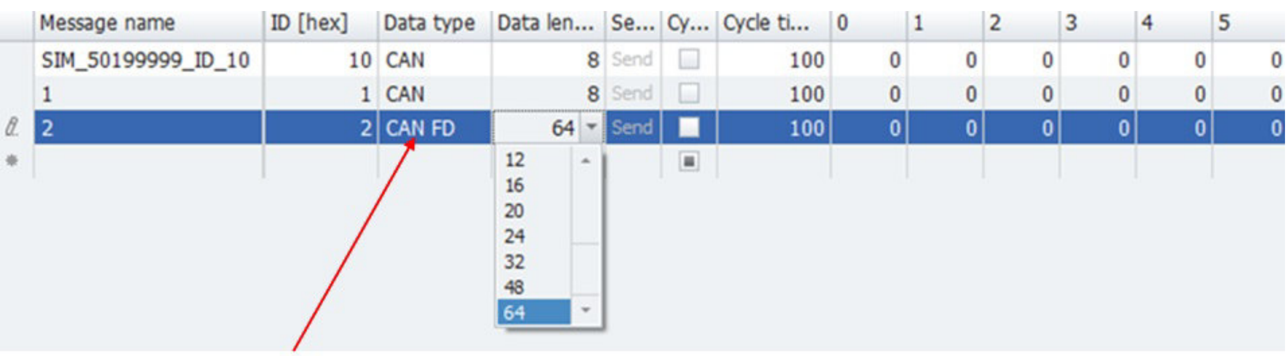
Context menu to change order of message IDs



[VI_180]

17.26.6 Instrument grid and columns

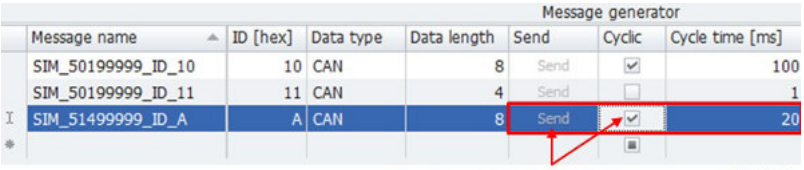
- **Message name** — The message name is selected from the drop down list from the loaded DBC file. When you enter message IDs manually the name is equal to the ID. The message name cannot be edited.
- **ID** — ID is predefined by the selected messages when a DBC file is loaded. When you enter messages manually you can define any ID in the valid HEX input range of 0- FF.
- **Data type** — In the column data type you select between CAN and CAN FD. The data type CAN FD is only available when the selected CAN card in the SIGNALS work space is supporting CAN FD or when you have no Traffic channel linked to the instrument. When CAN FD is selected the 64 bit messages can be configured.



Data type CAN / CAN FD depending on Can

[VI_181]

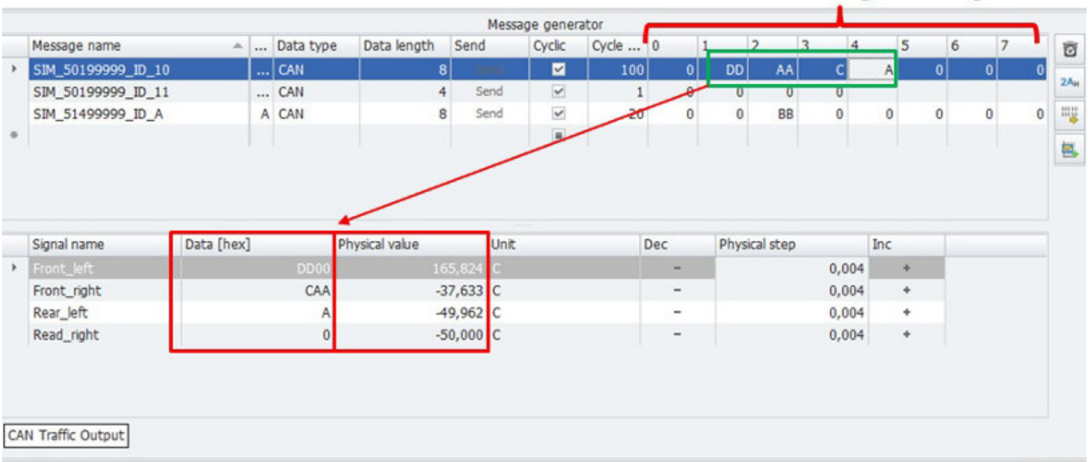
- **Data length** — The data length is related to the CAN data type. CAN is supporting up to 8 bit and CAN FD up to 64 bit. When you load a DBC file the length of each message ID is defined and the data byte grid is reflecting the length in the byte grid.
- **Send** — This is static information as the default function is send mode
- **Cyclic** — This checkbox is activating the cyclical output generation.
- **Cylce time** — Cycle time defines the frequency for the transfer. The slowest transfer rate is 10.000 ms = 10 sec.



Cyclic modus & cycle time [VI_182]

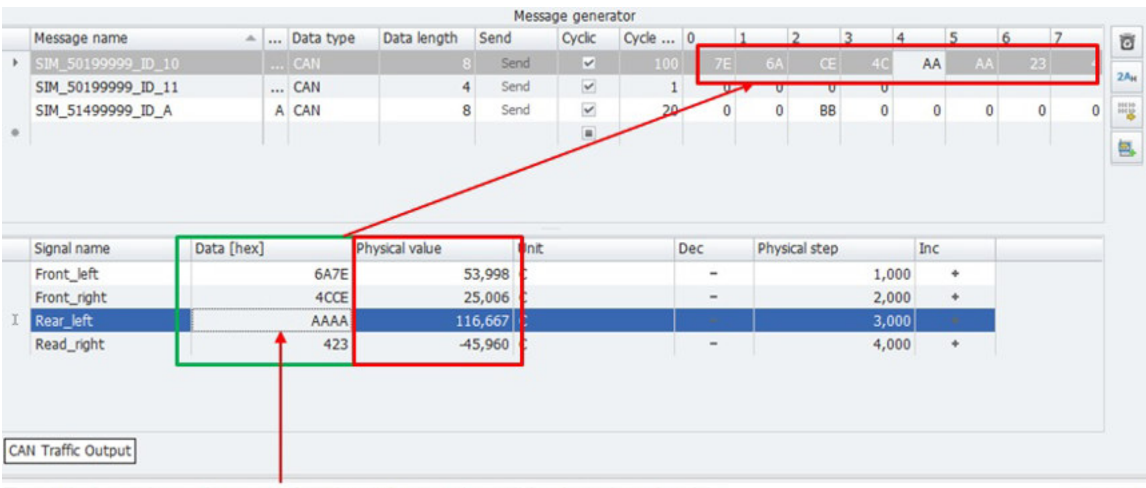
- **Data bytes** — In the byte grid you can directly enter the values you like to send. The byte values are directly converted into physical values on signal level in the lower part of the instrument.

Enter values for transfer in the message ID data grid.



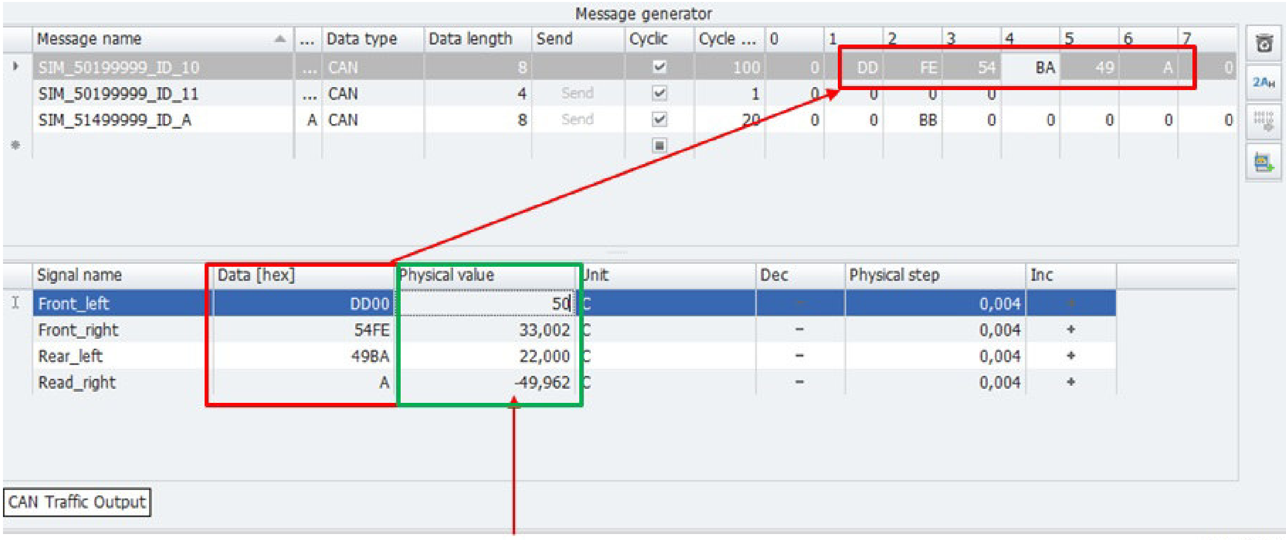
[VI_183]

You can enter alternatively data byte values on signal level. The physical values are updated automatically.



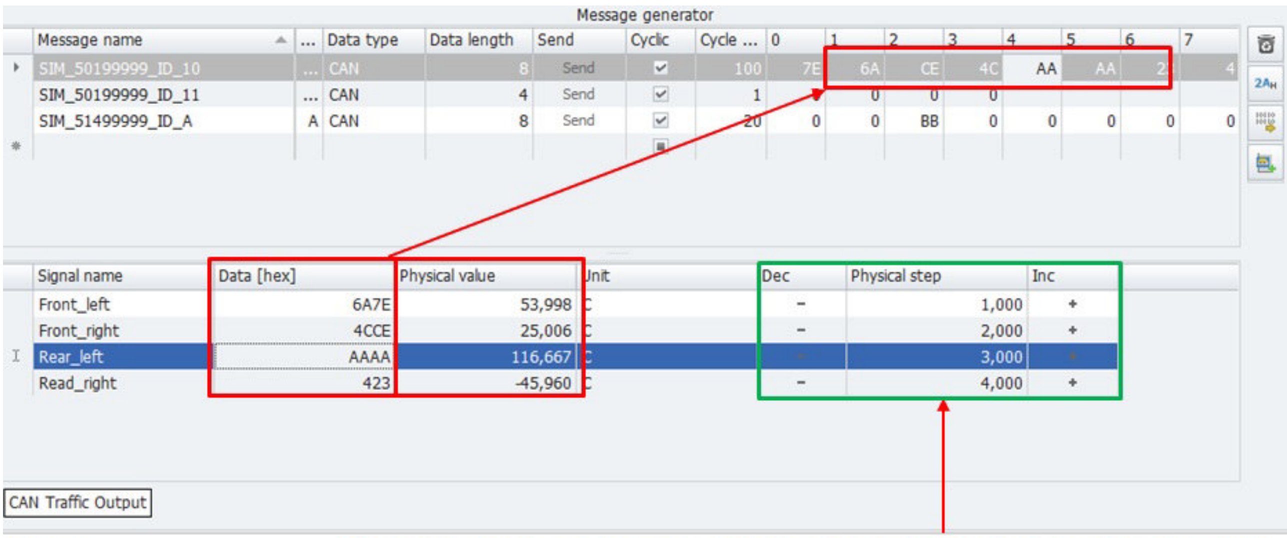
Enter byte values for transfer the "data column" in the signal grid. [VI_184]

Another possibility is to enter physical values directly in signal level.



Enter physical values for transfer in the signal grid. [VI_185]

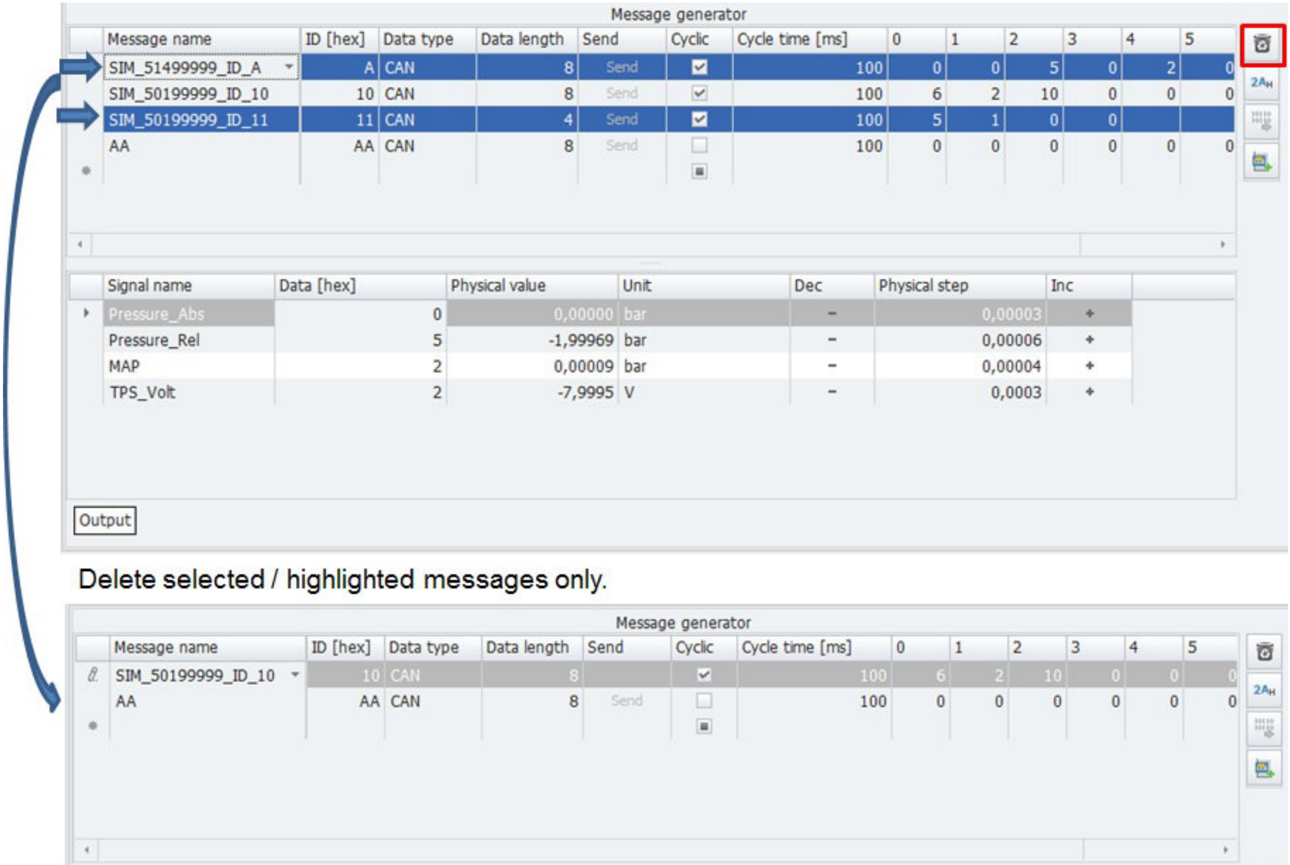
Finally you can add physical values also through the spin buttons by an individual defined step value. With every hit on the button the output value is changing by the defined value for the physical step.



[VI_186] Enter physical values through up (Inc) and down (Dec) buttons in the signal grid.

17.26.7 Instrument button to delete selected messages

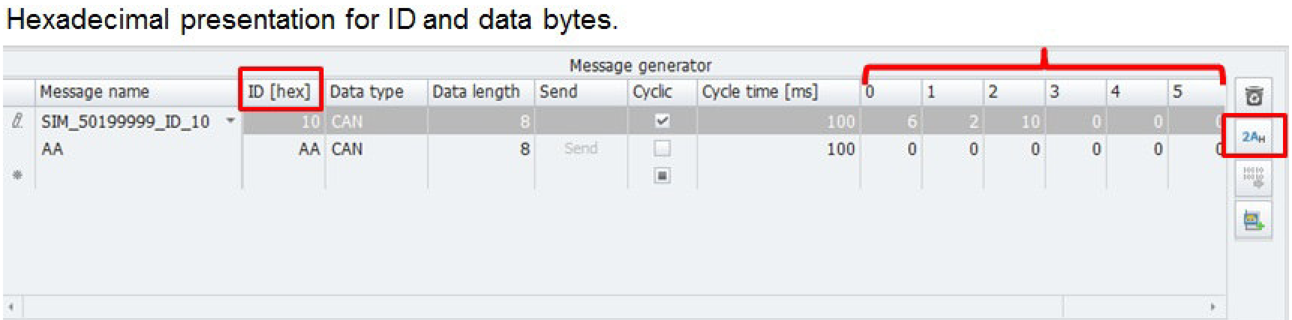
With the instrument delete button only the selected messages (lines) are deleted. You do not delete all messages.

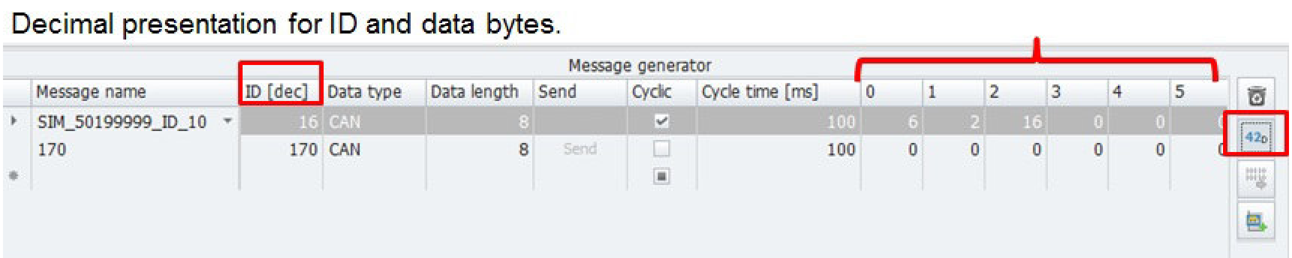


[VI_187]

17.26.8 Instrument button to switch between Hex and Dec data

With this button you switch ID and data byte presentation between hexadecimal and decimal presentation.

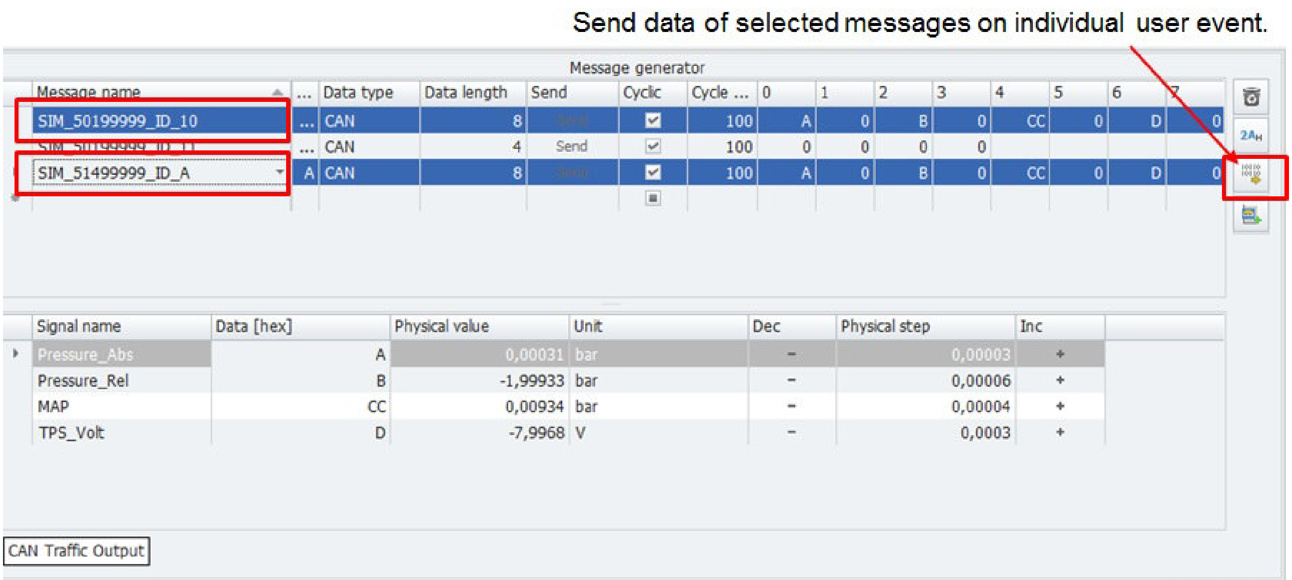




[VI_188]

17.26.9 Instrument button to send all selected messages manually

The data is sent only in the measurement mode of IPEmotion. When you activate the cyclical transfer the data values entered are transferred in this interval. However if you like to send specific messages manually at a user defined time point you can select the messages enter the value and hint the transfer button. The manual transfer can be executed inside the cyclical transfer too.



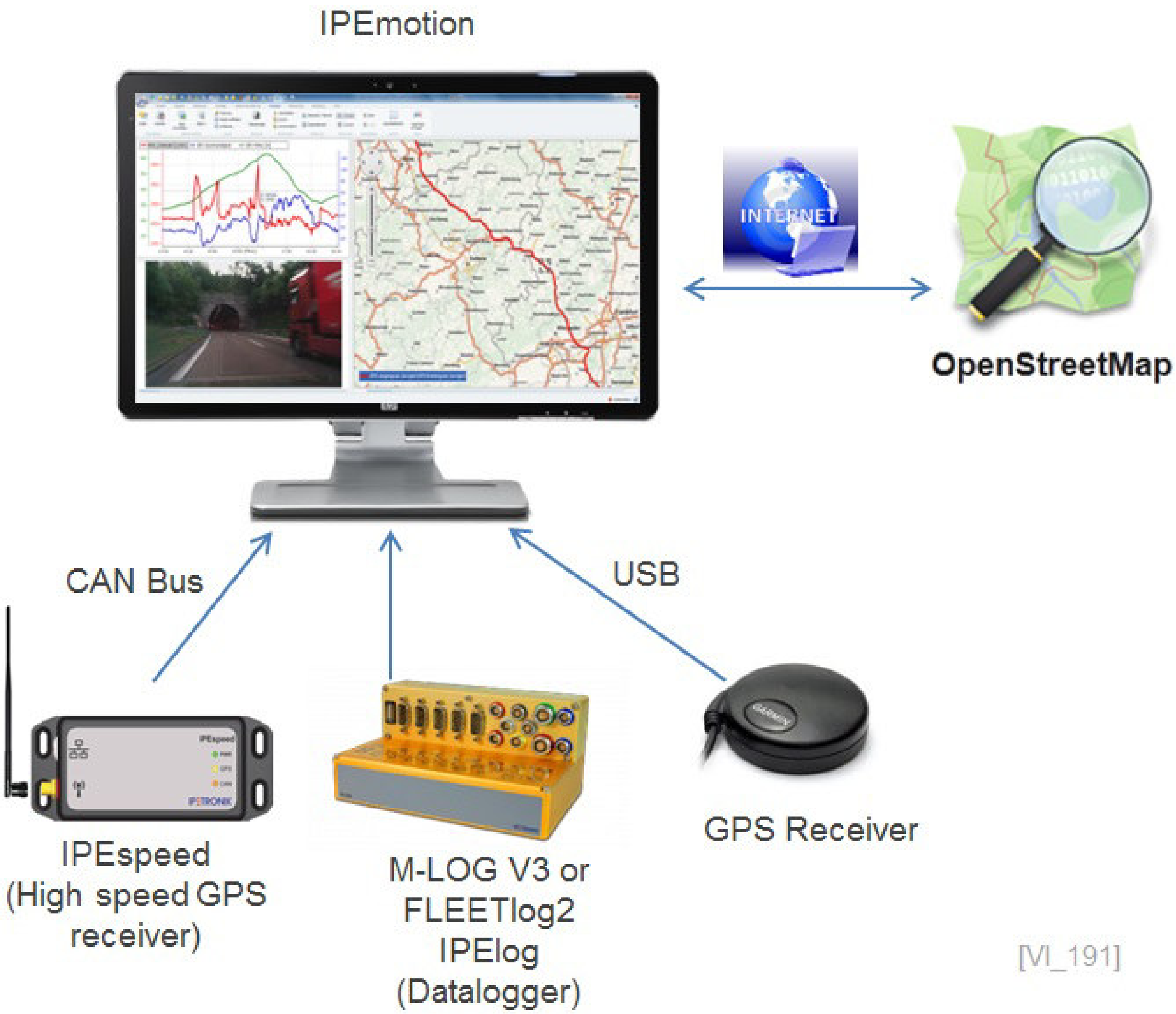
[VI_189]

17.27 Map

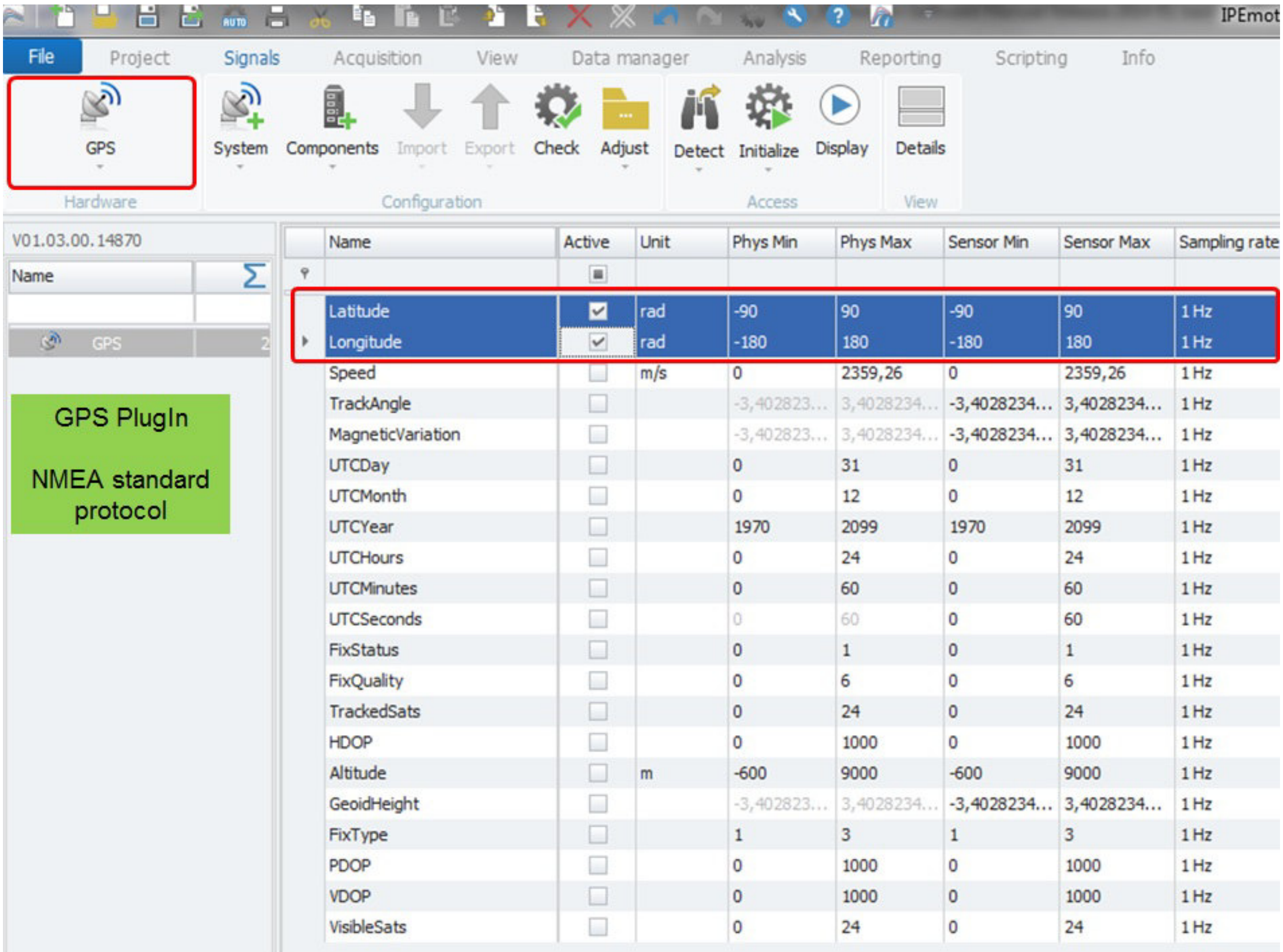
[VI_190]

17.27.1 Required PlugIn

For the Map instrument you need a GPS signal with Latitude and Longitude channels. Both channels combined show the location of your vehicle on the map. The GPS signal can be retrieved from different sources.



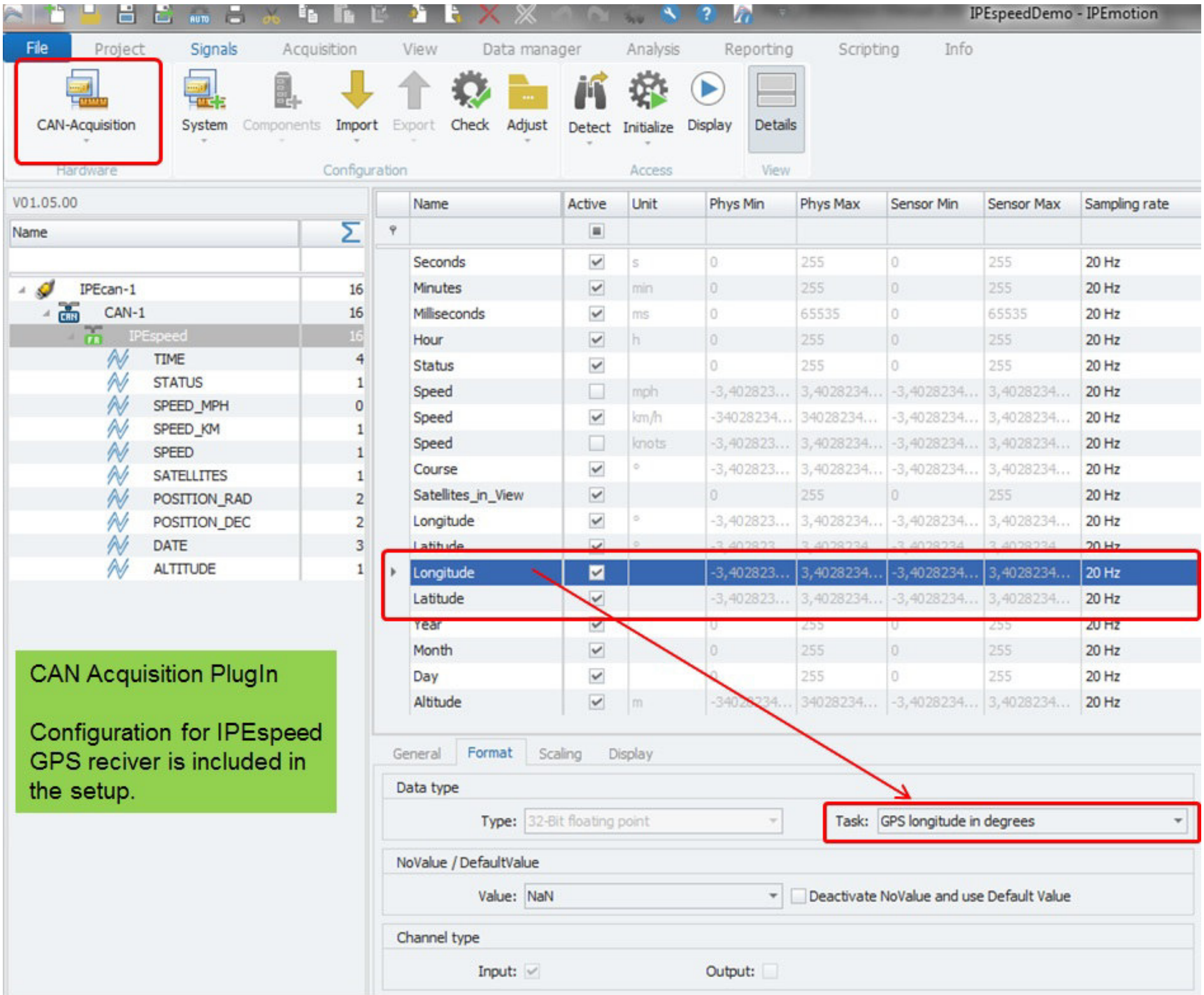
- ► GPS mouse — Here you can take any standard GPS receiver using an USB or serial interface which supports the standard NMEA protocol together with the GPS PlugIn.



[VI_192]

- IPEspeed

IPETRONIKs self-developed high speed GPS receiver. This receiver can be directly interfaced to the Laptop using a CAN card and the CAN Acquisition PlugIn. In order to get the signals in the right format from the IPEspeed GPS receiver, you should load the demo configuration IPEspeedDemo.IWF. In this configuration, the complete sensor setup is predefined. For the right format of the Latitude and Longitude the channels in the red box should be linked to the Map instrument. As indicated in the format tab sheet some special tasks are defined to ensure that the data format of the IPEspeed GPS receiver is processed correctly in IPEmotion.



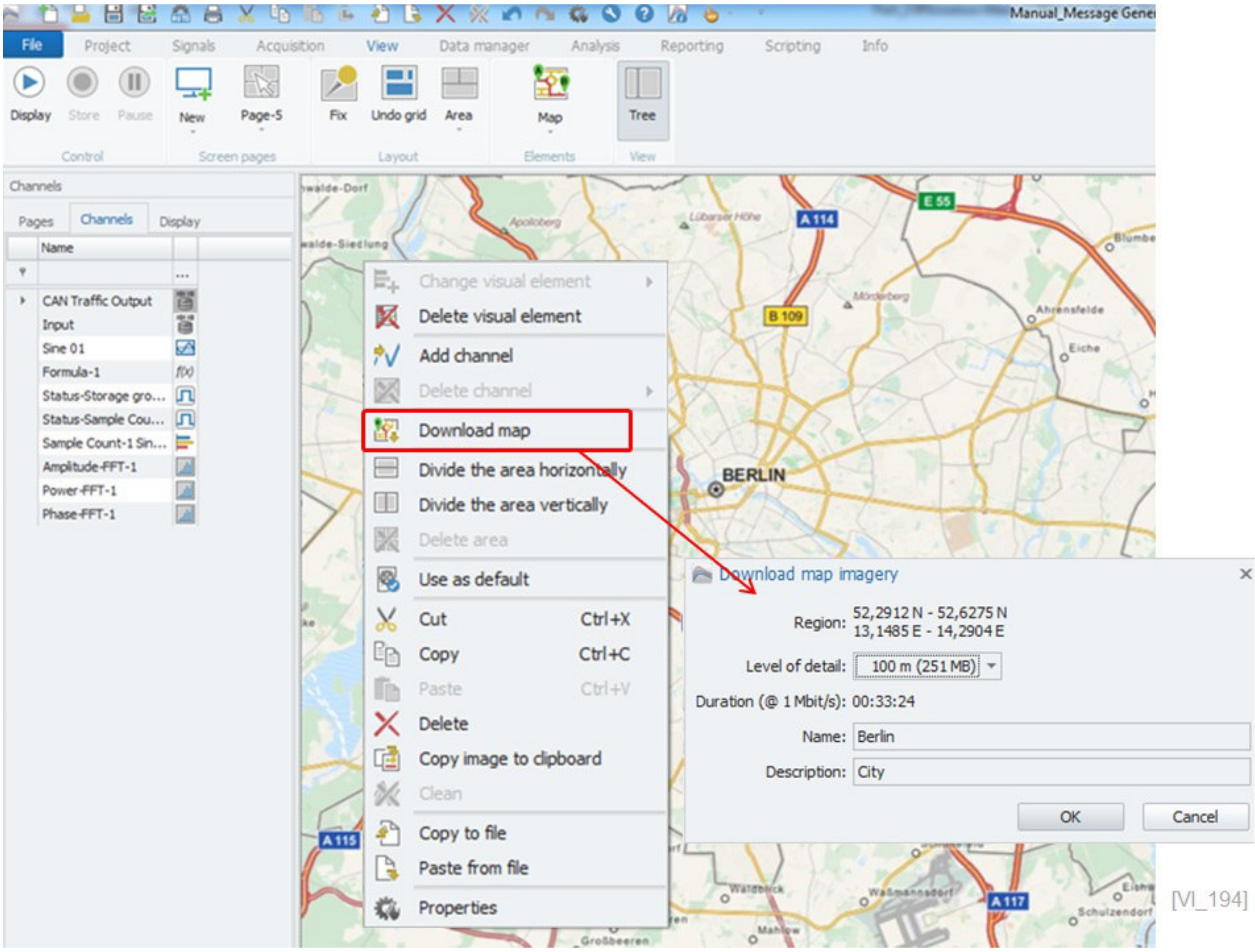
[VI_193]

- M-LOG V3 / FLEETLog / IPElog

You can also receive a GPS signal from IPETRONIK data loggers which have an interface to any GPS sensor. In this setup the GPS sensor is configured in the IPETRONIK LOG PlugIn and the GPS signals are sent to the PC over XCP service. For more details on how to configure the XCP service function have a look at the OPTIONS >Basic Settings >Automatic Service Administration in chapter 22.2.3.

17.27.2 Map context menu

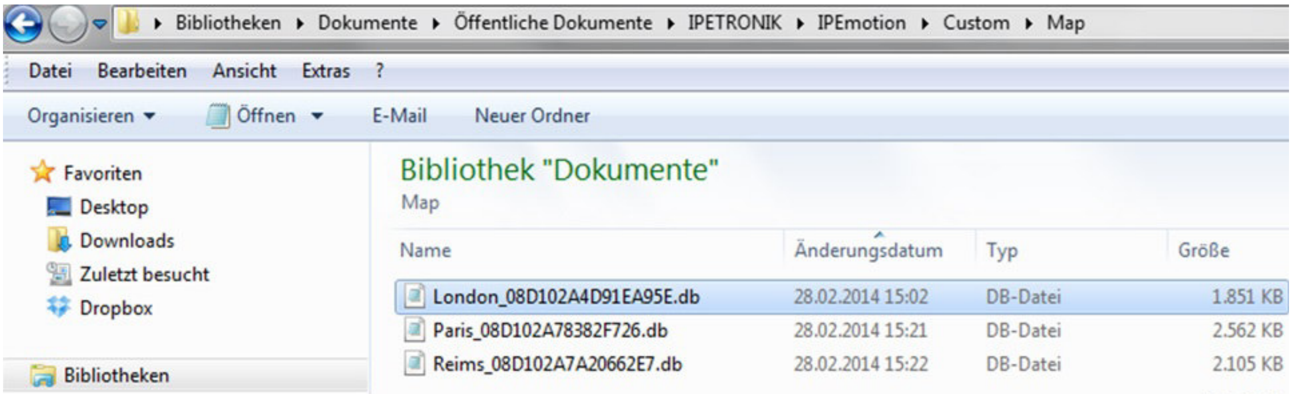
If you download map tiles through the map instrument in the VIEW or ANALYSIS work space, you define a corresponding data file.



[VI_194]

Information *Once the download is finished, the file is fixed and cannot be changed, any more. Adding more tiles or other geographic areas later to this data file is not possible.*

- **Region** — The coordinates refer to the visible geographic area covered in the instrument.
- **Level off detail** — The drop-down list offers predefined entries for different resolutions. The highest resolution is 25 m. If you select a large territory and a high resolution, the system automatically computes the amount of data you are downloading and the required time at a standard download rate of 1 Mbit/s. For large territories it is not possible to download all tiles to the highest resolution of 25 m.
- **Duration** — The duration is the time you need to download all tiles, provided you have a 1 Mbit download rate.
- **Name** — Name of the data file. The tiles are stored in a file called name-xyz.db located in the following directory.
  Win 7 C:/Users/Public/Documents/IPETRONIK/IPEmotion/Custom/Map
- **Description** — Description of the data file.



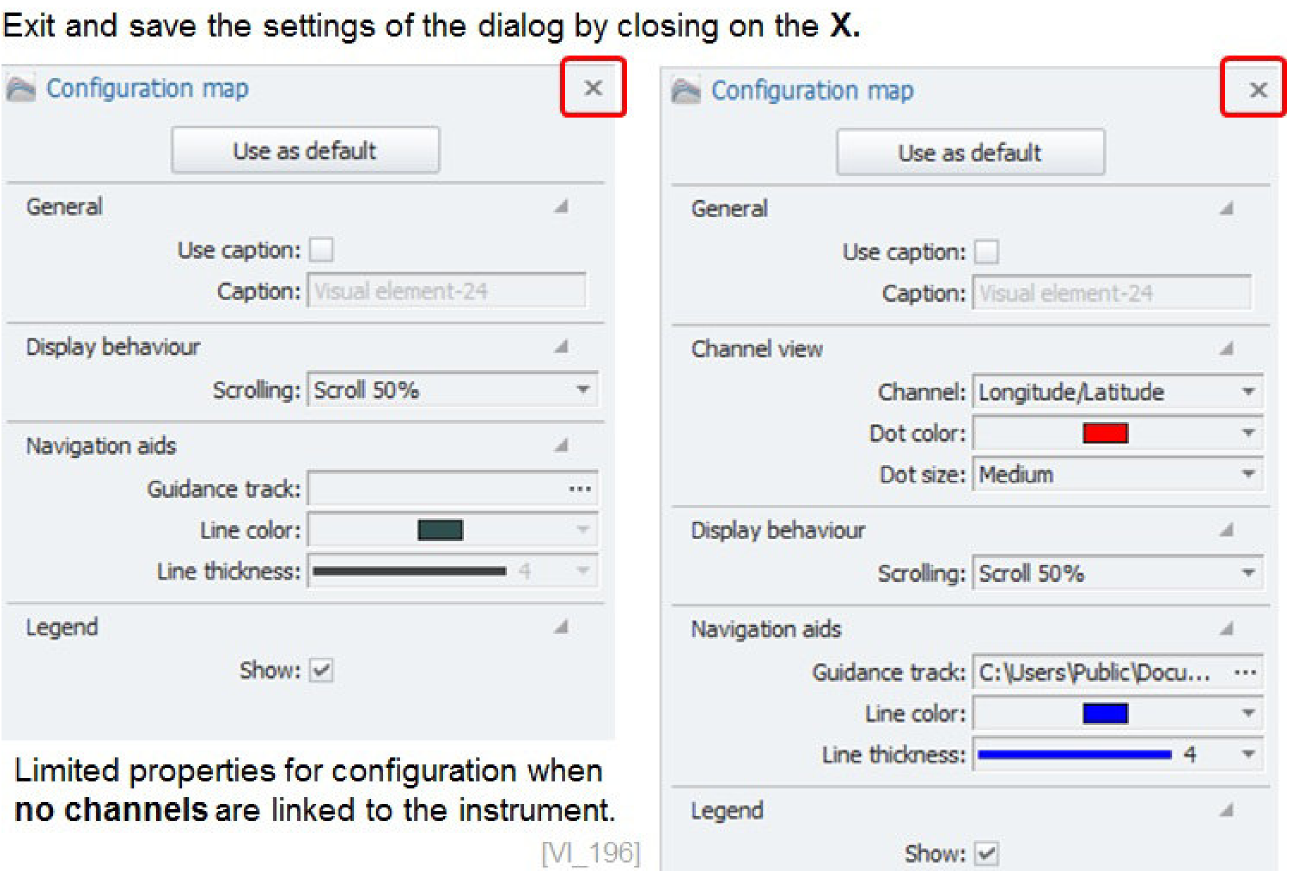
[VI_195]

All downloaded map files are listed in the OPTIONS under 'Maps'. You can only activate one database of your choice. For more information of the different data base settings see chapter 22.10.

Information

The selected data base in the OPTIONS is a global setting. This means it applies to all map instruments in VIEW and ANALYSIS. If you like to change the "default" map data base file you need to delete and reinsert the map instruments.

17.27.3 Map instrument head-up display



[VI_196]

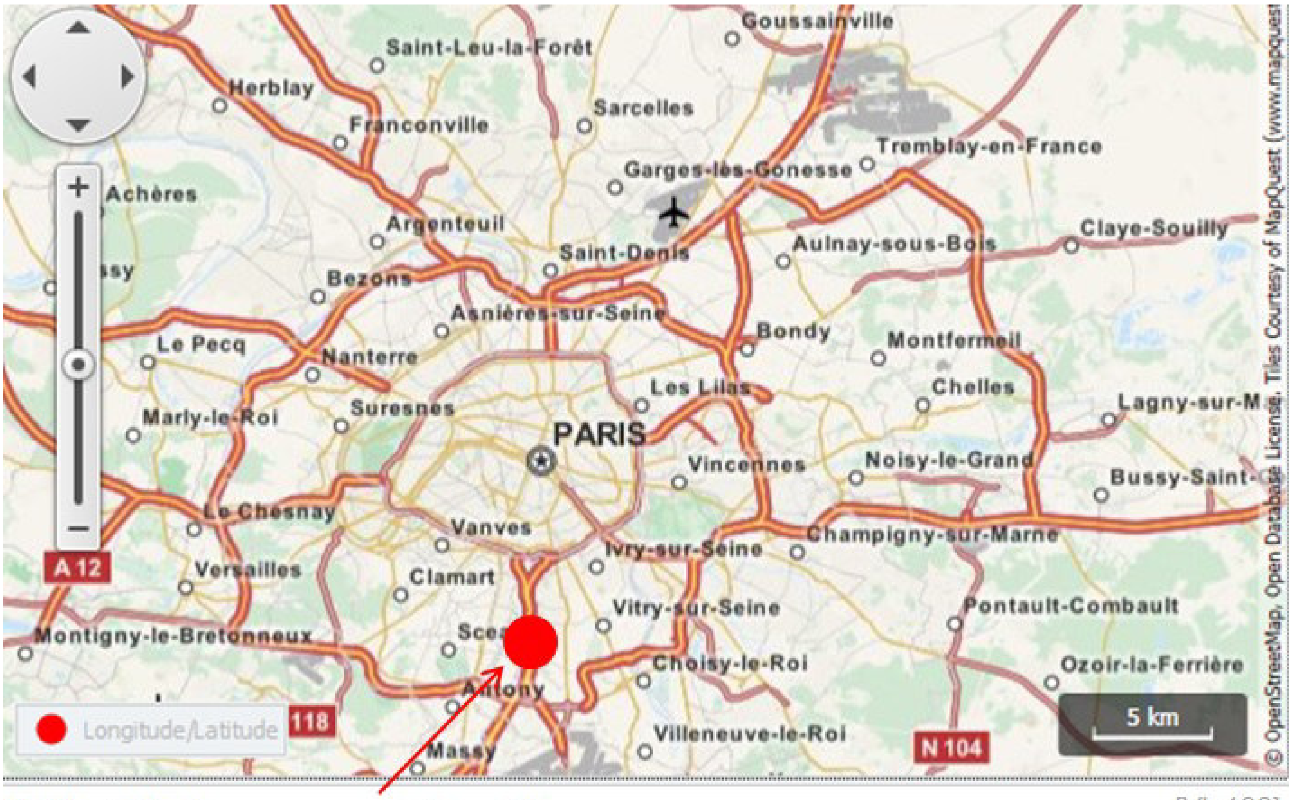
17.27.4 Channel view

- **Channel** — The channel is always a pair of Longitude & Latitude. It is important that you first link Longitude and then Latitude. If you link the channels the other way round, your GPS position will be wrong. You can link several pairs of these channels into the instrument. The map instrument accepts any channel, as the screenshot below shows.

Link several channel pairs to the instrument. [VI_197]

- **Dot color** — With the dot color you can define in which color your current position is indicated on the map. The dot is only visible during measurement if a valid GPS signal for longitude/latitude is received.

- **Dot size** — The dot size can be defined in Small, Medium, Large.



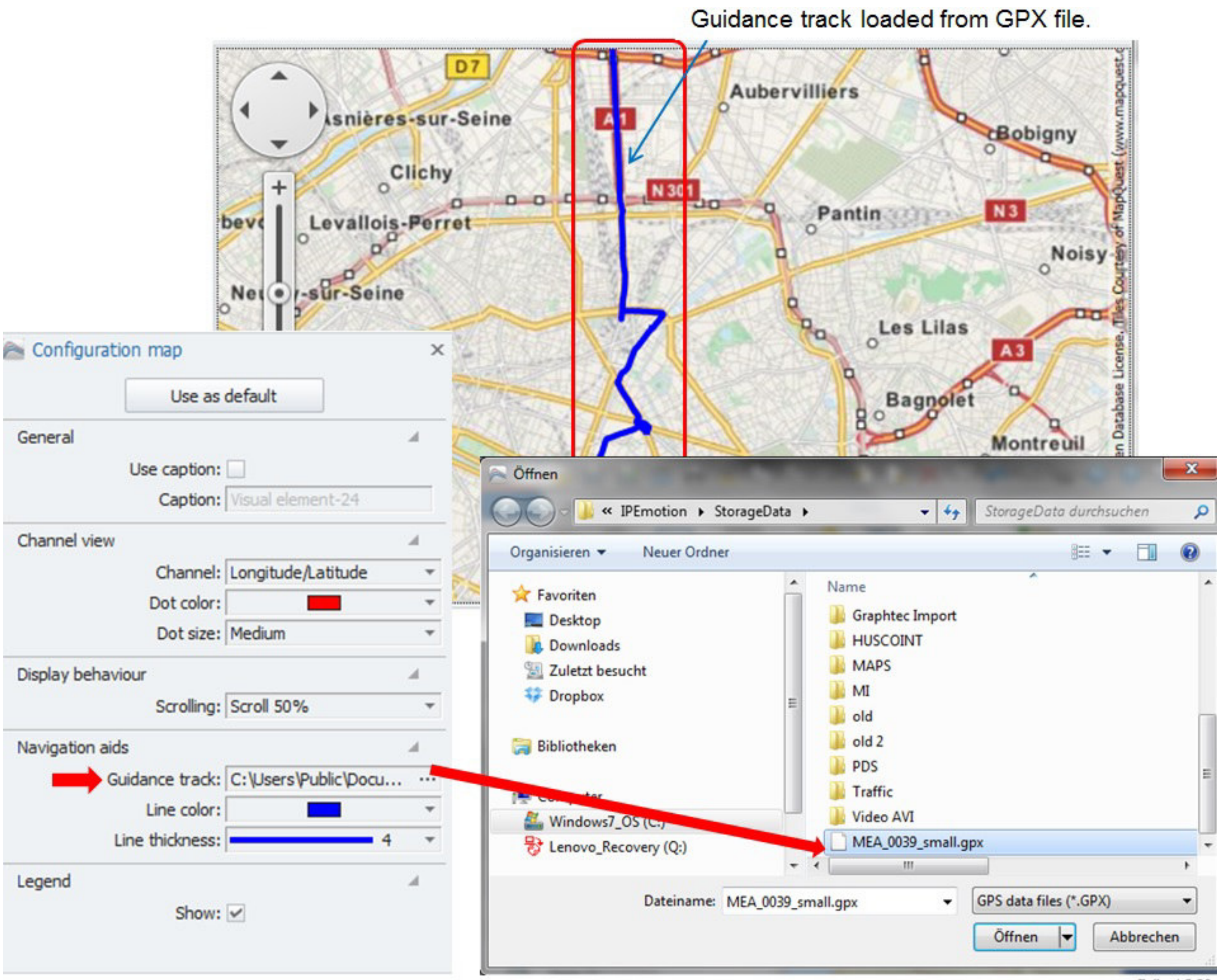
Dot is indicating your current position. [VI_198]

17.27.5 Display behavior

► Scroll continuously	The map is moving continuously and follows the GPS position.
► Scroll 50 %	The map is moving 50% forward in the direction of movement.
► Fixed	The map remains in the predefined section even if the GPS signal is outside the visible territory.

17.27.6 Navigation aids

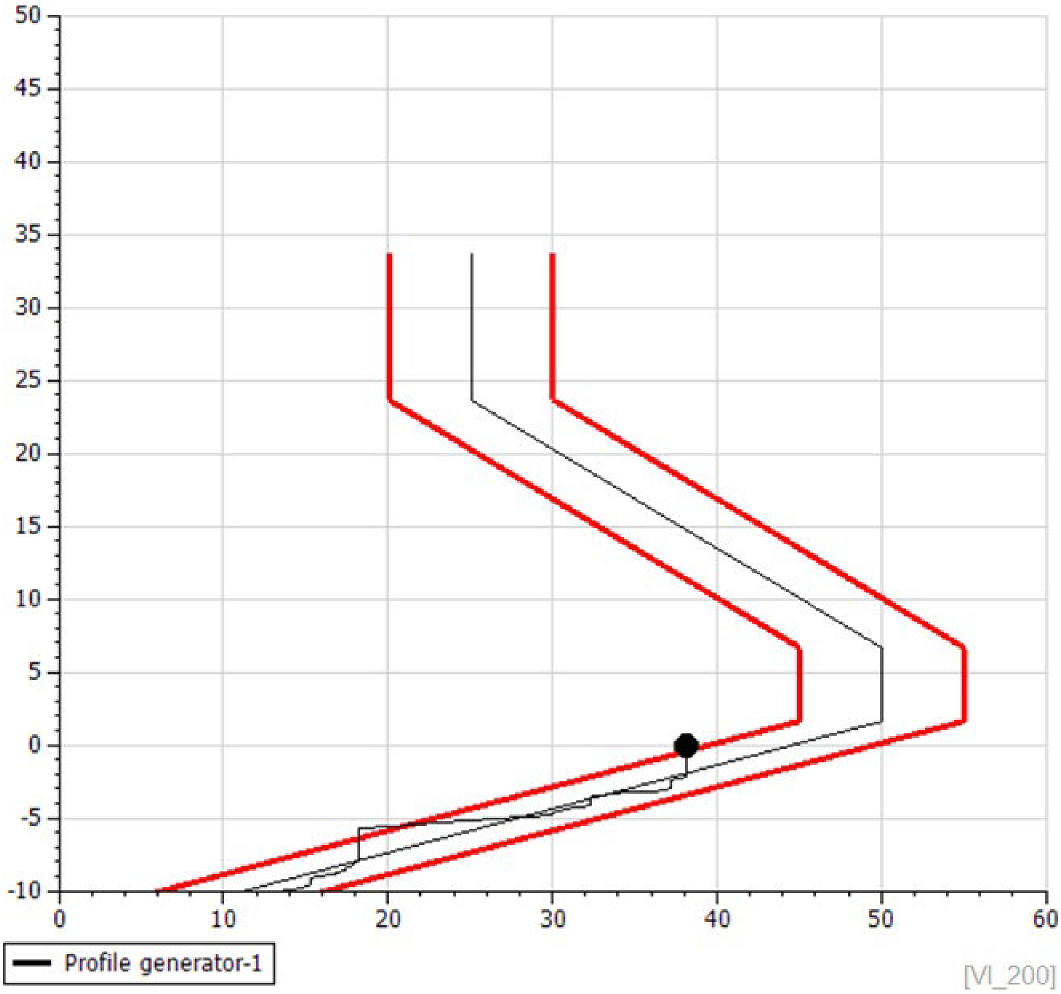
► Guidance track — You can load a reference track data file to compare your current position (dot) to a reference position. The use case is that drivers can load a reference track to the map instrument and can then track their online position and see if it matches the reference position. The guidance track can only be imported as a GPX file. The details about the GPX export will be discussed in DATA MANAGER chapter 18.7.5. The GPX data file can be included in the IWF configuration when this function is activated in the OPTIONS >Frequently used as discussed in chapter 22.1.2.



[VI_199]

► Line color	Here you can define the color of the guidance track line.
► Line thickness	Here you can define the thickness of the guidance track line.

17.28 Profile diagram

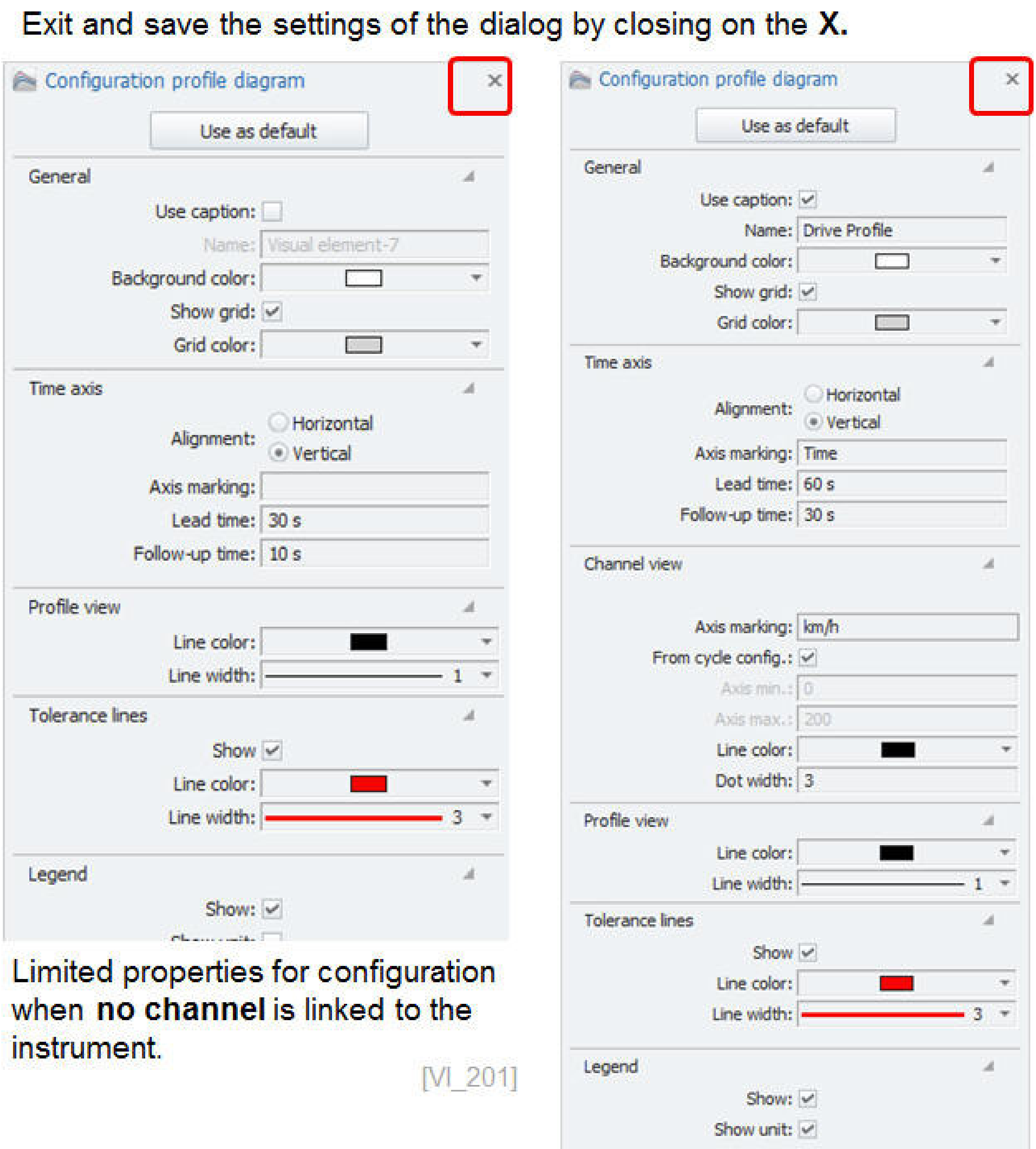


The profile diagram can be used for any application on the road or test benches e.g. in climatic wind tunnels (CWT) where the driver has to perform specific test according to speed or break tests. The instrument is a graphical display to graphically indicate to the driver the actions he should take.

Information	*The Profile diagram is only available in your instrument tool box if you purchase the Control module license 4.2.1.*

Refer to the ACQUISITION work space in chapter 14.10 to see the configuration details of the Profile generator.

17.28.1 Profile diagram head-up display



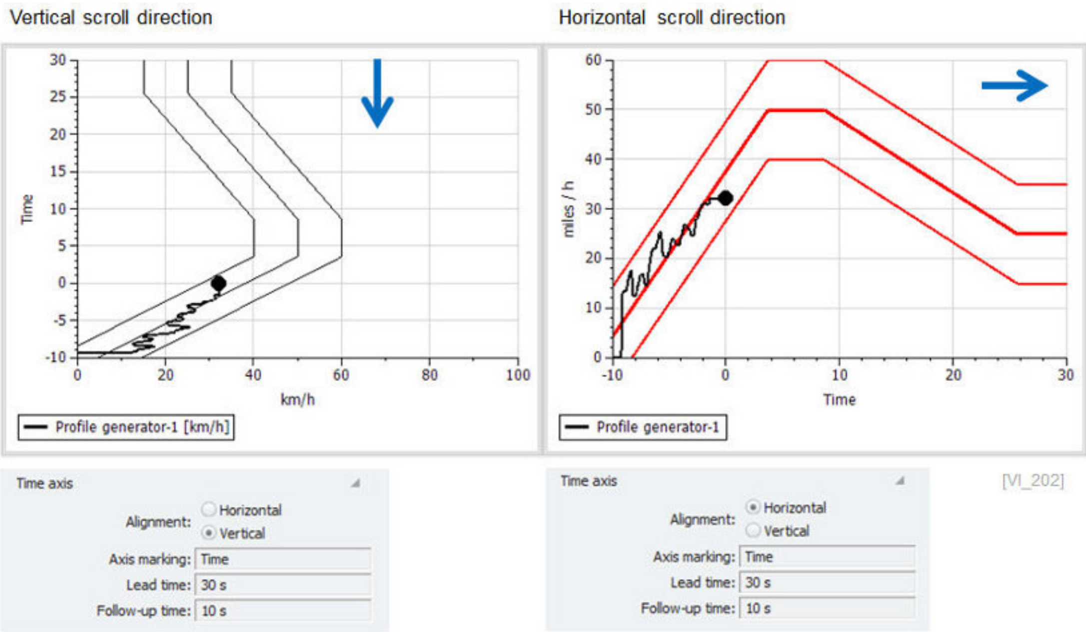
[VI_201]

17.28.2 General

See bar graph instrument 17.14.2.

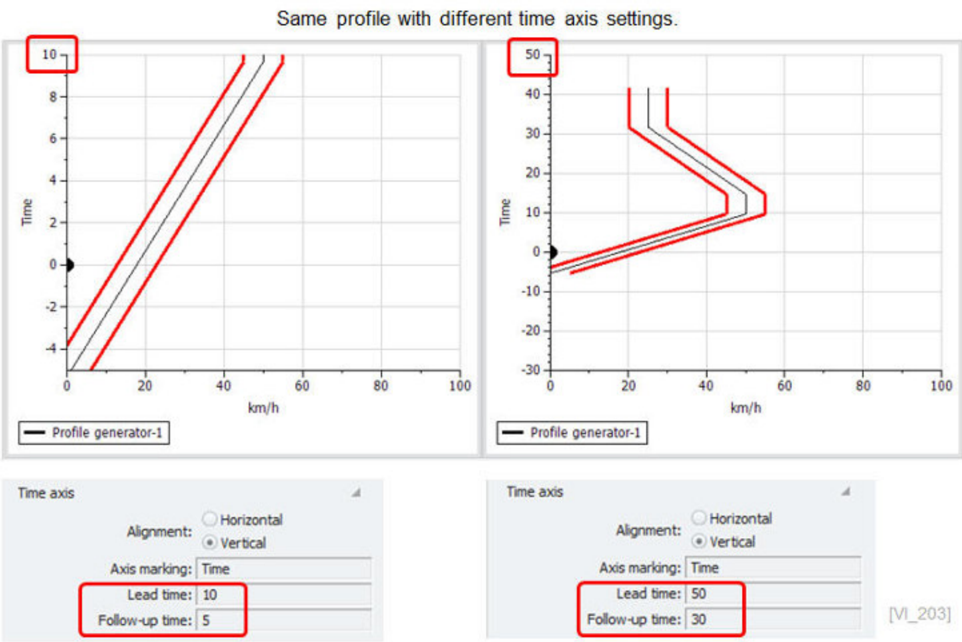
17.28.3 Time axis

- **Alignment** Here you define over the radio button the scroll direction of the instrument. You can have a horizontal or a vertical scroll behavior. In many wind tunnel test benches the vertical scroll direction is preferred by the drivers.



[VI_202]

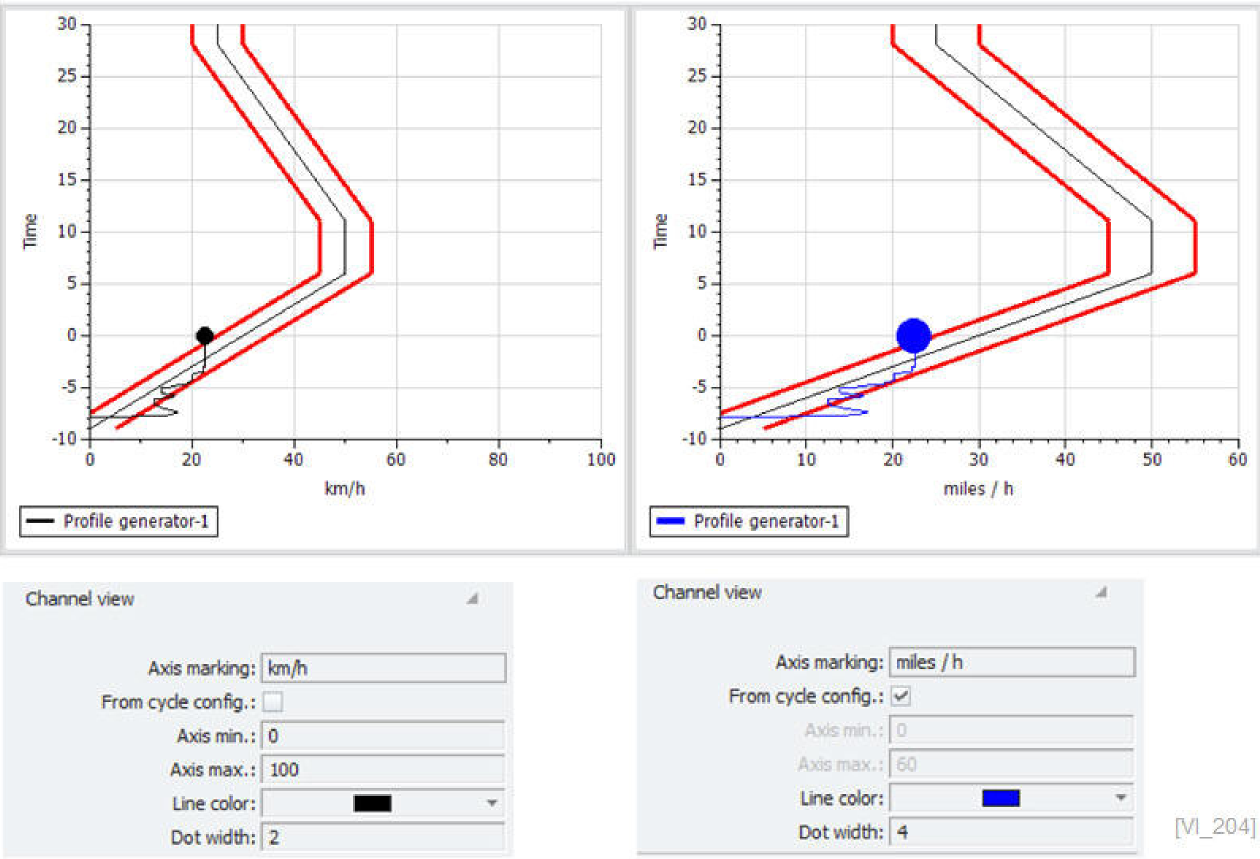
- **Axis marking** Adding a text label to the time axis.
- **Lead & Follow up time** This refers to the time axis display for the driver. With the lead time you define in seconds [s] how much of the future profile is visible to the driver. It is important for the driver to see the future profile in order to adapt his driving pattern accordingly to meet in the best possible way the target or reference speed profile line. The follow up time defined how much of the past profile is visible to the driver.



[VI_203]

17.28.4 Channel view

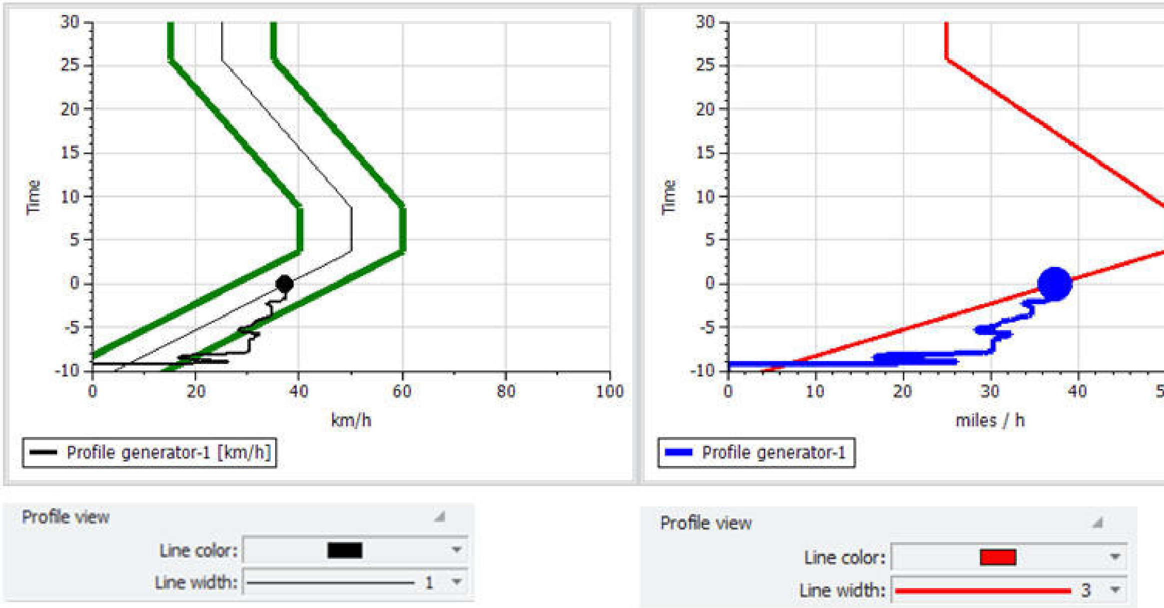
- **Axis marking** — Add a text label to the reference / actual source channel.
- **Min / max scaling** — The min and max display is by default taken from the settings of the Profile generator as defined in the display tab sheet 14.10.4.
- **Line color** — Refers to the color of the actual source channel. The source channel is linked to the Profile generator in the configuration tab sheet 14.10.3.
- **Dot width** — The source channel is highlighted by a dot with configurable dot size.



[VI_204]

17.28.5 Profile line

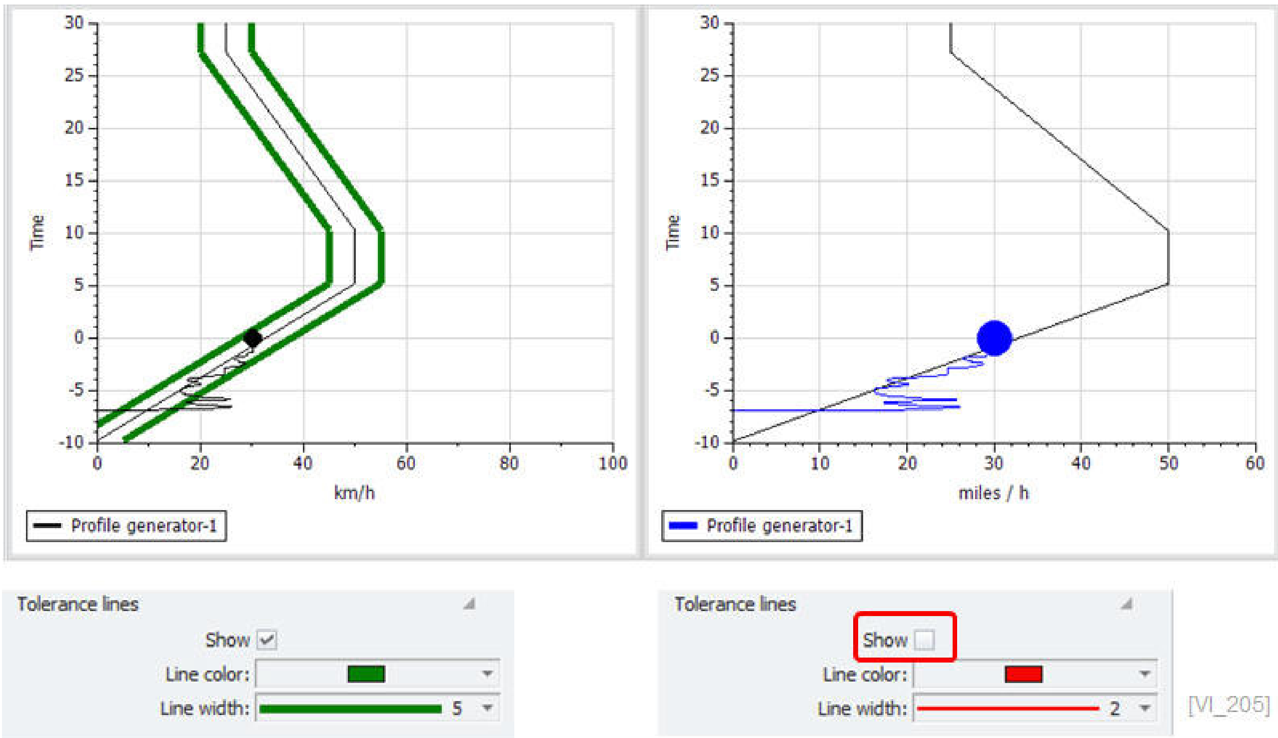
- Line color — Define the color of the reference profile.
- Line width — You can define the width of the reference profile.



[VI_204.1]

17.28.6 Tolerance lines

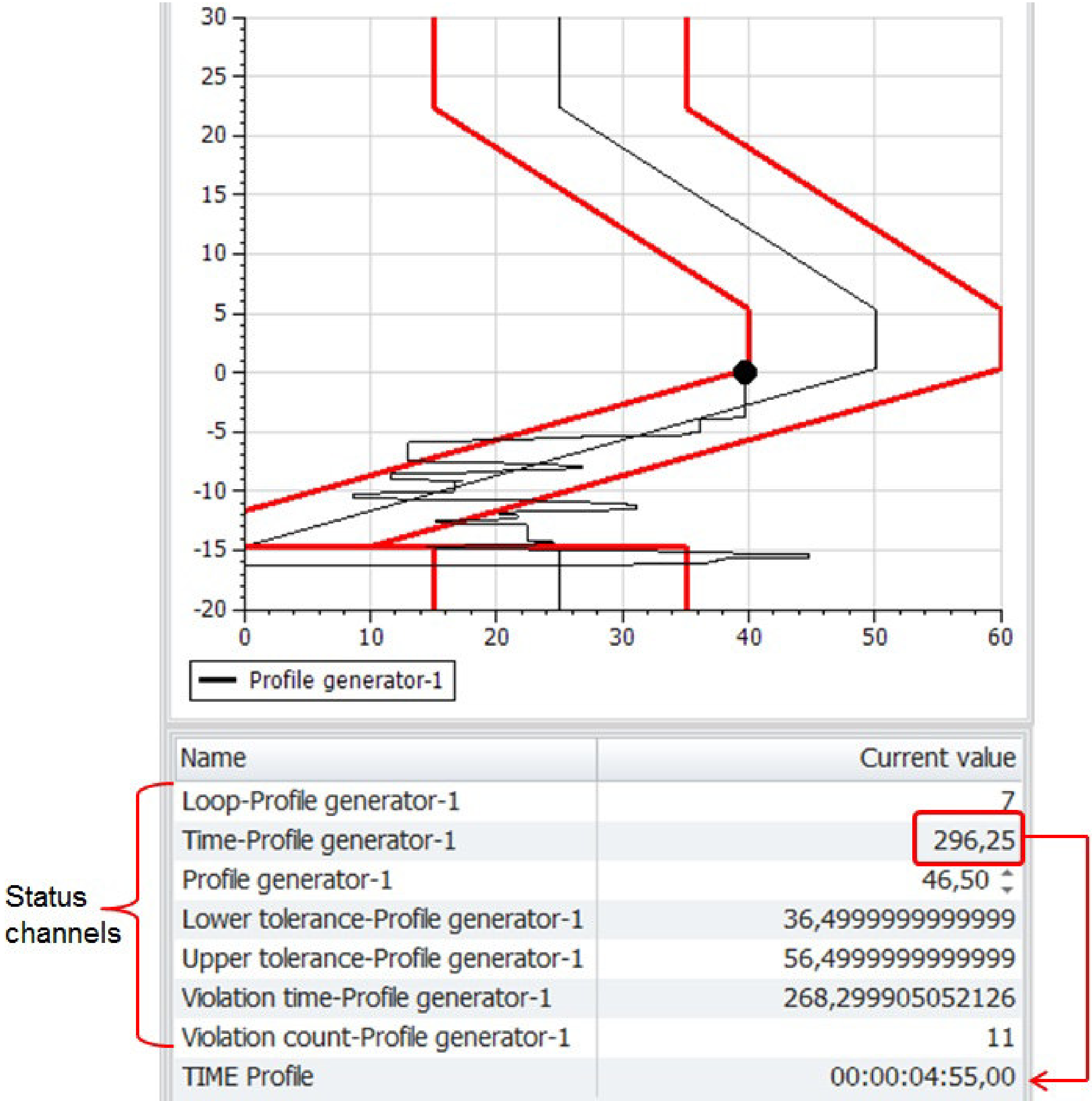
- Show — With the checkbox you enable the visibility of the tolerance lines. The tolerance lines are defined in absolute or relative terms in the Profile generator in the configuration tab sheet 14.10.3.
- Color — You can define individual color for the tolerance lines.
- Line width — You can define line width if the tolerance lines.



[VI_205]

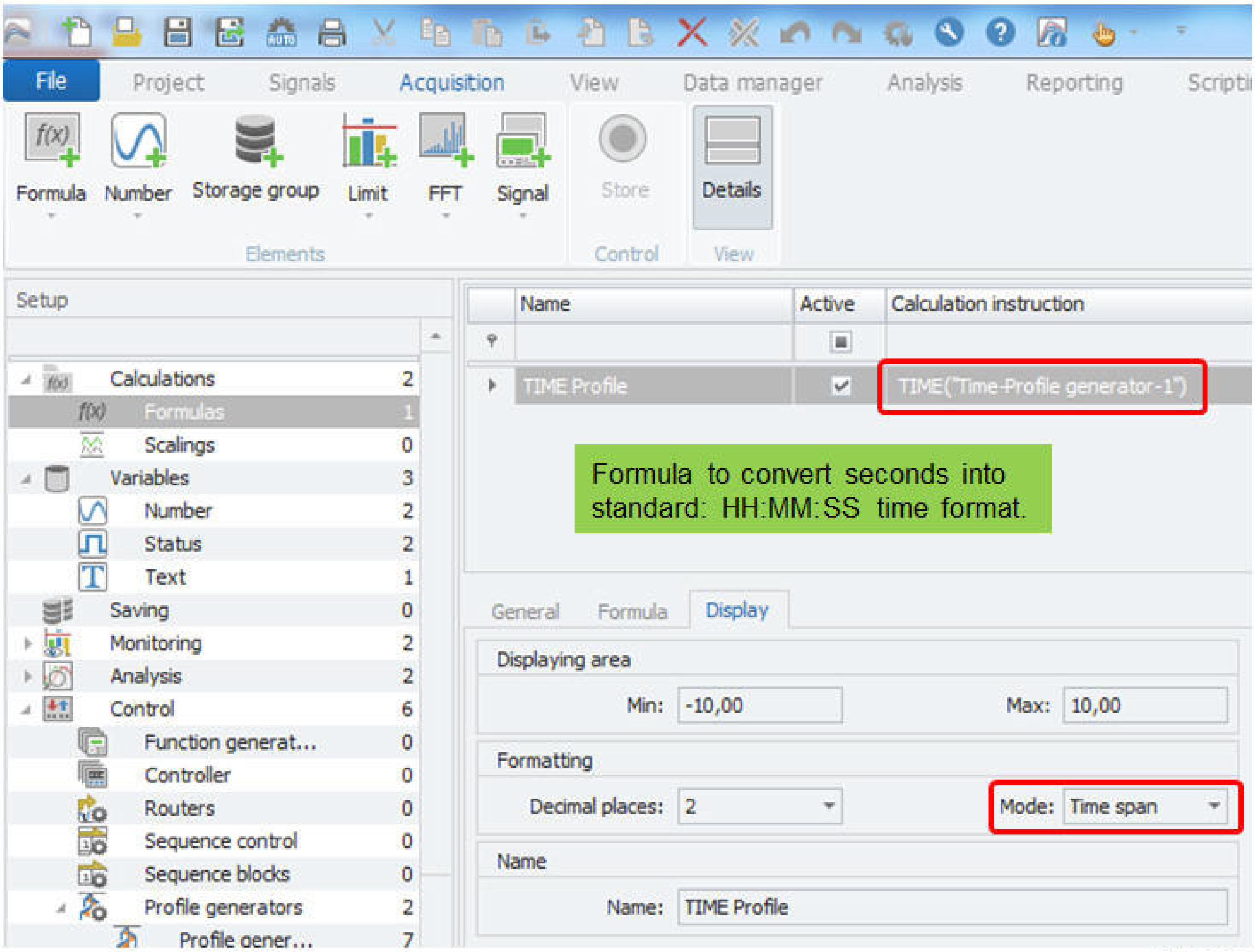
17.28.7 Status channels

As mentioned in chapter 14.10.6 the Profile generator is supporting a set of status channels when you enable in the OPTIONS the Expert mode 22.3.1. The status channels provide very useful information for the test driver and the reporting. These are internal channels computed during profile generation. These channels can be used as inputs for other math, logic and formula operations.



[VI_206]

- ► Loop — Is counting the number of loops the profile has be generated. The loop count is configured in the Profile generator configuration tab sheet 14.10.3.
- ► Time — This status channel is indicating how much time is elapsed since the start of the profile. Time is displayed in seconds. You can create a formula to convert the seconds into the standard time format of HH:MM:SS. See chapter 13.4, or search for this expression "HH:MM:SS".

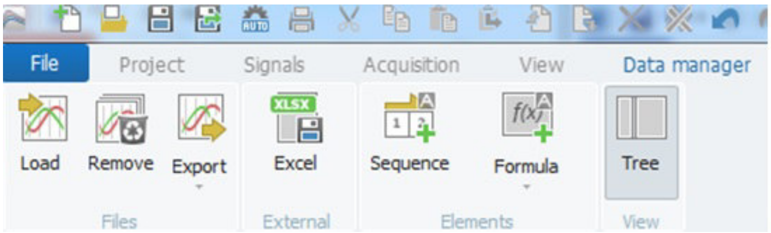


[VI_207]

- ► Lower tolerance — This channel is displaying the actual reading of the tolerance.
- ► Upper tolerance — This channel is displaying the actual reading of the tolerance.
- ► Violation time — This channel is displaying (integrating) the time in seconds for how long the source channel is outside of the tolerance bands. This is reflecting the time outside the lower and upper tolerance line.
- ► Violation count — The counter channel is counting the incidents how often the source channel has left the tolerance band.

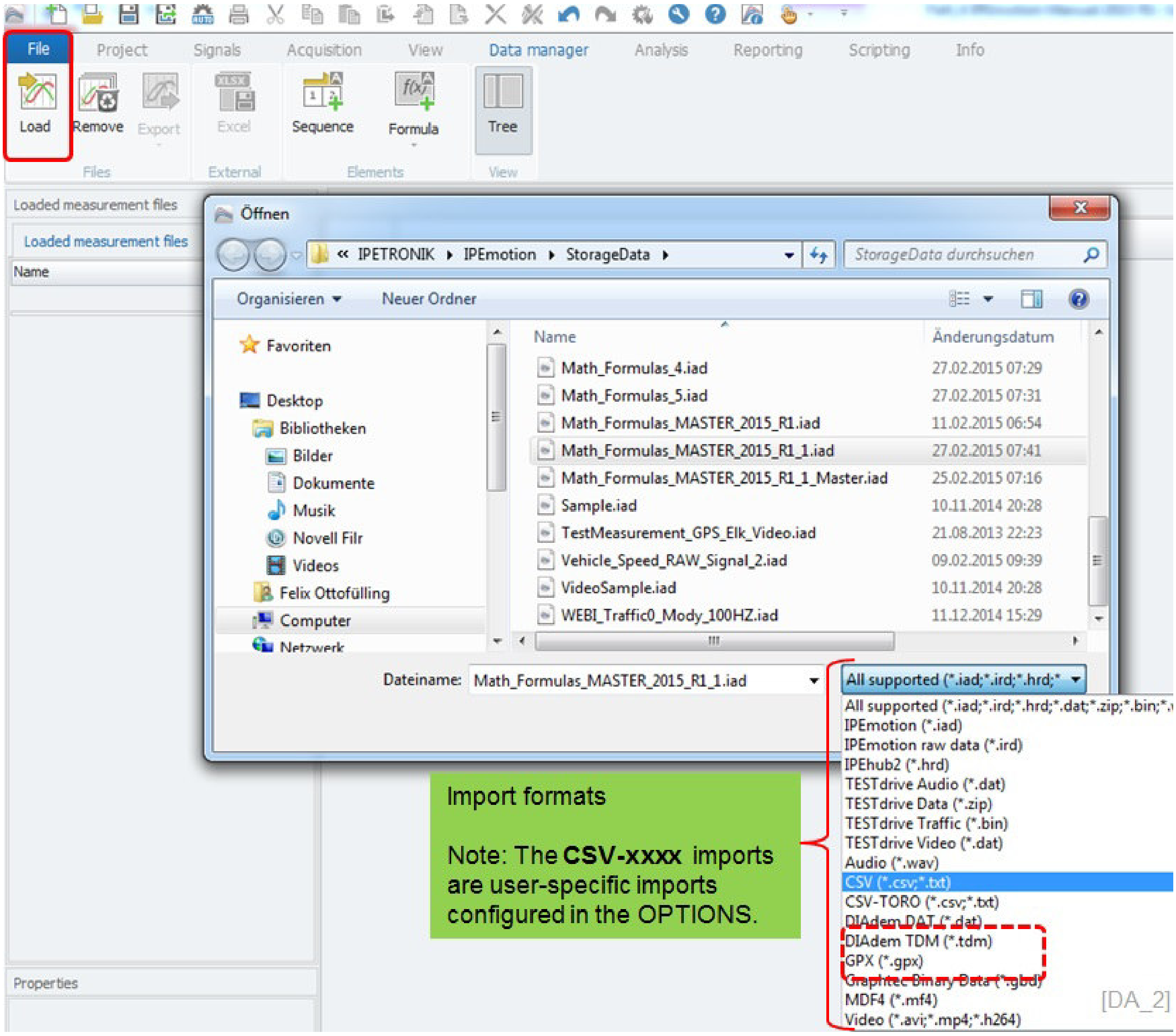
18 DATA MANAGER work space

18.1 Ribbon



[DA_1]

18.2 Load (Import)

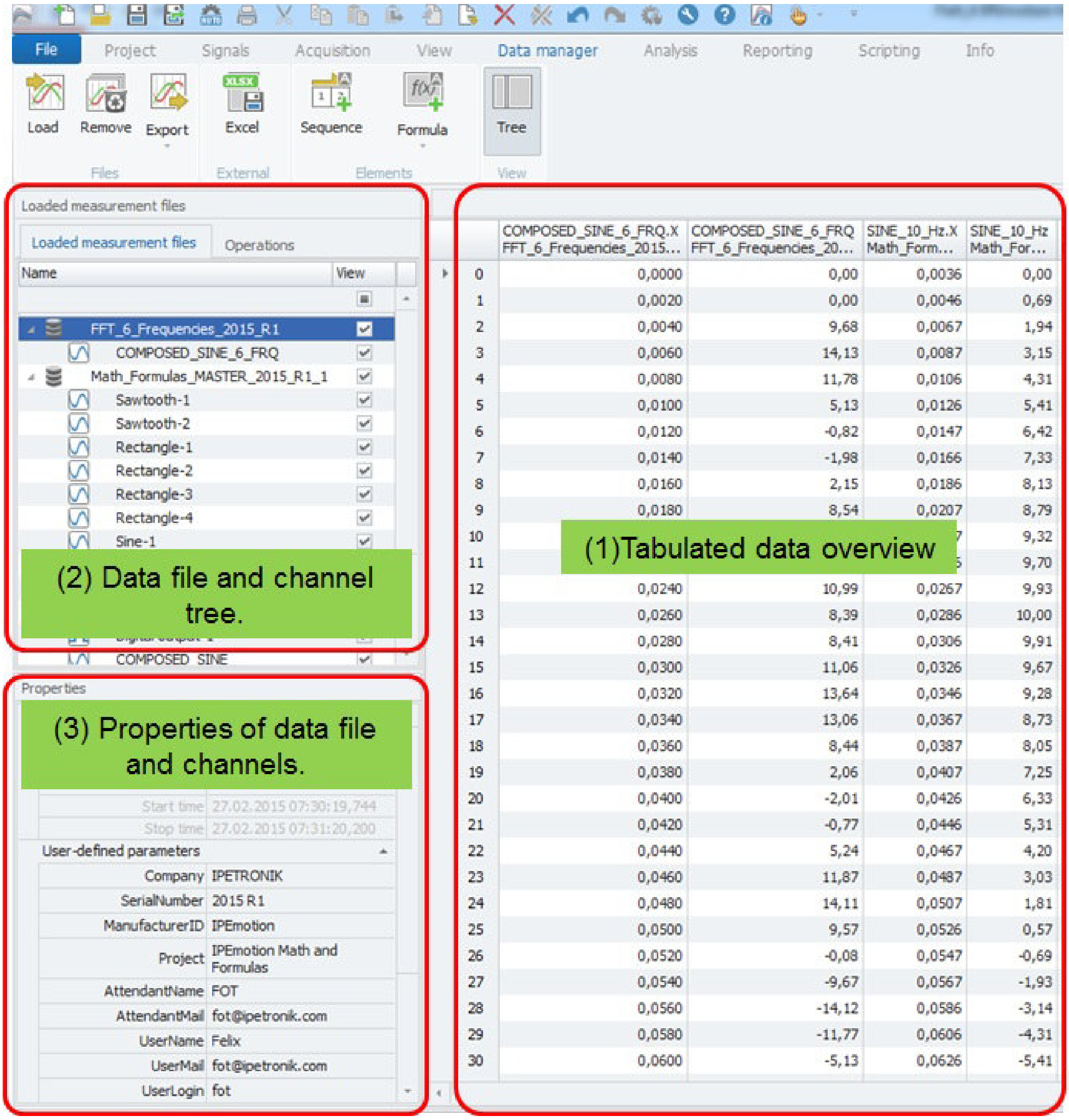


[DA_2]

If you hit the Load button, the file open dialog will come up. The supported import formats are found in the list box. The import formats are discussed in more detail in OPTIONS >Import in chapter 22.7. You can select and load several data files at once. If you already run the IPEmotion program and you like to load another data file, you can simply double-click on any IAD data file in your explorer and it will automatically be opened in your running IPEmotion program.

The DATA MANAGER is organized in three main areas.

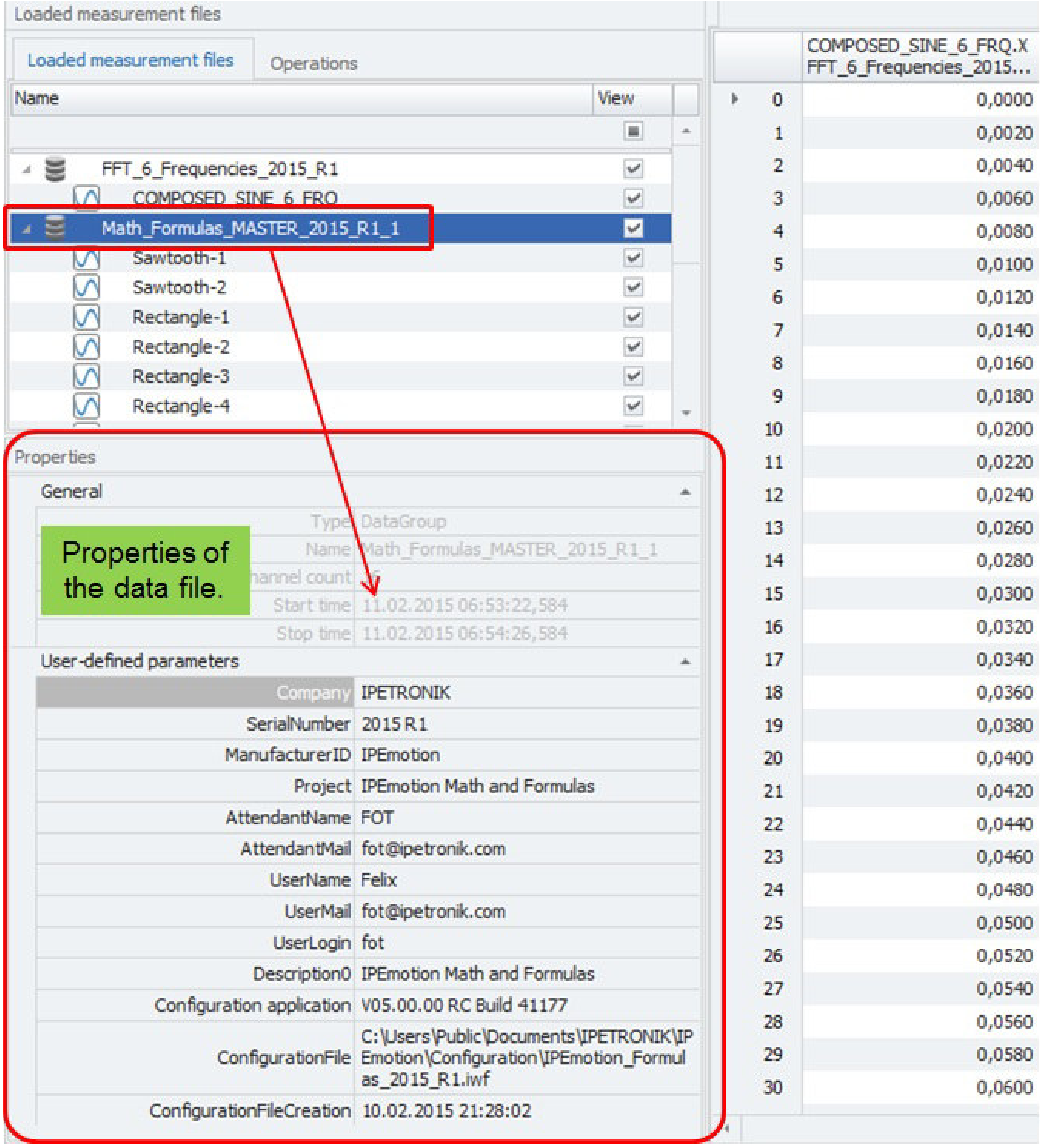
- First area — The main area is the tabulated data overview. Time stamps and measurement data are listed in columns for each channel.
- Second area — Is related to the data groups and the related channels. In this area you can also enable or disable channels and data groups.
- Third area — Shows properties of the data group or the channels.



[DA_3]

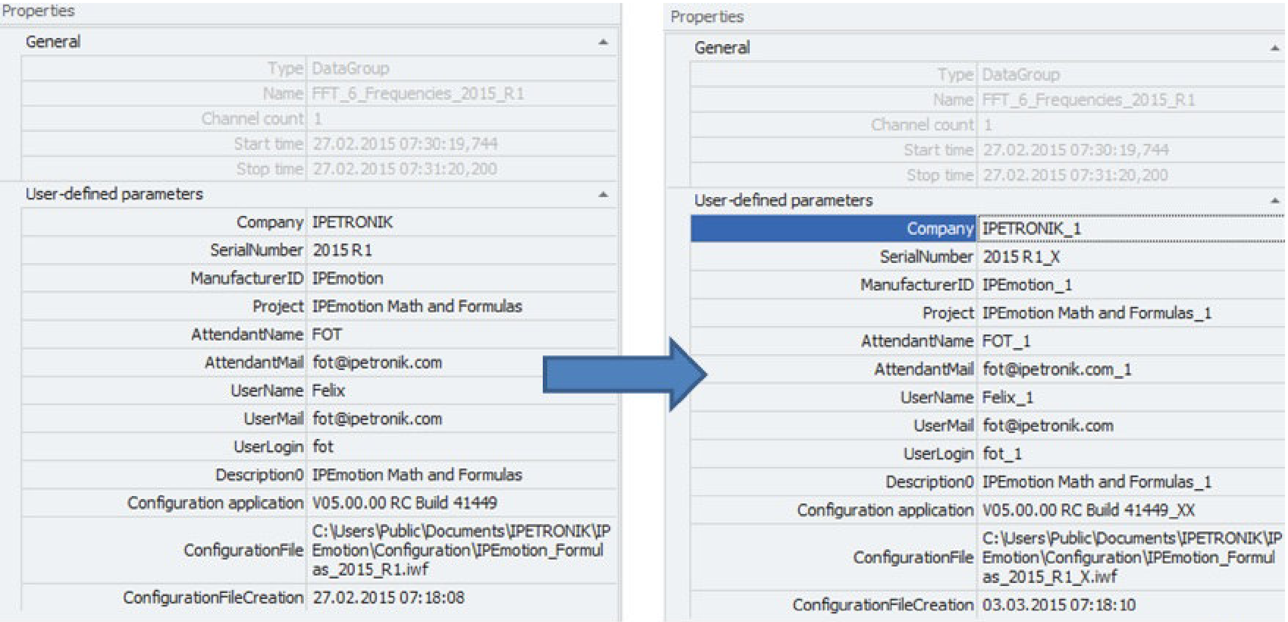
18.2.1 Edit data group properties

In the properties window you can see details of the data group. General properties are the name, channel count and time of the first recording and the last recording. These properties cannot be modified.



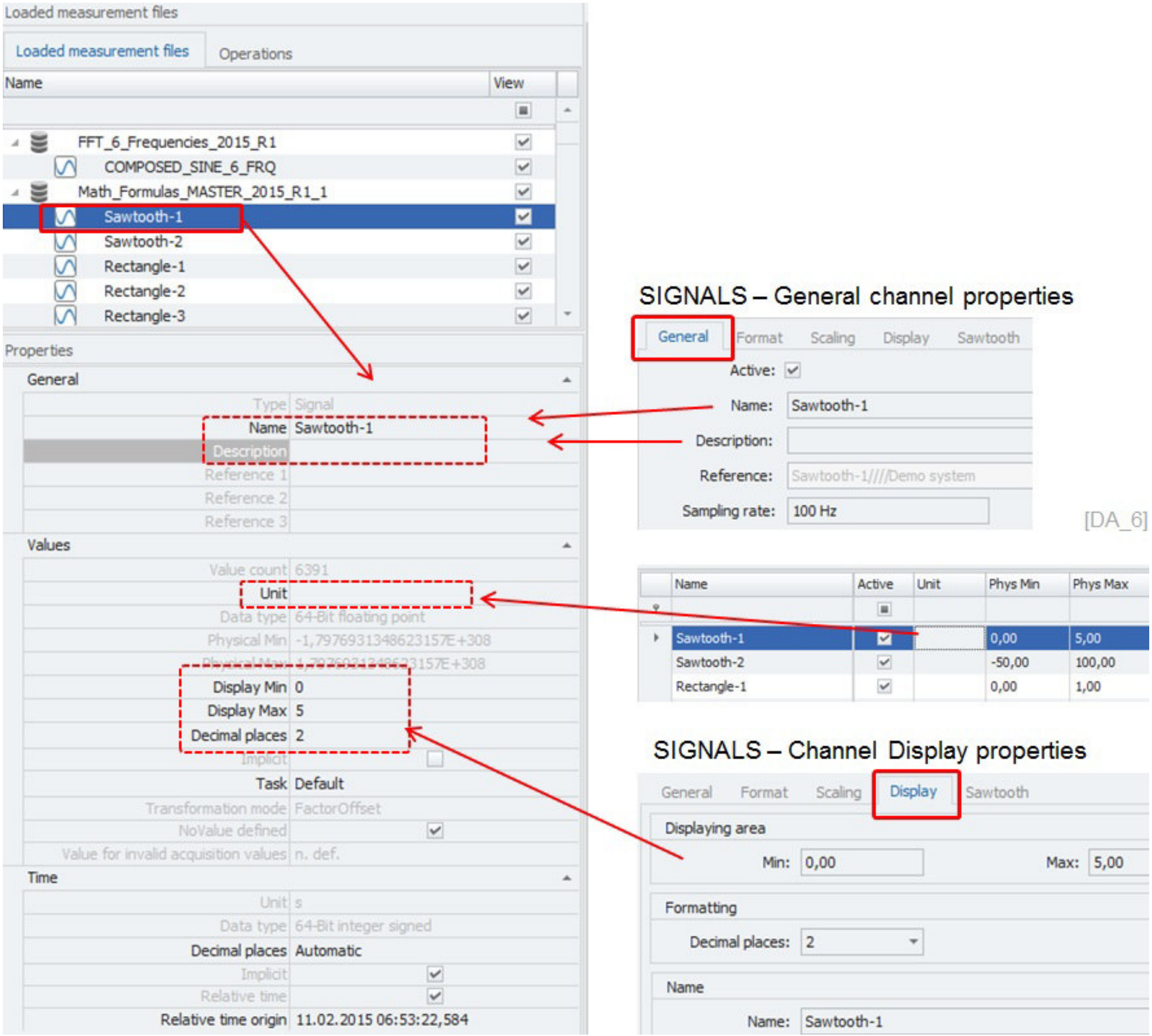
[DA_4]

In the section of the user-defined parameters, you will see all properties saved to the data file which are originating from the project properties. In the PROJECT work space you can enter and define your user-defined parameters. If the data file is saved, these parameters are included to the data file displayed in the section of the window. You will find more information about the PROJECT parameters in chapter 10. However, if you like you can modify the project parameters in the data manager. The modifications are only effective when you export the file to a new data file.



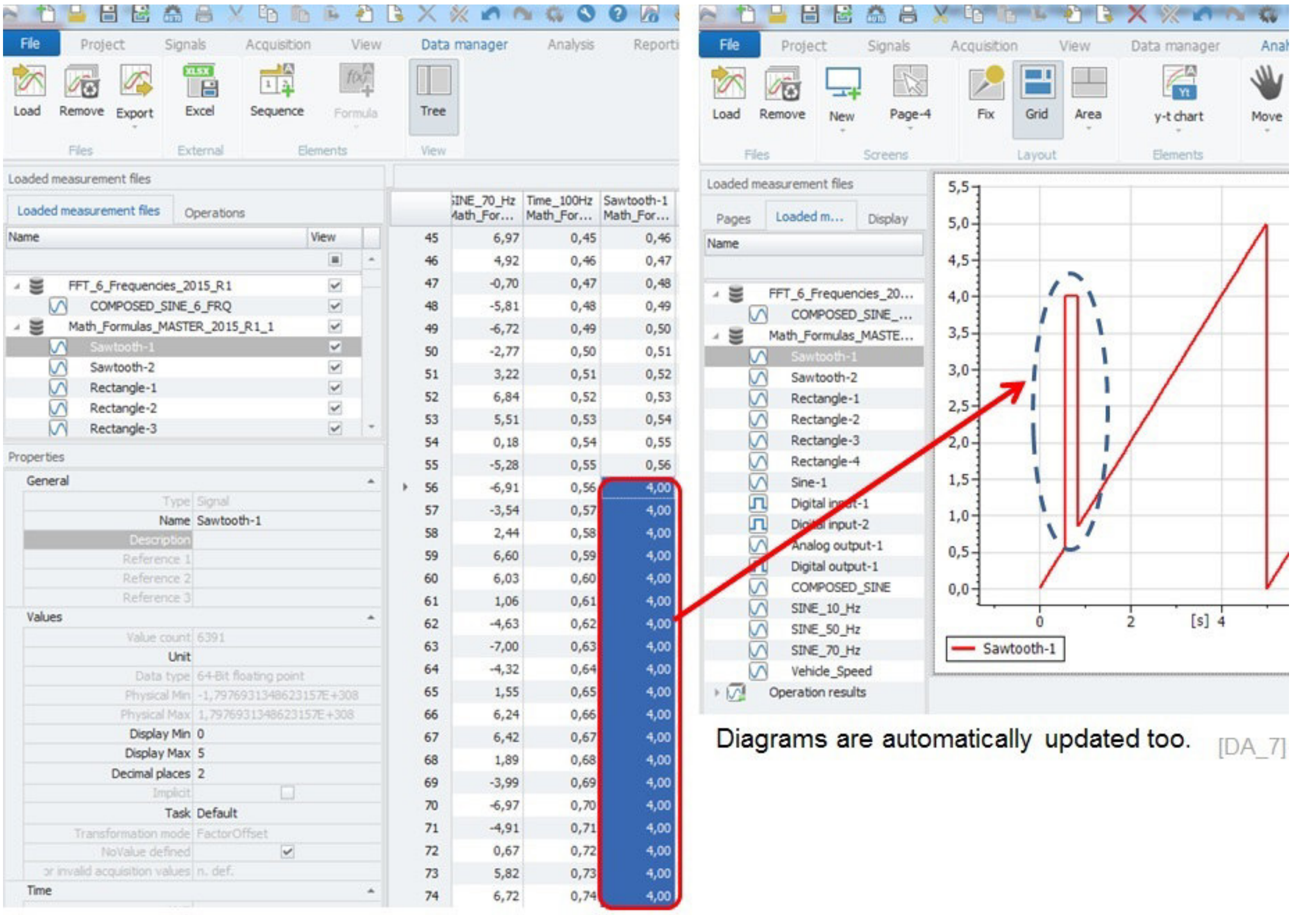
Modify project parameters after recording. [DA_5]

If you select a channel, you will see its properties. The General and Value-component properties are defined in the SIGNALS work space. The Time-component is related to the time channel and is automatically defined by IPEmotion.



18.2.2 Editing data records

You can modify and update data records in the DATAMANAGER grid.



Select cells and udpate values.

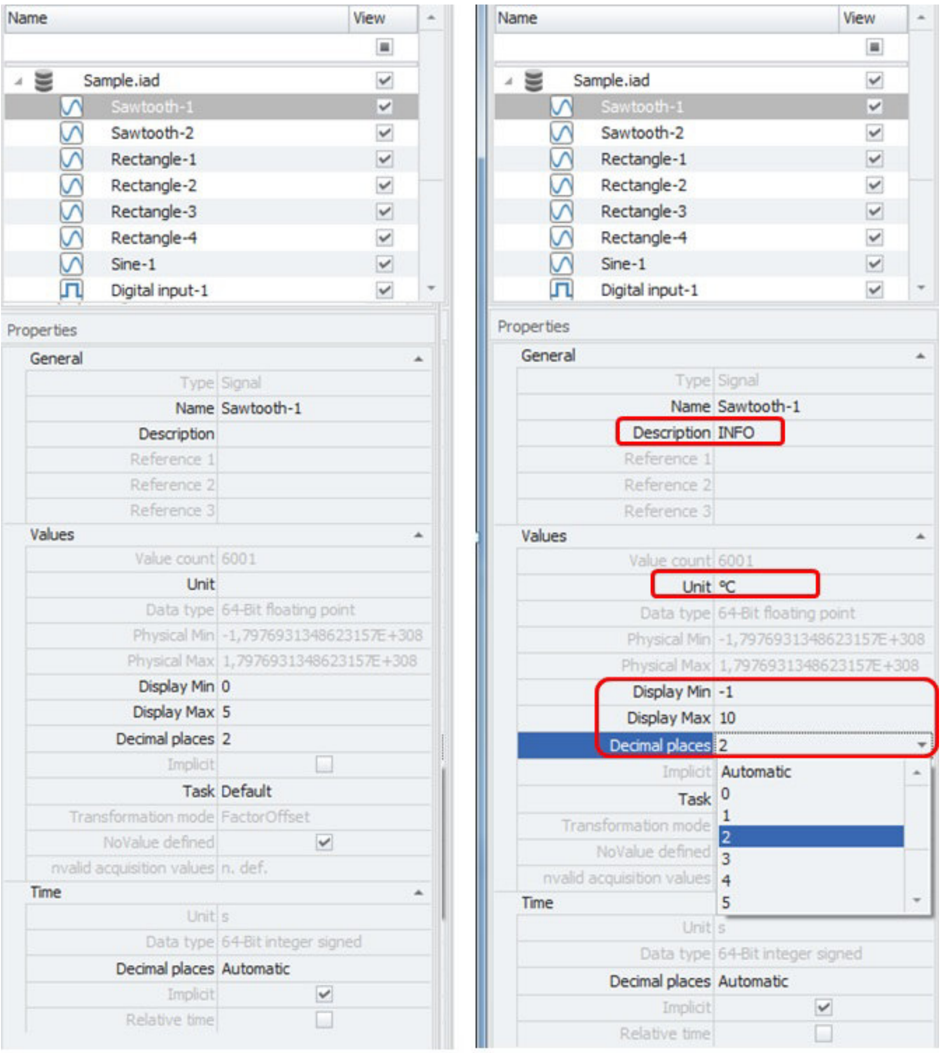
Diagrams are automatically updated too. [DA_7]

The changes become effective when you export the data file.

18.2.3 Channel properties

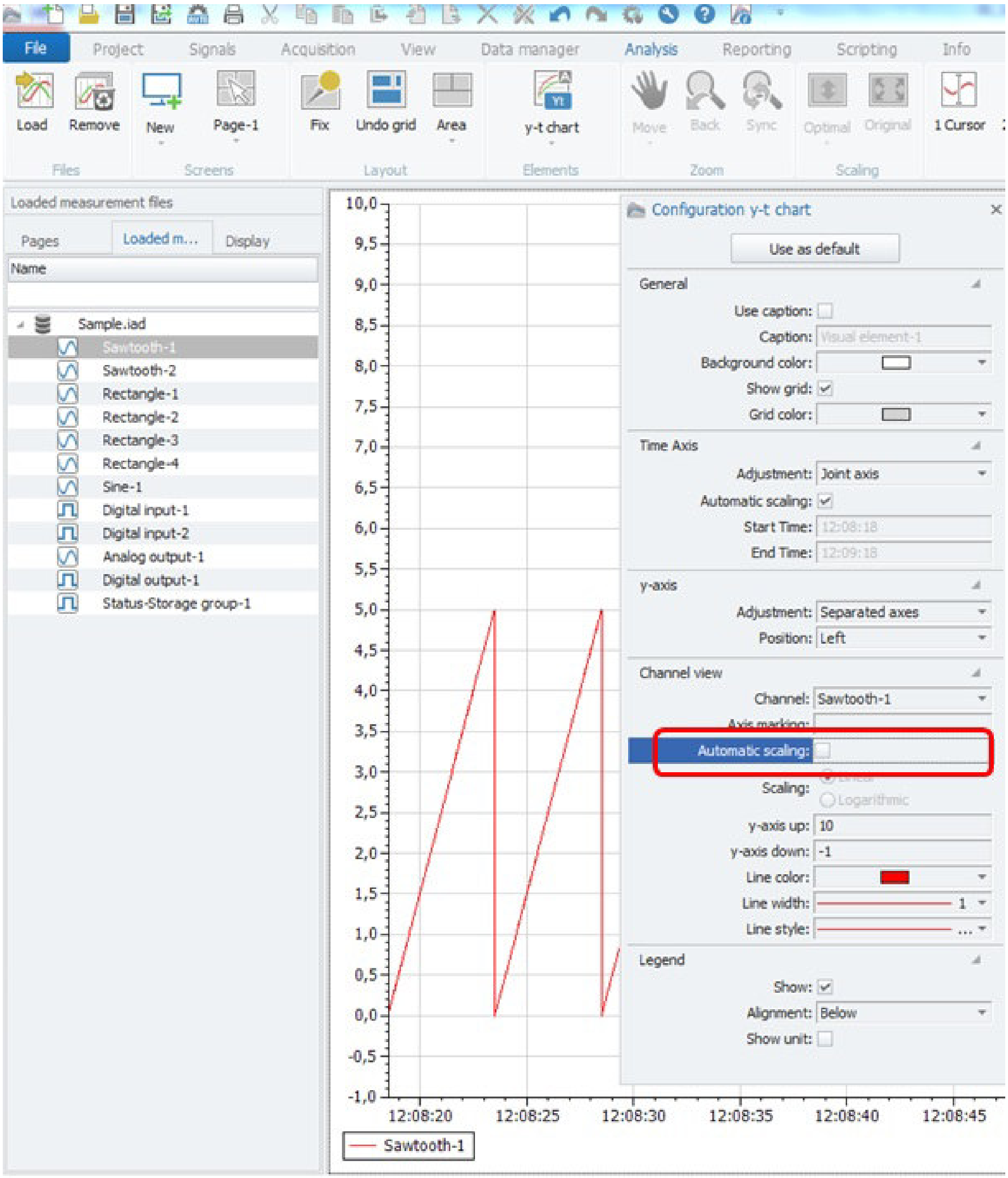
The channel properties can be edited as well. These parameters are defined in SIGNALS on channel level. You can modify them after recording is needed. The changes become effective when you export the data file. You can modify the following parameters.

► Description	Change channel description
► Unit	Change unit
► Display MIN / Max	Change display scaling Yt- and XY-diagrams
► Decimal places	Change the number of decimal places



Original channel properties Modified channel properties [DA_8]

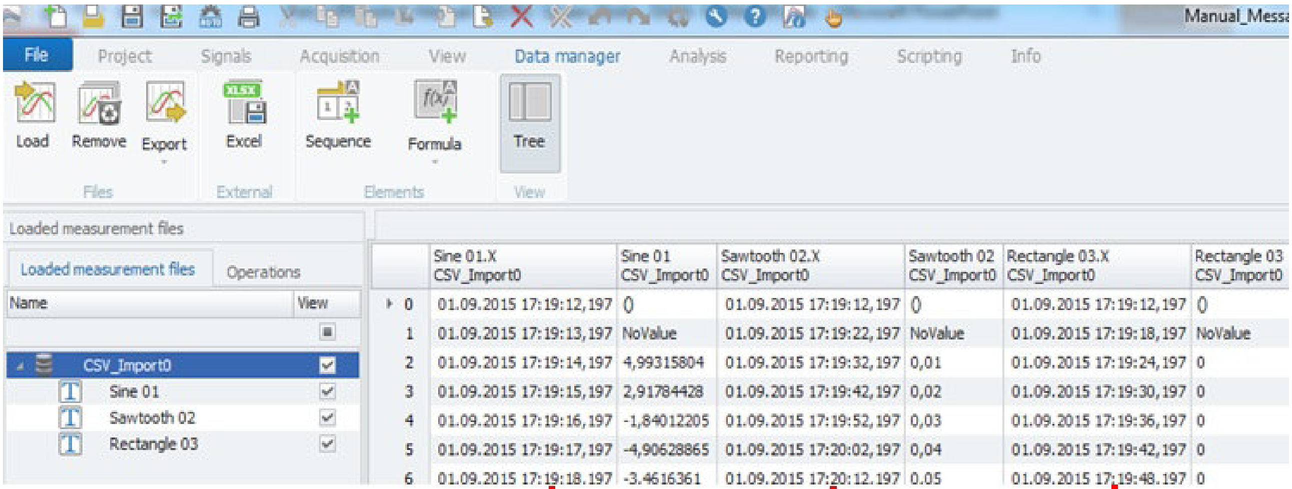
Example:
When you change the Display Min/Max properties they become effective in the Yt- or XY-diagram when you disable the automatic scaling function.



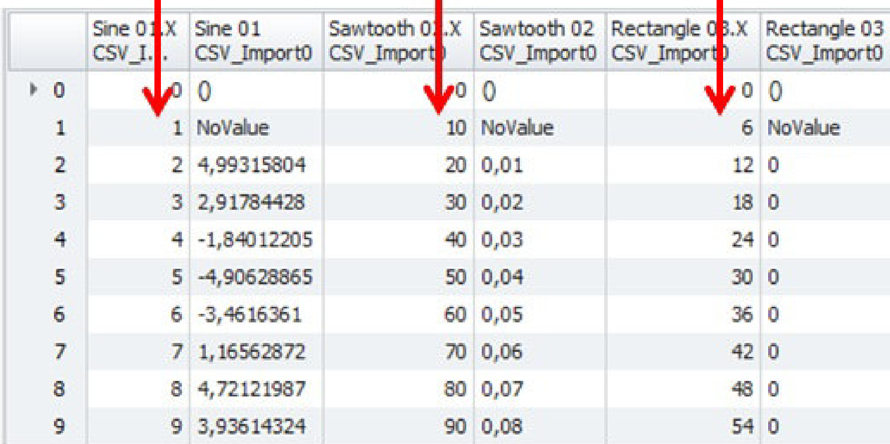
The new Display Min/Max scaling is effective when "Automatic Scaling" is deactivated. [DA_9]

18.2.4 Time channel format – relative / absolute

When you import a data the time channel format in the data grid, is influenced by the settings in the OPTIONS >Appearance 22.4.7. When the time channel is set to absolute time the full date and time is displayed in the time column for each channel. When in the settings in the option is defined for relative the time channel is starting from Zero and incrementing the numerical value by the sample rate.



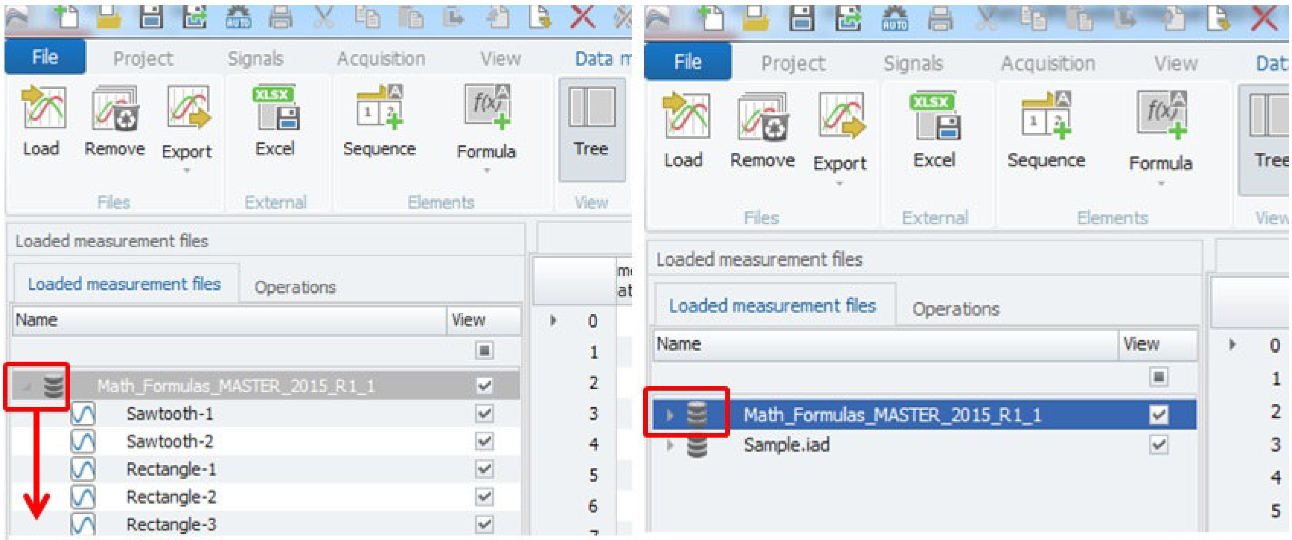
Absolute time channel format.



Relative time channel format. [DA_10]

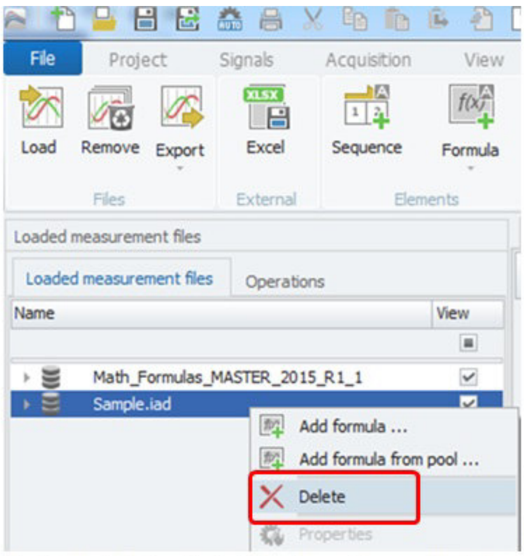
18.2.5 Working in the data file tree

- ► Hide / show channel tree — In the data file tree you have different configuration options. You can show or hide the channels of each data file.



Expand channel list Collapse channel list [DA_11]

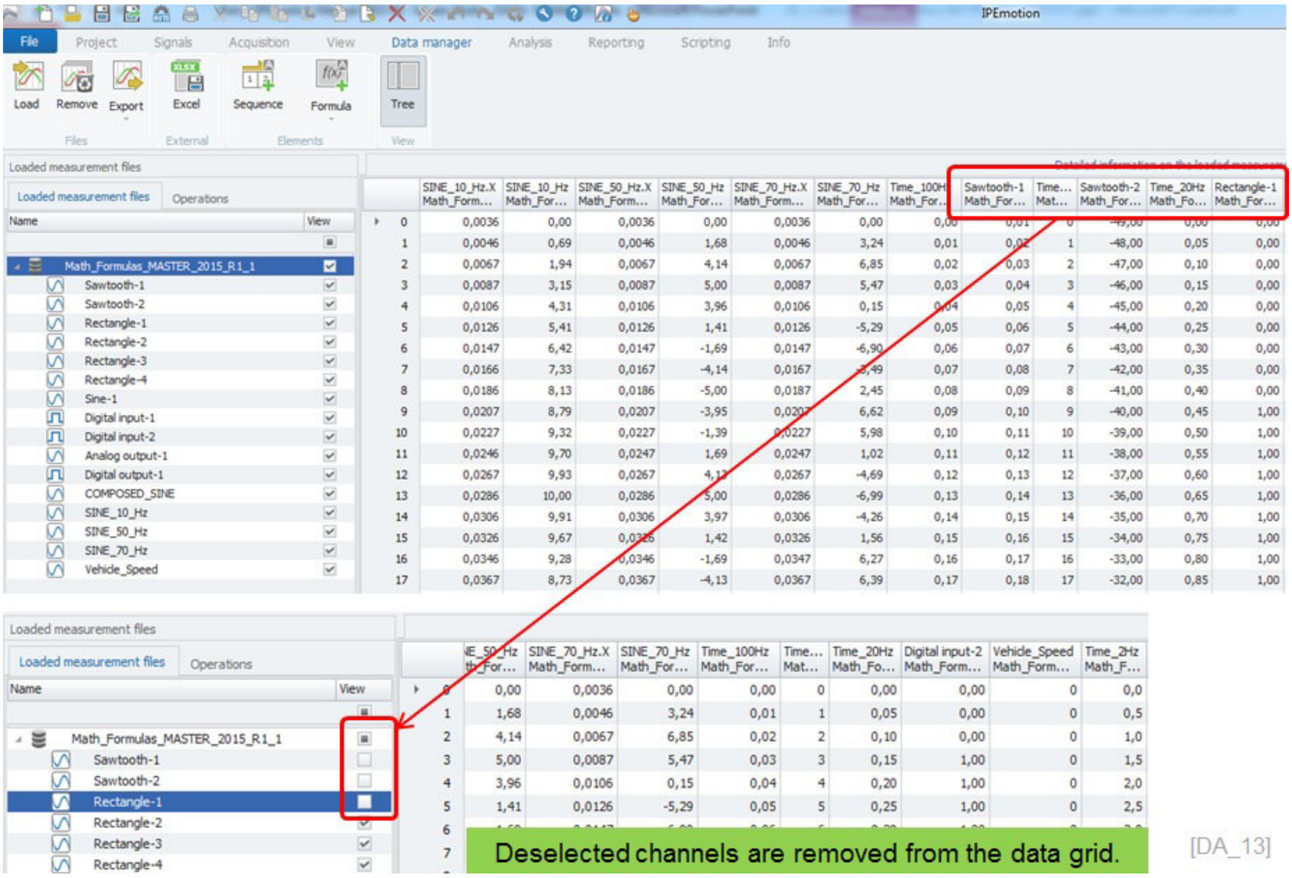
- ► Enable / disable channels — You can activate or deactivate all channels if you select or deselect the checkbox on data file level.
- ► Delete data files — You can delete individual files from the pool of all loaded files. With Ctrl+A you can select several files and delete them as well. This function is different from the REMOVE function that will be discussed below.



[DA_12]

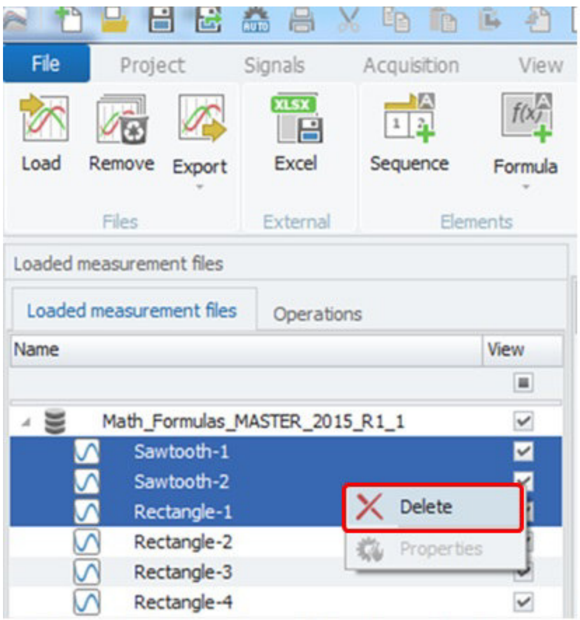
Delete individual data files from the pool of files.

- **Deactivate channels**: You can deactivate each channel individually by deselecting the checkbox. The channel grid is updated and the deselected channels are invisible.



[DA_13]

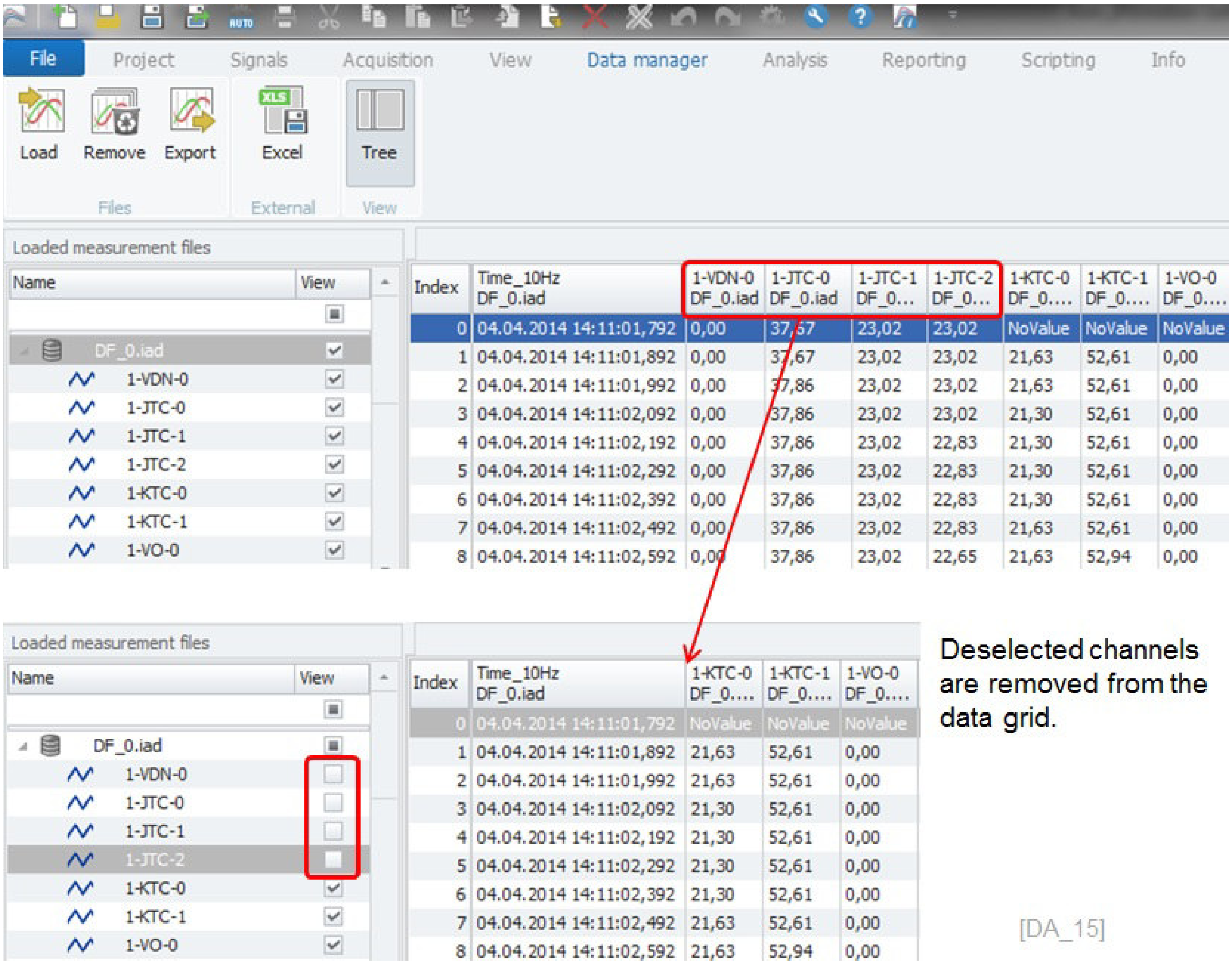
- **Delete channels**: The channel checkbox discussed above has only an impact on the data grid. If you like to remove a channel for the export, you need to select and delete the channel first.



[DA_14]

Select and delete channels from the data file.

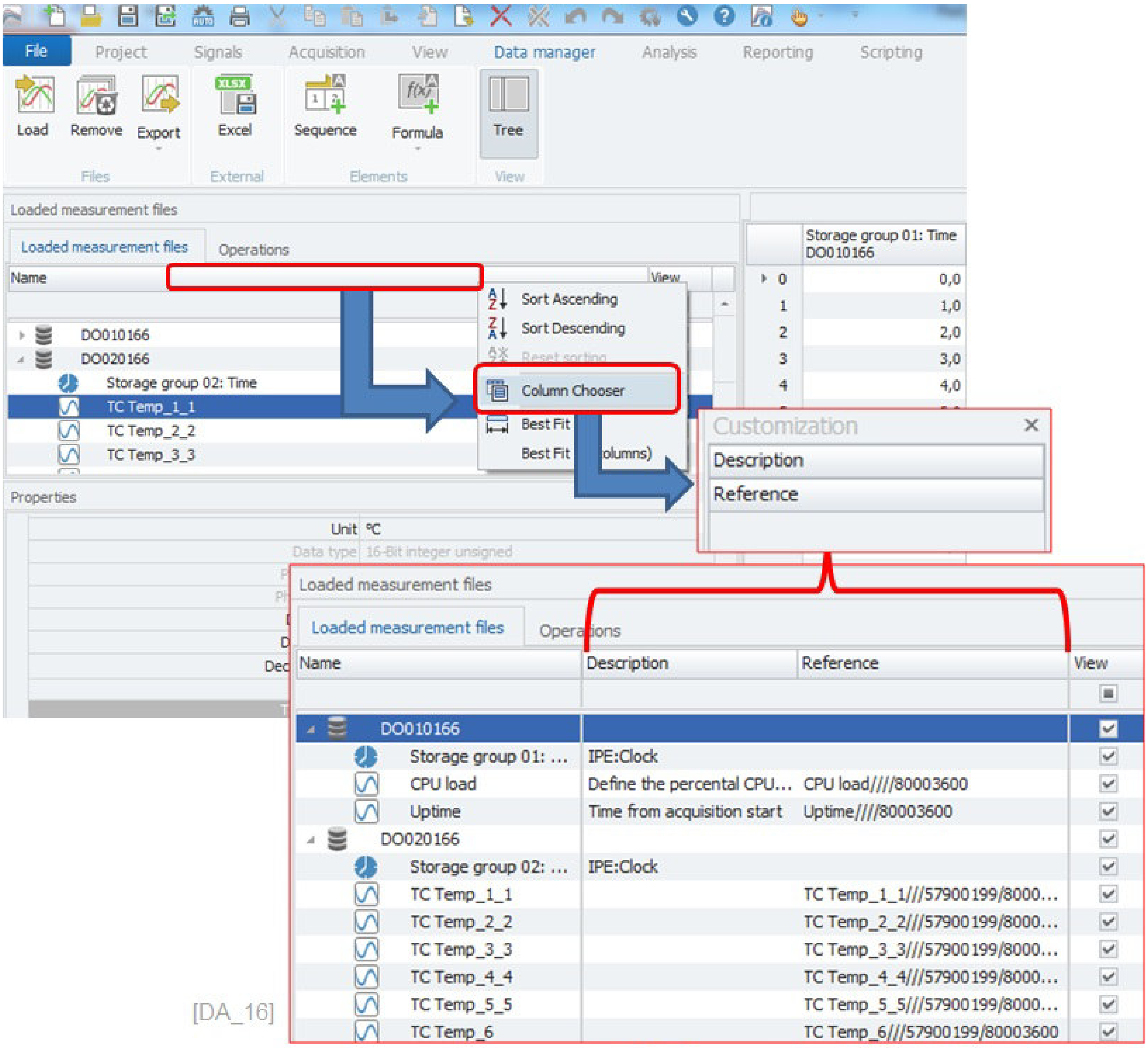
- **Merge Time channels** Every channel has a corresponding time channel. By default the data grid shows a time channel for every measurement channel. You can merge the time channels with a setting in OPTIONS >Data Manager in chapter 22.6.1.



[DA_15]

Information *When you activate the function "Merge Time channels" in the options the order of the channels in the data grid can change. Normally the channels have the same order as listed in the channel tree. However when the time channels are merged all channels in the data file with the same acquisition rate are grouped together.*

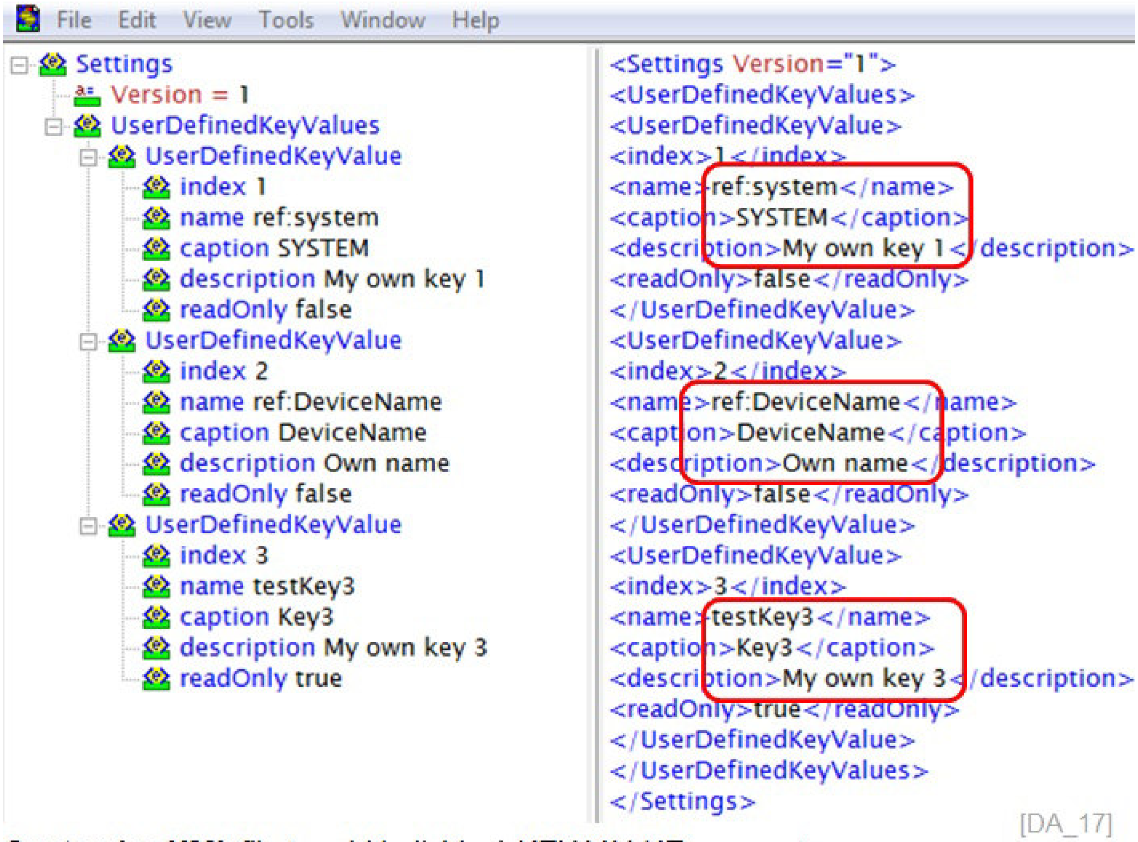
- **Column chooser** With the column chooser in the data file tree you can add valuable information to the channel list. By default you can add the channel description and the channel reference to the grid



Default customizing KEY VALUE pairs.

With the **Customize.XML** file you are able to add individual key-value parameters to the channel grid of the DATA MANAGER tree. The customize.XML file has to be installed in the installation directory of IPEmotion. Win 7 C:\Program Files (x86)\IPETRONIK\IPEmotion 2016 R2.1**Customize.xml**

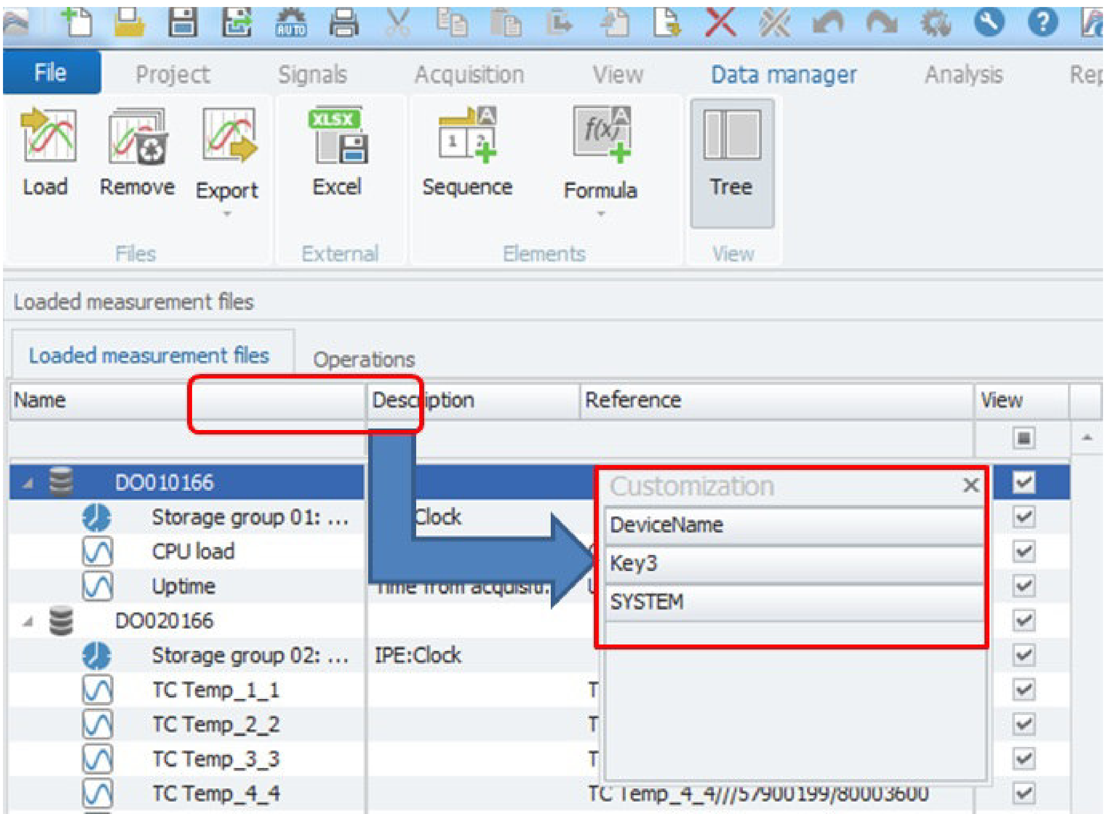
Information *The **Customize.XML** file can be used to add individual key-value pairs to the SIGANL channel grid too. See chapter 11.6.1.*



[DA_17]

Customize.XML file to add individual KEY VALUE parameters.

With the definition of **Customize.XML** new columns are added to the channel grid of the DATA MANAGER. The benefit is that you can add additional channel specific properties to the grid.



[DA_18]

Customize.XML is adding new columns to the column chose.

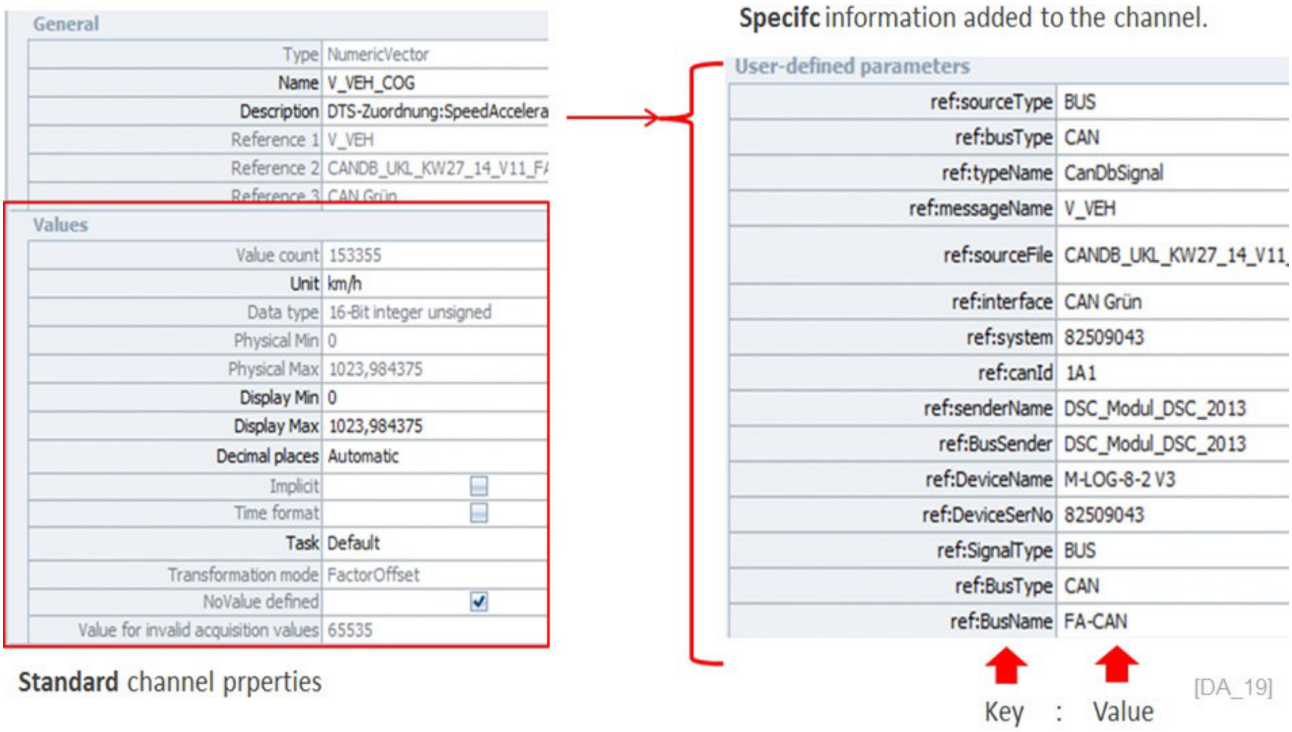
The customized key-value pairs are included in the detailed export column chooser too 18.3.4.

18.2.6 Saving key-value pairs to data files of the data loggers

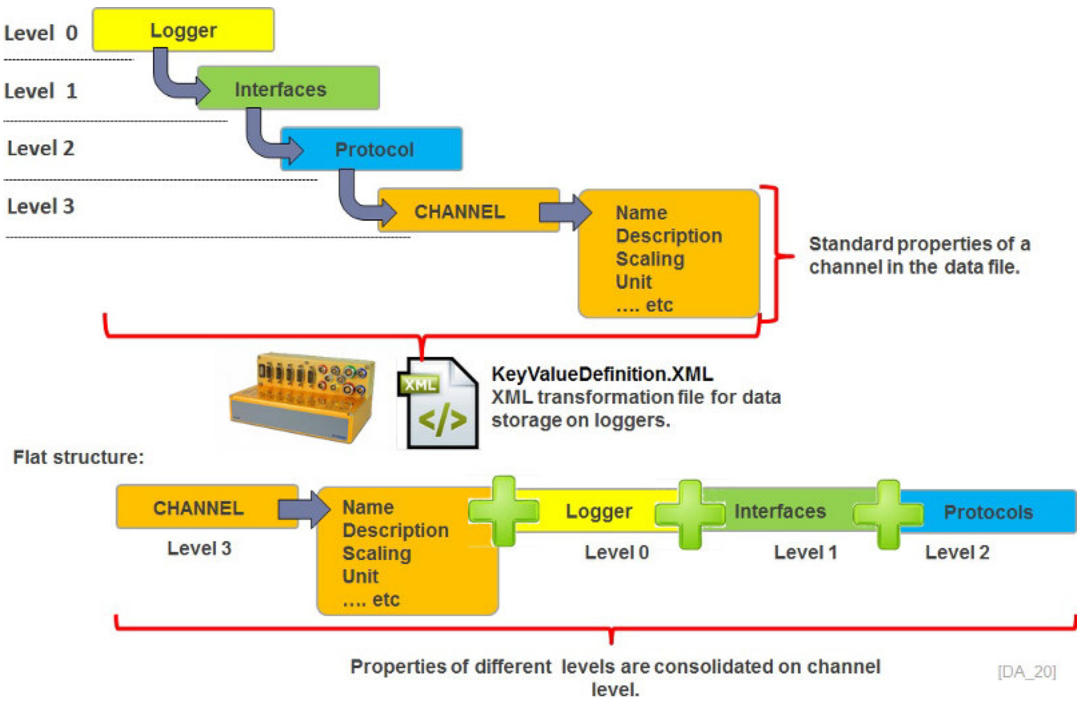
18.2.7 YouTube Resources

IPEmotion - Key-Value pairs and MDF4: https://youtu.be/T87XyggAs58

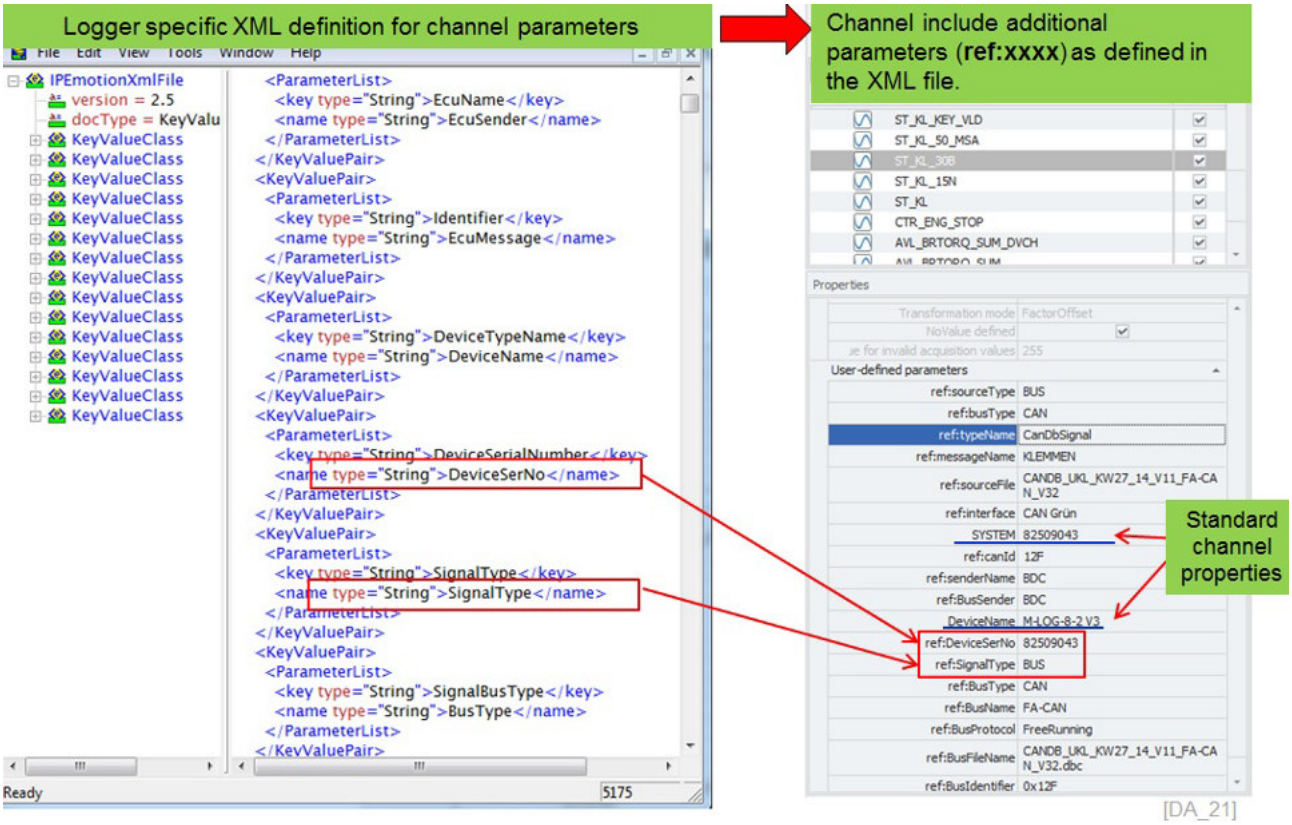
IPETRONIK data loggers can store customer specific key-value pairs in the data files. The main objective for the user is to add and link important information on channel level to the data file. In the screenshot below you can see how the standard information of measurement channel can be enriched with additional information.



The main idea is to add information tags (meta data) to on channel level so that from a data traceability point of view the user can easily identify along the whole hierarchy of the data acquisition system where the data is originating from. The following diagram is showing how the hierarchy can be reduced when using the XML schema.



The logger specific key-value definition XML file is stored in the following directory:
C:\ProgramData\IPETRONIK\IPEmotion 2016 R2.1 RC\MAL\IPETRONIK\IPETRONIK-Logger\
KeyValueDefinition.XML
As indicated below this XML file includes parameters which the user would like to store in addition to the general channel properties.



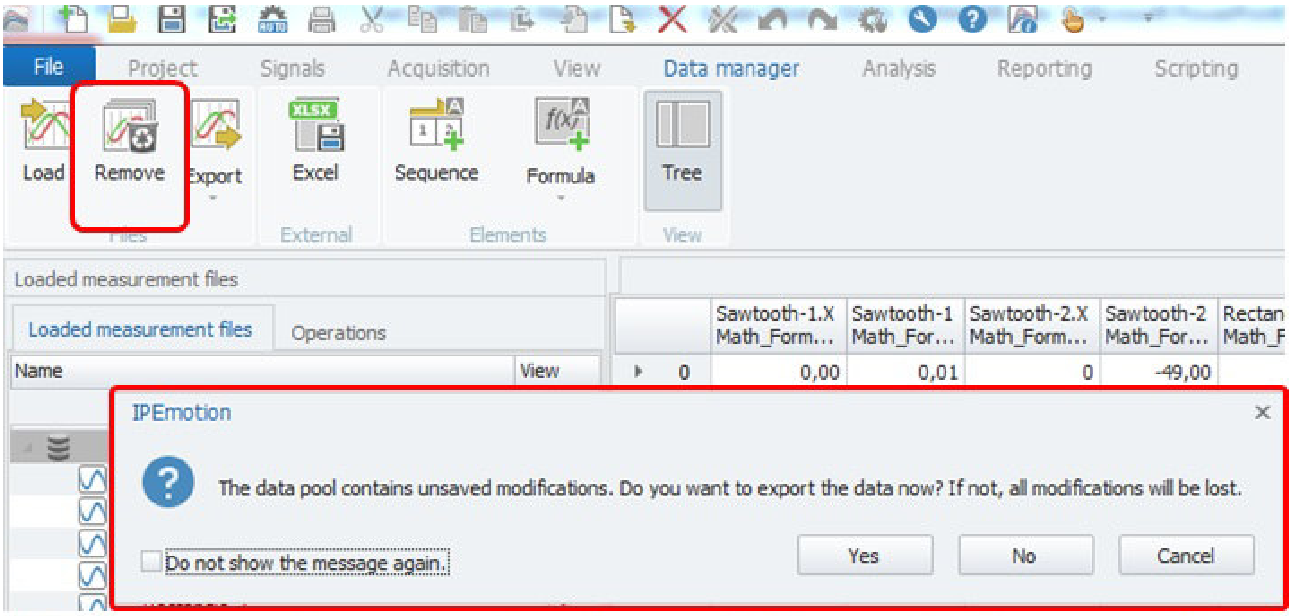
[DA_21]

Information *Only IPETRONIK developers have access to the exact parameter names in order to define them in the XML file.*

With the **Customize.XML** file the additional channel parameter stored in the data logger data file can be made accessible and visible to the channel grid of the DATA MANAGER 18.2.5.

18.2.8 Remove

With the remove function you can remove all data files. However if you made any modification to the data file, group properties, channel properties, delete channels are update data records you get a warning that these changes are not saved. Only when you export the file the changes are effective.



Warning message in case you have done modifications to the file. [DA_22]

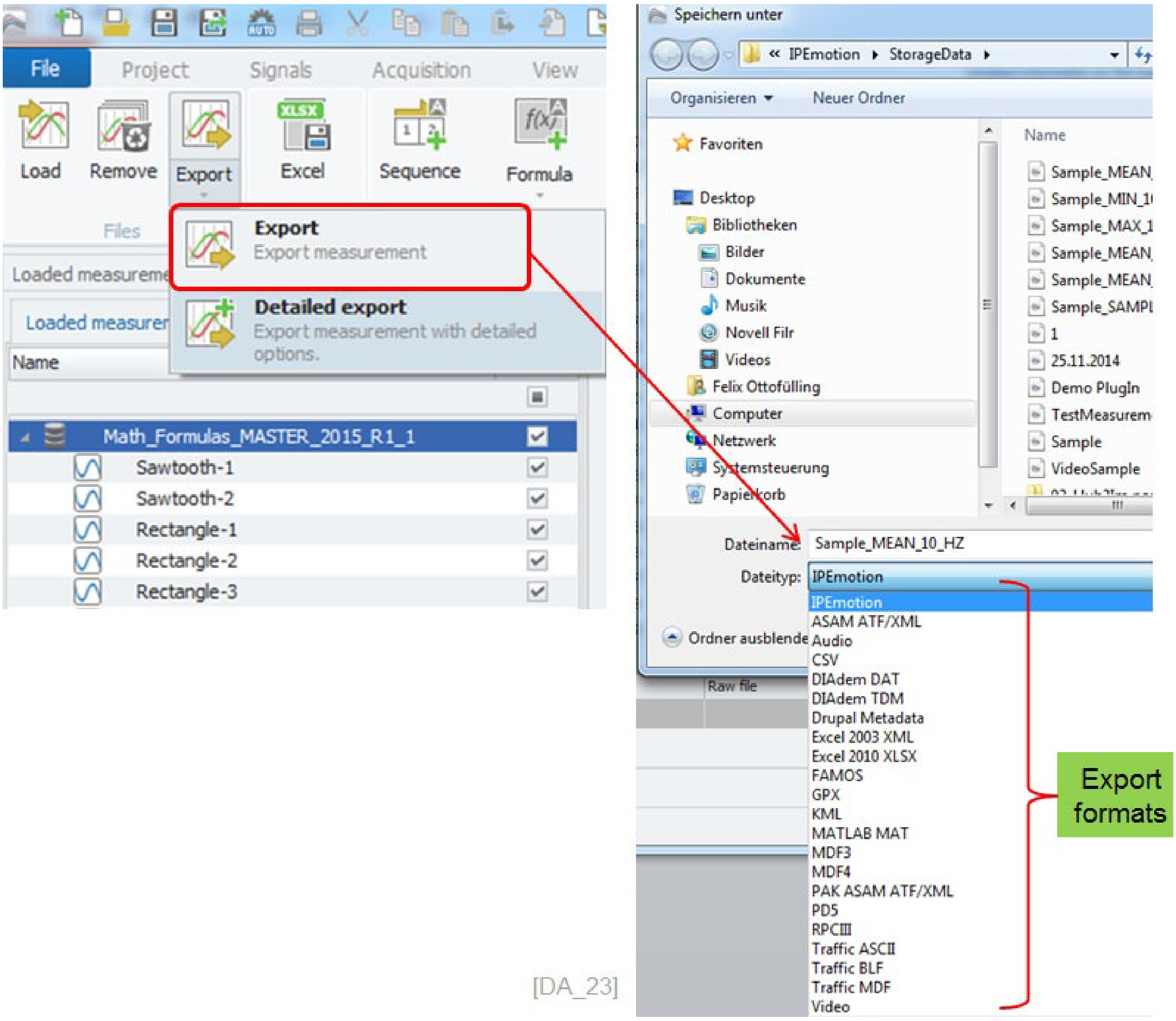
18.3 Data export

18.3.1 Youtube resources

IPEmotion – Data Post-Processing – Data Formats: http://youtu.be/2R3VCndYYHg

18.3.2 Export channel count is limited by the different Edition

You can load any data files and any supported format with every IPEmotion Edition. However, the export is limited to the same number of channels as defined for data storage. See chapter Editions 4.1 for more details on export restrictions. The supported export formats are discussed in more detail in OPTIONS >Export in chapter 22.8.



[DA_23]

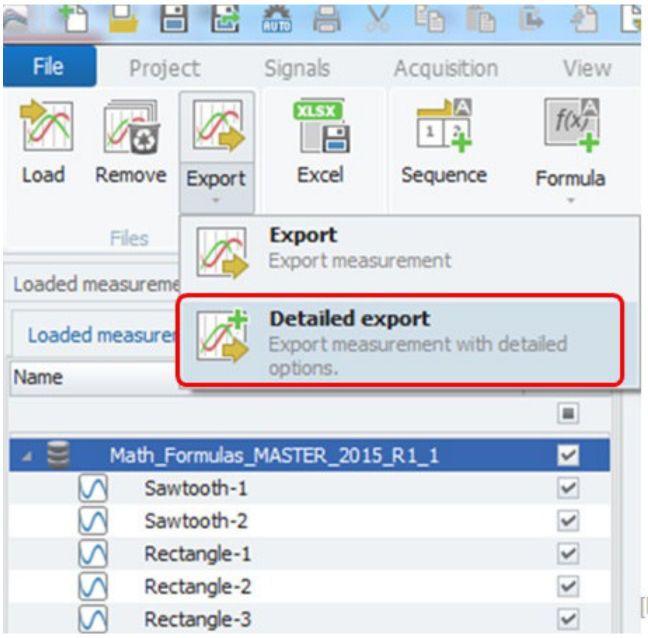
18.3.3 Different export behavior – deactivated vs. deleted channels

For data export it is important to consider that the software is behaving differently. In the normal export only the deleted channels are excluded and removed from the exported file. However if you use the detailed export all deselected channels from the export window are excluded from the export.

Information	*At any case if you delete a channel from a data file, this deletion will become effective after the export process. The original data file remains unchanged and keeps all data and all channels.*

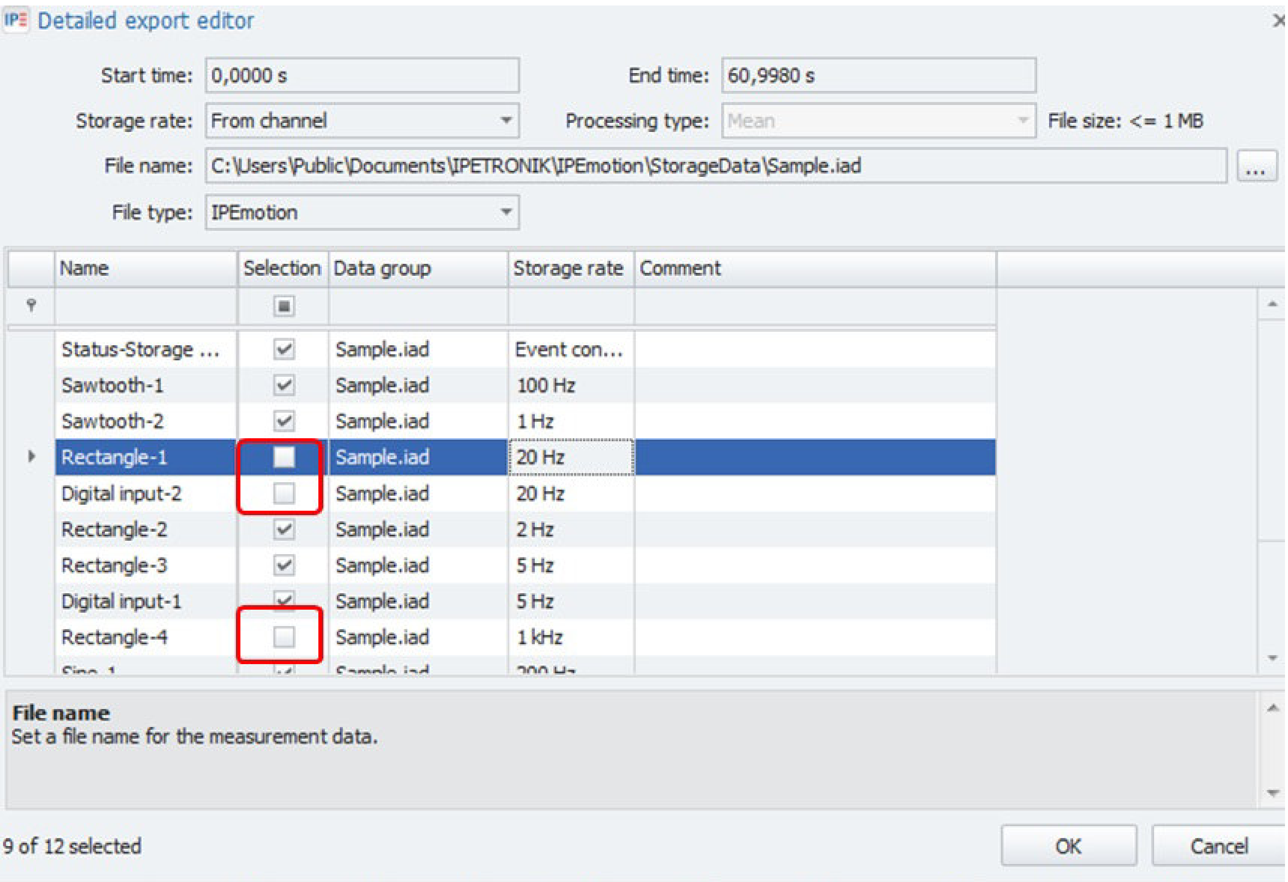
18.3.4 Detailed export

The data export offer special export settings which will be discussed in turn.



[DA_24]

The settings can be defined in the following interface.

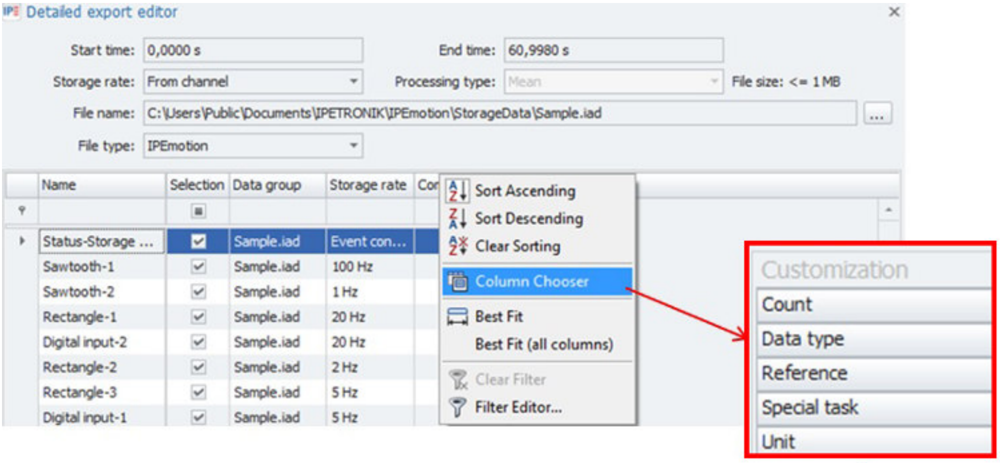


Ability to deselect channels from the data computation and export.

[DA_25]

Through the channel grid you can add 5 additional columns.

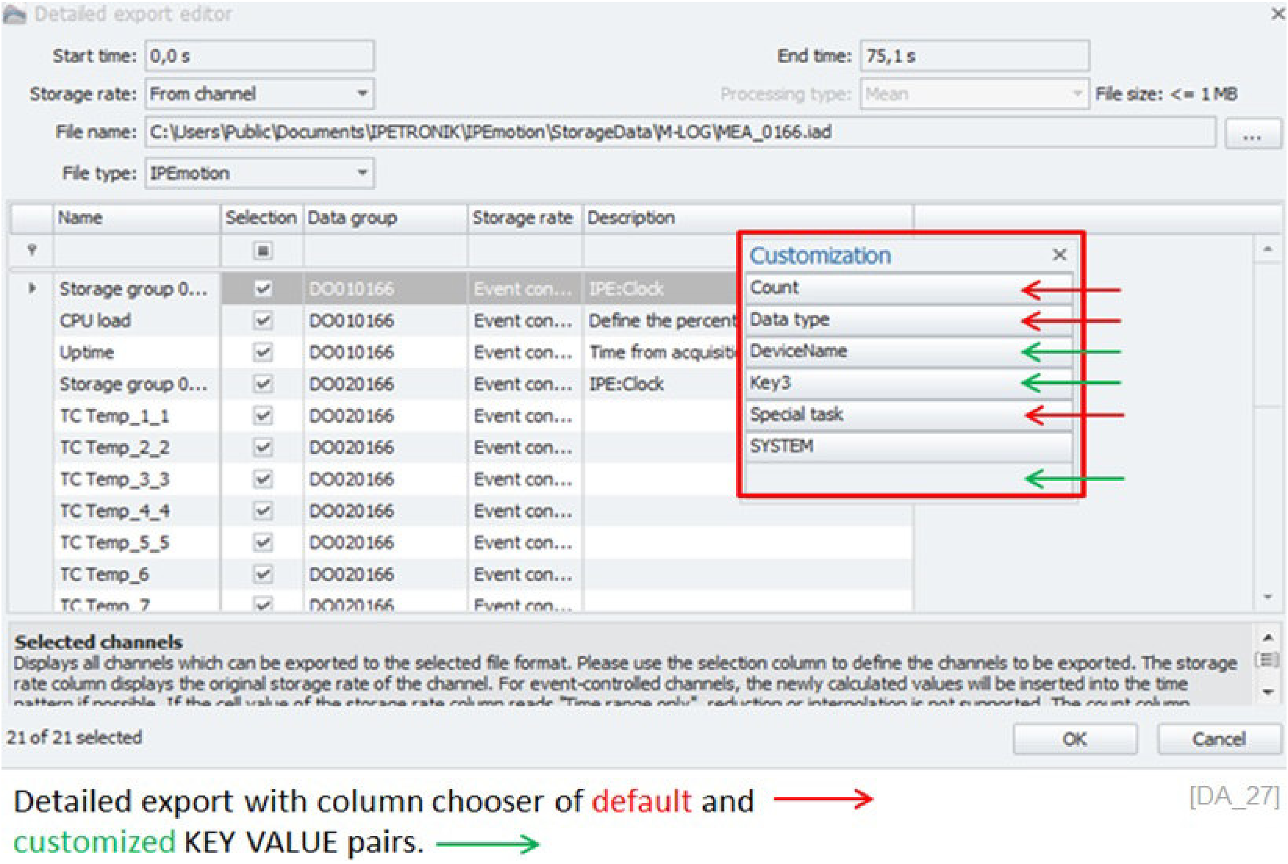
► Count	Indicating the number of sample in the data file.
► Data type	Indicating the data format when stored. The data format you can see on channel level in SIGNALS in the tab sheet "Format".
► Reference	Channel standard reference to determine the source of the data.
► Special task	The special task is also defined in SIGNALS in the tab sheet âĂIJFormatâĂİ 11.6.4.
► Unit	Units of the channel.
► Customized KEY-VALUE	All customized Key-value pairs defined in the Cutomize.XML file are included in the column chooser of the detailed export 18.2.5.



[DA_26]

Name	...	Data group	Storage rate	Description	Count	Data type	Reference	Special task	Unit
Sawtooth-1	☑	Sample.iad	100 Hz		6001	FLOAT64	Sawtooth-1///Demo system	Default	
Sawtooth-2	☑	Sample.iad	1 Hz		61	FLOAT64	Sawtooth-2///Demo system	Default	
Rectangle-1	☑	Sample.iad	20 Hz		1201	FLOAT64	Rectangle-1///Demo system	Default	
Rectangle-2	☑	Sample.iad	2 Hz		121	FLOAT64	Rectangle-2///Demo system	Default	
Rectangle-3	☑	Sample.iad	5 Hz		301	FLOAT64	Rectangle-3///Demo system	Default	

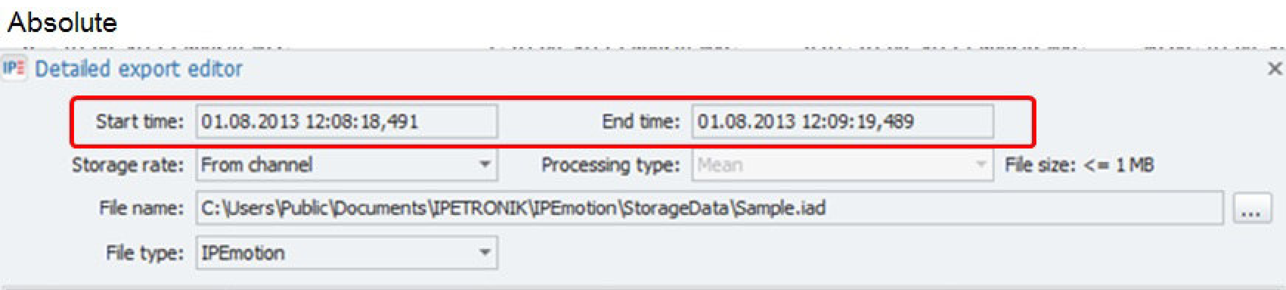
Detailed export including Customize.XML Key-value pairs too.



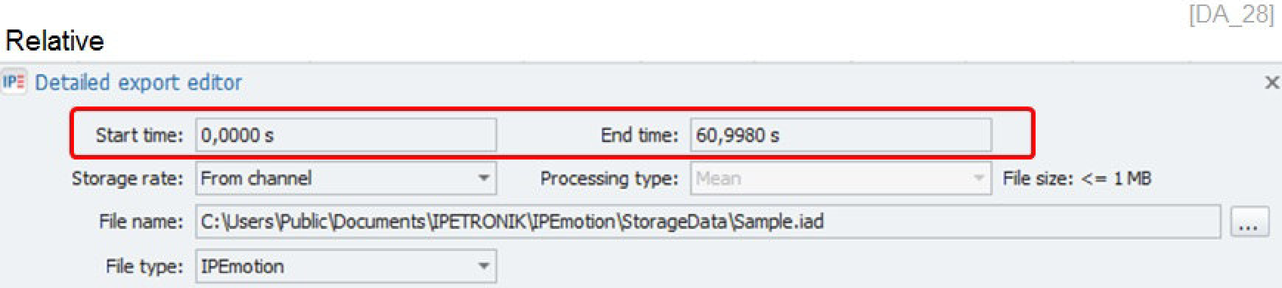
[DA_27]

18.3.5 Start and end time

With start and end time you define which pat of the data file should be exported or processed. In the OPTIONS you can define the time axis between relative and absolute. This time setting is reflected on the export time range.

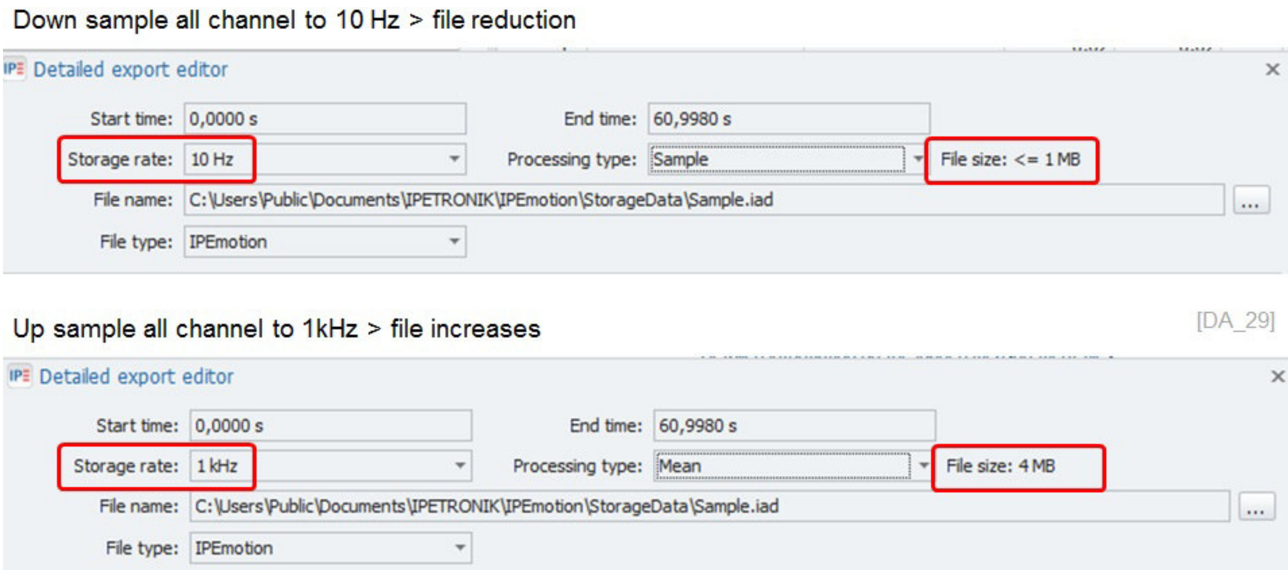


[DA_28]



18.3.6 File size calculation for IPEmotion .iad format

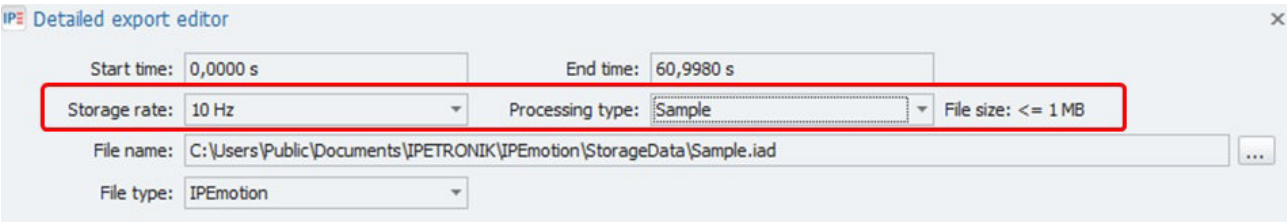
Depending on the sample rate selected you get an approximation of the file size after the export. This approximation is only an estimate for IPEmotion (.iad) files. The size of other formats can be different.



[DA_29]

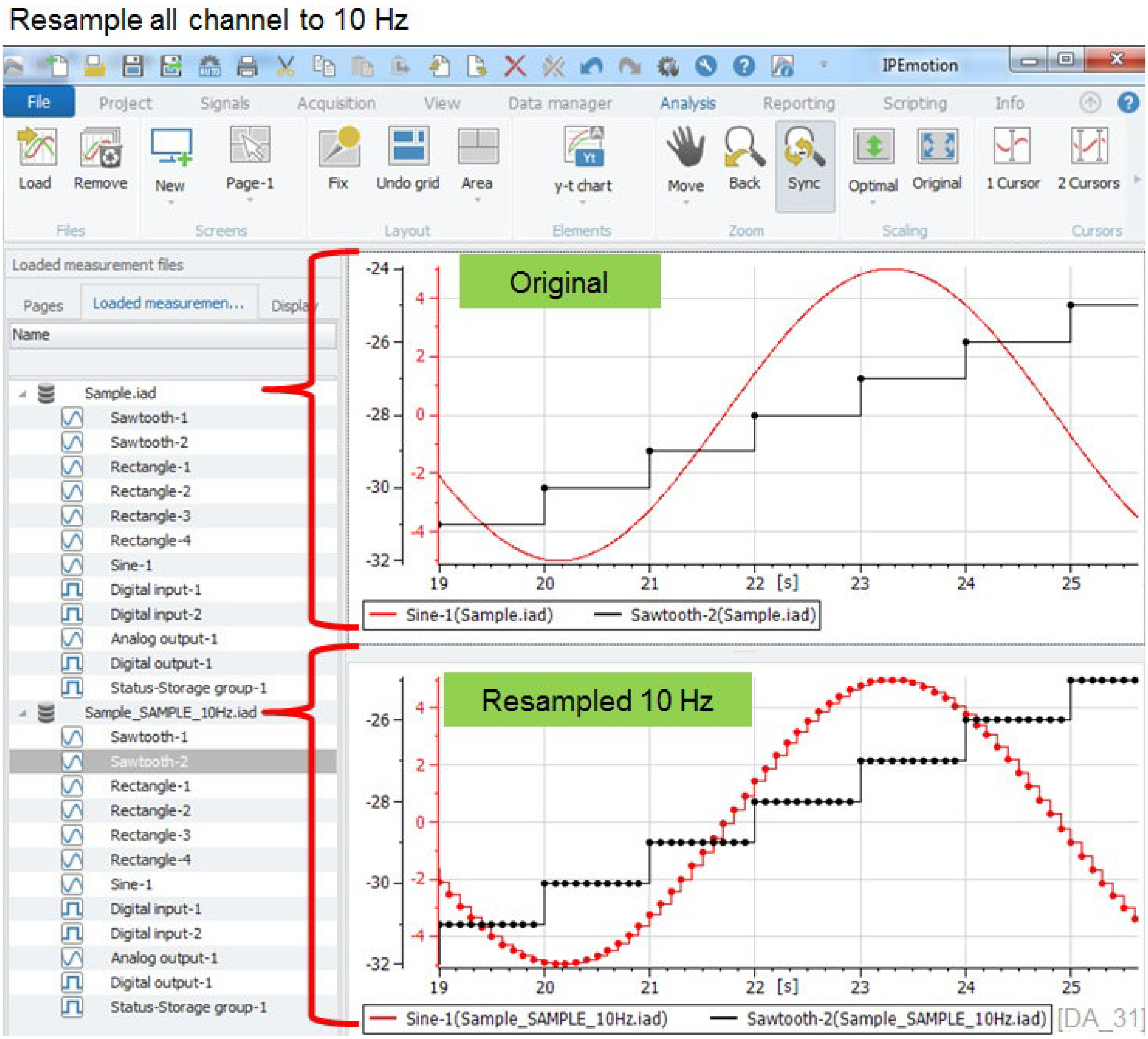
18.3.7 Storage rate and processing type – Sample

In these drop down lists you can define the sample rate you would like to apply to the processing rate. When you select sample and a corresponding sample rate all selected channels will be resampled.



[DA_30]

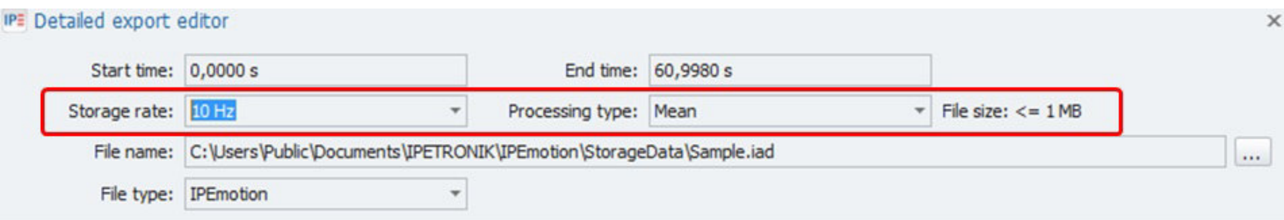
The graph below indicates how the original signals either reduced in sample rate (Sine-1) or are increased with additional values (Sawtooth-2). Finally all channels will have the same number of samples (sample rate) in the data file.



[DA_31]

18.3.8 Storage rate and processing type – MEAN

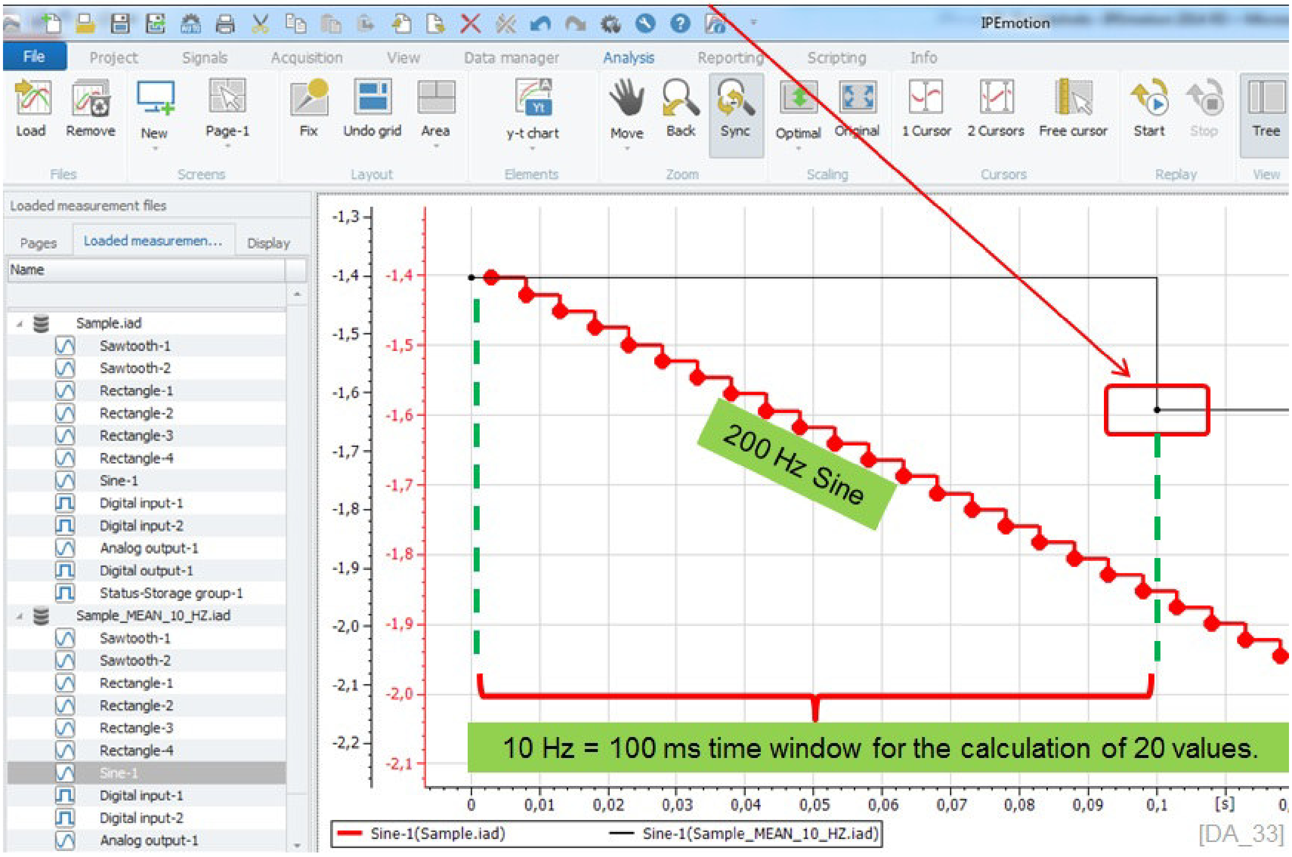
When you select the processing type MEAN the export function will calculate the mean value of all samples in the selected sample rate (time range).



[DA_32]

When the sample rate is 10 Hz it is equivalent to 100ms. The MEAN formula is then taking all sample from the original source channel (Sine-1) and is returning the MEAN value every 100ms. In this example the Sine-1 channel has a resolution of 200 Hz. In this case the software takes 20 samples to calculate the mean value as indicated in the diagram below.

Result of 10 Hz MEAN calculation of 20 values of the source channel.

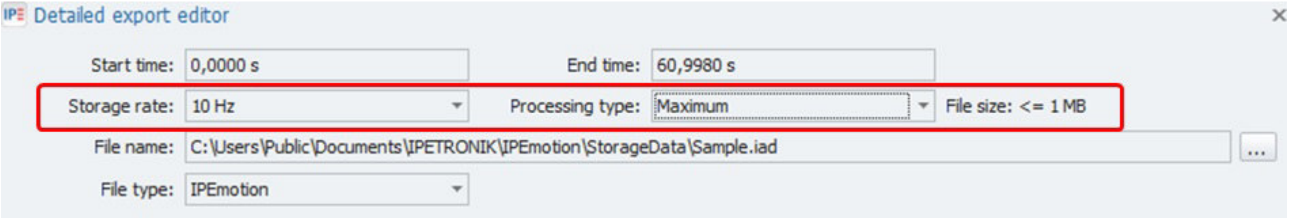


Information

When you apply MEAN, MIN or MAX calculations the resulting graph has inevitably a phase shift. This is caused by the fact that depending on the sample rate of the source channel and the output channel a time shift takes place.

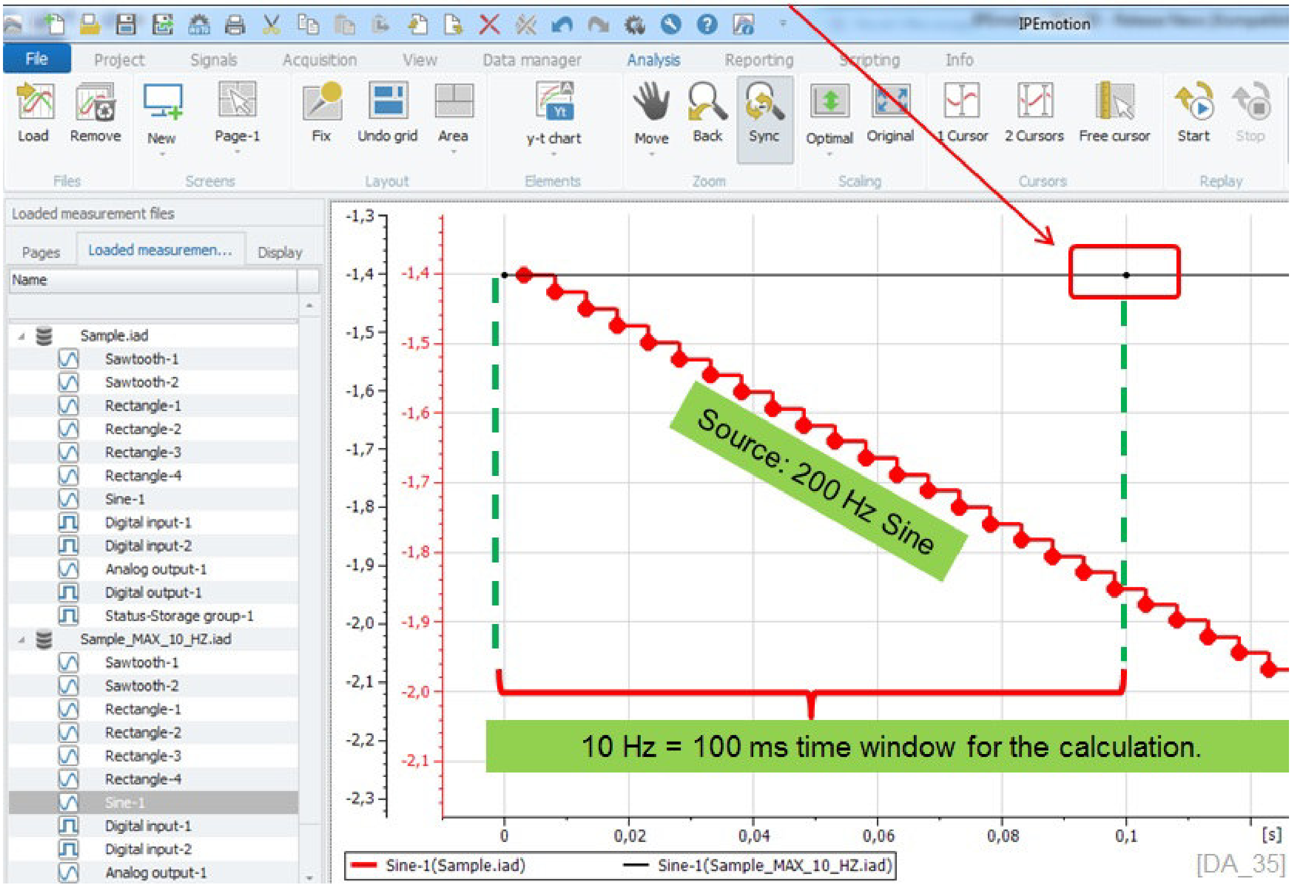
18.3.9 Storage rate and processing type – MAXIMUM

With MAXIMUM function you calculate the maximum out of the source channel. All sample of the source channel are included in the calculation. In this example 20 values of the 100 Hz Sine-1 channel are considered in computing the maximum.



[DA_34]

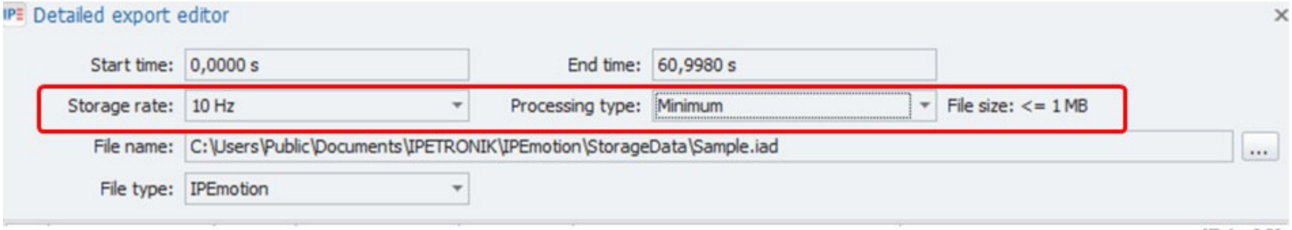
Result of 10 Hz MAX calculation of 20 values of the source channel.



[DA_35]

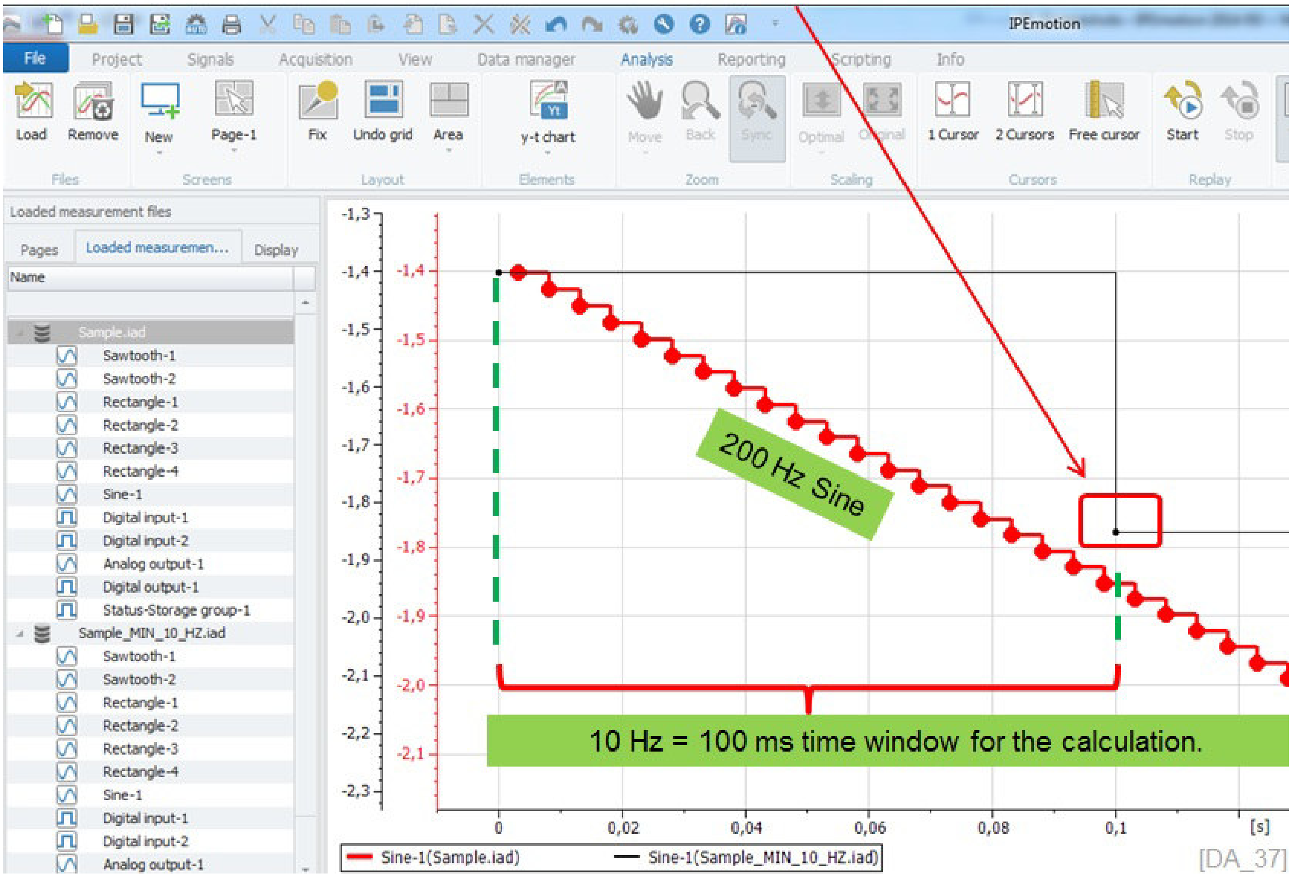
18.3.10 Storage rate and processing type – MINIMUM

With MINIMUM function you calculate the minimum out of the source channel.



[DA_36]

Result of 10 Hz MIN calculation of 20 values of the source channel.

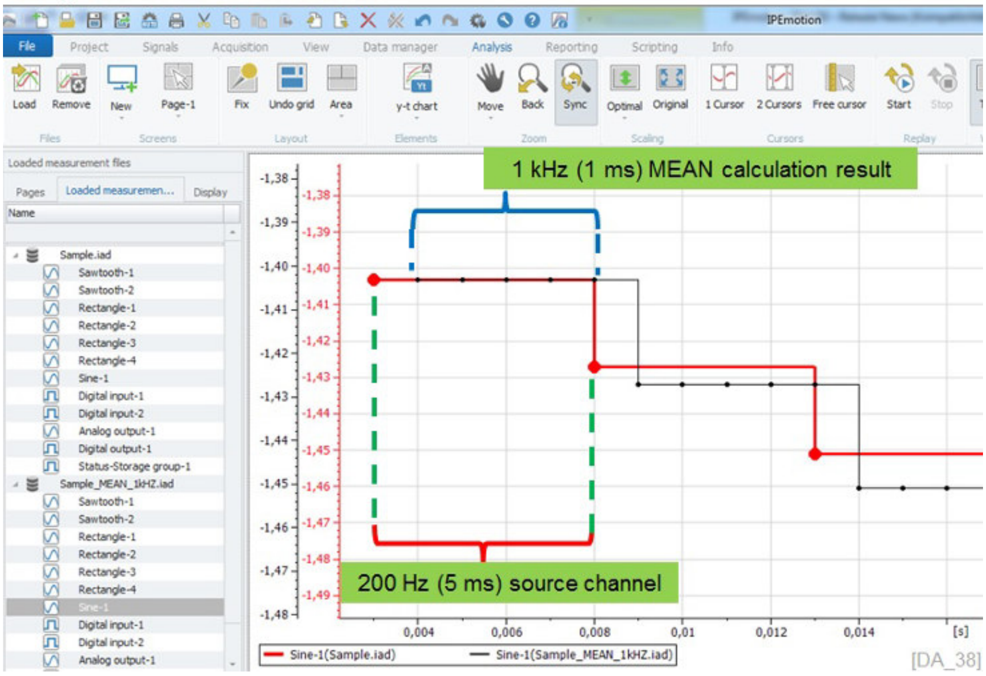


[DA_37]

18.4 Impact of increased sample rates

In the processing settings you can define computations (Sample, MIN, MAX, MEAN) with higher sample rates than the source channels. In this case the result is that additional samples are plotted and integrated to the resulting output signal. The diagram below indicates how a 200 Hz (5 ms between each measurement) signal is represented when the overall applied sample rate of 1 kHz (1 ms between each sample) is applied.

Example of 1kHz MEAN calculation.



[DA_38]

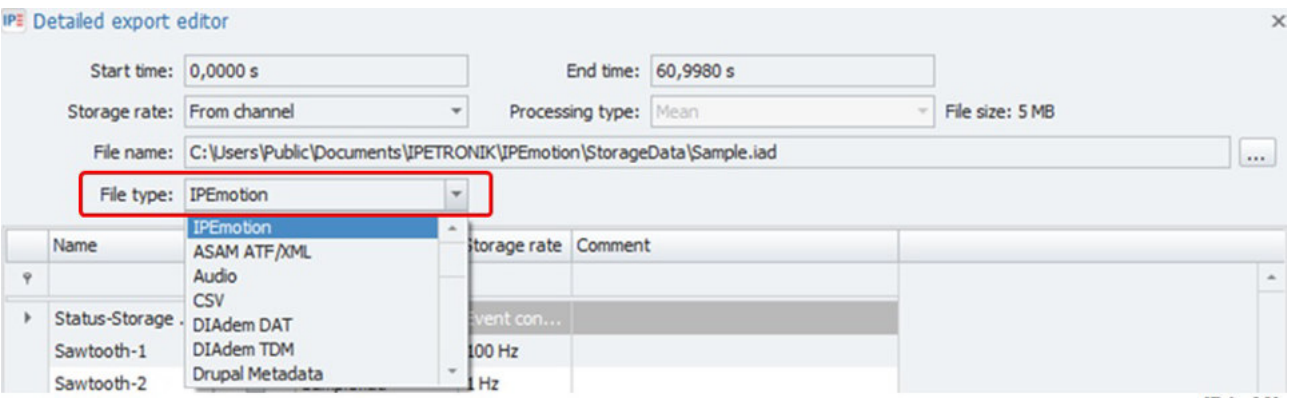
Information — *The software is not "inventing" or computing any intermediate data appoints. When the sample rate is smaller than data points are* ***excluded*** *(removed from the output signal. If the sample rate is higher than the source channel data points of the same values are* ***added*** *(filled) up to the out coming signal.*

18.5 File name and storage path

Here you can define the file name and the location where to export the new data file. The default directory is the one you have defined in the OPTIONS >Directory 22.11.

18.6 File type – data export formats

Here you can define in which formats you like to export the data.



[DA_39]

The following table provides an overview of all import and export formats.

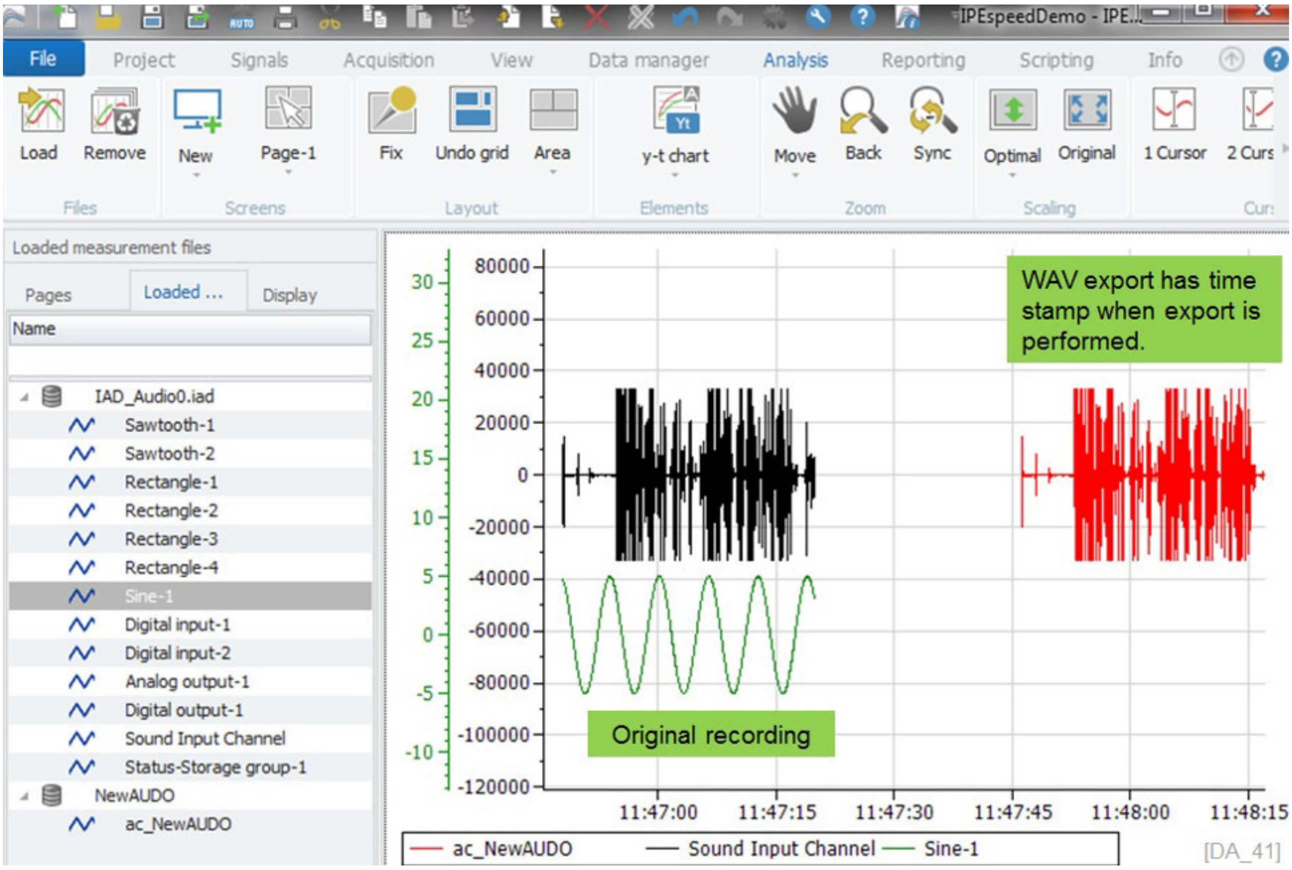
Format	File Type	Storage	Data Export	Data Import
IPEmotion	.iad & .ird	yes (iad)	yes	yes
CSV	.csv & .txt & .asc	yes (csv)	yes	yes
DIADEM	.dat & .tdm	yes	yes	yes
Drupal Metadata	.XML	yes	yes	
Excel 2003 XML	.xls & .xml	yes	yes	
Excel 2013 XLSX	.xlsx	yes	yes	
ASAM ATF/XML	.atfx	yes	yes	
PAK ASAM ATF/XML *	.atfx	yes	yes	
FAMOS	.dat	yes	yes	
MATLAB	.mat	yes	yes	
MDF 3	.mdf & .dat	yes (mdf)	yes	
MDF 4	.mf4	yes	yes	yes
PD5	.pd5	yes	yes	
RPCIII	.rsp	yes	yes	
Video	.avi	yes	yes	yes
AUDIO	.wav	yes	yes	yes
GPX	.gpx		yes	yes
G.I.N. audio	.wav		yes	
Graphtec	.gbd			yes
KML	.kml		yes	
TRAFFIC ASCII	.asc		yes	yes
TRAFFIC BLF	.blf		yes	
TRAFFIC MDF	.log. & .mdf		yes	
TESTdrive AUDIO	.dat & .wav		yes (atfx)	yes
TESTdrive Data Format	.zip			yes
TESTdrive Video Format	.dat			yes
TESTdrive Traffic Format	.bin			yes
Data export & online display e.g. in Yt graph: restricted to the channel count of the Edition:				
Basic = 10 / Lite = 64 / Standard = 256 / Professional, Developer, Analysis = no limit				

[DA_40]

18.7 Exports requiring particular attention

18.7.1 Audio Export [.WAV]

If your IAD data file includes an AUDIO channel, recorded e.g. from the SOUND PlugIn or through your M-LOG IPEaudio measurement system, you can run an AUDIO export. In this case, for every audio channel a separate WAV file is created. The new WAV file includes the starting time stamp of when the export was executed. There is no synchrony between the originally recorded file and the WAV file after the export.



18.7.2 Video Export

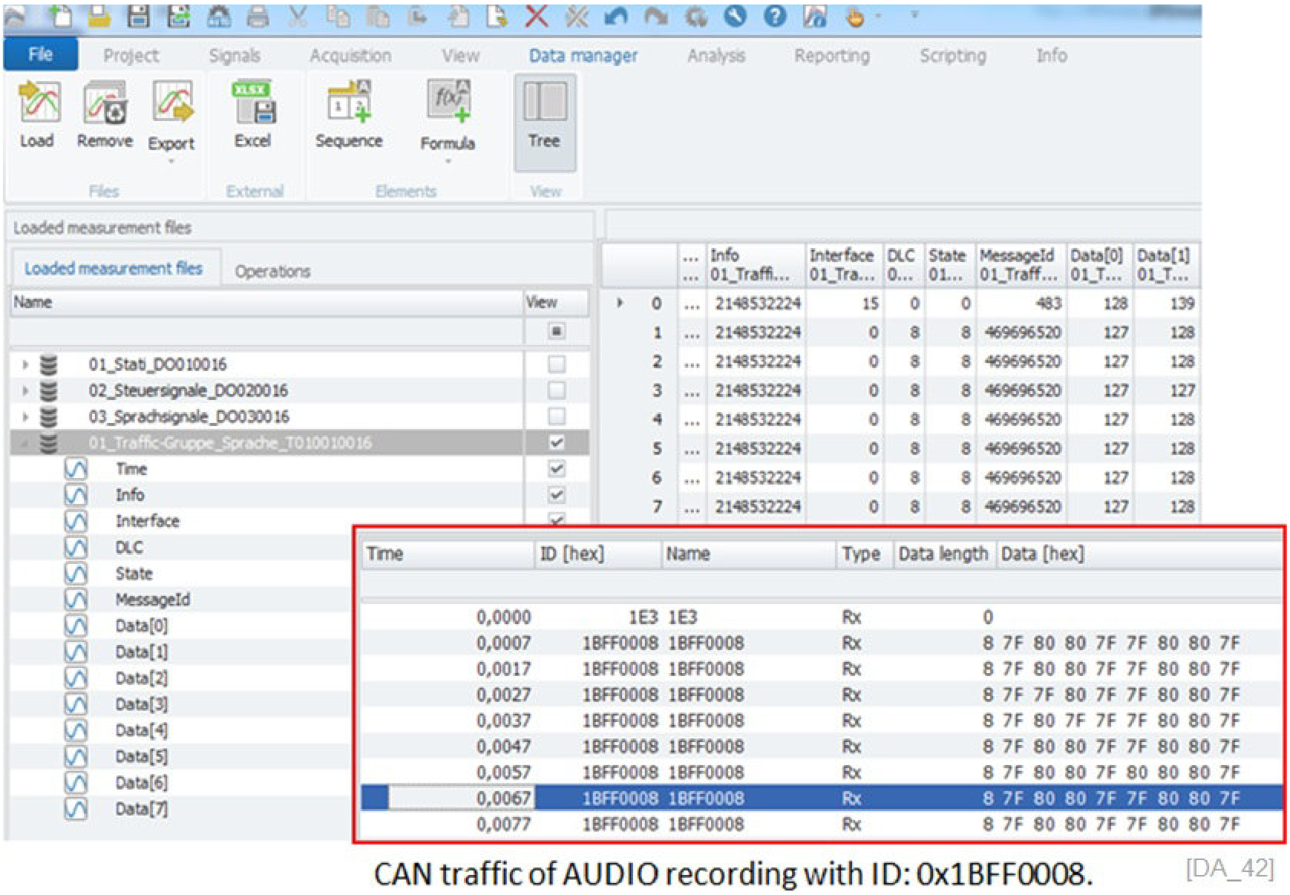
For every VIDEO channel, a separate AVI file is created. At video export, you can choose between different compression methods (CODEC). They are specified in OPTIONS >Export >VIDEO in chapter 22.8.21. The export of the video channel is the same as with the audio channel export. The new video files have a starting time stamp showing when the export was executed. There is no synchrony between the originally recorded file and the WAV file after the export.

18.7.3 PAK ASAM ATF/XML Export

This is an export for audio and sound analysis for the Müller BBM PAK software package. This export requires special attention in the settings in OPTIONS. Here you can define a damping factor which depends on the gain factor of the IPEaudio signal conditioner and the selected microphone. For more details see OPTIONS >Export >PAK ASAM ATF/XML in chapter 22.8.16. This export is licenses together with the Acoustic Module 4.2.3.

18.7.4 GIN Audio Export

Audio signals recorded from G.I.N microphones based on the CAN traffic format can be exported to WAV format to play back the audio recordings. The audio recording must be stored with an IPETRONIK data logger in the traffic file format and storage group. The audio (WAV) export is automatically considering all traffic messages starting with ID **0x1BFF0008** as audio recordings. See option 22.8.11.



[DA_42]

18.7.5 GPX export

The GPX files contain GPS position coordinate data which is required for the Map instrument to load a reference track (see chapter VIEW >Map instrument 17.27.6). The GPX export is only possible if the data file includes Longitude, Latitude and Altitude channels in the right format. To ensure that the channels have the right format you need to define a special task in the SIGNALS >Format tab sheet. For more details see chapter 11.6.4.

18.7.6 Excel export

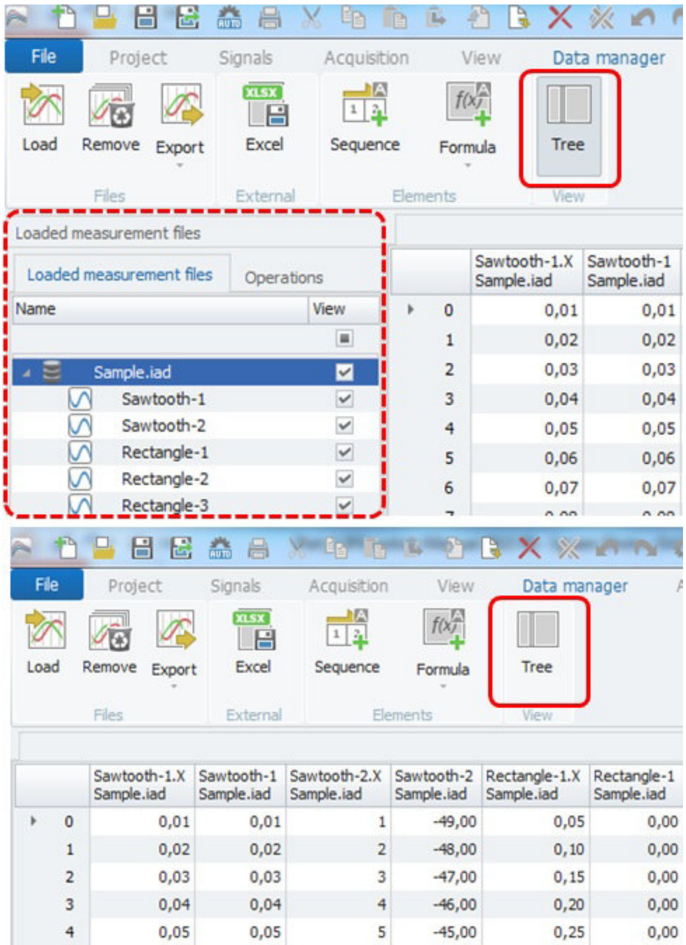
The ribbon supports a direct Excel 2010 (XLSX) export. If you execute an Excel export, the Video and Audio data records cannot be interpreted and exported by Excel.

18.8 Merging channels and data files

Merging data files is an important function. Generally, every data file is treated as a separate entity in the DATA MANAGER. However, if you have data files with common channels, merging the files can be useful. The benefit is that you only have one data group including all channels. This has a particular impact on the graphical display in the Yt- charts and on other post-processing functions. See more details in OPTIONS >DATA MANAGER in chapter 22.6.3.

18.9 Enable / disable Tree

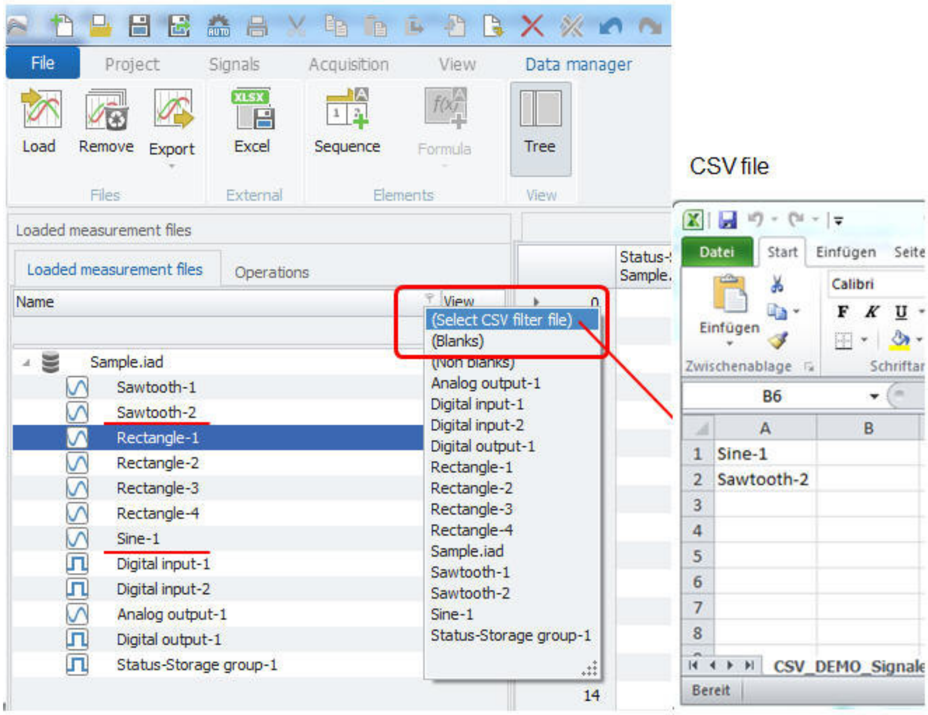
With the tree button you can hide or show the data file / channel tree.



Tree is disabled - not visible. [DA_43]

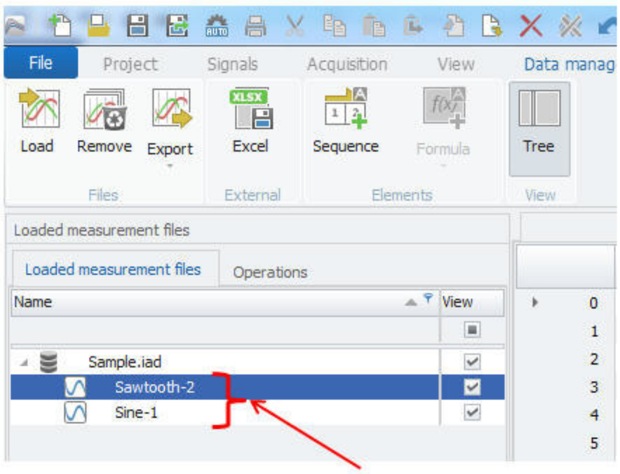
18.10 Filter functions - CSV file

In the DATA MANAGER workspace in the measurement file tab sheet a filter function is implemented. The filter is supporting also CSV reference files in order to select specific channels from large data files with many channels easily.



CSV filter for channel selection [DA_45_1]

The CSV file has to include the exact channel names you like to filter. When the file is loaded all other channels are invisible.



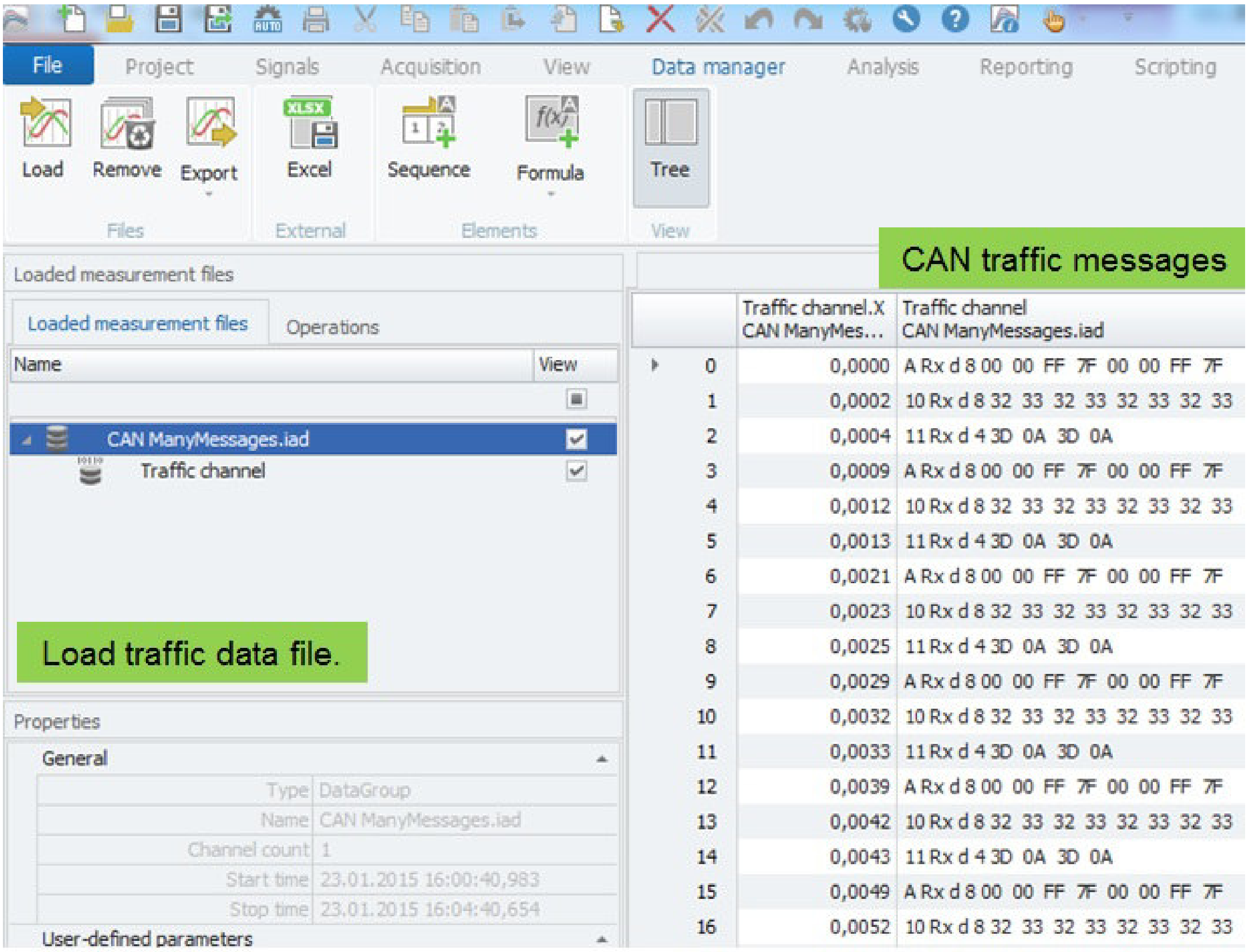
Filtered channel list according to CSV selection. [DA_45_2]

18.11 Traffic measurement

With the Protocols PlugIn you can measure CAN, CAN FD, LIN and FlexRay bus traffic. This traffic channel can be stored in the storage group. See chapter VIEW >Traffic Analyzer instrument 17.25.1 for more details how to activate the Traffic channel and to show online traffic measurements in the Traffic Analyzer instrument.

18.11.1 Loading traffic data file

Then you load your Traffic data file into the DATA MANAGER.

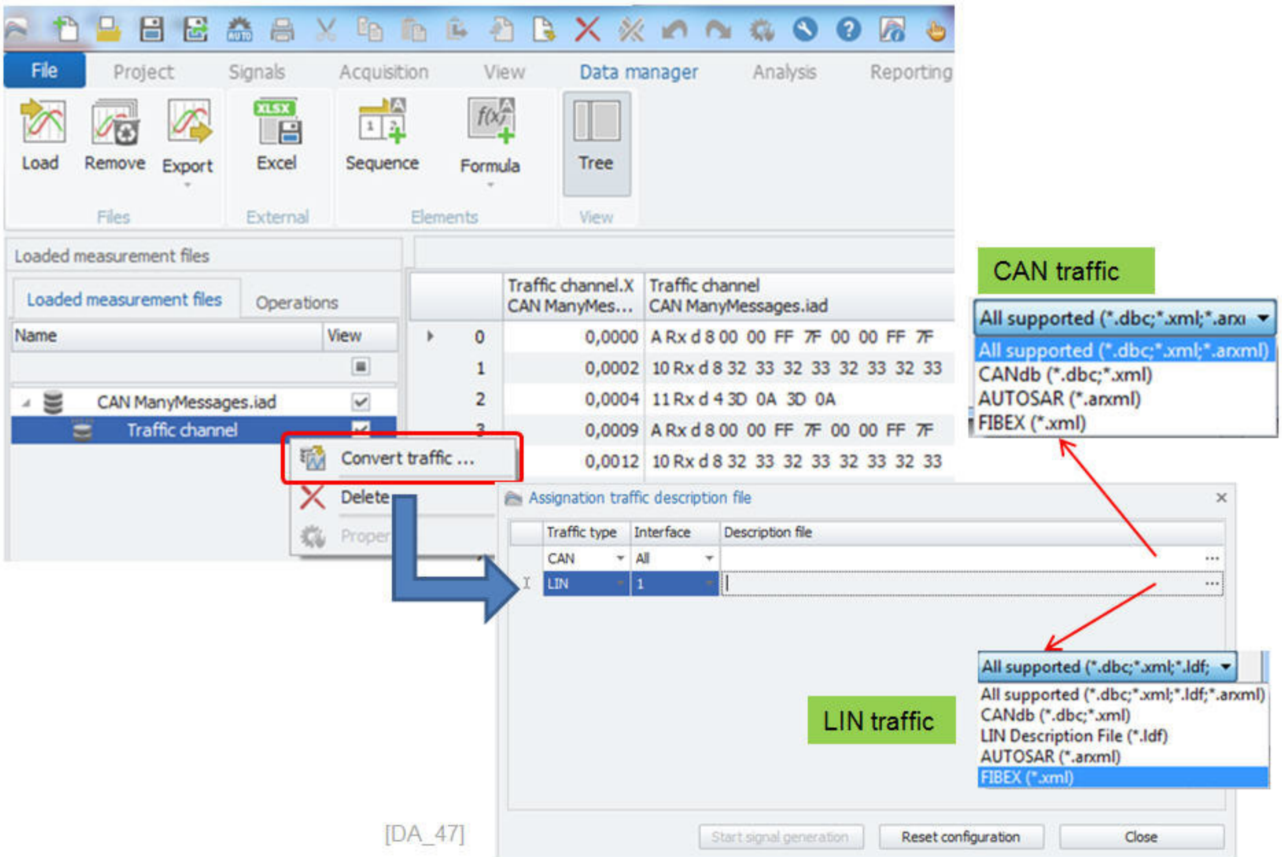


[DA_46]

18.11.2 Convert traffic back to signals

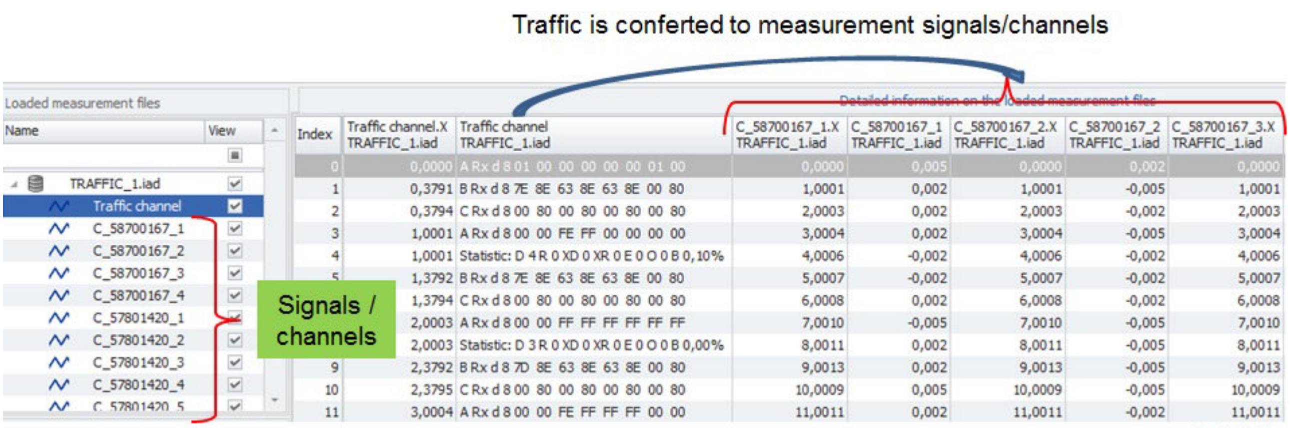
The CAN, CAN FD, LIN and FlexRay traffic recodings can be converted into signals with the following description file formats:

- dbc (DBC file format)
- xml (DBC file format)
- ldf (DBC file format)
- arxml (Autosar file format)
- xml (Fibex file format)



[DA_47]

Here you can see how the DBC / LDF file is converting the CAN message to measurement channels (names) and shows the numerical values of the measurement.



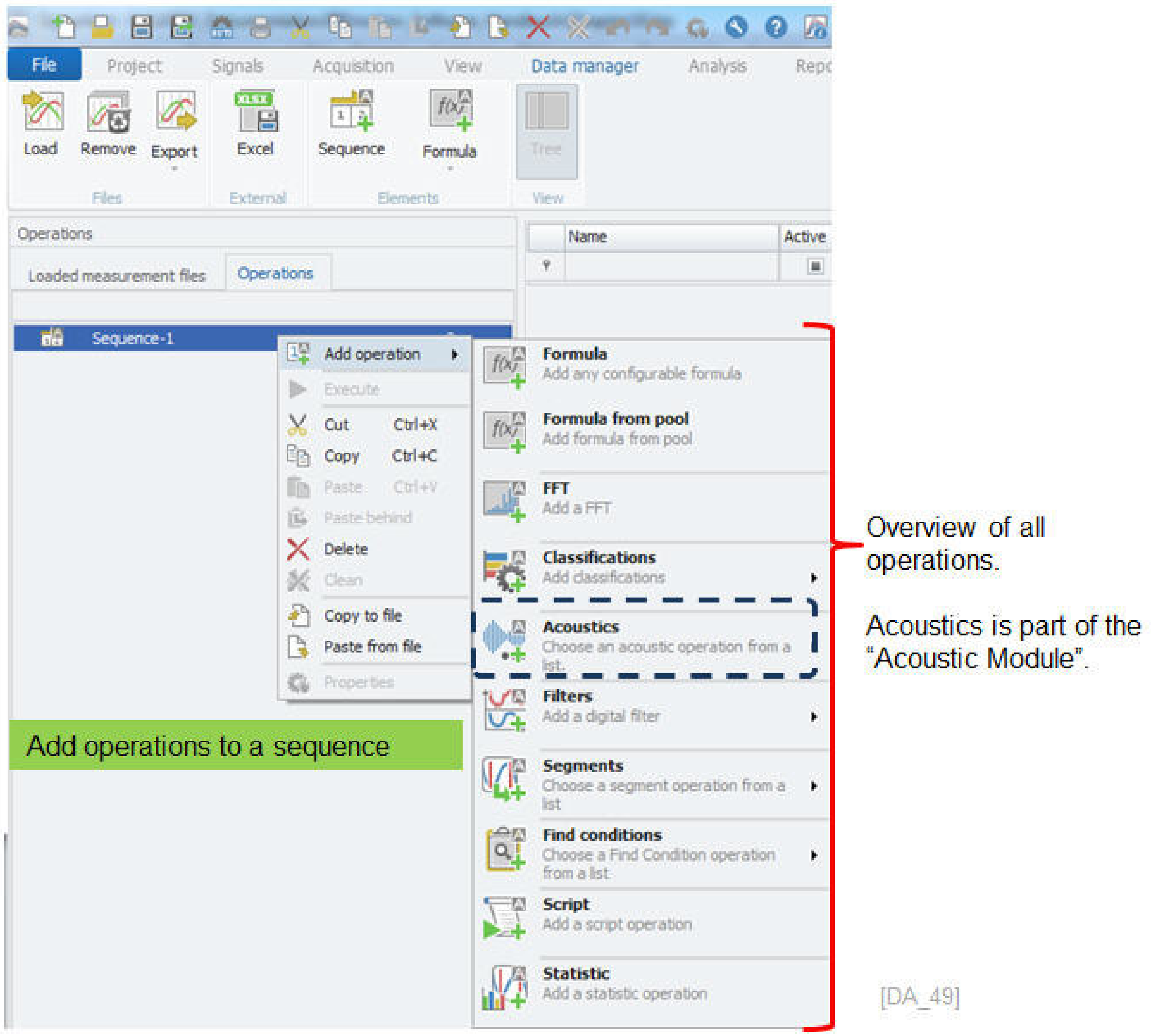
[DA_48]

18.12 Sequences for post processing

18.12.1 YouTube resources

IPEmotion - Data Post-Processing - Sequences and Operations: http://youtu.be/ISwMrUPyoA4

The offline data processing is supporting operation sequences. Within the operation sequence, you can define different operations to be applied to the channels of the original data file or to intermediate calculation results. The concept of the sequence is to process a source channel in consecutive order as defined in the sequence. You can create several sequences with different processing steps.



You can add the operations to a sequence from the ribbon or from the sequence context menu. You can create the following post processing functions which will be explained in detail below:

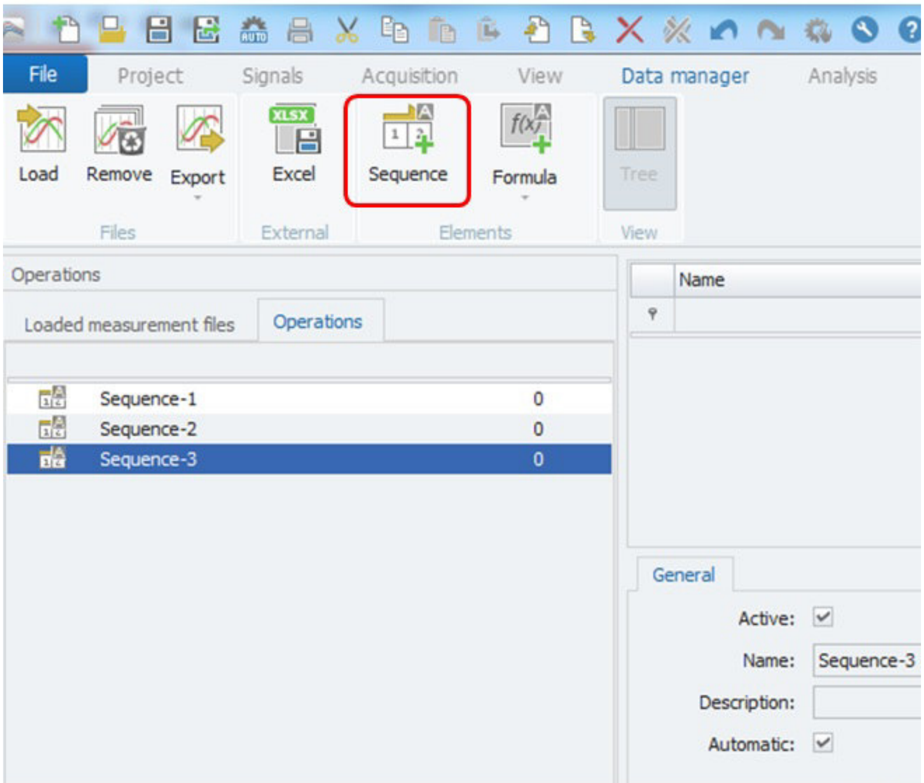
- Formulas — This includes all online math functions and operations.
- Formula from Pool — Retrieve formulas from the pool.
- FFT — Fast Fourier Transformation.
- Classification — Refers to offline classification methods

- Acoustics — This operation is only available if you have the Acoustic Module [4.2.3]. It is a special operation to calculate the Campbell diagram, Order Analysis or Overall Level 19.19.
- Filter — Low pass filter: Passes only frequencies below cut-off frequency. High pass filter: Passes only frequencies over cut-off frequency. Band pass filter: Passes only frequencies within the lower and upper cut-off frequency. Band stop filter: Passes only frequencies below the lower and over the upper cut-off frequency. Inverted band pass filter.
- Segment — This operation allows you to select a specific section of graph.
- Find conditions — This function can search for specific data points or time points
- Script — This operation will give you the ability to perform specific functions which are beyond the standard tool box.
- Statistic — This function is calculating standard statistic functions lime MIN, MAX, MEAN etc. from a selected channel.

18.12.2 Create a Sequence – General tab sheet

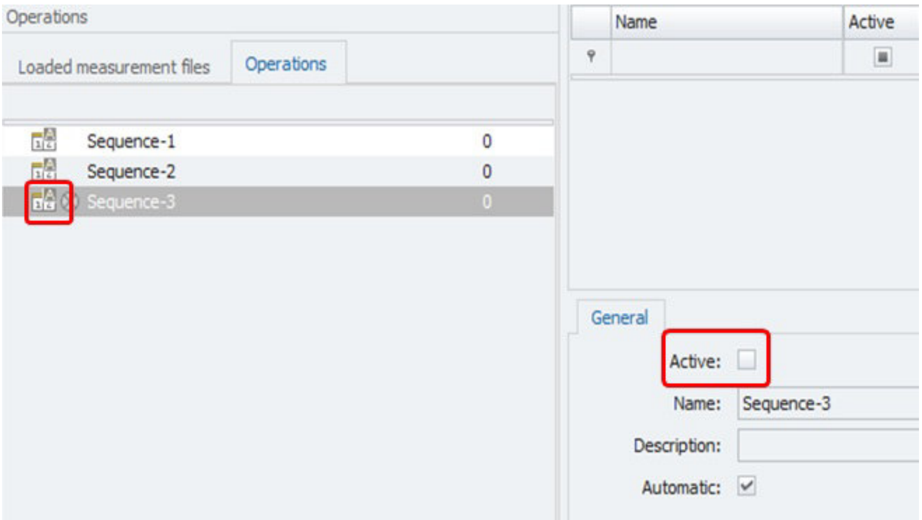
In order to execute any of the post processing function you have to create a post processing sequence.

Create sequence



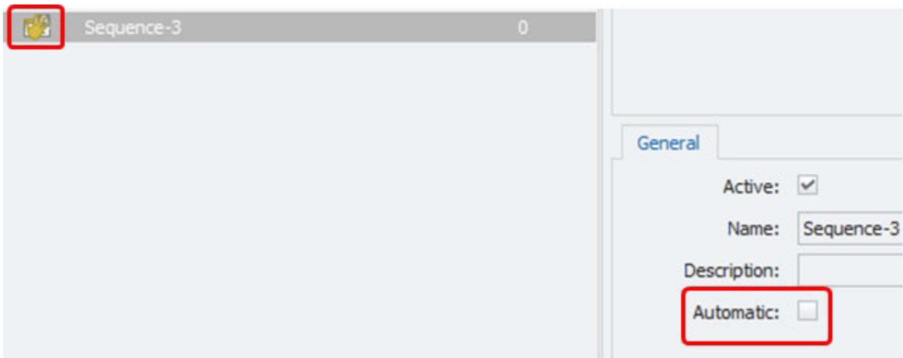
[DA_50]

- **Active** — Activating the sequence. This indicated in the tree list.



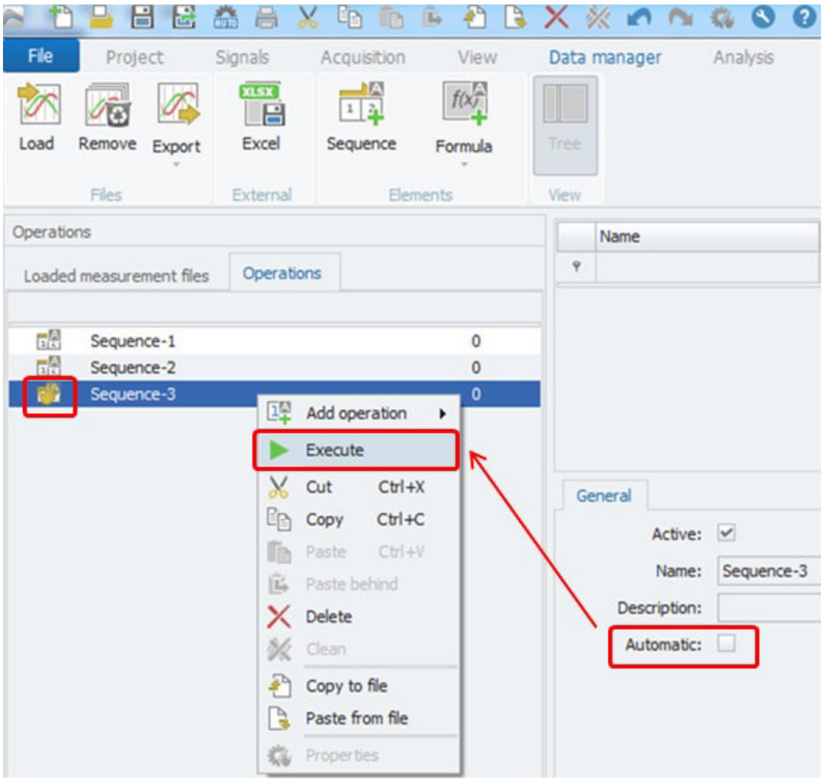
Deactivated Sequences [DA_51]

- **Name** — Define a name for the sequence
- **Description** — Add a more detailed description to the sequence
- **Automatic** — With the automatic check box you control the execution of the sequence. By default the sequence has an automatic execute. When you load a data file or you create a new processing function it is directly executed.



Automatic function disabled. [DA_52]

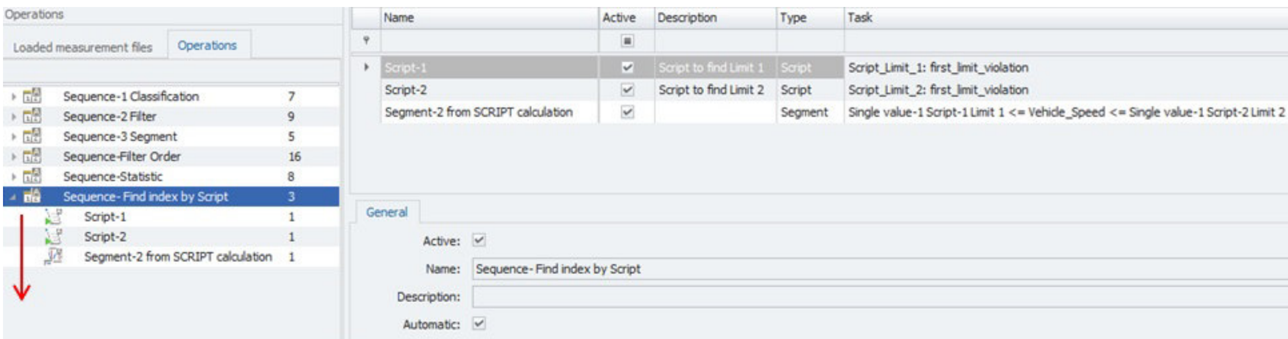
- ► Execute manually — When you deactivate the Automatic check box, you can execute the sequence manually from the context menu. A dedicated icon is indicating when a sequence is in the manual operation mode.



When the automatic mode (default) is deactivated you can trigger a sequence operation from the context menu. [DA_53]

18.12.3 Impact of the order of operations

Another important aspect is the right order within one sequence. The operations inside a sequence are processed in the same order as they are listed. In this example first operation Script 1 then operation Script 2 and finally the segment operation is executed.



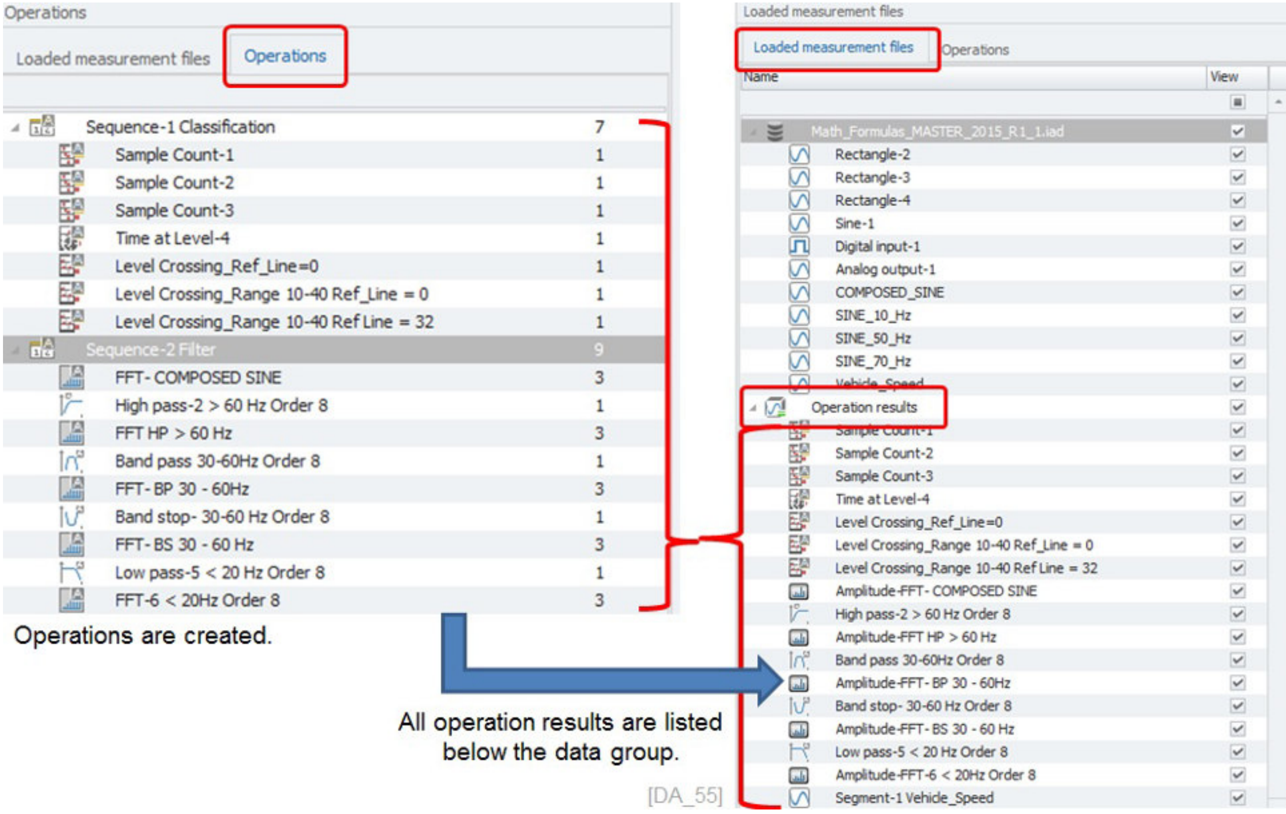
Important: Consider the right processing oder of operations.
Ouputs which serve as inputs for other operations have to be calculated first. [DA_54]

Information

If you would like to use the result of one operation as an input to another operation you need to accommodate both functions in the same sequence. You cannot jump between sequences and use operation a of sequence A as an input for operation in sequence B.

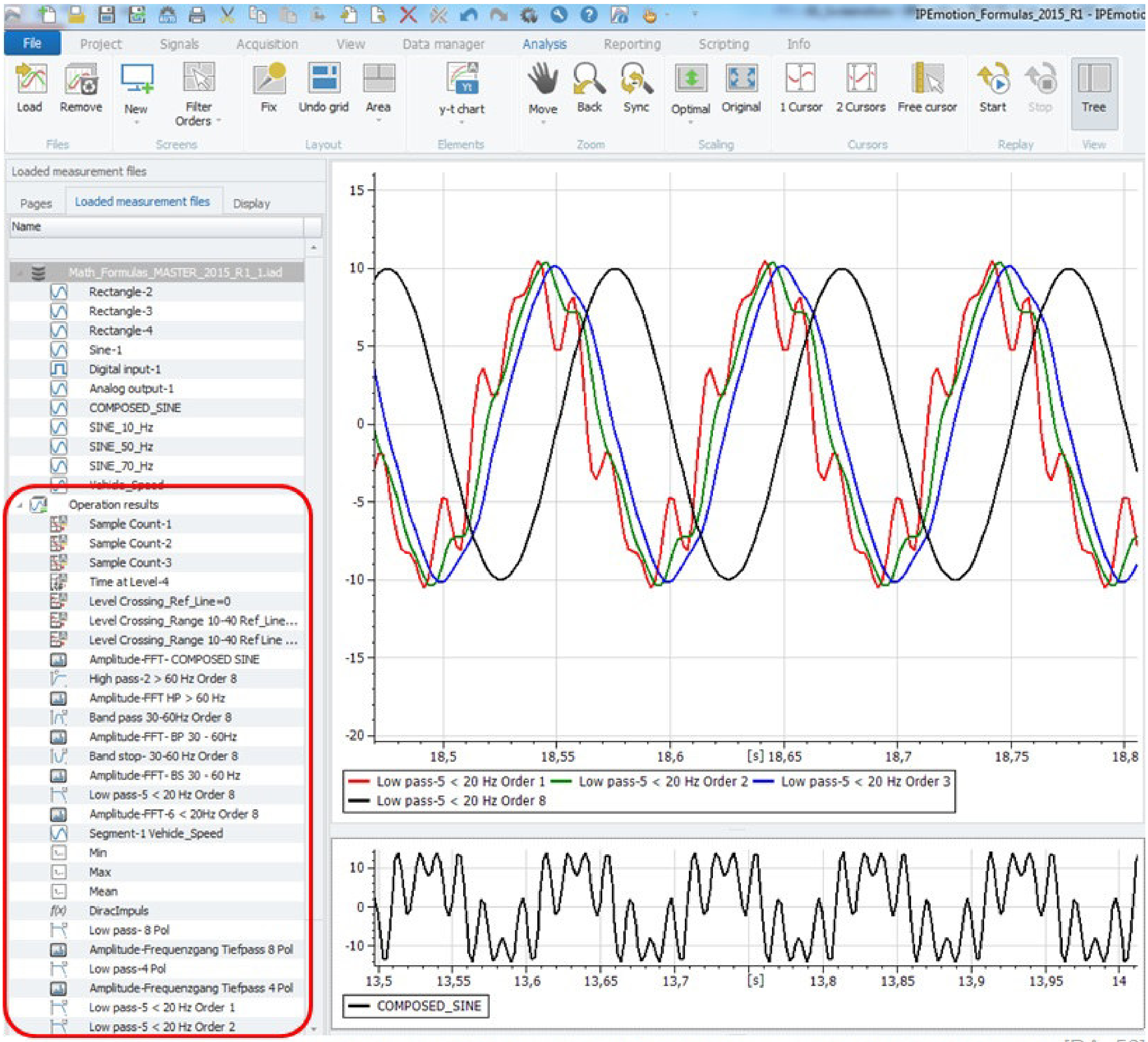
18.12.4 Operation results for analysis and data export

If you create operations, they will be visible and displayed at the end of the channel tree.



[DA_55]

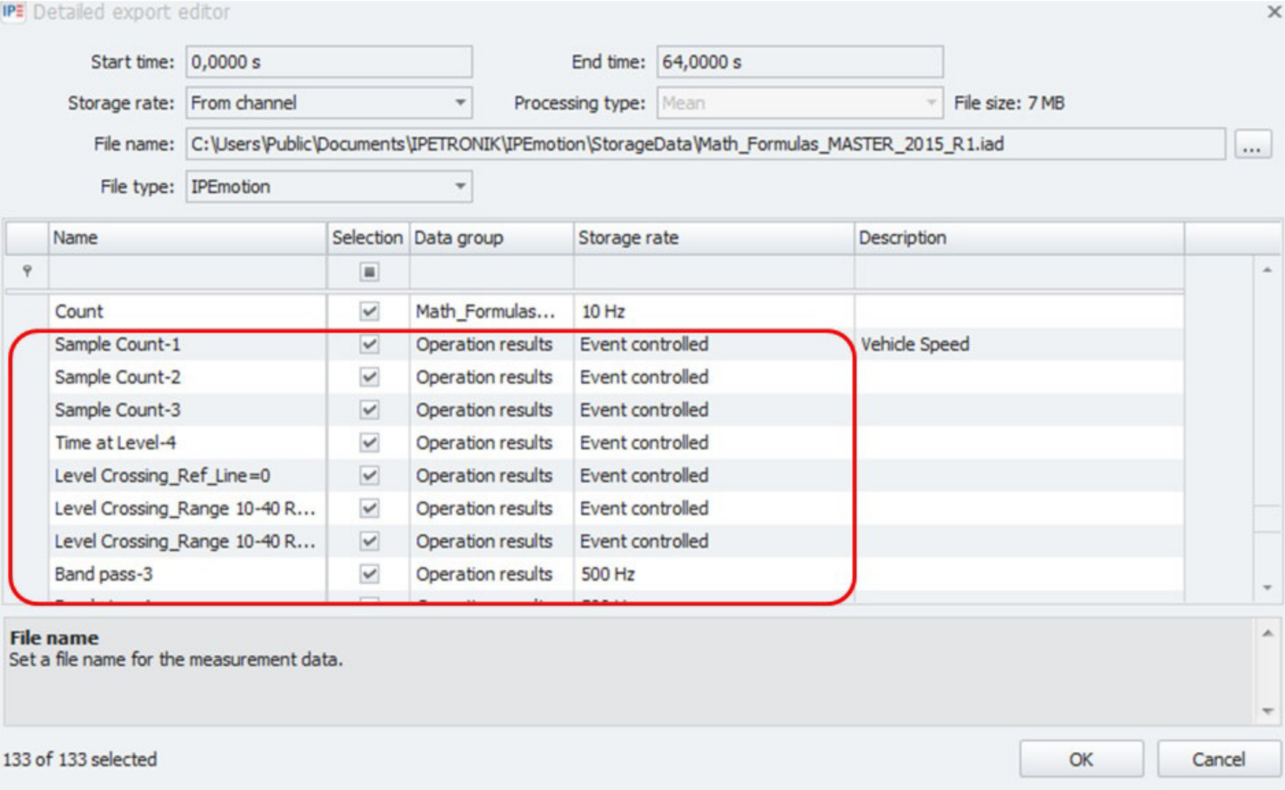
All operation result channels can be linked to diagrams in the ANALYSIS work space.



All operation result channels are available as inputs for other operations or to display in instruments in ANALYSIS.

[DA_56]

All operation results represented as channels in the data pool can be exported into a new data file. When you export the calculations into a new data file the results are saved.

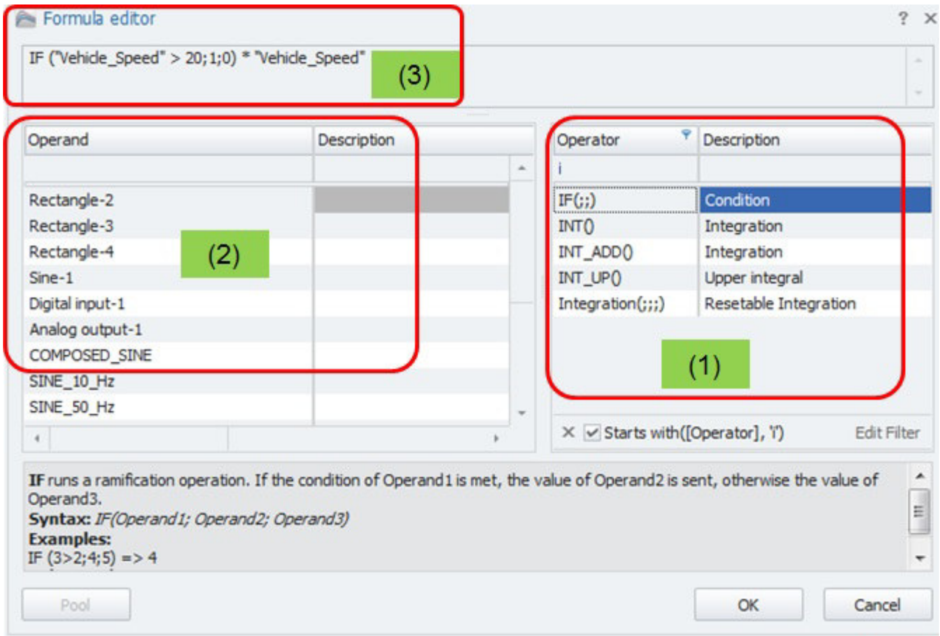


All operations with their results can be exported together with the original channels to a new data file. [DA_57]

18.13 Formula

18.13.1 YouTube resources

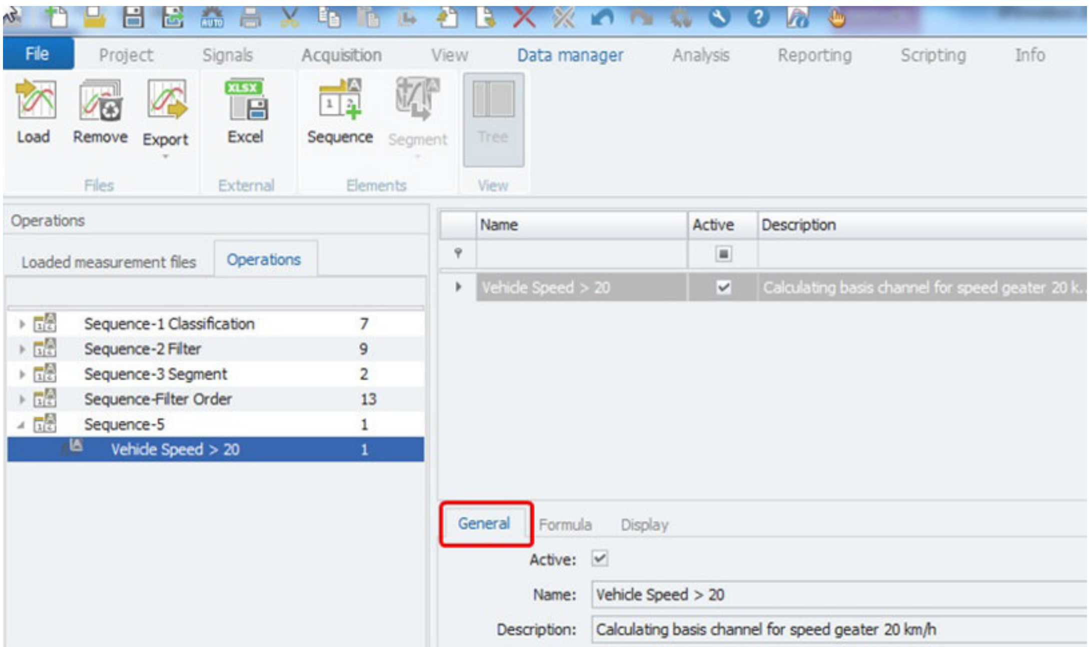
IPEmotion - Data Post-Processing – Formula: http://youtu.be/2Eu0fyE-pIs
The offline formulas can be applied to the data file for post processing calculations.



Create your formula. [DA_58]

- Operator (1): This list provides an overview of the supported math and logic functions.
- Operator (2): List of all channels loaded from the data file. Including post processing result channels too.
- Calculation instruction (3): Overview of the specific calculation instruction. You can directly edit the formula in this text field.

18.13.2 General – tab sheet

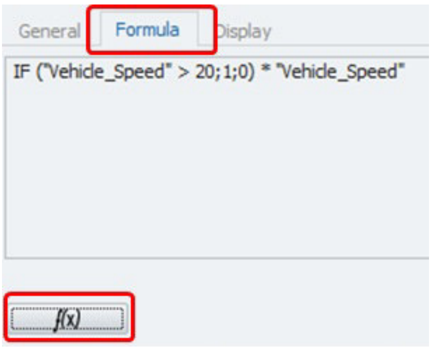


[DA_59]

- ► Active — With this check box you can enable the formula and run the calculation.
- ► Name — The default name after creating is "Formula-X" having an incrementing index.
- ► Description — To define a supplementary description of the formula.

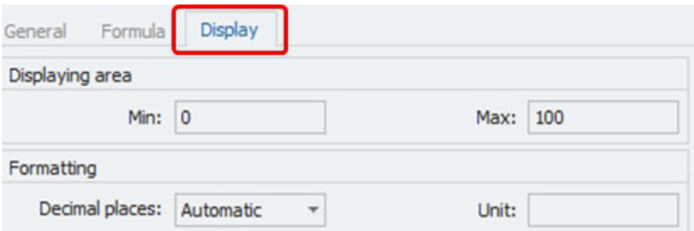
18.13.3 Formula – tab sheet

In this tab sheet you define the syntax of the formula operation.



Calculation instruction > Access to the formula editor. [DA_60]

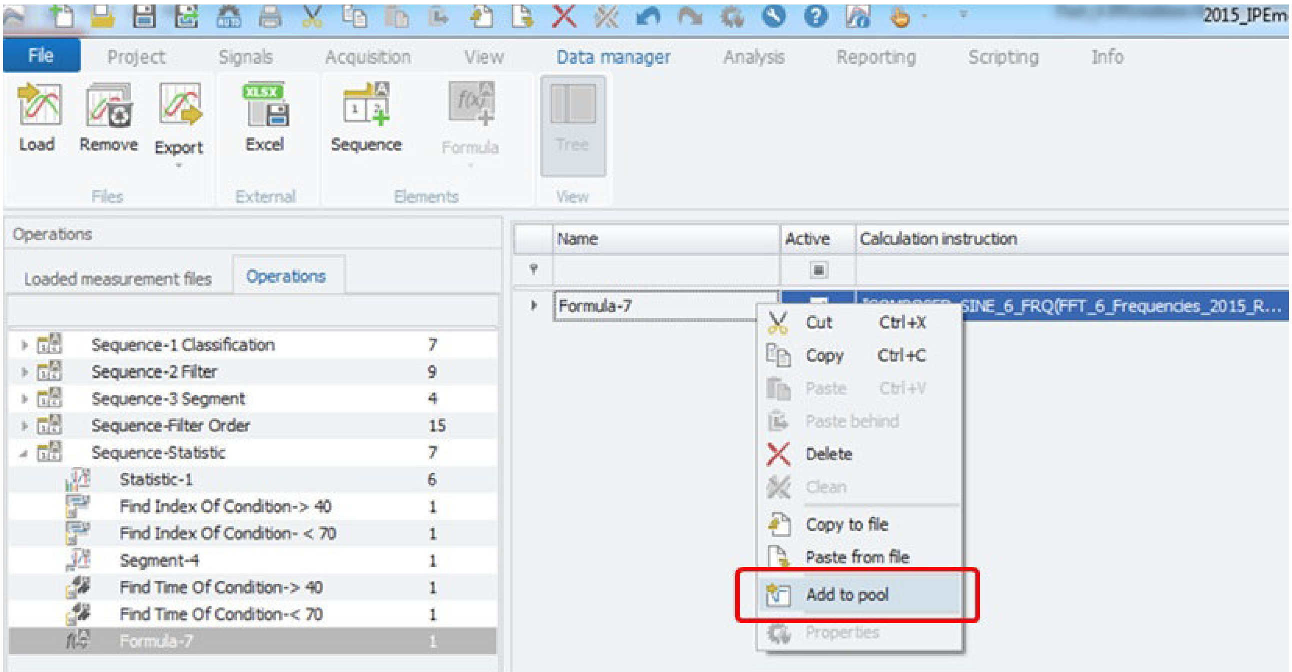
18.13.4 Display – tab sheet



[DA_61]

- ► Display area — Covers the default setting of the Y-axis in the Yt- and XY-chart.
- ► Formatting — Covers the number of decimal places in numerical instruments.

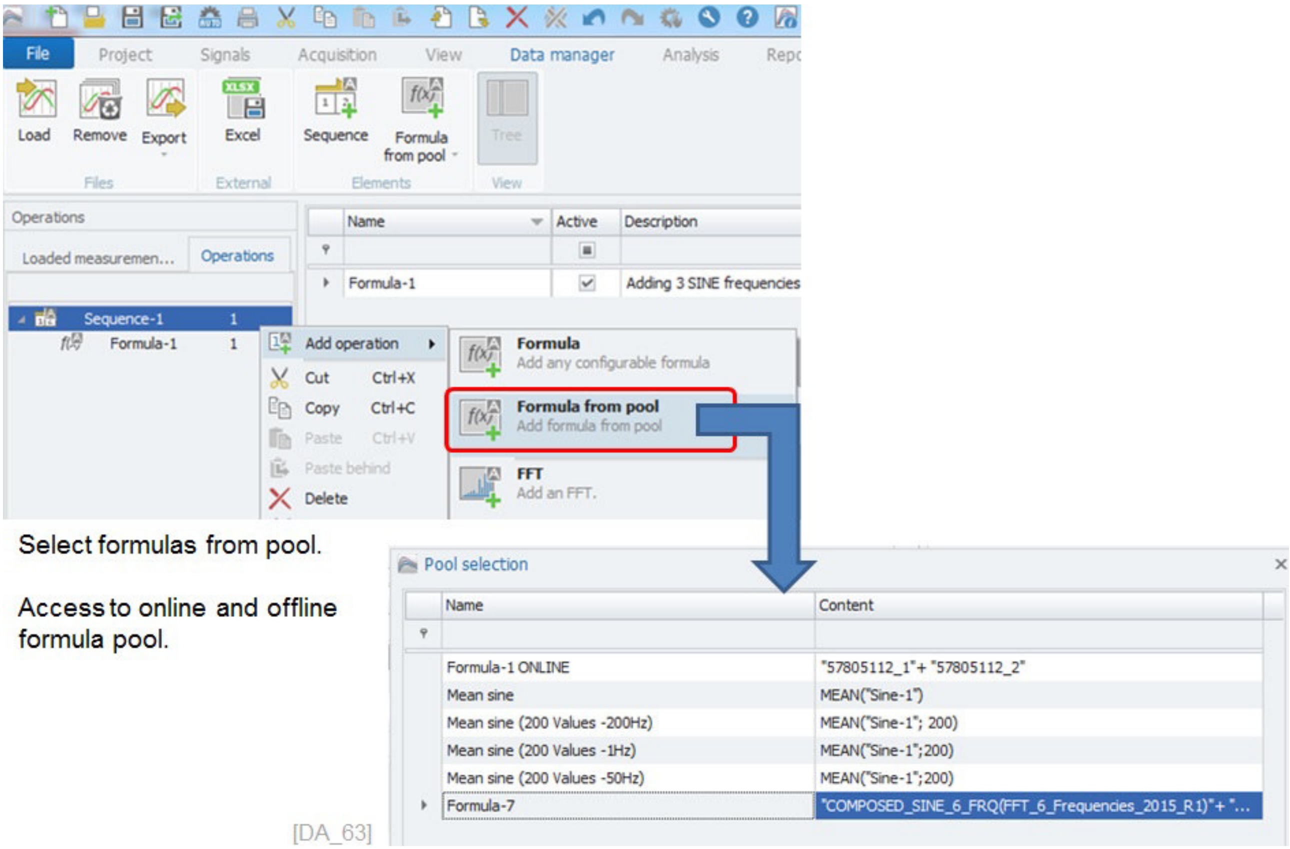
Add the offline formula to the overall formula pool to save the formula for future use.



Add formula to pool. [DA_62]

18.13.5 Formula from pool

You can use online formulas from the ACQUISITION work space and offline formulas you created in DATA MANAGER. See chapter for online formulas 13.2.2.

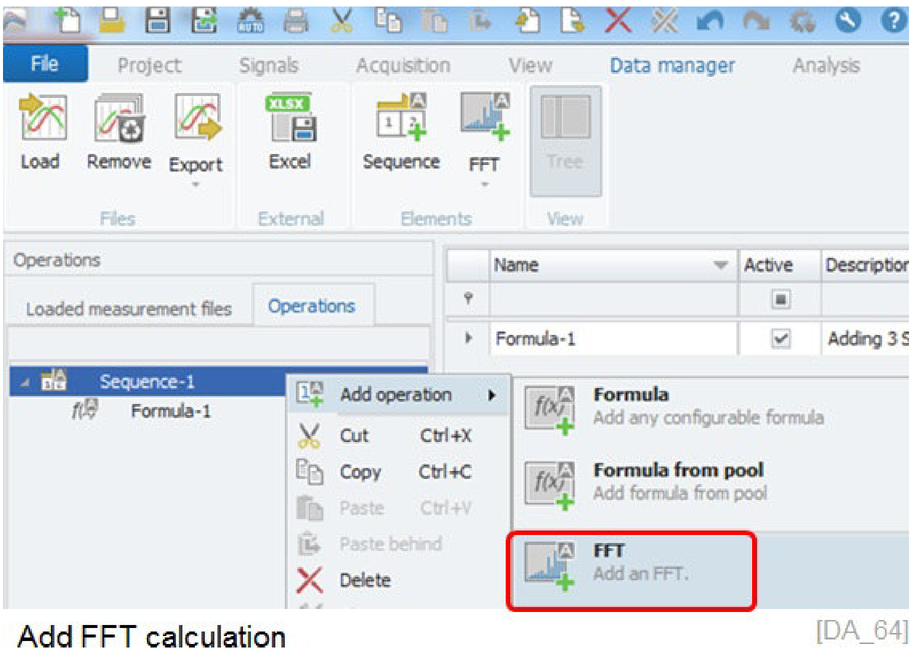


[DA_63]

18.14 FFT

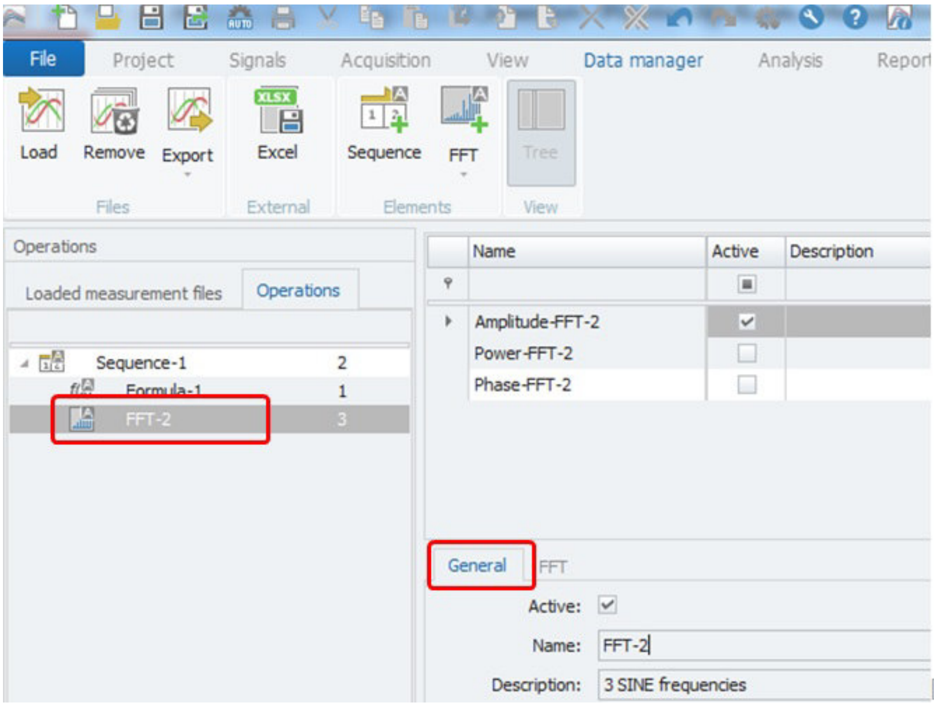
18.14.1 YouTube resources

IPEmotion - Data Post-Processing - FFT Analysis: http://youtube/5Xv47A-gv-U
The FFT (Fast Fourier Transformation) can be calculated in the post processing operations.



[DA_64]

18.14.2 General – tab sheet

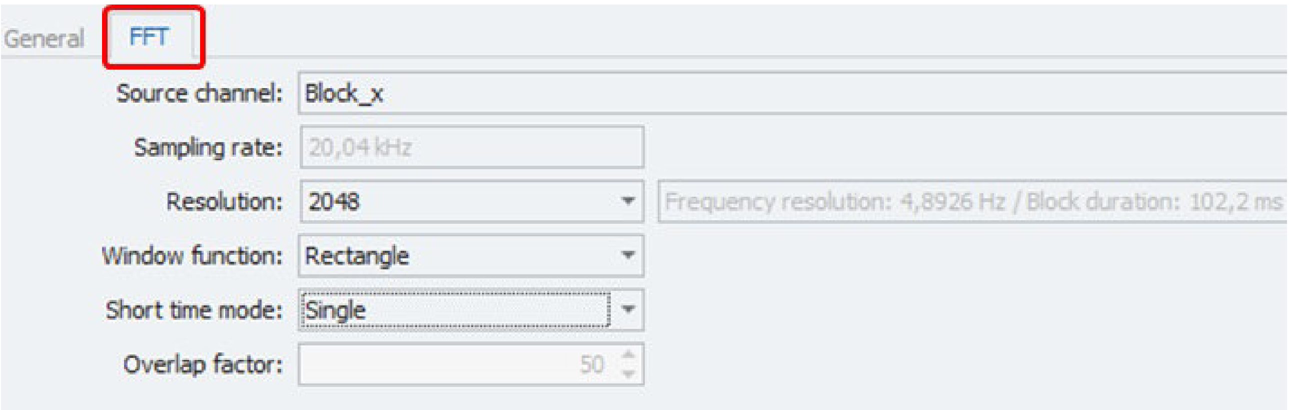


[DA_65]

- ► Active — With this checkbox you activate / deactivate the FFT calculation.
- ► Name — Refers to the name of the FFT.
- ► Description — Here you can add an additional description to the FFT.

18.14.3 FFT – tab sheet

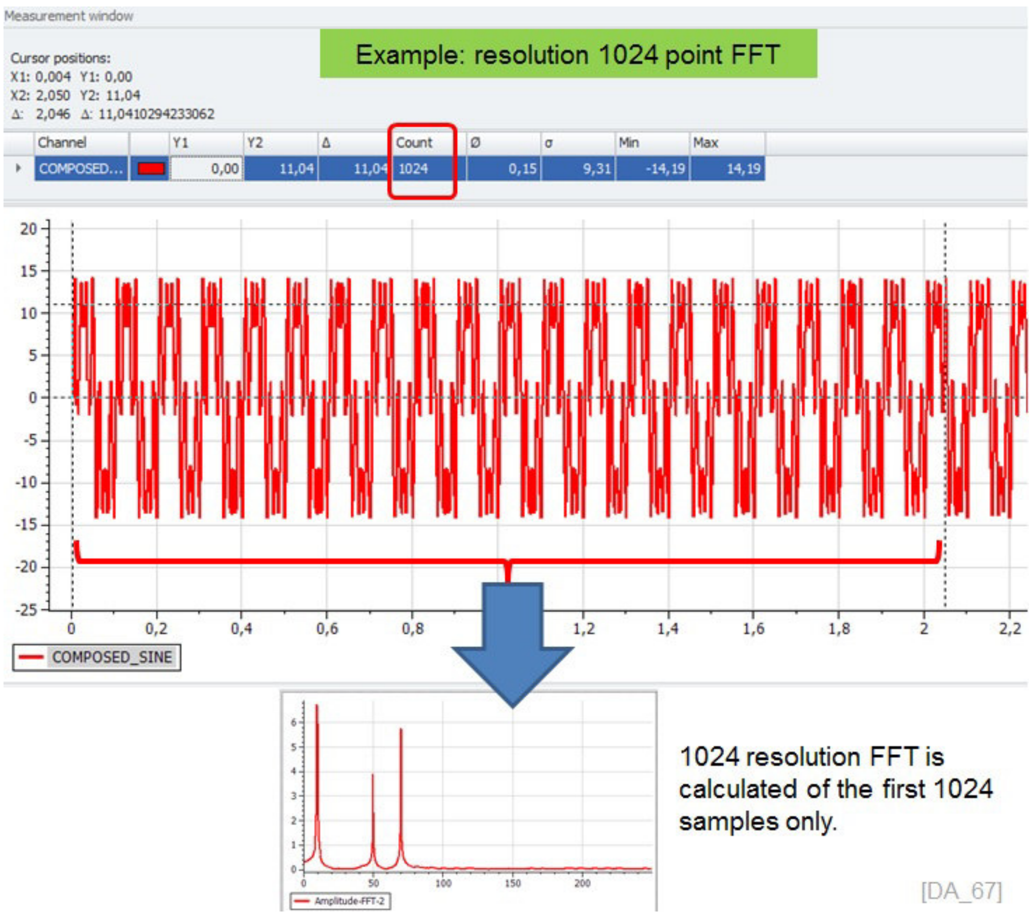
In this tab sheet you define the FFT calculation parameters for the source channel.



[DA_66]

- **Source channel** — This is the signal channel which is subjected to the FFT calculation.
- **Sample rate** — Indicating the sample rate of the selected source channel.
- **Resolution** — The resolution is related to the number of taken samples to calculate the FFT. The resolution or number of samples subjected to an FFT calculation is a drop down list. Based on the selected resolution the corresponding frequency and block duration is calculated:,Block duration = Resolution / Sample Rate Frequency Resolution = (Sample rate / 2) / Resolution
- **Window function** — The window function is particularly important if only very few periods of signals are included in the calculation and the trigger point of the signal recording gets an important impact on the computed result. The following window functions are supported: Rectangle, Hanning, Hamming, Backman, Bartlett.
- **Short time mode** — Single: the FFT is only calculated from the first block of data. The following screenshot is an example for a 1024 point resolution FFT. Average: In this case the resulting FFTs is an arithmetic average from all FFTs calculated over the complete data file. For the average FFT calculation the overlap factor is an important setting too.
- **Overlap factor** — If this check box is activated, the FFT is calculated from all data included in the data file. With factor (%) you can define the overlap of the FFT calculation. 0% = no overlap

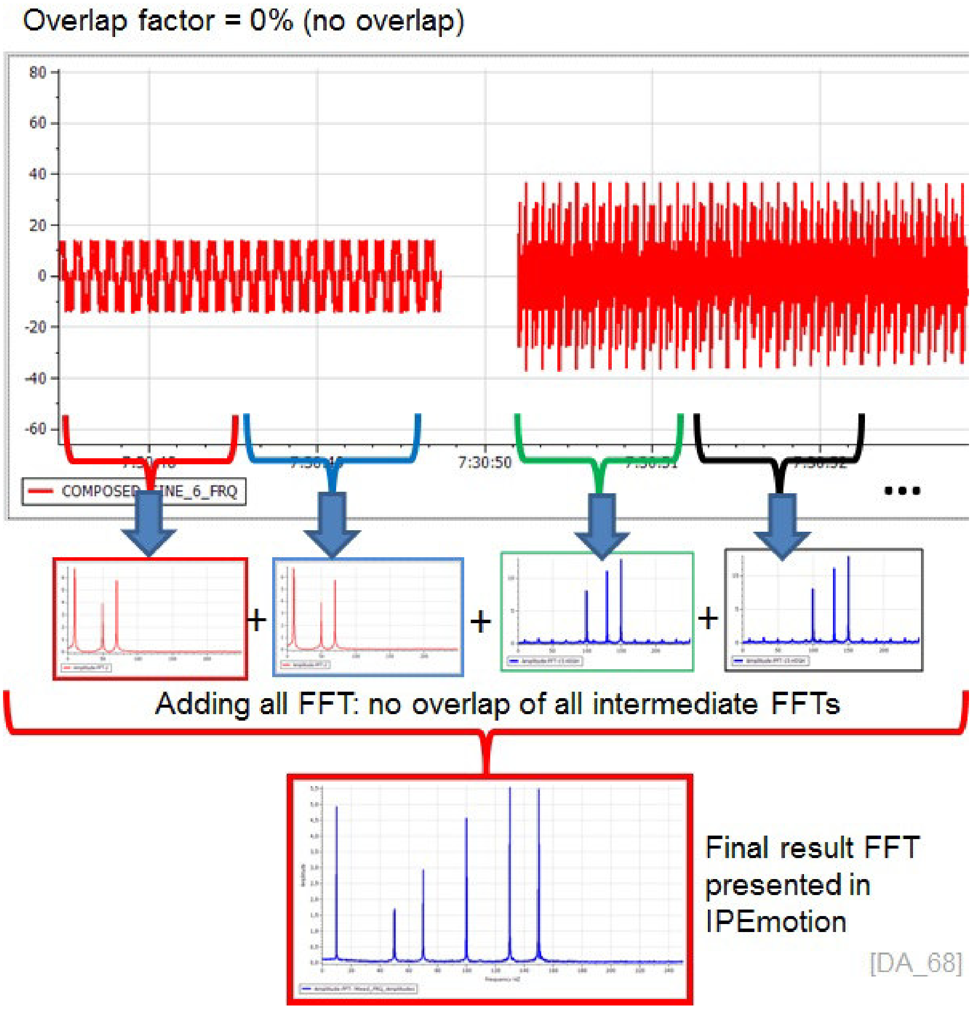
Example: Short time mode: Single



[DA_67]

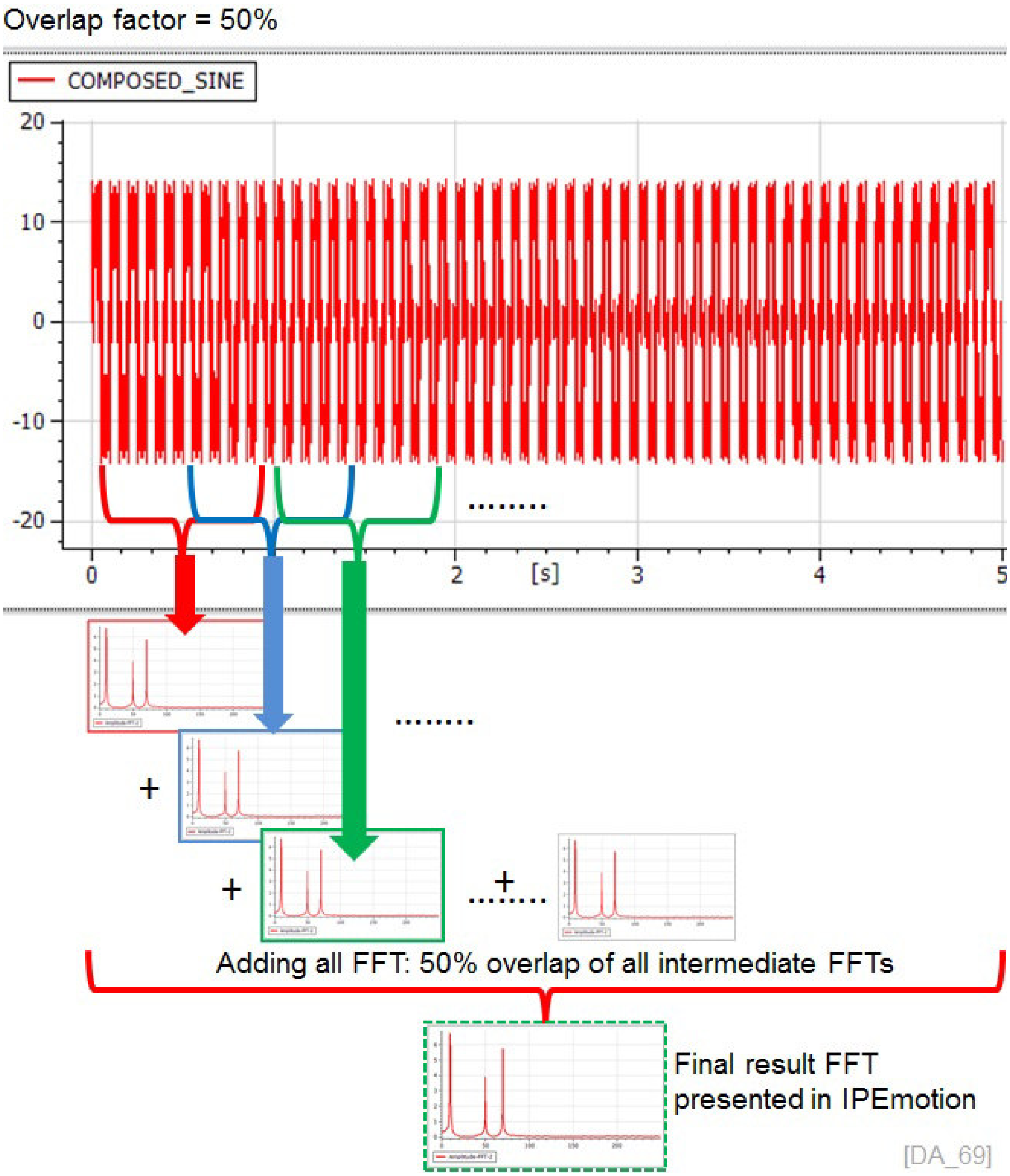
Information *All other data points of the measurement file are not included in the FFT calculation.*

Example: Short time mode: Average: 0% overlap
Using this setting, the FFT is calculated from data blocks in the size of the resolution with no overlap. In this example, the block size is 1024 samples.



[DA_68]

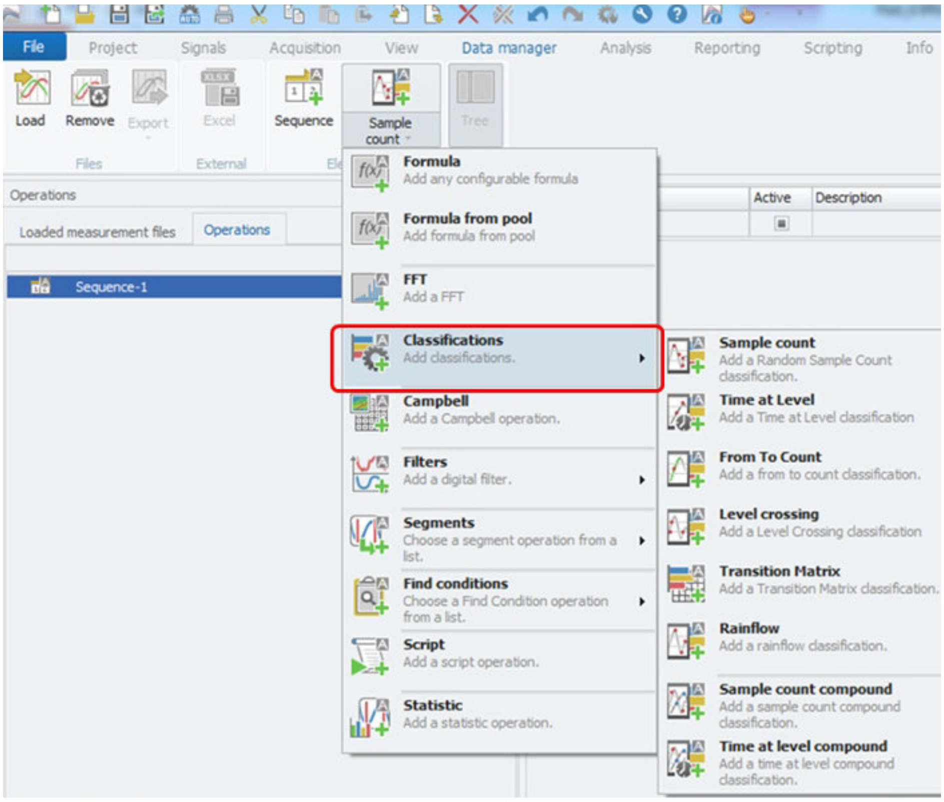
Example: Short time mode: Average: 50% overlap
With this setting the FFT is calculated from data blocks in the size of the resolution with 50% overlap. Every FFT is including 50% of the data points from the previous data block.



[DA_69]

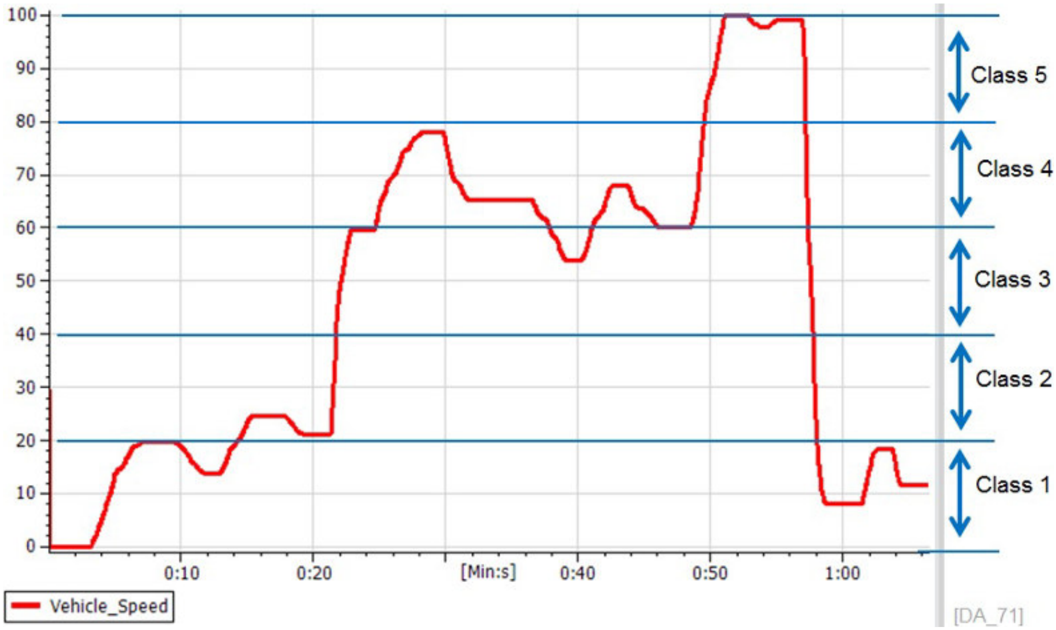
18.15 Introduction to classification

In the post processing sequence you can also include classifications. Eight different classification methods are supported.



Create classifications [DA_70]

The classification is calculating different statistical values from the source signal by grouping the data (samples) according to the criteria. Each classification method will be explained with an example using the same source signal as indicated below.



[DA_71]

The results of the classification calculation can be presented in a histogram instrument 19.6 in the ANALYSIS workspace. The result of 2D classifications is presented in the classification table 19.7 or in the classification grid 19.8.

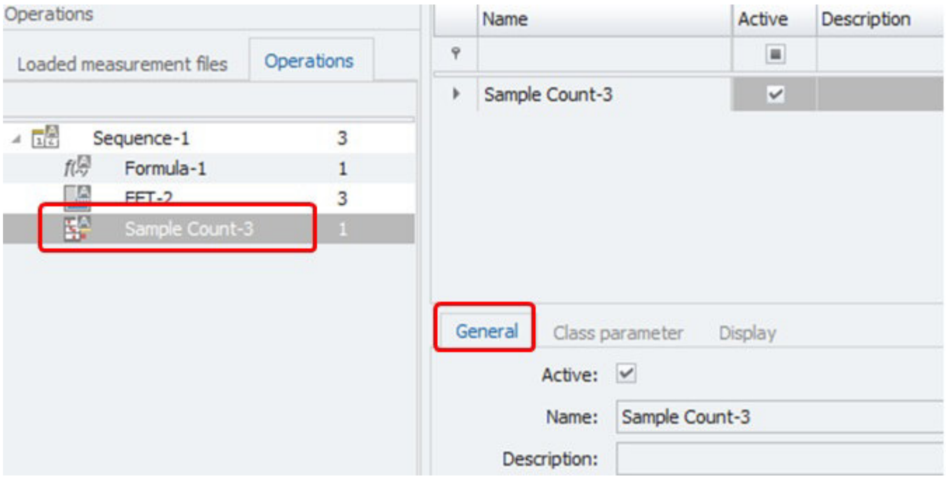
18.16 Sample count classification

The sample count classification is counting the number of samples (measurements) of each class.

18.16.1 YouTube resources

IPEmotion – Post-Processing – Sample Count Classification: http://youtu.be/6y0z9jX2Ct8

18.16.2 General – tab sheet

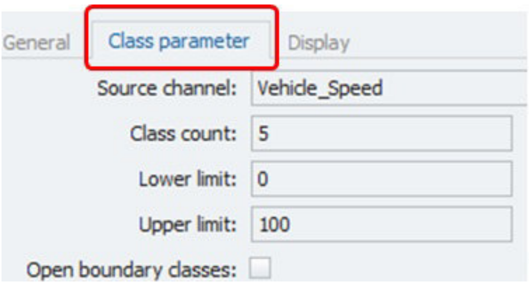


[DA_72]

- ► Active This checkbox activates / deactivates the classification calculation.
- ► Name Refers to the name of the classification.
- ► Description Here you can add an additional description to the classification.

18.16.3 Class parameter – tab sheet

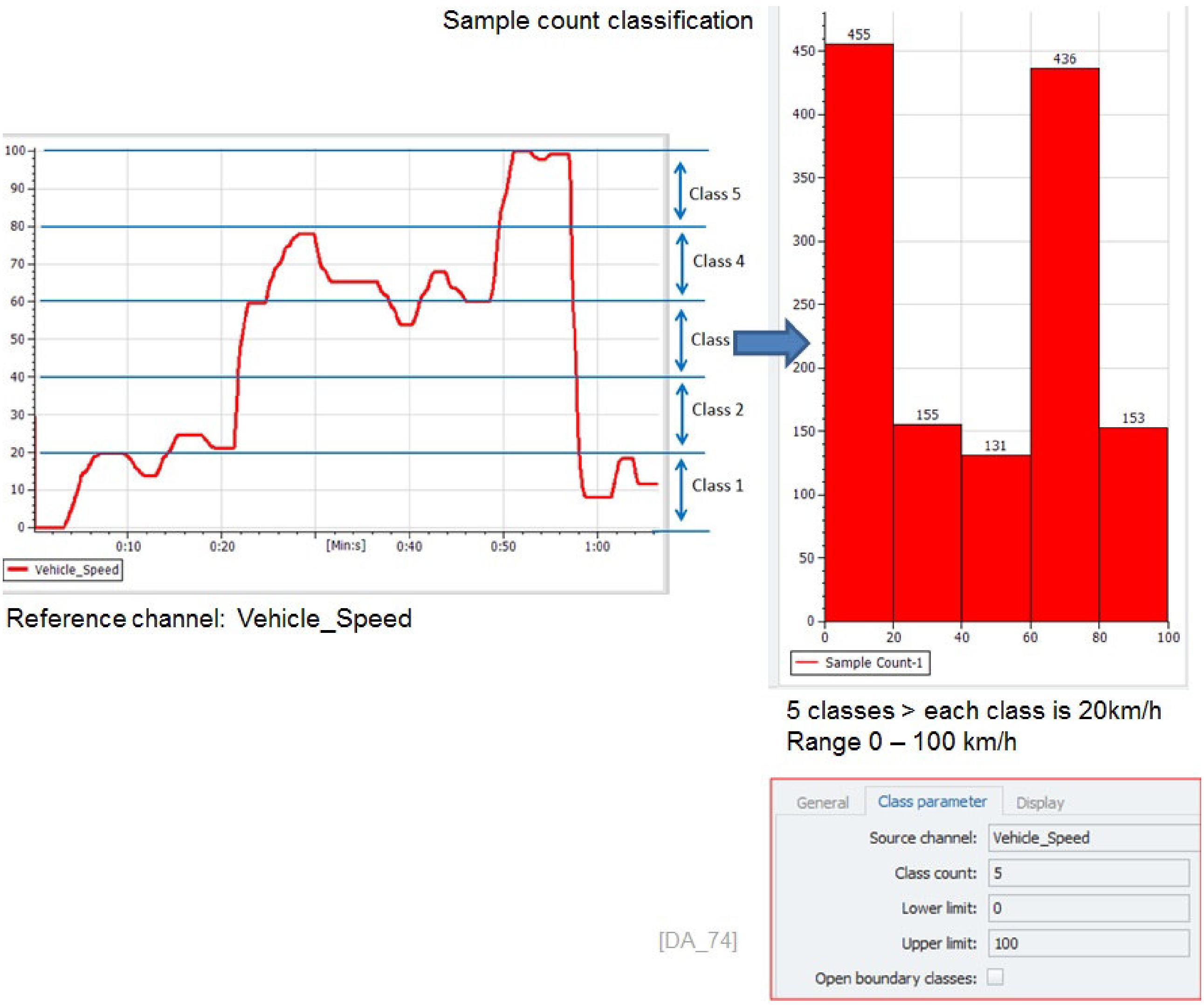
In this tab sheet you define the setting for the classification calculation.



[DA_73]

► Source channel	Select the source channel to calculate the classification.
► Class count	Class count defines in how many classes you will divide the range of your lower and upper limit. The classes are divided in equidistant sizes.
► Lower limit	Is the starting point of your classification considering the smallest measurements you like to include in your classification.
► Upper limit	Refers to the highest measurements you like to include for the calculation.
► Open boundary	Here you can define how to deal with the data outside the lower and upper limits. If the checkbox is activated the data is included in the adjacent upper and lower classes.

Example: Sample Count Classification (standard settings)
The source channel “Vehicle_Speed” is ranging from 0 to 100 km/h and all measurements (samples) are included in the calculation of the sample count classification as the upper and lower limit ranging from 0 to 100 km/h.



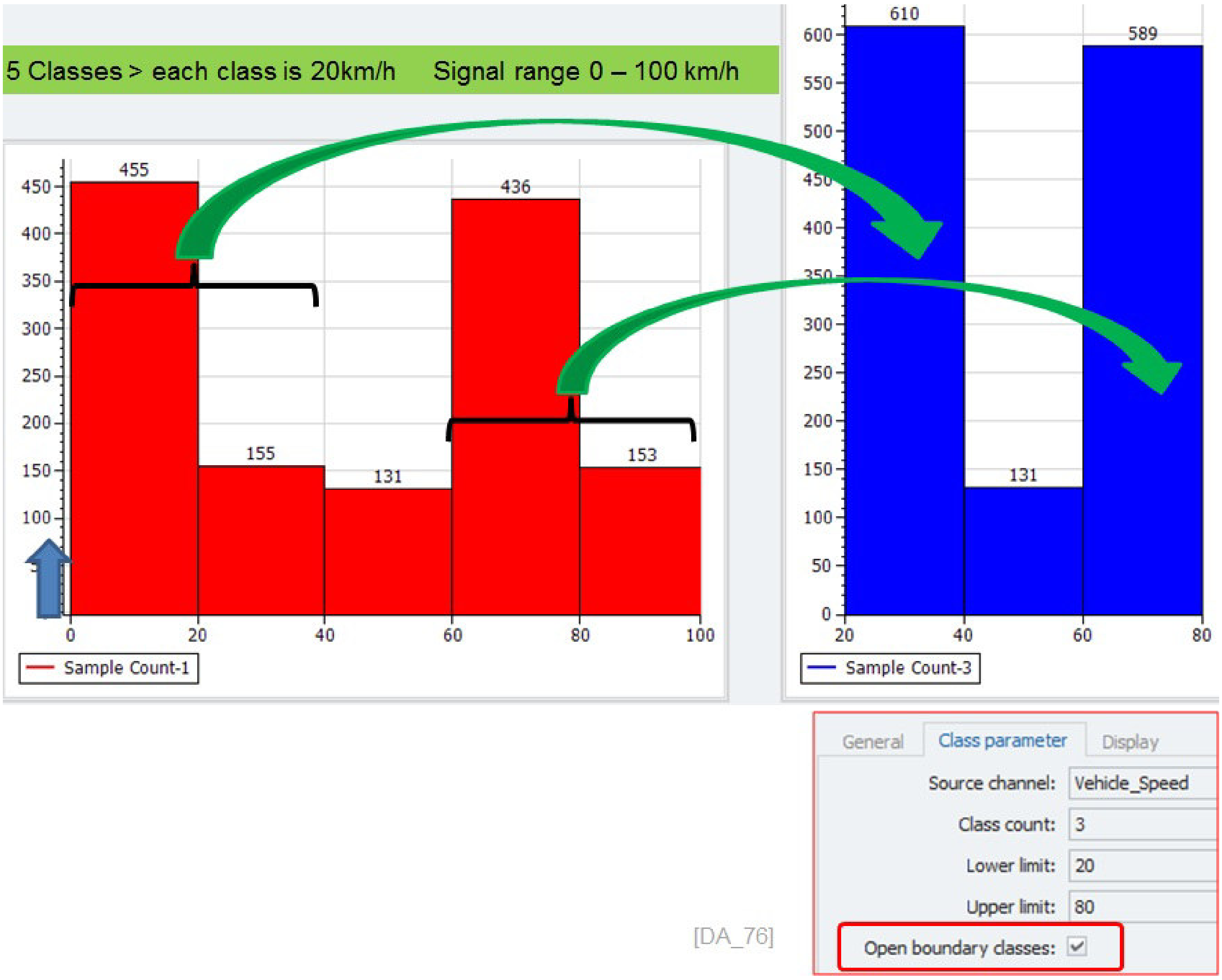
[DA_74]

Example: Sample Count Classification (impact of upper and lower limit)
In this example you will see how the upper and lower limit have an impact on the classification calculation. If you narrow down the measurement range e.g. from 20 – 80 km/h sample outside, the limits are not included in the statistic calculation as the screenshot below is indicating.

[DA_75]

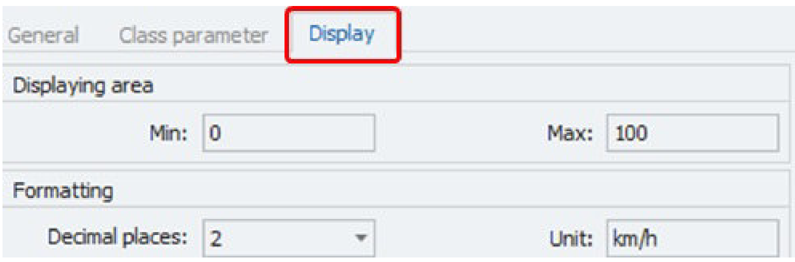
Example: Sample Count Classification (impact of open boundary checkbox)
In this example you will see the impact of the open boundary check box. If you activate the open boundary checkbox, the measurements outside the lower and upper limit will be included in the classes next to the lower and upper boundary class. In the example below the calculations are:

- Lower limit including open boundary: $455 + 155 = 610$
- Upper limit including open boundary: $153 + 436 = 589$



[DA_76]

18.16.4 Display – tab sheet



[DA_77]

► Display area	Defines the default range for Y axis scaling when channel is added to an instrument like Yt, XY, or histogram.
► Formatting	Defines the number of decimal places when value measurements are indicated.
► Unit	Refers to the unit of the classification. Note: The unit cannot be displayed in the instrument nor in the calculation grid.

18.17 Time at level classification

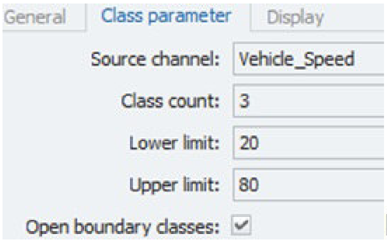
This classification statistic is counting the time in seconds [s] for how long a signal stays in a given class.

18.17.1 General – tab sheet

See section sample count classification 18.16.2.

18.17.2 Class parameter – tab sheet

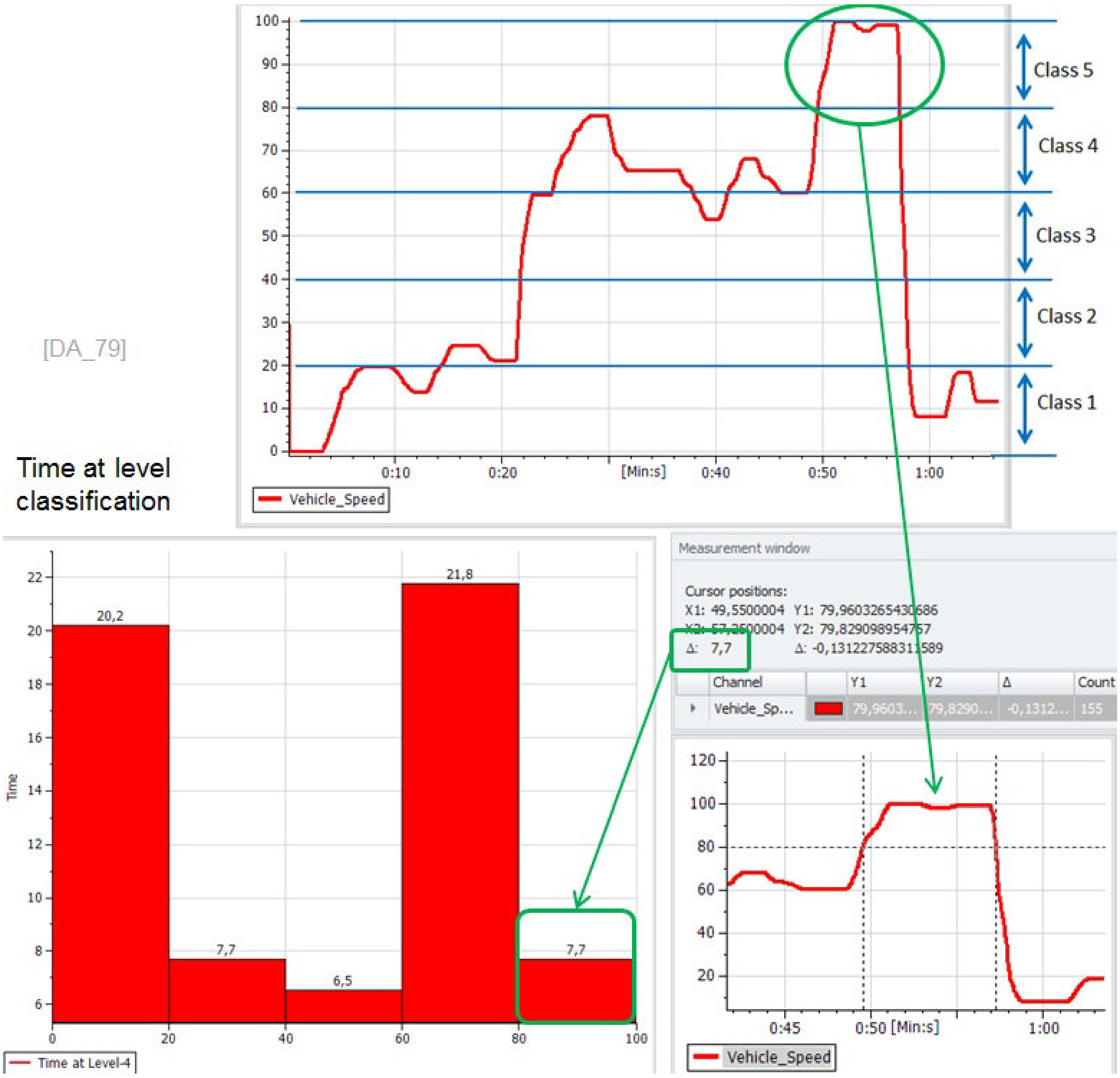
See section sample count classification 18.16.3.



[DA_78]

Example: Time at Level Classification
In the example below, we have 5 speed classes with the size of 20km/h. As indicated the signal is only for a short time period in the 80 -100 km/h class. If you use the measurement cursors, you can see the time difference is 7,7 sec in the measurement statistic window. The classification is calculating the same value.

[DA_79]



18.17.3 Display – tab sheet

See section sample count classification 18.16.4.

18.18 From to count classification

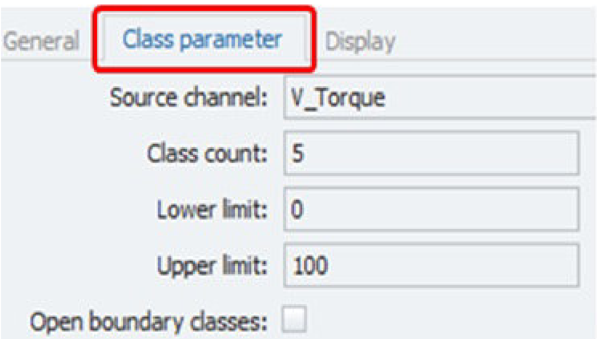
This classification statistic is calculating how often a signal is crossing adjacent classes.

18.18.1 General – tab sheet

See section sample count classification 18.17.1.

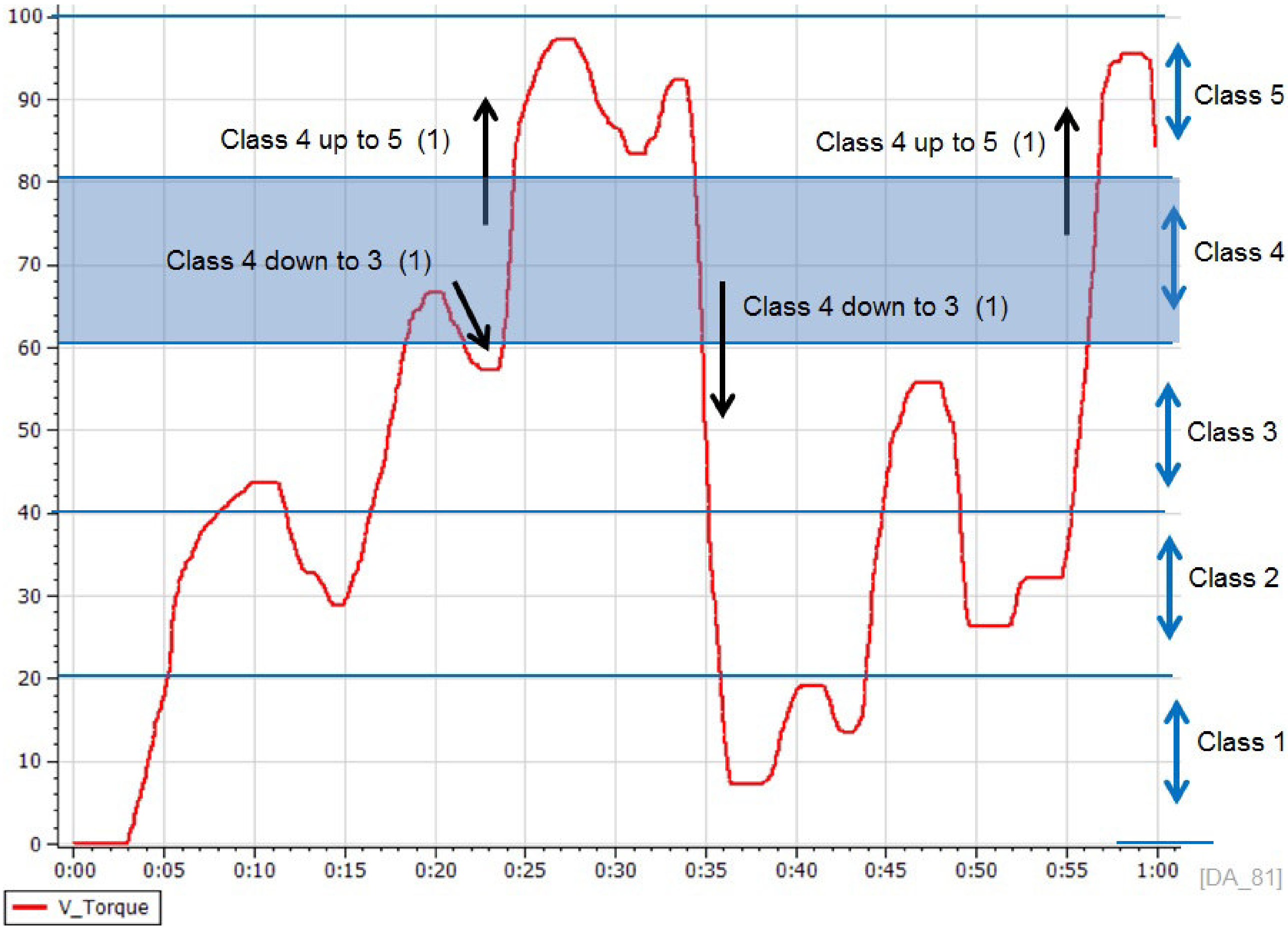
18.18.2 Class parameter – tab sheet

See section sample count classification 18.17.2.



[DA_80]

See section sample count classification
Example: From to count classification (from class 4 to adjacent classes)
The following example it will be explained how the classification result is calculated. The following signal is classified.



[DA_81]

The result in the matrix table is the following:

Crossing to adjacent class

From class			Class 1	Class 2	Class 3	Class 4	Class 5
			0 ... 20	20 ... 40	40 ... 60	60 ... 80	80 ... 100
	C1	0 ... 20	0	2	0	0	0
	C2	20 ... 40	1	0	4	0	0
	C3	40 ... 60	0	3	0	3	0
	C4	60 ... 80	0	0	2	0	2
	C5	80 ... 100	0	0	0	1	0

From To Count-5

[DA_82]

The algorithm is counting how many times the signal from a given class is changing to the next class below or above. In the example the classification result in the table is showing that the signal starting from reference class 4 was crossing twice to class 3 (40 – 60) and two times to the higher class 5 (80-100).

18.19 Level crossing classification

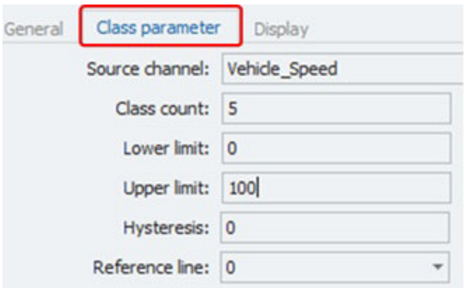
This classification statistic is calculating the number of times a signal is crossing a class. This method is calculating the positive class crossings but also considering negative class passes depending on the reference line. The reference line has an impact on how positive or negative class crossing will be counted.

18.19.1 General – tab sheet

See section sample count classification 18.16.2.

18.19.2 Class parameter – tab sheet

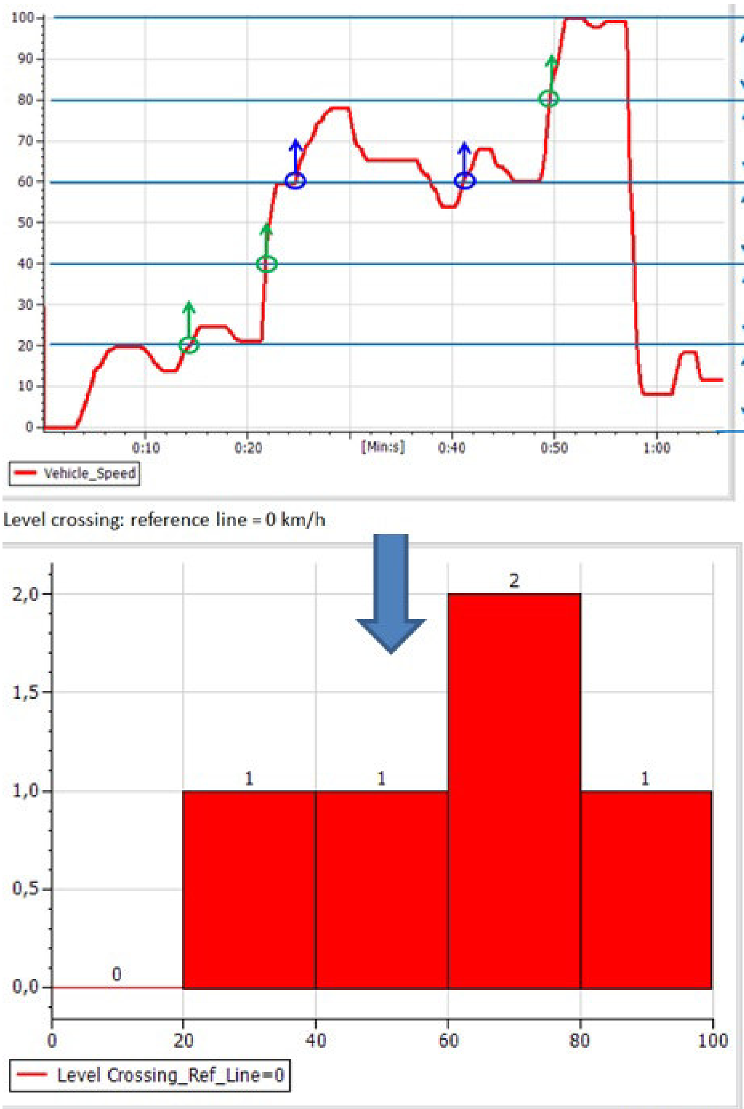
See section sample count classification 18.16.3.



[DA_83]

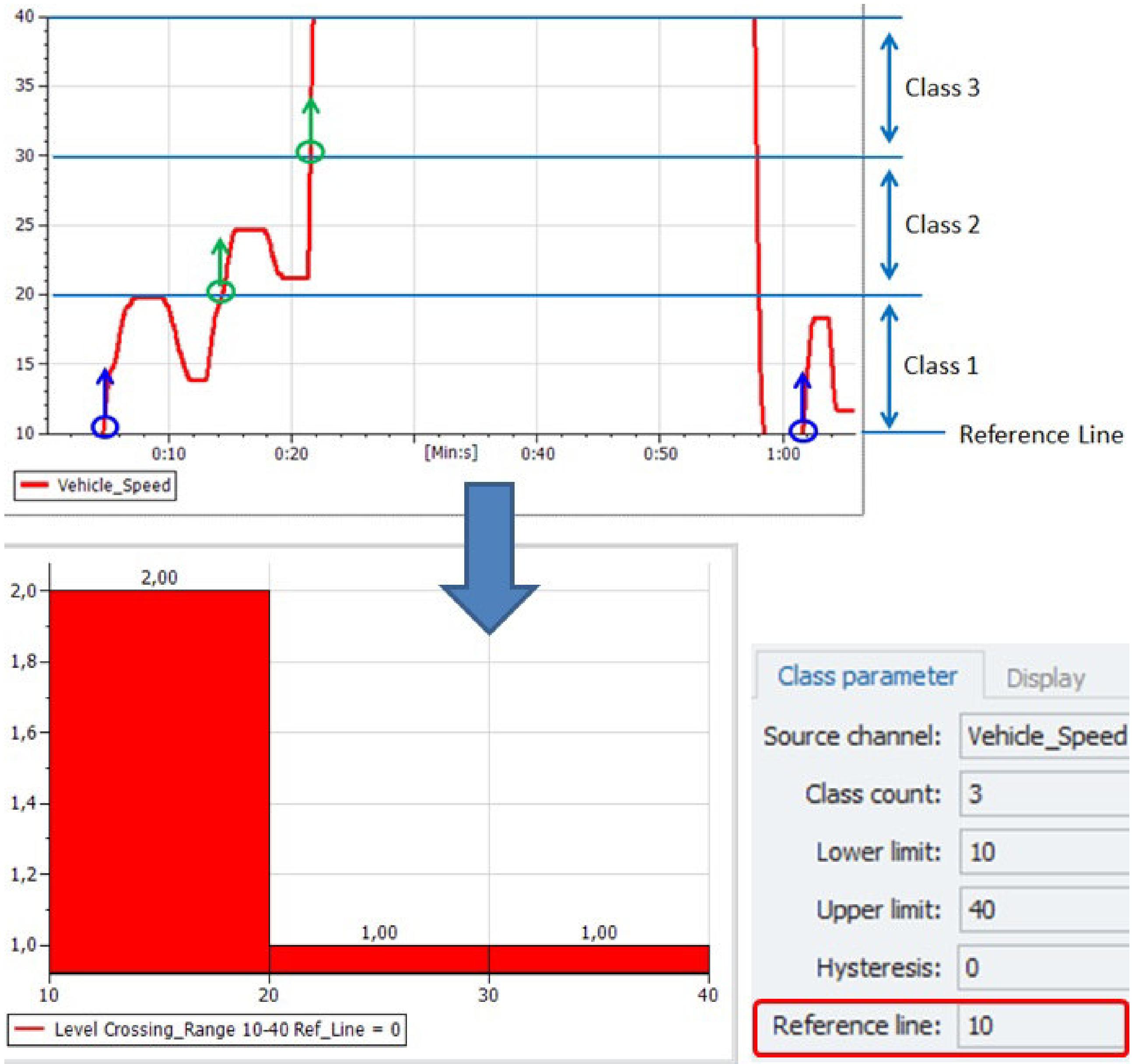
- Source channel — Select the source channel to calculate the classification.
- Class count — Class count defines in how many classes you will divide the range of your lower and upper limit. The classes are divided in equidistant sizes.
- Lower limit — Is the starting point of your classification considering the smallest measurements, you like to include in your classification.
- Upper limit — Refers to the highest measurements, you like to include for the calculation.
- Hysteresis — The hysteresis is adding a tolerance to the calculation if a signal is oscillating on the border of a class.
- Reference line — The reference line is considered as a starting point for positive counting. However, when the reference line is greater than the start samples the algorithm is counting falling signals below the reference line, too.

Example: Level crossing Classification (reference line = 0)
The following example shows how the reference signal “Vehicle_Speed” is processed in the level crossing classification. Every time the signal is crossing a class in the positive direction the counter is incremented. In this example the reference line is starting at 0 km/h. The speed signal is starting at 0 km/h. There is no positive level crossing counted of the first speed class ranging from 0 – 20km/h because the signal is already starting in this class.



Level crossing classification. [DA_84]

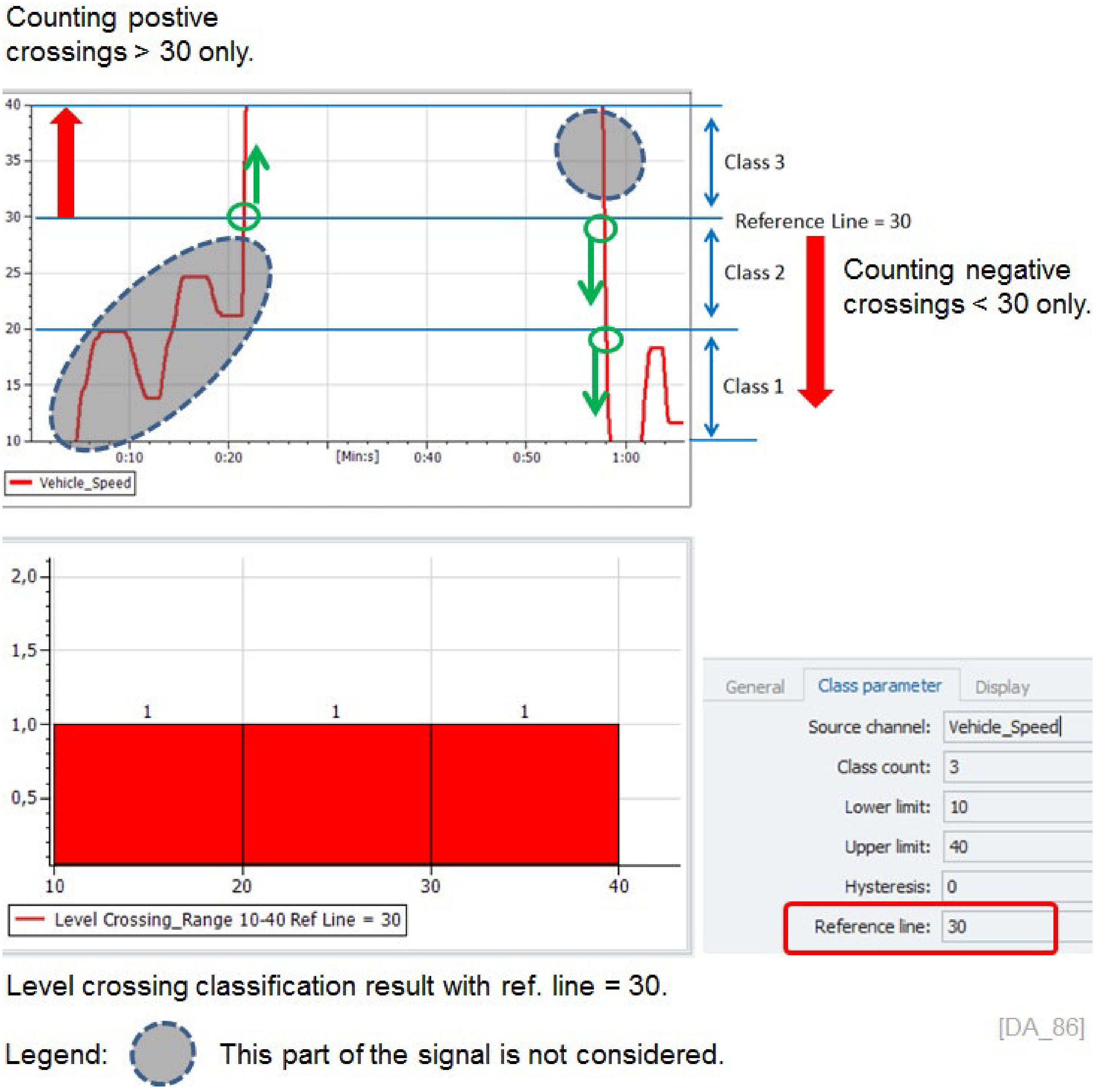
Example: Level crossing classification (Range 10 – 40 km/h, reference line = 10)
The following example will show the impact of the upper and lower limit of the level crossing classification. The considered part of the signal is in the range of 10 - 40 km/h. The reference line is defined to 10 km/h which is on the lower limit of the first class.



Level crossing classification result.

[DA_85]

Example: Example: Level crossing classification (Range 10 – 40 km/h, reference line = 30)
In this example you can see the impact of the reference line shifted to a value e.g. 32 km/h. In this case all positive crossings above 32 are considered for the level crossing calculations. There is only one positive level crossing the selected range of 10 - 40km/h. However, the level crossing classification is also considering all negative classes crossing on the descending signals. In this case, the signal is crossing the negative direction of class 2 and class 1.



[DA_86]

18.19.3 Display – tab sheet

See section sample count classification 18.16.4.

18.20 Transition matrix classification

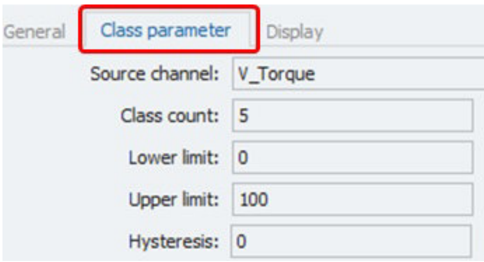
This classification statistic is calculating is counting all events where a signal is reaching from a maxima or a minima from a given class to another class.

18.20.1 General – tab sheet

See section sample count classification 18.16.2.

18.20.2 Class parameter – tab sheet

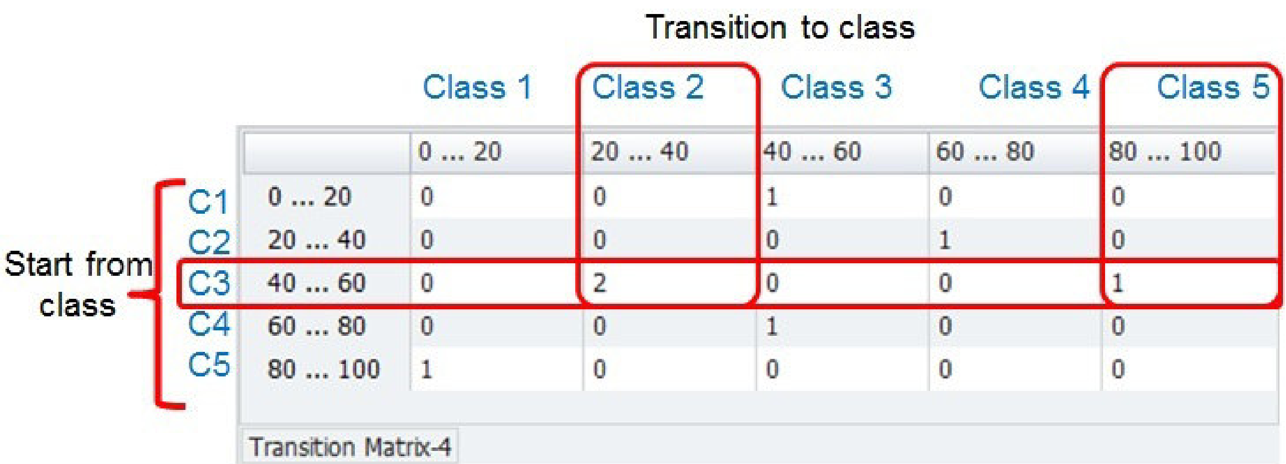
See section sample count classification 18.16.3.



[DA_87]

- Source channel: Select the source channel to calculate the classification.
- Class count: Class count defines in how many classes you will divide the range of your lower and upper limit. The classes are divided in equidistant sizes.
- Lower limit: Is the starting point of your classification considering the smallest measurements, you like to include in your classification.
- Upper limit: Refers to the highest measurements, you like to include for the calculation.
- Hysteresis: The hysteresis is adding a tolerance to the calculation if a signal is oscillating on the border of a class.

Example: Transition matrix (From class 3)
In this example we will explain the counting results from the start class 3.

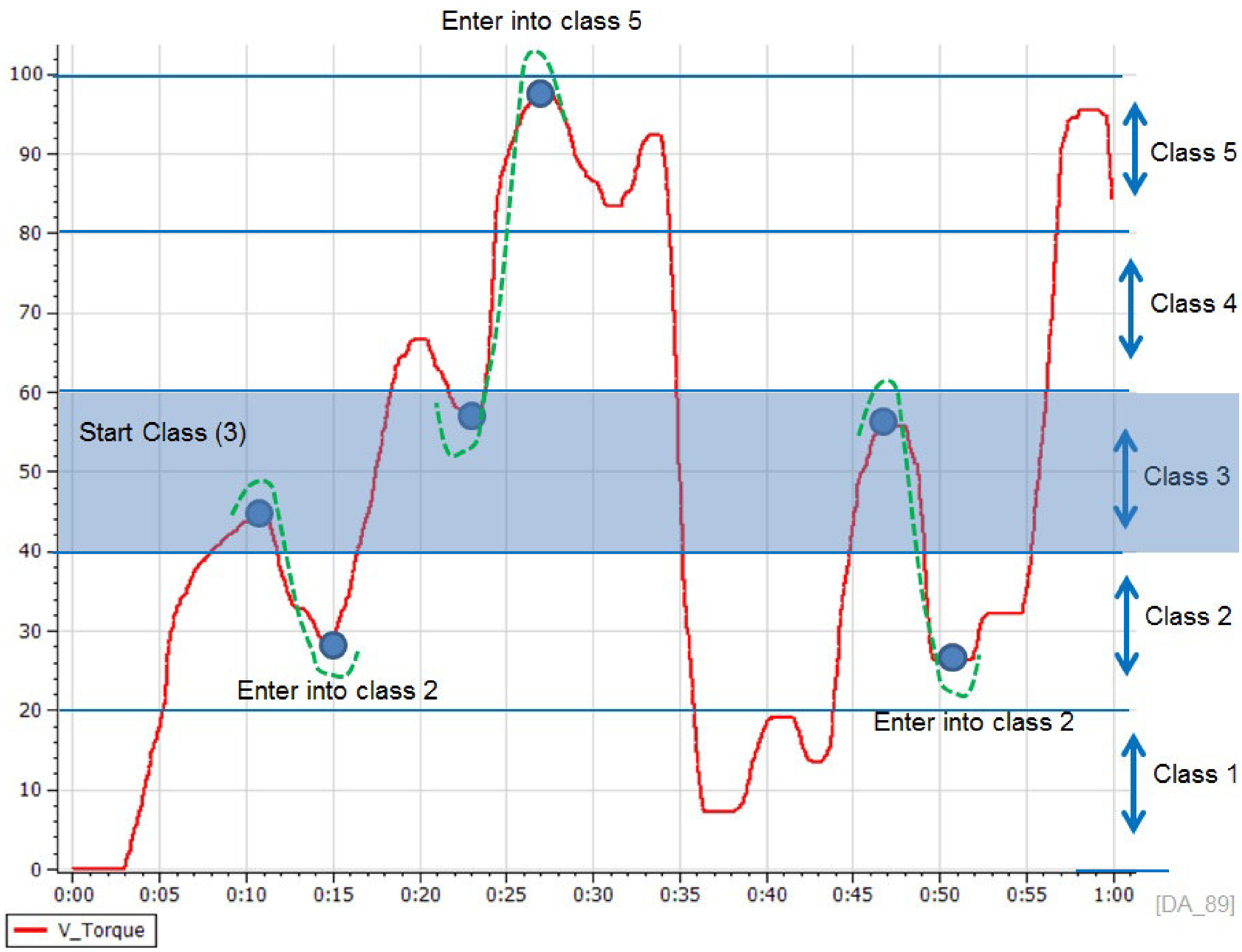


		Class 1	Class 2	Class 3	Class 4	Class 5
		0 … 20	20 … 40	40 … 60	60 … 80	80 … 100
C1	0 … 20	0	0	1	0	0
C2	20 … 40	0	0	0	1	0
C3	40 … 60	0	2	0	0	1
C4	60 … 80	0	0	1	0	0
C5	80 … 100	1	0	0	0	0

[DA_88]

The results of the 2D classification can be presented graphically in the classification grid 19.8.

The counting results shows, that the signal is changing 2 times from class class3 into class 2 and one time from class 3 into class 5.



[DA_89]

18.21 Rainflow classification

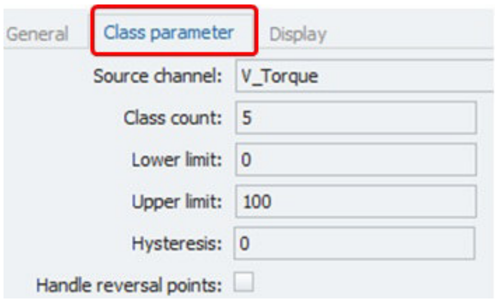
This classification statistic is very popular for fatigue test and load monitoring applications on mechanical structures

18.21.1 General – tab sheet

See section sample count classification 18.16.2.

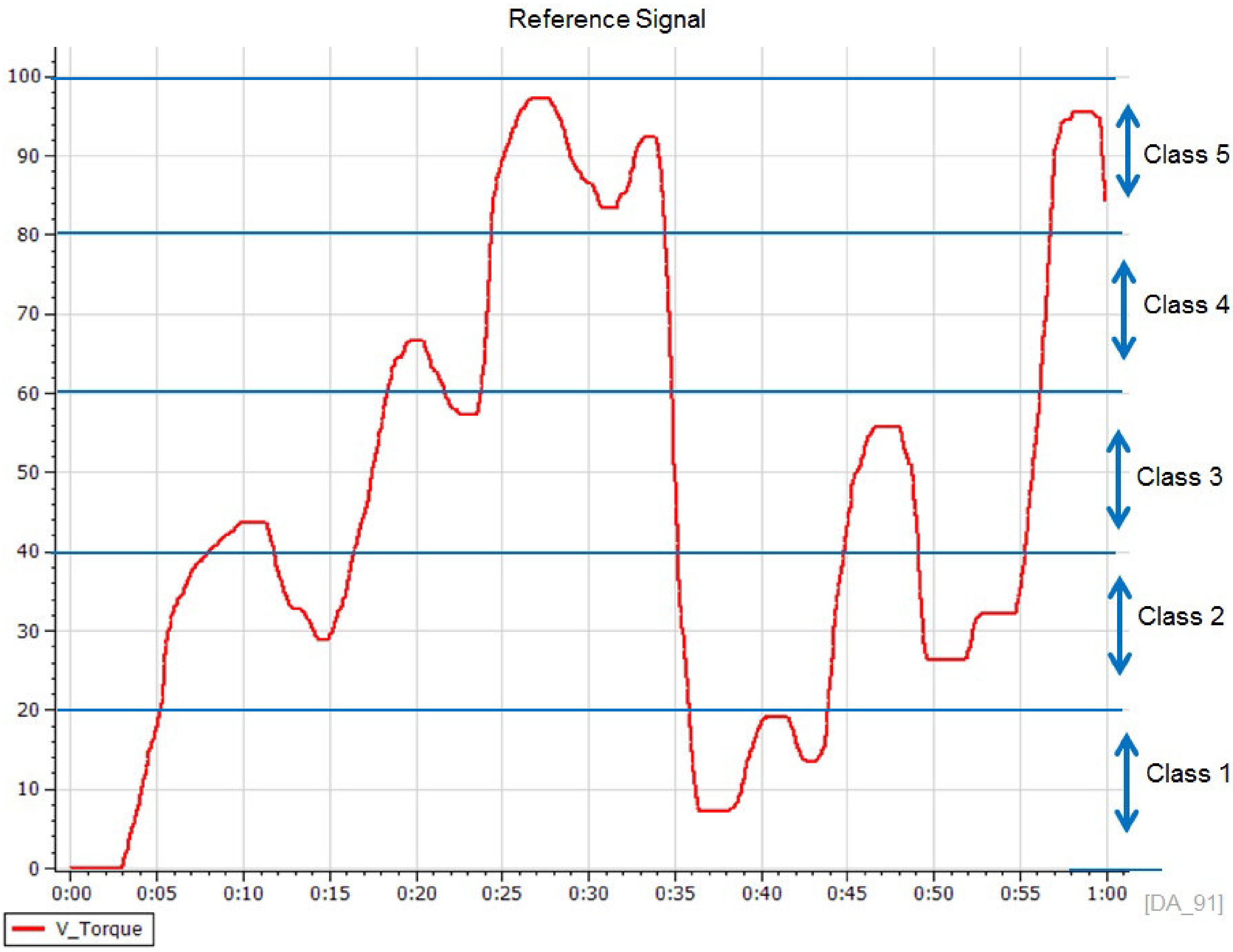
18.21.2 Class parameter – tab sheet

See section sample count classification 18.16.3.



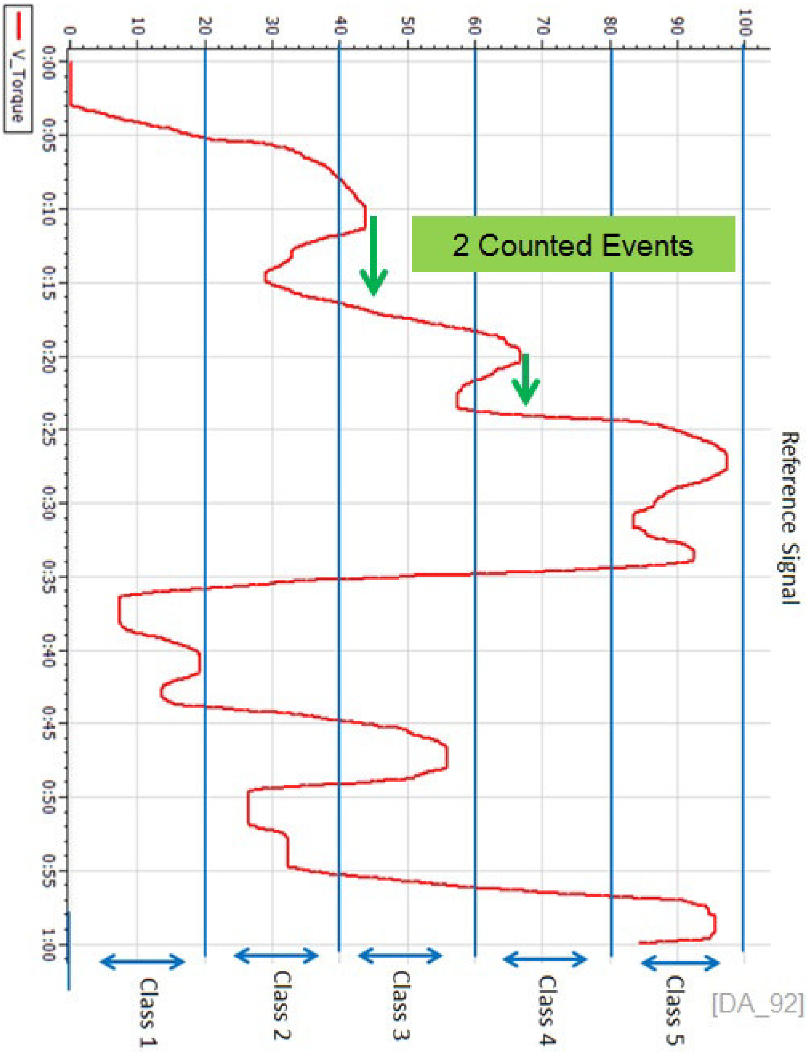
[DA_90]

The result of a Rain flow classification will be applied to the signal below.



[DA_91]

To understand the counting result it is recommended to rotate the signal by $90\,^{\circ}\mathrm{C}$ to get a better graphical understanding of the rain flow.



[DA_92]

Only 2 events are counted and presented in the matrix.

To class

From class	Class 1	Class 2	Class 3	Class 4	Class 5
	0 ... 20	20 ... 40	40 ... 60	60 ... 80	80 ... 100
0 ... 20	0	0	0	0	0
20 ... 40	0	0	0	0	0
40 ... 60	0	1	0	0	0
60 ... 80	0	0	1	0	0
80 ... 100	0	0	0	0	0

Rainflow-3

[DA_93]

The results of the 2D classification can be presented graphically in the classification grid 19.8.

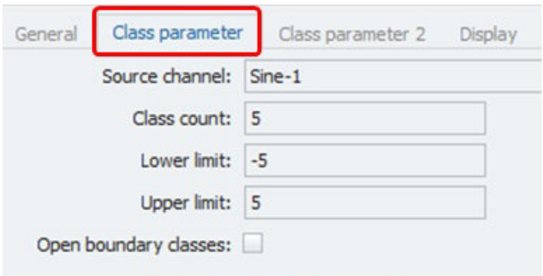
18.22 Sample count compound classification

This classification statistic is closely related to the sample count classification 18.16. This classification method is considering 2 channels and counts only the values (data points) where both channels are overlapping in the class.

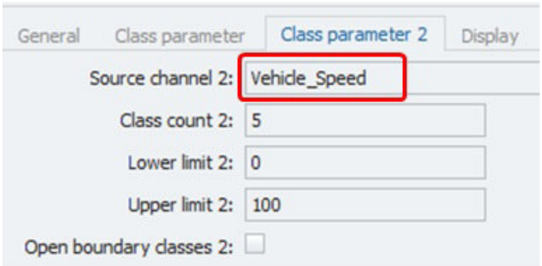
18.22.1 General – tab sheet

See section sample count classification 18.16.2.

18.22.2 Class parameter – tab sheet



Class parameters for first channel

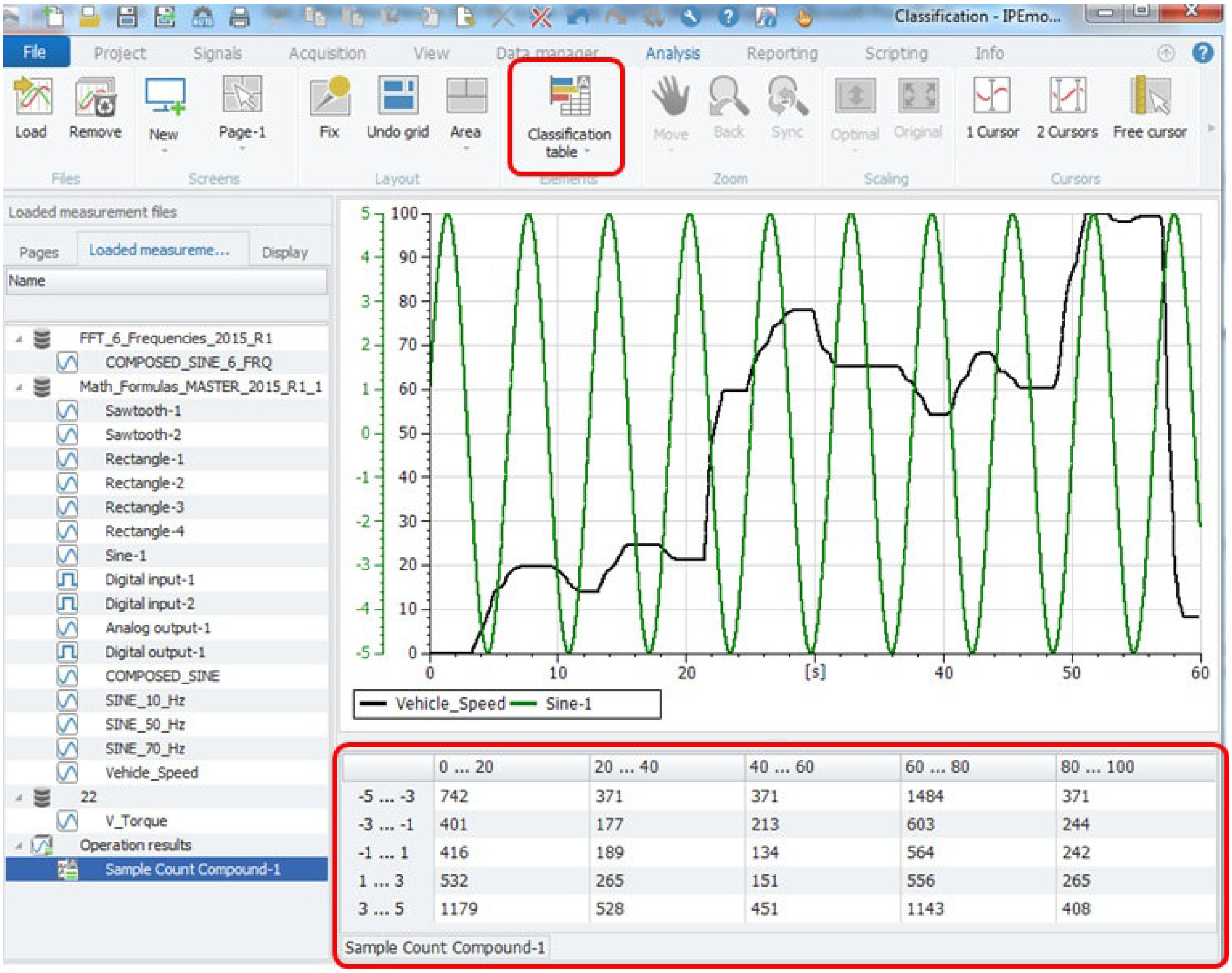


[DA_94]

Class parameters for second channel

- **Source channel** — Select the source channel to calculate the classification.
- **Class count** — Class count defines in how many classes you will divide the range of your lower and upper limit. The classes are divided in equidistant sizes.
- **Lower limit** — Is the starting point of your classification considering the smallest measurements, you like to include in your classification.
- **Upper limit** — Refers to the highest measurements, you like to include for the calculation.
- **Open boundary classes** — This setting includes all samples outside of the first and last calls and adds it to the adjacent classes. See example in section 18.16.3.

The results are presented in the analysis work space in the classification table instrument.

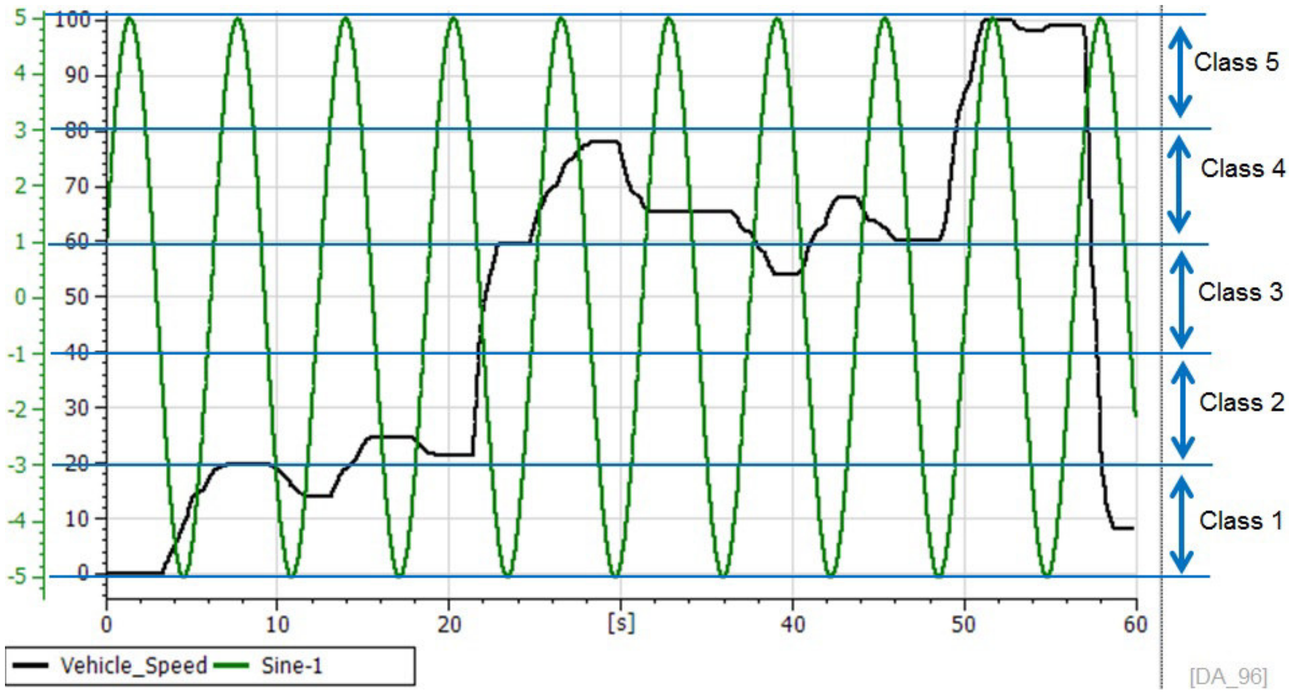


	0 ... 20	20 ... 40	40 ... 60	60 ... 80	80 ... 100
-5 ... -3	742	371	371	1484	371
-3 ... -1	401	177	213	603	244
-1 ... 1	416	189	134	564	242
1 ... 3	532	265	151	556	265
3 ... 5	1179	528	451	1143	408

Classification results presented in the classification table instrument. [DA_95]

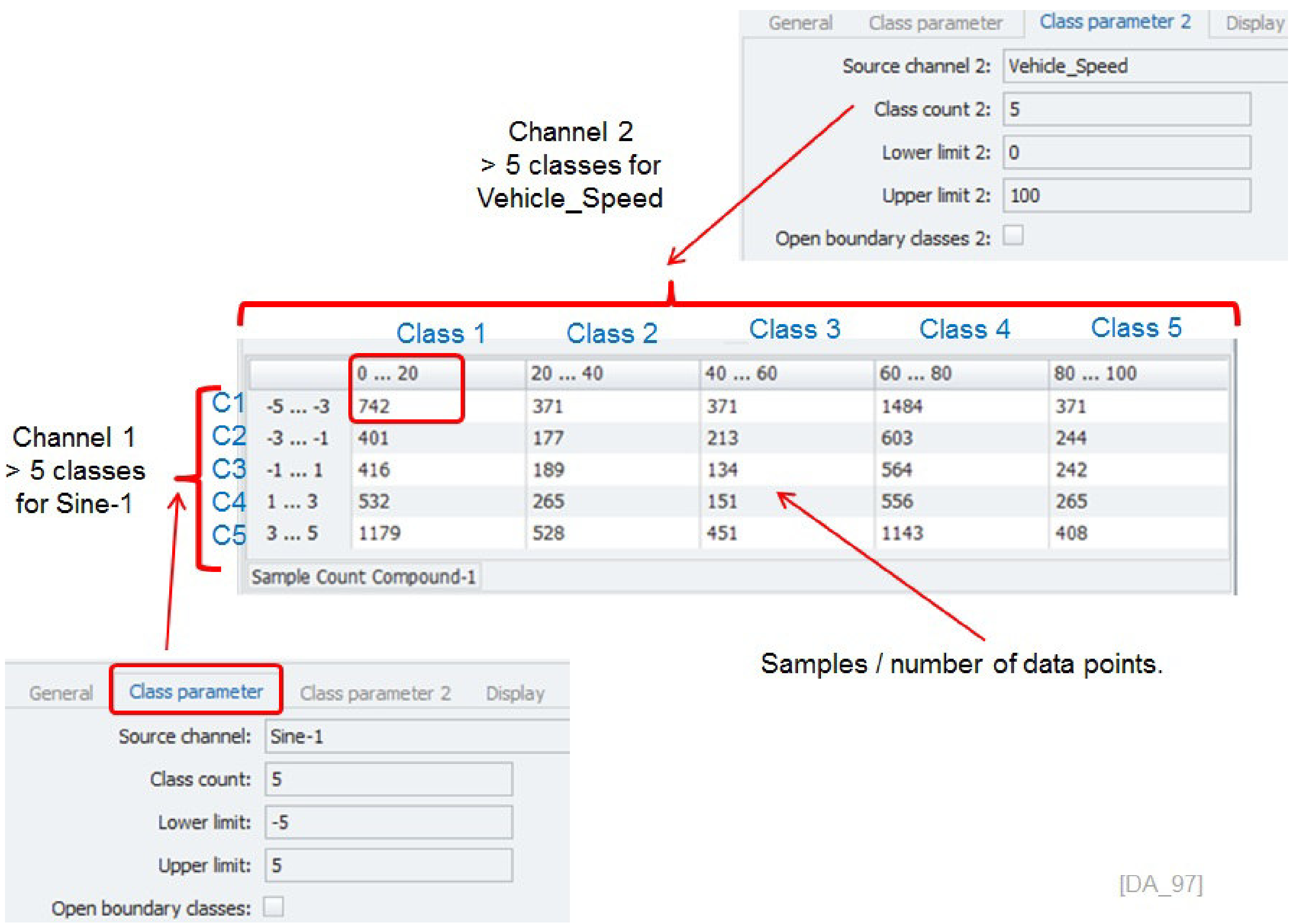
The following chart is graphically indicating 5 classes which were defined for the following two channels:

- Vehicle speed range from 0 – 100
- Sine-1 range from -5 - +5



[DA_96]

The class ranges are reflected in the classification table. For channel one the 5 classes are ranging from -5 to 5 and for the second channel the class parameters are ranging from 5 to 100.



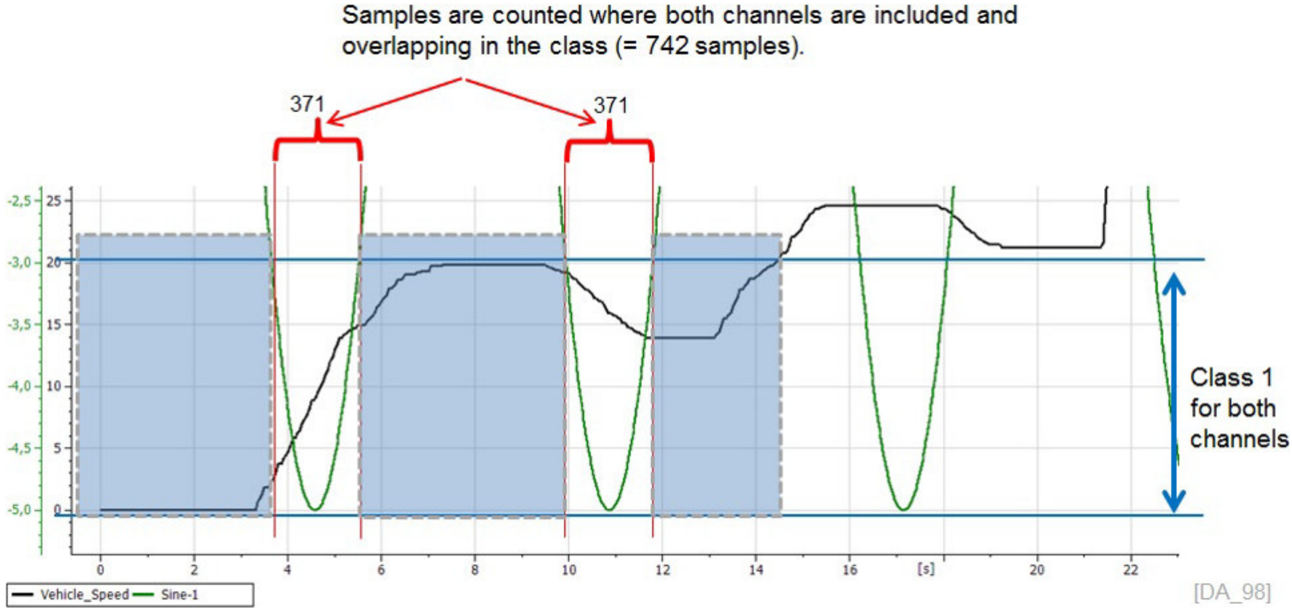
		Class 1	Class 2	Class 3	Class 4	Class 5
		0 ... 20	20 ... 40	40 ... 60	60 ... 80	80 ... 100
C1	-5 ... -3	742	371	371	1484	371
C2	-3 ... -1	401	177	213	603	244
C3	-1 ... 1	416	189	134	564	242
C4	1 ... 3	532	265	151	556	265
C5	3 ... 5	1179	528	451	1143	408

[DA_97]

The results of the 2D classification can be presented graphically in the classification grid 19.8.

Example 1: Sample count compound classification (Class 1 / Class 1)

The classification method is only counting the samples of the channel with the higher sample rate, which is in this example, the Sine-1 channel. Only those samples get counted where both signals are included / overlap in the defined class range. In this example the Sine-1 channel and the “Vehicle_Speed” channel overlap in the indicated white areas.



[DA_98]

Example 2: Sample count compound classification (Class 5 / Class 2)

In this example we show how the result (528 samples) for the following class 5 / class 2 is computed.

Channel 2 > 5 classes for Vehicle_Speed

Channel 1 > 5 classes for Sine-1

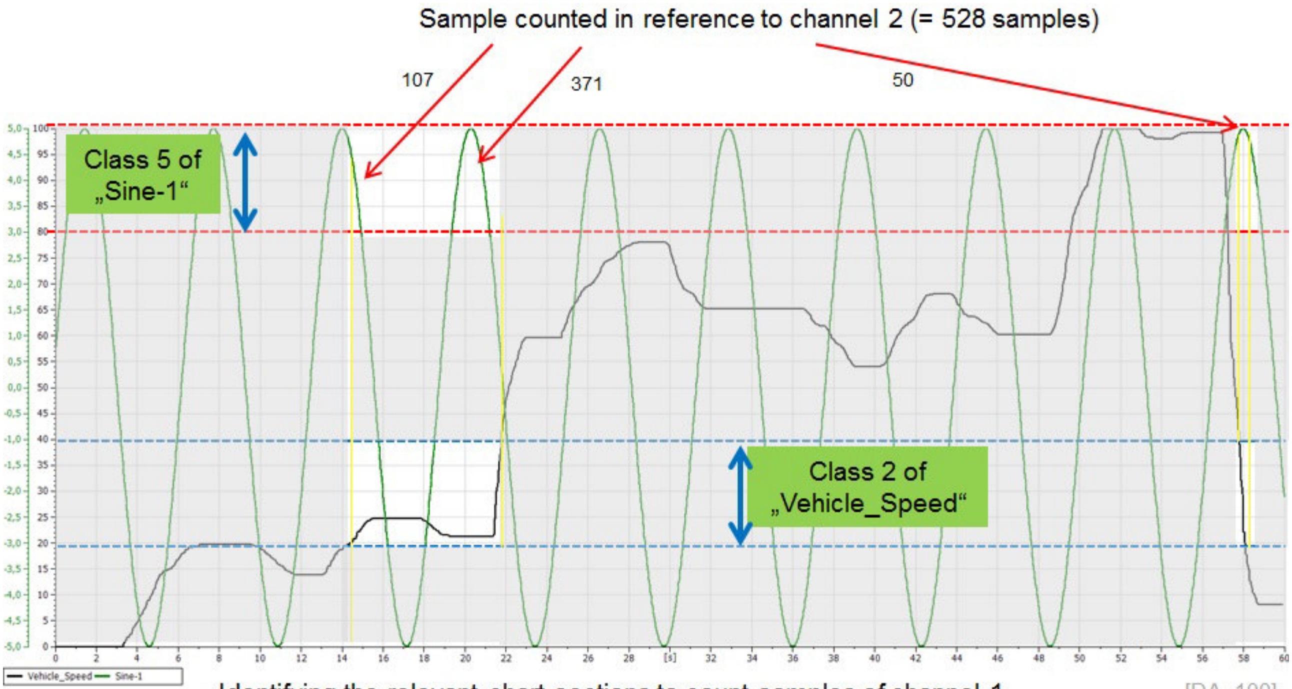
		Class 1	Class 2	Class 3	Class 4	Class 5
		0 ... 20	20 ... 40	40 ... 60	60 ... 80	80 ... 100
C1	-5 ... -3	742	371	371	1484	371
C2	-3 ... -1	401	177	213	603	244
C3	-1 ... 1	416	189	134	564	242
C4	1 ... 3	532	265	151	556	265
C5	3 ... 5	1179	528	451	1143	408

Sample Count Compound-1

Example for: Class 5 / Class 2 sample counting

[DA_99]

The following diagram is indicating 2 white areas where both channels Sine-1 (class 5) and Vehicle_Speed (class 2) are overlapping.



Identifying the relevant chart sections to count samples of channel 1. [DA_100]

18.23 Time at Level Compound

This classification statistic is very closely related to the Time at level classification. In this case the time is counted, how long a single is staying in a giving class. As a compound classification method the same principle as in sample count compound classification is applied in order to identify the relevant sections of the chart.

18.23.1 General – tab sheet

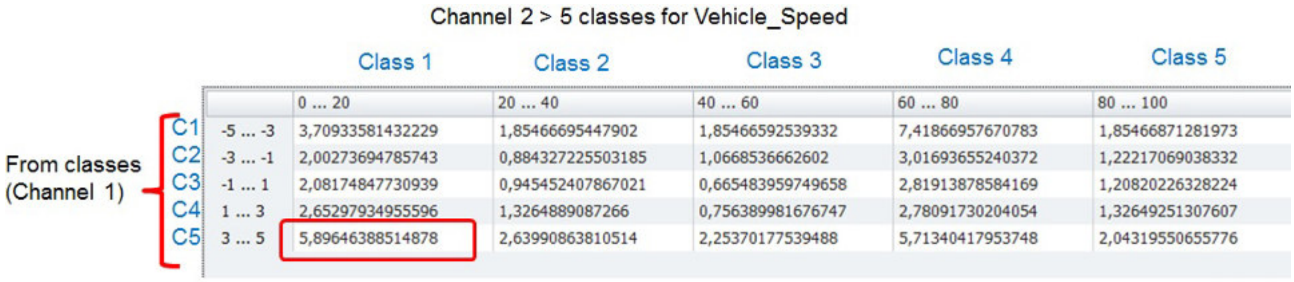
See section sample count classification 18.16.2.

18.23.2 Class parameter – tab sheet

See section sample count compound classification 18.22.

Example 1: Time at level compound classification (Class 5 / Class 1)

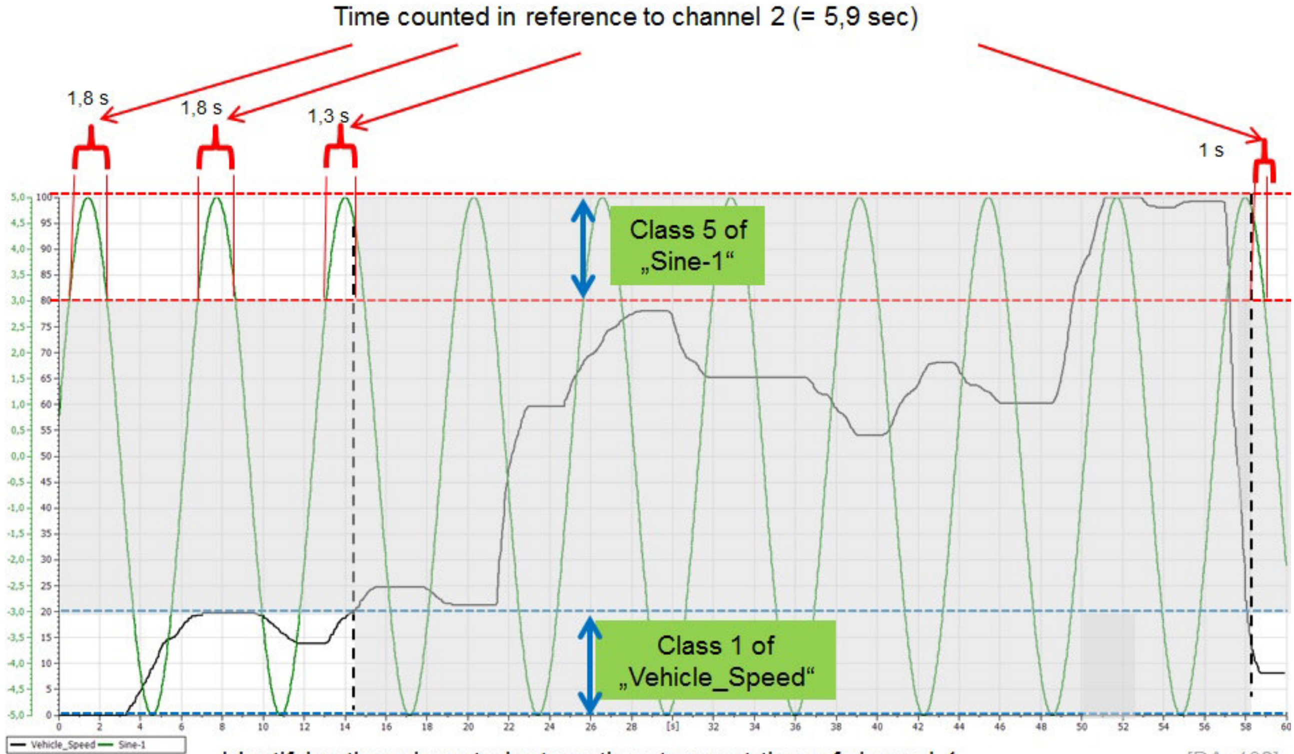
In this example below we will show how the result for the following class 5 / class 1 (5.9 seconds) is computed.



		0 ... 20	20 ... 40	40 ... 60	60 ... 80	80 ... 100
C1	-5 ... -3	3,70933581432229	1,85466695447902	1,85466592539332	7,41866957670783	1,85466871281973
C2	-3 ... -1	2,00273694785743	0,884327225503185	1,0668536662602	3,01693655240372	1,22217069038332
C3	-1 ... 1	2,08174847730939	0,945452407867021	0,665483959749658	2,81913878584169	1,20820226328224
C4	1 ... 3	2,65297934955596	1,3264889087266	0,756389981676747	2,78091730204054	1,32649251307607
C5	3 ... 5	5,89646388514878	2,63990863810514	2,25370177539488	5,71340417953748	2,04319550655776

Matrix is presenting time in seconds. [DA_101]

The results of the 2D classification can be presented graphically in the classification grid 19.8.
The white areas indicate those sections of channel 1 (Sine in class 5) with is overlapping with channel 2 (Vehicle_Speed in class 1). When we use the cursor tool and count the time of all segments of channel 1 we arrive at the computed result of 5.9 seconds.

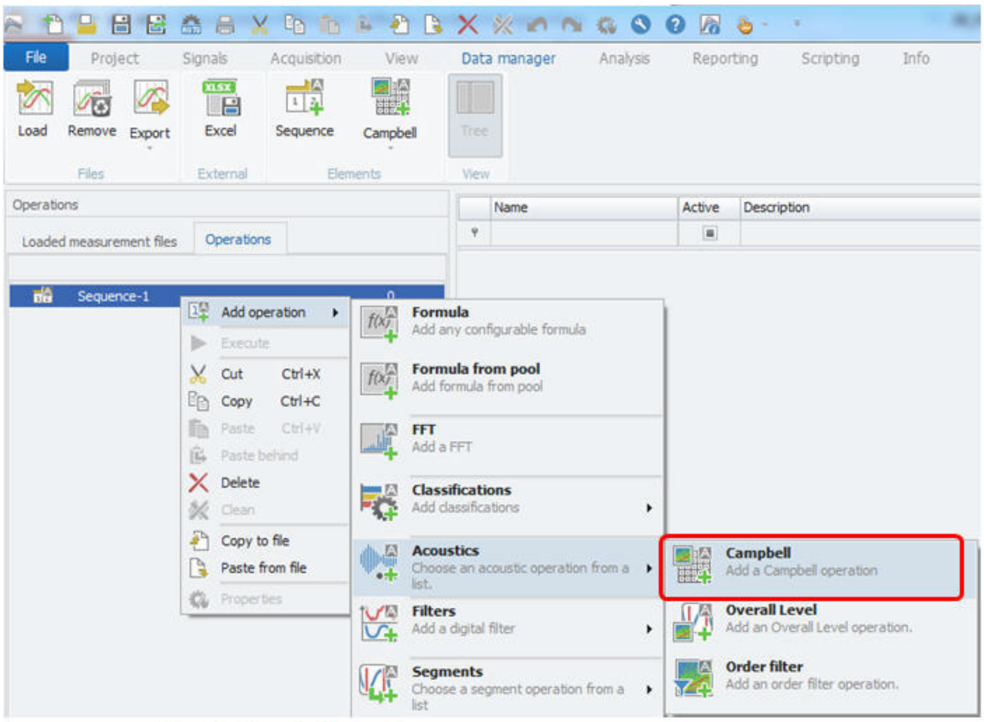


Identifying the relevant chart sections to count time of channel 1. [DA_102]

18.24 Campbell

18.24.1 YouTube resources

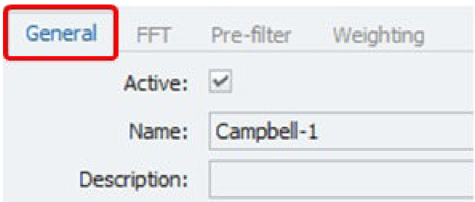
IPEmotion – Post-Processing – Campbell: https://youtu.be/RqMItapsBcs
The Campbell operation is a based on the FFT operation by adding additional filter weighting function to present data the data in the Campbell instrument in the ANALYSIS work space 19.19.



Create Campbell operation [DA_103]

18.24.2 General – tab sheet

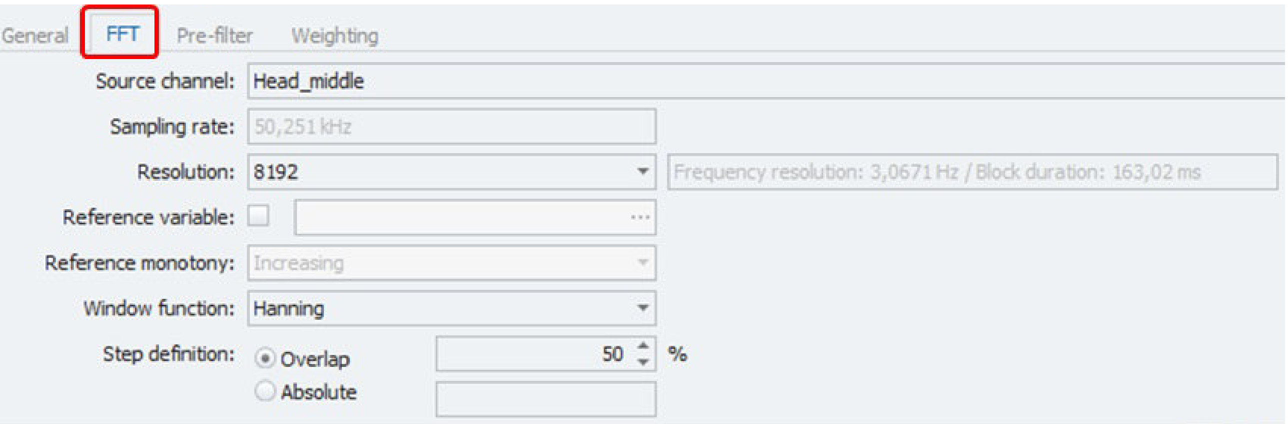
See section sample count classification 18.16.2.



[DA_104]

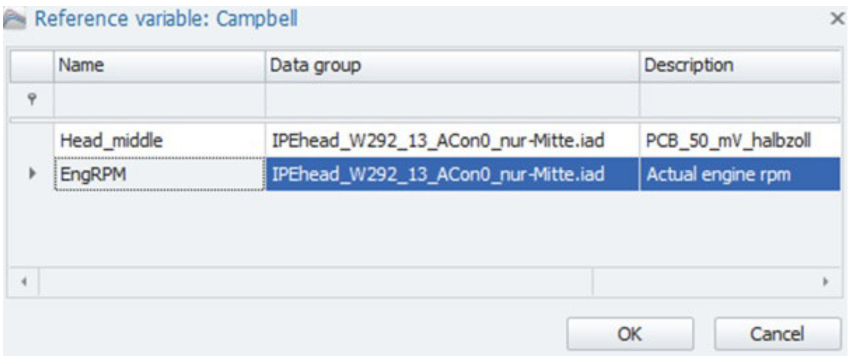
18.24.3 FFT – tab sheet

The FFT tab sheet offers the most detailed configuration options how the FFT for the Campbell diagram is calculated.



[DA_105]

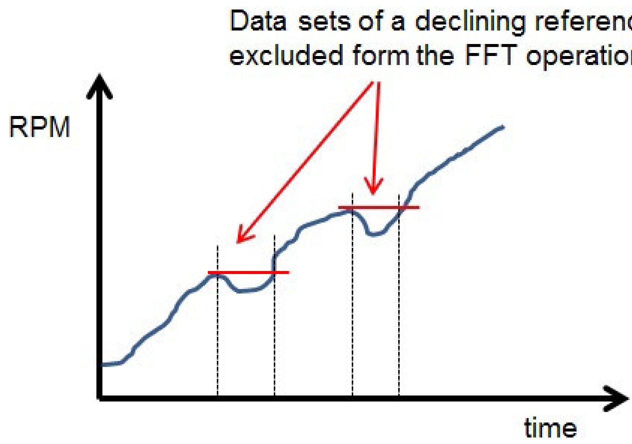
- **Source channel** — This is the signal channel which is subjected to the FFT calculation.
- **Sample rate** — Indicating the sample rate of the selected source channel.
- **Resolution** — The resolution is related to the number of taken samples to calculate the FFT. The resolution or number of samples subjected to an FFT calculation is a drop down list. Based on the selected resolution the corresponding frequency and block duration is calculated:
  Block duration = Resolution / Sample Rate Frequency Resolution = Sample Rate / Resolution
  When you increase the FFT resolution you increase the accuracy of the sequence but you lose accuracy in regard to the time base.
- **Reference variable** — In the standard configuration all FFTs are calculated in regard to the time base. However in many cases it is reasonable to plot FFTs not against time but against another channel which is correlating to the measurement sound and vibration frequencies. A popular channel is the engine RPM when you are investigating acoustic effects in a car.



Select a reference channel for FFT calculation [DA_106]

- **Reference monotony**

  This setting is related to an increasing or decreasing reference signal e.g. RPM. For the FFT calculation it is important that only FFTs included to the Campbell diagram which are originating from an monotony increasing or decreasing signal.



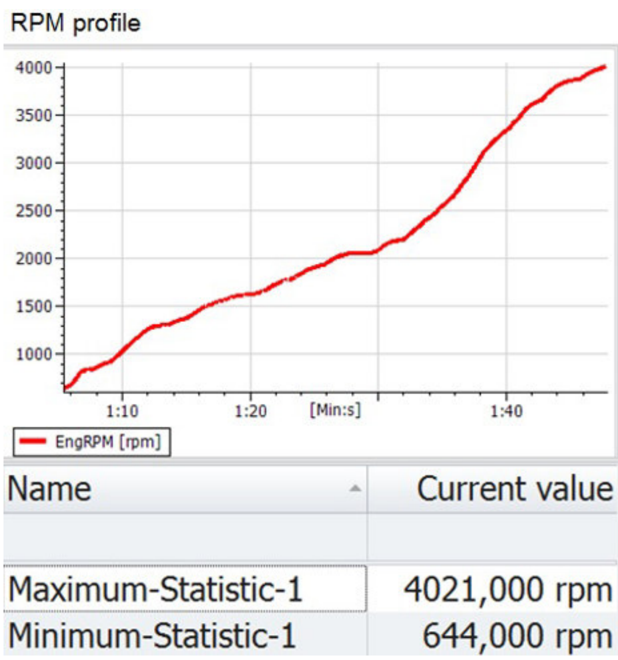
Profile of an increasing reference signal. [DA_107]

- **Window function**

  The window function is particularly important if only very few periods of signals are included in the calculation and the trigger point of the signal recording gets an important impact on the computed result. The following window functions are supported: Rectangle, Hanning, Hamming, Backman, Bartlett.

- **Step definition**

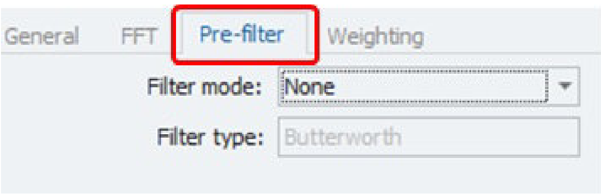
  Overlap: The overlap function is the same behavior as explained in the FFT analysis. With the overlap you specify how much data of the previous data block is included in the FFT calculation 18.14.3.
  Absolute: With this setting you can define the absolute step width for the FFT calculation. The default value is calculated by the following formula: (Max value – Min value) / 500
  The user can change the step definition to other values depending on the desired results in the Campbell diagram. In the example below the default step definition:
  (4021 rpm – 644 rpm) / 500 = 6,75 rpm



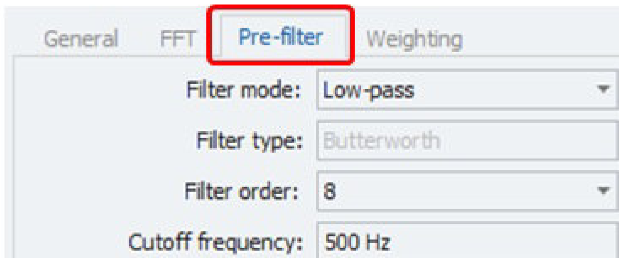
[DA_108]

18.24.4 Pre-filter – tab sheet

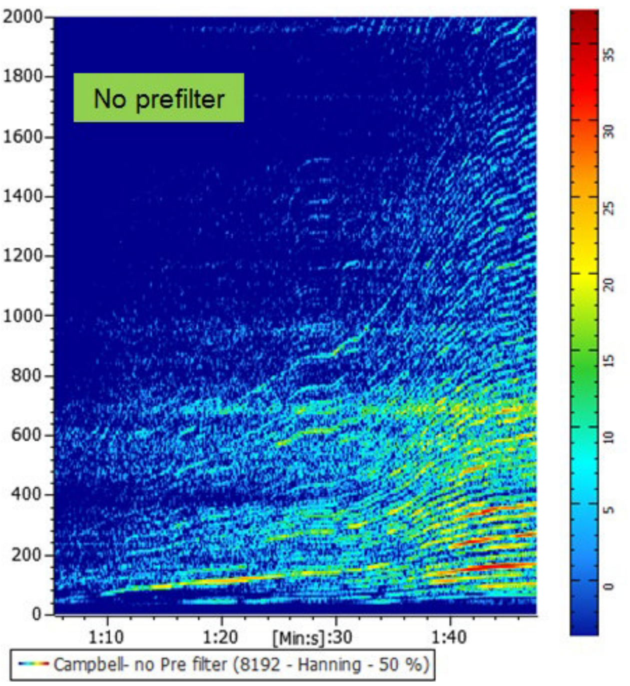
The pre-filter tab sheet support the filter functions as discussed in section 18.28. With the filter operation specific signal frequency can be damped.

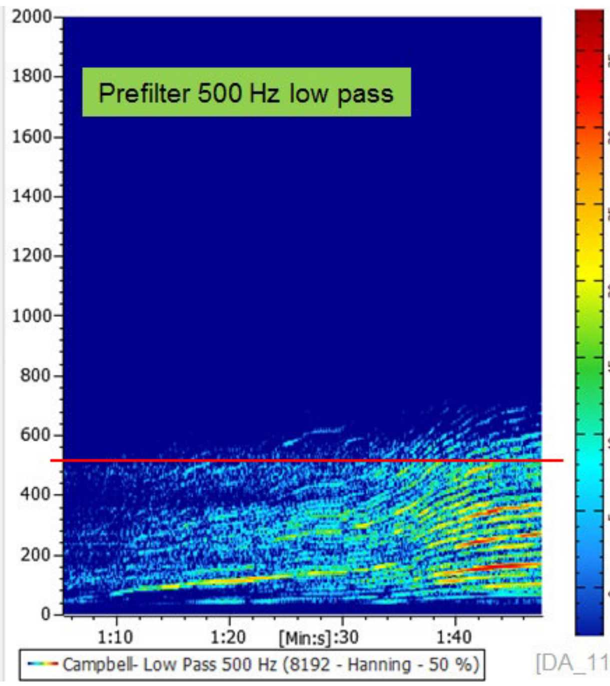


[DA_109]



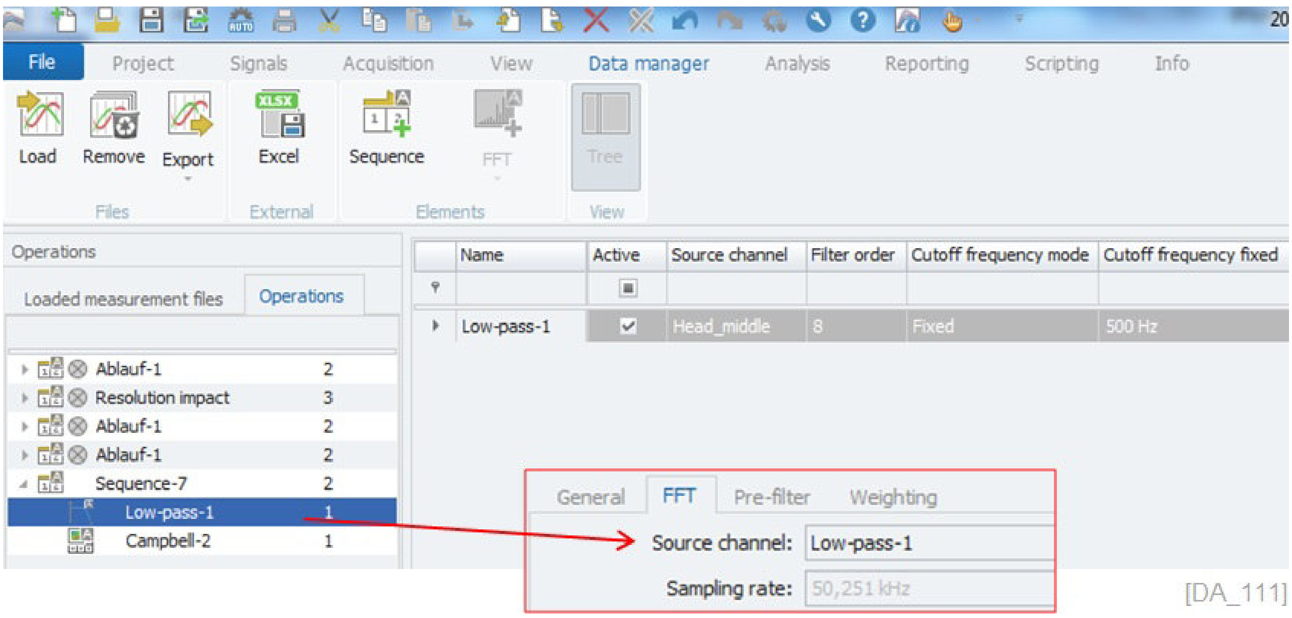
The Campbell diagram with the pre-filter is showing now values above the 500 Hz line. The filter damping is of course not perfect there some frequencies are still crossing the 500 border line.





[DA_110]

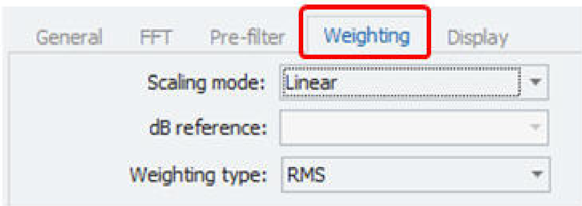
If you like you can also operate the pre-filter operation before the Campbell operation and use the result of the pre-filter as an input to the Campbell operation.



[DA_111]

18.24.5 Weighting – tab sheet

The weighting function is a very important setting for the Campbell operation. The weighting function parameters have to be configured to present the data in a normative format.

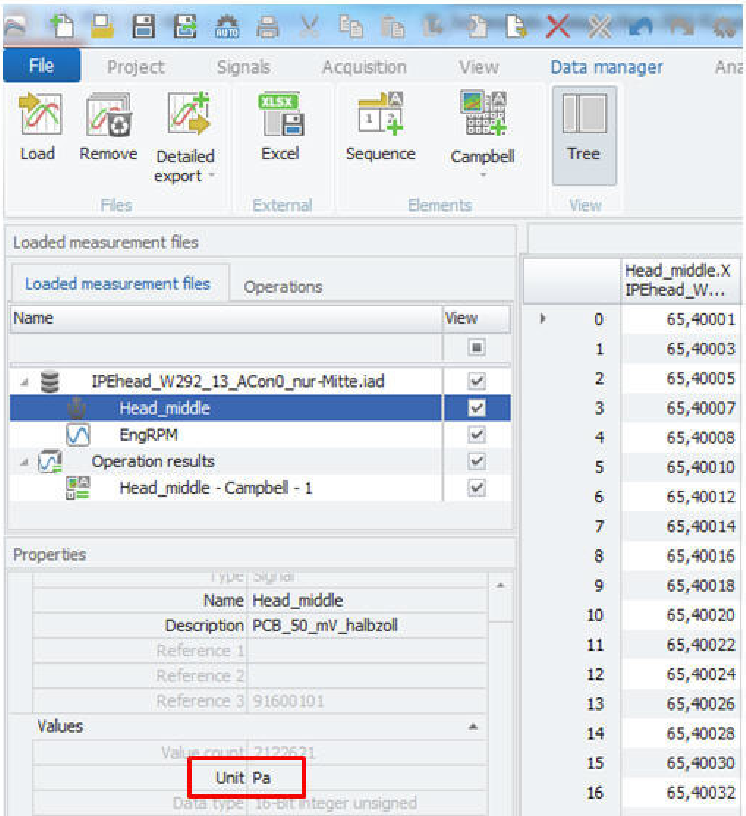


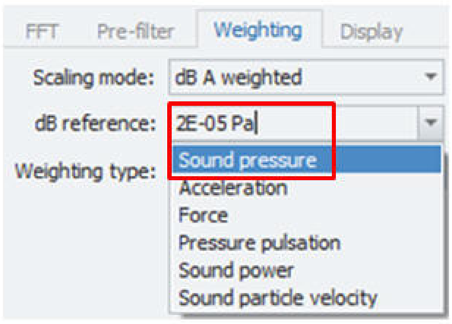
[DA_112]

The following scaling modes and recommended reference values are defined:

- Linear Scaling has no impact to the calculated results.
- dB unweighted
- dB A weighted
- dB B weighted
- dB C weighted
- dB D weighted

With the weighting function it is possible to compensate different sound pressure levels accordingly to human hears. The correct reference values are depending on the application. For the Campbell operation a drop down and edit field makes the selection of the weighting factors more user friendly. You can only select or add new weighting factors which match to the unit of the source channel.





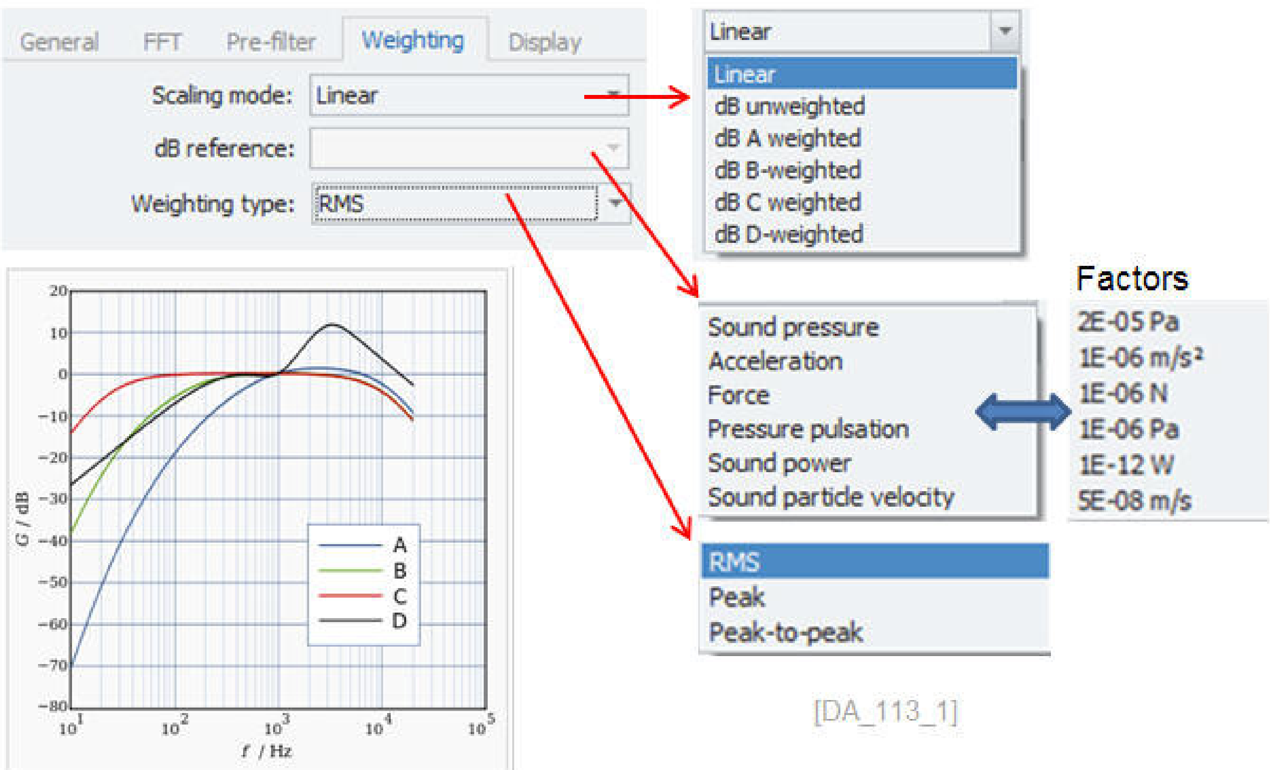
Drop down / edit field to select weighting factors.
Unit of source channel should match to the unit of weighting factor.

[DA_113]

⚠	***Attention!***	*When the source channel has no unit defined the weighting factor shall have not unit too.*

The weighing types are defined as:

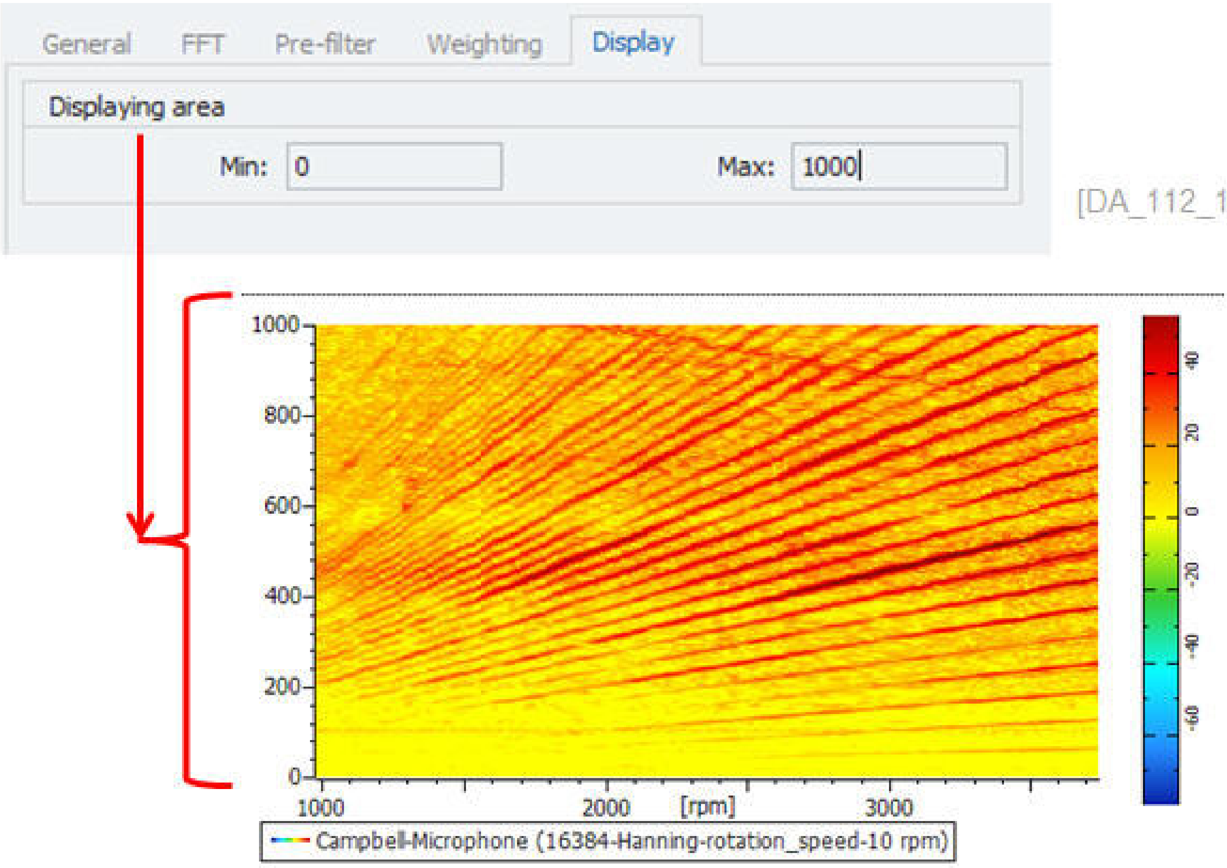
- RMS (Root Mean Square)
- Peak value
- Peak to Peak value



[DA_113_1]

18.25 Display - tabs heet

The display range for the y-axis (frequency) can be defined in the display tab sheet of the Campbell operation.

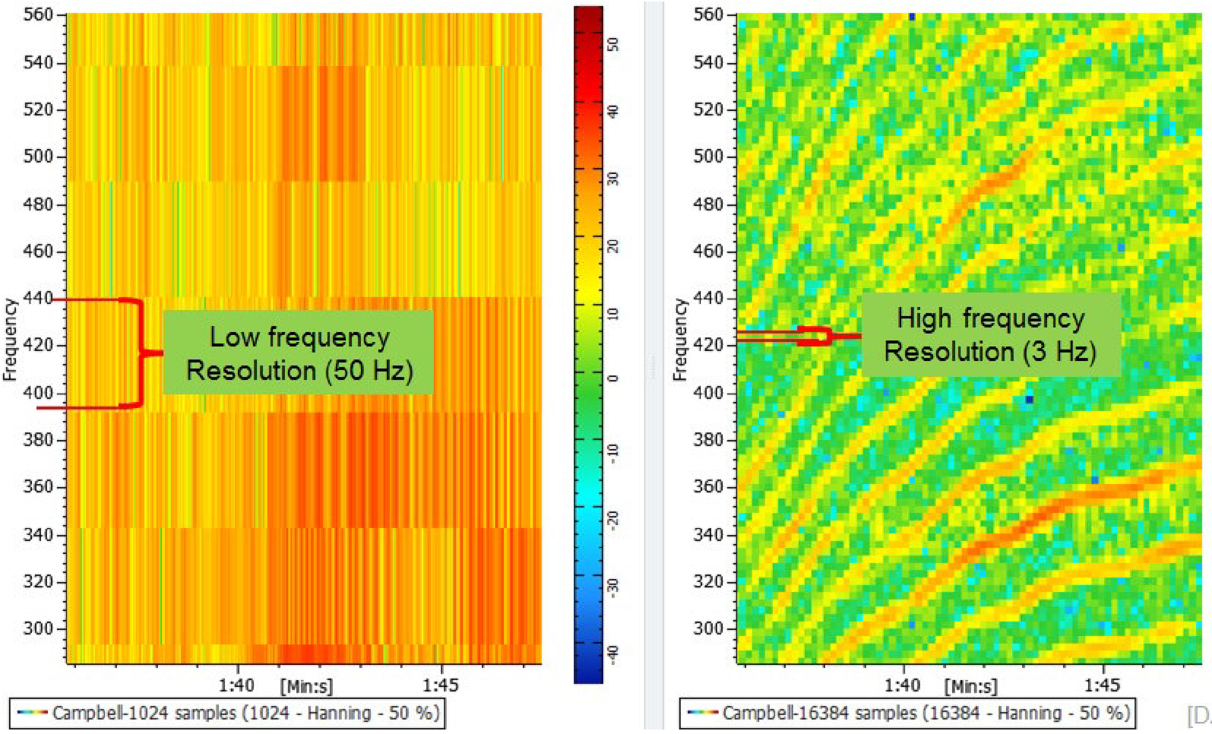

General
FFT
Pre-filter
Weighting
Display
Displaying area
Min: 0
Max: 1000
1000
800
600
400
200
0
1000
2000
[rpm]
3000
40
20
0
-20
-40
-60
Campbell-Microphone (16384-Hanning-rotation_speed-10 rpm)

[DA_112_1]

18.25.1 Impact of different Campbell operation settings

In this example you will see how the different Campbell operation settings impact the results and the data presentation of the Campbell diagram. The configuration settings of the diagram itself are explained in section 19.19.

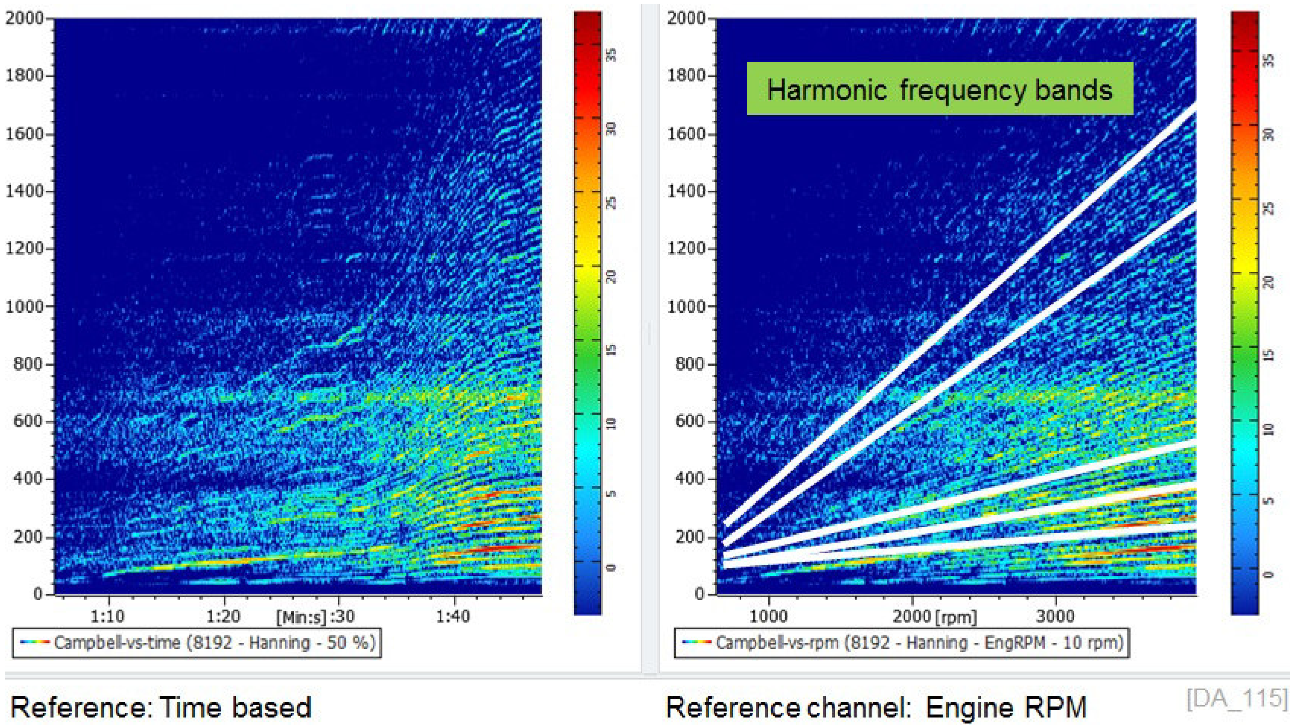
Example Resolution (number of samples considered for FFT calculation)
In order to calculate the FFT of 50 kHz raw signal, a defined number of samples (resolution) have to be taken into the calculation. In the example below a low the resolution (1024 samples) is compared by a high resolution (16384 samples). As you can see along the Y-axis the resolution is about a 50 Hz (very low) caused by the small number of samples (1024) and in contrast you see 3 Hz high frequency resolution Campbell diagram as a result of a high number (16394) of samples included in the FFT calculation.



[DA_114]

If you need to investigate high frequency resolution you should consider a high number of samples to calculate the Campbell diagram.

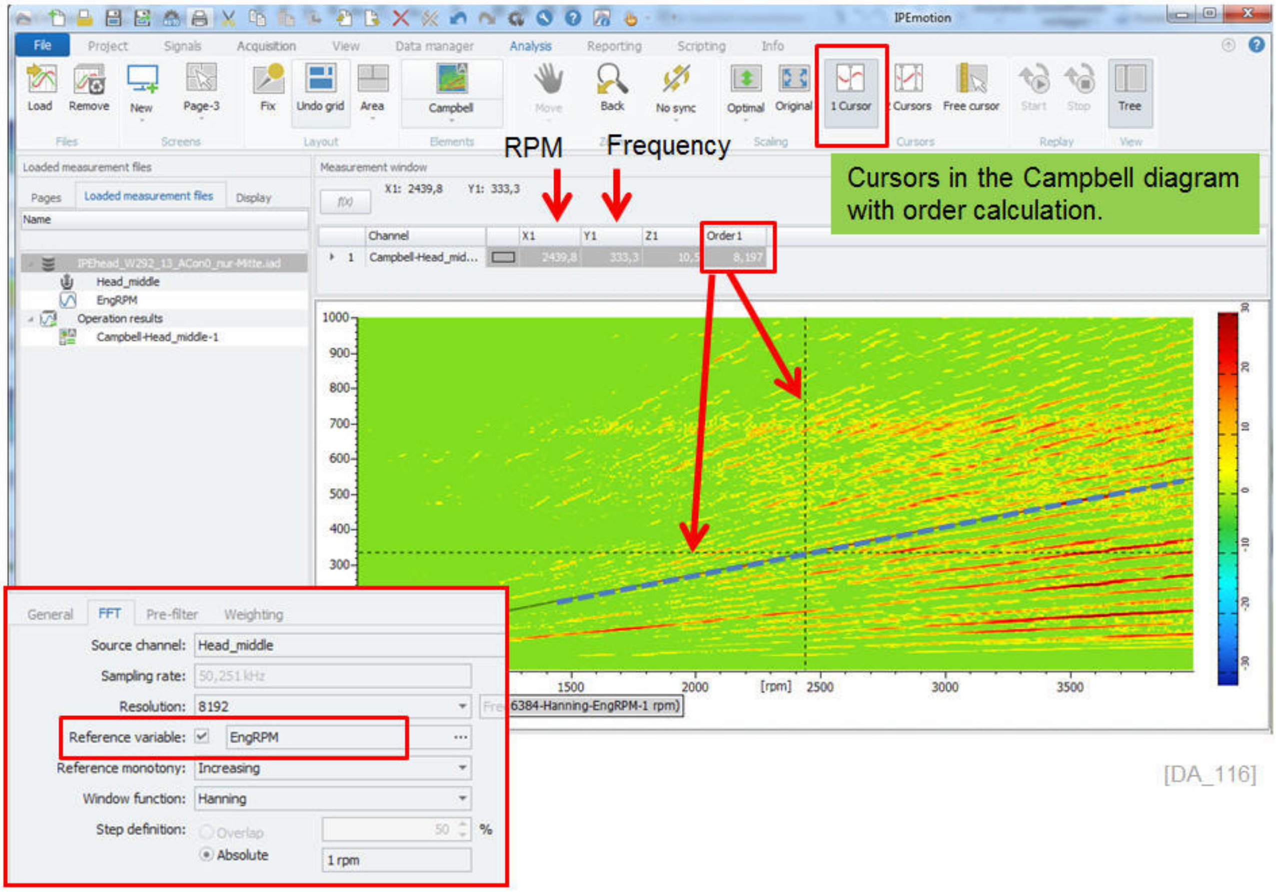
Example: Impacts of using a reference channel (non-time based Campbell)
Another configuration option is to use another reference channel than the time base. In this example the engine RPM is used to calculate the Campbell diagram.



[DA_115]

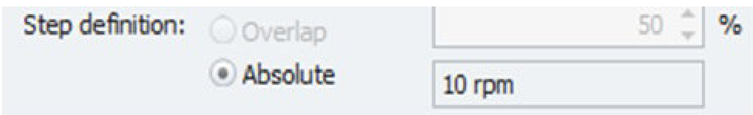
When we use a reference channel which is correlating with the vibrations and acoustic effects like the engine RPM on vehicles we see a different presentation of the Campbell diagram. The harmonic frequency bands starting from the same point and allow better analysis to identify at which engine RPM level which frequencies which high amplitudes occurred. High amplitudes are indicated in red color and indicated higher noise levels. The Campbell diagram is supporting cursors to display the order information in the measurement window. The order is available when a reference channel based on RPM is included to the Campbell operation.

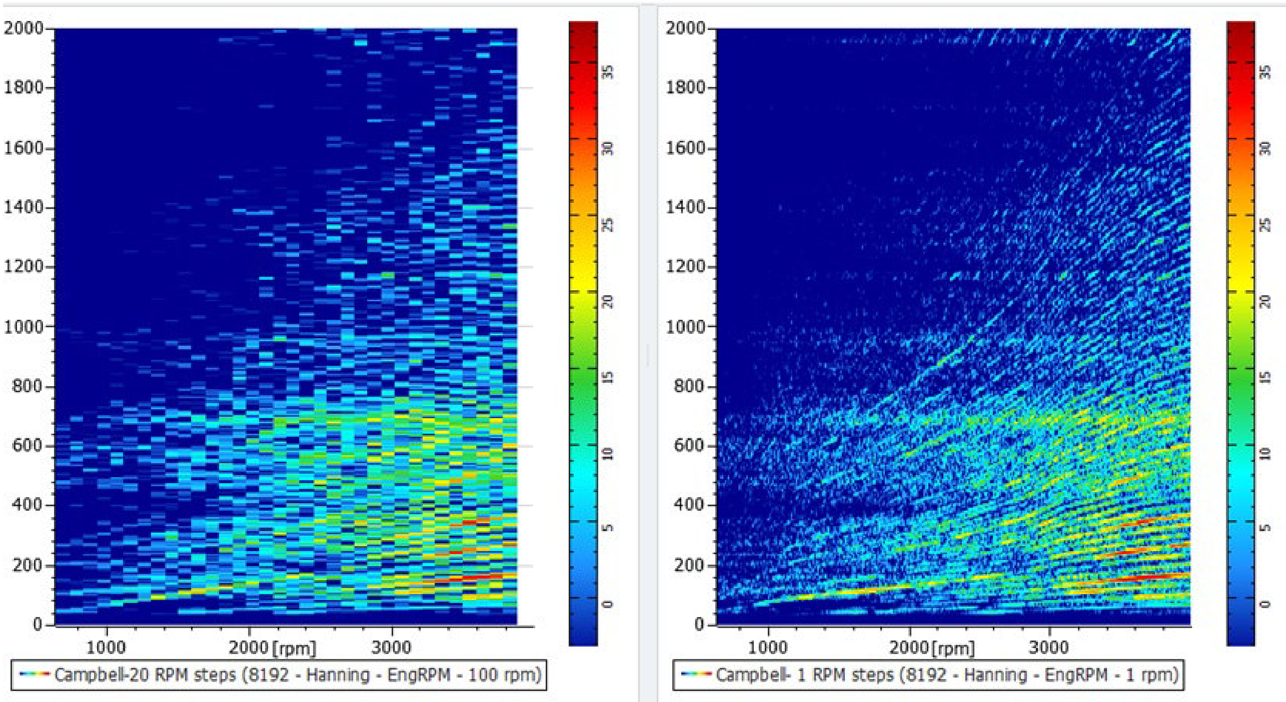
The order is calculated by the following formula: $[Order] = \frac{Frequency\,[Hz]}{\text{Reference Channel[RPM]}} * 60$ >$17 = \frac{1.000\,[\text{Hz}]}{3.500\,[\text{RPM}]} * 60$



[DA_116]

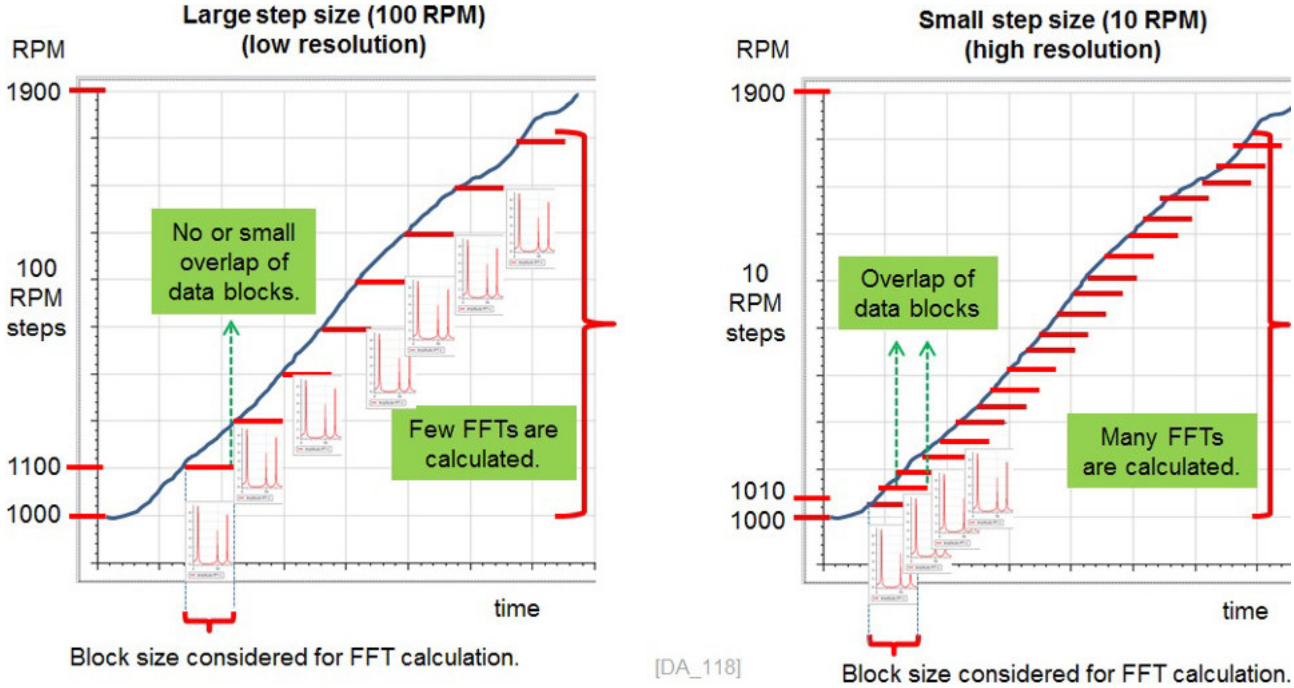
When you use a separate reference channel you have to consider the setting for the step definition in absolute value. The step definition has a big impact on the result of the Campbell diagram.





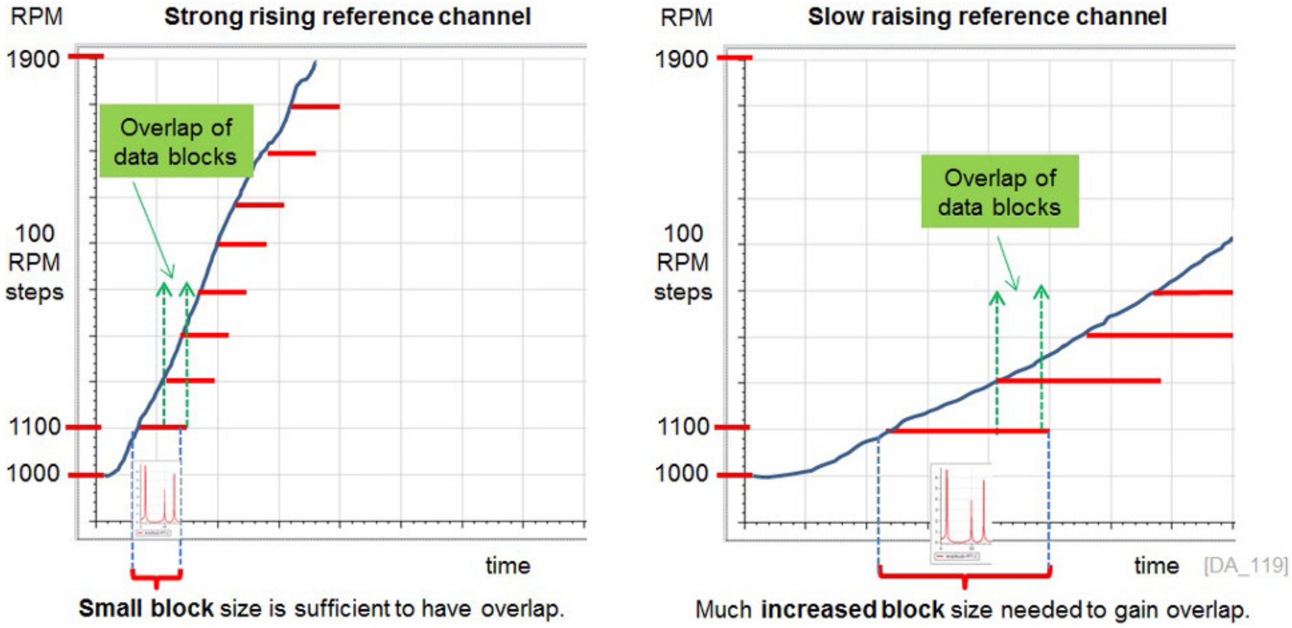
Large step size (100 RPM) Small step size (1 RPM) [DA_117]

When you consider a large step size only a few FFT are calculated and therefore the resolution of the Campbell diagram is going down. The following sketch is indicating how the step size is impacting how many FFT are calculated along the RPM profile.



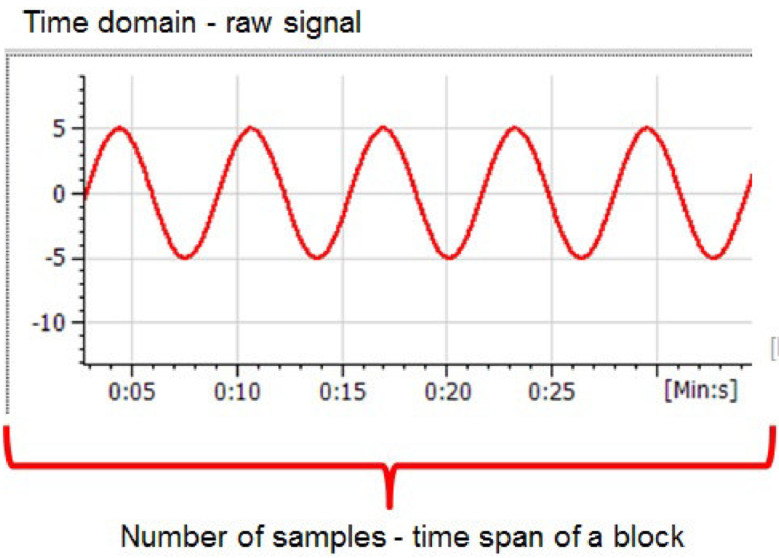
[DA_118]

A large step size and block size have an impact on how many FFT are calculated. In the example below you see how different reference profiles have impact to the FFT calculation. When the reference channel has a high gradient (strong rise) the data block for FFT reach still a good overlap when with a small block size (resolution). However when the reference signal is rising very slowly and you define a large step size you need to increase the block length (number of samples) to gain a reasonable overlap.



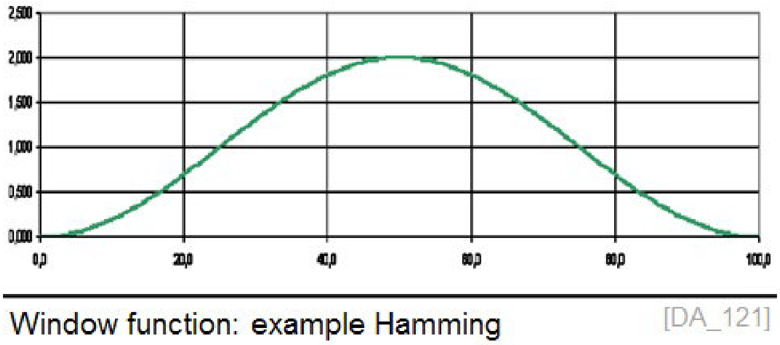
[DA_119]

Example: Impacts of the Window function and the overlap
The window functions are very important to ensure a clean FFT calculation without to many artefacts originating from the start and end section of the raw signal. The window function is smoothing the start and end section of data block before the FFT is calculated. Each wind function has a different weighting and smoothing function which has a positive impact on the frequency resolution (Hamming window) or on the amplitude accuracy.



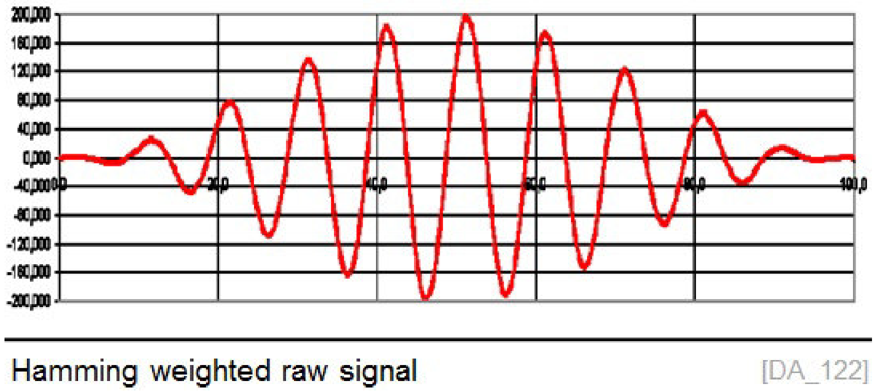
[DA_120]

With the window function in intake and outlet section of the raw signal are smoothed.



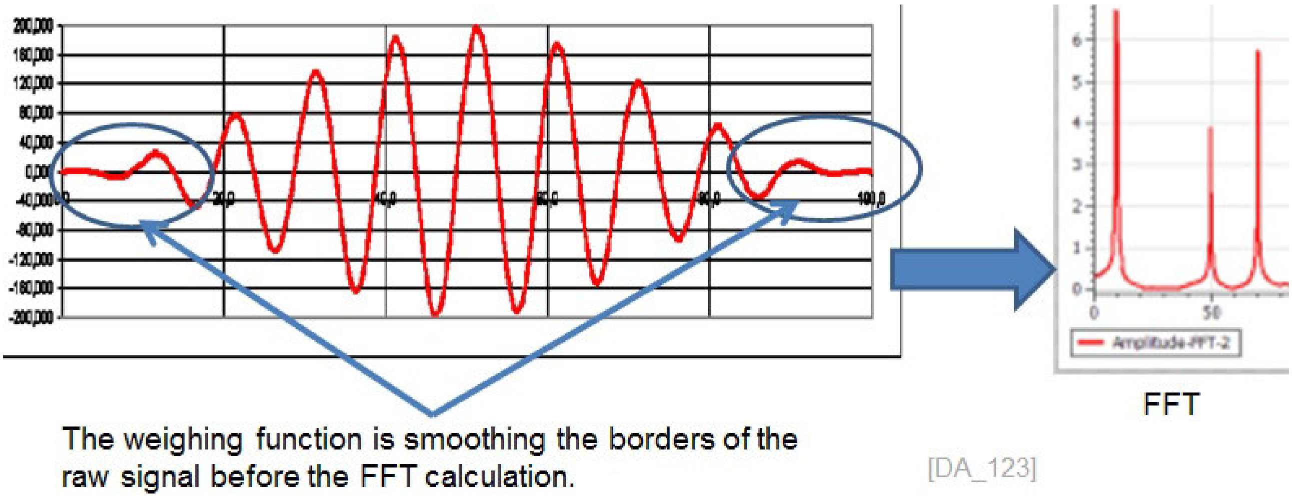
[DA_121]

This is now the hamming weighted raw signal (time domain signal).



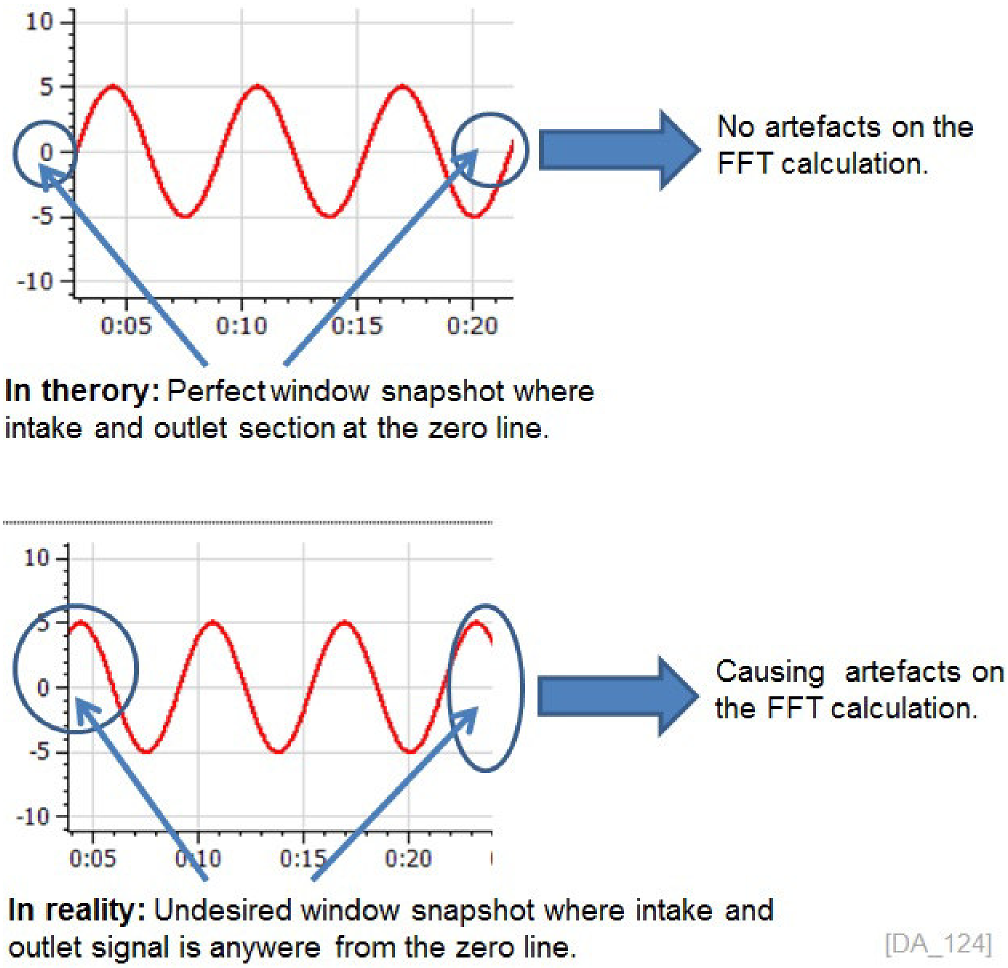
[DA_122]

A window function is very important to smooth the intake and outlet time domain signal .Otherwise the FFT is calculating because of the mathematical model unwanted (artefact) frequencies and associated amplitudes.



[DA_123]

The example below shows the same time domain signal but the window snapshot is varying and therefore the FFT calculation results from the same signal is different just because of the different waveform from the start and end section.



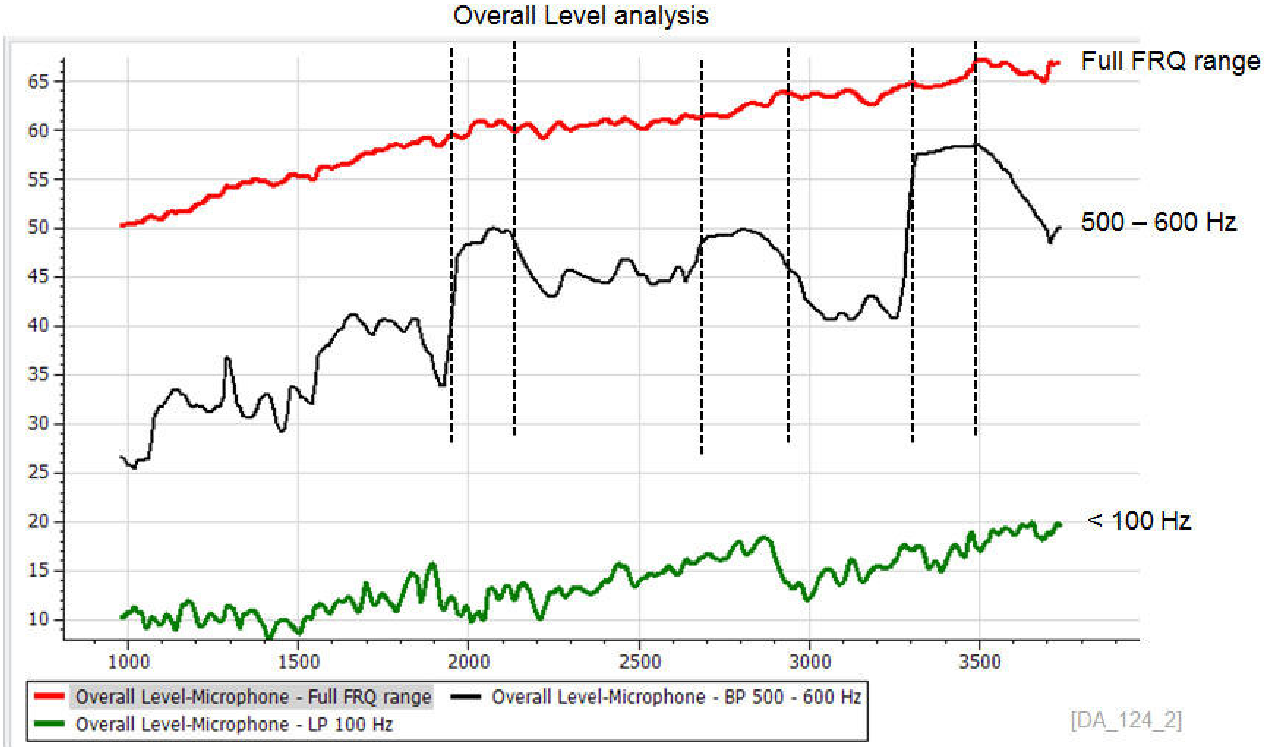
[DA_124]

18.26 Overall Level

The Overall Level operation has the same settings as the Campbell operation. With the Overall Level operation it is possible to identify which frequency ranges contribute mostly to the sound level to investigate the source of origin. The result of the operation is presented in a XY-chart. In the example below 3 overall level calculations are performed.

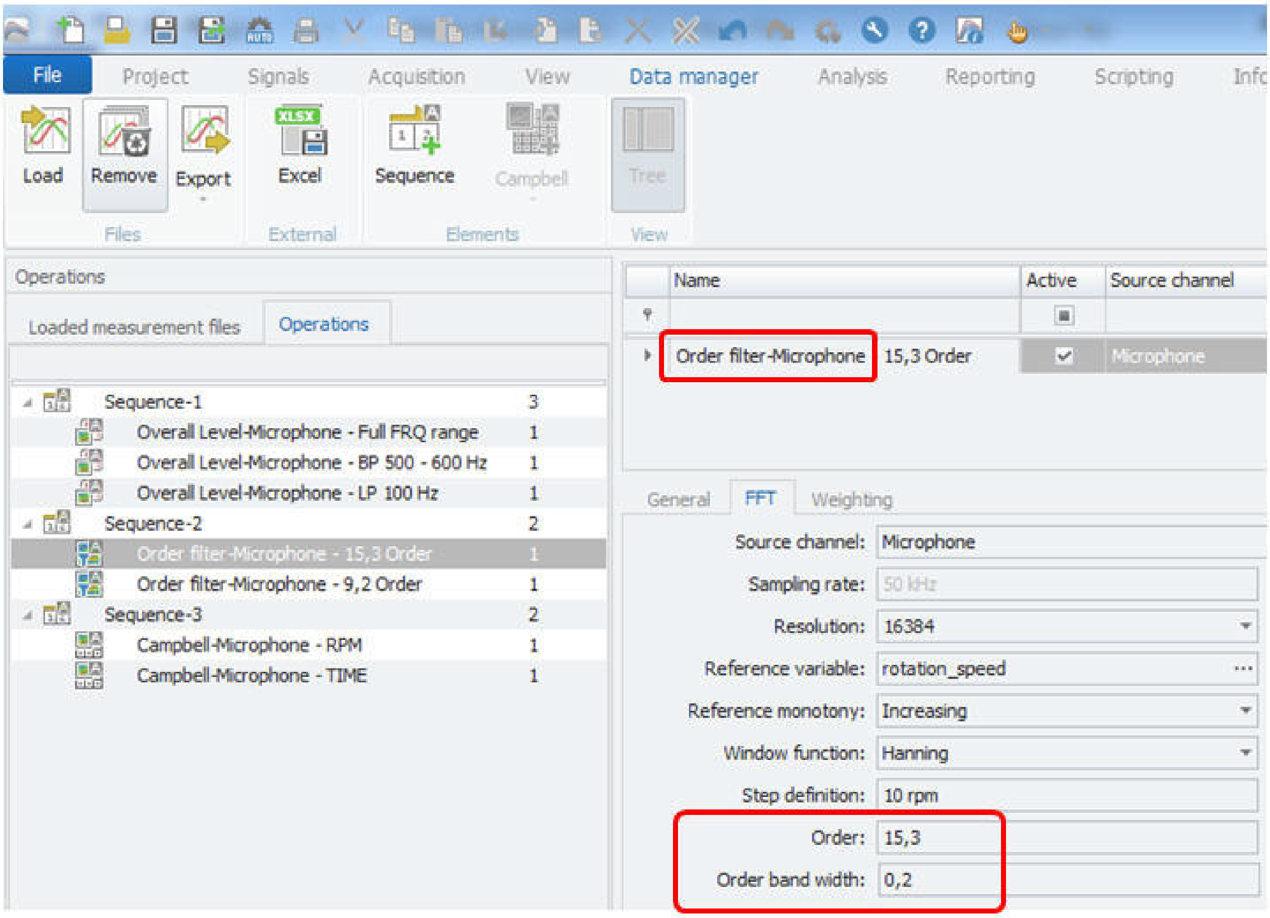
- Red line - Includes all frequencies from the raw signal (always highest signal)
- Black line - Includes only frequencies in the range of 500 âĂŞ 600 Hz
- Green line - Includes only frequencies below 100 Hz

The main use case of this operation is to identify in which frequency ranges have the main impact to the overall sound level. The black line indicates strong impacts in the 500 âĂŞ 600Hz range at 3 different RPM ranges. In this example the 2000 rpm, 2750 rpm and 3400 rpm have the highest contribution. It becomes also apparent that the low frequency range in the area of 100 Hz and smaller has only a very limited impact to the overall sound level.



18.27 Order Filter

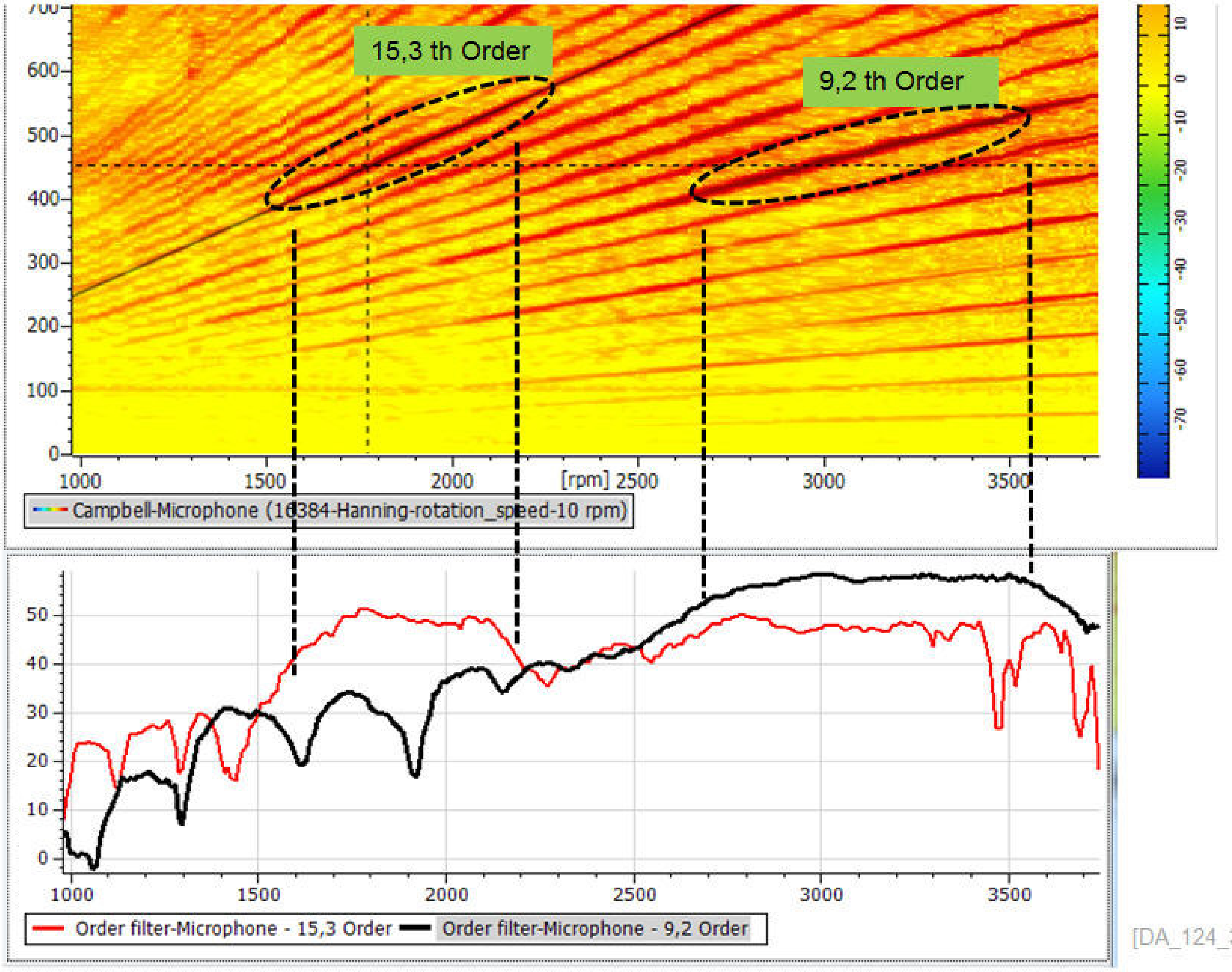
The Order Filter operation is supporting almost the same configuration settings as the Campbell operation. The main difference is that the Oder filter is not supporting any overlap configuration.



Order Filter operation [DA_124_4]

- **Order** — Here you define which order you like to analyse. To identify the orders the order cursor of the Campbell diagram can be used 18.28.6.
- **Order band width** — efines how narrow or widely you include FFT lines in the calculation .

This operation is useful to calculate the amplitudes for a specific order across the time or RPM range. The Oder filter is particularly useful in cooperation with the order cursor of the Campbell diagram. With the order cursor you can identify the order number which is of interest.



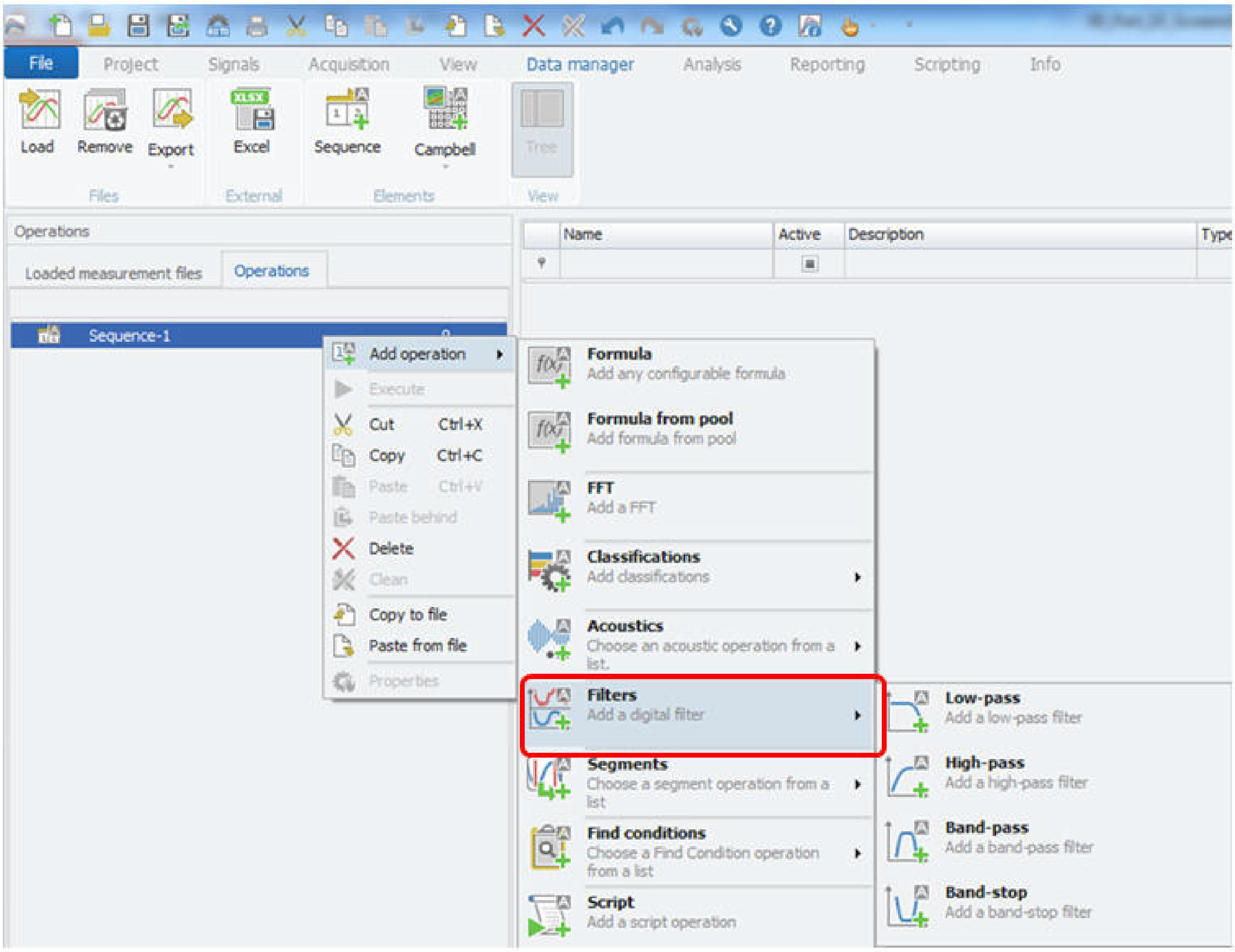
[DA_124_3]

In the example above a Campbell diagram is compared with the result of the Oder Filter. With the order cursor the two orders with high amplitudes where identify. This are the orders of 15,3 and the 9,2. The Order Filter operation is now returning exactly the amplitude level across the full RPM range. You can identify that the 15,3 order has the highest values in the RPM range 1.600 to 2.200. The 9,2 order has the highest amplitudes in the range of 2.700 to 3.500 RPM. The results between the Campbell diagram and the Order Filter operation match exactly.

18.28 Digital filters – Butterworth

18.28.1 YouTube resources

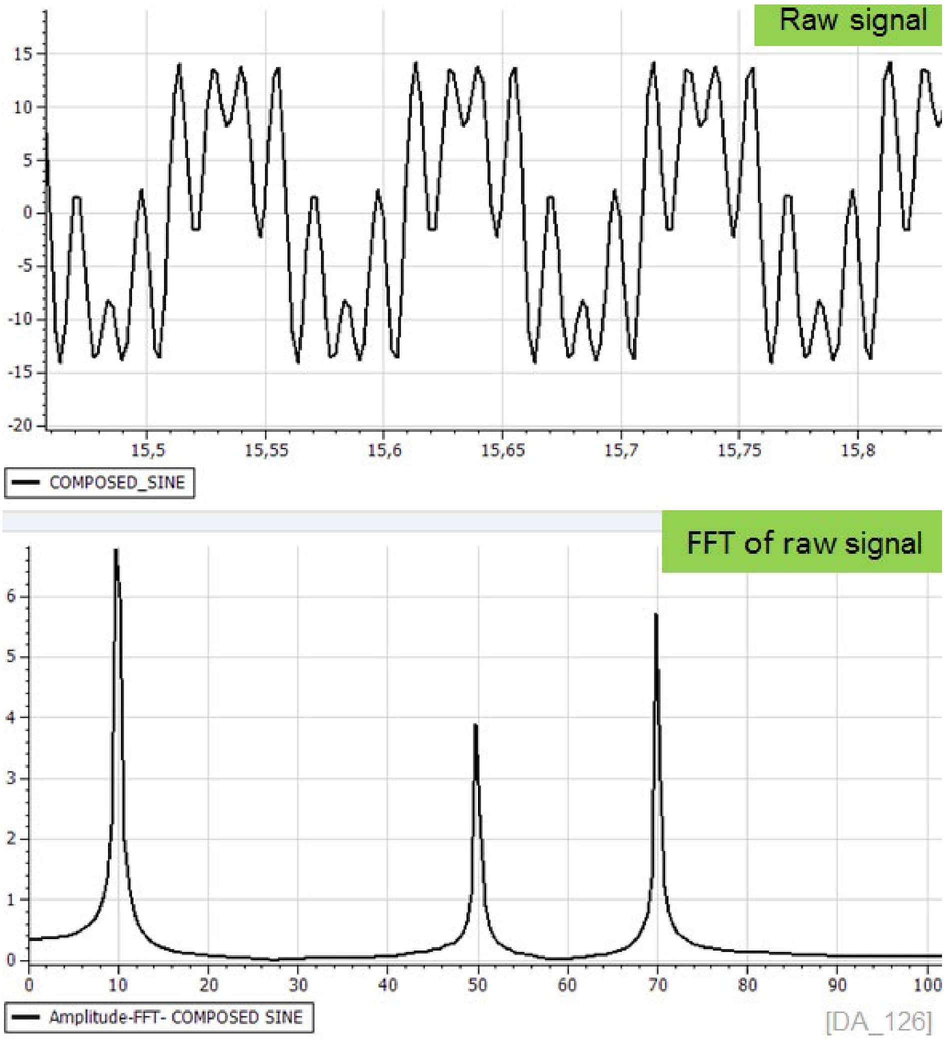
IPEmotion – Post-Processing – Digital Filters: http://youtube/SZ2_CBk1dj4
Creating digital filters for online calculations are discussed in chapter ACQUISITION 13.4. For post processing operations, the digital filters can be applied, too. Using the Butterworth filters, you can filter certain frequencies from your signal in order to avoid to e.g. anti-aliasing effects.



Create Filter operations [DA_125]

Example: FFT from an unfiltered signal

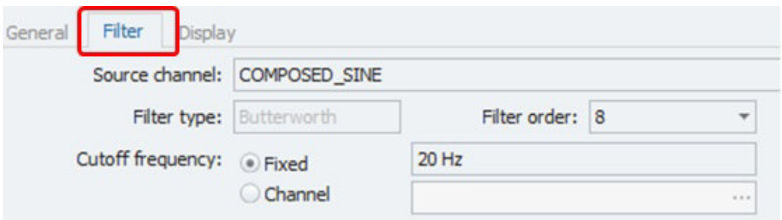
The function of different filters and the impact of filter orders will be explained by using FFTs from a noisy source signal e.g. with 3 main defined frequencies of 10 Hz, 50 Hz and 70 Hz.



[DA_126]

18.28.2 Low pass filter

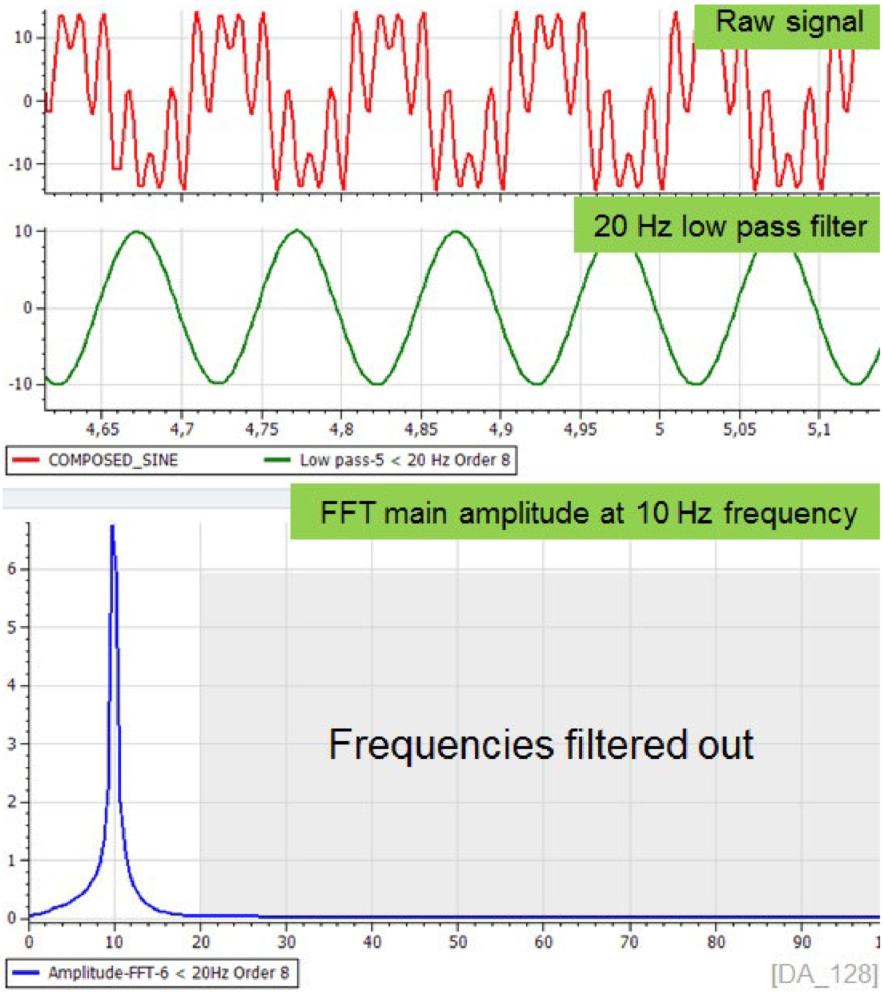
With the low pass filter you will only keep frequencies below cut-off frequency.



[DA_127]

► Source channel	Select the source channel which should be filtered.
► Filter order	Filter order can be defined between 1 and 8 poles. Higher filter orders will increase the strength of the filter as demonstrated in chapter 18.28.6.
► Filter type	Fixed defined as Butterworth.
► Cut-off frequency	In this case defined as low pass frequency.
► Channel	Here you can define a variable channel as parameter for the operation. See example 18.32.

Example: Low pass filter
If you e.g. set the cut-off frequency to 20 Hz, all signals below 20Hz can pass the filter and all higher frequencies are blocked as indicated below.



[DA_128]

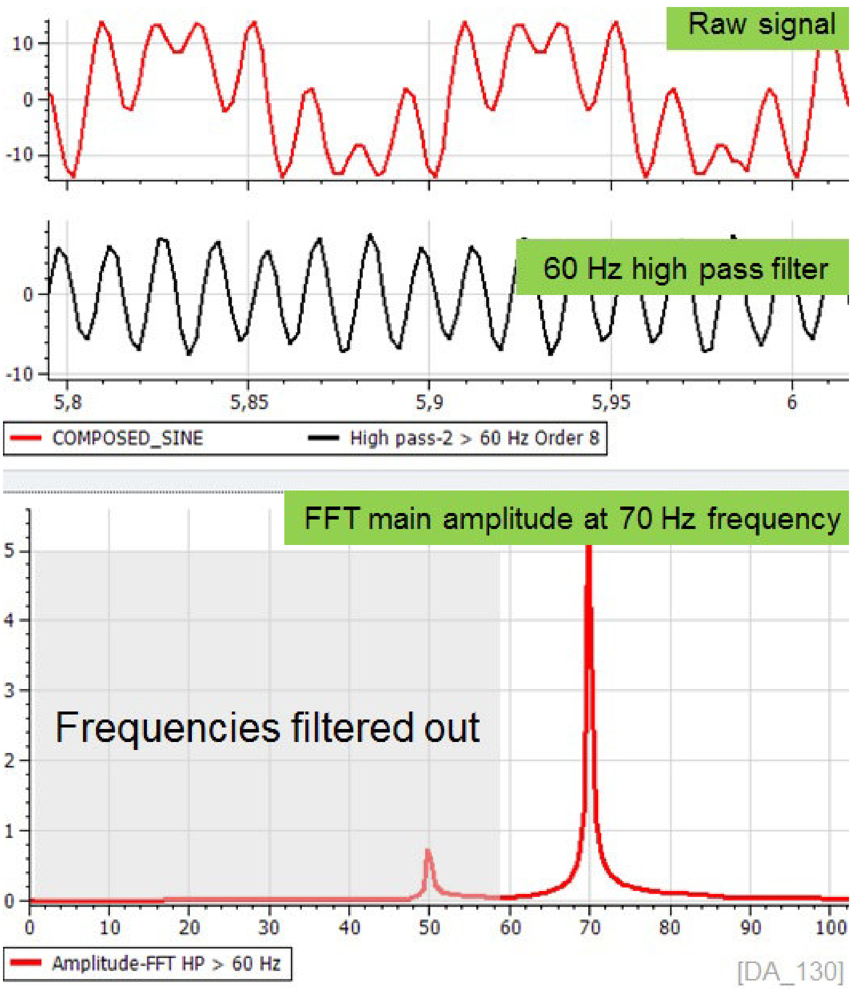
18.28.3 High pass filter

The high pass filter will allow all frequency to pass which are above the cut-of frequency.

[DA_129]

- Source channel — Select the source channel which should be filtered.
- Filter order — Filter order can be defined between 1 and 8 poles. Higher filter orders will increase the strength of the filter as demonstrated in chapter 18.28.6.
- Filter type — Fixed defined as Butterworth.
- Cut-off frequency — In this case defined as low pass frequency.
- Channel — Here you can define a variable channel as parameter for the operation. See example 18.32.

Example: High pass filter >60 Hz
If you e.g. set the cut-off frequency to 60 Hz, all signals over 60Hz can pass the filter and all smaller frequencies are blocked as indicated below.

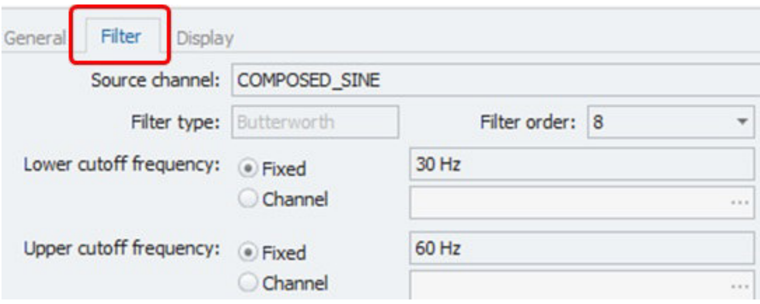


[DA_130]

Note: Filters are not perfect and cannot shut of the undesired frequencies completely. There are still around the cut-off frequency >60Hz some undesired signal components as indicated at 50Hz.

18.28.4 Band pass filter

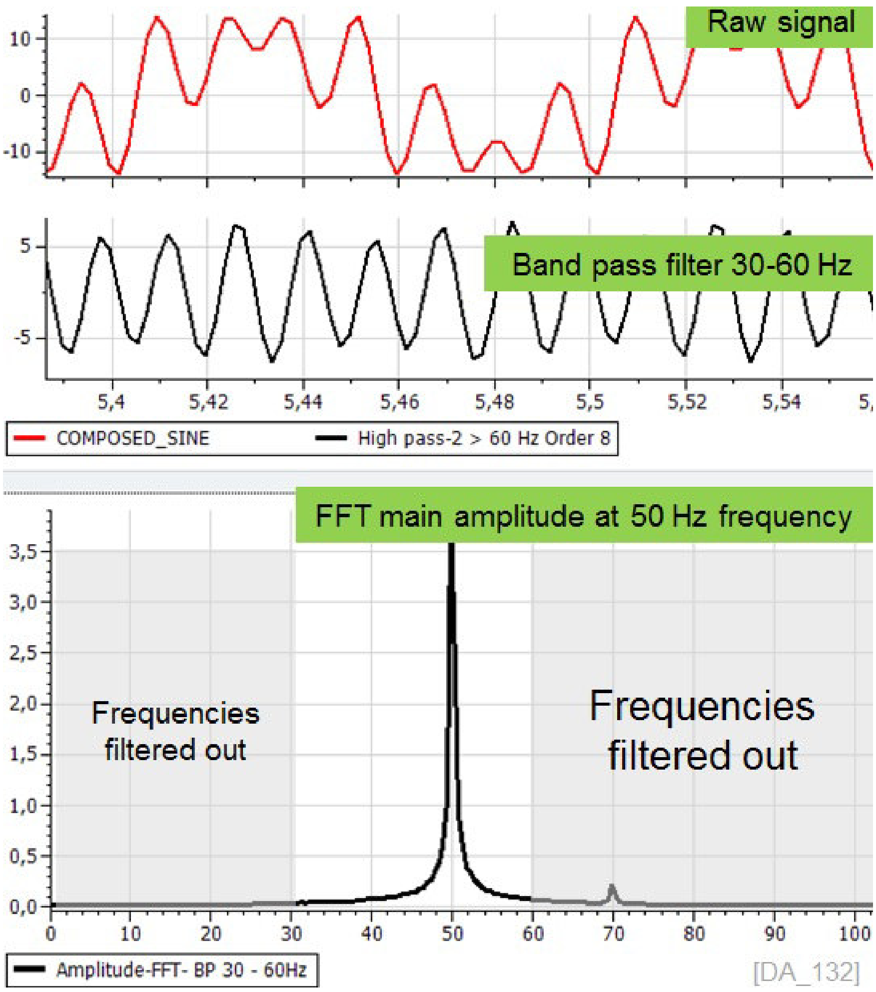
The Band pass filter will only accept and pass frequencies which are in between the lower and upper band.



[DA_131]

- **Source channel** — Select the source channel which should be filtered.
- **Filter order** — Filter order can be defined between 1 and 8 poles. Higher filter orders will increase the strength of the filter as demonstrated in chapter 18.28.6.
- **Filter type** — Fixed defined as Butterworth.
- **Lower cut-off frequency** — In this case defined as lower pass frequency.
- **Upper cut-off frequency** — In this case defined as highest frequency to pass.
- **Channel** — Here you can define a variable channel as parameter for the operation. See example 18.32.

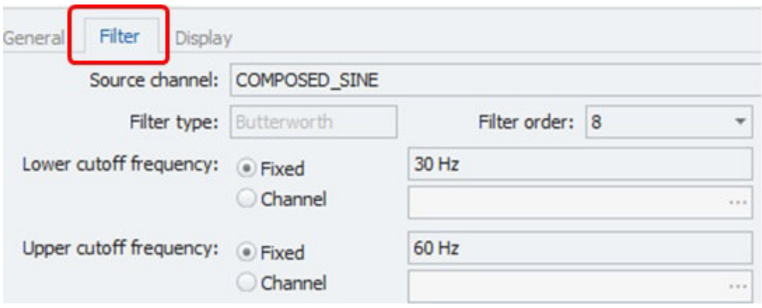
Example: Band pass filter in the range of 30 – 60 Hz
If you e.g. set. the cut-off frequency in the range of 30 - 60 Hz, all frequency signals below 30 Hz and over 60 Hz are filtered out.



[DA_132]

18.28.5 Band stop filter

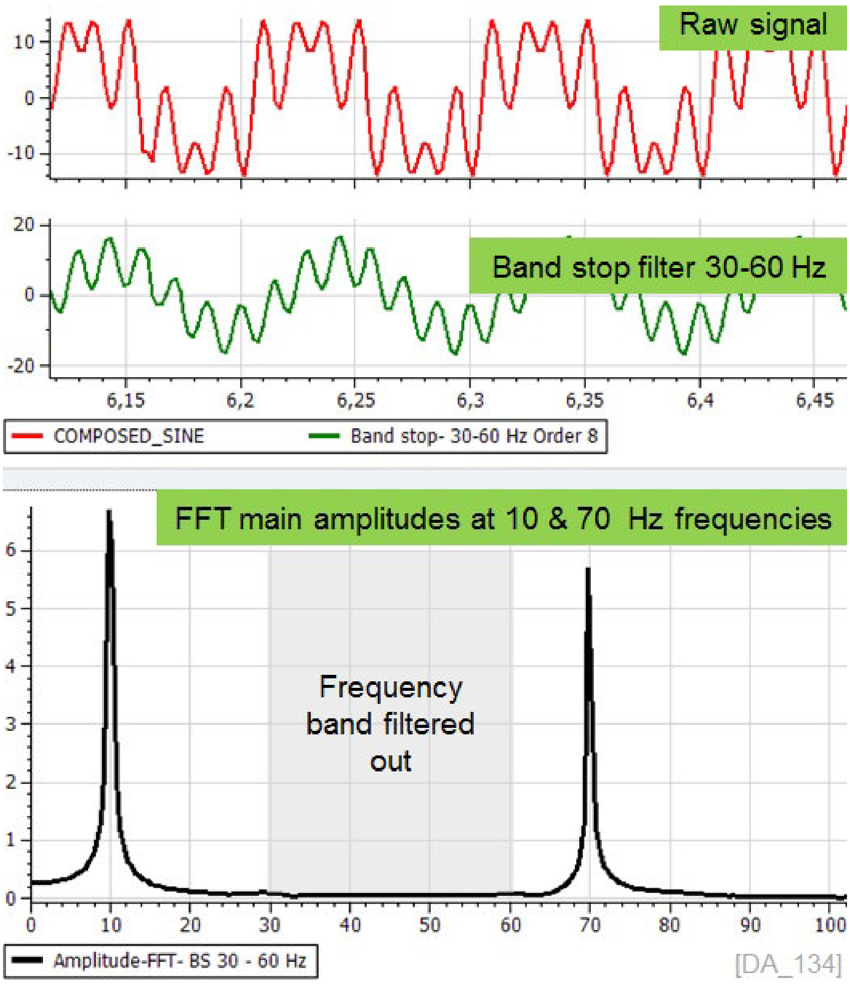
This filter will stop and depress all frequency components which are lying with the lower and upper cut-off frequency. It is principally an inverted band filter.



[DA_133]

- ► Source channel — Select the source channel which should be filtered.
- ► Filter order — Filter order can be defined between 1 and 8 poles. Higher filter orders will increase the strength of the filter as demonstrated in chapter 18.28.6.
- ► Filter type — Fixed defined as Butterworth.
- ► Lower cut-off frequency — In this case defined as lower pass frequency.
- ► Upper cut-off frequency — In this case defined as highest frequency to pass.
- ► Channel — Here you can define a variable channel as parameter for the operation. See example 18.32.

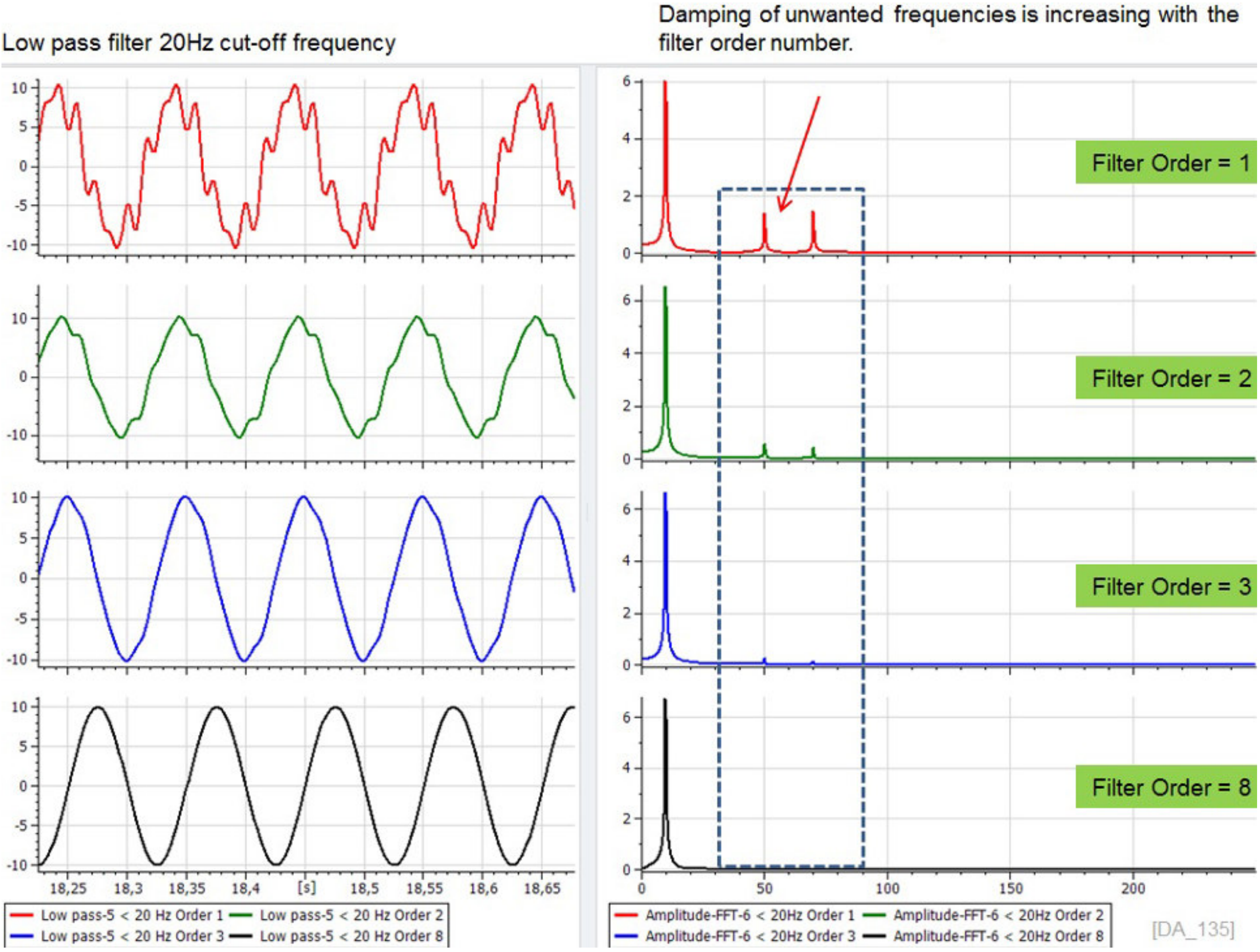
Example: The band stop filter in the range between 30 – 60 Hz
If you e.g. set the cut-off frequency in the range of 30 - 60 Hz, all frequency signals within 30 Hz and up to 60 Hz are filtered out.



[DA_134]

18.28.6 Impact of the filter order

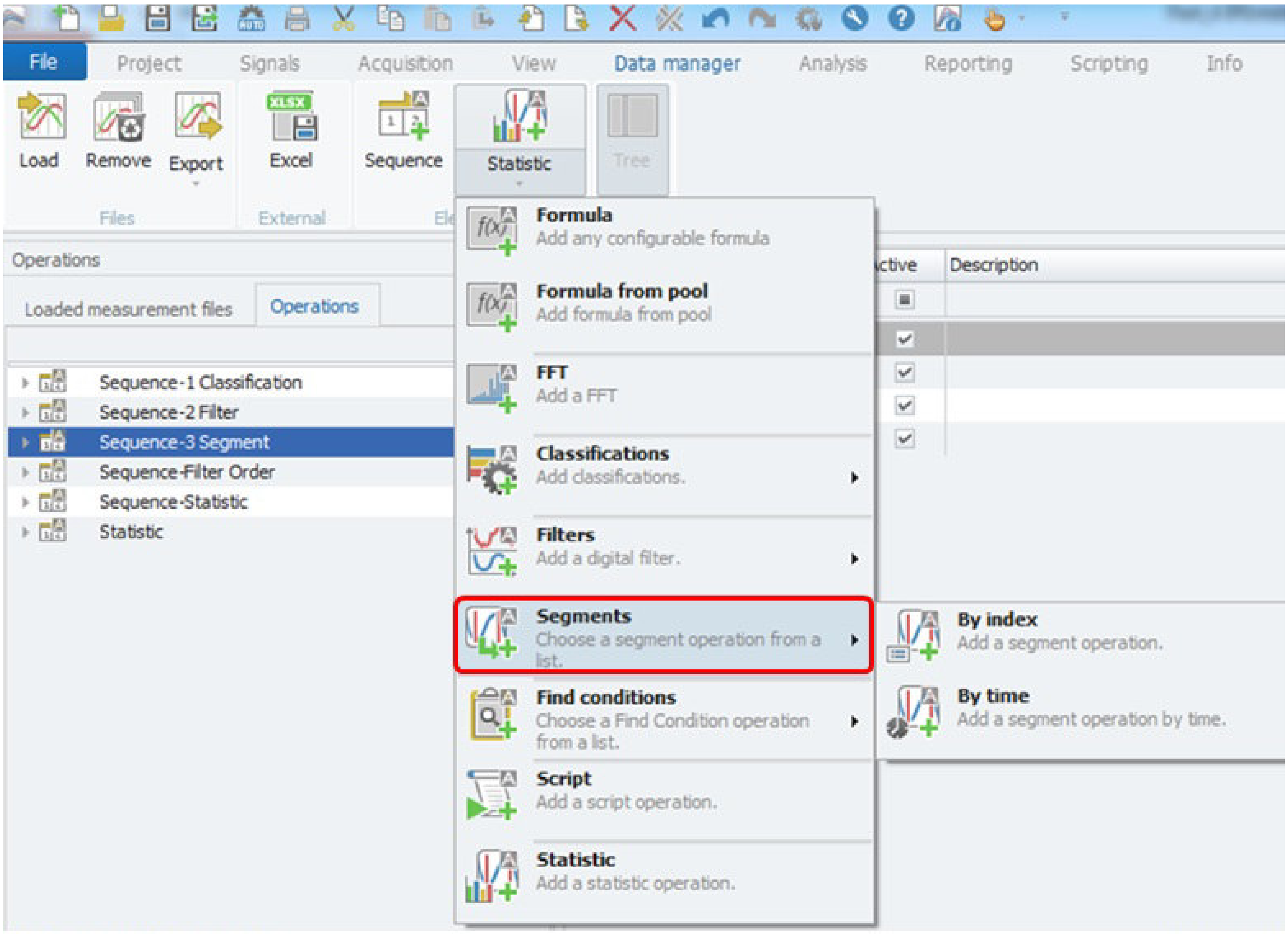
The filter order is ranging from 1 to 8. A higher order number is increasing the filter strength and the damping of the unwanted frequencies is increasing.



[DA_135]

18.29 Segment

With the segment operation you can cut out a defined section of a source channel.

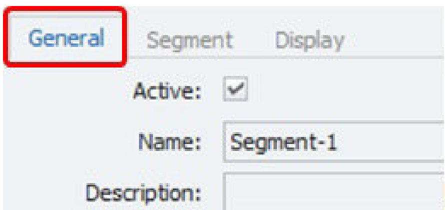


Segment operation [DA_136]

18.29.1 Youtube Resources

IPEmotion – Post-Processing – Segment Operation: http://youtu.be/cAfTi8ILXyA

18.29.2 General – tab sheet



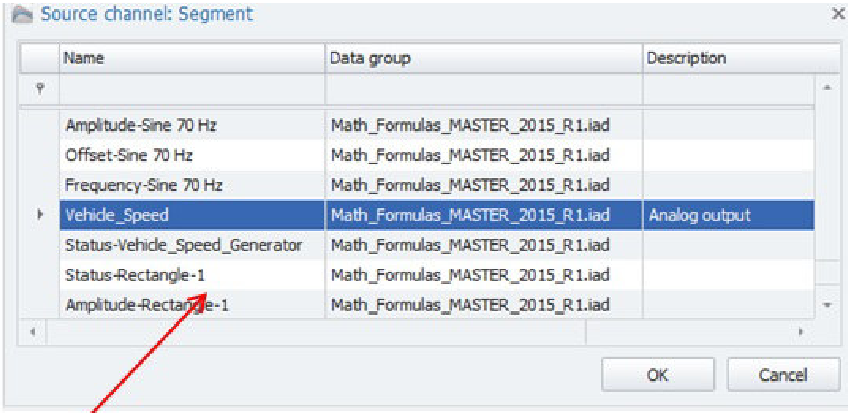
[DA_137]

- Active — This checkbox activates / deactivates the segment operation.
- Name — Refers to the name of the segment.
- Description — Here you can add an additional description for the segment.

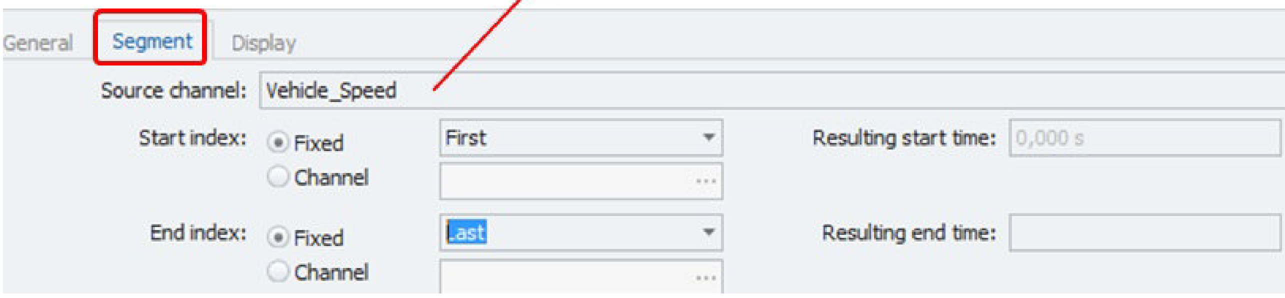
18.29.3 Segment by INDEX – tab sheet

In this tab sheet you define the source channel and the start and stop data point.

- Source channel — Here you select any channel from the loaded data files. The segment operation cannot access any post calculated channels.



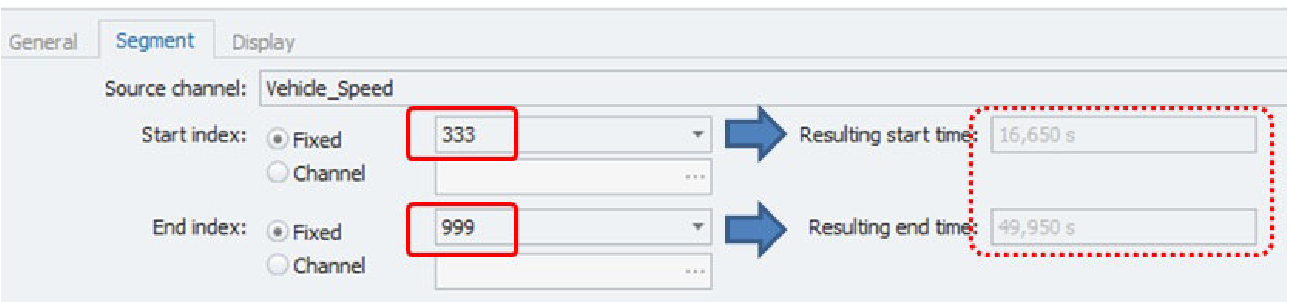
[DA_138]



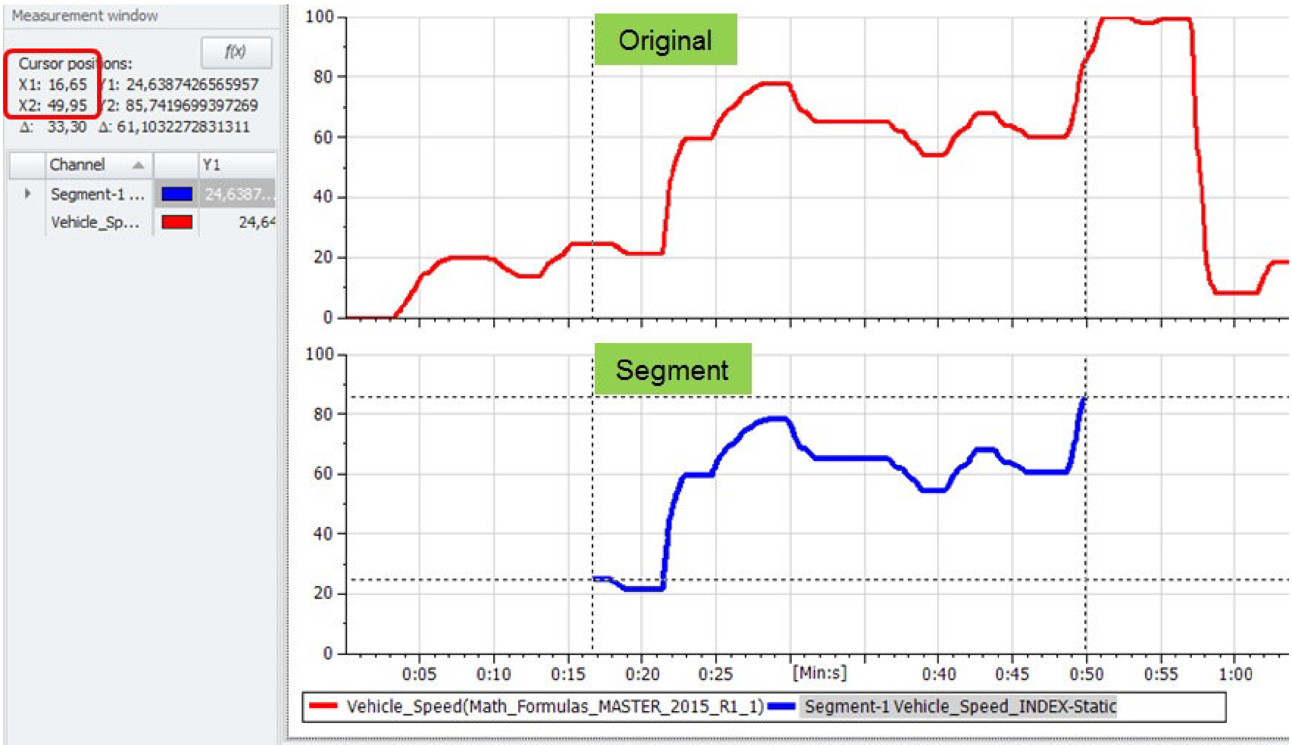
- Start index — Here you define the first sample to start with. Default value is "First".
- Resulting start time — The software is converting the start index into a start time point.
- End index — Here you define the last sample you like to stop. Default value is "Last".
- Resulting end time — The software is converting the end index into an end time point.
- Channel — Here you can define a variable channel as parameter for the operation.

Example: Fixed start Index

Define static Start / End index.



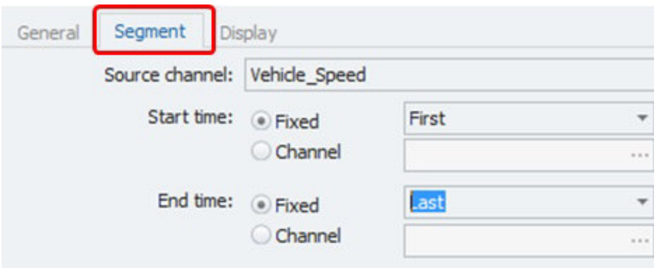
[DA_139] Corresponding time points are calculated.



Segment operation example. [DA_140]

18.29.4 Segment by TIME – tab sheet

Another segment configuration option is to define the start and endpoint by time in [s].



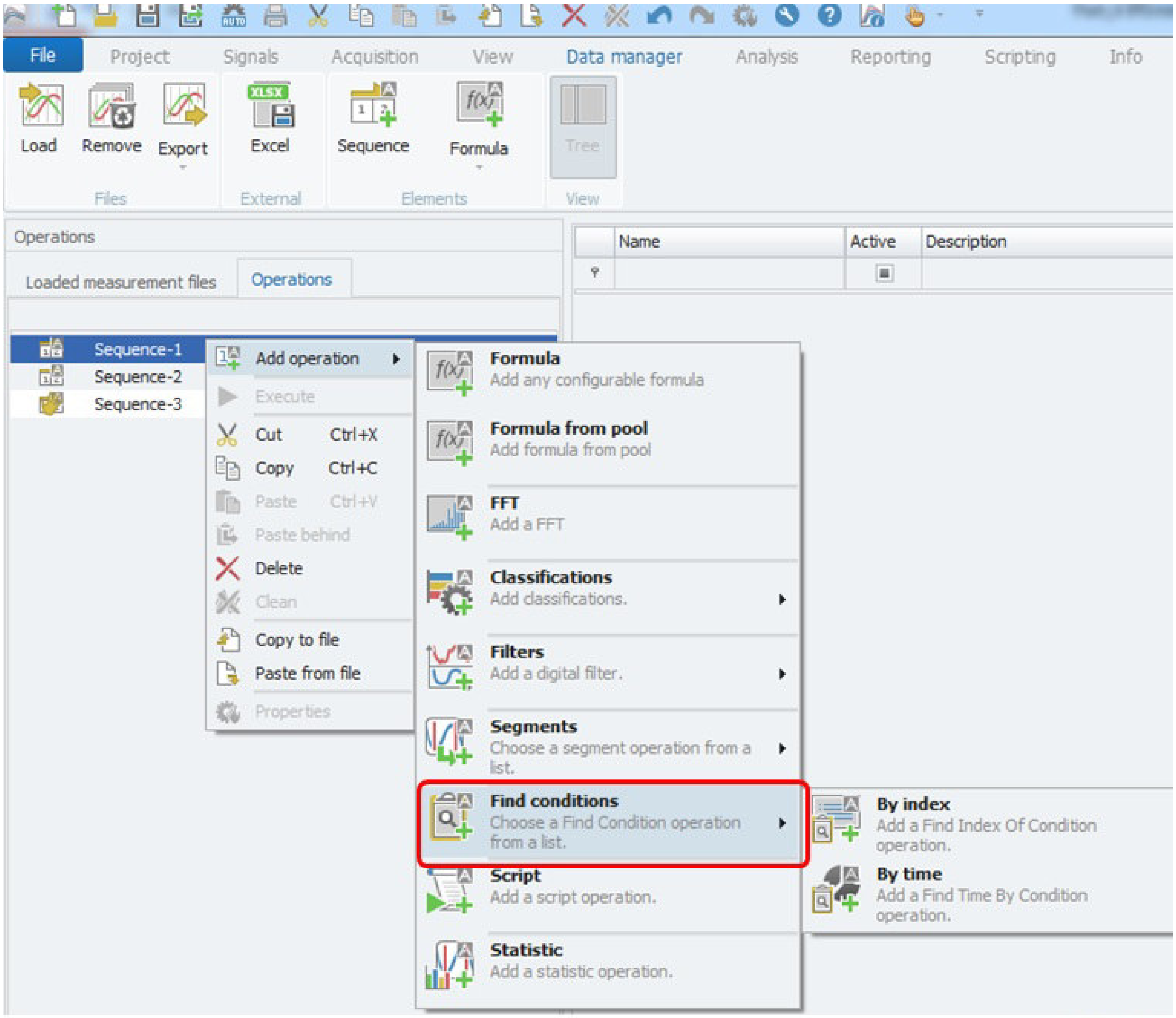
Segment defined by time point. [DA_141]

- **Start time** — Here you define the start time point. Default value is First.
- **End time** — Here you define the end time point. Default value is Last.
- **Channel** — Here you can define a variable channel as parameter for the operation. See example 18.32.

18.30 Find conditions

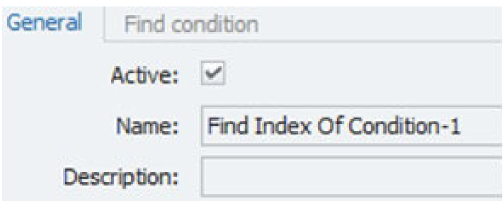
18.30.1 Youtube Resources

IPEmotion – Post-Processing – Find Conditions: http://youtu.be/8VK8jYINEZ4
With the find condition operation you can search for specific index or time point.



Find conditions [DA_142]

18.30.2 General – tab sheet

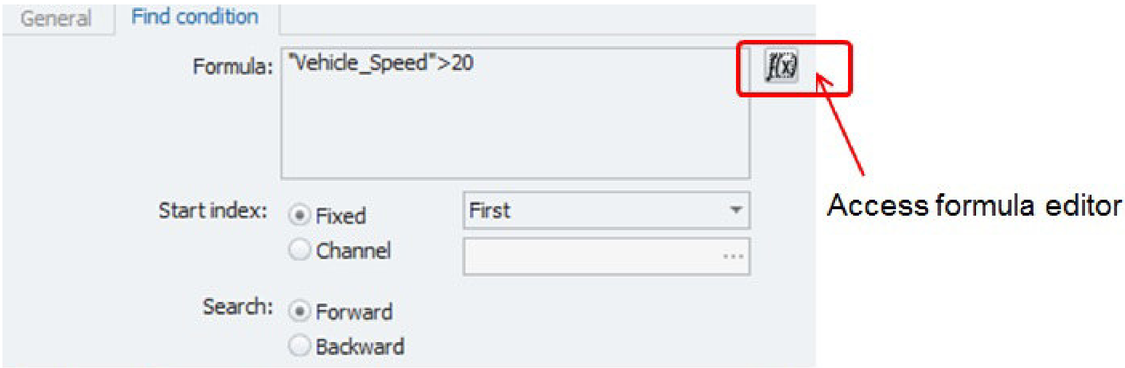


[DA_143]

- Active — This checkbox activates / deactivates the script operation.
- Name — Refers to the name of the script operation.
- Description — Here you can add an additional description for the script.

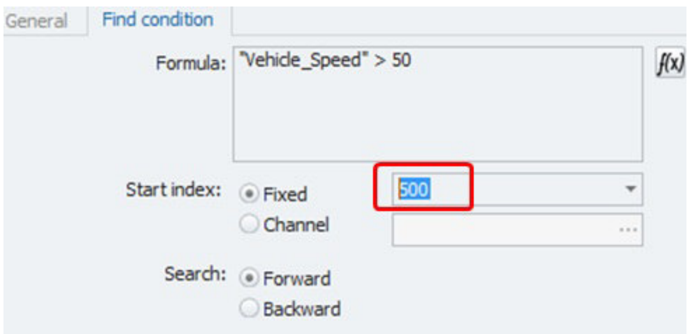
18.30.3 Find condition by index / time – tab sheet

When you select the find condition by index or time the search result will be either a specific index or a time point. The output of this index can be considered as input for the segment operation.



Find condition – returns index [DA_144]

- **Formula** Define your math or logic operation to search for a specific event. For more information how to use the formula interface see section 18.13.
- **Start Index** In the fixed radio button you can select from the drop down list if you like to start from the beginning with the first measurement, or if you like to start searching from the end. This drop down list is a drop / edit field and you can define your individual start index or time point.

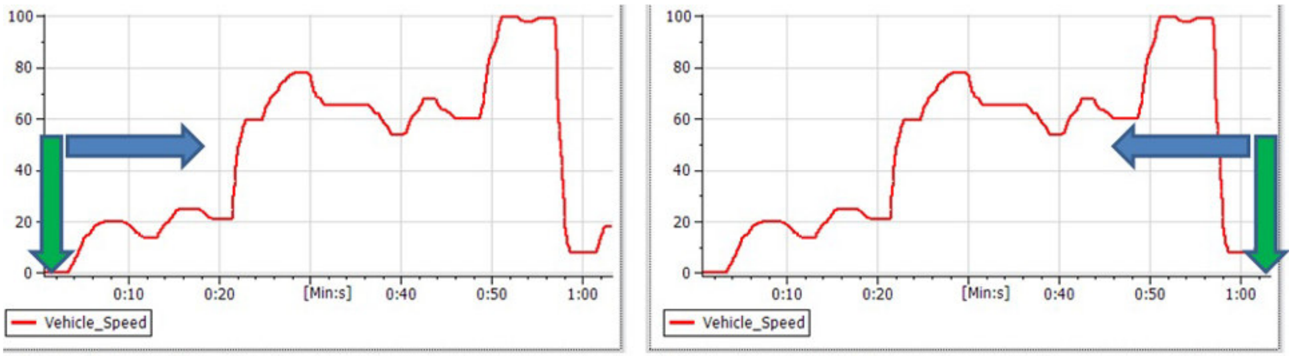


Start index: drop / edit field [DA_145]

This setting First or Last as to be selected in relation with the search direction.

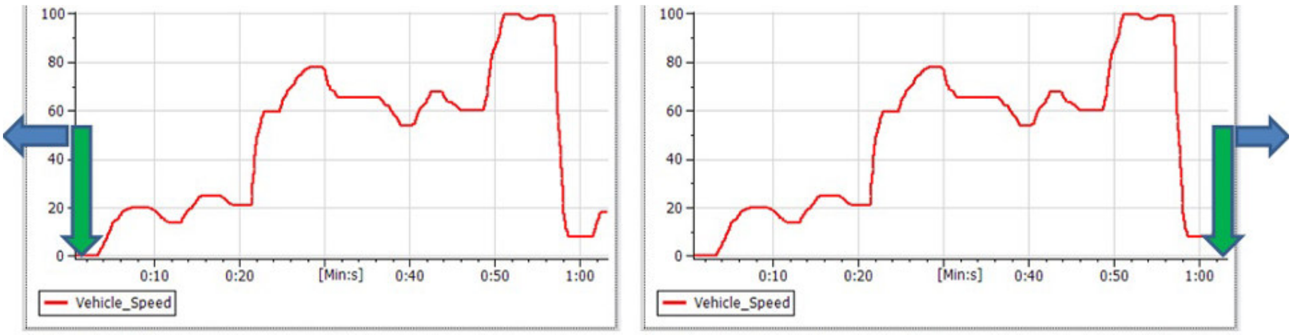
- **Channel** Here you can define a variable channel as parameter for the operation. See example 18.32.
- **Search** Define the search direction. Forward is searching from the beginning of the data recording. Backward is searching for the end time point.

Example 1:
Start index and search direction have to be defined logically correct to get the desired results. This configuration is able to generate search results.



First and forward Last and backward [DA_146]

When the search start point and direction are configured like this you will not identify any reasonable result.



First and backward – no result Last and forward – no result [DA_147]

Example 2:
The following analysis screen shows the different results (index or time) of the same find conditions.

[DA_148]

Example 3:
Search direction with different output results for the same condition depending on the search direction.

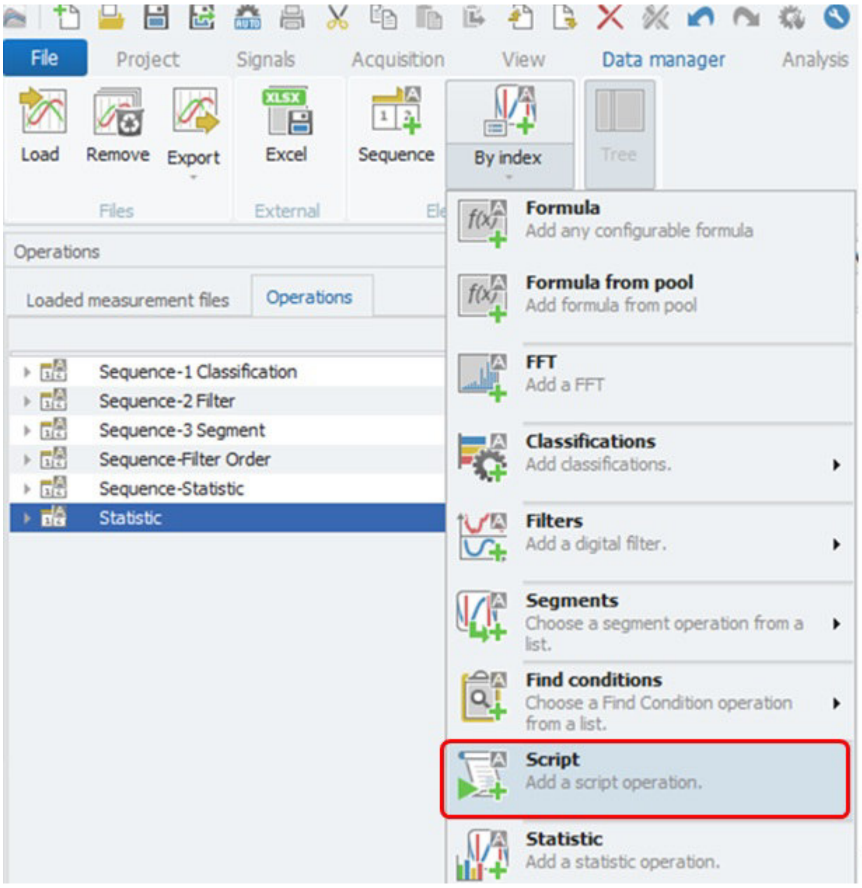
Forward search from first data record.

Backward search from last data record.

[DA_149]

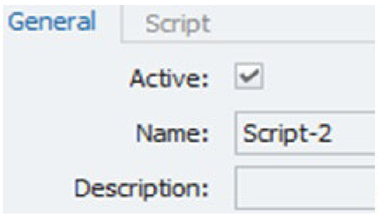
18.31 Script

The post processing functions are supporting scripting operations, too. In the sequence of operations you can add scripts to perform any function you like to apply to channels and the data file. The script gives you a lot of flexibility to perform individual calculations which are not available through the point and click GUI interface.



[DA_150]

18.31.1 General – tab sheet

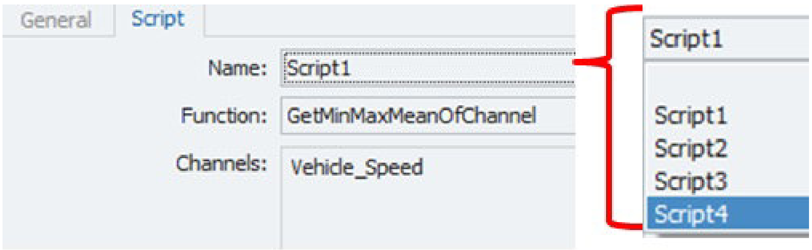


[DA_151]

► Active	This checkbox activates / deactivates the script operation.
► Name	Refers to the name of the script operation.
► Description	Here you can add an additional description for the script.

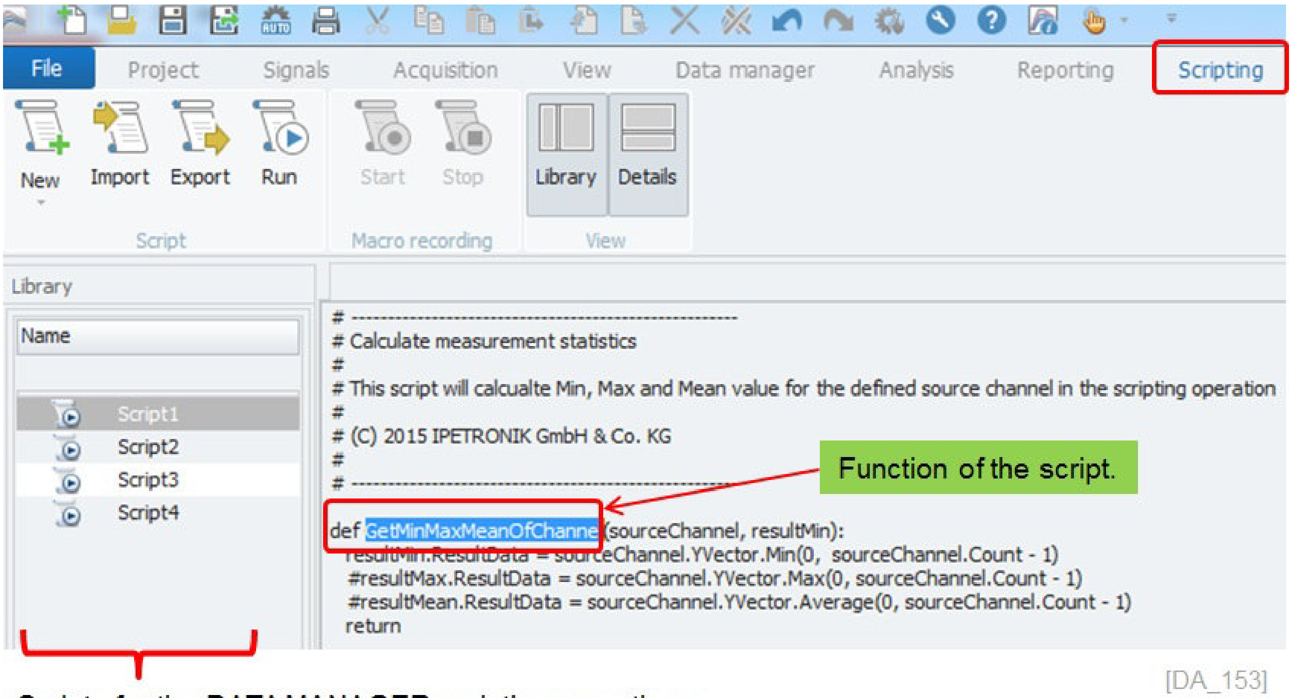
18.31.2 Script – tab sheet

In the script tab sheet you configure the following parameters.



Select script from pull down list. [DA_152]

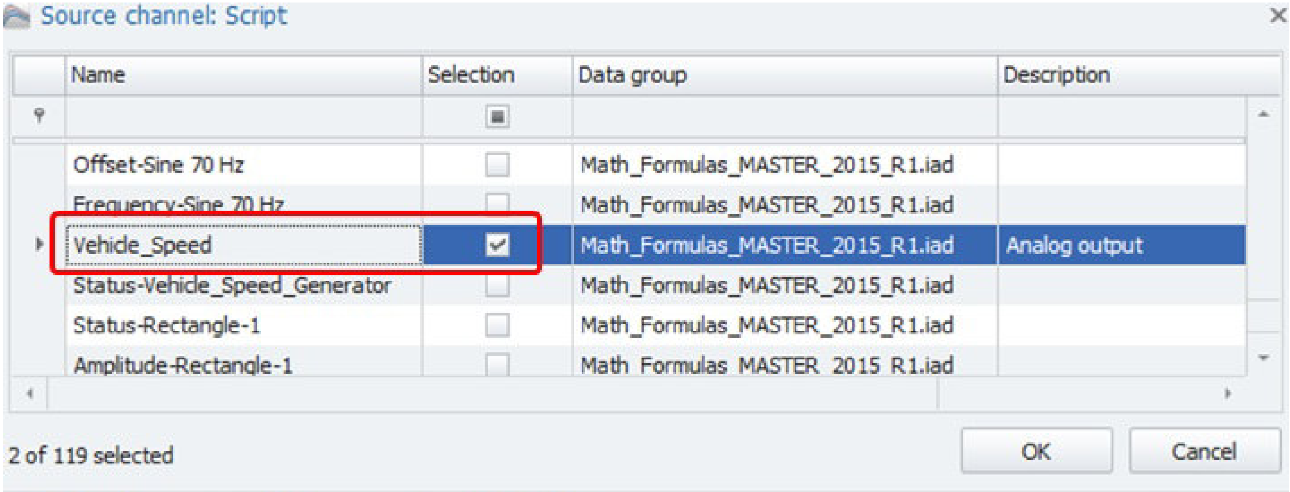
- ► Name — Here you select the script you like to use for the data processing from a drop down list. In order to be able to select a script, you need to define the script in the SCRIPTING work space. The SCRIPTING work space is only available in the Demo, Student, Professional, Developer and Analysis Edition.



[DA_153]

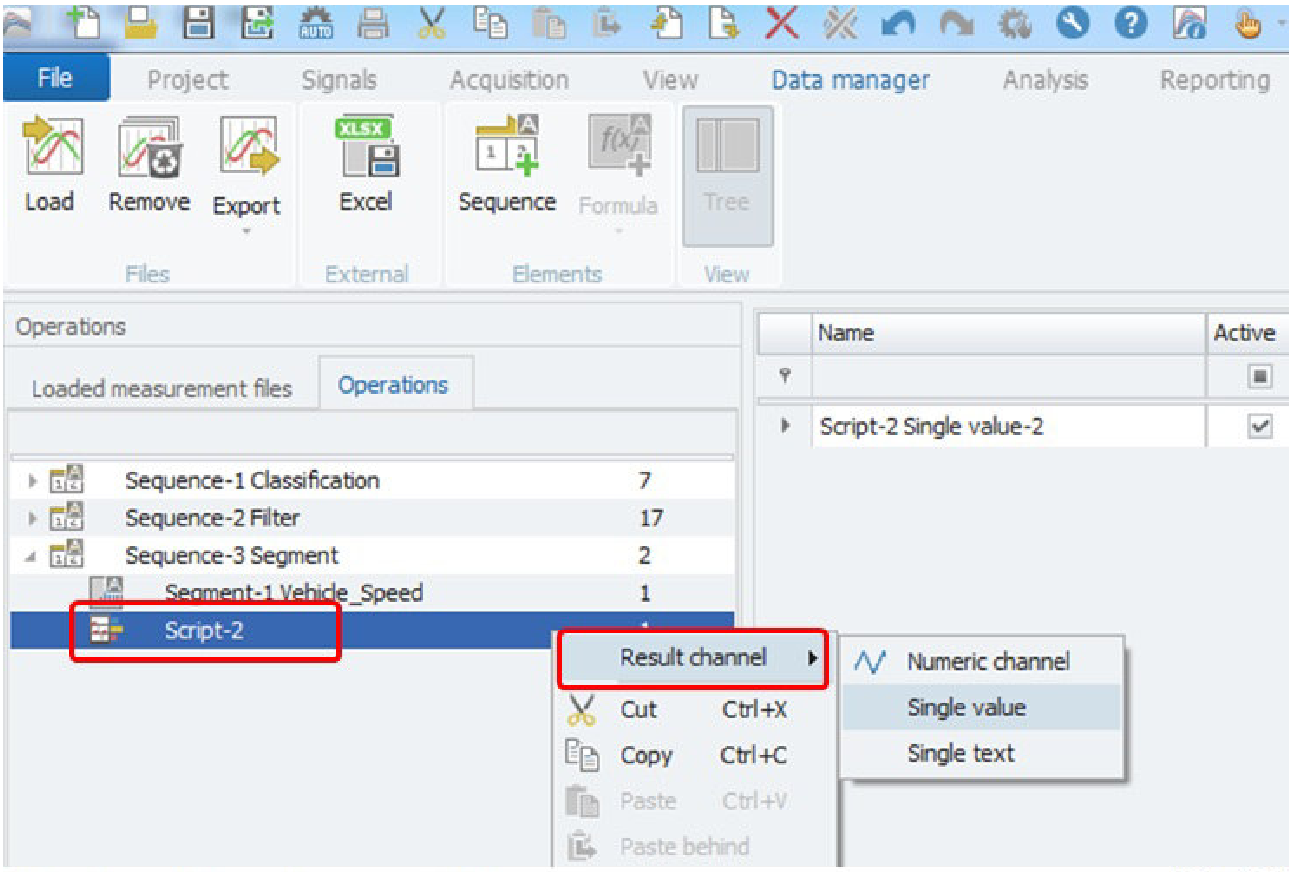
Scripts for the DATA MANAGER scripting operations.

- ► Function — Here you define within the script the function you like to execute. The function is defined in the script.
- ► Channels — Here you can select the relevant channels you like to consider for the script from the list of all channels of the data file.



Select channel(s) from loaded data file. [DA_154]

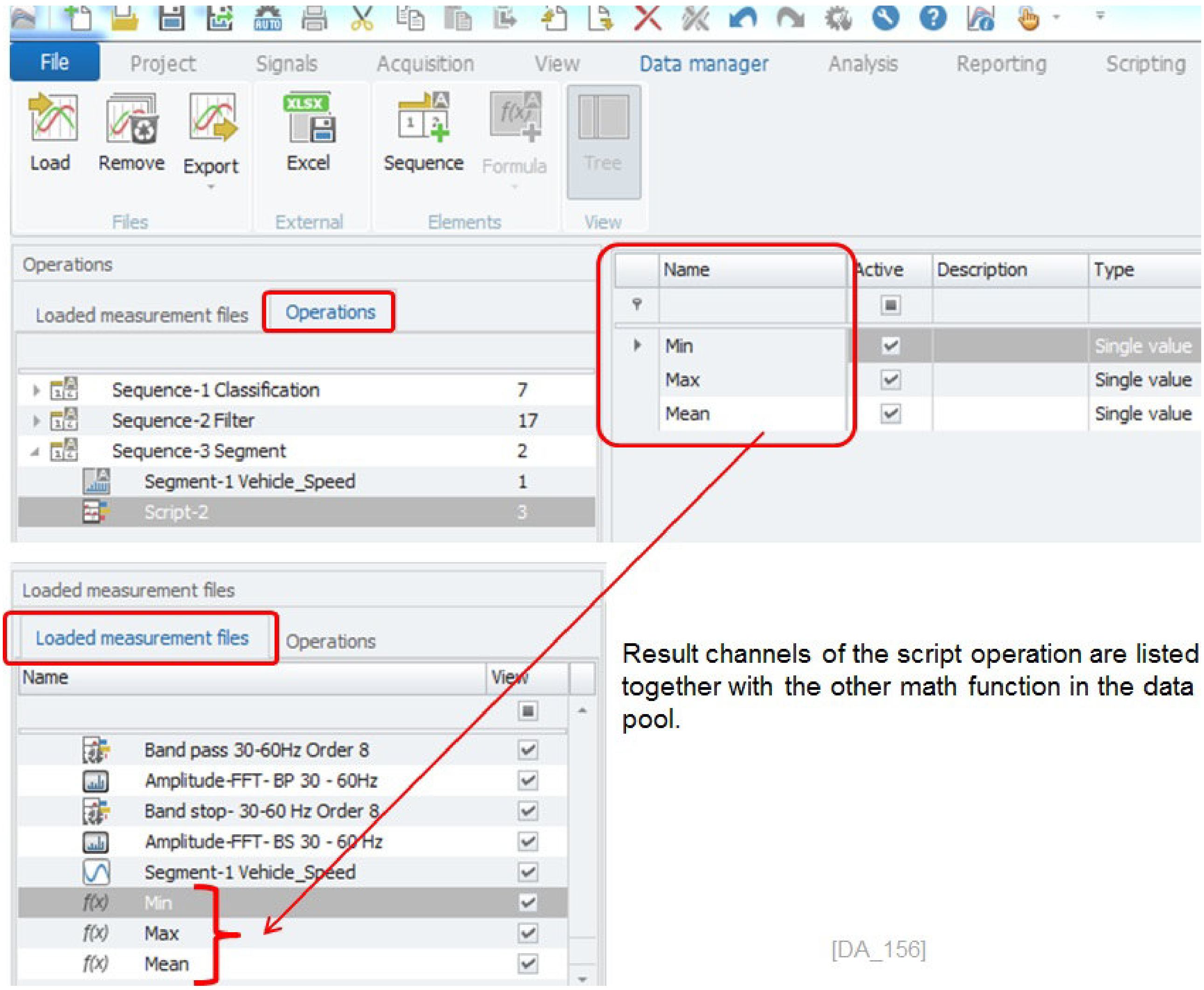
Finally, you need to create the result channels to show and store the result of the script calculations.



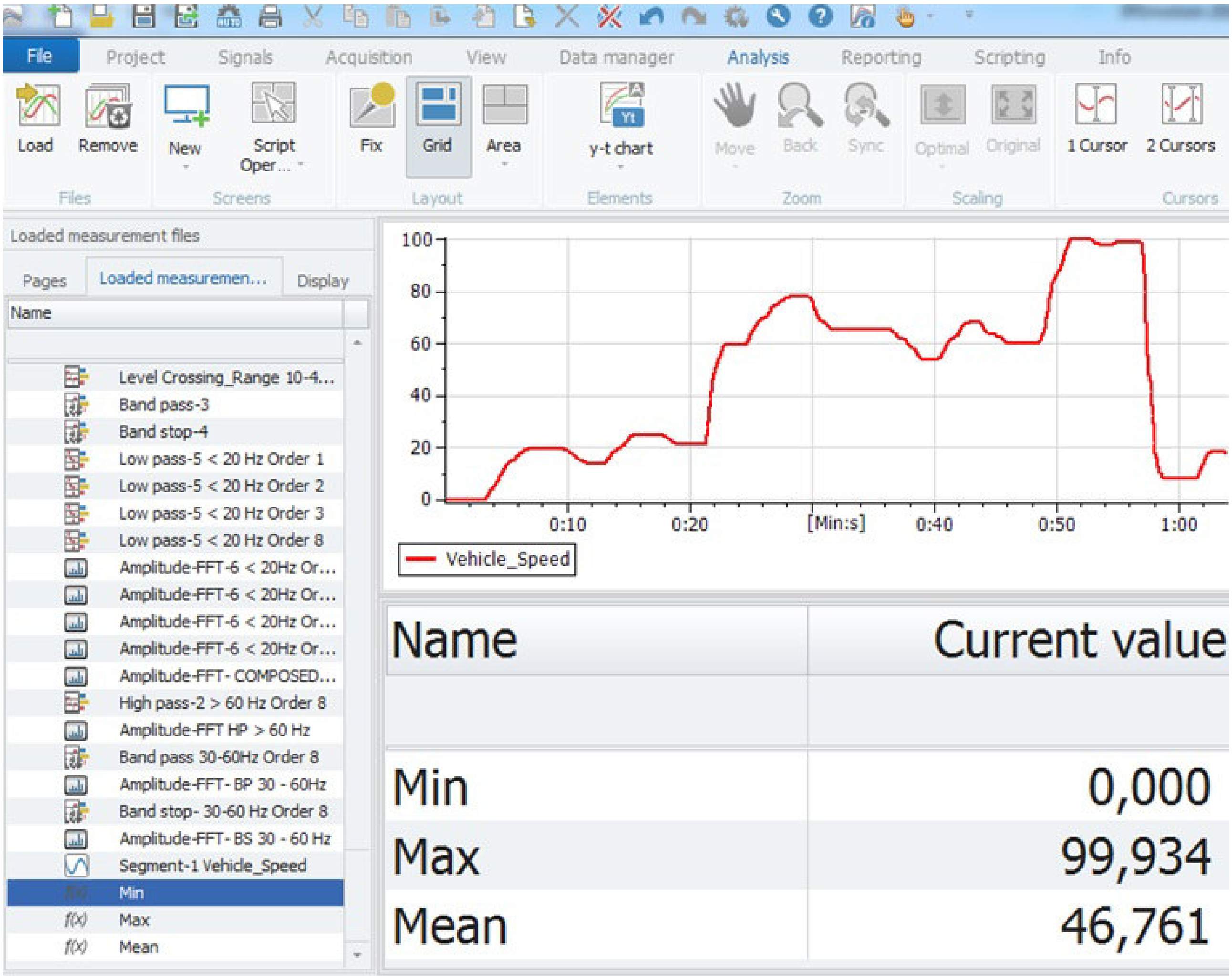
Create script operation result channels. [DA_155]

There are 3 different result channels available. The type of result channel should be matching to the result of the script.

► Numeric channel	This channel type can accommodate many calculation results. This is a suitable format if you like to process a complete signal with your script.
► Single value	This channel type can accommodate only one final result coming out from the scripting calculation. This is the required channel type if you like to link variable cut-off frequencies or on variable segment operations.
► Single text	This channel is dedicated to show text messages only.



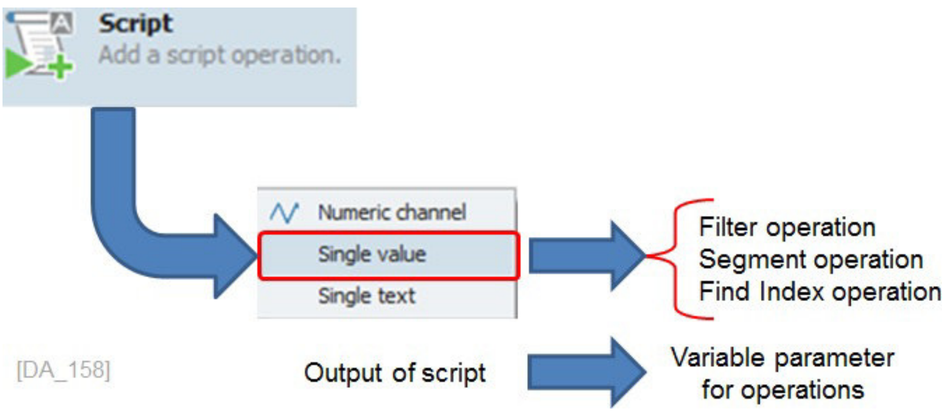
Script result channels are linked to an instrument.



Show results of the script operation in the table instrument. [DA_157]

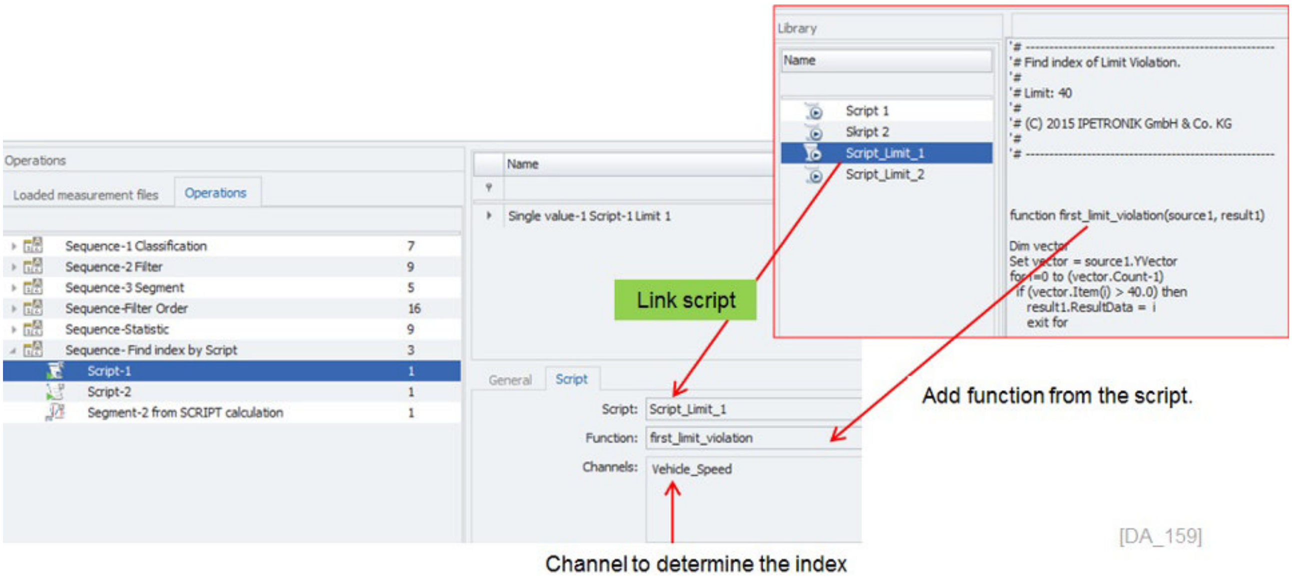
18.32 Example: Use script operations for variable parameters

As discussed above the Segment operation, Filter operation, Find index operation can link a channel as variable input function. Most frequently a scripting operation is selected to calculate variable parameter for these operations. In this example we will define the segment not statically but calculated the segment start and endpoint dynamically based on a script operation.



[DA_158]

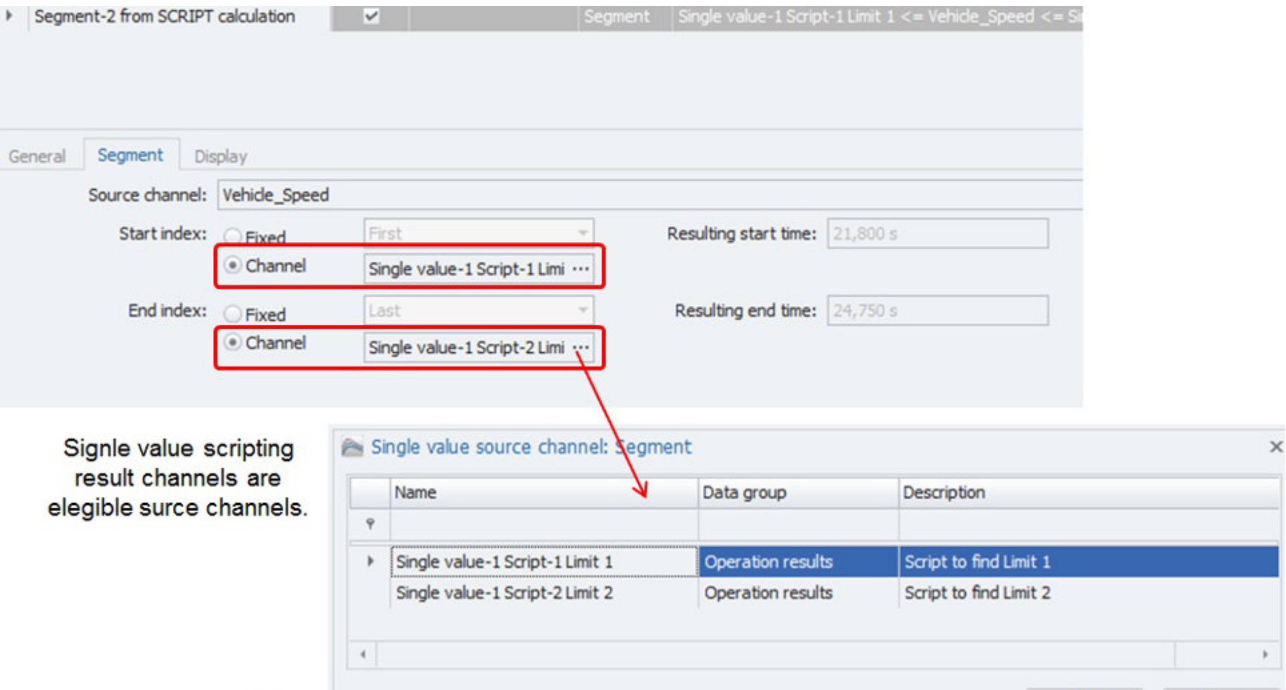
The following screenshot shows a configuration of a scripting operation to determine the first index. A similar scripting operation to determine the end index is created too.



[DA_159]

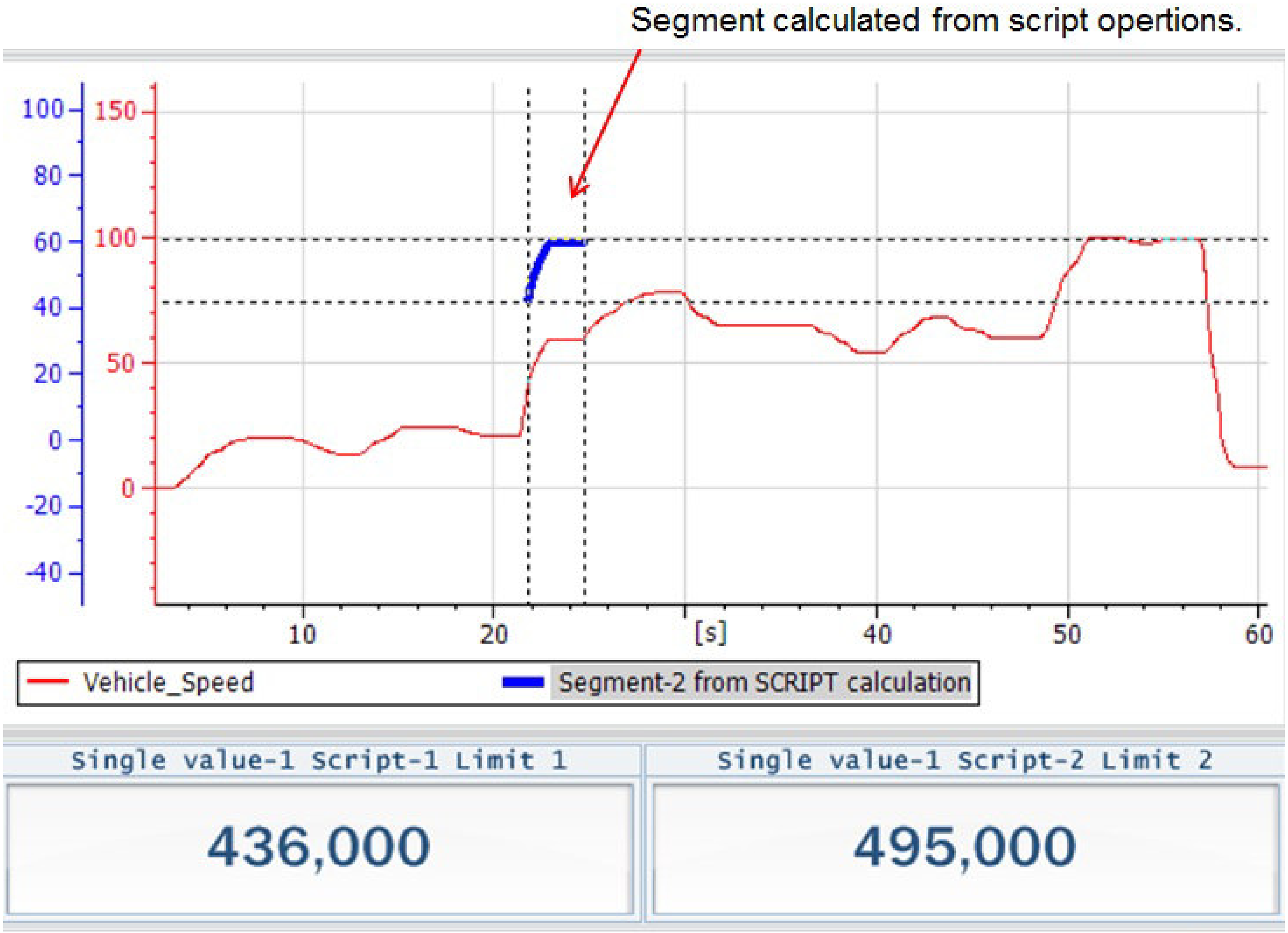
These to scripting results channels are linked to the segment.

The output of the scripting operation must be defined as a “Single value”. This number can be used as a variable input parameter for the operations like filter, segment or index. An important aspect is the right order of operations inside the sequence as discussed in the introduction 18.12.3. The single value outputs of the two scripts can be used as variable input parameter for e.g. segment operation.



[DA_160]

The analysis screenshot shows graphically the result of the segment operation.

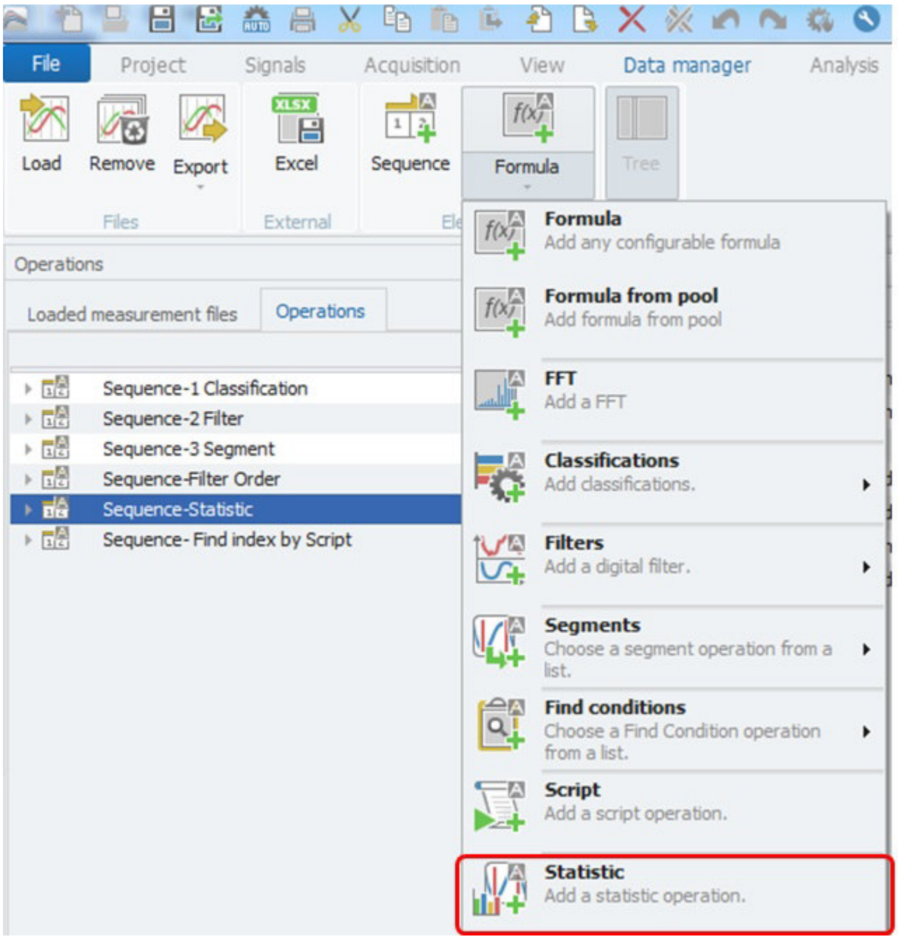


[DA_161]

18.33 Statistic

18.33.1 Youtube Resources

IPEmotion – Post-Processing – Statistic Operation: http://youtu.be/ot5MOX-iFec
The statistic operation is a dedicated post processing function to calculate several statistic indicators for a source channel in one operation.

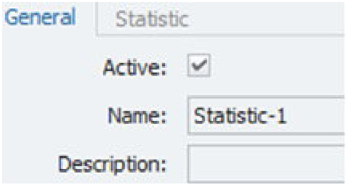


[DA_162]

The output channels of the statistic operation are listed below. For details about the different calculations refer to chapter 13.4.

- Minimum
- Maximum
- Mean
- Root mean square
- Variance
- Standard deviation

18.33.2 General – tab sheet

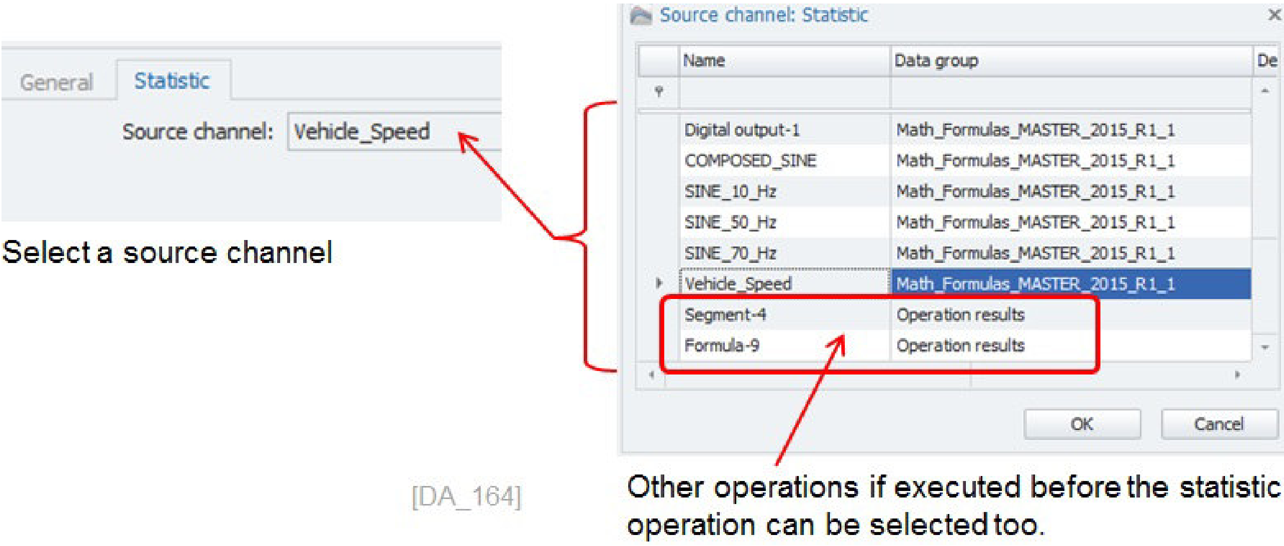


[DA_163]

- ► Active — This checkbox activates / deactivates the script operation.
- ► Name — Refers to the name of the script operation.
- ► Description — Here you can add an additional description for the script.

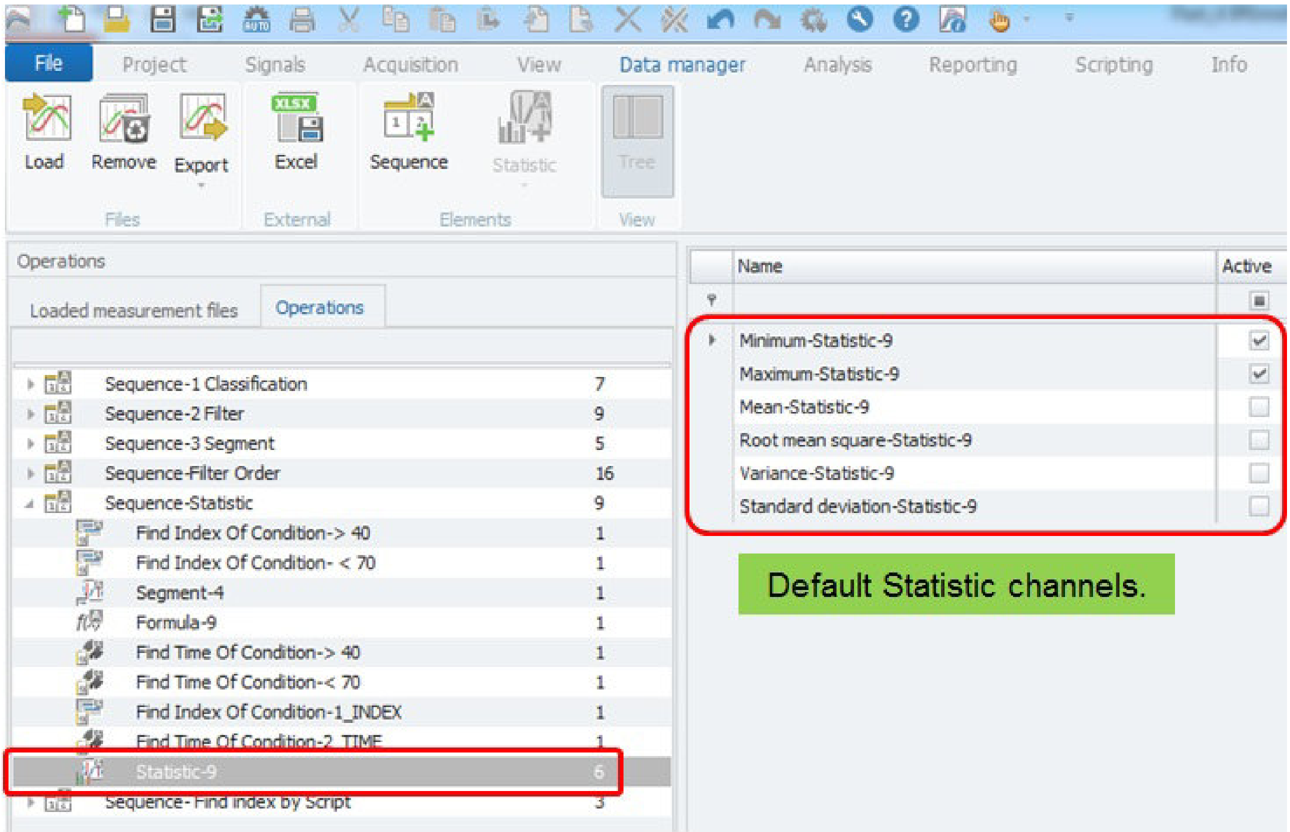
18.33.3 Statistic – tab sheet

- ► Source channel — Select one channel which is the basis to calculate the statistic values. If you have other operations already included in the sequence these channels can be selected too. For more details refer to 18.12.3.



[DA_164]

The result of the static operation is resented in 6 channels. By default the Minimum and Maximum is activated. If you like to get the statistic results of the other channels activate them manually.



[DA_165]

Results of the statistic calculation presented in a table instrument in the ANALYSIS work space.

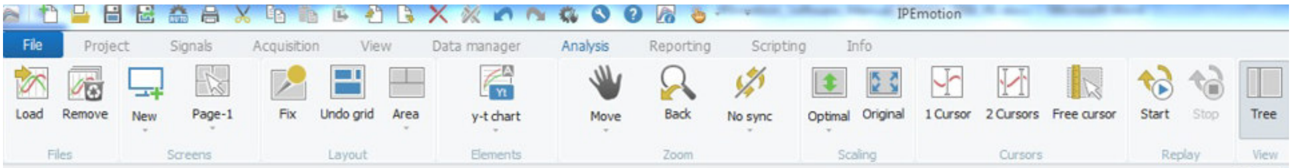
Name	Current value
Minimum-Statistic-9	0,000
Maximum-Statistic-9	99,934
Mean-Statistic-9	46,761
Root mean square-Statistic-9	55,806
Variance-Statistic-9	928,428
Standard deviation-Statistic-9	30,470

[DA_166]

19 ANALYSIS Work Space

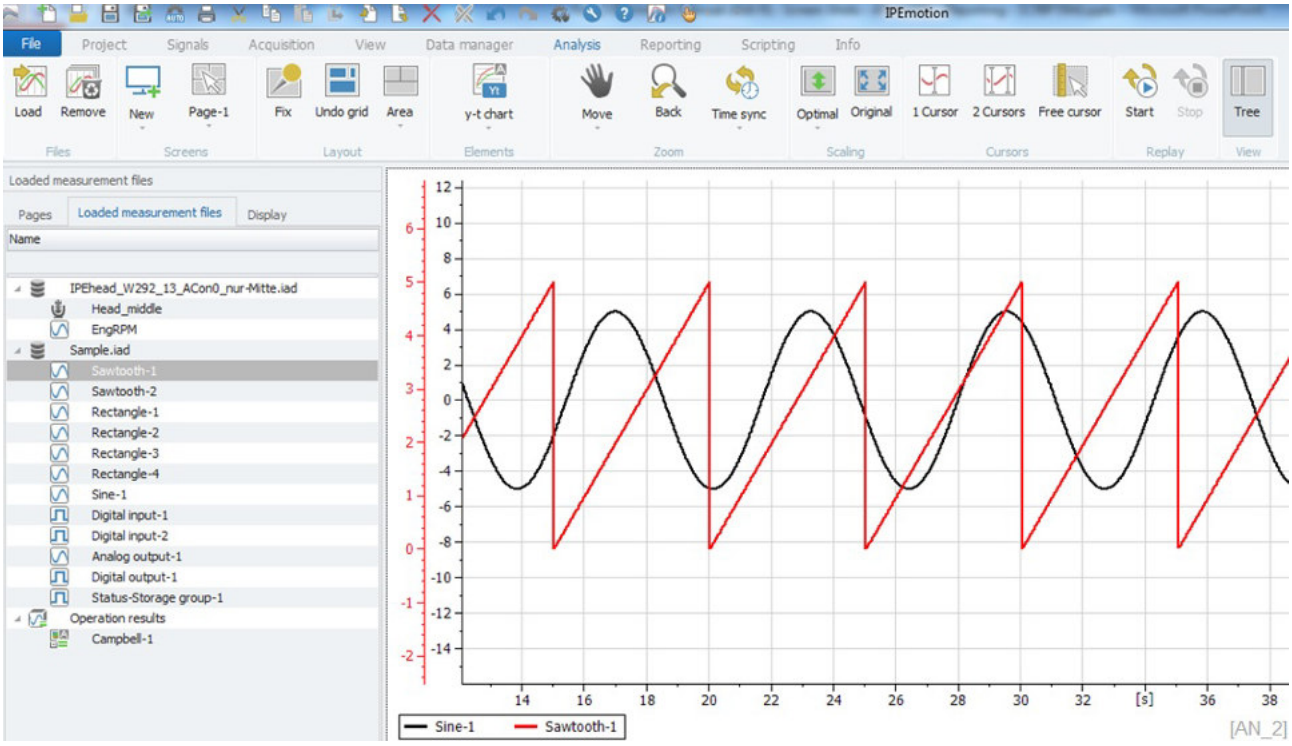
19.1 Ribbon

In the ANALYSIS work space you can perform graphical data analysis.



[AN_1]

Example of a Yt-chart:



[AN_2]

19.1.1 Load (Import)

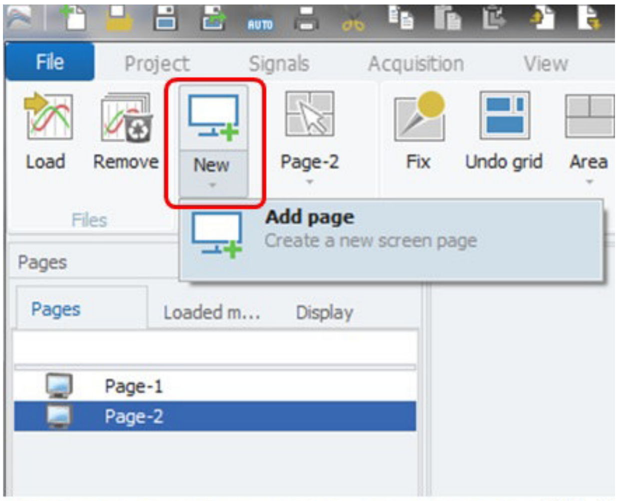
With load you will access the file open dialog to brows for your data files. As discussed in the DATA MANAGER 18.2.

19.1.2 Remove

With remove all loaded data files are removed from the ANALYSIS and DATA MANAGER work space.

19.1.3 New

In New you can add pages to build your analysis instruments.

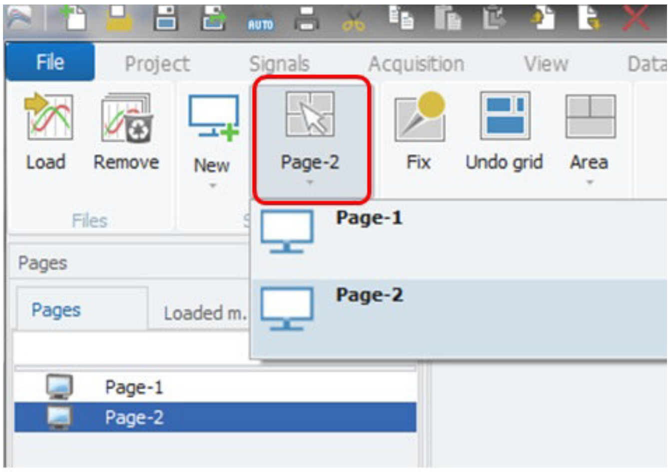


Add pages to build your analysis instruments. [AN_3]

Information *The number of display pages is restricted by different editions. See the overview table of chapter Software Editions 4 for more details. If you exceed the number of permitted pages you will get a warning message.*

19.1.4 Page

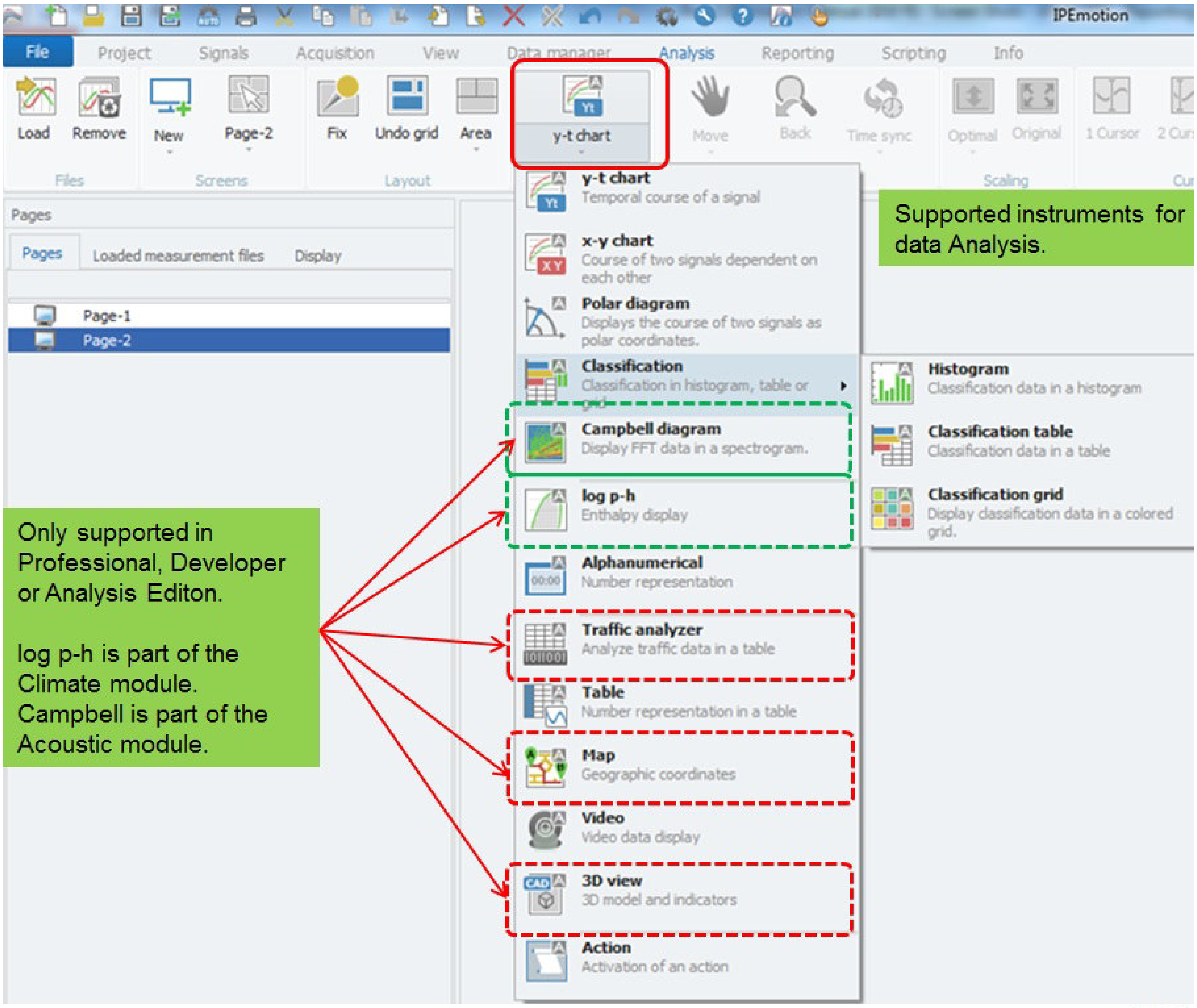
Here you can navigate between pages directly from the ribbon.



Navigate directly between pages from the ribbon. [AN_4]

19.1.5 Instruments

In Instruments you can select from 13 different instruments. Each instrument will be discussed in detail.



[AN_5]

Information

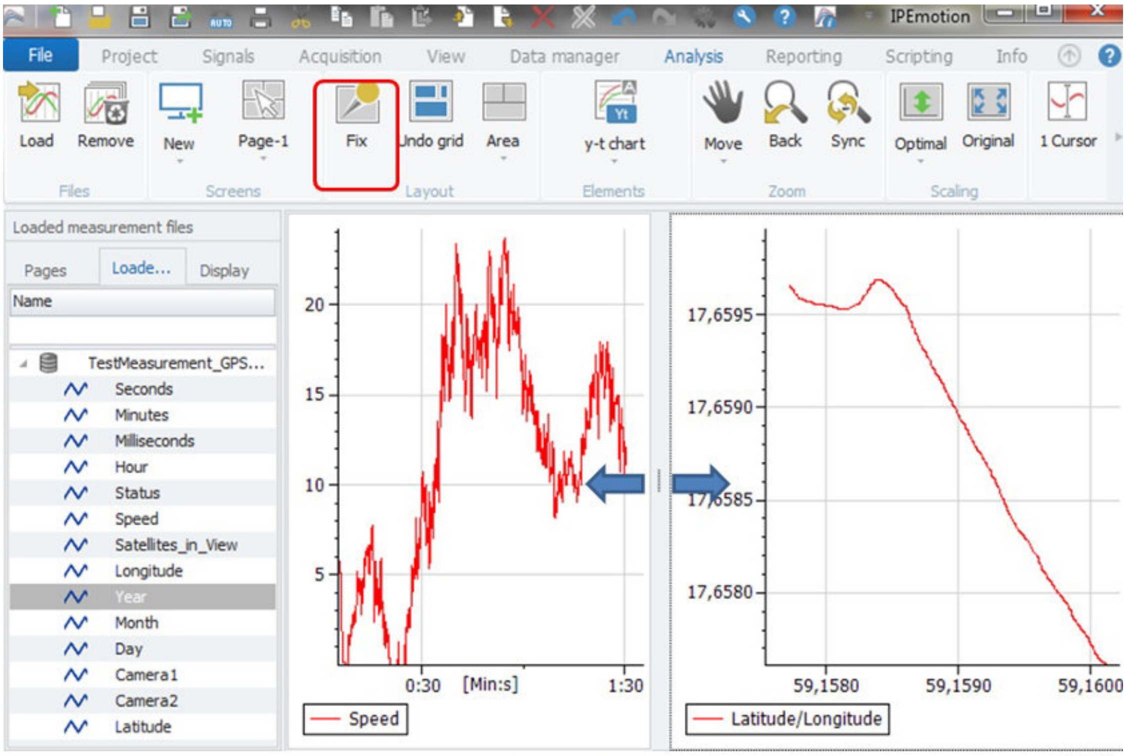
The Map, Traffic Analyzer, 3D view, log p-h and Campbell instruments are only available if you have a suitable license. For the Map and Traffic Analyzer and 3D view instrument you need a Professional, Developer or Analysis edition. For the log p-h instrument you need the Climate module additionally. See chapter Software Edition for more details 4. For the Campbell diagram you need the Acoustic module 4.2.3.

19.2 Transfer view pages and instruments from VIEW to ANALYSIS

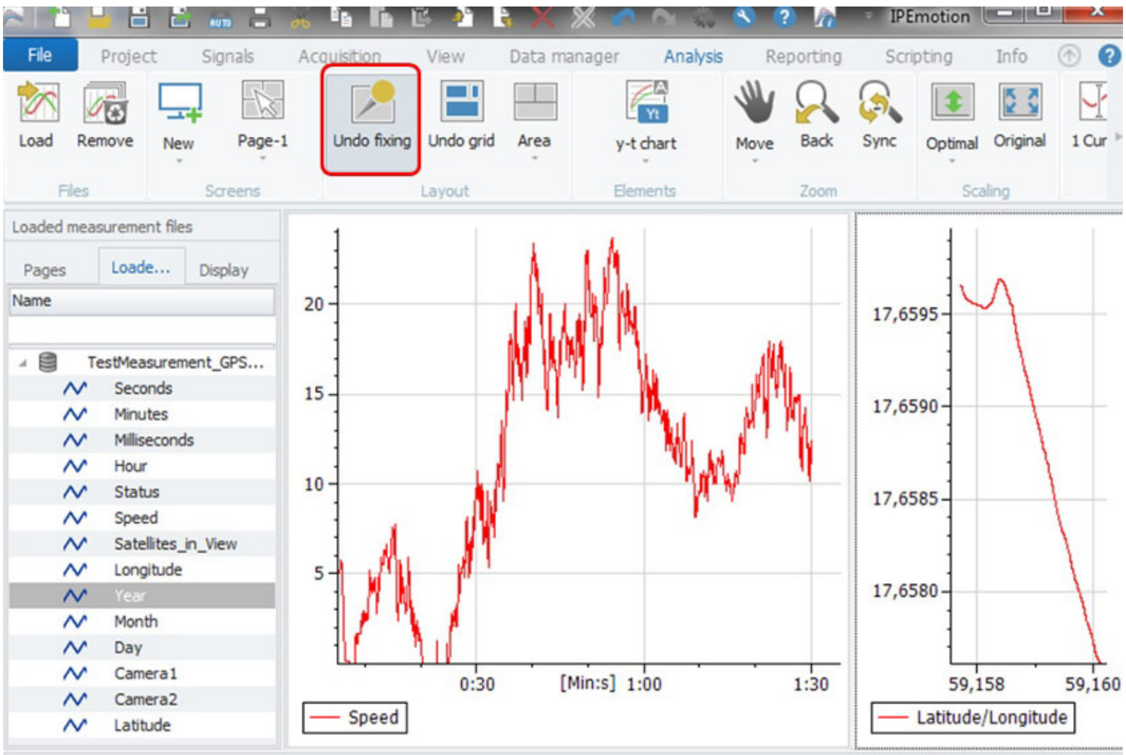
As discussed in VIEW 17.1 you can transfer an instrument configuration through the context menu from VIEW to ANALYSIS.

19.2.1 Layout – Fix / Undo fixing

With the Fix / Undo fixing function you can either change the size of the instrument containers or freeze the position. The layout function is the same as discussed in VIEW in chapter 17.2.6.



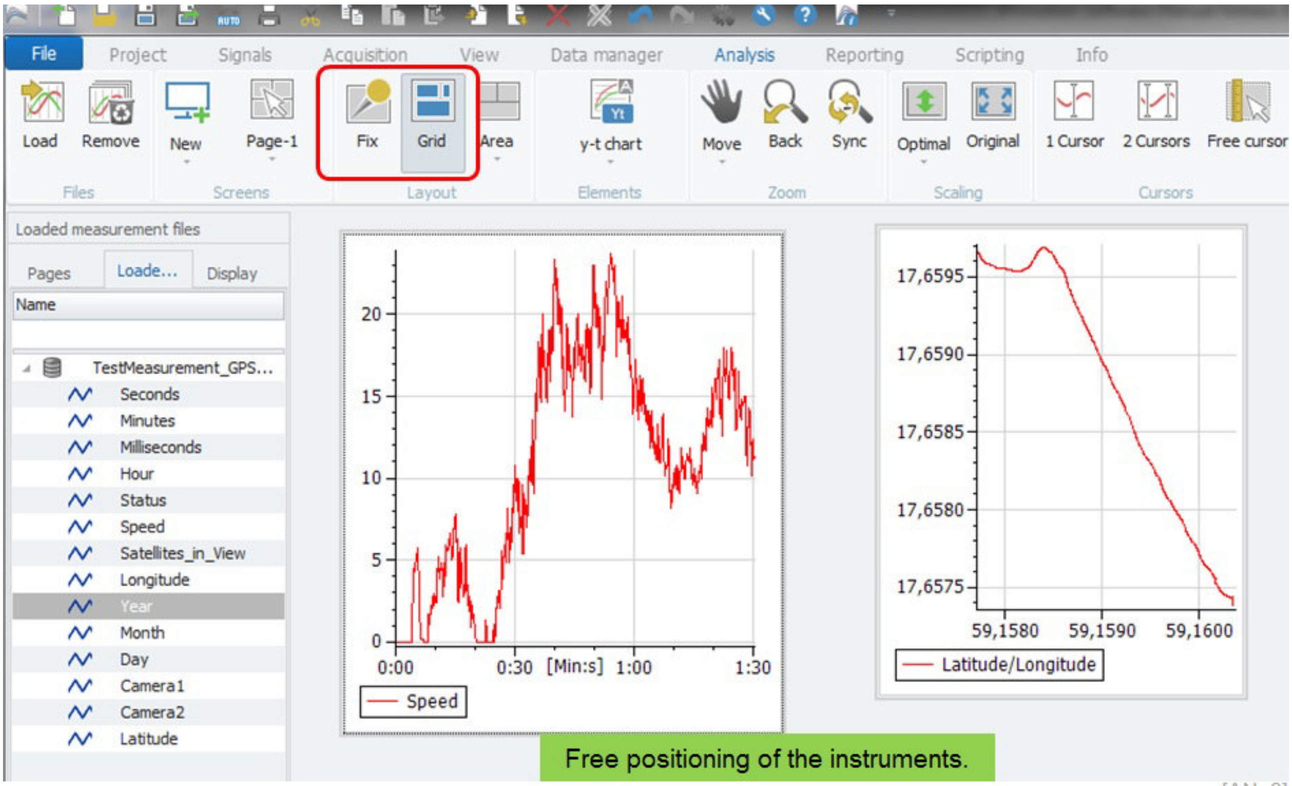
Change size of instrument container. [AN_6]



Size of instrument container is fixed and cannot be changed. [AN_7]

19.2.2 Layout – Undo grid

The instruments are arranged automatically on the page by the software, considering the order of creation. If you resolve (undo) the grid you can allocate and position the instruments at any place. The layout function is the same as discussed in VIEW in chapter 17.2.7.

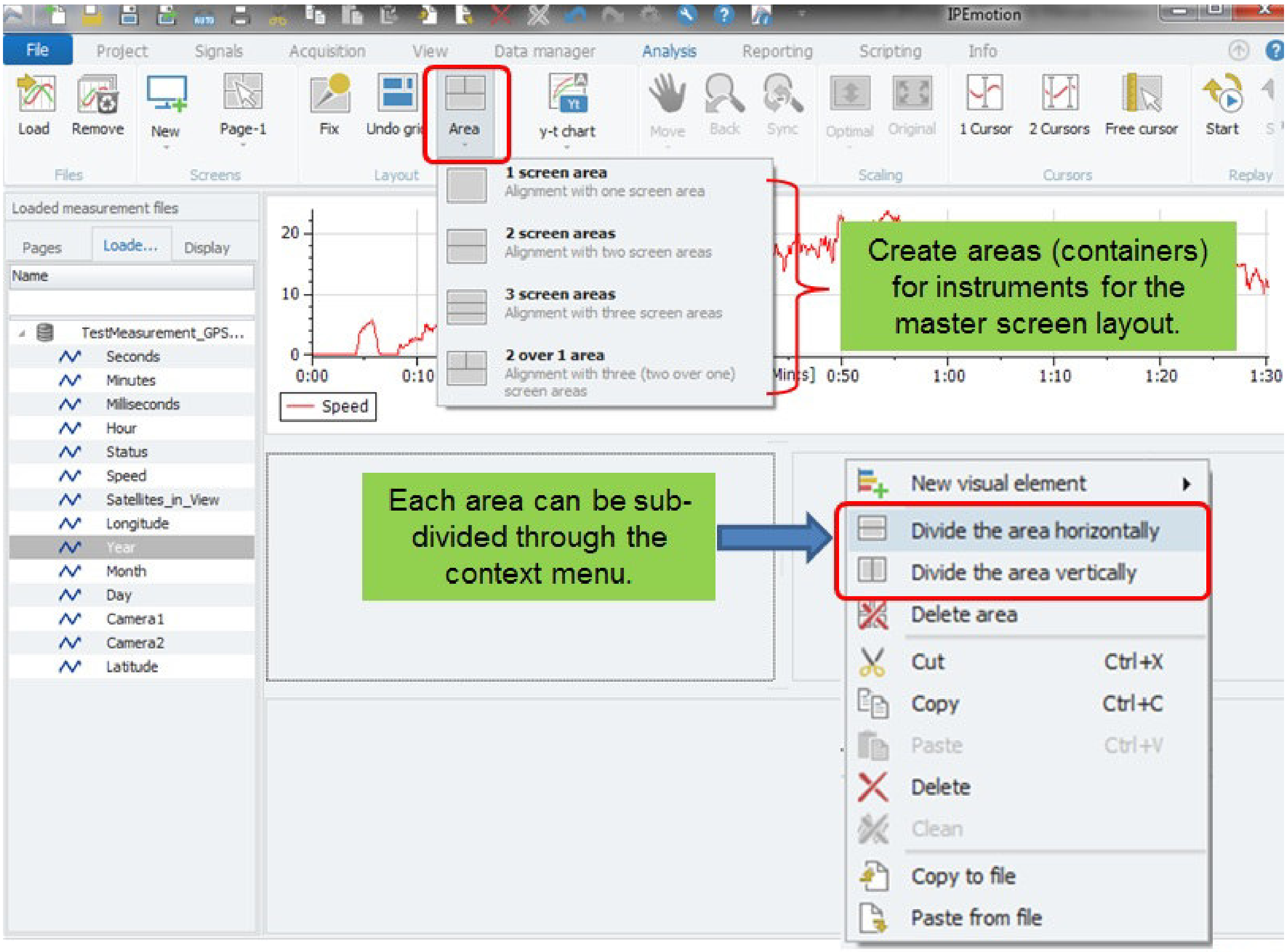


[AN_8]

Information *When the screen page is still in **fixed mode** the undo grid function is ineffective.*

19.2.3 Layout – Area

With the area function you can split the view page in a basic structure of the instrument containers before you start adding instruments. Each area is considered as a container for one instrument type. If you like, you can subdivide each container through the context menu. The layout function is the same as discussed in VIEW in chapter 17.2.8.

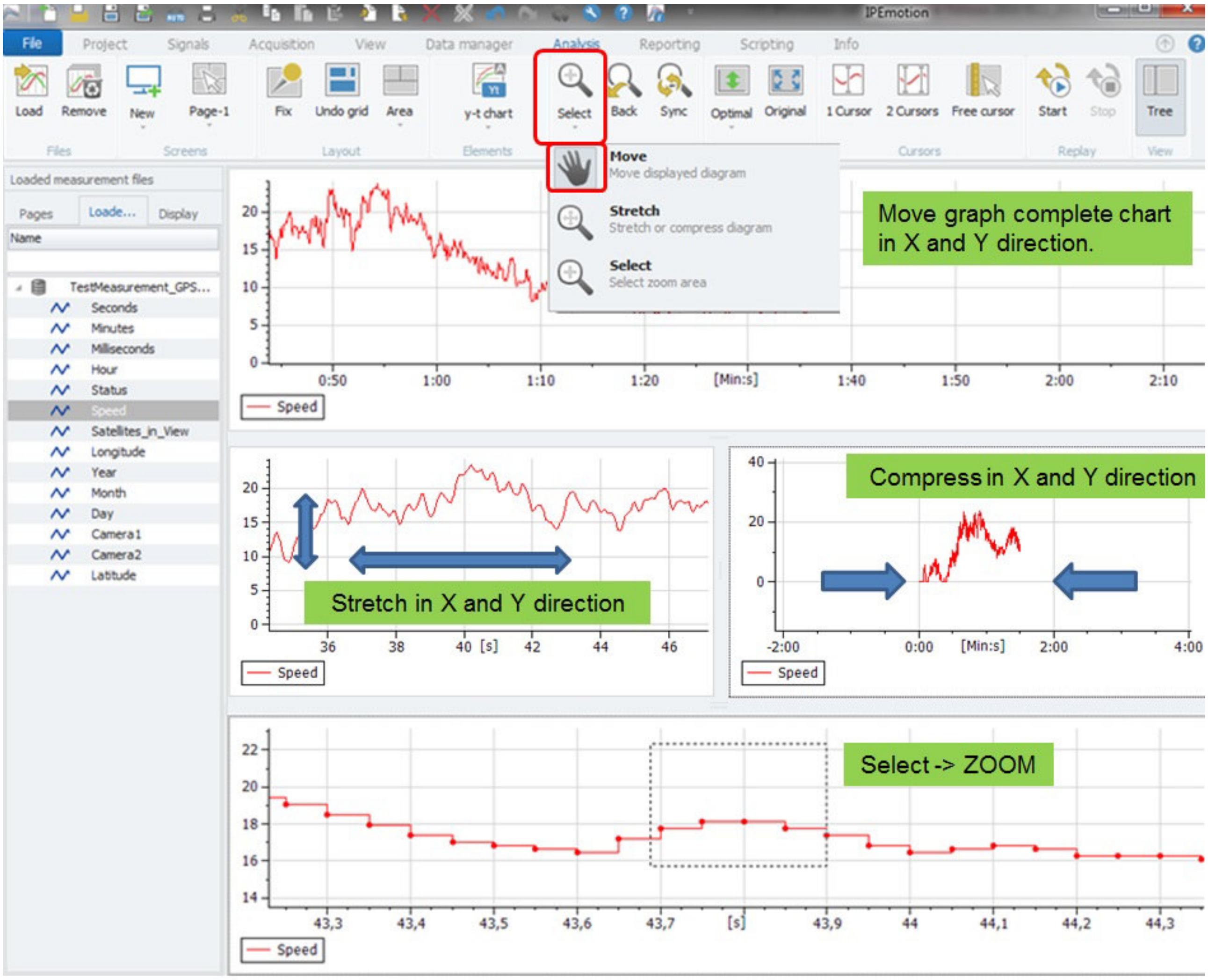


[AN_9]

19.2.4 Move / Stretch / Select

These are 3 operations to perform chart analysis functions.

- Move graph in X- and Y- direction
- Compress and stretch in X- and Y- direction
- Select – ZOOM in the graph



[AN_10]

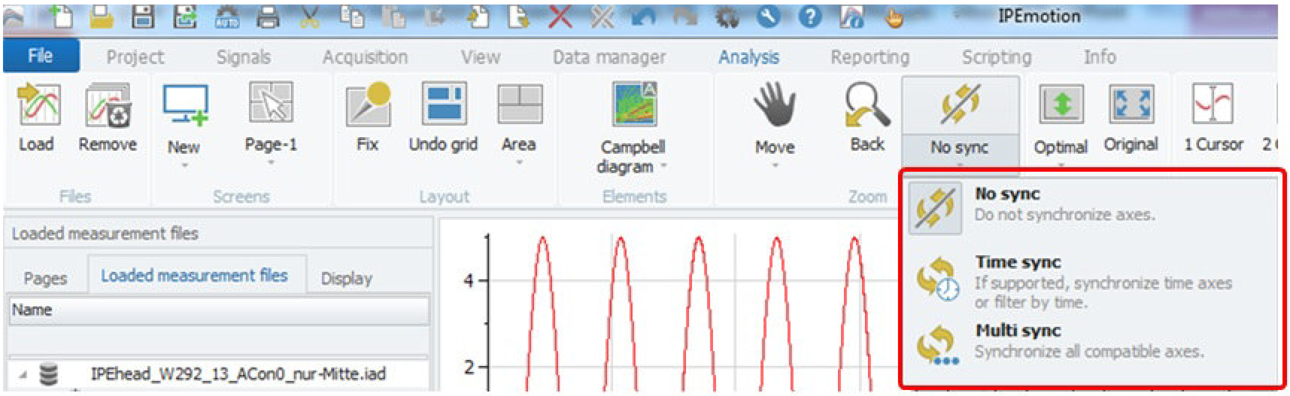
19.2.5 Back

With the back button you undo all Stretch, Move, Select commands performed in the Yt-diagram and XY-diagram. If you delete the diagrams or remove the data file, the back commands are deleted from the internal memory of diagram as well.

Information *The other instruments like Map, log-ph and Video do not support any Move, Stretch, Select, Back or Sync functions.*

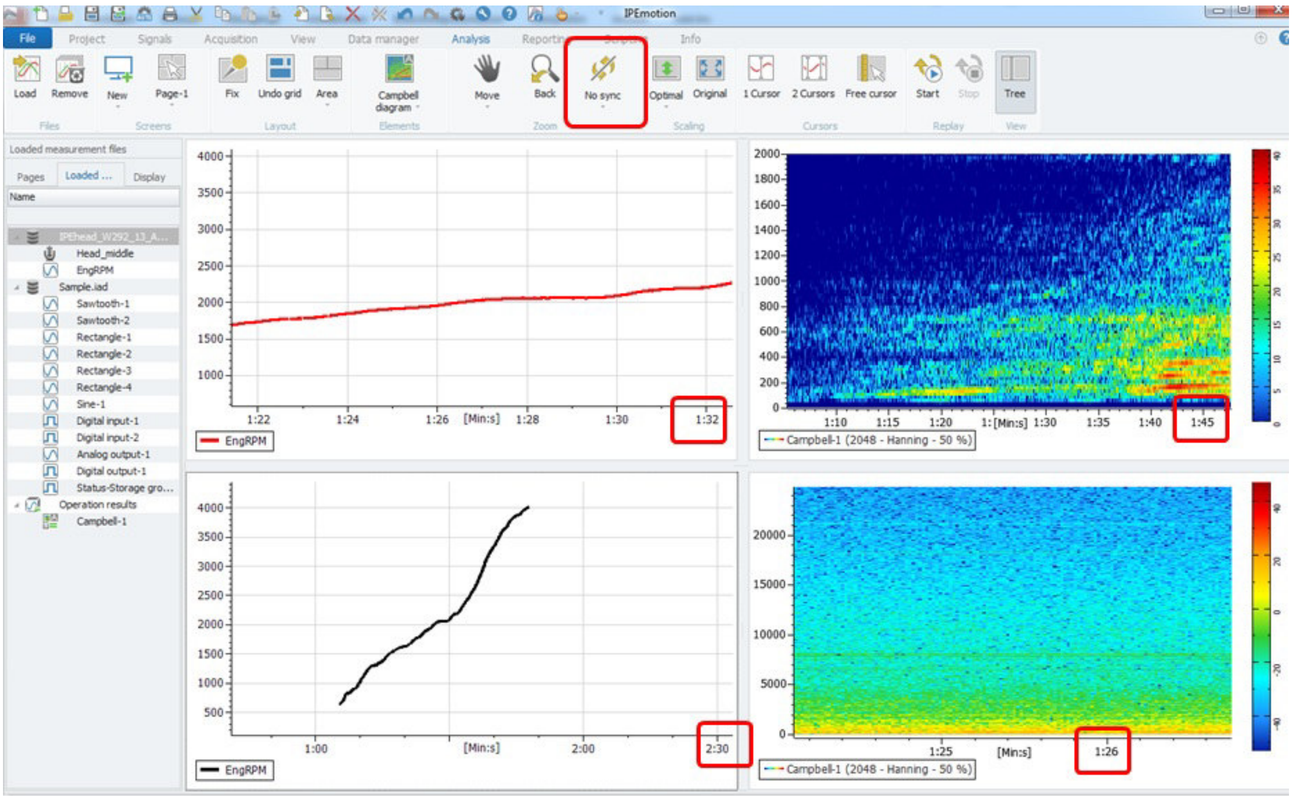
19.2.6 Sync

The Sync function is effecting the time Yt-chart, XY-chart and the Campbell diagram. It is supporting 3 different settings which will be explained in turn.



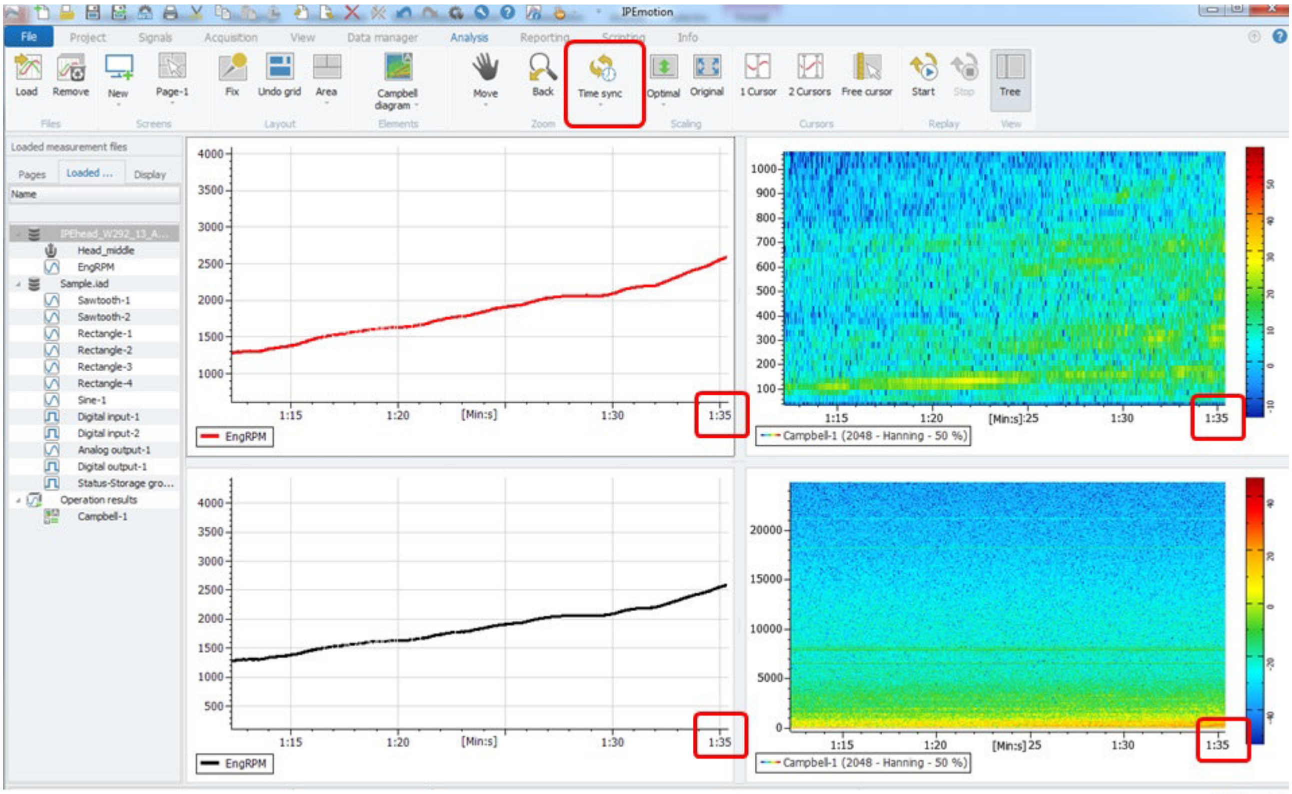
Sync functions [AN_11]

- ► No Sync With the no sync setting all Yt-diagrams have individual time axis settings.



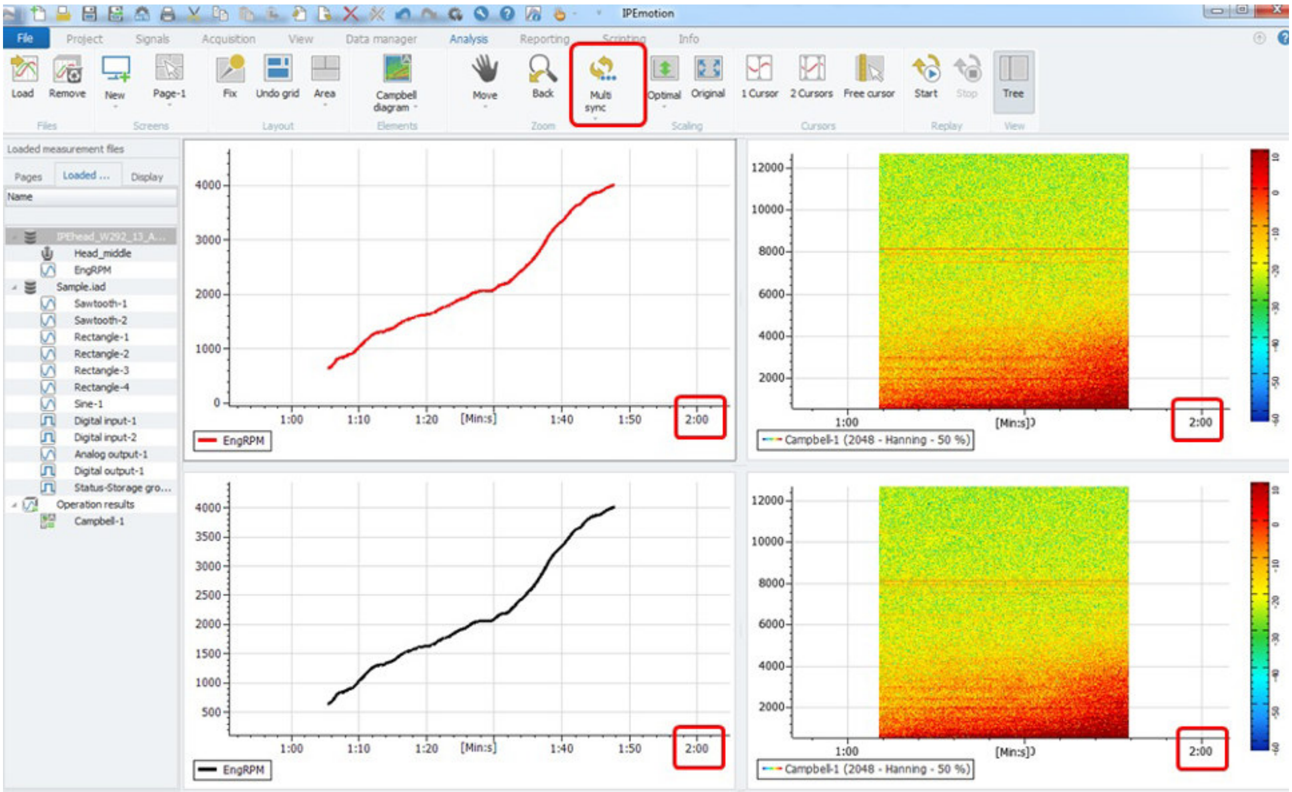
„No Sync“ setting selected. Every instrument has an indivisual time axis setting. [AN_12]

- **Time Sync** When you hit the Sync button all diagrams (Yt, XK and Campbell diagram) on all pages are updated with the time axis settings of the diagram which was most recently configured. The Sync function is only applied to the time axis (x-axis).



„Time Sync“ setting selected. Every instrument has the same time axis setting. [AN_13]

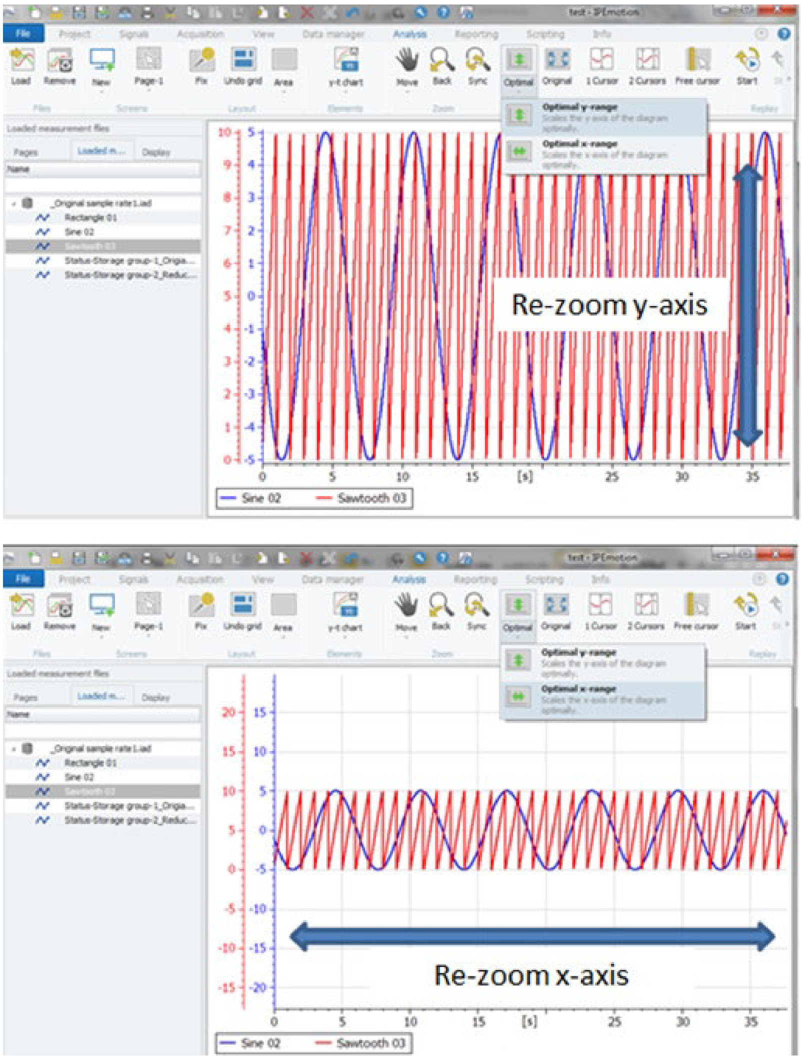
- Multi Sync — With the Multi Sync function all time axis of diagrams (Yt, XY, Campbell) and the Y-axis and color axis scaling of the Campbell diagram are automatically synchronized to all other Campbell diagrams. With this function it is very easy to configure several Campbell diagrams with the same settings.

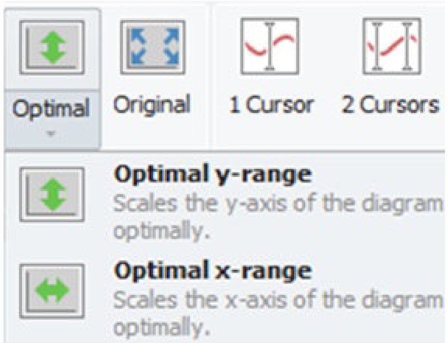


„Multi Sync“ setting selected. Any change on the time axis and in the Campbell diagram is updated. [AN_14]

19.2.7 Optimal X-Y Zoom

On the Yt- and YX-chart you can now apply zoom function for the x-range and y-range.





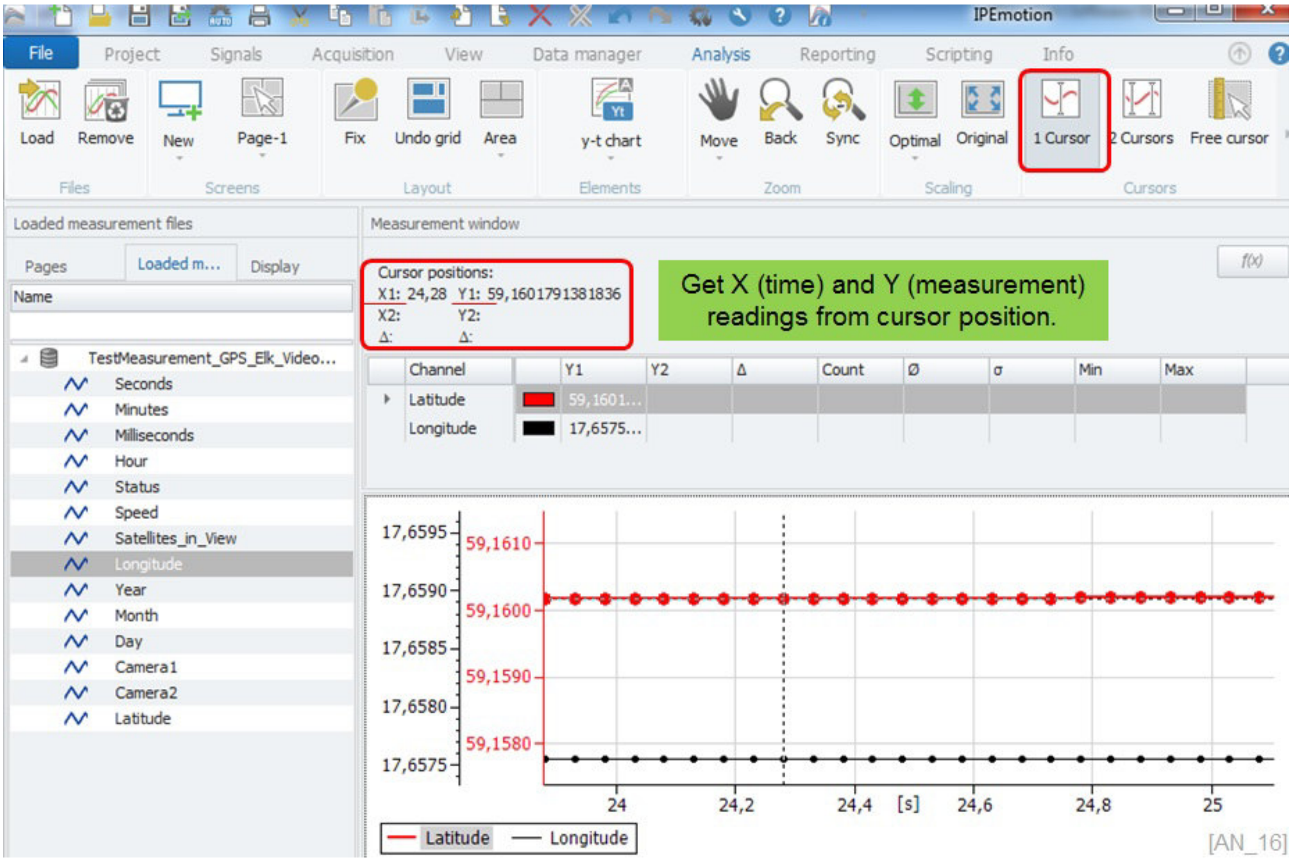
[AN_15]

19.2.8 Original

If you hit the Original button you perform a complete rezoom along the time axis (X-axis) and Y-axis of the Yt- and XY-diagram.

19.2.9 1 Cursor

If you select one cursor you can read the value (X and Y) of the data point selected in the measurement statistic window.

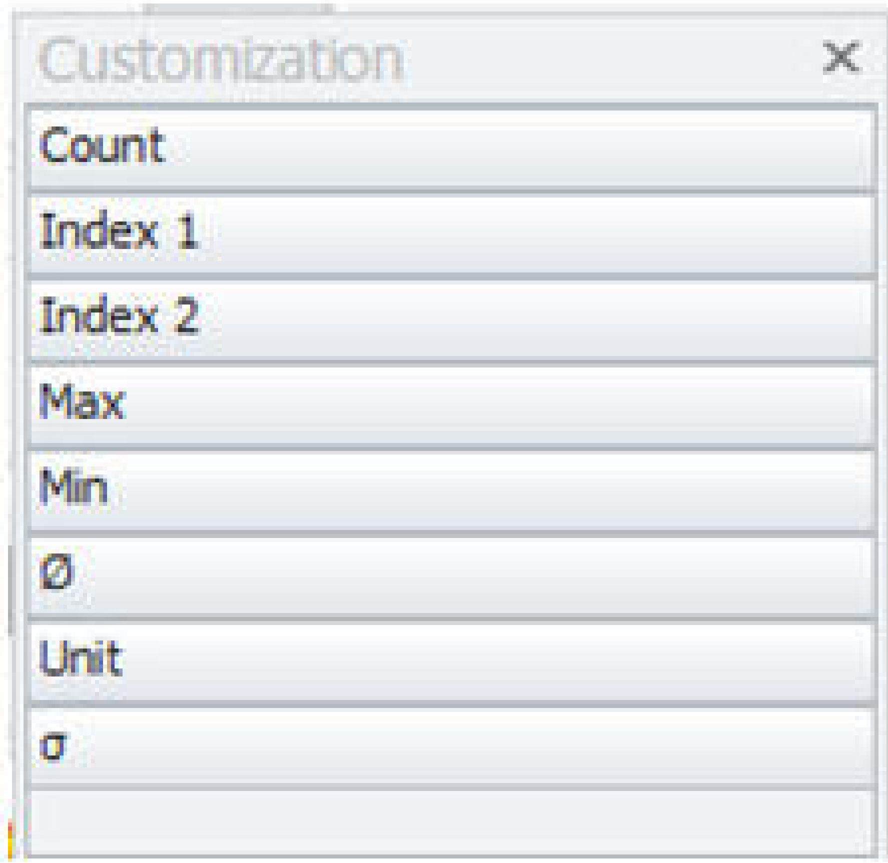


[AN_16]

19.2.10 2 Cursors

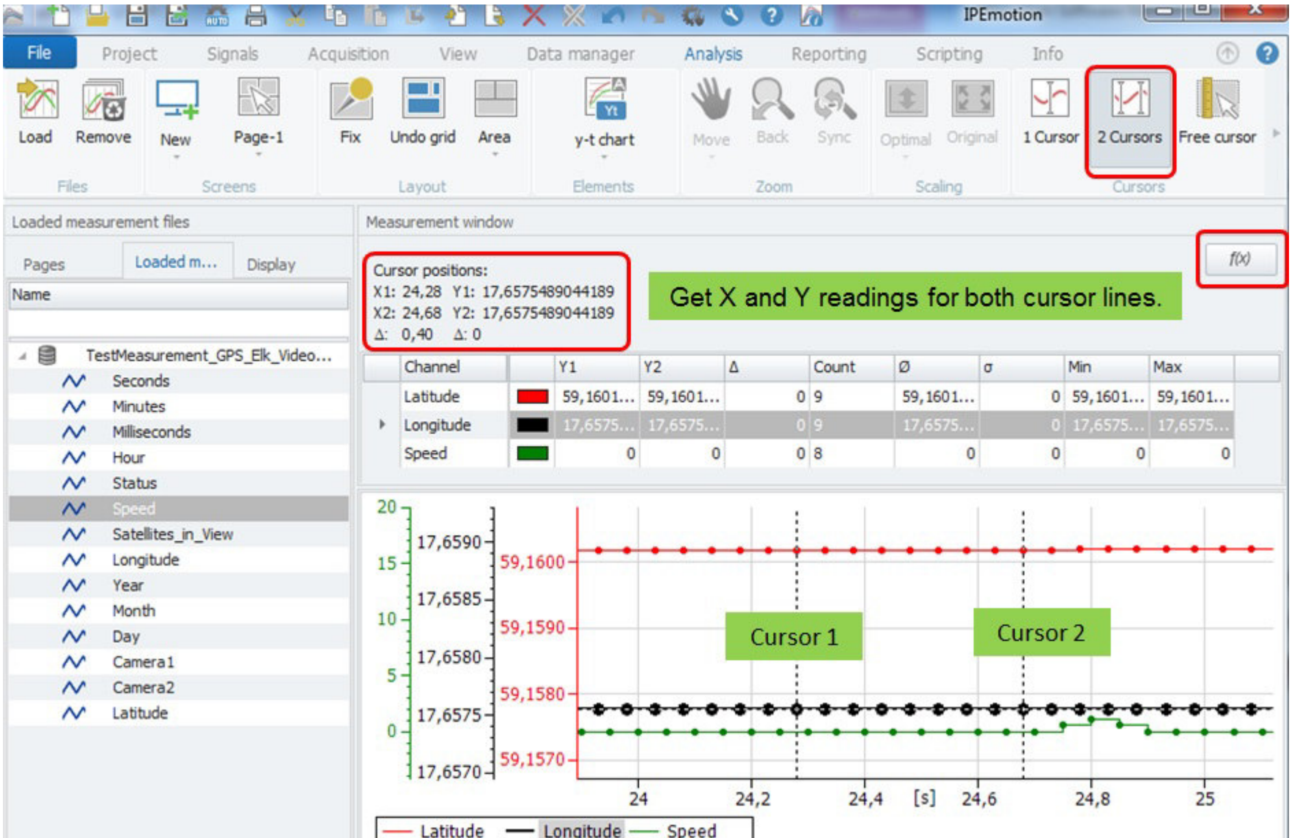
If you activate 2 cursors the measurement window will indicate the time difference between the cursor lines. If you hit the ***f(x)*** button the measurement statistics between the two cursor lines will be calcualted. The statistics in the cursor window covers:

- Count of samples
- Index 1
- Index 2
- Minimum value
- Maximum value
- Average
- Unit
- Standard deviation



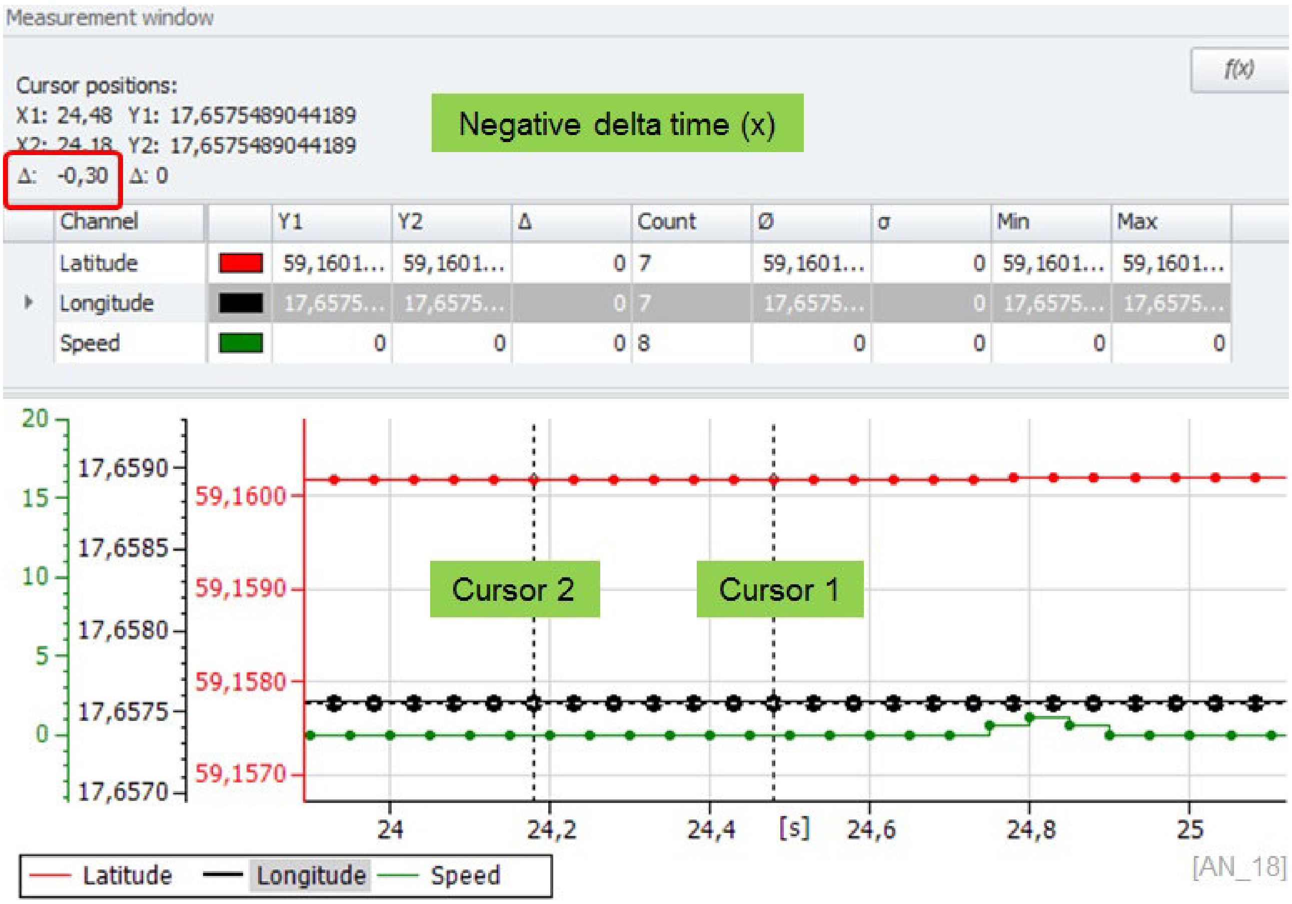
[AN_16_1]

If you move the cursor, the statistical values need to be recalculated by hitting on the ***f(x)*** button again.



[AN_17]

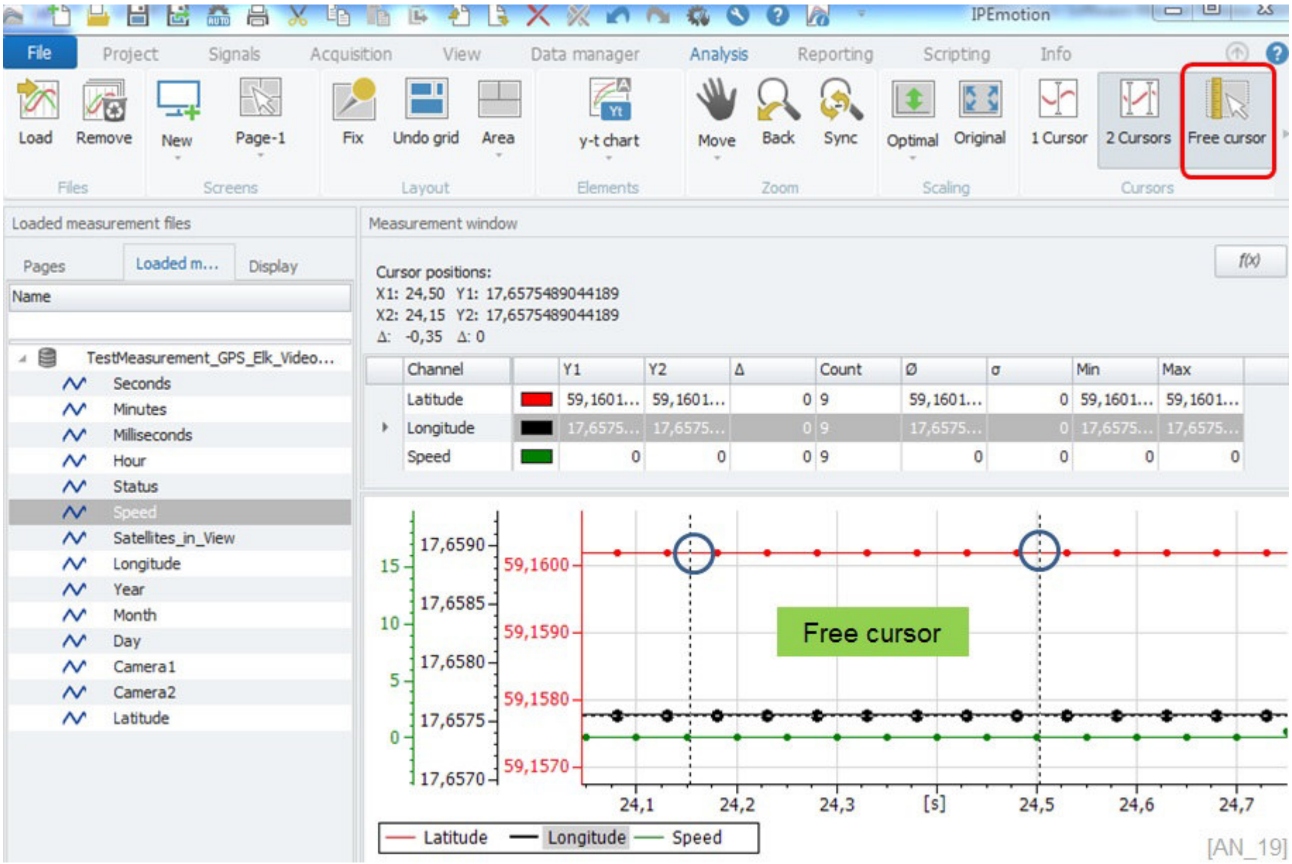
If you move cursor 2 in front of cursor 1 the delta X (time) is calculated with a negative result.



[AN_18]

19.2.11 Free cursor

The standard behavior of the cursor is that the lines snap to the data points of the selected / highlighted channel. With the free cursor function, the cursor lines can be positioned between data points.



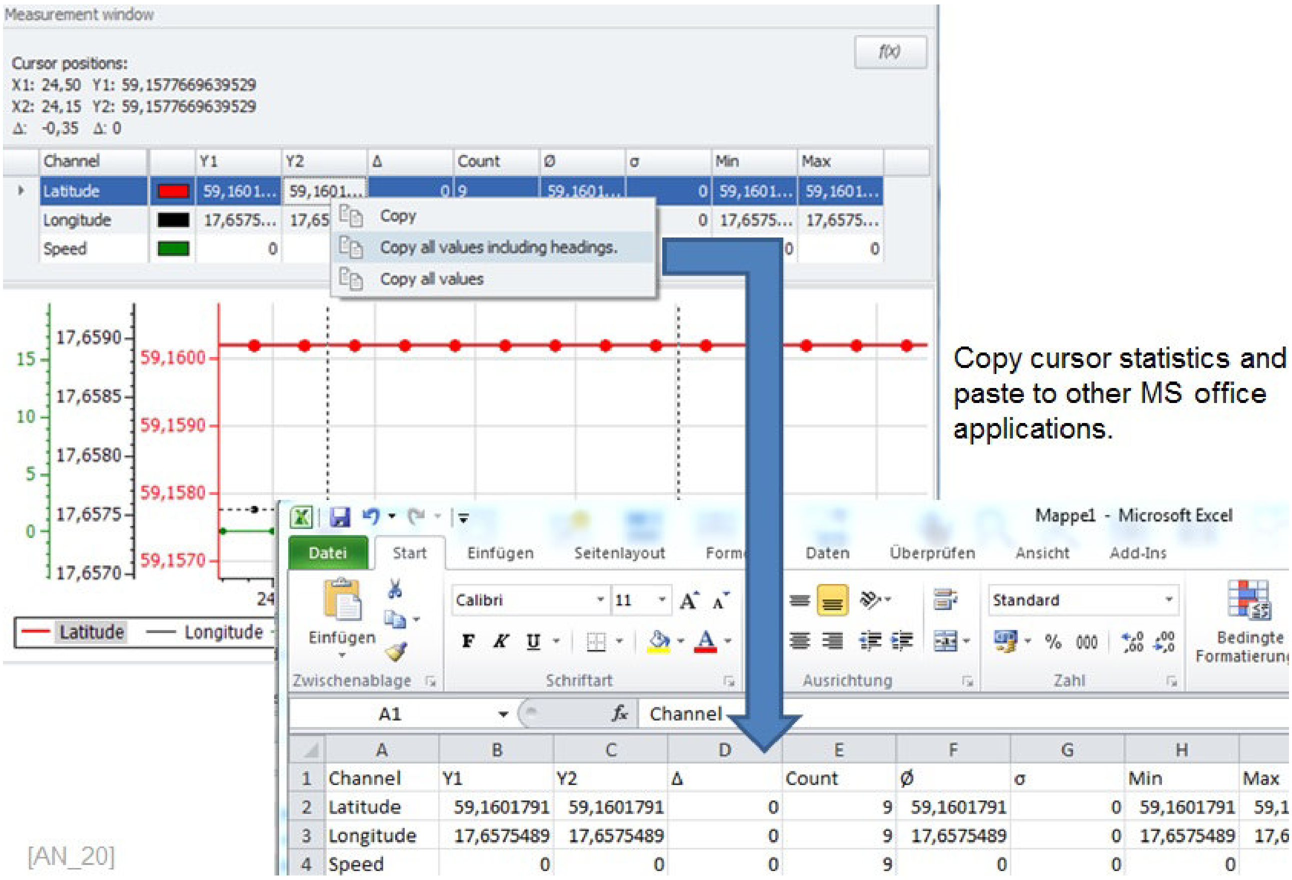
Channel		Y1	Y2	Δ	Count	Ø	σ	Min	Max
Latitude		59,1601...	59,1601...	0	9	59,1601...	0	59,1601...	59,1601...
Longitude		17,6575...	17,6575...	0	9	17,6575...	0	17,6575...	17,6575...
Speed		0	0	0	9	0	0	0	0

[AN_19]

Information *The cursor statistics are calculated on the basis of the data points in between the cursor lines and not based on the exact cursor position.*

19.2.12 Copying data from the measurement window to other programs

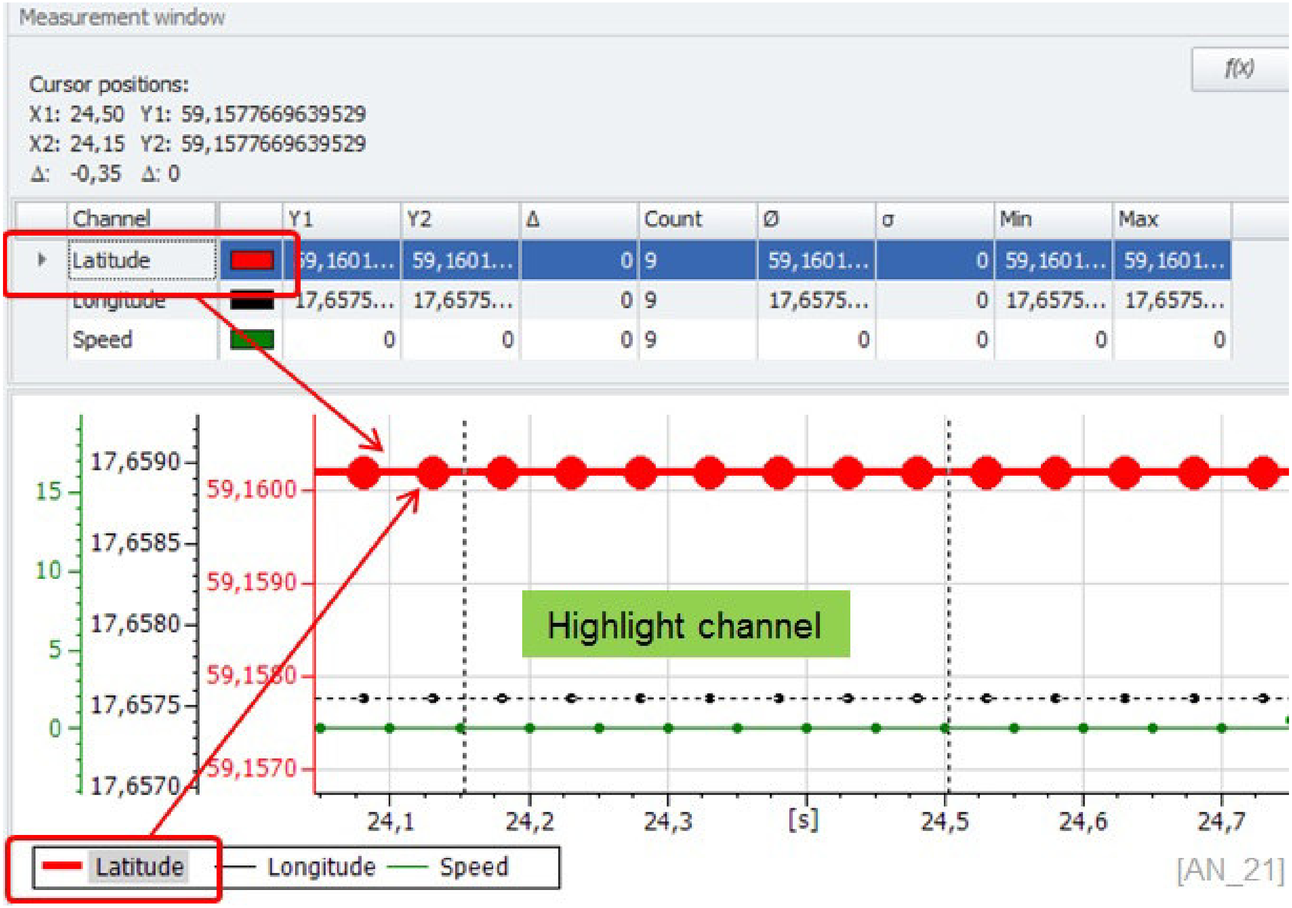
Using the cursor, you can now copy the data from the measurement statistics to other MS office applications like Excel, Word, PowerPoint etc. The measurement window is only available if you select to use the extended measurement window in the Options (Analysis).



[AN_20]

19.2.13 Channel highlighting through cursor statistics and legend

You can highlight a channel in the graph either by selecting the channel through the measurement window or just by selecting the channel through the legend in the diagram.



[AN_21]

19.2.14 Start

If you hit the start button one cursor line is generated and the cursor line is moving chronologically along the visible section of the graph. The start, pause and stop button are particularly useful when you have video signals as well.

19.2.15 Pause

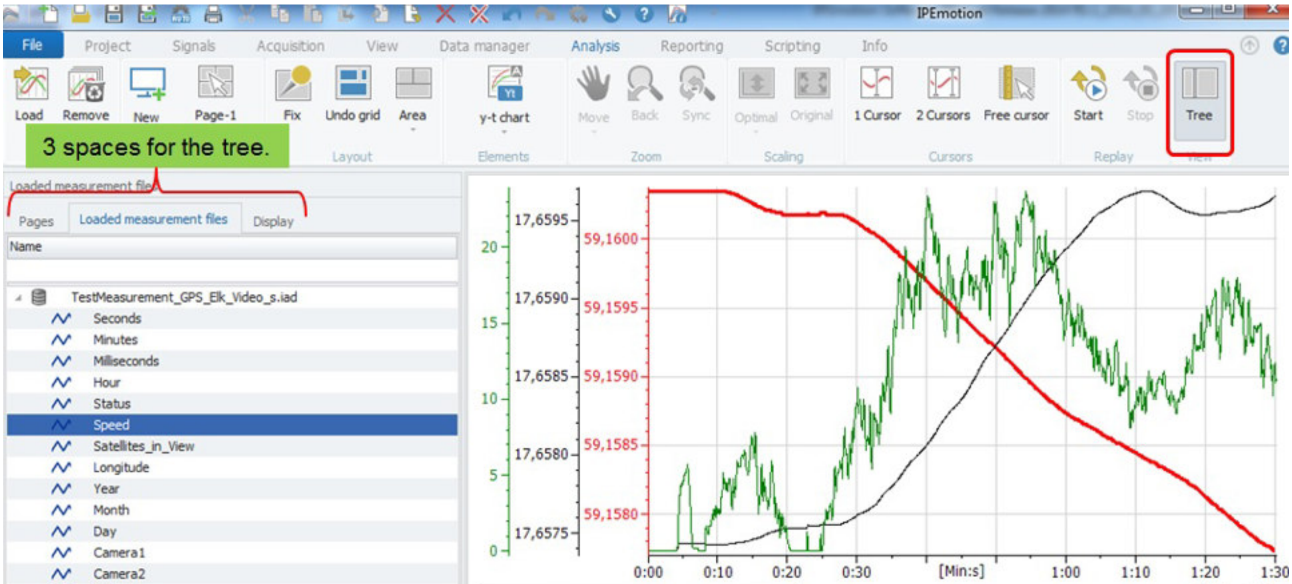
When you hit the pause button the cursor stops at this position. When you hit the start button again the cursor keeps moving on.

19.2.16 Stop

When you hit the stop button the cursor stops and resets back to the beginning of the graph.

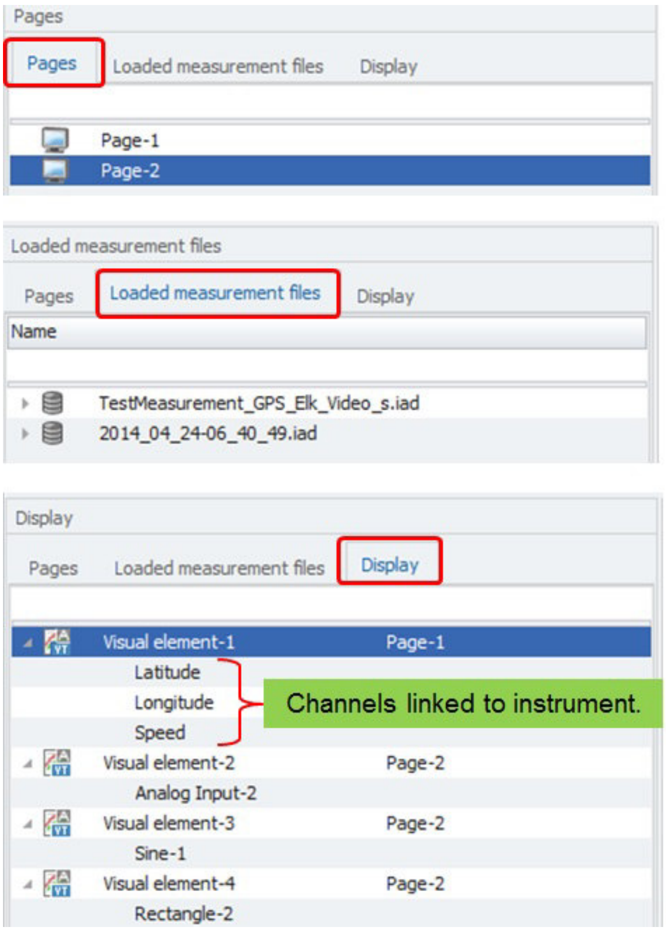
19.2.17 Tree

With the tree button you can enable or disable the tree on the left hand side. In the tree you can switch between 3 different work spaces.



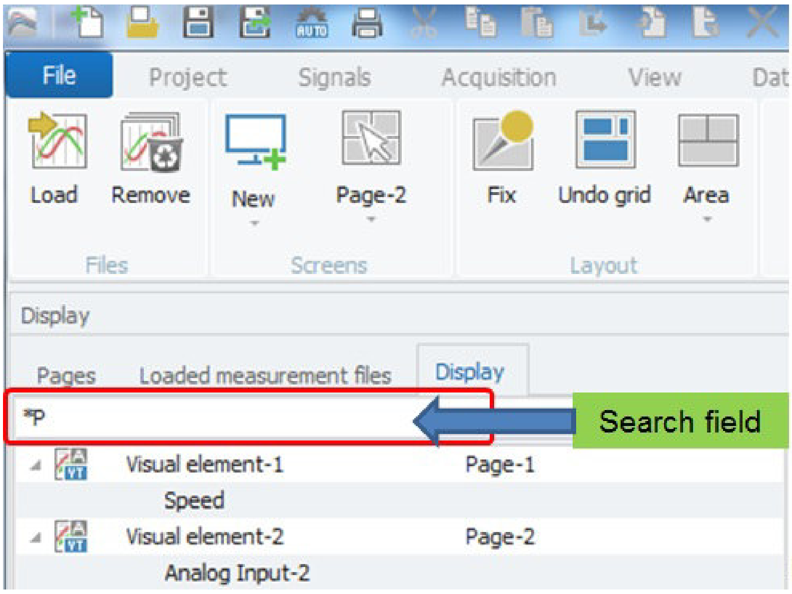
[AN_22]

- ► Page — On the page tab sheet you get an overview of all analysis pages you have created as discussed in this chapter in section 19.1.3.
- ► Loaded measurement files — In this area you will see all loaded data files as discussed in section 19.1.1.
- ► Display — In this tab sheet you have an overview of all instruments created and the related channels to the instrument.



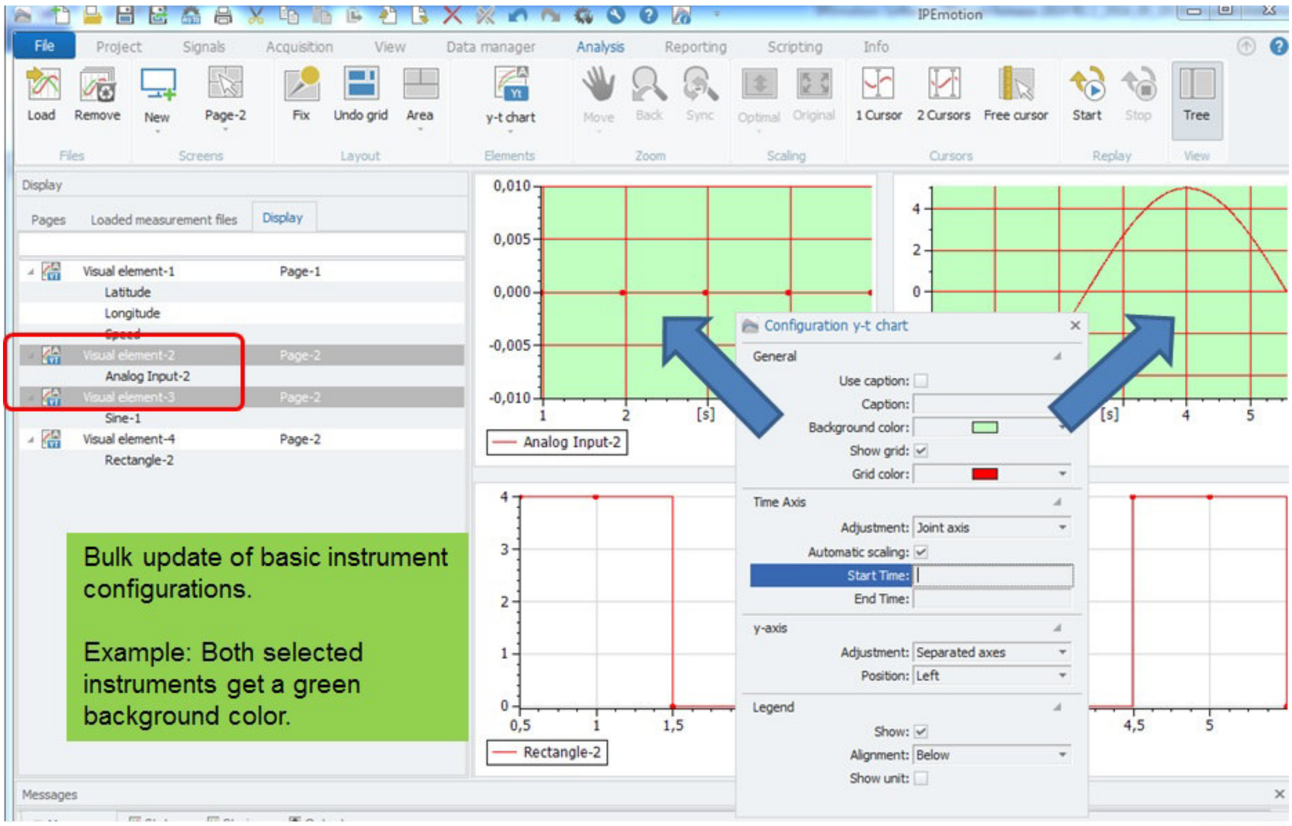
[AN_23]

In the tree you can search for instrument, page or channel names.



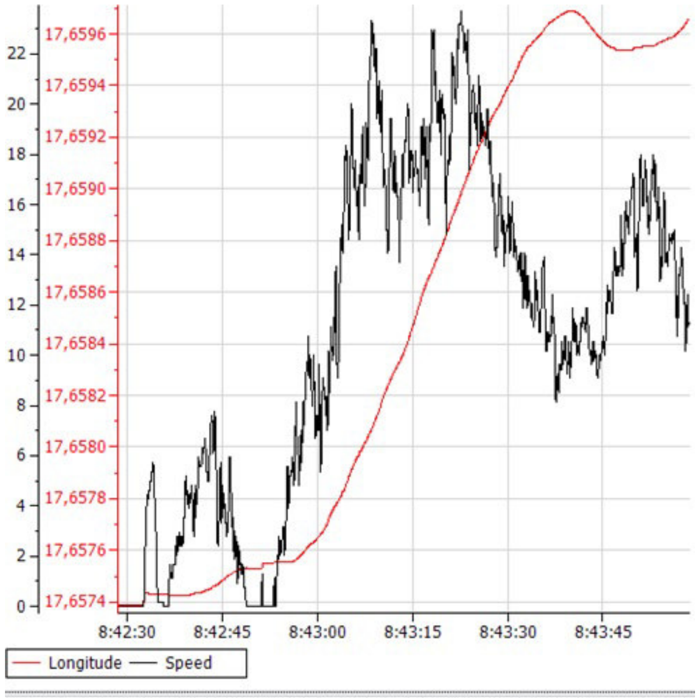
[AN_24]

Within the display tab sheet you can perform a bulk update of all selected instruments across all pages like in the VIEW work area discussed. This is convenient if you have many diagrams and the basic setup of all diagrams should look the same. You just need to select the diagrams and open the instrument properties headup display.



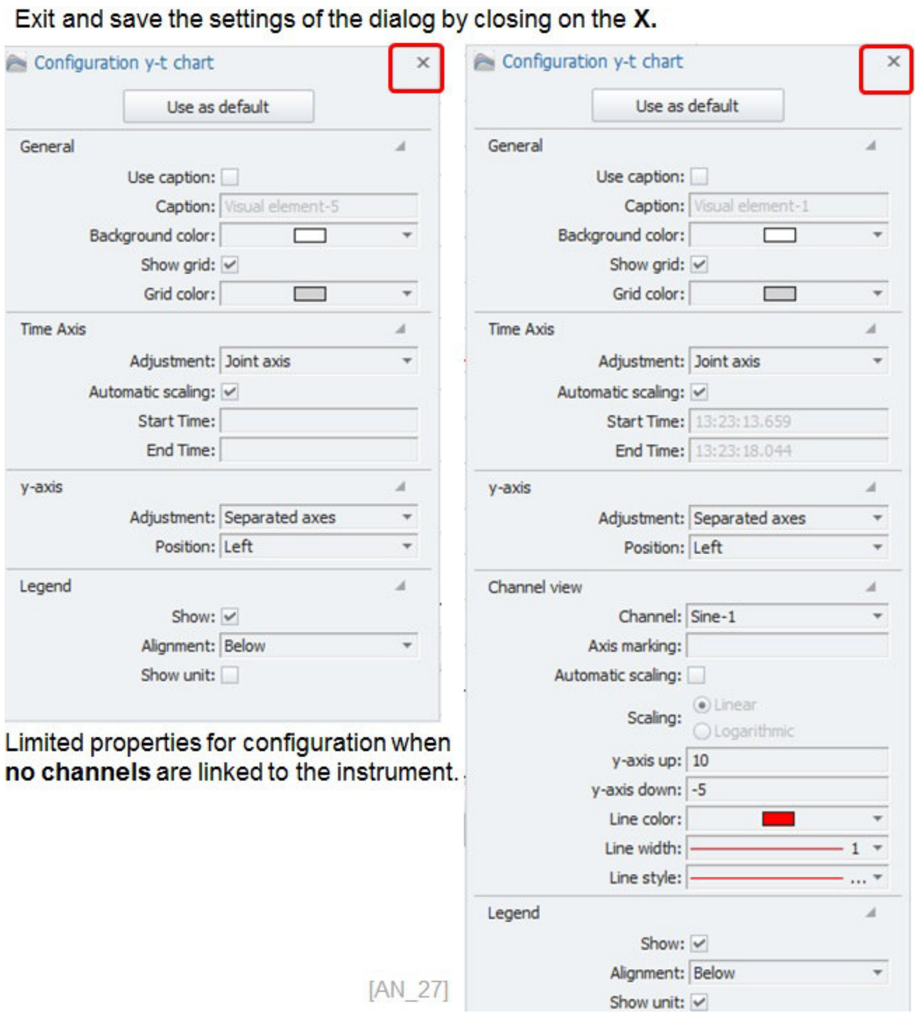
[AN_25]

19.3 Yt- chart



[AN_26]

19.3.1 Yt- chart head up display



[AN_27]

19.3.2 Use as default

As discussed above, you can save all configurations of an instrument by hitting the default button. In this case, the software creates a template file and every new instrument you create will comply with this template. The templates are managed under Application Menu >Administration. For more details see chapter 6.8.

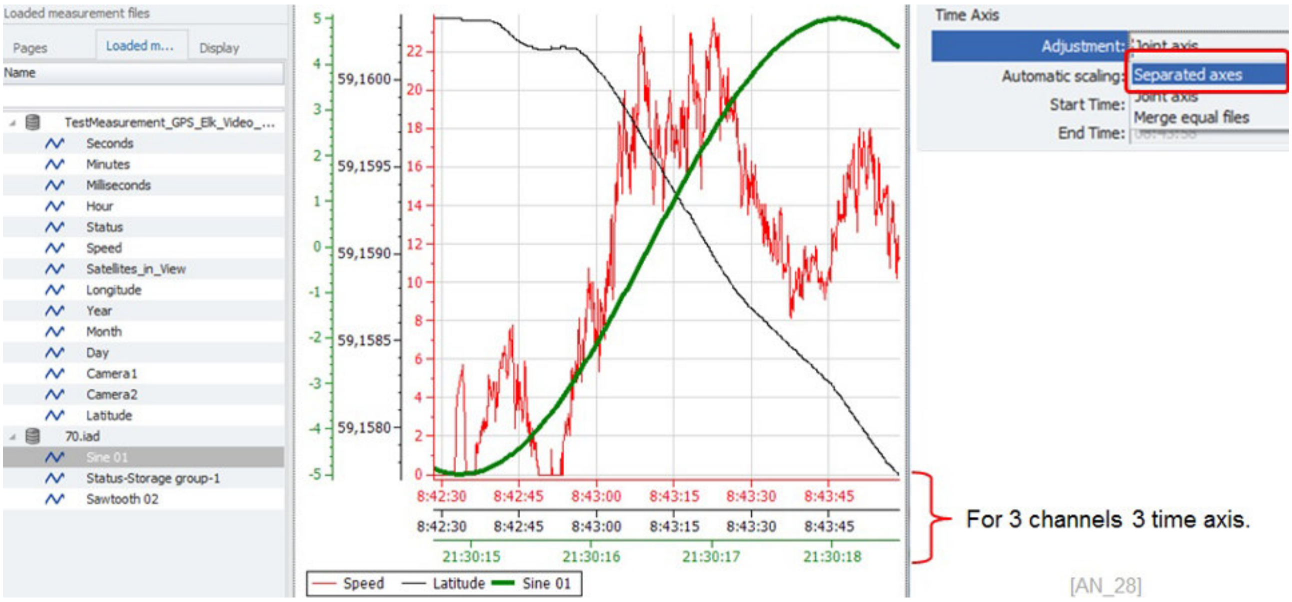
19.3.3 General

- See configuration options in chapter VIEW >Yt- chart 17.7.4.

19.3.4 Time Axis

- Adjustment

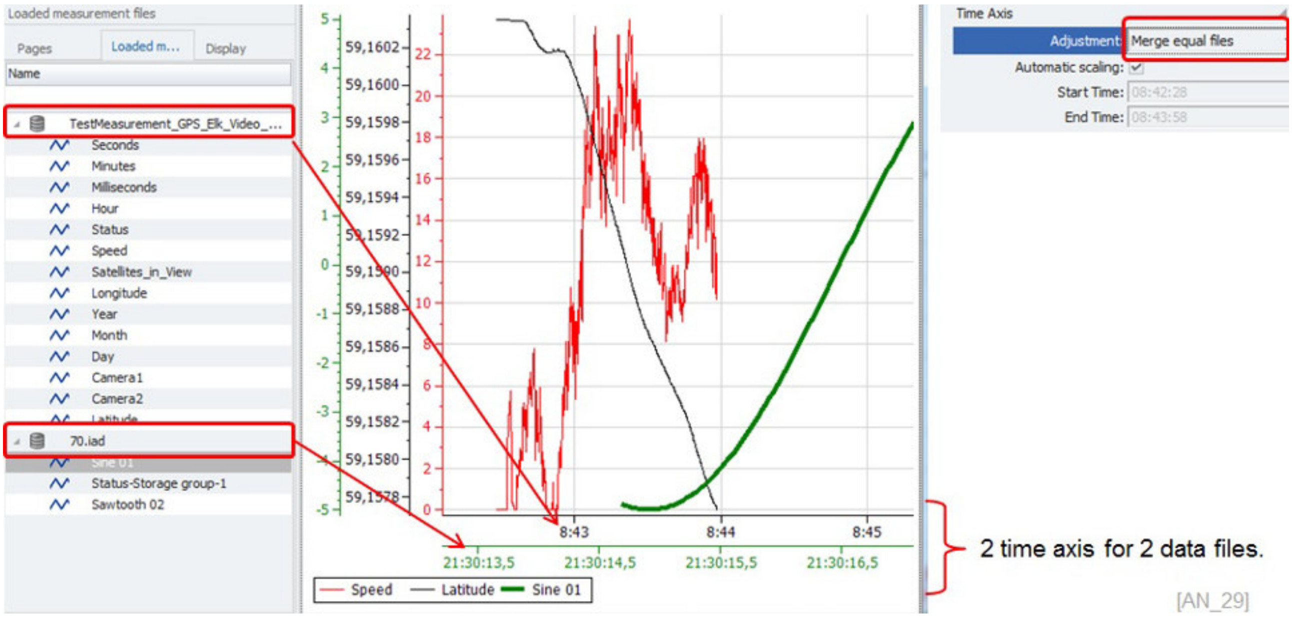
If you select the mode âĂIJSeparated axesâĂİ, the Yt-diagram shows a separate time line for each channel included in the diagram. You can move, stretch and compress the time line for each channel individually as the screen shot below indicates.



[AN_28]

► Adjustment

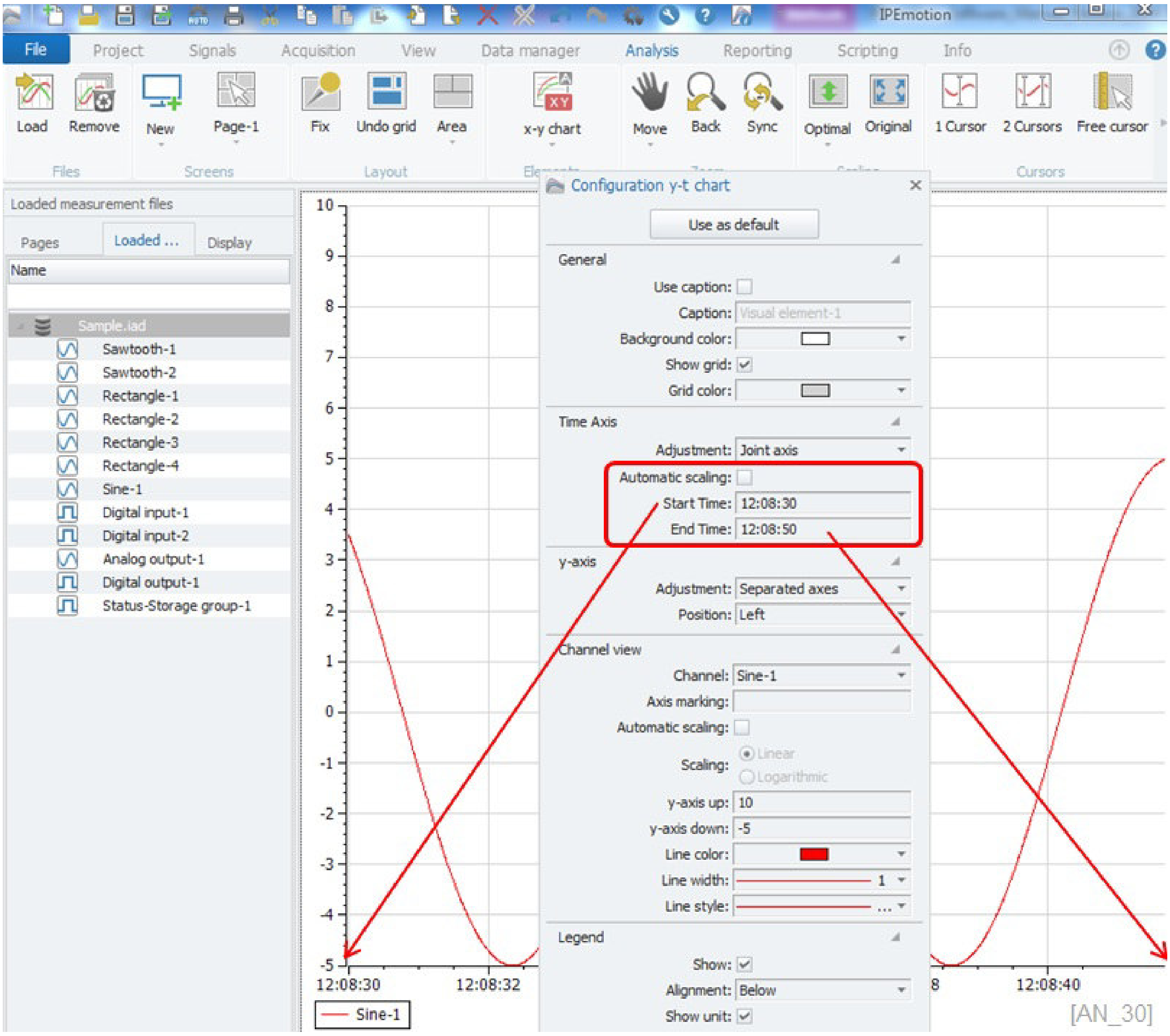
If you need to compare channels of different data files, you can use the mode "Merge equal files". In this configuration, all channels of the same data file are aligned to a common timeline. If you move, stretch or compress the time line, this is applied to all channels of the related data file



[AN_29]

- Automatic Scaling

The time span in the Yt- chart can be defined. To activate this function, the automatic time axis scaling needs to be deactivated. After defining the start and end time, the Yt- chart is setting the time axis to the defined position. This function can also be used through the scripting / COM interface. This gives you the ability to zoom and cut out a specific time span of the data file to perform your analysis.

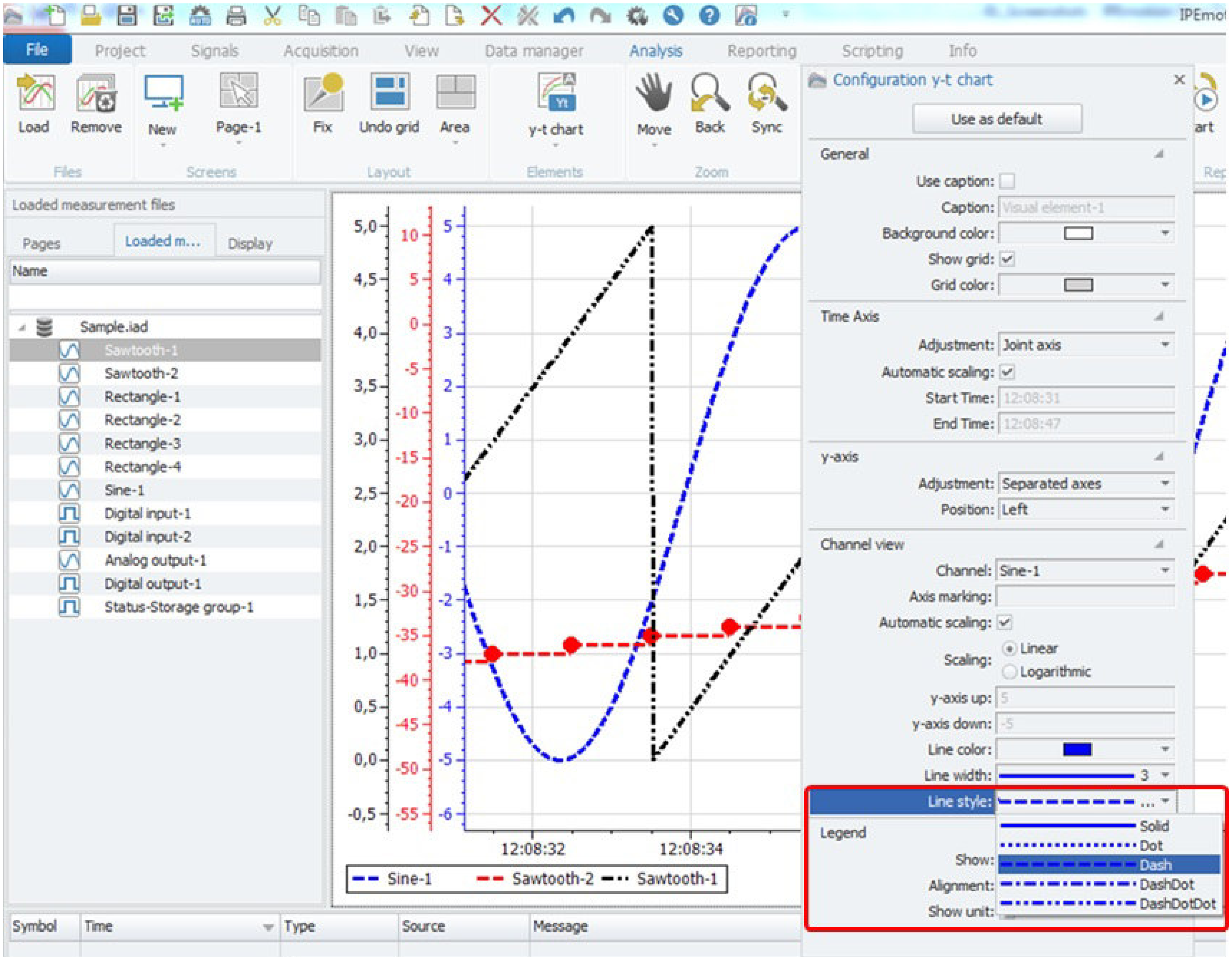


19.3.5 Y-axis

- Adjustment — See configuration options in chapter VIEW >Yt- chart 17.7.4.
- Position — See configuration options in chapter VIEW >Yt- chart 17.7.4.

19.3.6 Channel view

- See configuration options in chapter VIEW >Yt- chart 17.7.7.
    - Line Style — The line style is a specific function which is not supported in the online VIEW. Here you can define 5 different line types. The default line style is Solid also used in VIEW. The other analysis specific line styles are: Dot, Dash, DashDot, DasDotDot.

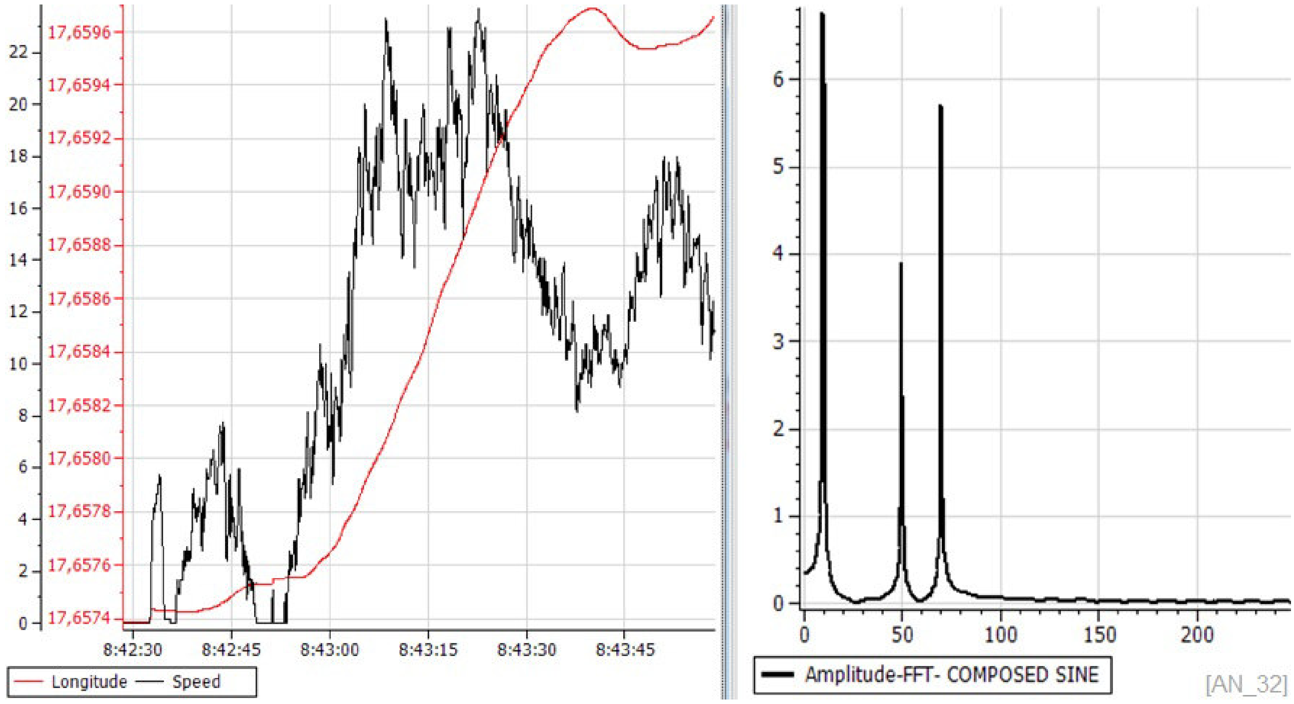


[AN_31]

19.3.7 Legend

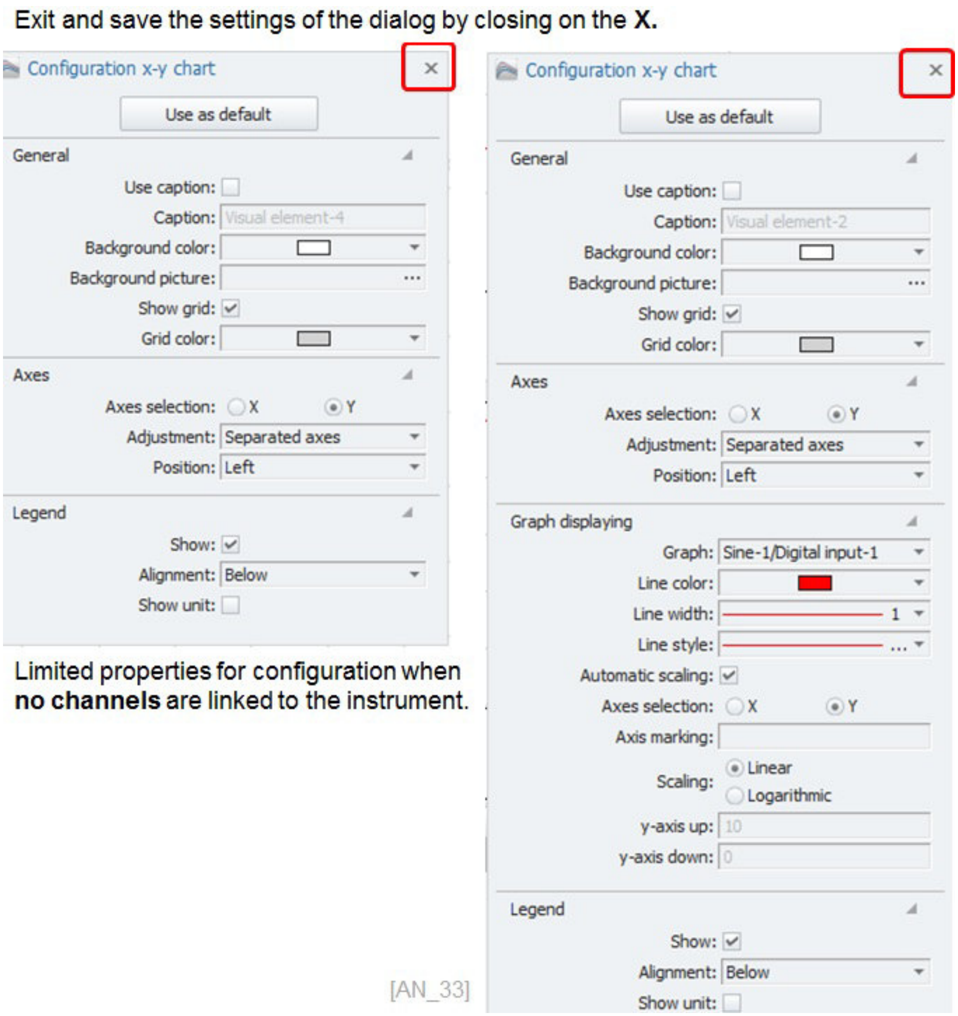
- See configuration options in chapter VIEW >Yt- chart 17.7.8.

19.4 x-y chart / FFT display



[AN_32]

19.4.1 x-y chart head up display



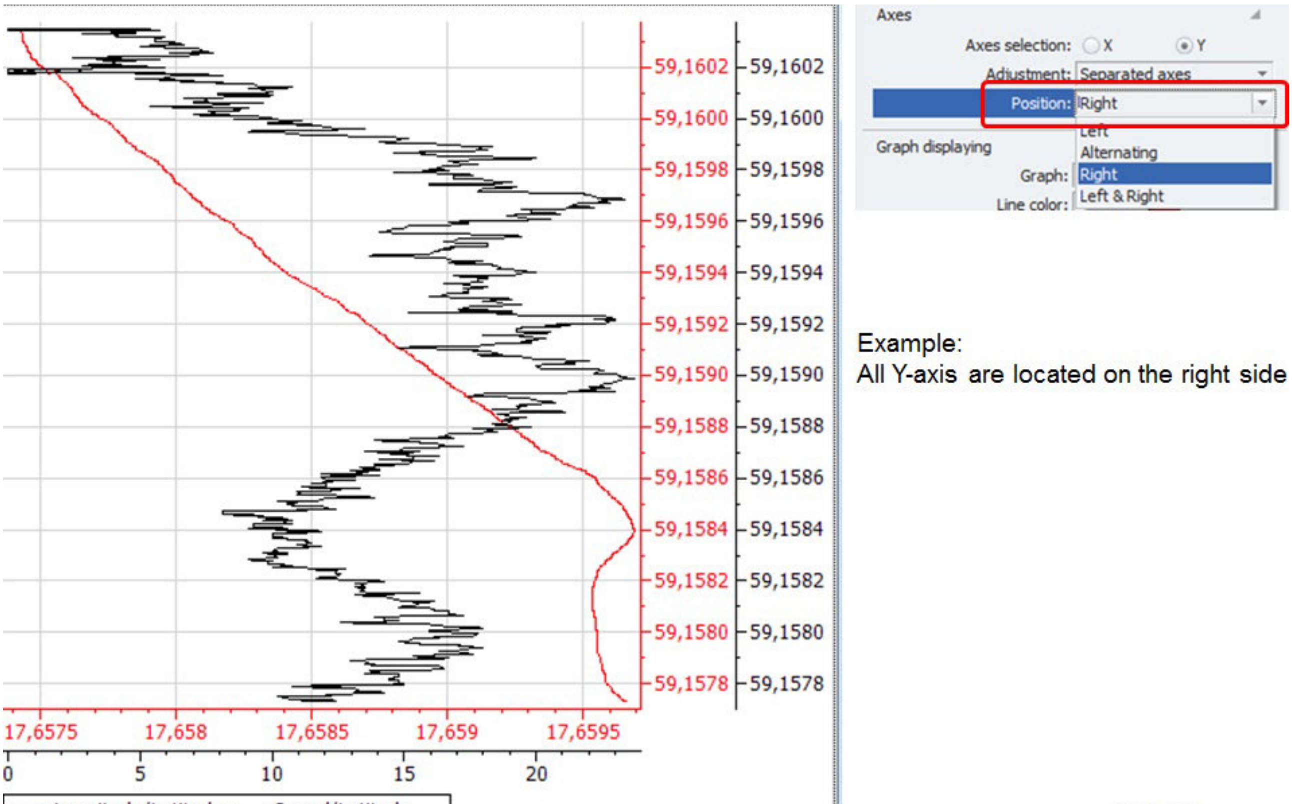
[AN_33]

19.4.2 General

- See configuration options in chapter VIEW >Yt- chart 17.8.

19.4.3 Axis

- See configuration options in chapter VIEW >Yt- chart 17.8.4.
  - Position — In the configuration display of the Yt- chart you can decide about the location (left, right, alternating or both sides) for the Yt- chart. The screenshot below shows the display of the Y-axis location on the right side of the diagram.



[AN_34]

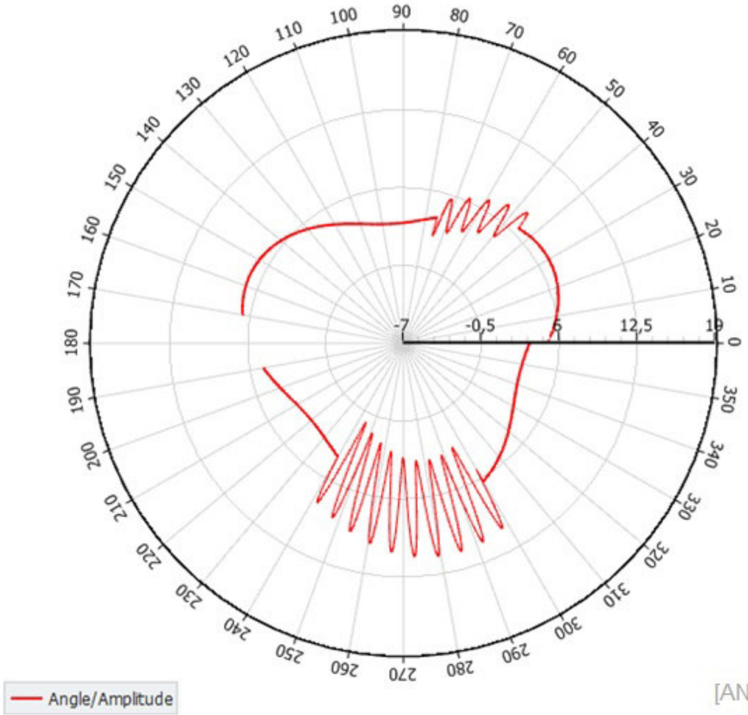
19.4.4 Graph displaying

- See configuration options in chapter VIEW >x-y chart 17.8.5.
  - Line Style — Refer to Yt-chart discussed above 19.4.4.

19.4.5 Legend

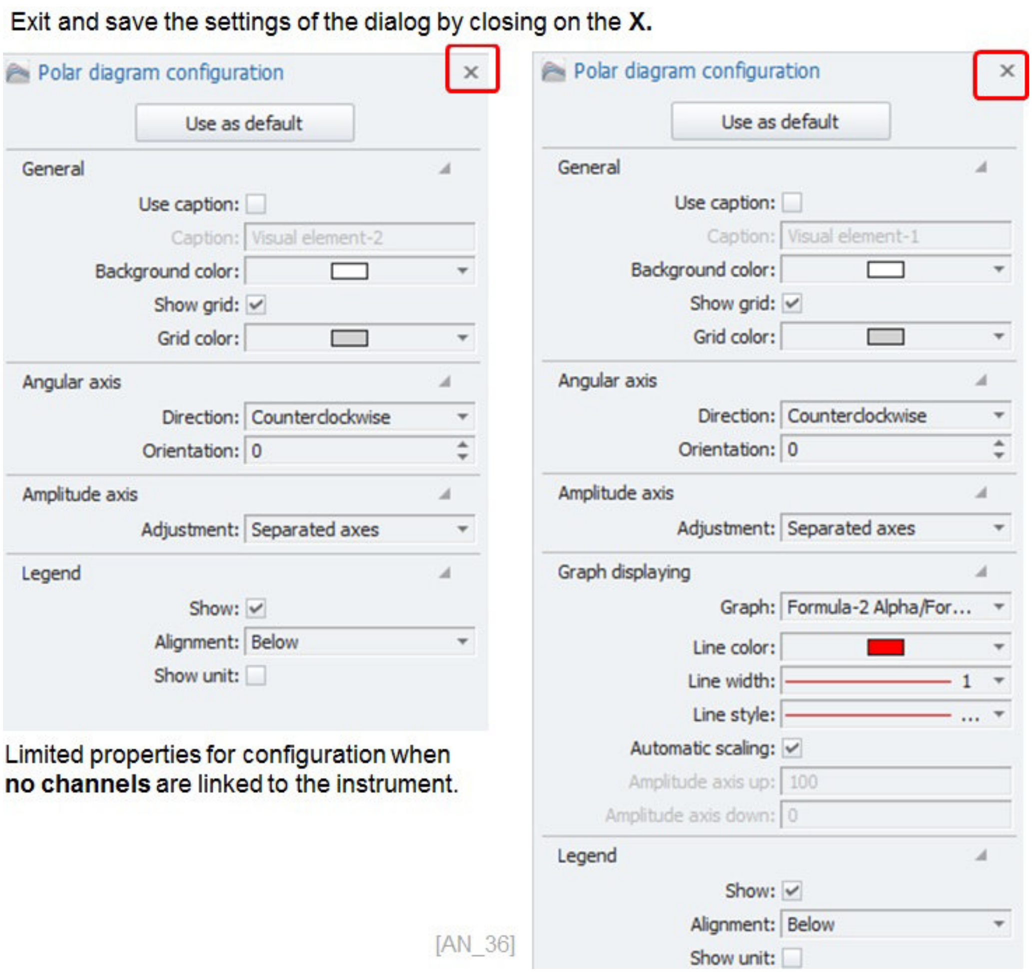
- See configuration options in chapter VIEW >Yt- chart 17.7.8.

19.5 Polar diagram



[AN_35]

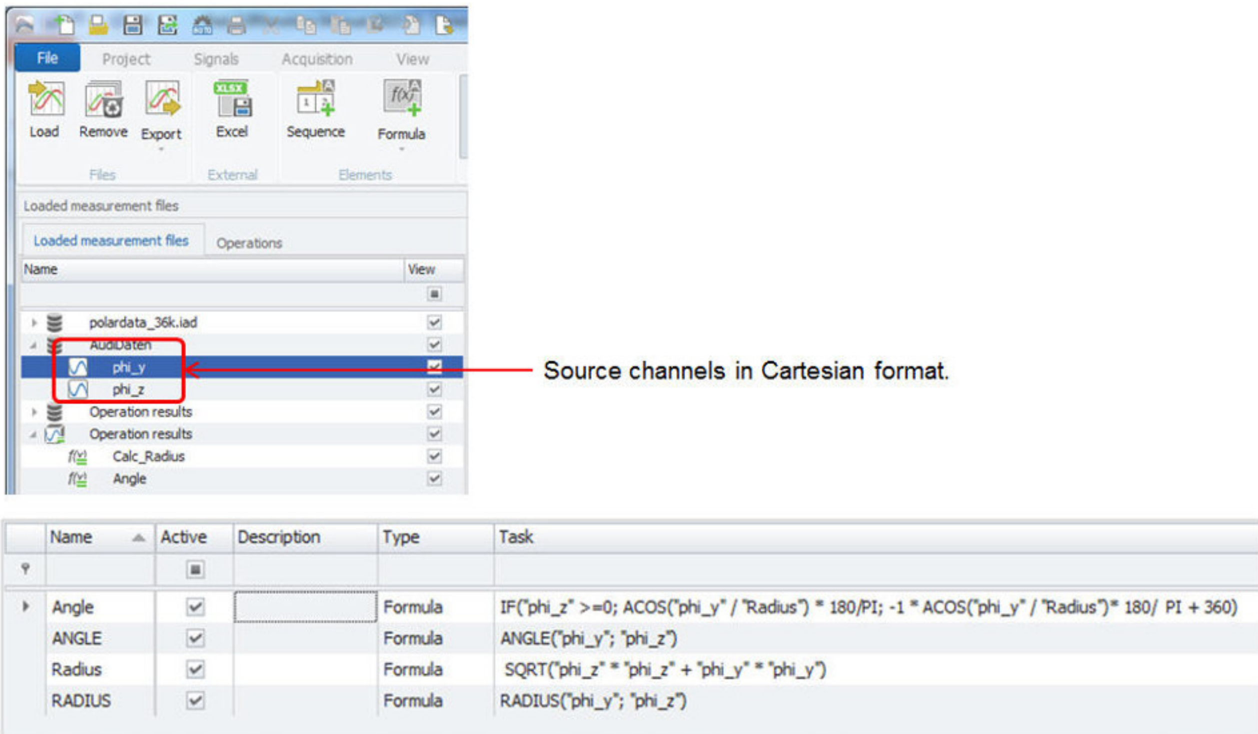
19.5.1 Polar diagram head up display



[AN_36]

19.5.2 Polar coordinate input channels

The polar diagram requires 2 input channels in polar coordinates. One channel must represent the radius and the other channel the angle. Both channels together generate the graph. If you do not have recorded the data in polar coordinates you can generate polar coordinates in the post processing using the following formulas:



Name	Active	Description	Type	Task
Angle	✓		Formula	IF("phi_z" >=0; ACOS("phi_y" / "Radius") * 180/PI; -1 * ACOS("phi_y" / "Radius")* 180/ PI + 360)
ANGLE	✓		Formula	ANGLE("phi_y"; "phi_z")
Radius	✓		Formula	SQRT("phi_z" * "phi_z" + "phi_y" * "phi_y")
RADIUS	✓		Formula	RADIUS("phi_y"; "phi_z")

Radius & Angle formula to convert Cartesian coordinates into Polar coordinates. [AN_37]

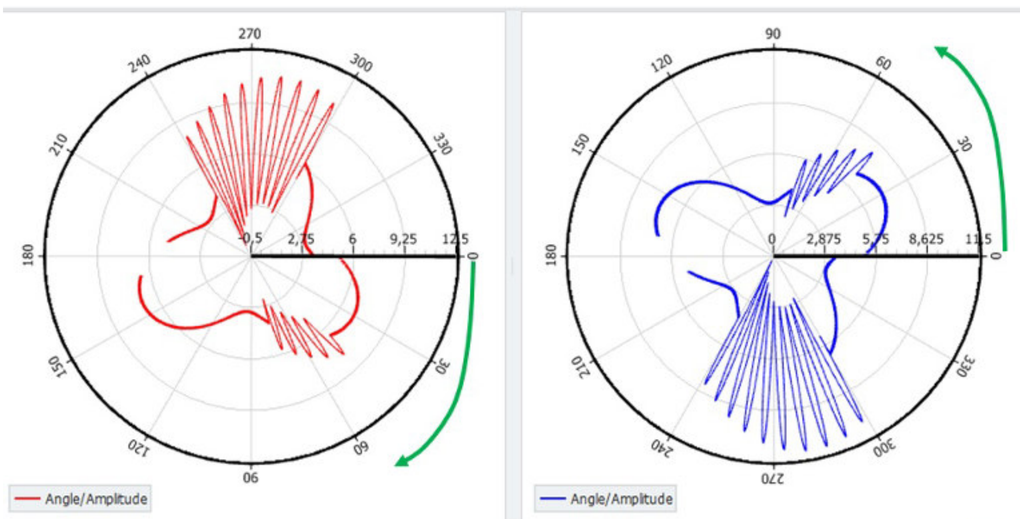
19.5.3 General

- See configuration options in chapter VIEW >Yt-chart 17.8.

19.5.4 Angular Axis

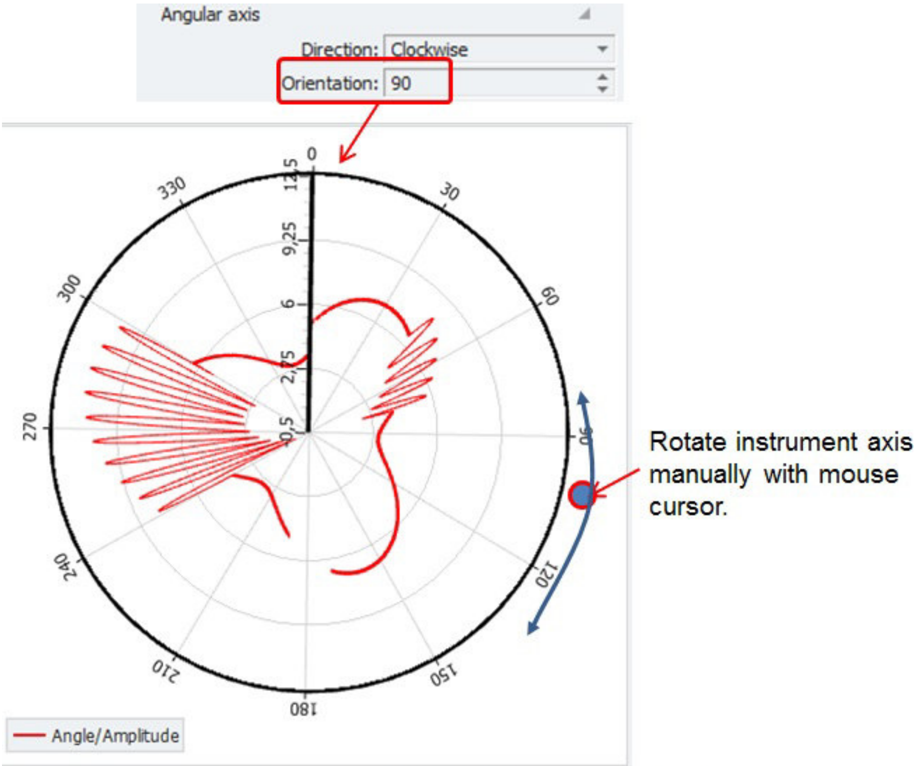
- Direction — Define the angle orientation clockwise or counterclockwise direction.

Counterclockwise orientation



Clockwise orientation [AN_38]

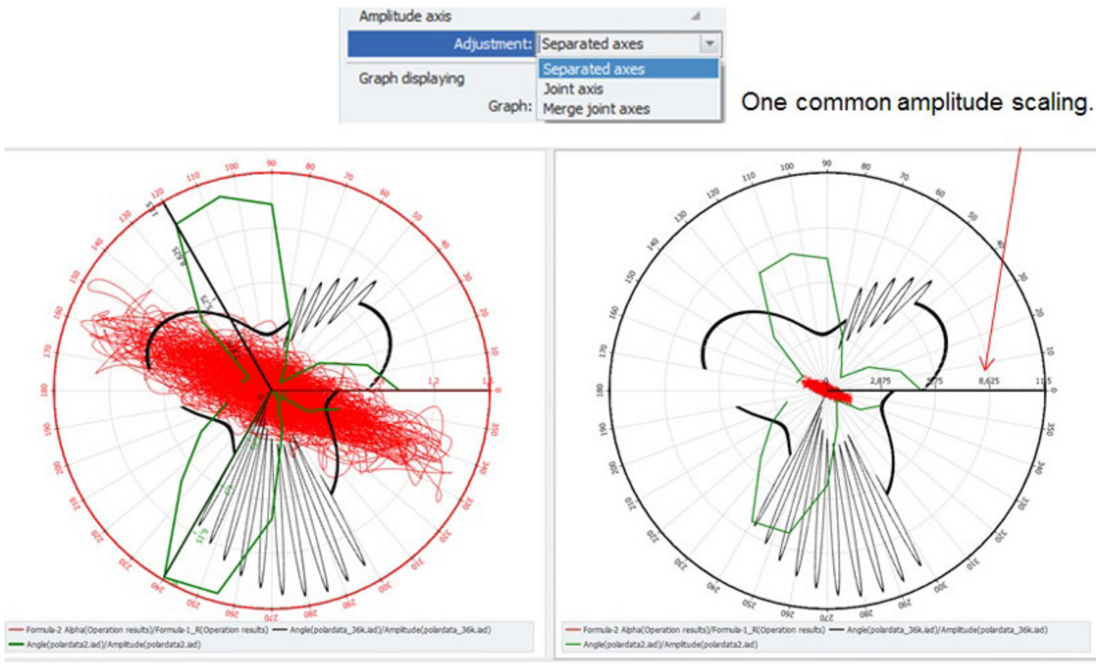
- **Orientation** — With the input of the orientation angel the instrument is rotated. The instrument can be rotated manually with left mouse click inside the labeling of the angles.



Rotate instrument in the range of 0 – 360°. [AN_39]

19.5.5 Amplitude Axis

- **Adjustment** — Here you can define whether all signals scaled along the same axis of along separate axes. The function âĂIJMerge joint axesâĂİ is grouping all axis with the same min âĂŞ max scaling range together.



3 separate amplitude axes. One joint amplitude axis. [AN_40]

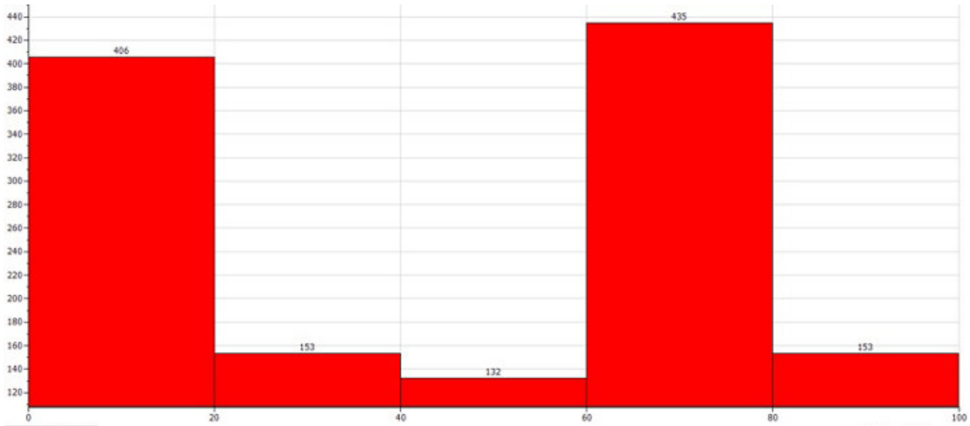
19.5.6 Graph displaying

- ► See configuration options in chapter VIEW >x-y chart 17.8.5.
- ► Line Style: Refer to Yt-chart discussed above19.4.4.

19.5.7 Legend

- ► See configuration options in chapter VIEW >Yt- chart 17.7.8.

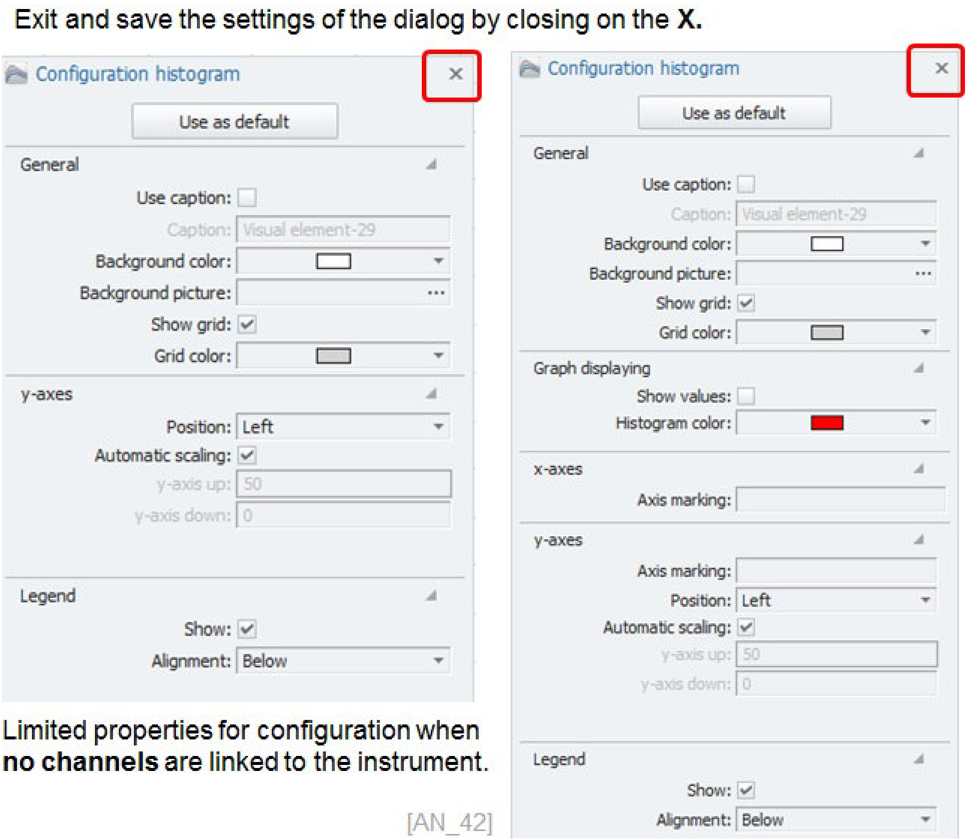
19.6 Histogram



[AN_41]

The histogram can present data in columns. Currently, the results of the classifications are presented in this diagram type. The configuration of an offline classification is discussed in chapter 18.15. The configuration of the online classification is explained in chapter 13.12.

19.6.1 Histogram head up display



[AN_42]

19.6.2 General

- See configuration options in chapter VIEW >Yt- chart 17.8.

19.6.3 Graph displaying

- See configuration options in chapter VIEW >x-y chart 17.8.5.
  - Line Style — Refer to Yt-chart discussed above 19.4.4.

19.6.4 X-Axis

- Axis marking — Here you can define a name for the X axis.

19.6.5 Y-axis

- Axis marking — Here you can define a name for the Y axis.
- Position — Here you define the position of the axis. See example in chapter 19.4.3.

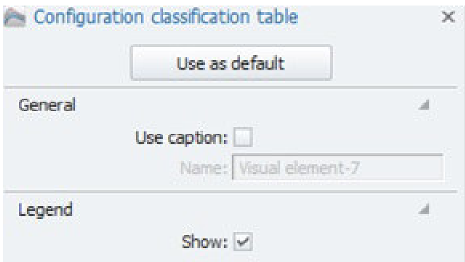
19.6.6 Legend

- See configuration options in chapter VIEW >Yt- chart 17.7.8.

19.7 Classification table

To display the result of the 2D classification methods a classification table instrument is available. The configuration of the instrument is very limited to the basic function to show the legend and instrument caption.

19.7.1 Classification table head up display



[AN_43]

The result of the 2D classification operations explained in the DATA MANAGER 18.15 can be presented in this instrument.

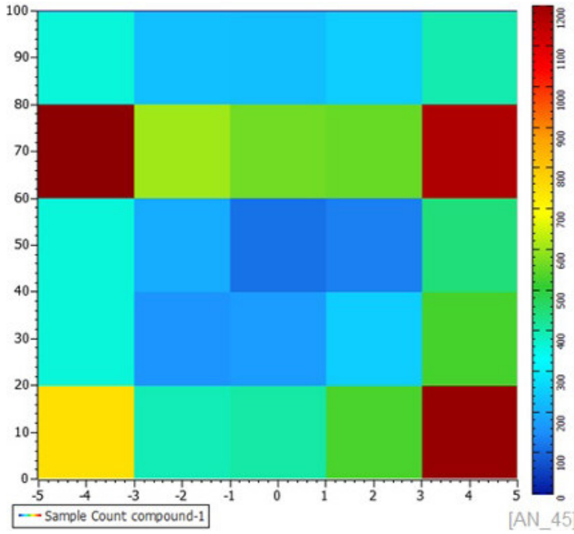
	-10 ... -6	-6 ... -2	-2 ... 2	2 ... 6	6 ... 10
-10 ... -6	0	0	0	0	0
-6 ... -2	0	0	0	0	0
-2 ... 2	0	0	0	0	297
2 ... 6	0	0	0	0	0
6 ... 10	0	0	298	0	0

Transition Matrix-1

[AN_44]

The results of the 2D classifications can be presented graphically in the classification grid 19.8.

19.8 Classification grid



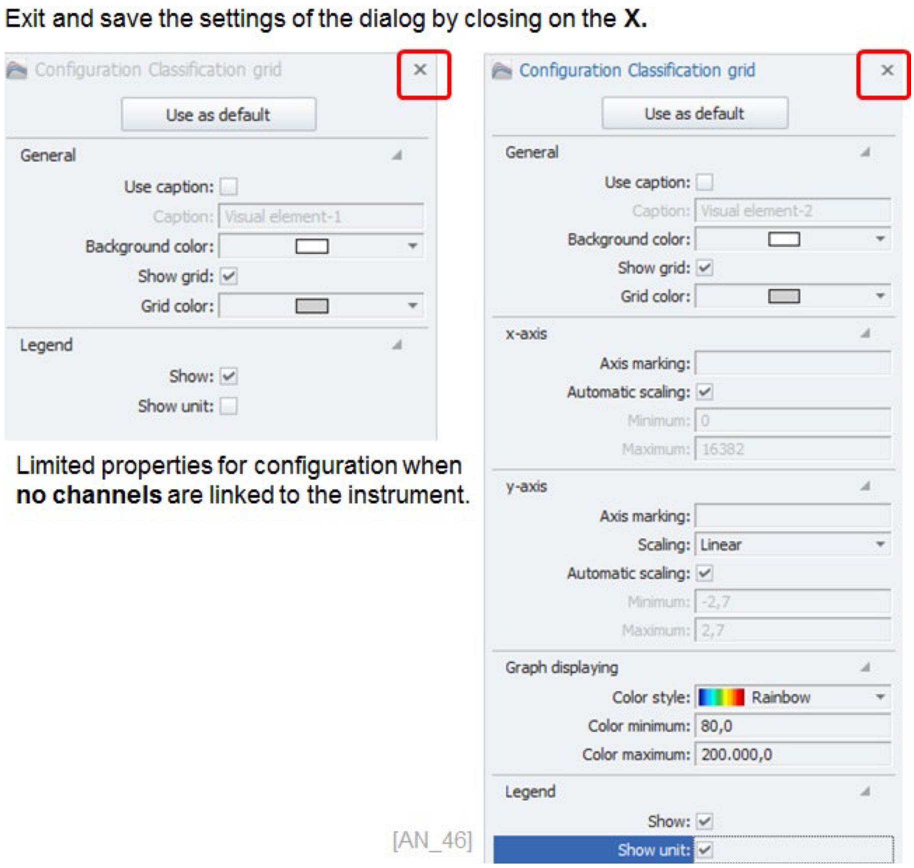
[AN_45]

The classification grid is a complementary display instrument to show the results of 2D classification methods graphically.

- From to Count
- Rainflow
- Transition Matrix
- Sample count Compound
- Tim at Level Compound

19.8.1 Classification grid head up display

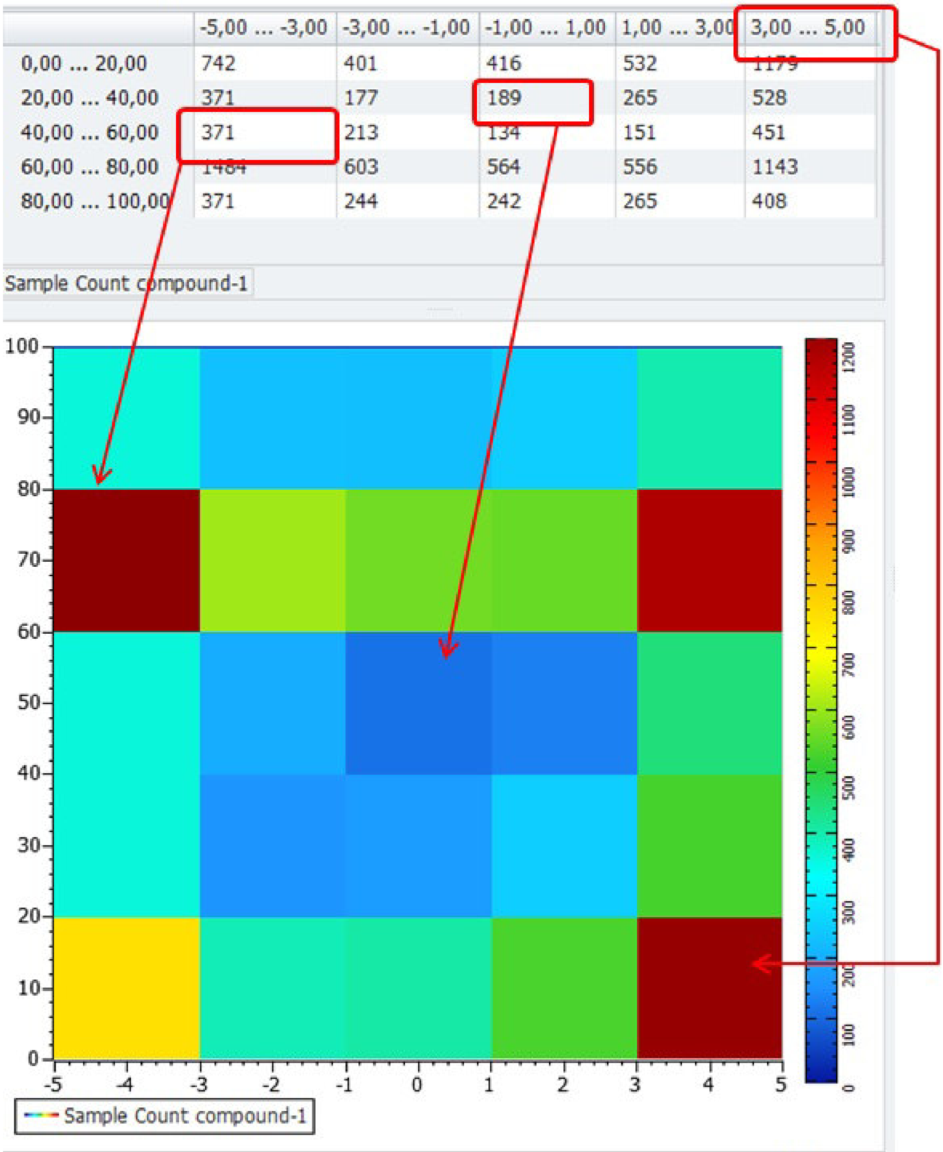
The configuration properties are related to the Campbell diagram as discussed in section 19.19.



[AN_46]

Example: Present results of the classification table in the classification grid

Nummerical presentation in the classification table.

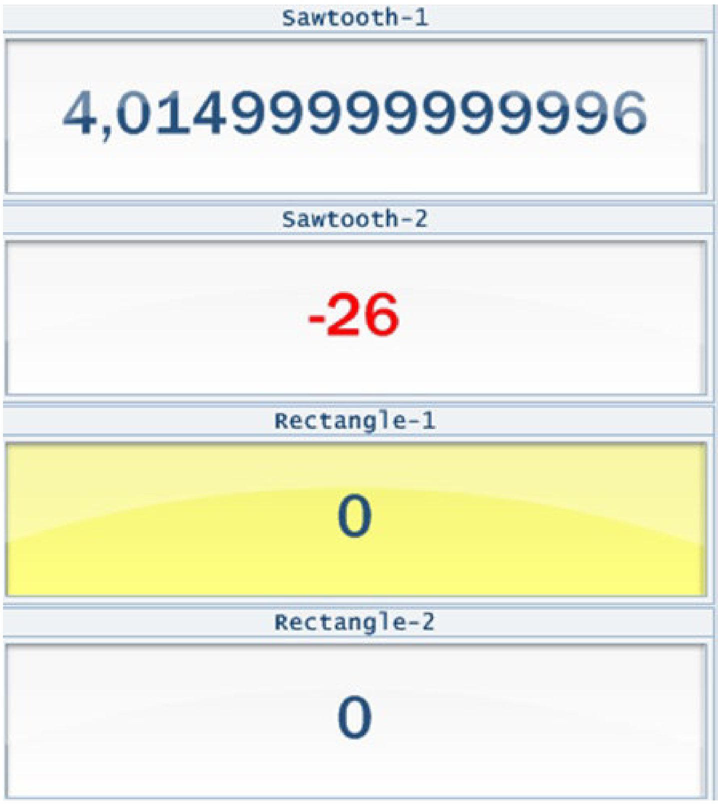


	-5,00 ... -3,00	-3,00 ... -1,00	-1,00 ... 1,00	1,00 ... 3,00	3,00 ... 5,00
0,00 ... 20,00	742	401	416	532	1179
20,00 ... 40,00	371	177	189	265	528
40,00 ... 60,00	371	213	134	151	451
60,00 ... 80,00	1484	603	564	556	1143
80,00 ... 100,00	371	244	242	265	408

Graphical presentation in the classification grid.

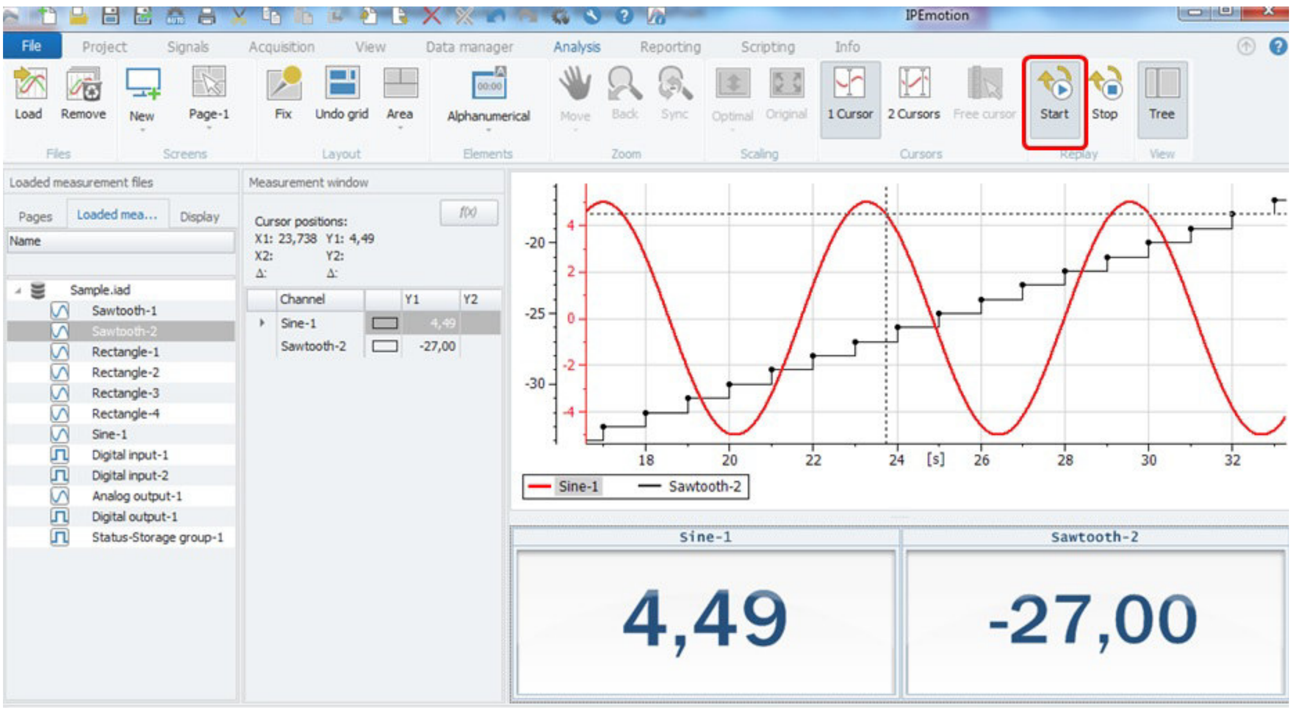
[AN_47]

19.9 Alphanumerical



[AN_48]

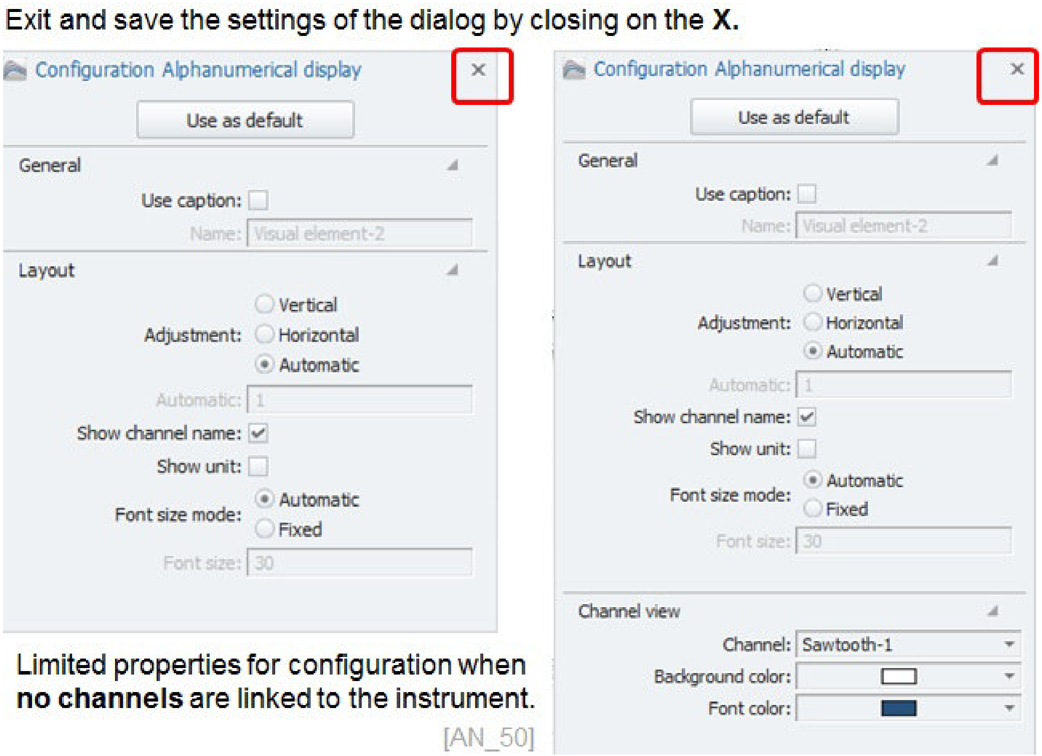
You can read values in the alphanumerical instrument when you hit the play button and the cursor is scrolling though the data or when you move the cursor manually. When you activate 2 cursors the values if cursor 2 will be displayed in the instrument.



Instrument shows readings when cursor is activated.

[AN_49]

19.9.1 Alphanumerical head up display



[AN_50]

19.9.2 General

- ► Use caption — With this check box you can activate and display an individual instrument name. See chapter 19.11.2.

19.9.3 Layout

For configuration see chapter VIEW >Alphanumerical instrument 17.13.2.

19.9.4 Channel view

For configuration see chapter VIEW >Alphanumerical instrument 17.13.3.

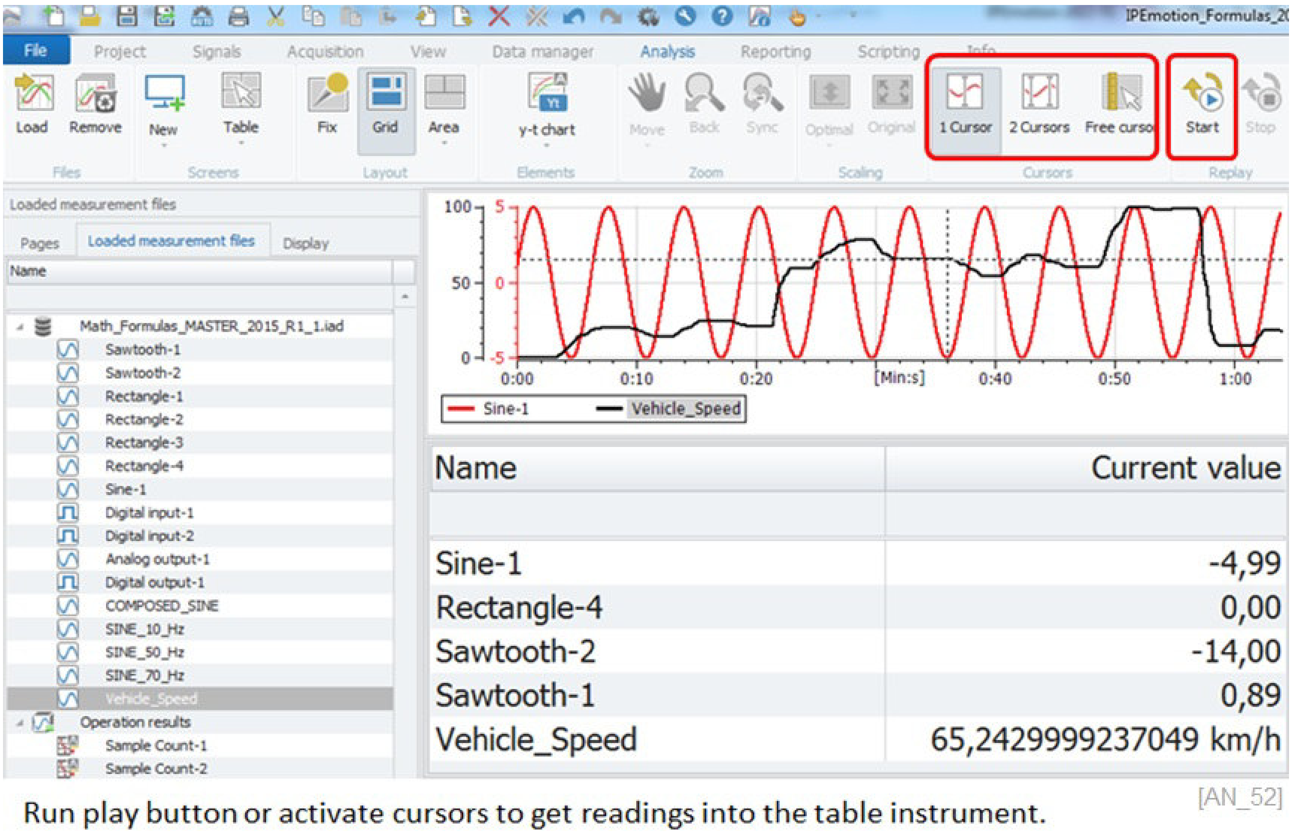
19.10 Table

Name	Current value
Sine-1	1,46
Rectangle-4	5,00
Sawtooth-2	-18,00
Sawtooth-1	1,53
Vehicle_Speed	65,7694361791409 km/h

[AN_51]

19.10.1 Show readings

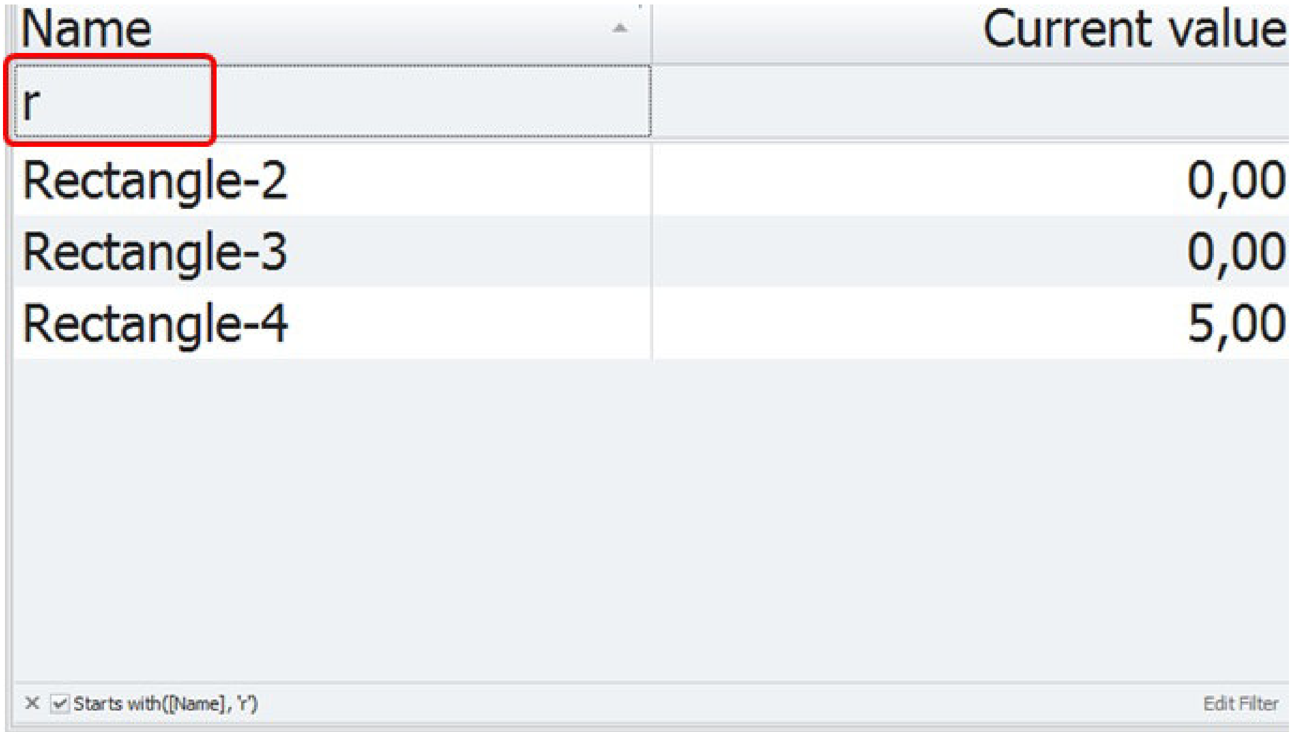
With drag and drop you add channels to the instrument. In order to get readings in the table instrument, you need to hit the play button or use cursors to update the data in the instrument. If you have more than one cursor, the values of cursor 1 will be presented in the instrument.



[AN_52]

19.10.2 Table configuration

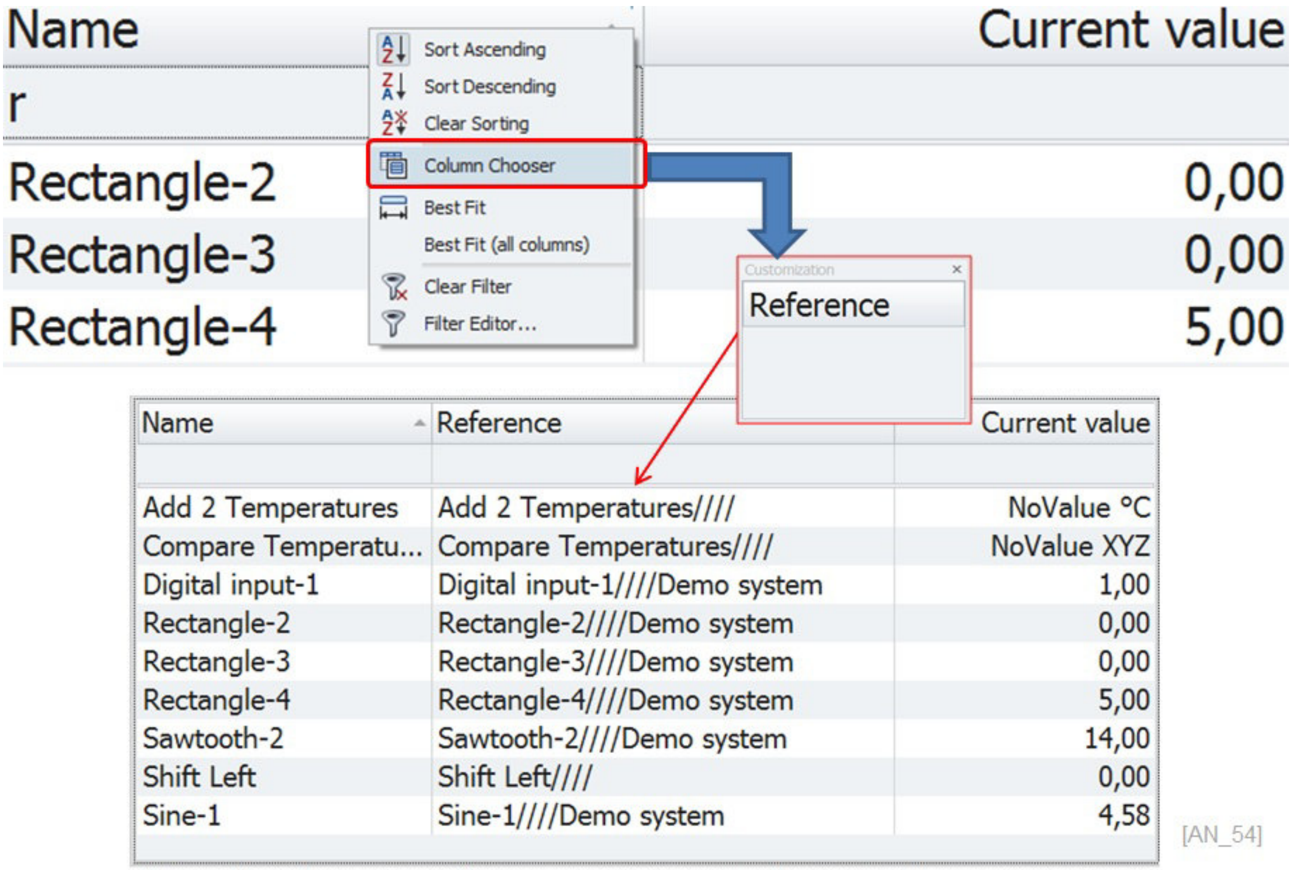
The table instrument is supporting the following configuration functions. You can filter by channel name.



Filter and search function by column.

[AN_53]

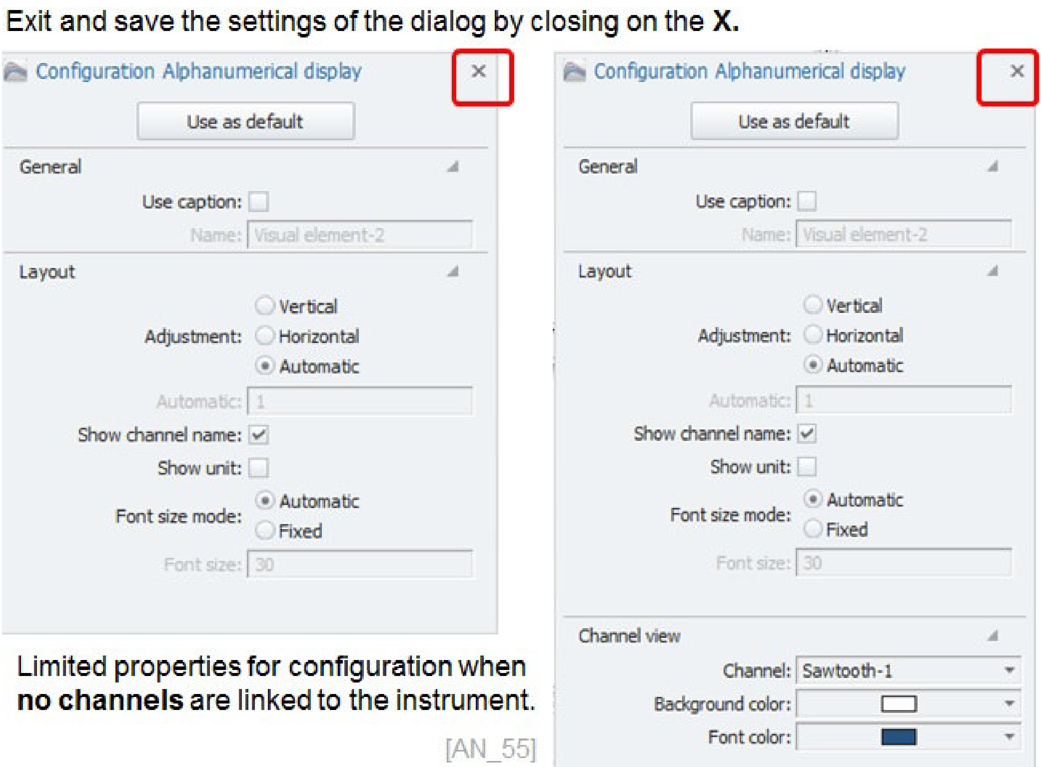
With the column chooser you can add one supplementary column with information of the channel reference to the channel grid.



[AN_54]

Use column chooser to add more parameters to the channel grid.

19.10.3 Table head up display



[AN_55]

19.10.4 General

- Use caption — With this check box you can activate and display an individual instrument name. See chapter 19.11.2.

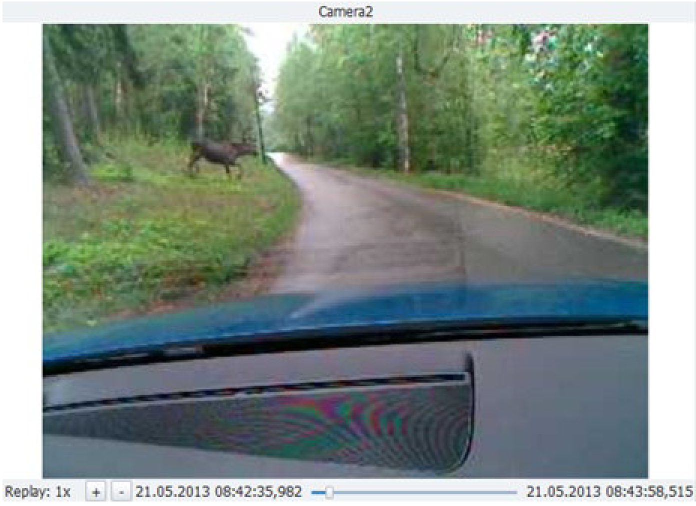
19.10.5 Layout

For configuration see chapter VIEW >Alphanumerical instrument 17.13.2.

19.10.6 Channel view

For configuration see chapter VIEW >Alphanumerical instrument 17.13.3.

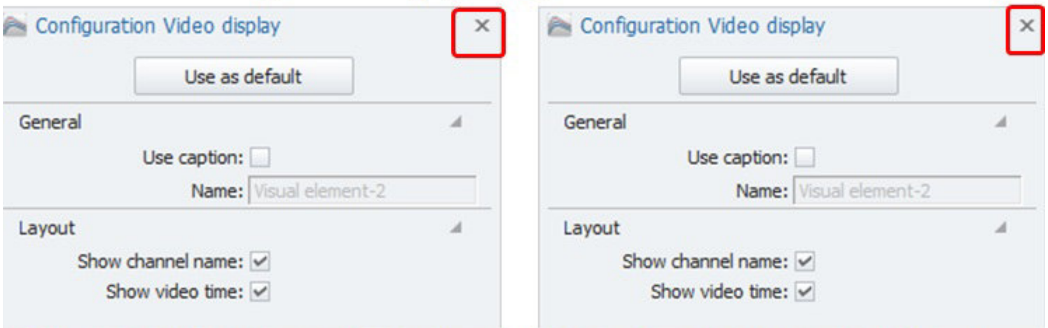
19.11 Video display



[AN_56]

19.11.1 Video head up display

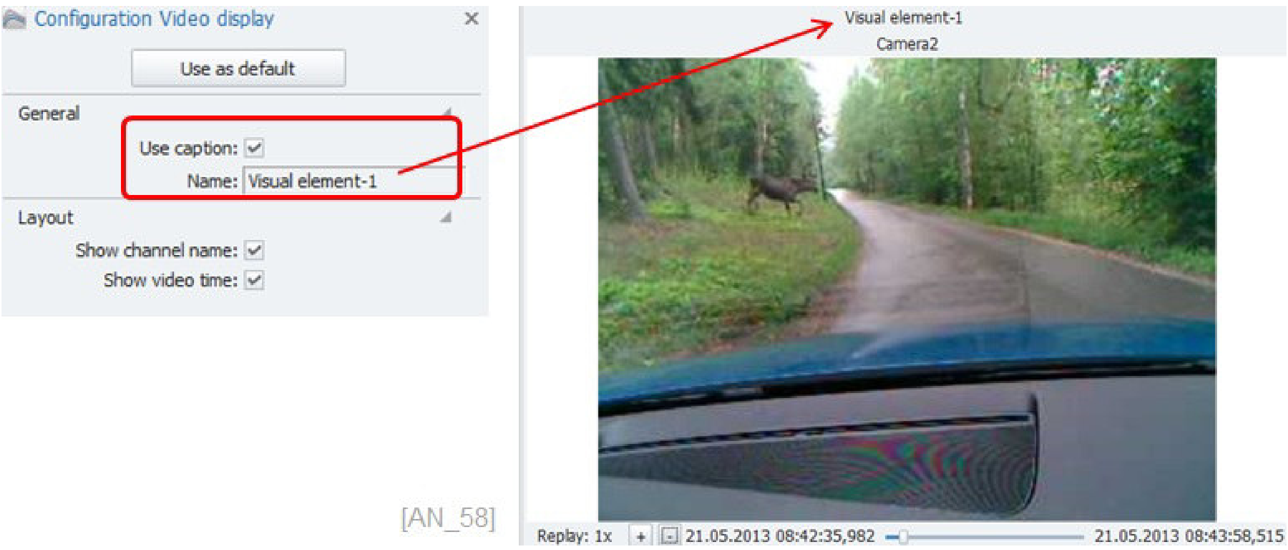
Exit and save the settings of the dialog by closing on the **X**.



This instrument shows with and without a related Video channel the same properties. [AN_57]

19.11.2 General

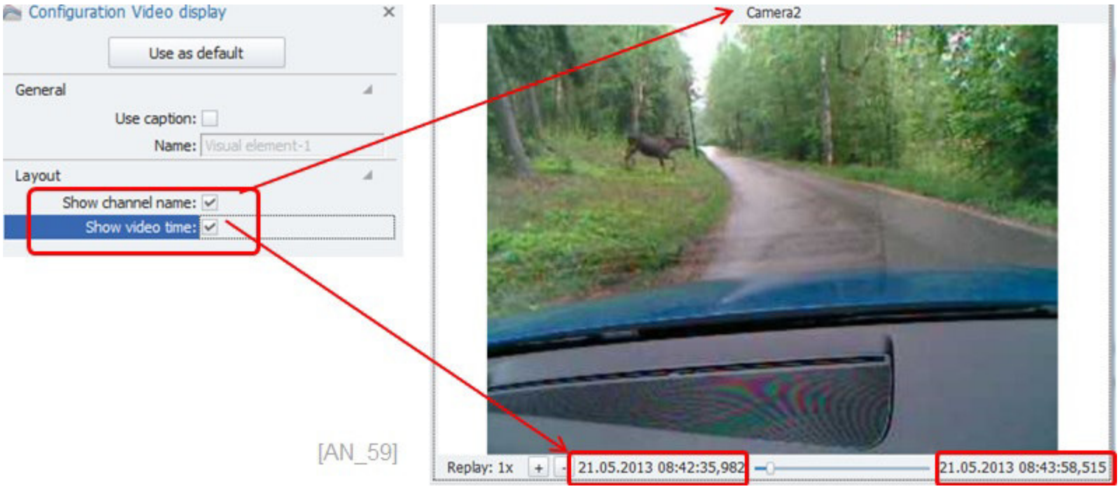
- ► Use caption — With this check box you can activate and display an individual instrument name. See chapter 19.11.2.



[AN_58]

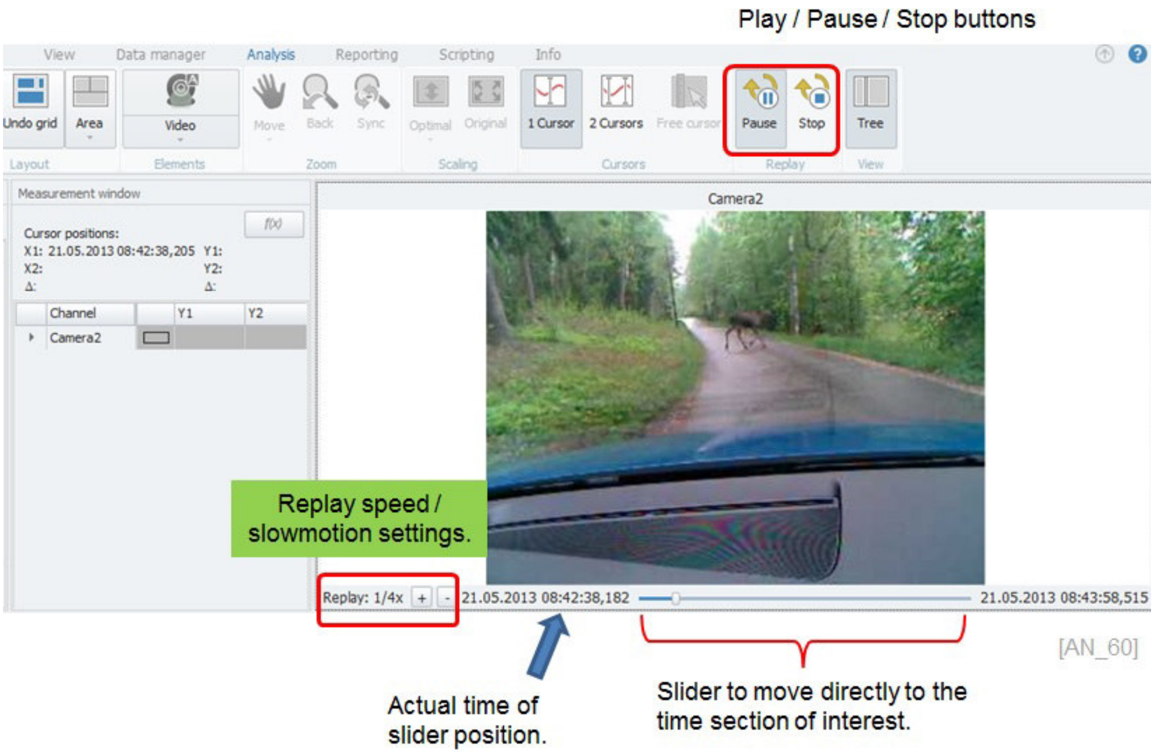
19.11.3 Layout

- **Show channel name** — With this check box you activate and display the video channel name in the top line of the instrument.
- **Show video time** — With this check box you activate the first and last recording time stamp beside the slide controller.



[AN_59]

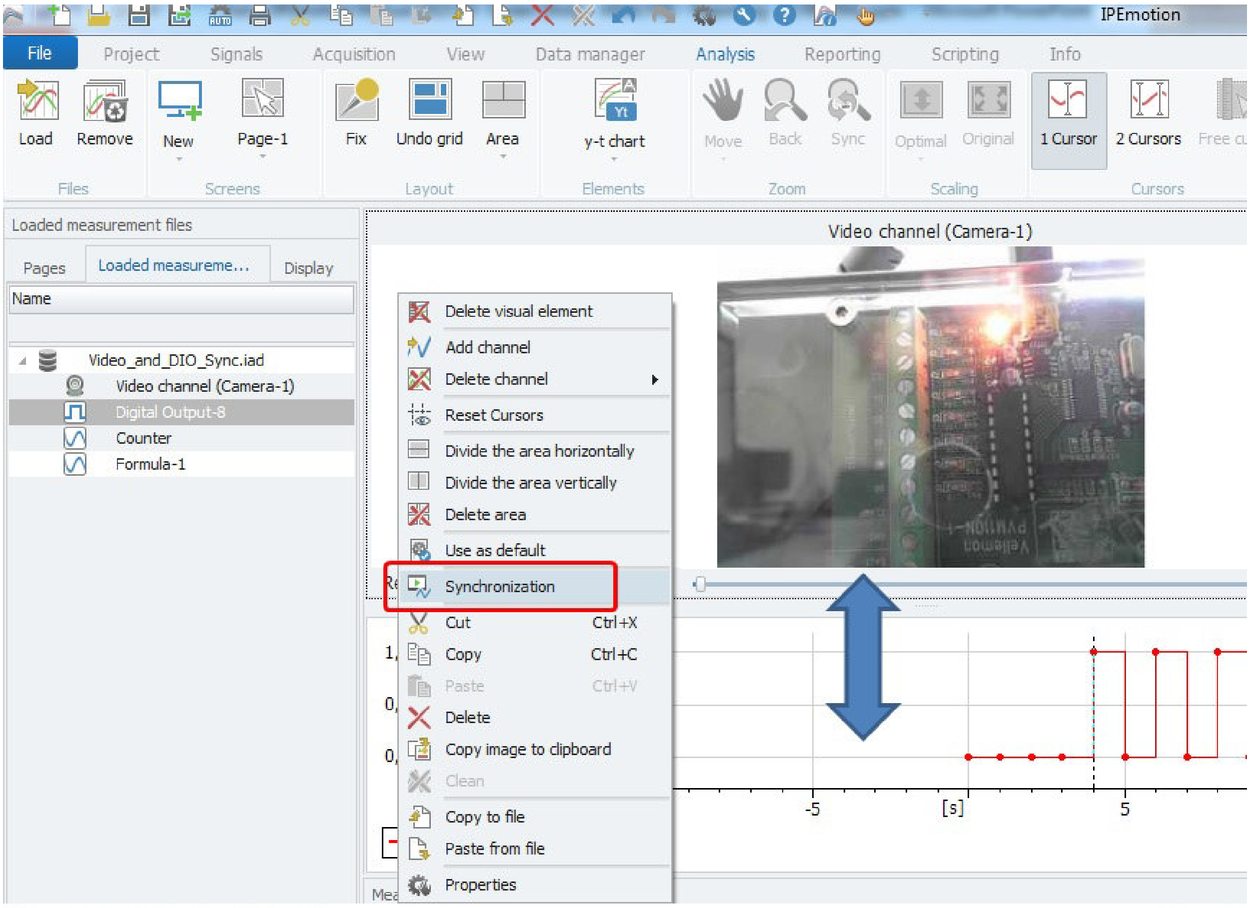
- **Replay** — With the replay + / - button you can adjust the speed how fast the video should be replayed when you hit the play button. You can increase the replay speed with "plus" or you can turn it to slow motion with "minus". The default speed setting is 1 which is equal to the recording speed. The replay speed settings are: x2 / x4 / x8 / x16 / x32 / x64
The replay slow motion settings: x1/2 / x1/4 / x1/8 / x1/16 / x1/32 / x1/64



[AN_60]

19.11.4 Video offline synchronization

Video signals can be offline synchronized with other measurements signals. The context menu of the video instrument supports a function called “Synchronization”.

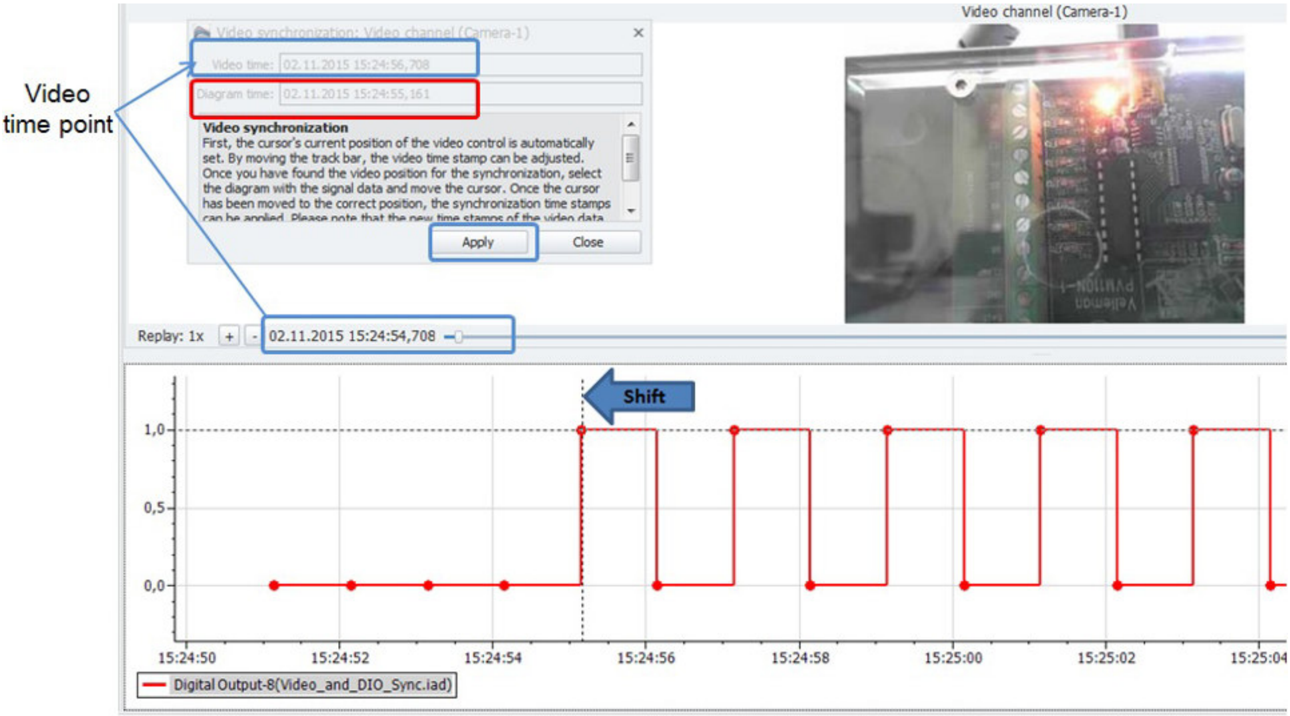


Video offline synchronization. [AN_61]

In the following example you will see a video signal which shows a 1,5 seconds time shift between the recorded digital LED status channel (high / low) and the corresponding video signal (LED red / off).

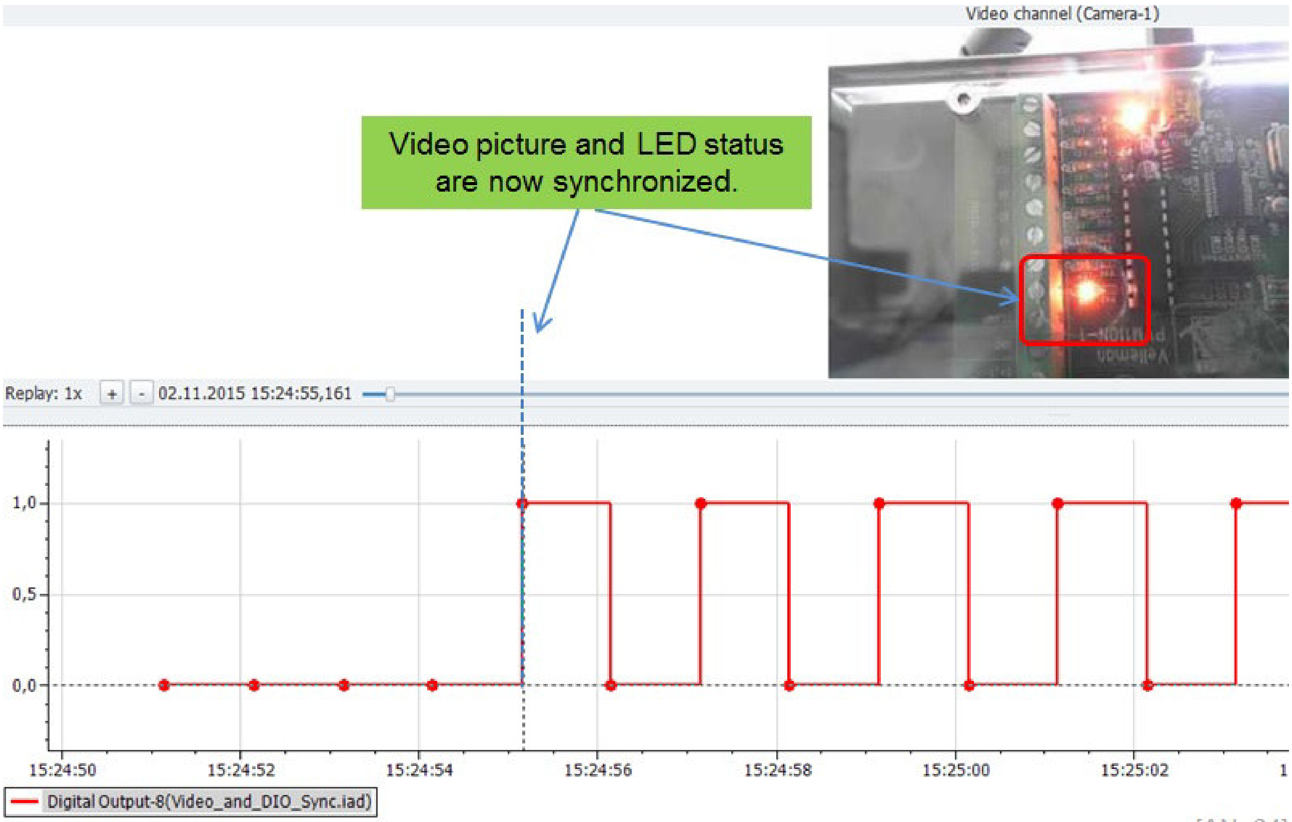
Video signal was recorded with a 1,5 s time shift. [AN_62]

With the synchronization function the video signal can be manually aligned and shifted to your defined reference signal position. In the first step you move the video slider to the right picture. After that you move the cursor in the diagram with your reference channel to the right position. When you execute the "Apply" function the offset is applied to the video channel time stamps.



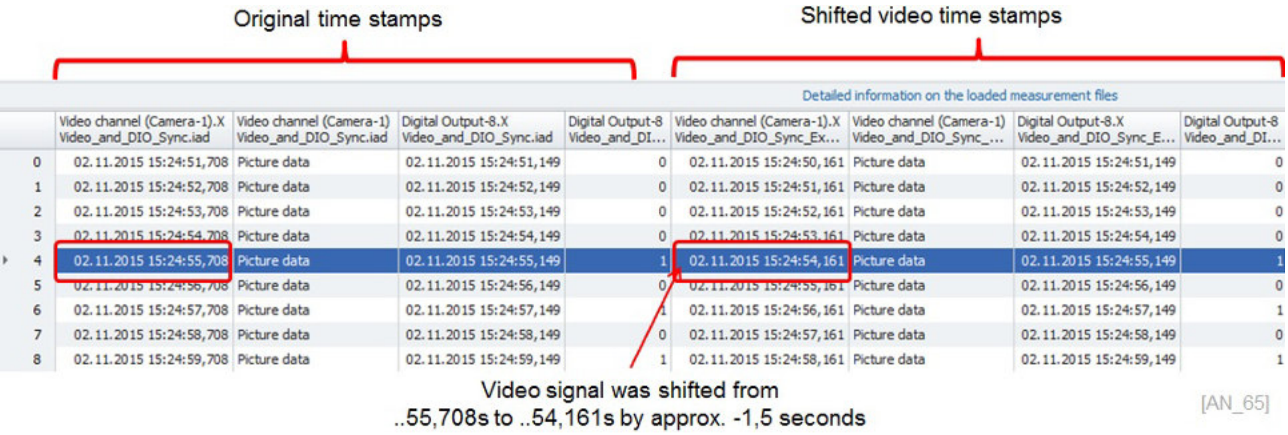
Move cursor in the diagram to the right position to shift video picture time stamp accordingly. [AN_63]

The original time stamps of the video file is now shifted and aligned to the reference channel time stamp.



Time of video channel is shifted and synchronized. [AN_64]

The impact of the time shift can be seen in the data manager too.

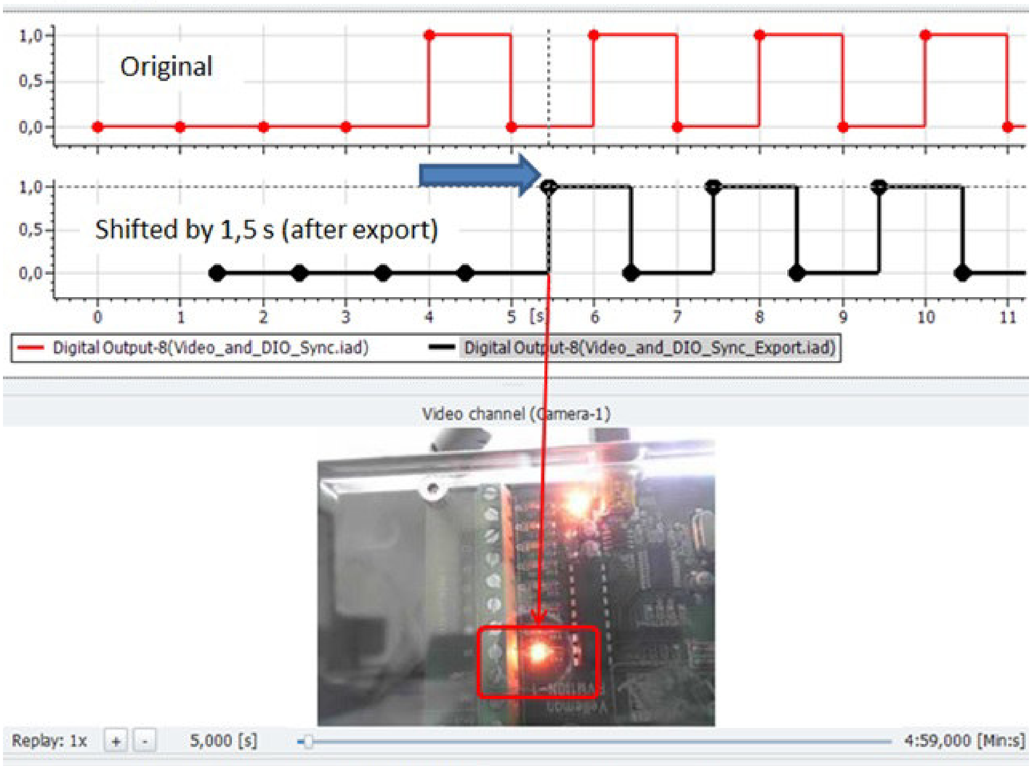


	Video channel (Camera-1).X Video_and_DIO_Sync.iad	Video channel (Camera-1) Video_and_DIO_Sync.iad	Digital Output-8.X Video_and_DIO_Sync.iad	Digital Output-8 Video_and_DI...	Video channel (Camera-1).X Video_and_DIO_Sync_Ex...	Video channel (Camera-1) Video_and_DIO_Sync_...	Digital Output-8.X Video_and_DIO_Sync_E...	Digital Output-8 Video_and_DI...
0	02.11.2015 15:24:51,708	Picture data	02.11.2015 15:24:51,149	0	02.11.2015 15:24:50,161	Picture data	02.11.2015 15:24:51,149	0
1	02.11.2015 15:24:52,708	Picture data	02.11.2015 15:24:52,149	0	02.11.2015 15:24:51,161	Picture data	02.11.2015 15:24:52,149	0
2	02.11.2015 15:24:53,708	Picture data	02.11.2015 15:24:53,149	0	02.11.2015 15:24:52,161	Picture data	02.11.2015 15:24:53,149	0
3	02.11.2015 15:24:54,708	Picture data	02.11.2015 15:24:54,149	0	02.11.2015 15:24:53,161	Picture data	02.11.2015 15:24:54,149	0
4	02.11.2015 15:24:55,708	Picture data	02.11.2015 15:24:55,149	1	02.11.2015 15:24:54,161	Picture data	02.11.2015 15:24:55,149	1
5	02.11.2015 15:24:56,708	Picture data	02.11.2015 15:24:56,149	0	02.11.2015 15:24:55,161	Picture data	02.11.2015 15:24:56,149	0
6	02.11.2015 15:24:57,708	Picture data	02.11.2015 15:24:57,149	1	02.11.2015 15:24:56,161	Picture data	02.11.2015 15:24:57,149	1
7	02.11.2015 15:24:58,708	Picture data	02.11.2015 15:24:58,149	0	02.11.2015 15:24:57,161	Picture data	02.11.2015 15:24:58,149	0
8	02.11.2015 15:24:59,708	Picture data	02.11.2015 15:24:59,149	1	02.11.2015 15:24:58,161	Picture data	02.11.2015 15:24:59,149	1

[AN_65]

To save the time shift changes permanently you need to export the data file. As indicated below you can compare that the synchronized digital channel has shifted his time channel by 1,5 seconds to match the first digital high signal to the right position of the movie showing correspondingly first time a red status LED light.

Compare digital reference before and after time shift.



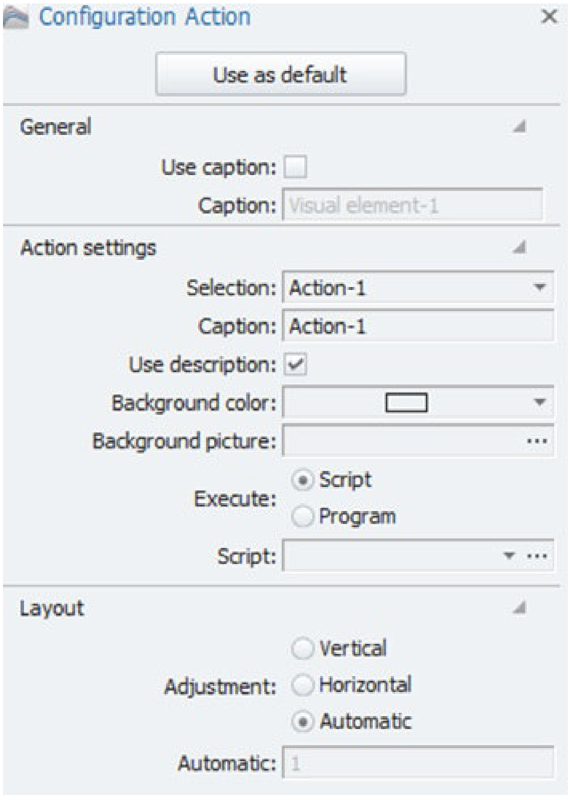
After export digital signal and video file in are synchronized.

[AN_66]

19.12 Action Button

[AN_67]

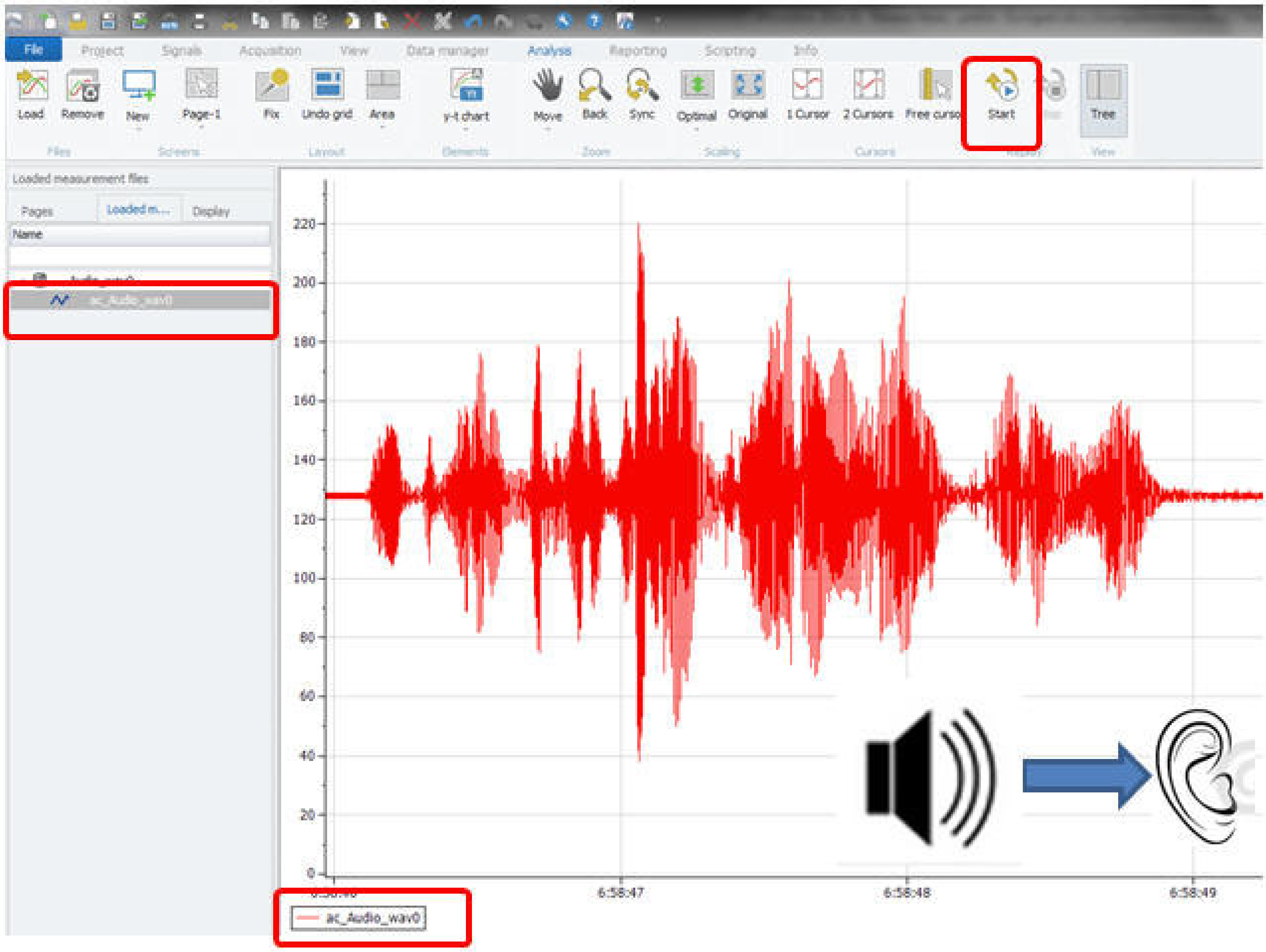
The configuration properties of the Action button in VIEW and ANALYSIS are exactly the same. The chapter VIEW for details 17.21.



[AN_68]

19.13 Play back sound / voice over speakers

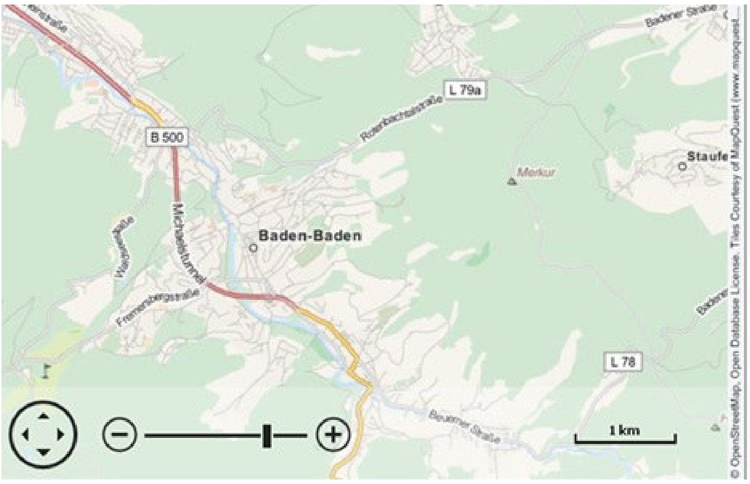
If you import data files IAD or WAV or MEA.ZIP etc.. which include an audio channel, you can listen to the sound / voice recording. In order to play back the sound, you need to activate one cursor and select the sound channel through the Yt-chart instrument legend or the measurement statistics window. When you record Audio data through the PC you should take the latest PC-Sound Card Demo PlugIn. If you cannot listen to your audio recordings refer to chapter SIGANLS >Format tab sheet 11.6.4 to check the task settings.



Audio play back > select channel and press Start [AN_69]

19.14 Instruments for Professional, Developer and Analysis Edition

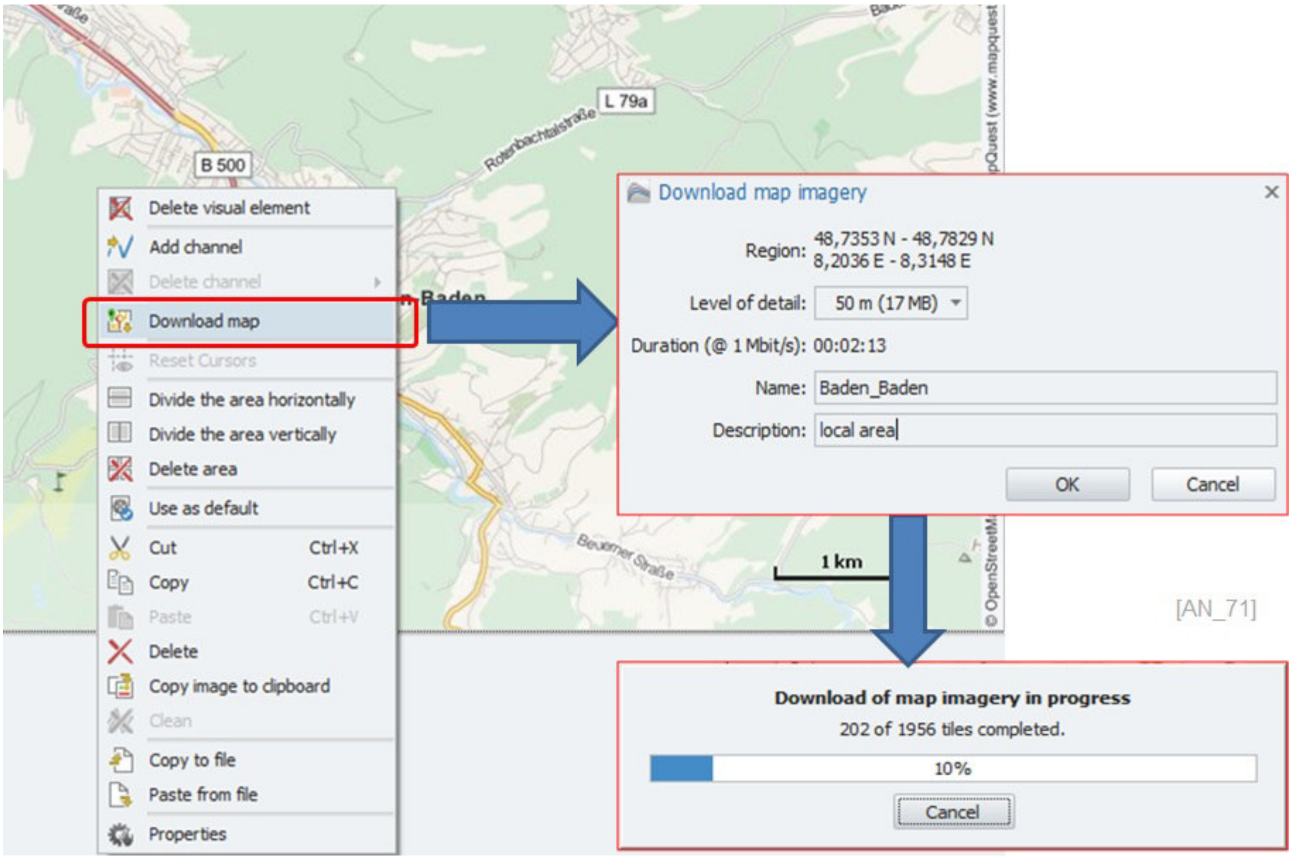
19.15 Map



[AN_70]

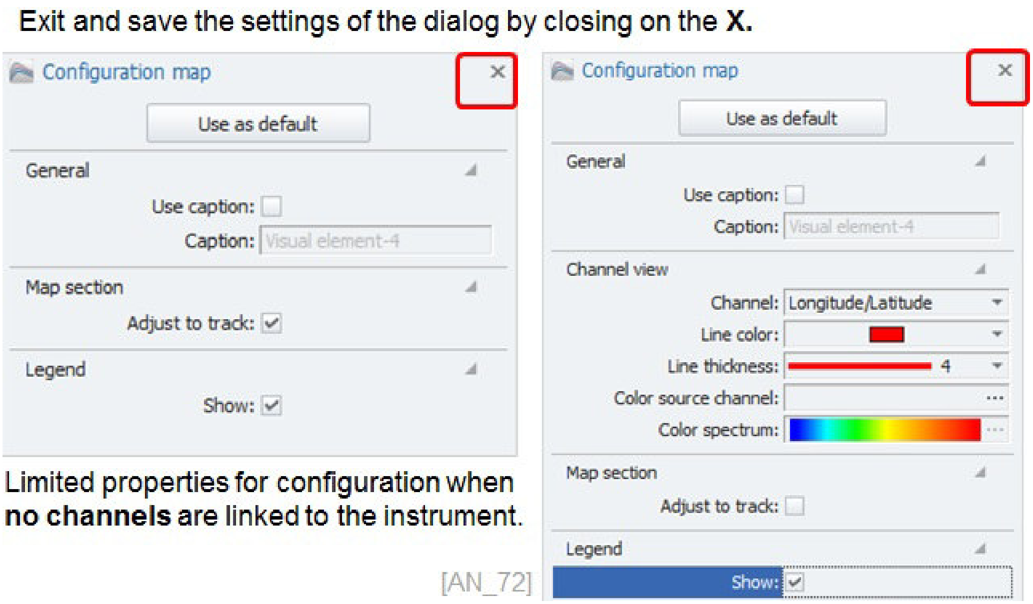
19.15.1 Standard context menu

In the standard context menu you can download the map tiles into a defined data base. The data bases are managed in the OPTIONS >Map. More details are in chapter 22.10. The area you download is the visible part in the map instrument. Depending on the zoom level you can select different levels of detail. The software is than calculating how many tile in Mega Byte you are downloading at your defined level of detail.



[AN_71]

19.15.2 Map head up display



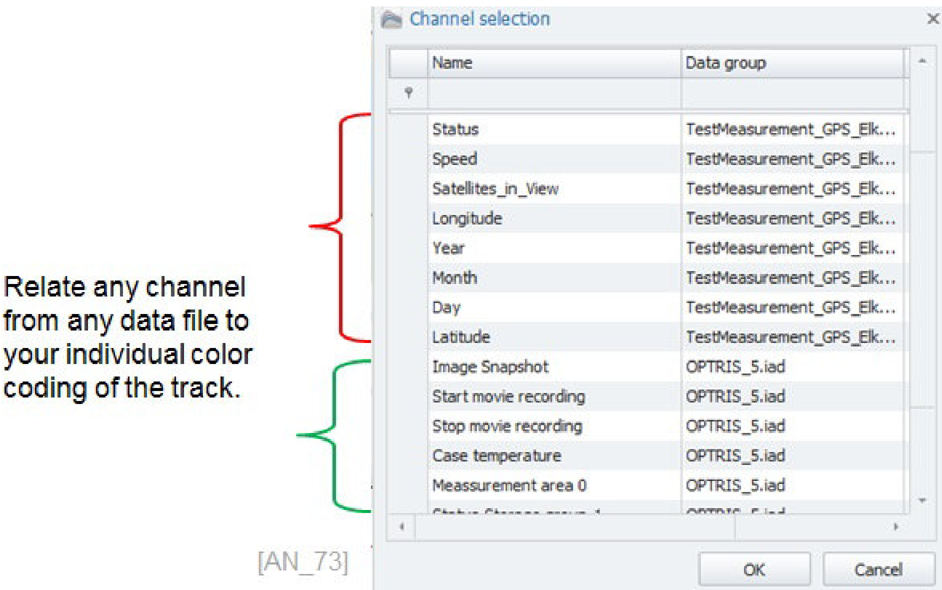
[AN_72]

19.15.3 General

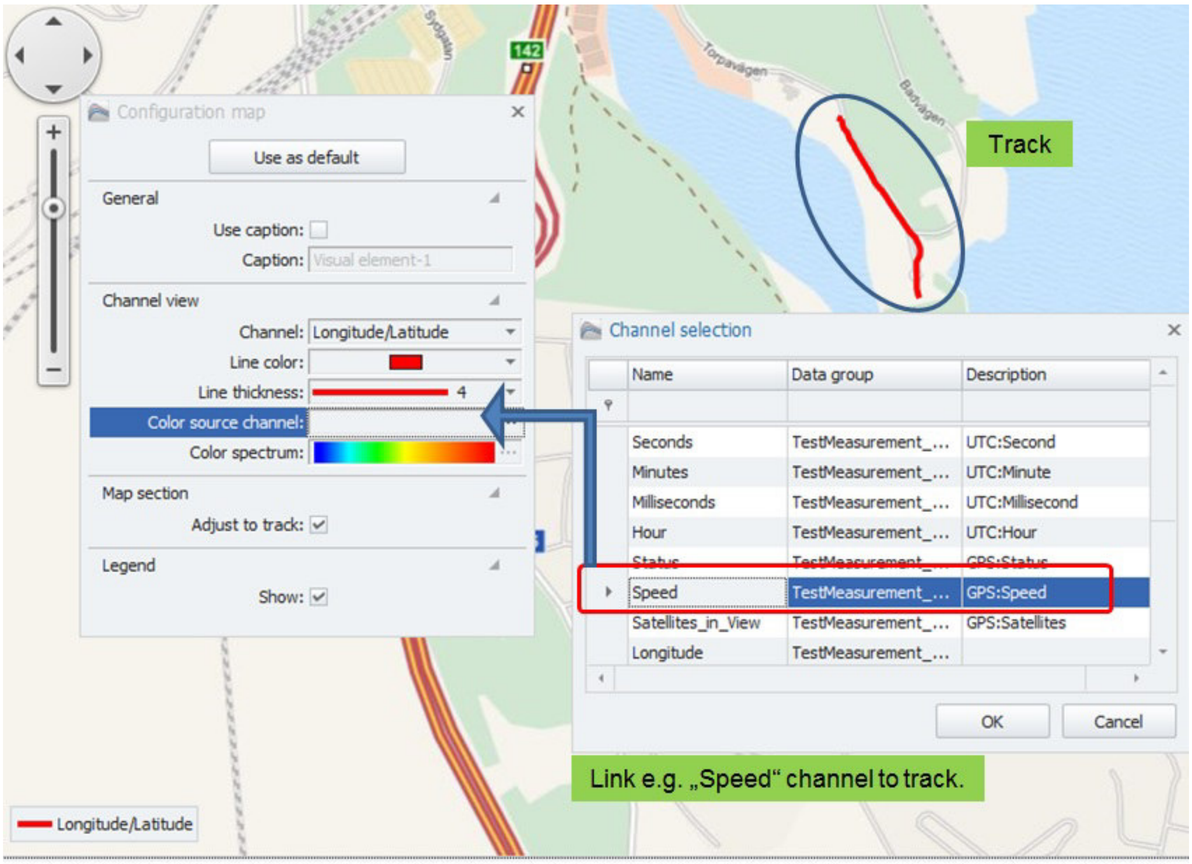
- See configuration options in chapter VIEW >Yt- chart 19.8

19.15.4 Channel view

▶ Channel	Here you select the channel pair. The first channel you drag and drop to the diagram is always related to the x-axis. The second channel is related to the y-axis.
▶ Line color	Refers to the line color of the channel pair.
▶ Line thickness	Refers to the line thickness of the channel pair.
▶ Color source channel	You can relate a third channel to the Map instrument indicated through a color coding along the track. The 3rd channel is adding a 3rd dimension to the GPS position. Apart from plotting the track from the coordinates(longitude & latitude) for each measurement point, you can now relate a color code from another channel e.g. âĂIJSpeedâĂİ along the track. You can select any channel from the data file.



[AN_73]



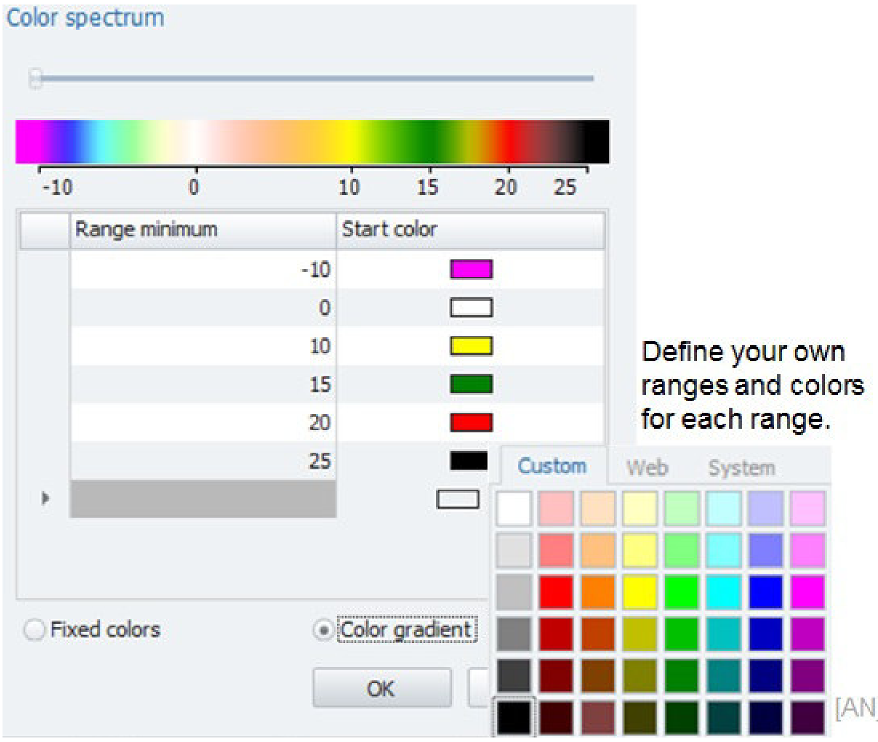
[AN_74]

► Color Spectrum

You can define any individual color for your spectrum. There are only 2 different types of the presentation: The gradient mode is gradually shifting to the next color. The fixed color mode defines one color only for each intersection.

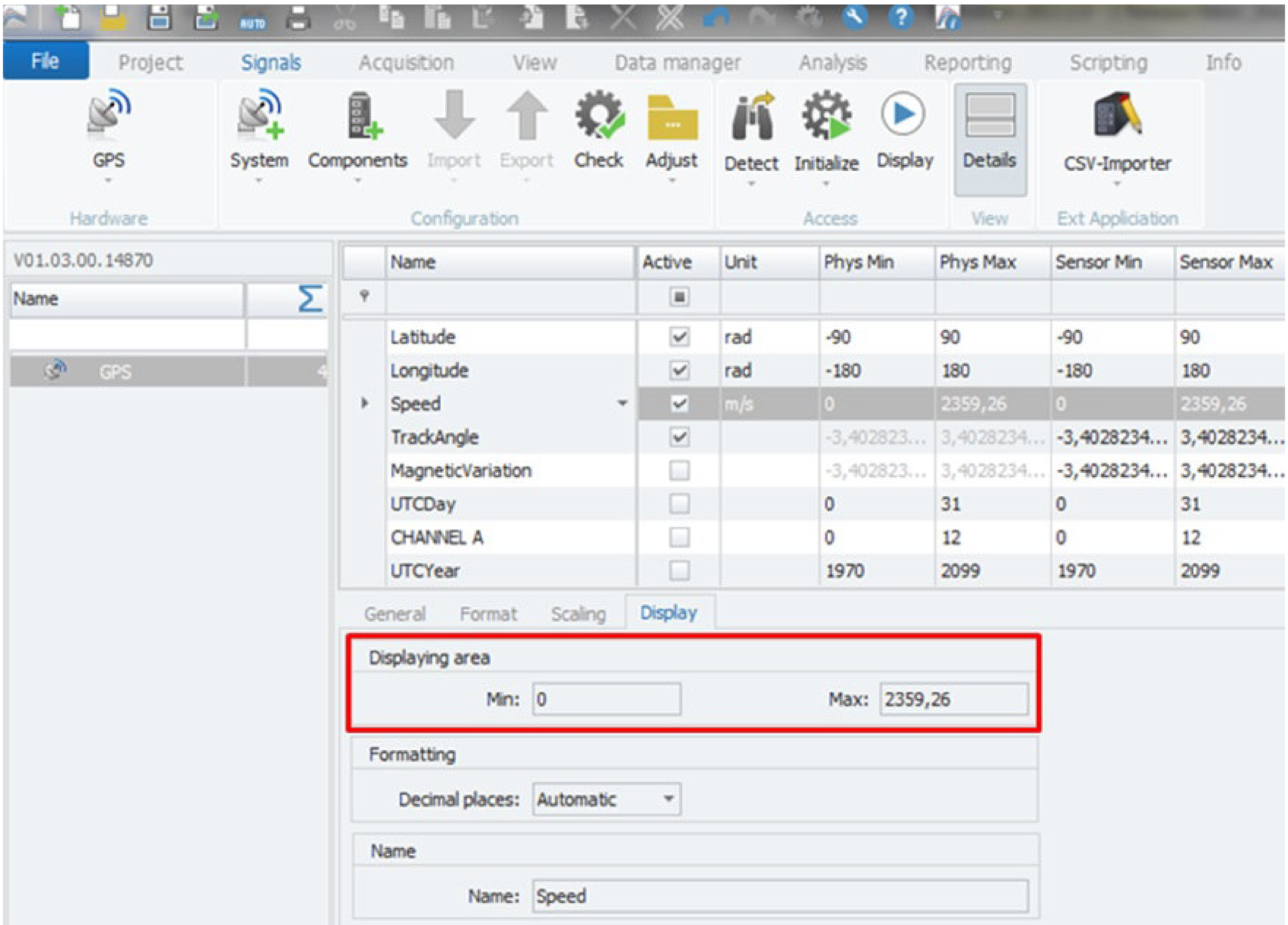
[AN_75]

The color spectrum / scale can be individually defined. You can manually add entries to the table and define your individual color for the measurement ranges for the selected channel.



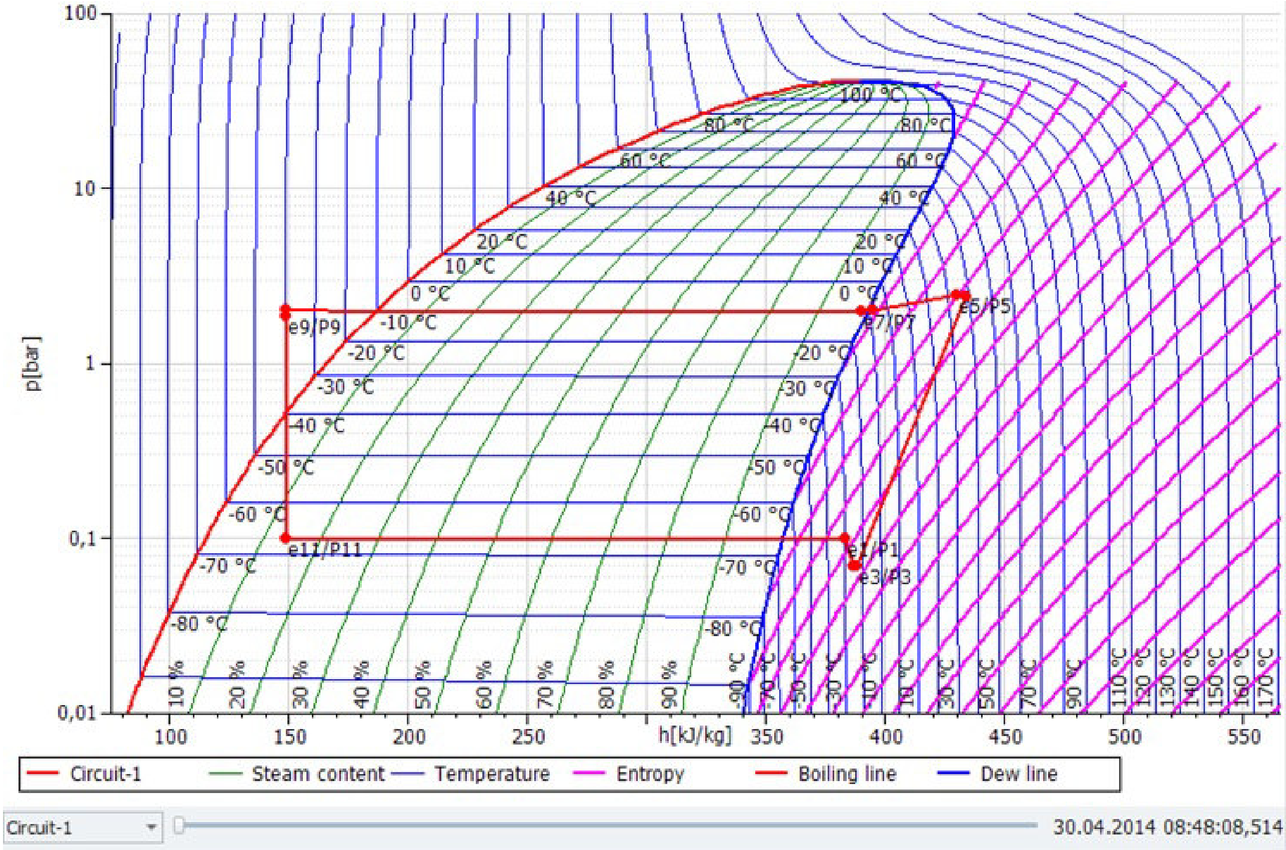
[AN_76]

The default range settings are taken automatically from the settings of the **Displaying area**.



[AN_77]

19.16 Log p-h

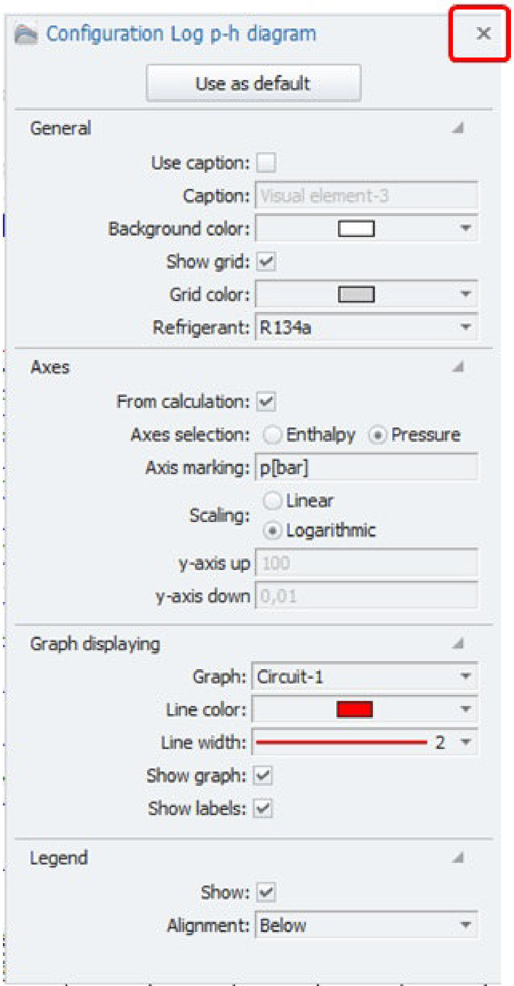


[AN_78]

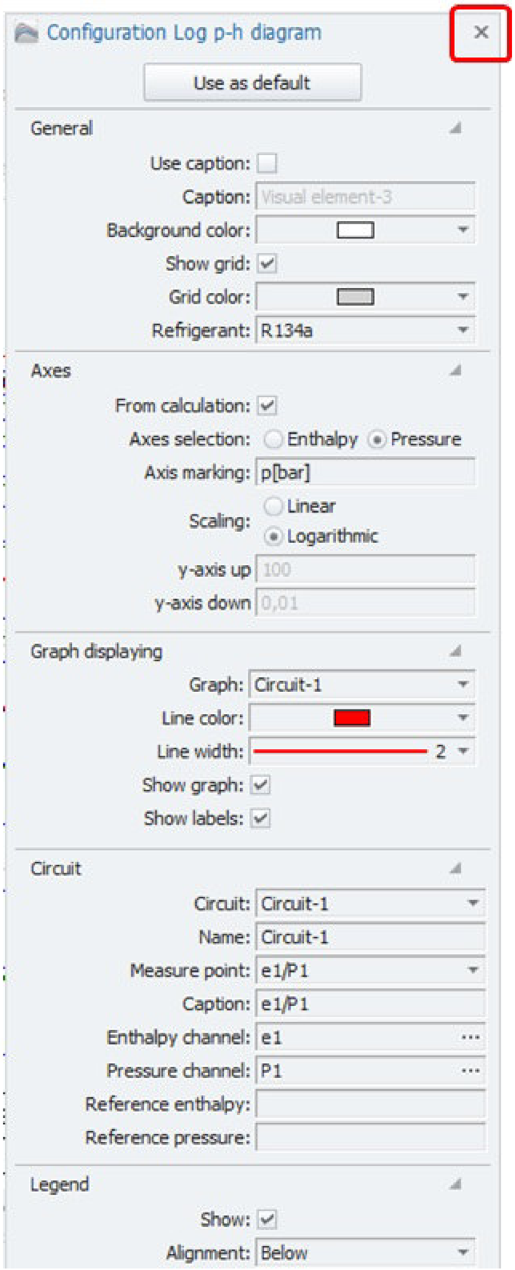
Note: The Log p-h instrument is only availed when your license includes the climate module. See chapter Editions and modules for more details 4.2.2.

19.16.1 Log p-h head up display

Exit and save the settings of the dialog by closing on the **X**.



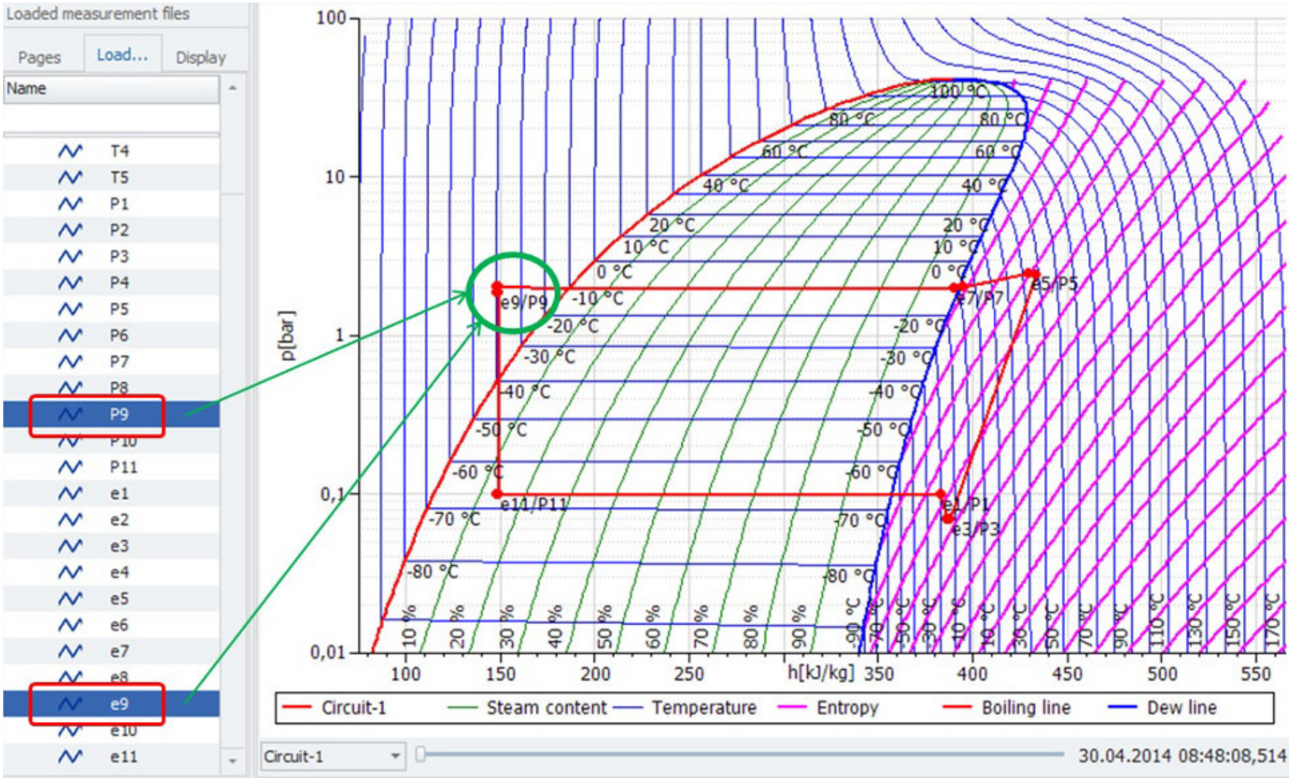
Limited properties for configuration when **no channels** are linked to the instrument.



[AN_79]

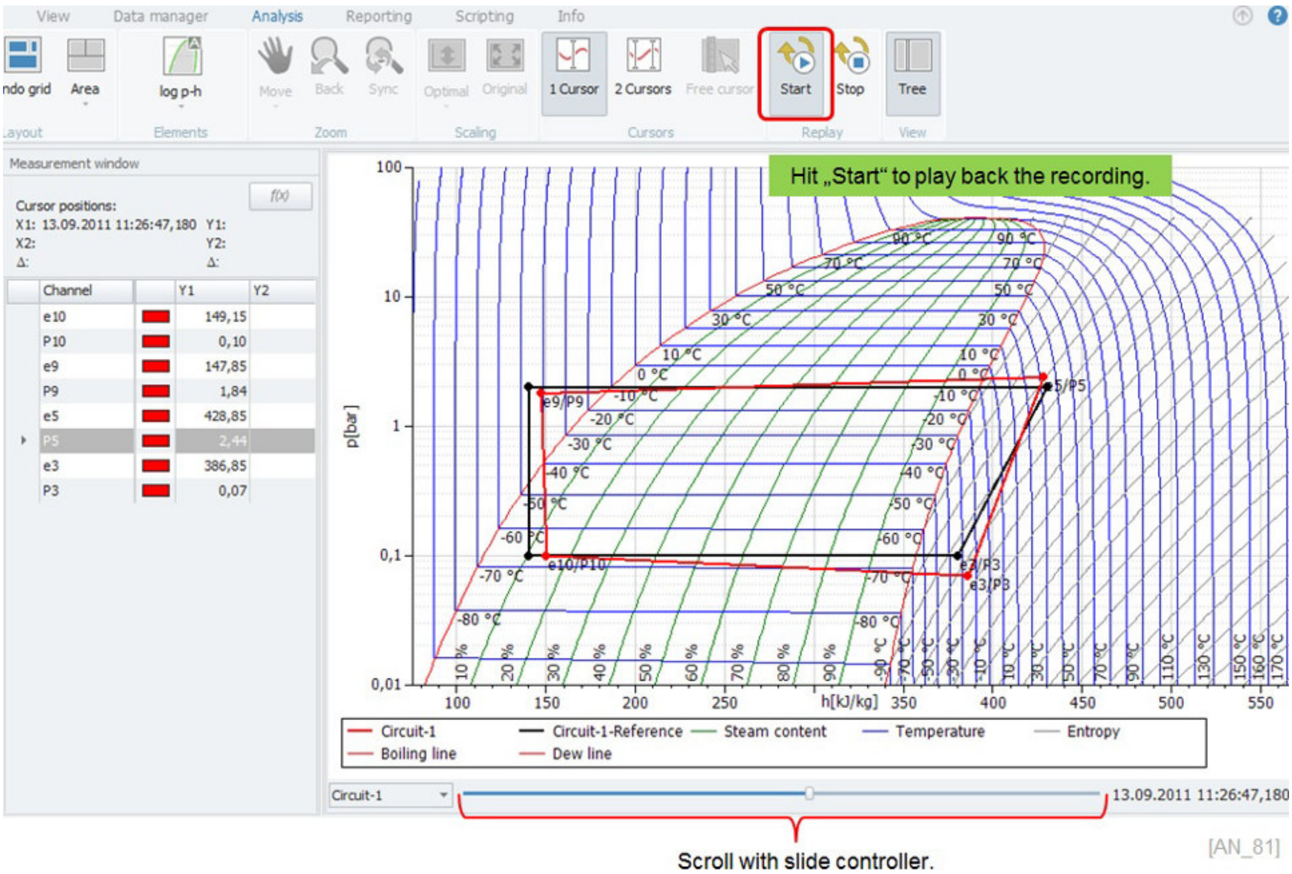
19.16.2 Link channels to the diagram

In order to get the log p-h diagram plotted you need to link your pressure and enthalpy channels from the data file to the diagram. It is important that the channels are linked as pairs to the diagram.



[AN_80]

With the Start button you can replay the recording.



[AN_81]

19.16.3 General

- **Refrigerant** — Here you can select the refrigerant from the list box. The same refrigerant (Formula index) of the online enthalpy calculation should be used for the log p-h diagram in order to get a correct presentation of the data. The refrigerants are included in the REFPROP database and the selected type has a strong impact on the presentation of the log p-h diagram.

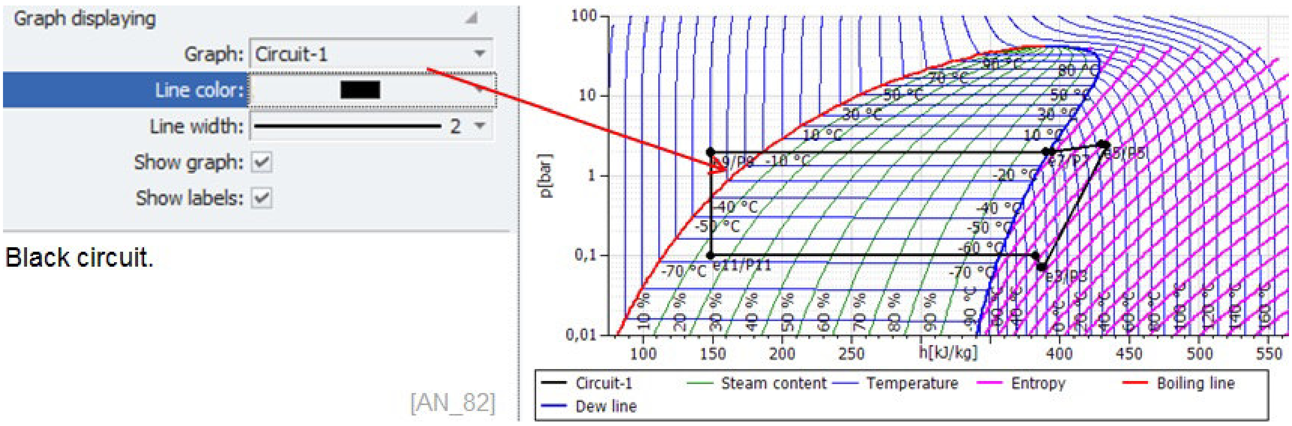
  Formula Index 1 R134a
  Formula Index 2 R1234yf
  Formula Index 3 R22
  Formula Index 4 R404a
  Formula Index 5 R410a
  Formula Index 6 R507a
  Formula Index 7 R744 (CO2)
  Formula Index 8 R718 (H2O)
  Formula Index 9 R729 (N2+O2+Ar)

19.16.4 Axis

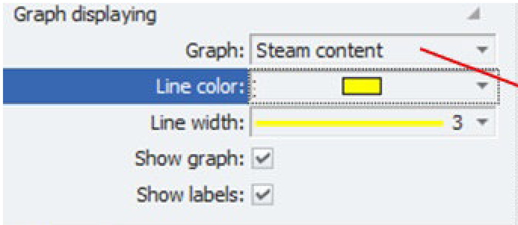
- See configuration options in chapter VIEW >Yt-chart 17.8.4.

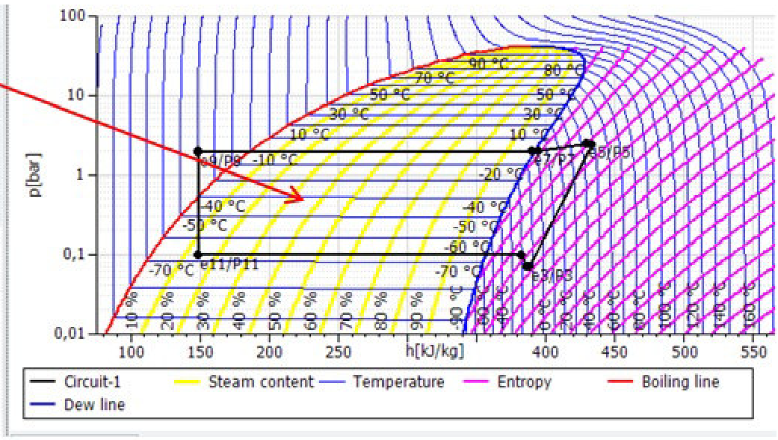
19.16.5 Graph displaying

- **Graph** — Here you can configure the graphical presentation of the log p-h diagram. This covers the areas of the thermal circuit, reference circuit, steam content, temperature, entropy, boiling line and dew line. The configuration of a reference circuit is discussed below. The impact of the setting to the diagram is demonstrated on 3 examples: Circuit-1, Steam content and Temperature.

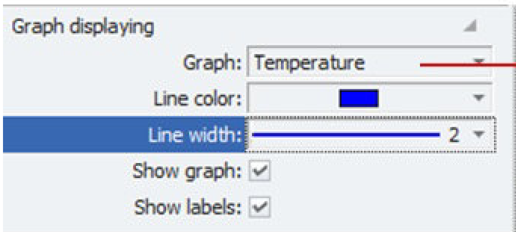


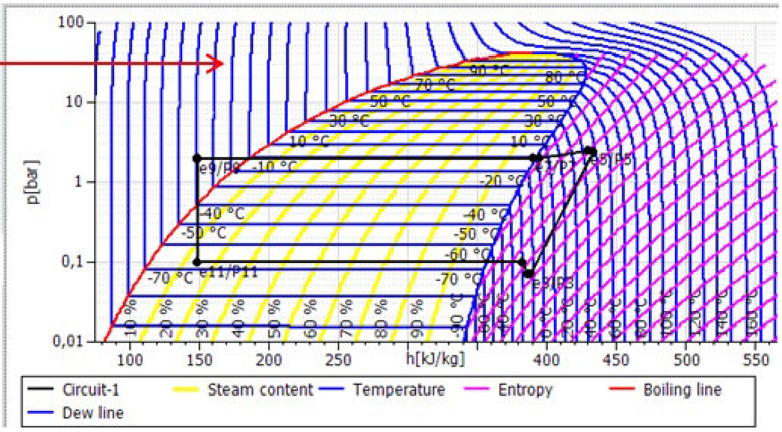
[AN_82]





Yellow steam area.





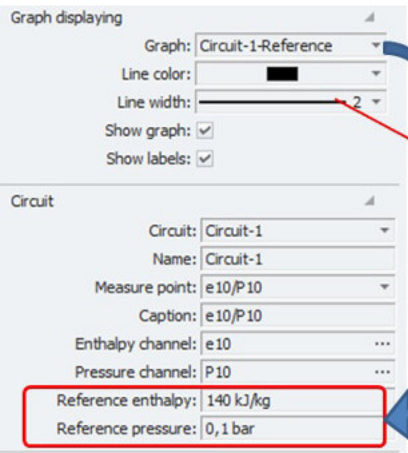
Blue temperature graphs.

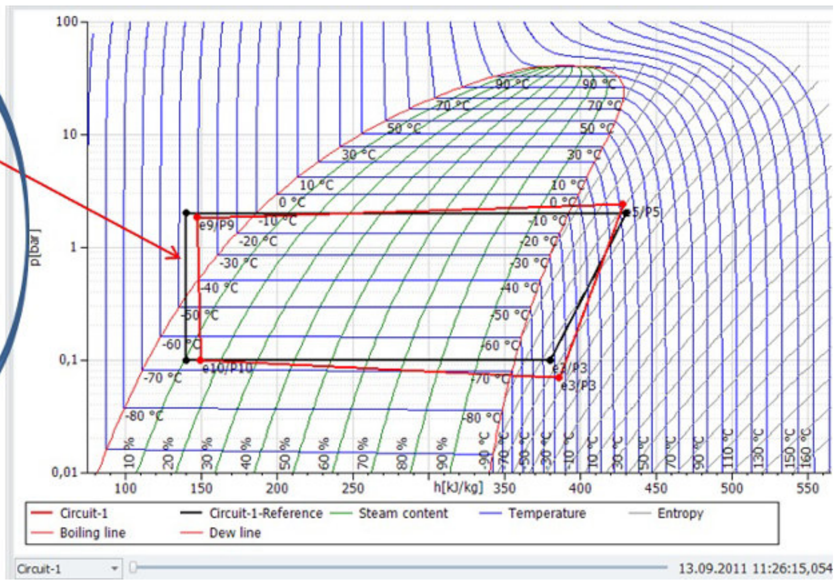
[AN_83]

19.16.6 Circuit

► Circuit

You can also define a reference circuit for each measurement point. In order to define the reference measure points you select the measurement point and enter manually the reference enthalpy and reference pressure. The black graph is indicating a reference thermodynamic cycle.





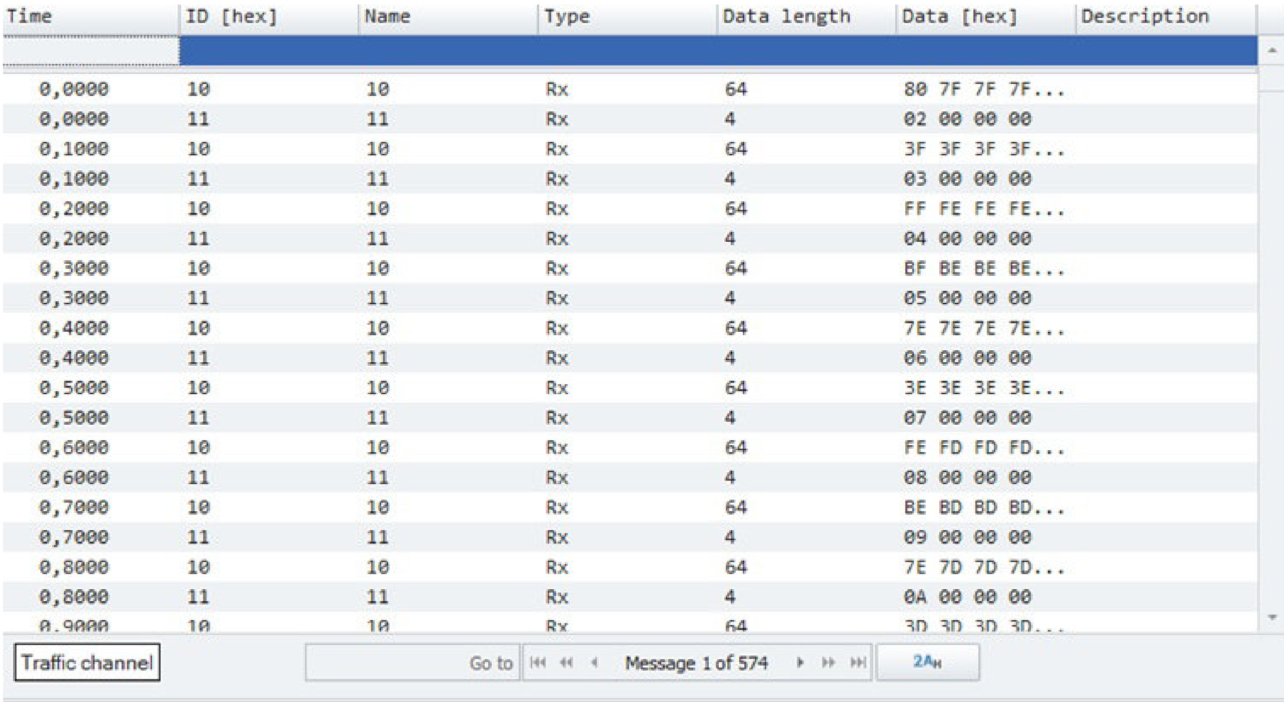
Define for every measure point (ex/px) a reference circuit.

[AN_84]

19.16.7 Legend

► See configuration options in chapter VIEW >Yt-chart 17.7.8.

19.17 Traffic Analyzer



Time	ID [hex]	Name	Type	Data length	Data [hex]	Description
0,0000	10	10	Rx	64	80 7F 7F 7F...	
0,0000	11	11	Rx	4	02 00 00 00	
0,1000	10	10	Rx	64	3F 3F 3F 3F...	
0,1000	11	11	Rx	4	03 00 00 00	
0,2000	10	10	Rx	64	FF FE FE FE...	
0,2000	11	11	Rx	4	04 00 00 00	
0,3000	10	10	Rx	64	BF BE BE BE...	
0,3000	11	11	Rx	4	05 00 00 00	
0,4000	10	10	Rx	64	7E 7E 7E 7E...	
0,4000	11	11	Rx	4	06 00 00 00	
0,5000	10	10	Rx	64	3E 3E 3E 3E...	
0,5000	11	11	Rx	4	07 00 00 00	
0,6000	10	10	Rx	64	FE FD FD FD...	
0,6000	11	11	Rx	4	08 00 00 00	
0,7000	10	10	Rx	64	BE BD BD BD...	
0,7000	11	11	Rx	4	09 00 00 00	
0,8000	10	10	Rx	64	7E 7D 7D 7D...	
0,8000	11	11	Rx	4	0A 00 00 00	
0,9000	10	10	Rx	64	3D 3D 3D 3D...	

[AN_85]

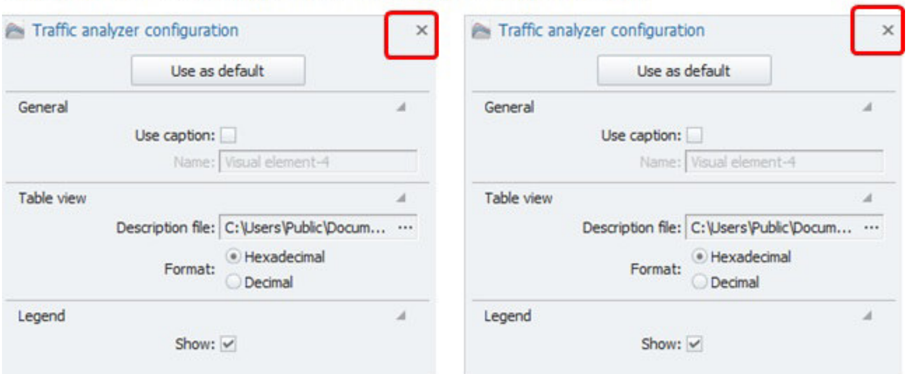
19.17.1 Supported traffic file import formats

You can import traffic data recordings from the following formats only.

- .IAD — IPEmotion data files
- TESTdrive TRAFFIC — Traffic recordings from IPETRONIK data loggers
- .HRD — Traffic data files stored by IPEhub2 CAN card
- ASC — ASC II traffic files including CAN or FlexRay traffic

19.17.2 Traffic Analyzer head up display

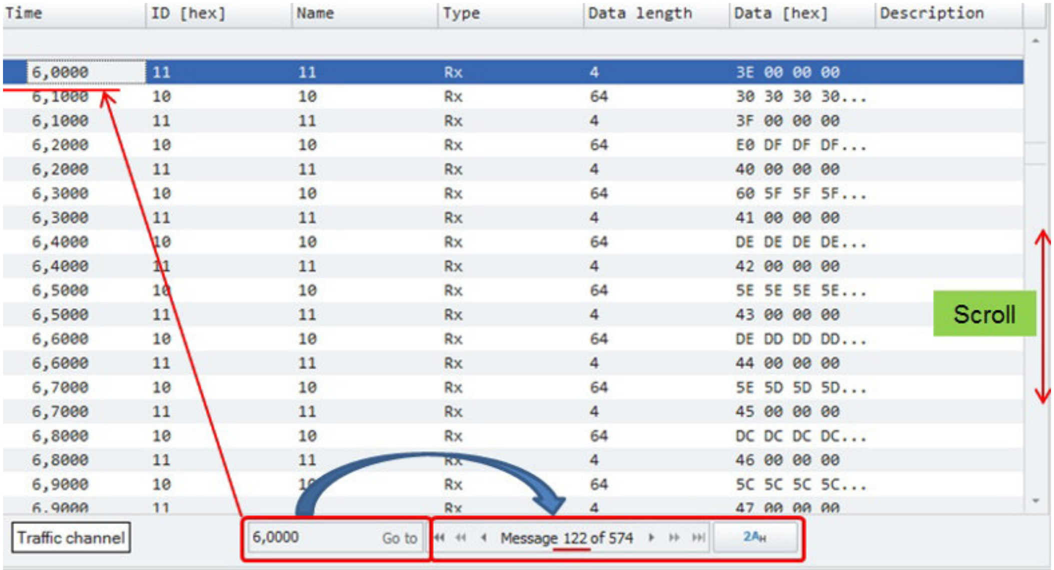
Exit and save the settings of the dialog by closing on the **X**.



No channel specific configuration options. [AN_86]

19.17.3 Traffic analyzer configuration for CAN messages

You can search for a specific time point or by ID, Name, Type. Alternatively, you can navigate between pages or scroll within one page.

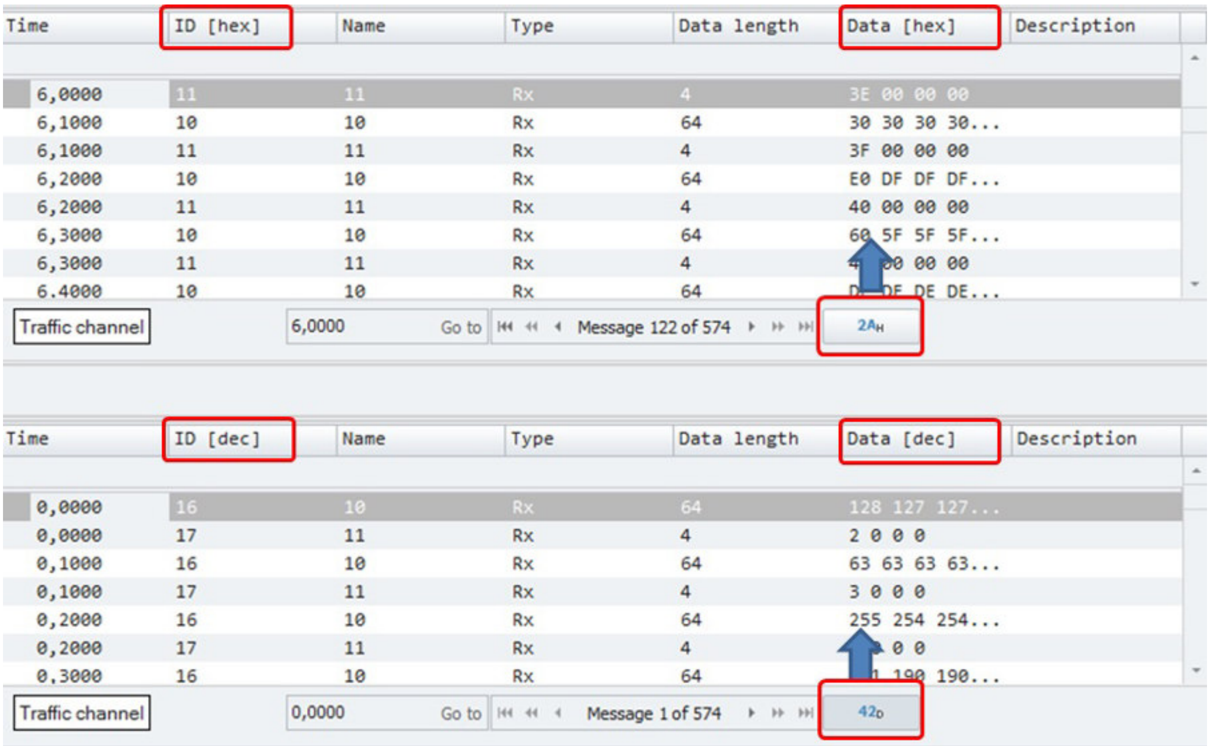


Search for a specific time point. [AN_87]

Information

The search function is only searching for data within one page. One page has a maximum of 10.000 records. In conclusion the search operation is not searching through the whole data file.

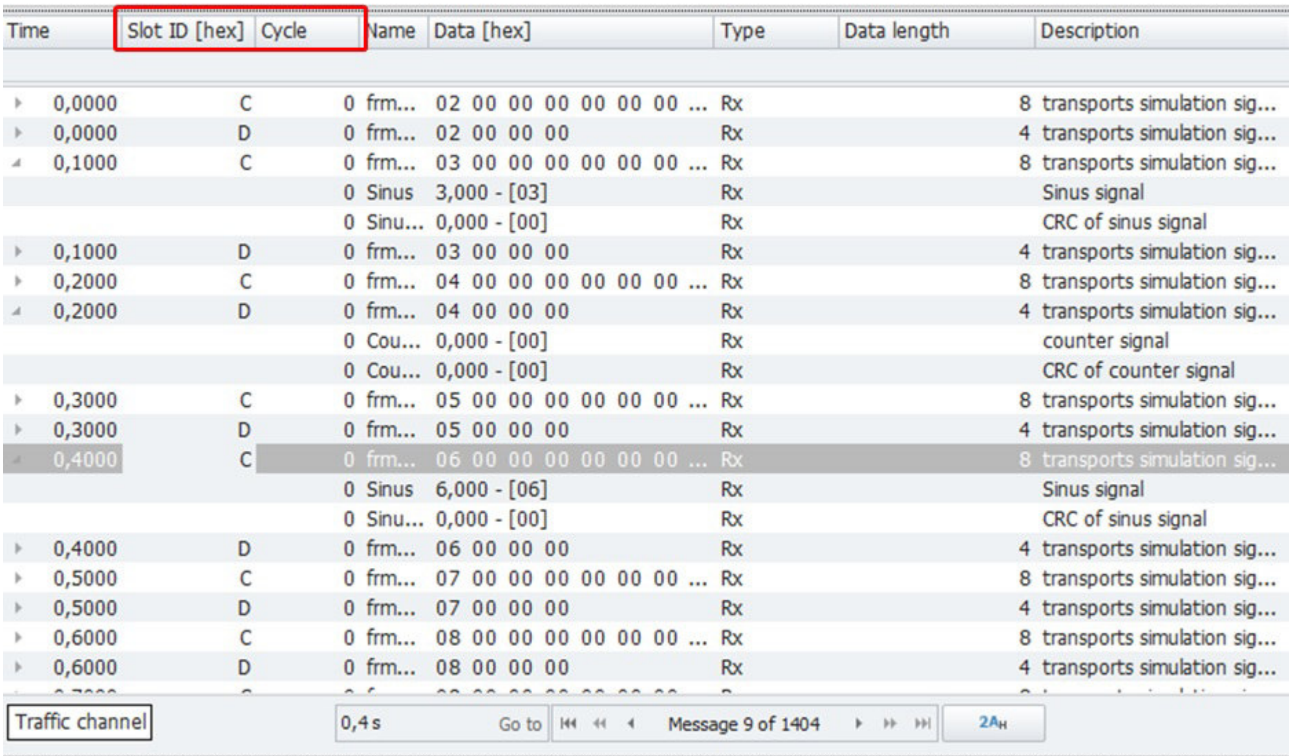
For more information about the column Data length and DLC see chapter VIEW 17.25.14.
With a button next to the page navigation bar you can change the data presentation from decimal numbers to hexadecimal.



Button to switch between DECIMAL and HEX presentation. [AN_88]

19.17.4 Traffic analyzer configuration for FlexRay messages

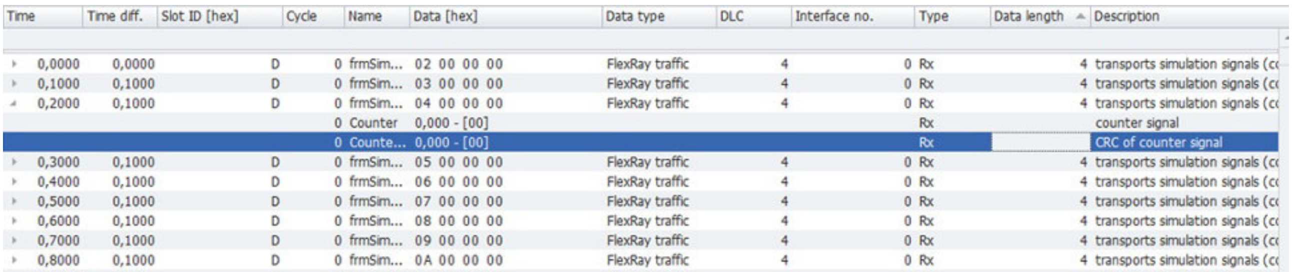
The traffic analyzer instrument can present FlexRay traffic. You can also link a corresponding XML file to convert FlexRay traffic into signals.



Time	Slot ID [hex]	Cycle	Name	Data [hex]	Type	Data length	Description
0,0000	C	0	frm...	02 00 00 00 00 00 00 ...	Rx	8	transports simulation sig...
0,0000	D	0	frm...	02 00 00 00	Rx	4	transports simulation sig...
0,1000	C	0	frm...	03 00 00 00 00 00 00 ...	Rx	8	transports simulation sig...
		0	Sinus	3,000 - [03]	Rx		Sinus signal
		0	Sinu...	0,000 - [00]	Rx		CRC of sinus signal
0,1000	D	0	frm...	03 00 00 00	Rx	4	transports simulation sig...
0,2000	C	0	frm...	04 00 00 00 00 00 00 ...	Rx	8	transports simulation sig...
0,2000	D	0	frm...	04 00 00 00	Rx	4	transports simulation sig...
		0	Cou...	0,000 - [00]	Rx		counter signal
		0	Cou...	0,000 - [00]	Rx		CRC of counter signal
0,3000	C	0	frm...	05 00 00 00 00 00 00 ...	Rx	8	transports simulation sig...
0,3000	D	0	frm...	05 00 00 00	Rx	4	transports simulation sig...
0,4000	C	0	frm...	06 00 00 00 00 00 00 ...	Rx	8	transports simulation sig...
		0	Sinus	6,000 - [06]	Rx		Sinus signal
		0	Sinu...	0,000 - [00]	Rx		CRC of sinus signal
0,4000	D	0	frm...	06 00 00 00	Rx	4	transports simulation sig...
0,5000	C	0	frm...	07 00 00 00 00 00 00 ...	Rx	8	transports simulation sig...
0,5000	D	0	frm...	07 00 00 00	Rx	4	transports simulation sig...
0,6000	C	0	frm...	08 00 00 00 00 00 00 ...	Rx	8	transports simulation sig...
0,6000	D	0	frm...	08 00 00 00	Rx	4	transports simulation sig...

Traffic analyzer with FlexRay traffic. [AN_89]

In the screen shot below all available columns from the column chooser are added to the instrument.



Time	Time diff.	Slot ID [hex]	Cycle	Name	Data [hex]	Data type	DLC	Interface no.	Type	Data length	Description
0,0000	0,0000	D	0	frmSim...	02 00 00 00	FlexRay traffic	4	0	Rx	4	transports simulation signals (c
0,1000	0,1000	D	0	frmSim...	03 00 00 00	FlexRay traffic	4	0	Rx	4	transports simulation signals (c
0,2000	0,1000	D	0	frmSim...	04 00 00 00	FlexRay traffic	4	0	Rx	4	transports simulation signals (c
			0	Counter	0,000 - [00]				Rx		counter signal
			0	Counte...	0,000 - [00]				Rx		CRC of counter signal
0,3000	0,1000	D	0	frmSim...	05 00 00 00	FlexRay traffic	4	0	Rx	4	transports simulation signals (c
0,4000	0,1000	D	0	frmSim...	06 00 00 00	FlexRay traffic	4	0	Rx	4	transports simulation signals (c
0,5000	0,1000	D	0	frmSim...	07 00 00 00	FlexRay traffic	4	0	Rx	4	transports simulation signals (c
0,6000	0,1000	D	0	frmSim...	08 00 00 00	FlexRay traffic	4	0	Rx	4	transports simulation signals (c
0,7000	0,1000	D	0	frmSim...	09 00 00 00	FlexRay traffic	4	0	Rx	4	transports simulation signals (c
0,8000	0,1000	D	0	frmSim...	0A 00 00 00	FlexRay traffic	4	0	Rx	4	transports simulation signals (c

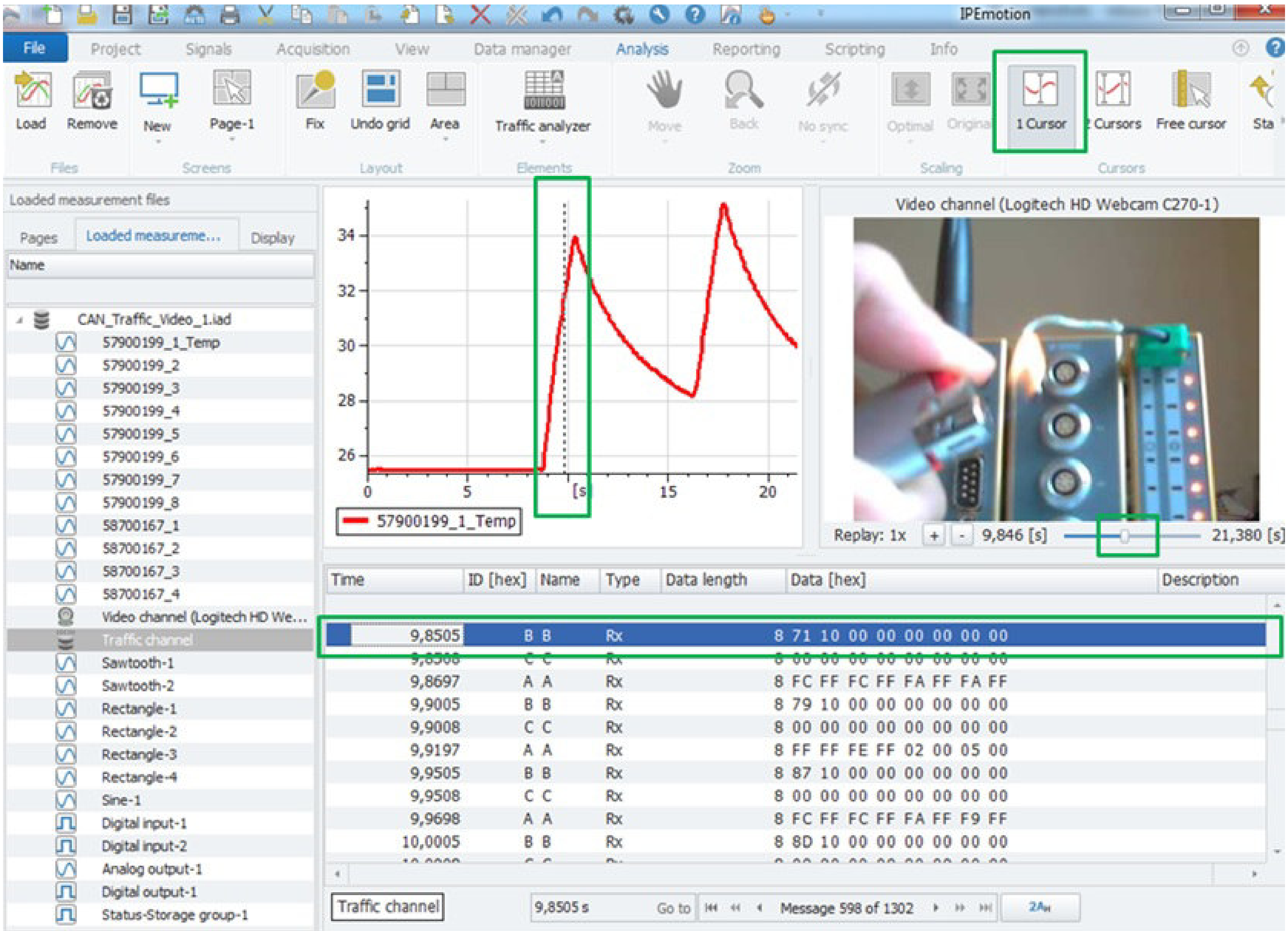
All additonal columns linked to the instrument. [AN_90]

19.17.5 Synchronized Analysis: Signals – Traffic – Video measurements

The data analysis function is supporting with active cursors a synchronized display of data originating from different measurement input types:

- Signals
- Video channels
- Traffic channels

You can use the cursor and search in any of the display elements and the updated cursors position or the selected CAN traffic value will updated the other instruments accordingly. Using the slide controller of the video instrument will update the cursors in the chart and the traffic readings.

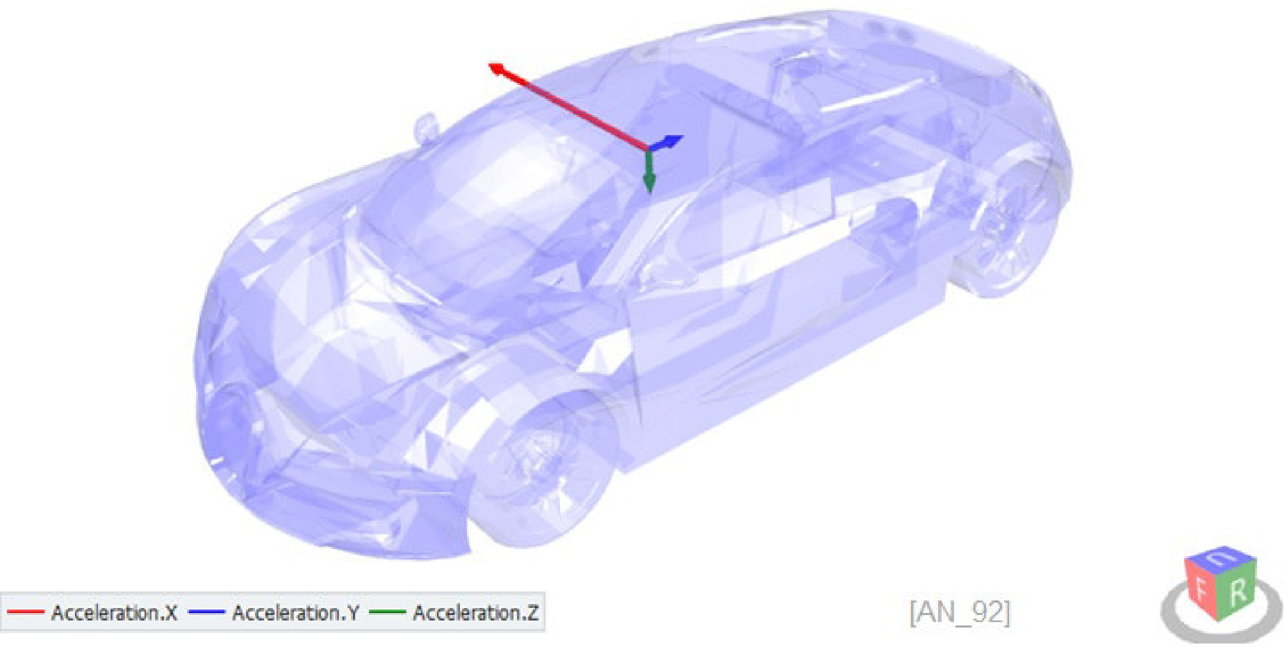


Synchronized analysis of CAN Signal / Video / Traffic data. [AN_91]

19.18 3D view instrument

19.18.1 Youtube resources

IPEmotion - Analysis Toolbox - 3D view: http://youtu.be/Au6RHlXyvgc



[AN_92]

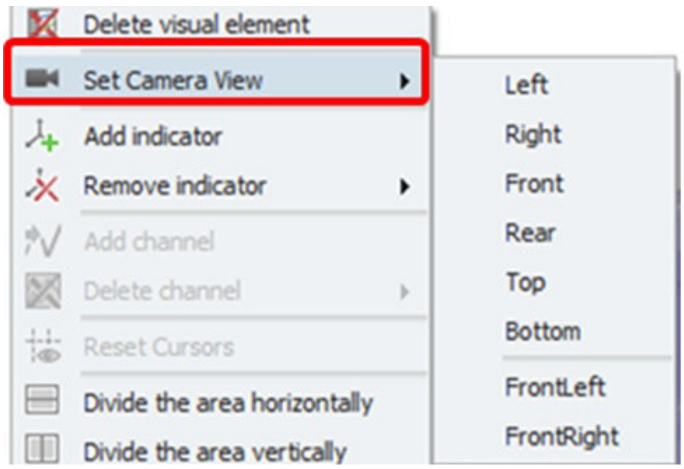
The 3D view instrument shows STL files. STL files are generated from CAD programs and display the surface of objects. Within the 3D view instrument you can display graphical indictors in the 3D object. There are many applications for this instrument possible. Some examples are:

- Display strength of forces of 3-axis strain gauge sensors.
- Display vibrations measured von 3-axis accelerometers.
- Display steering wheel angle.
- Display accelerations.

19.18.2 3D view instrument configuration

19.18.3 Set camera view

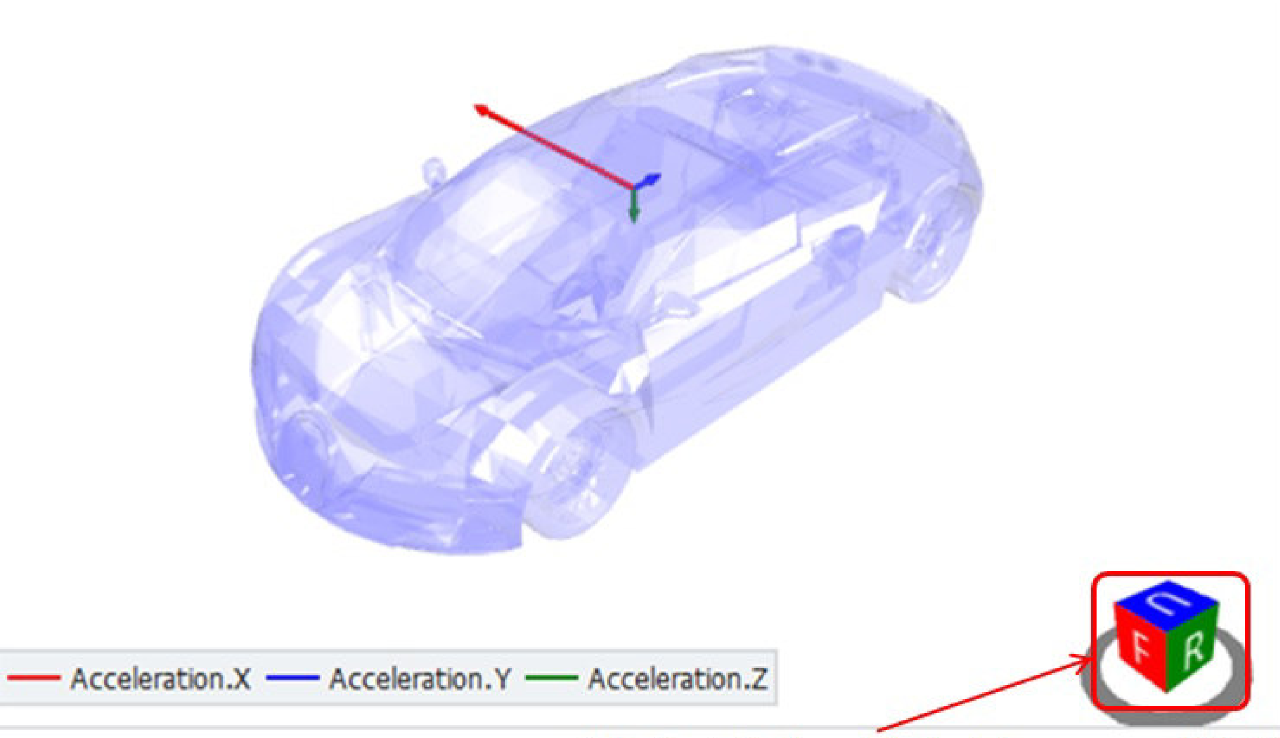
In instrument level you can select the camera view. With this view you can position the object in a define angle.



[AN_93]

Another tool in order to align the model is the cube object. The cube is presenting the 6 different view angles. With a single klick to one of the surfaces of the cube the model is changing its orientation.

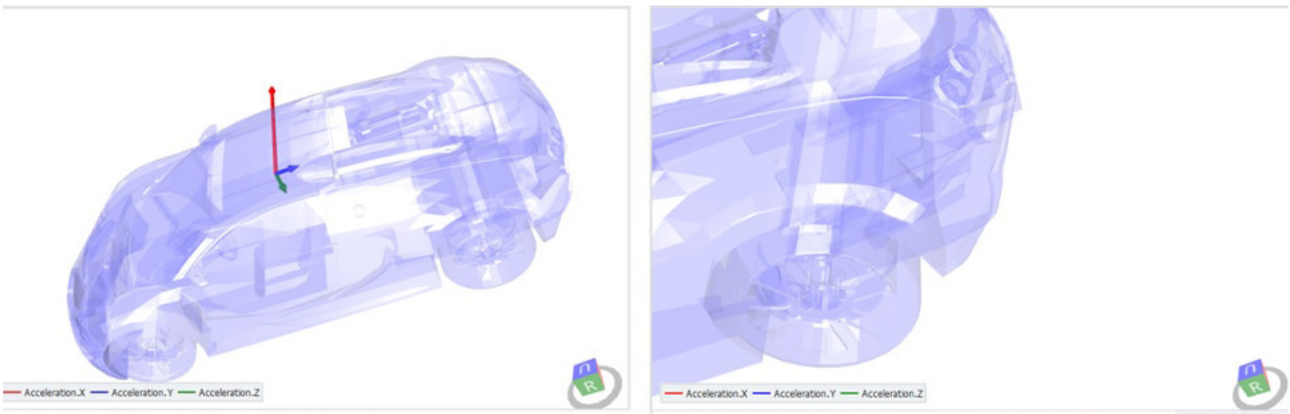
- F = Front
- L = Left
- B = Back/Rear
- R = Right
- U = Up
- D = Down



Cube for defined model orientation. [AN_94]

19.18.4 Manual object rotation

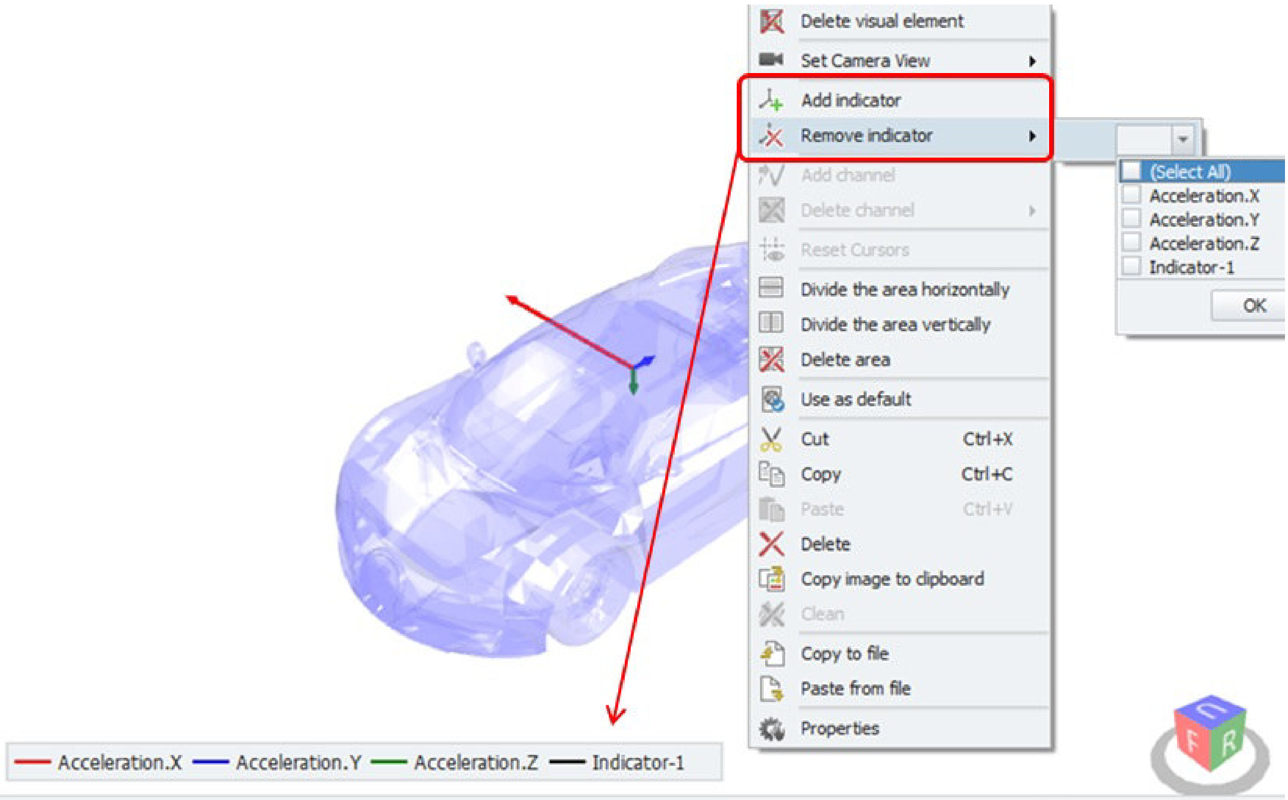
You can rotate the object to any individual view position. The object can be rotated using the CONTROL Key and left mouse button to drag the object to the required position. You can also zoom to the instrument and move it inside the instrument container. With the function key “Pos1” you jump back to the original orientation of the STL model.



Example of a manually selected position. Example of a zoom and moving inside the instrument. [AN_95]

19.18.5 Add / remove indicators

Indicators are the general objects which can be graphically presented in the instrument.



Add or remove indicators. [AN_96]

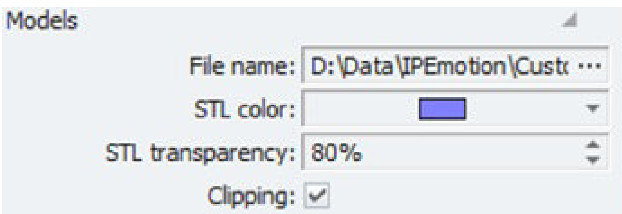
19.18.6 3D view instrument head up display

19.18.7 General

- ► See configuration options in chapter VIEW >Yt- chart 17.7.4.

19.18.8 Model

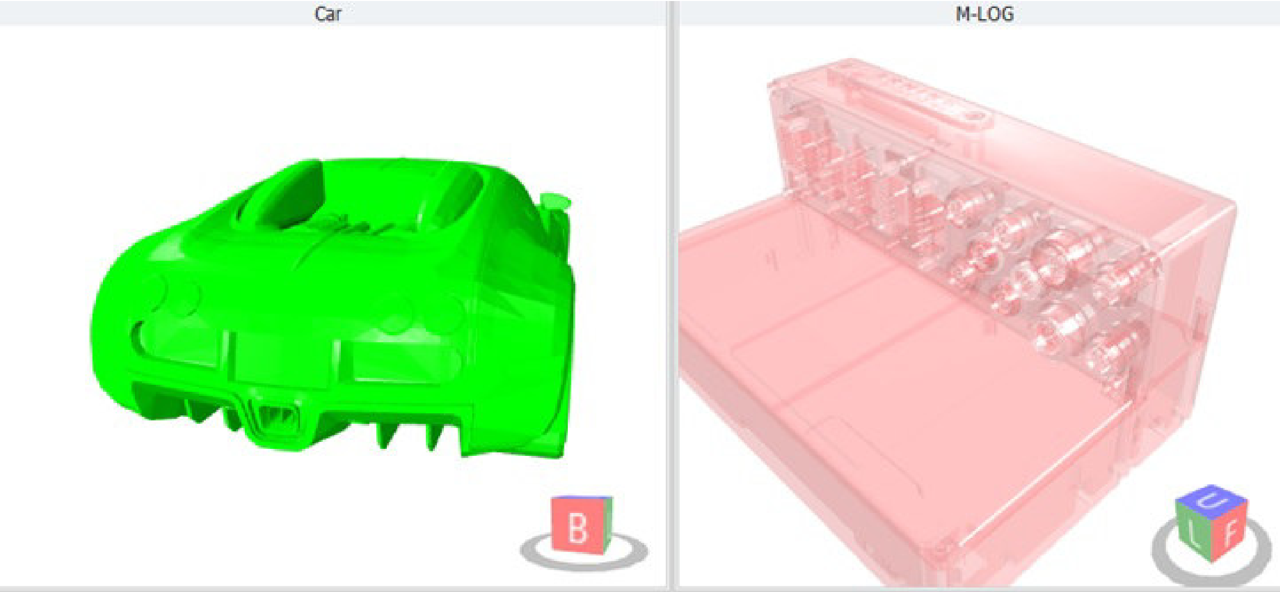
In models you define the properties if the model.



[AN_97]

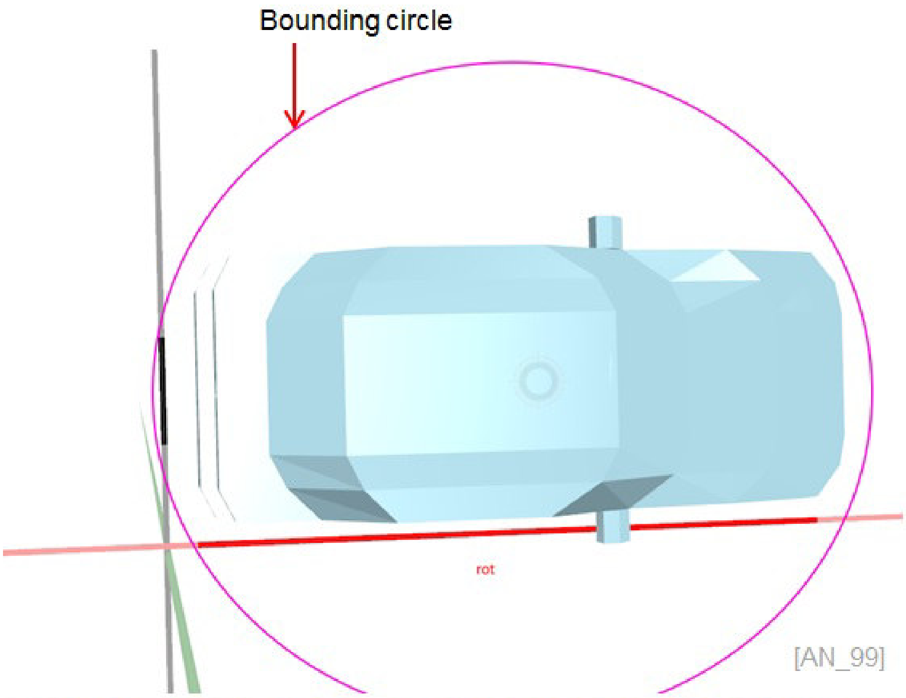
► File name	Select a STL from your local drives. The STL file part of the IWF configuration. When you transfer an IWF file to another computer the related 3D model is transferred to and will be installed on the new computer in the directory: C:/Users/Public/Documents/IPETRONIK/IPEmotion/Custom/3DModels The model is only transferred and included in the configuration when in the OPTIONS >Frequently used the function include external files is activated 22.1.2.
► STL color	Define the color of the 3D object.

- **STL transparency** — You can define the object transparency from 0 âĂŞ 99%. Transparency is required if you like to see the indicators located inside the object. See example in section 19.18.13.



Example of transparency = 0% Example of transparency = 80% [AN_98]

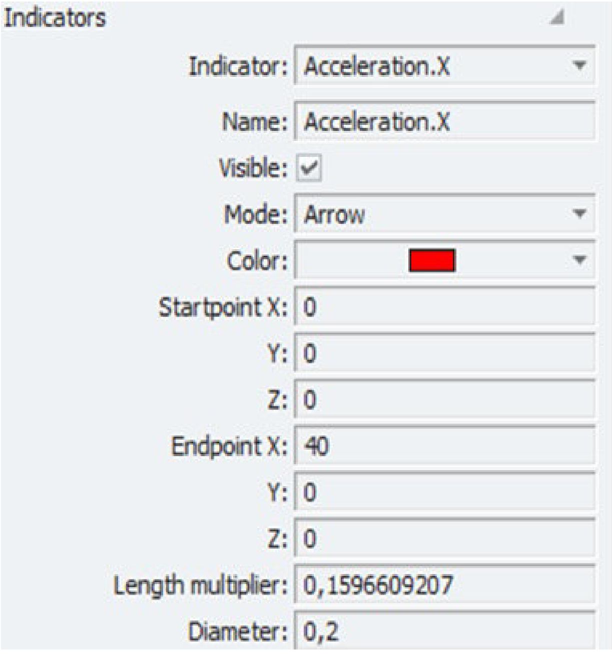
- **Clipping** — With the clipping function the graphical elements of the indicators outside the 3D cube of the object are removed.



Sections outside the bounding cricle are invisble when clipping is active.

19.18.9 Indicators

For the indicator configuration you have to consider many details in order to get the desired results. In the following each setting will be explained in general. A detailed example will follow here after 19.18.11.



[AN_100]

► Indicator	The indicator itself hat to be created from the context menu as explained in section 19.18.12. The initially created indicator has default name called "Indicator âĂŞn".
► Name	In this field you can change the default name to a meaningful name.
► Visible	With the visible check box you show or hid the indicator in the 3D view instrument.
► Mode	The indicator can have different display modes. Currently arrow and line mode is supported.
► Color	Here you define the color of the indicator.
► Start point X	Here you define the start point X- coordinate.
► Start point Y	Here you define the start point Y- coordinate
► Start point Z	Here you define the start point Z- coordinate
► End point X	Here you define the end point X- coordinate
► End point Y	Here you define the end point Y- coordinate
► End point Z	Here you define the end point Z- coordinate
► Length multiplier	The length multiplier is a factor which is computed in reference to the overall scaling. See details in the example below.
► Diameter	Configure the diameter of the arrow or line.

19.18.10 Legend

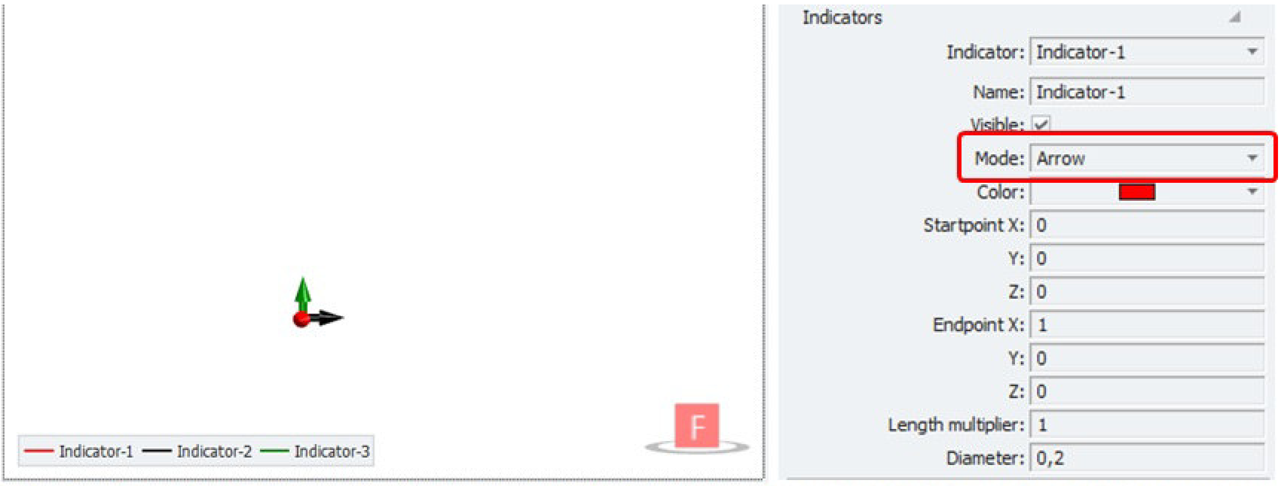
Hide or show the legend with the indicator names.

19.18.11 Example of an 3D view instrument setup

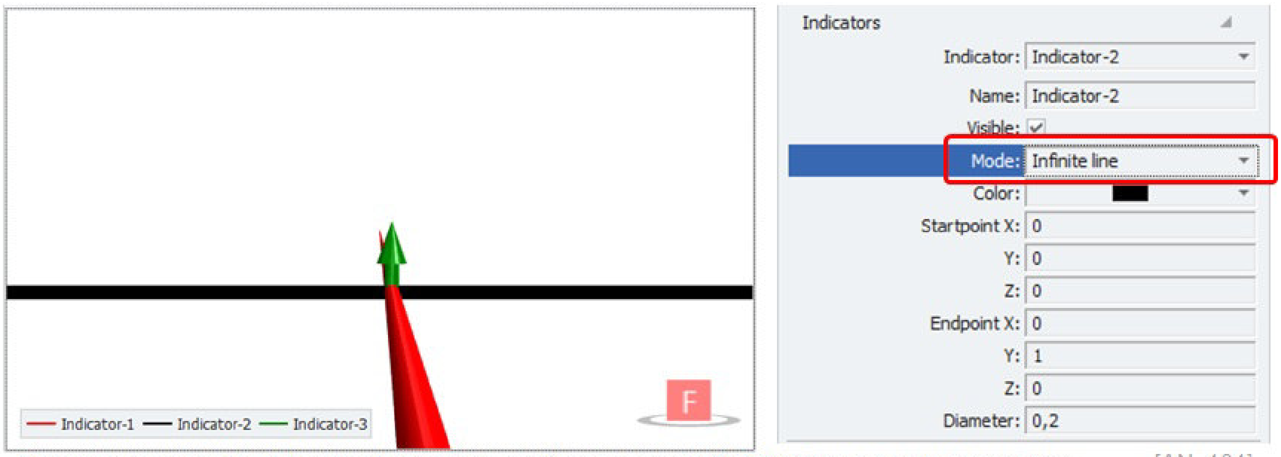
The configuration of a 3D instrument requires some knowledge which will be discussed below.

19.18.12 Creating indicators

When you setup the 3D view instrument you need to decide how many indicators you like to show in the model. You need to create indicators first in order to proceed with the detailed configuration. Apart from the default arrows you can change the indicators to infinite lines too.



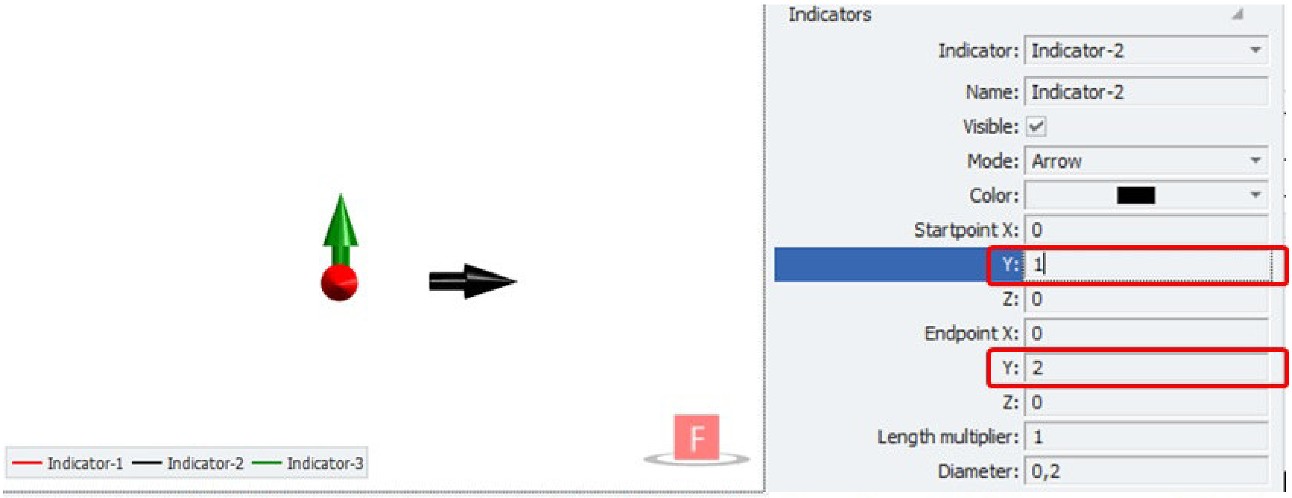
Example: 3 indiactors (default arrow) are created, starting all at the same point (0;0;0) in the coordinate system.



Example: Indicator 1 & 2 have infinite line mode, passing at (0;0;0) in the coordinate system. [AN_101]

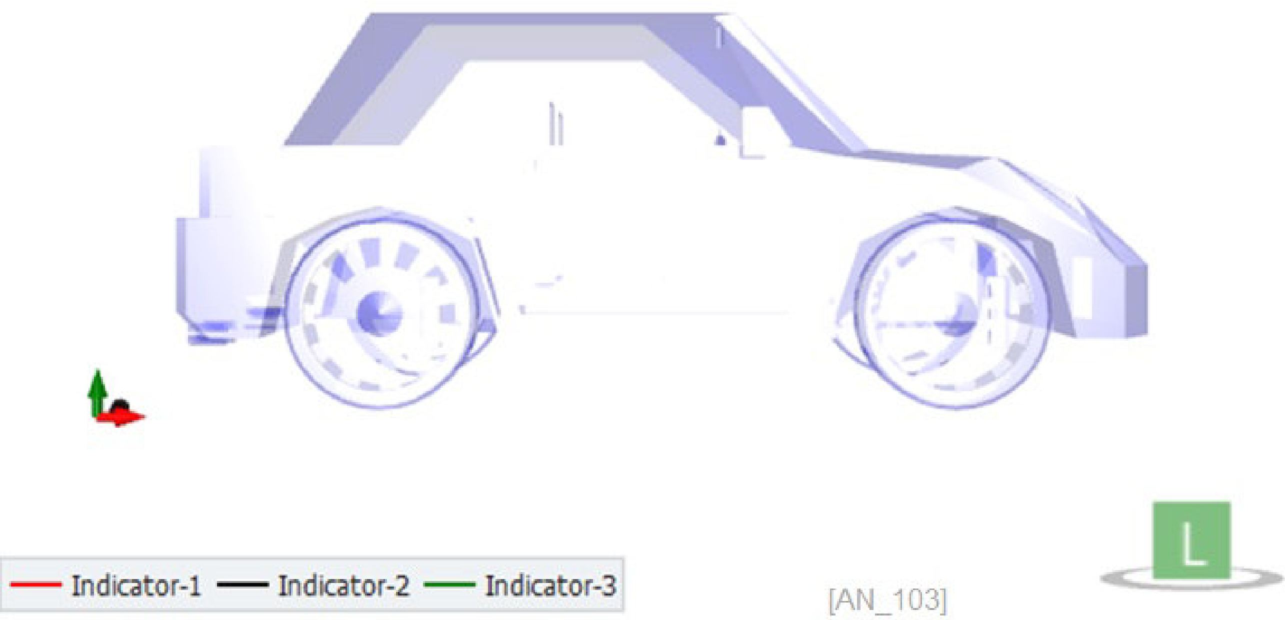
19.18.13 Defining start point coordinates in reference to the STL model

The default start points for the indictors is the center of the coordinate system which is (0;0;0). You can move the start point of the indicators as presented below. In this example indicator 2 (black) is just shifted by one distance unit to the left.



Example: Indicator 2 (Y-direction) has a new start point (0,1;0) and an end point (0;2;0) [AN_102]

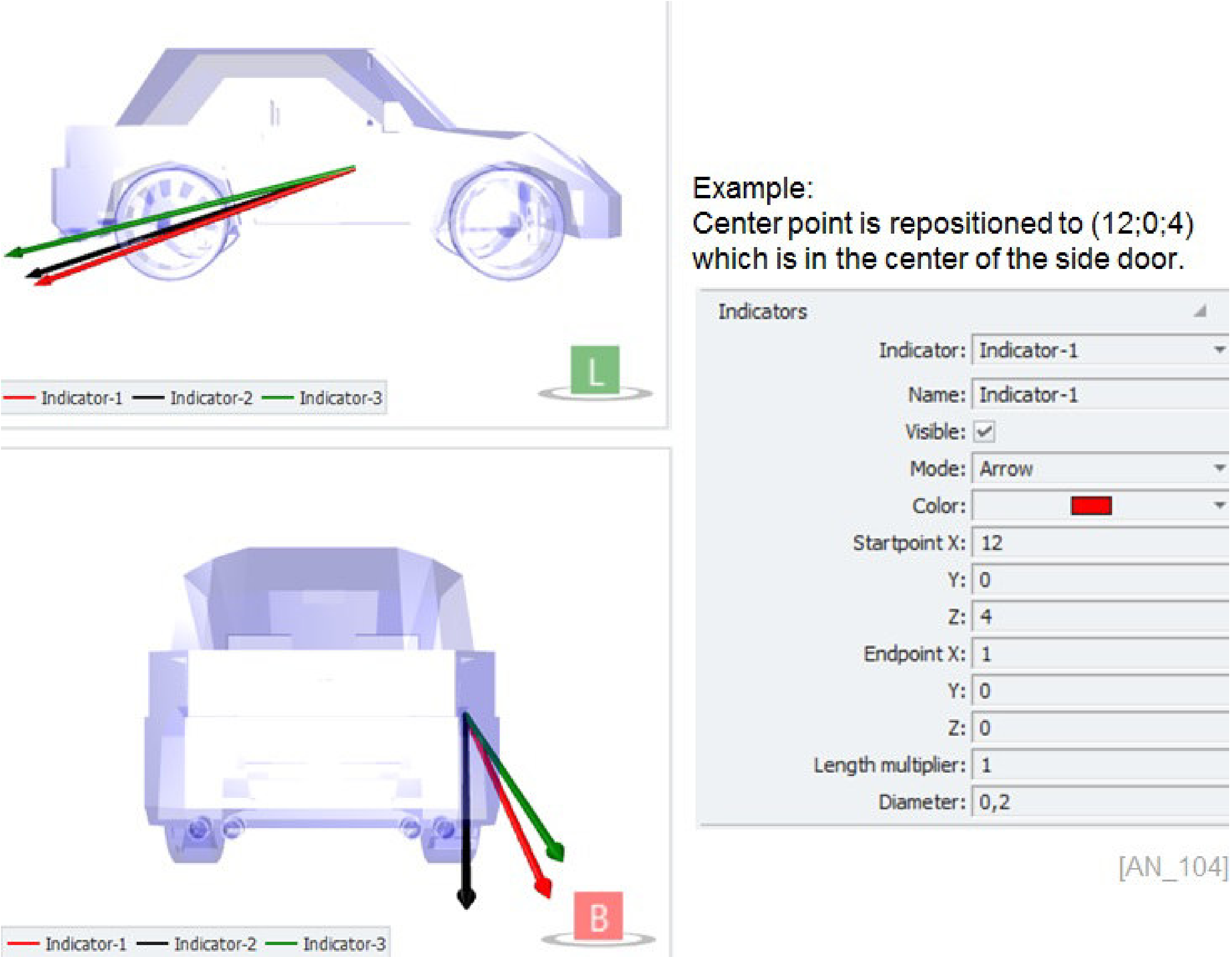
When you like to place the starting point of your indicators to a specific location of the STL model you have to know the coordinates of the STL model. These coordinates you get from the CAD program where the original model is created. In the example below you can see that the STL model is located quite close to the center coordinates (0;0;0).



[AN_103]

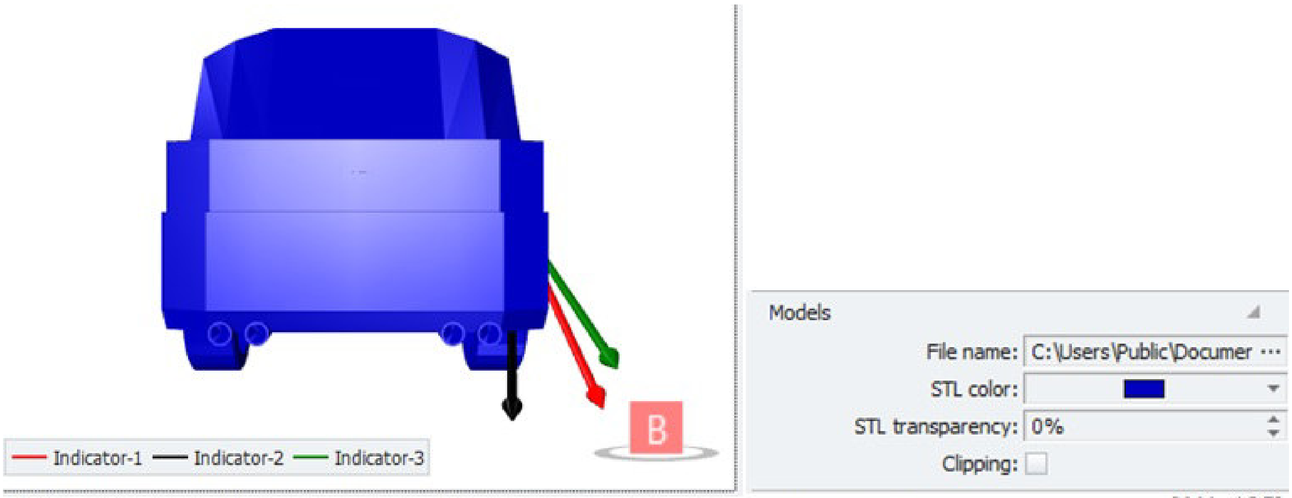
Example: STL model is closely located to the center of the coordinate system (0;0;0).

However if you like to place the starting point of the indicators (arrows, or line) somewhere inside the STL model you have to ask the CAD file developer for the detailed coordinates. Alternatively you move them manually through try an error to the desired position. In this example the center is located inside the door.



[AN_104]

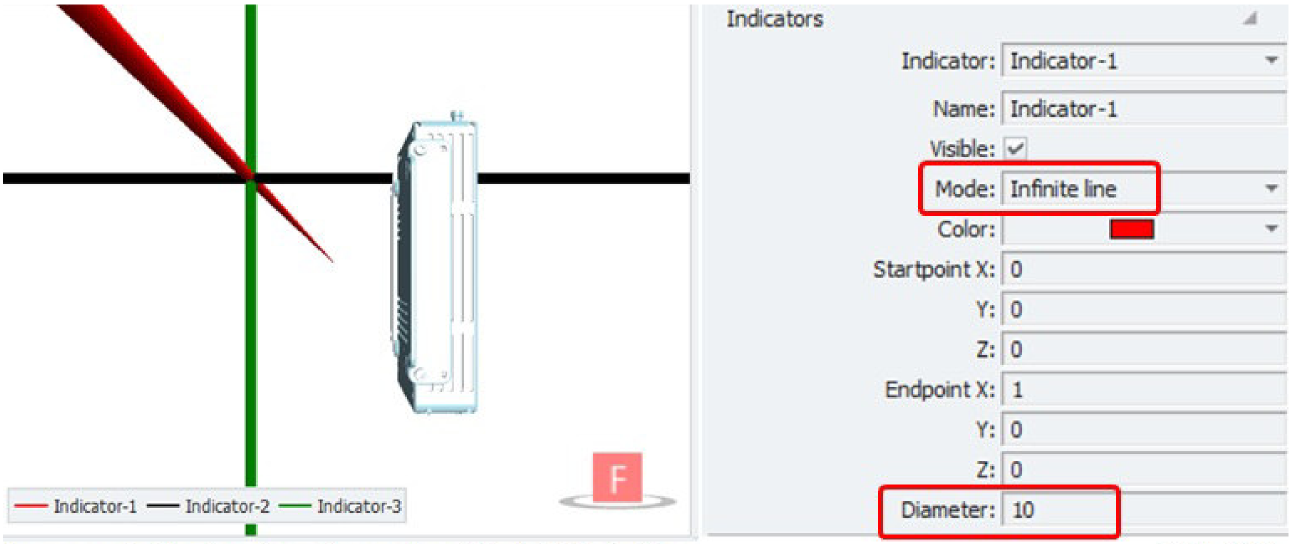
If the model is configured for transparency the indicators originating from inside the model are invisible.



0% transparency is hiding parts of the indicators originating from inside the model. [AN_105]

⚠ ***Attention!***

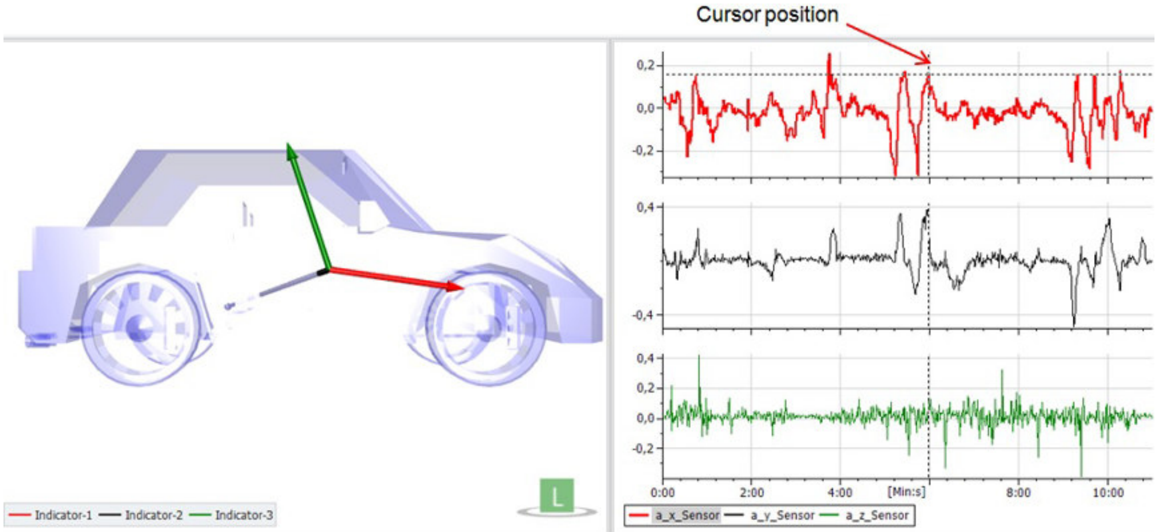
In some cases you import your STL file and you cannot see anything. In this case it is most likely that the STL coordinates are very far away from the center coordinates. The instrument is zooming to a high macro level which is then reducing the resolution so that you cannot see model or your indicators. Help: To establish visibility you may increase significantly indicator line thickness or switch to infinite line to see the indicators relative to the STL model. Finally you have to find the right (X,Y,Z) starting points to place the indicators at the right location to the instrument.



Increase indicator diameter and switch to infinite line [AN_106]

19.18.14 Updating vectors though scripting operations

So far you have seen how to configure and locate the indicators and how to load STL files. Finally you would like to show graphically the magnitude and direction of the indicators to understand more about the circumstances you are investigating. In order to update indicator direction and magnitude you need to use scripting function. With the scripting function you can execute the updates. In the example below the measurement of acceleration in X, Y, and Z direction is graphically update in reference to the cursor position.

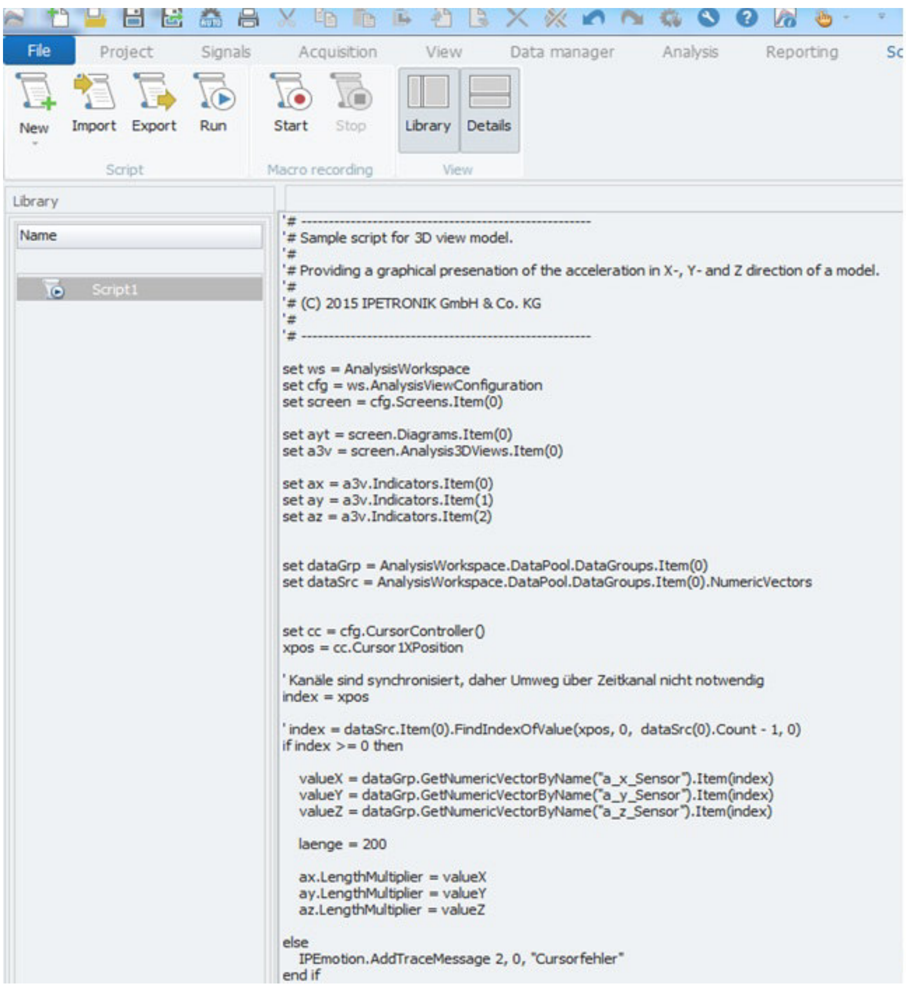


Update Indicators

Scripting operation is updating indicators according to cursor position.

[AN_107]

Scripting example:

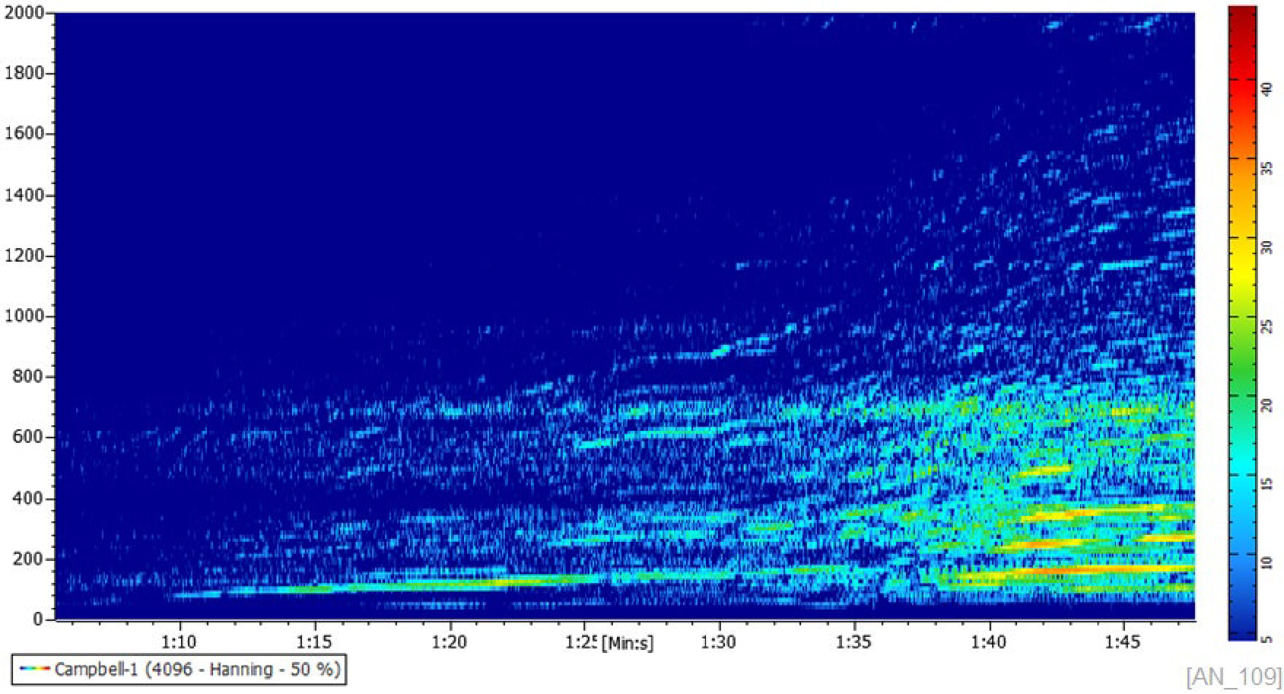


[AN_108]

19.19 Campbell

19.19.1 You tube resources

IPEmotion – Acoustic analysis with Campbell instrument: https://youtu.be/uPVTp6tpFe4

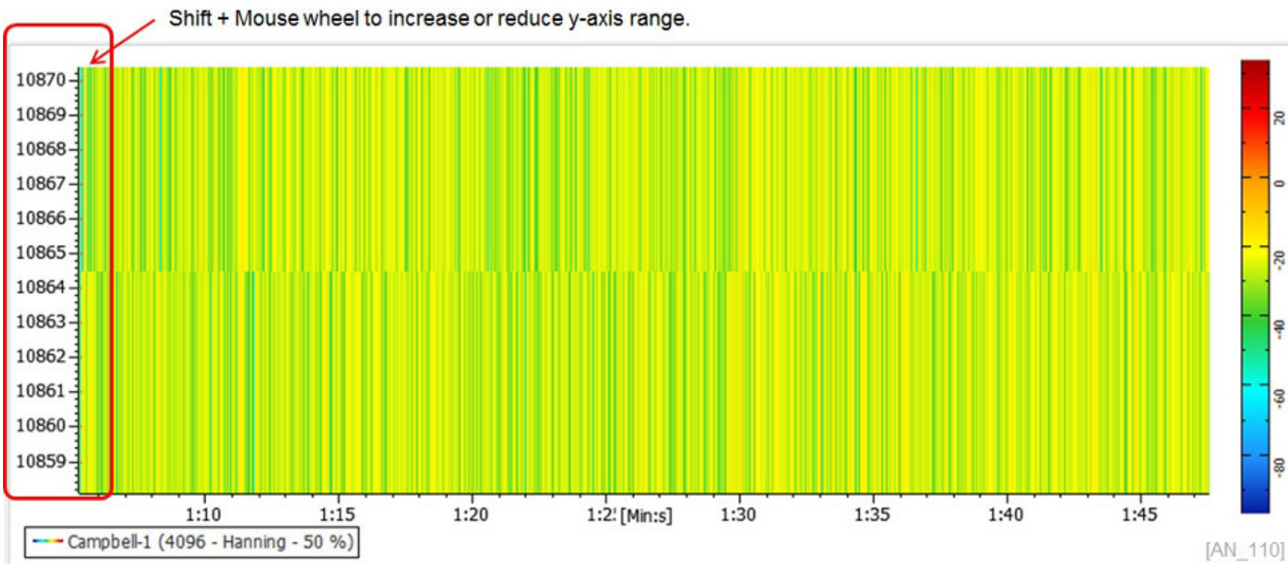


[AN_109]

The configuration settings of the Campbell operation are explained in this chapter 18.24.

19.19.2 Instrument configuration functions

- Y-axis (frequency) On the y-axis you define the frequency range. With the shift + mouse wheel you can in increase or reduce the frequency axis. With a click on the Y-axis and an up/down movement you can shift the complete Y-axis.



[AN_110]

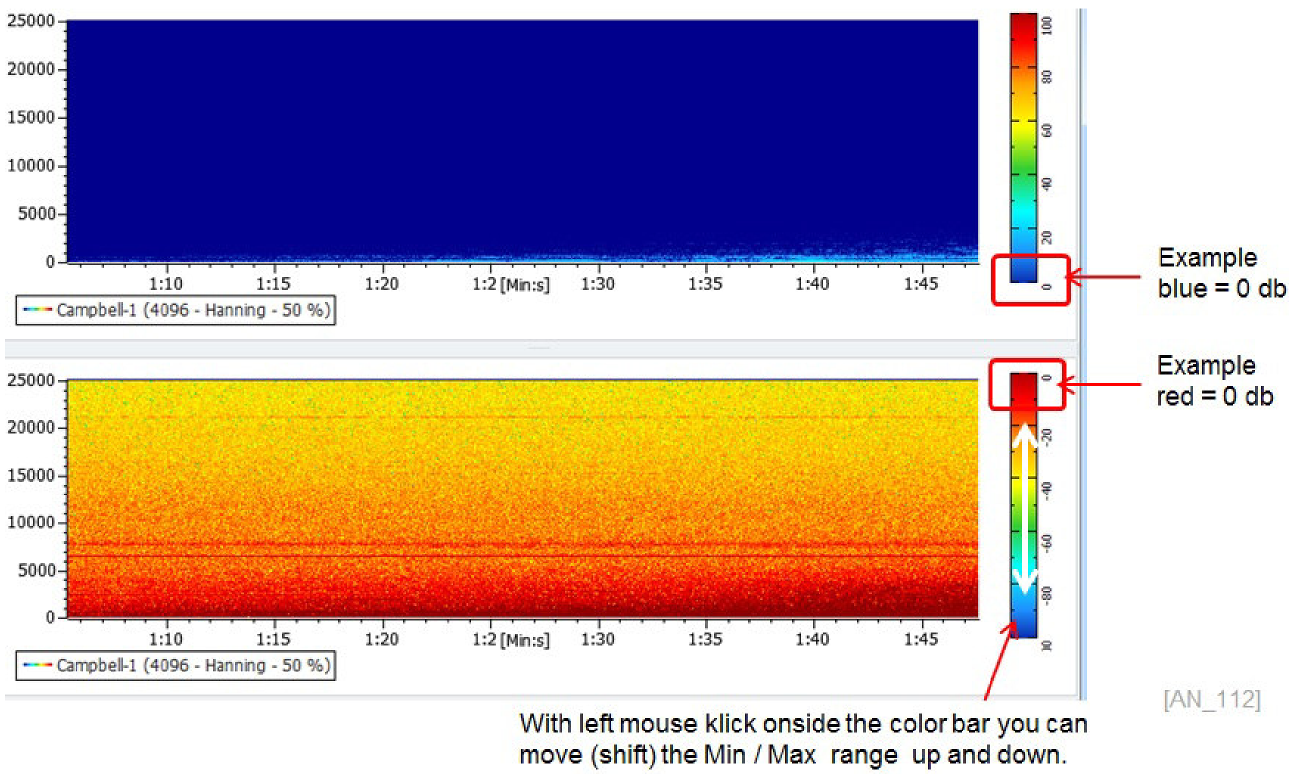
- X-axis (time / ref channel) On the x-axis you can display either the time or a reference channel. The type of axis presented on the x-axis is depending on the Campbell operation settings 18.24.3. With the shift + mouse wheel you can in increase or reduce the frequency axis. With a click on the x-axis and a left/right movement you can shift the complete X-axis.

[AN_111]

► Color bar scaling

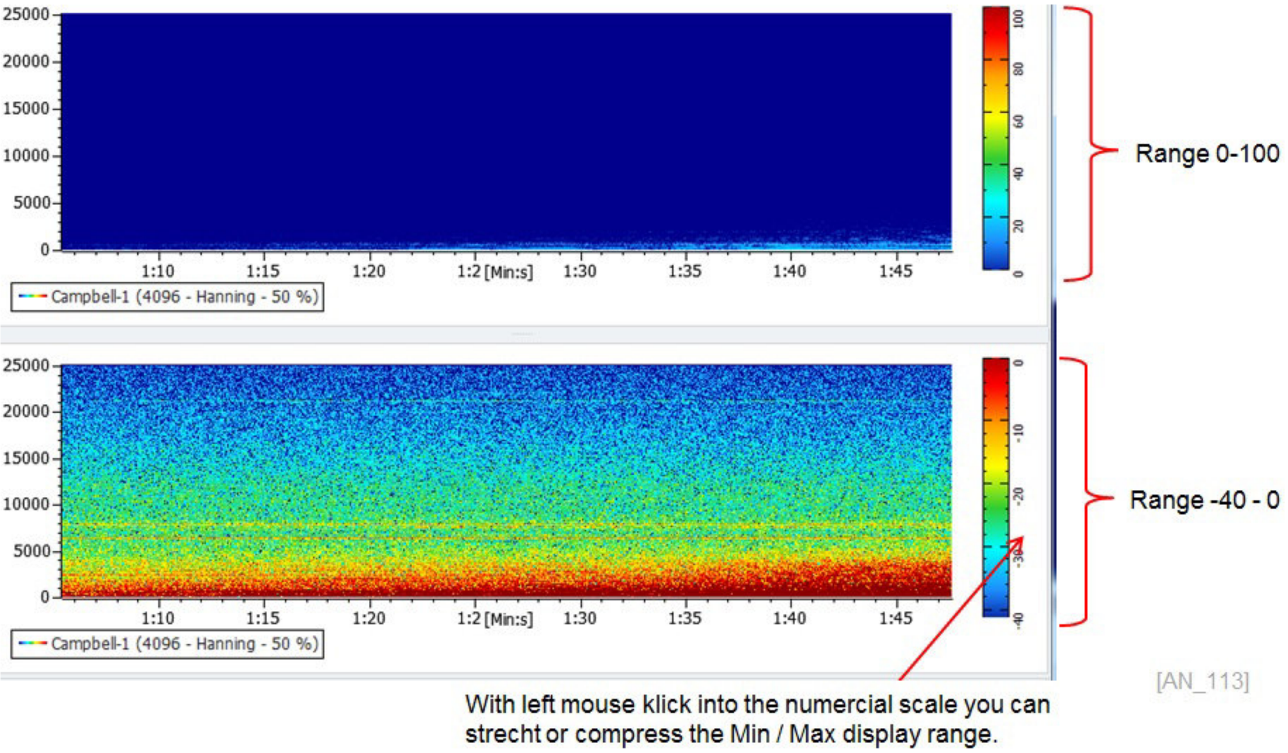
The most important function are the move and scaling function in the color bar and the numerical range. With this configuration functions you can achieve the desired contrast for the spectrums and amplitudes.

In the example below the upper Campbell diagram shows all areas with amplitude around ZERO (0 db) in dark blue. However in the lower diagram the display color range was changed /shifted where the color blue is indicating all signals with amplitude -100 db. All red signals have amplitude of around ZERO. Because of the shifted color min / max range the FFT amplitude spectrum can better identified in the lower Campbell diagram.



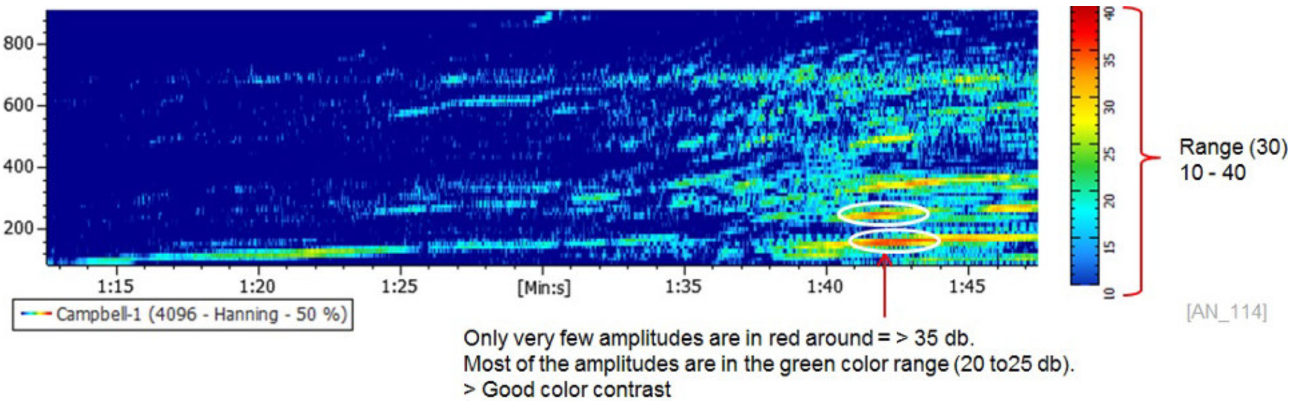
[AN_112]

Another configuration function is to change the display range. When you left click into the numerical axis of the color scale you can you can stretch and compress the numerical Min / Max display range.



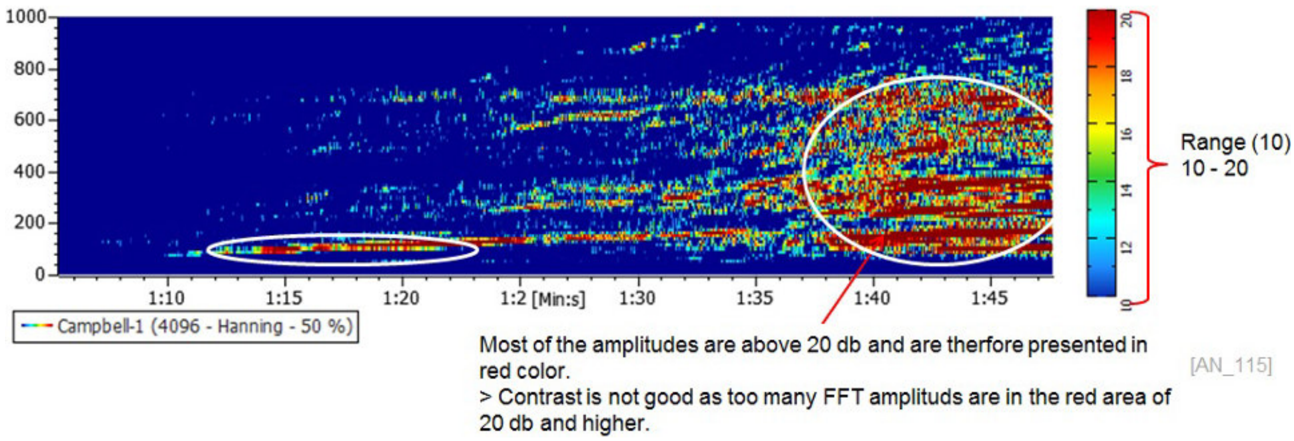
[AN_113]

In the following example you will see how the selected range on the graphical presentation of the amplitudes and the level of detail. In this example a very good range von 30 db (10 = blue to 40 = red) was selected and there is a good resolution between the red and yellow/green amplitude areas visible.



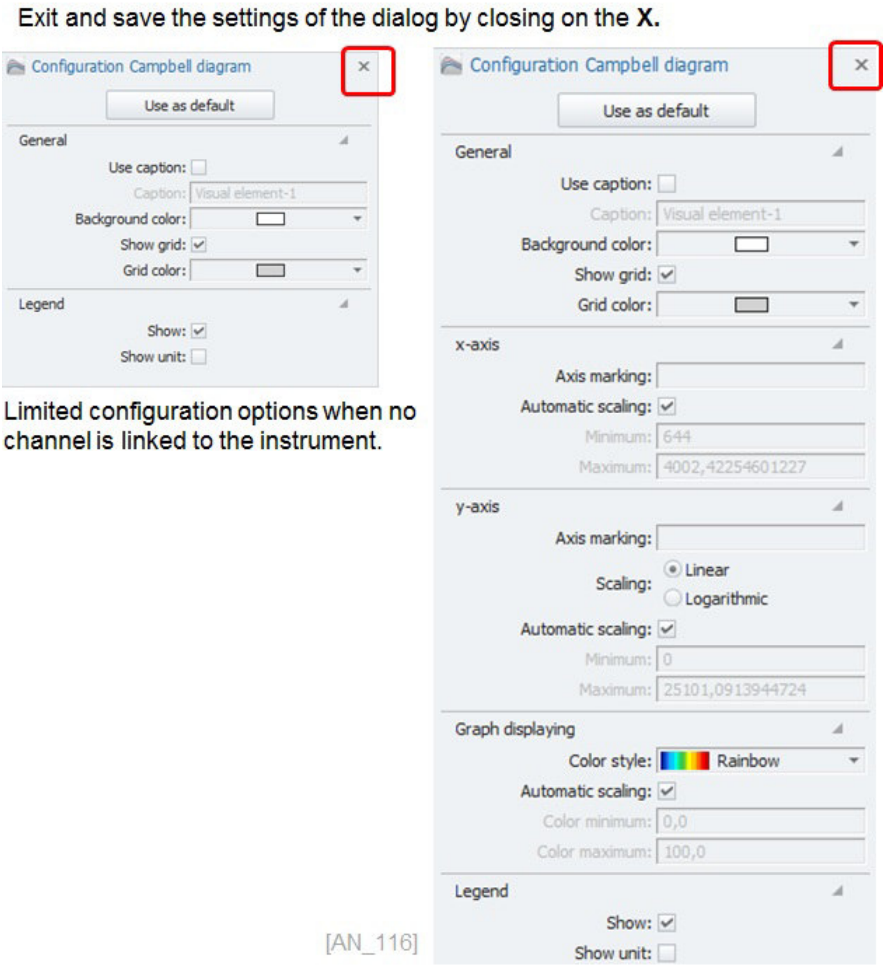
[AN_114]

In the example below the range was set to 20 db (10 = blue to 30 = red). In this case all signals above 30 are indicated in red color. The result is that this scaling in the range from 10 – 20 db is not well suited as all amplitudes above 20 db cannot be differentiated clearly. They are all grouped together in the red color range.



[AN_115]

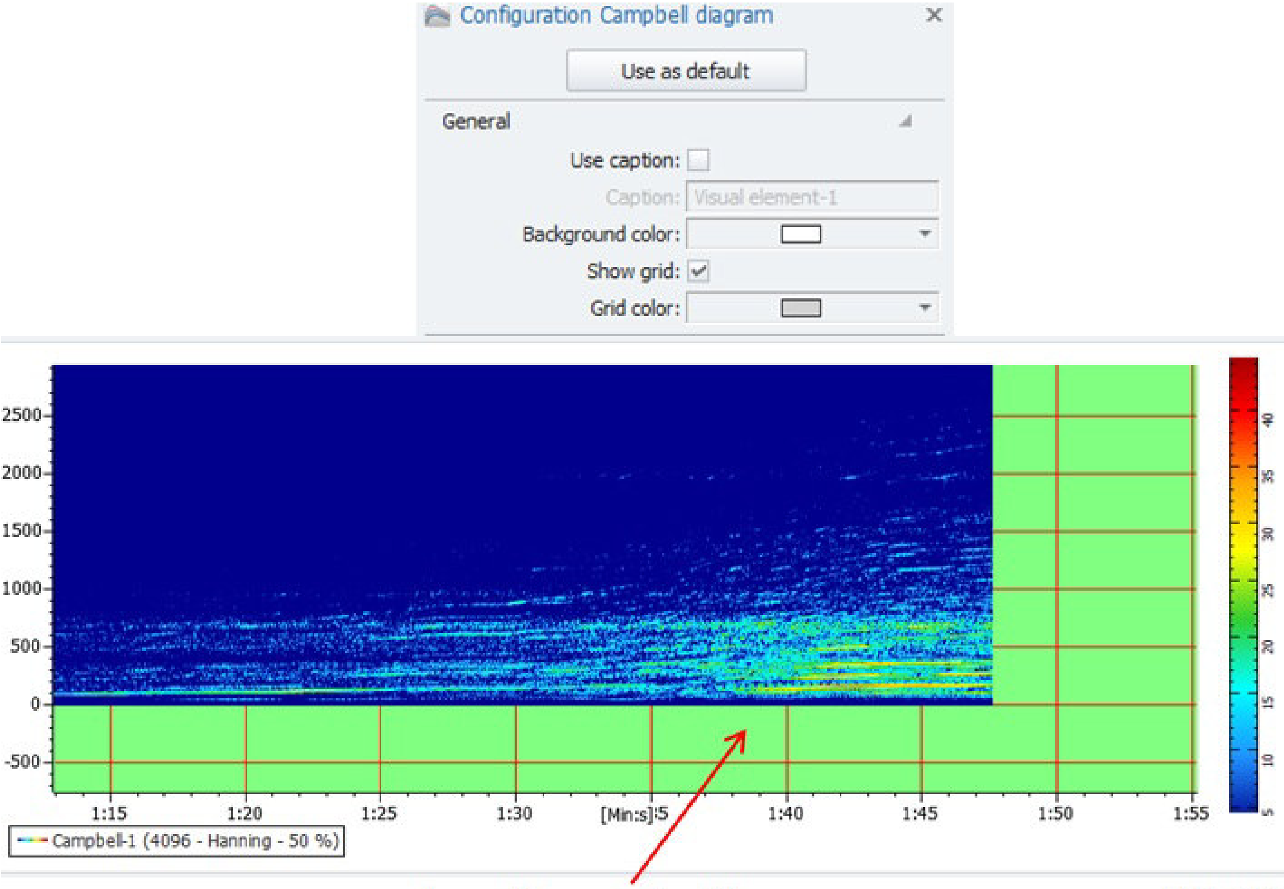
19.19.3 Campbell diagram head up display



[AN_116]

19.19.4 General

The general settings are only visible when no Campbell operation is linked to the diagram or when the diagram is moved and other empty areas appear. For more details see configuration options in chapter VIEW >Yt- chart 17.7.4.



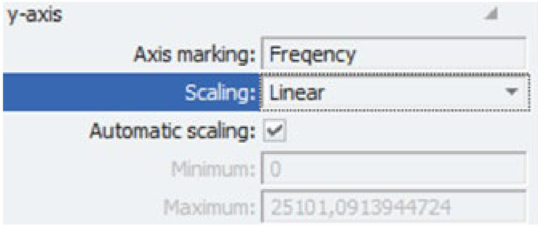
Area with general settings. [AN_117]

19.19.5 X-axis

Time based [AN_118] Referenced based min / max scaling.

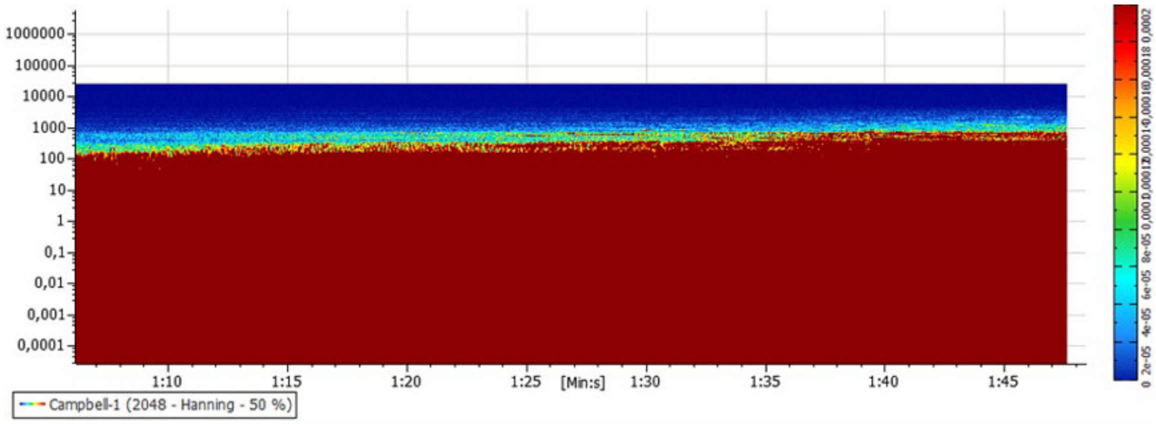
- **Axis marking** — Refers to a name displayed along the x-axis.
- **Automatic scaling** — Takes the time values from the data file into the diagram. You can deactivate the checkbox and define your own time span for the display range in the diagram. When you configure the Campbell operation with a reference channel then the Min max scaling of the x-axis from the reference channel is considered.

19.19.6 Y-axis



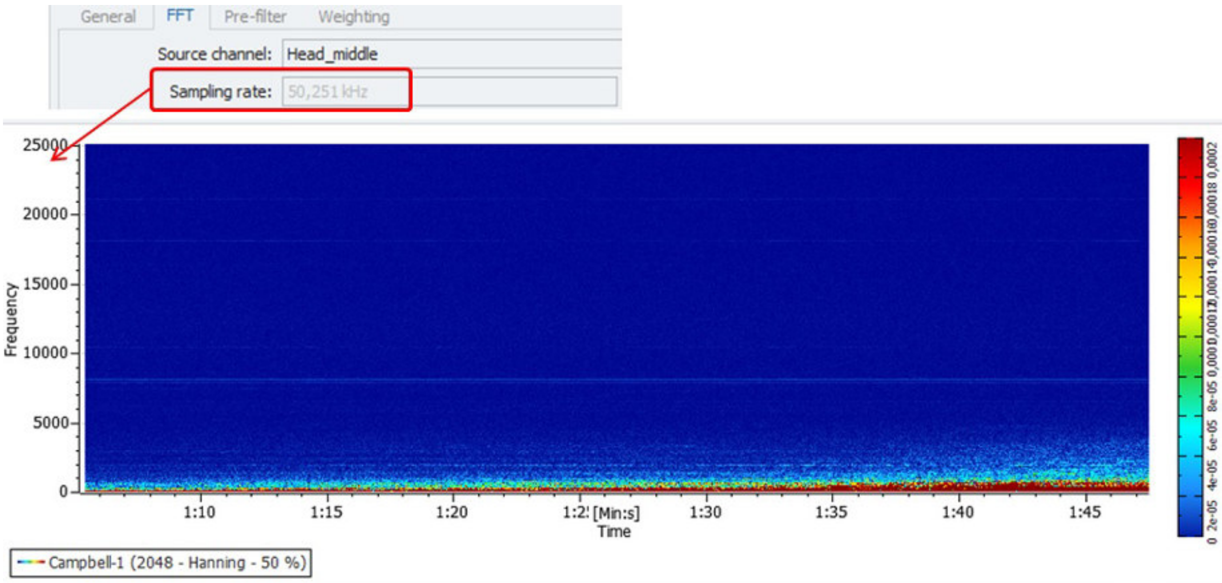
[AN_119]

- **Axis marking** — Refers to a name displayed along the Y-axis which is related to the frequency.
- **Scaling** — The frequency can be scaled in linear and logarithmic mode. In the screenshot below logarithmic scaling was selected.



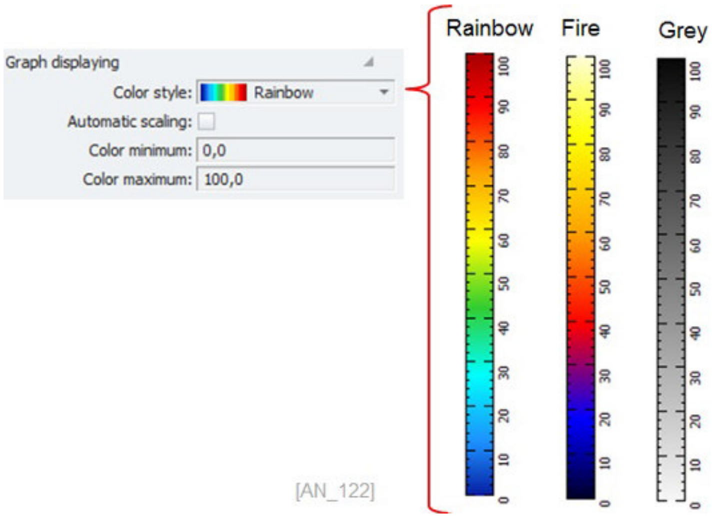
Logarithmic scaling of frequency Y-axis. [AN_120]

- **Automatic scaling** — This included the frequency range which is based on the calculation: sample rate of source channel divided by 2. In this example the source channel was sampled at 50 kHz and the frequency display range is up to 25 kHz. If you are searching for data in a lower frequency range you should lower the display range.



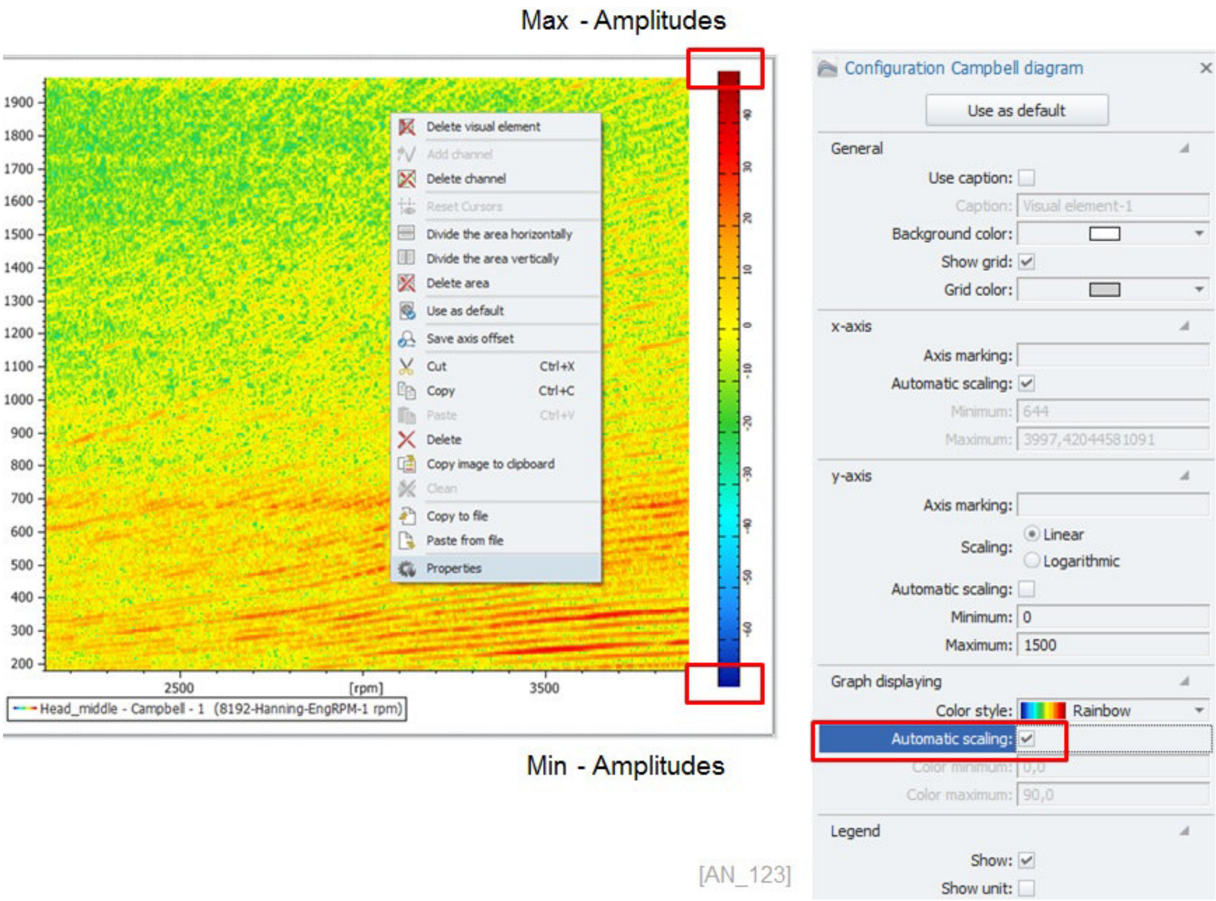
Max frequency scaling = source channel sample rate / 2 [AN_121]

19.19.7 Graph displaying



[AN_122]

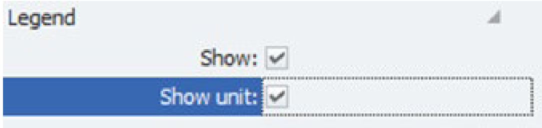
- Color style — Three default color styles can be selected. Rainbow, Fire, Grey.
- Automatic Scaling — The default setting is automatic scaling. In this case, the Min and Max values are taken from the actual FFT amplitudes calculations the complete color range is spread across the Min and Max values



[AN_123]

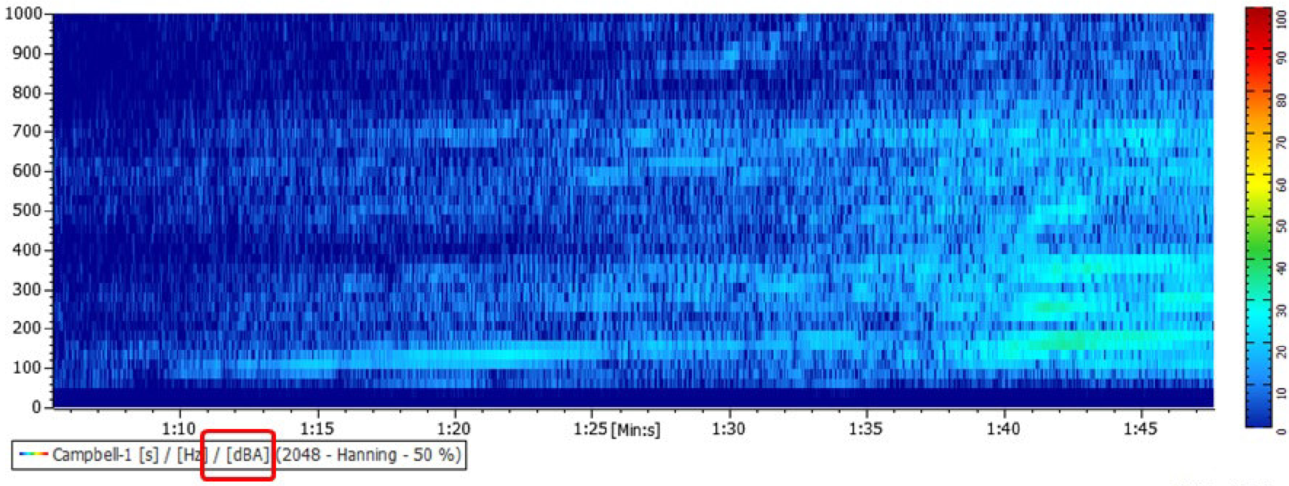
- Color min / max — Refers to the upper and lower ends of the color scale. Examples are explained in section 19.19.2.

19.19.8 Legend



[AN_124]

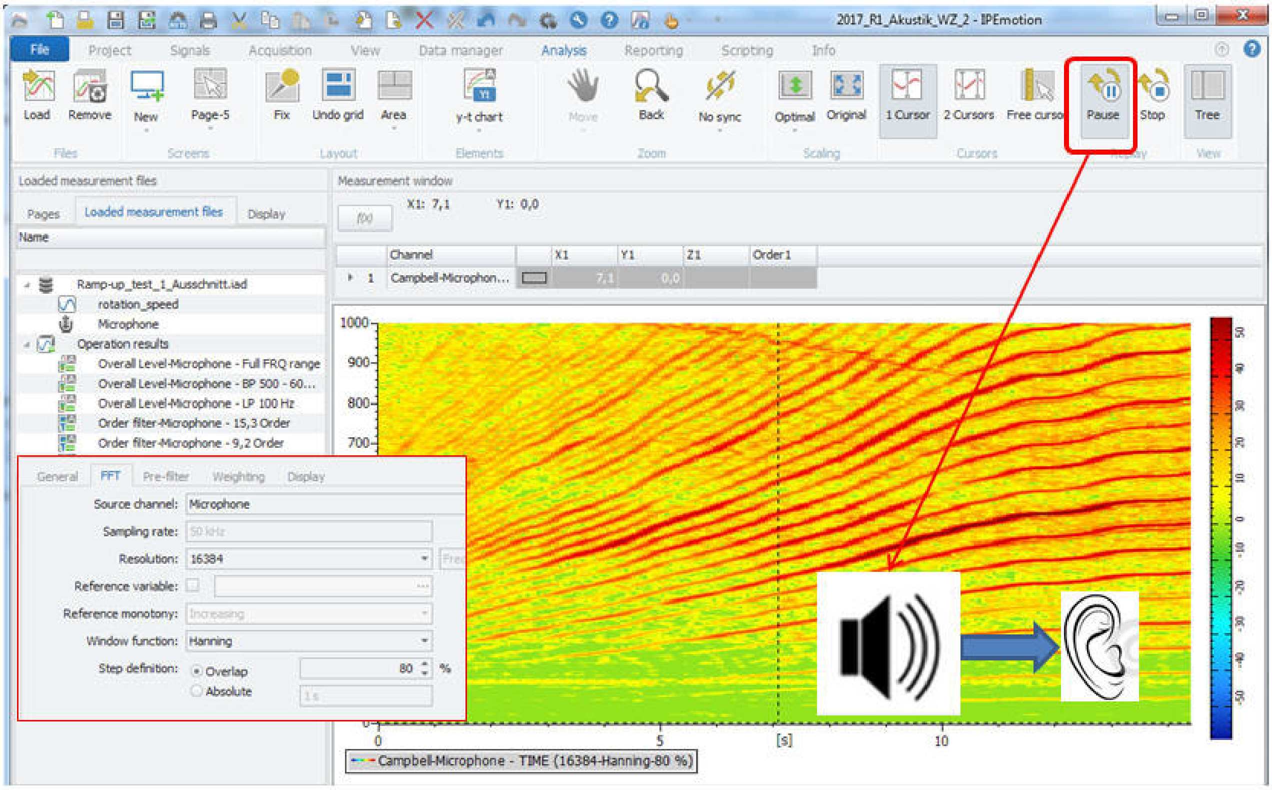
- Show — Display or hide the legend.
- Show unit — This display option includes information about the sample rate in Hz



Unit check box – enables display of selected weighting function in the Campbell operation. [AN_125]

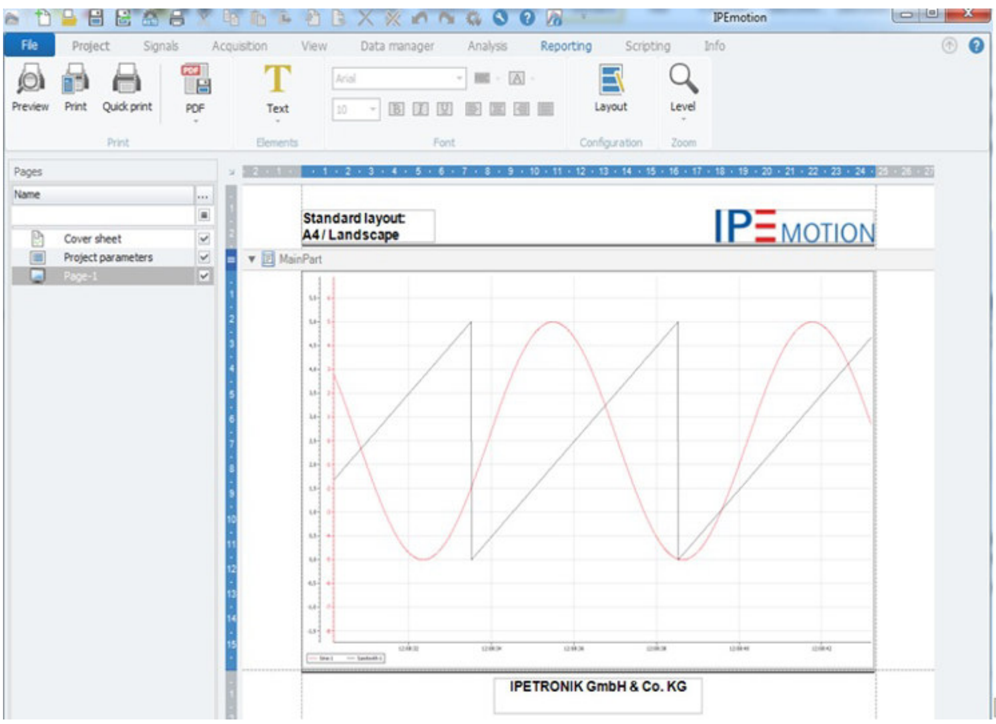
19.19.9 Audio play back

The Campbell diagram is supporting an audio play back function. This function is particularly useful in order to perform an acoustic validation of the recorded data before to start more detailed post processing tasks. The output of audio data is currently only possible when the Campbell operation is time based.



Audio play back for **time** based Campbell operations. [AN_126]

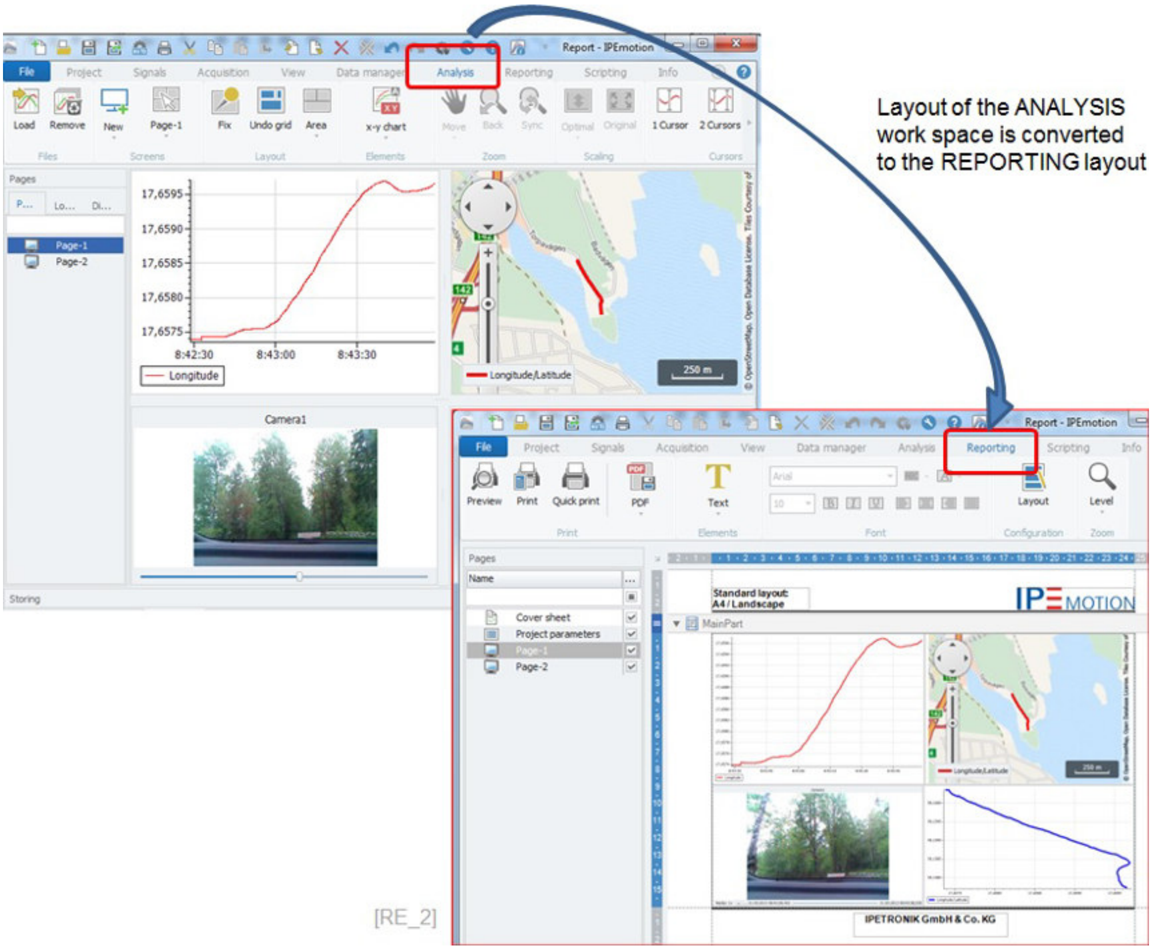
20 REPORTING work space



[RE_1]

20.1 Automatically generated

The basic report layout is automatically generated when you change to the Reporting work space. The layout you define in the analysis is automatically converted into the report template.

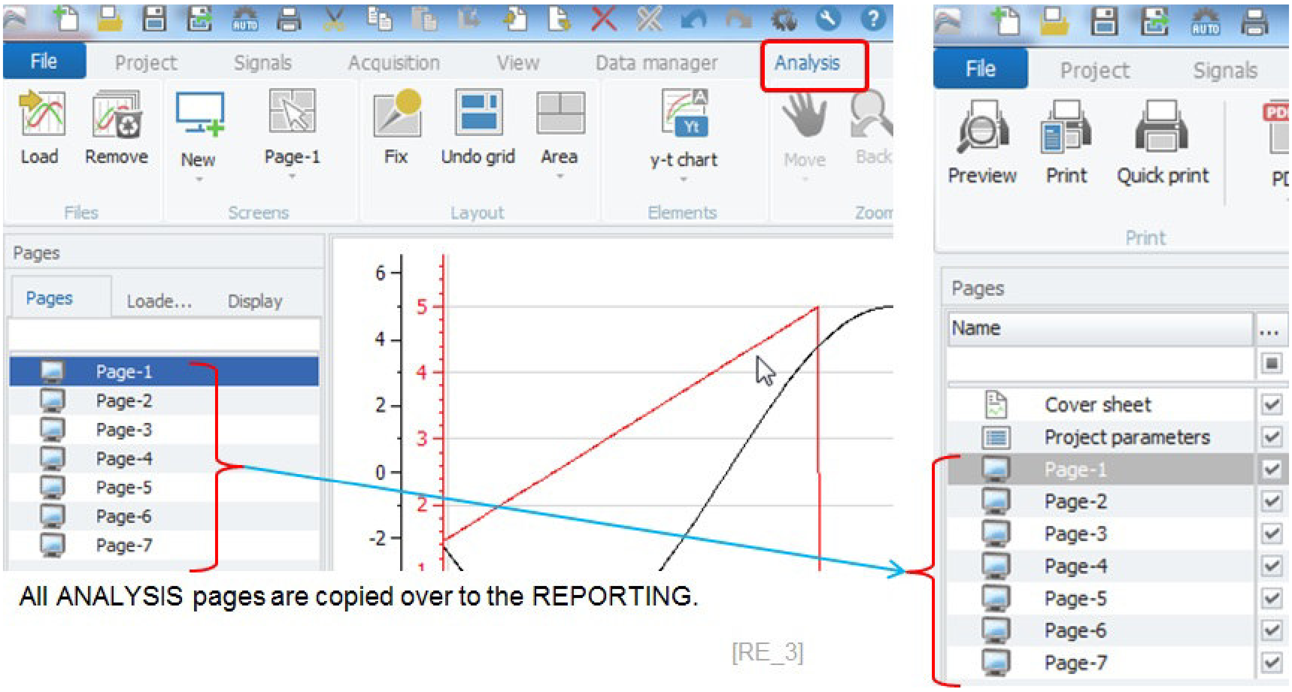


[RE_2]

20.1.1 Generic Report structure

When the report is generated the following structure is automatically available to you.

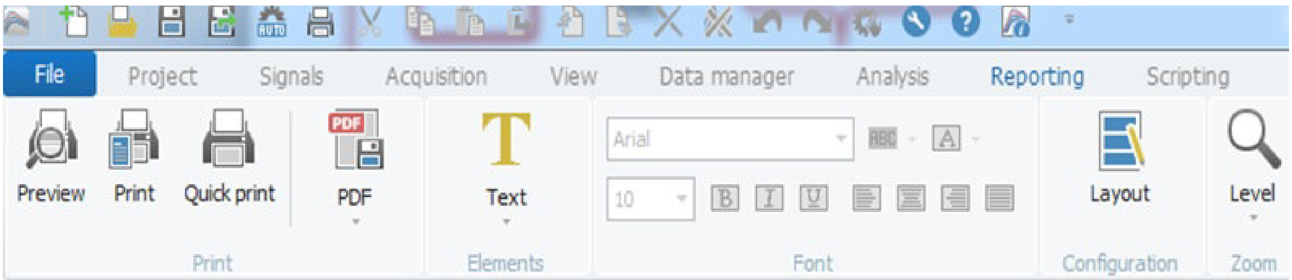
- **Report cover sheet** — The cover sheet is the first page of the report. You can edit this pages with the tools discussed below.
- **Project Parameters** — This page shows all project parameters of all loaded data files. This can cover many pages when you load many data files which have plenty of parameters stored inside.
- **Pages** — The pages are automatically generated from the ANALYSIS work space. All pages from the ANALYSIS are transferred to the report.



[RE_3]

20.2 Report Ribbon

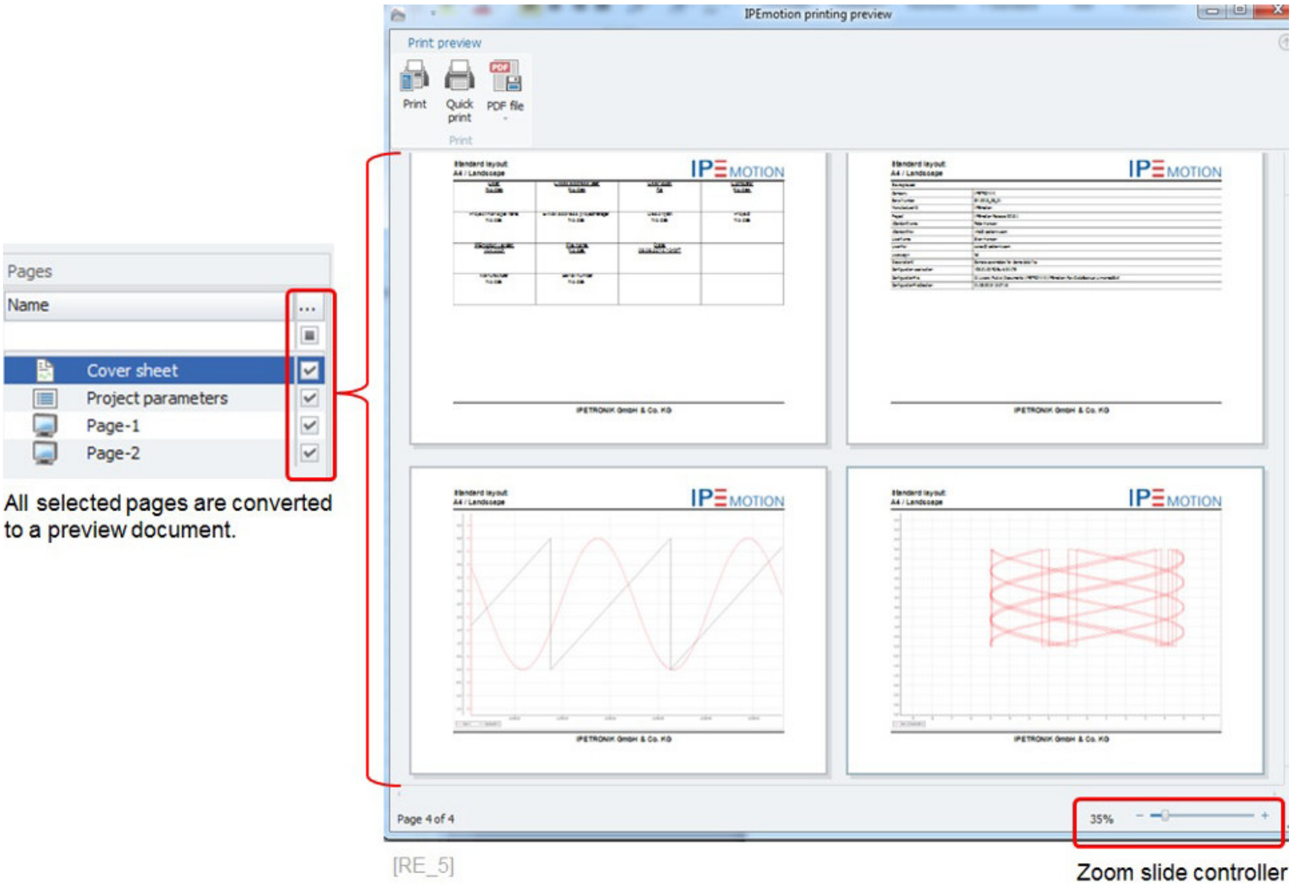
The report ribbon covers basic functions to modify the report and add graphical elements or text fields. However, the layout designer is a powerful editor to add valuable information to the report.



[RE_4]

20.2.1 Print

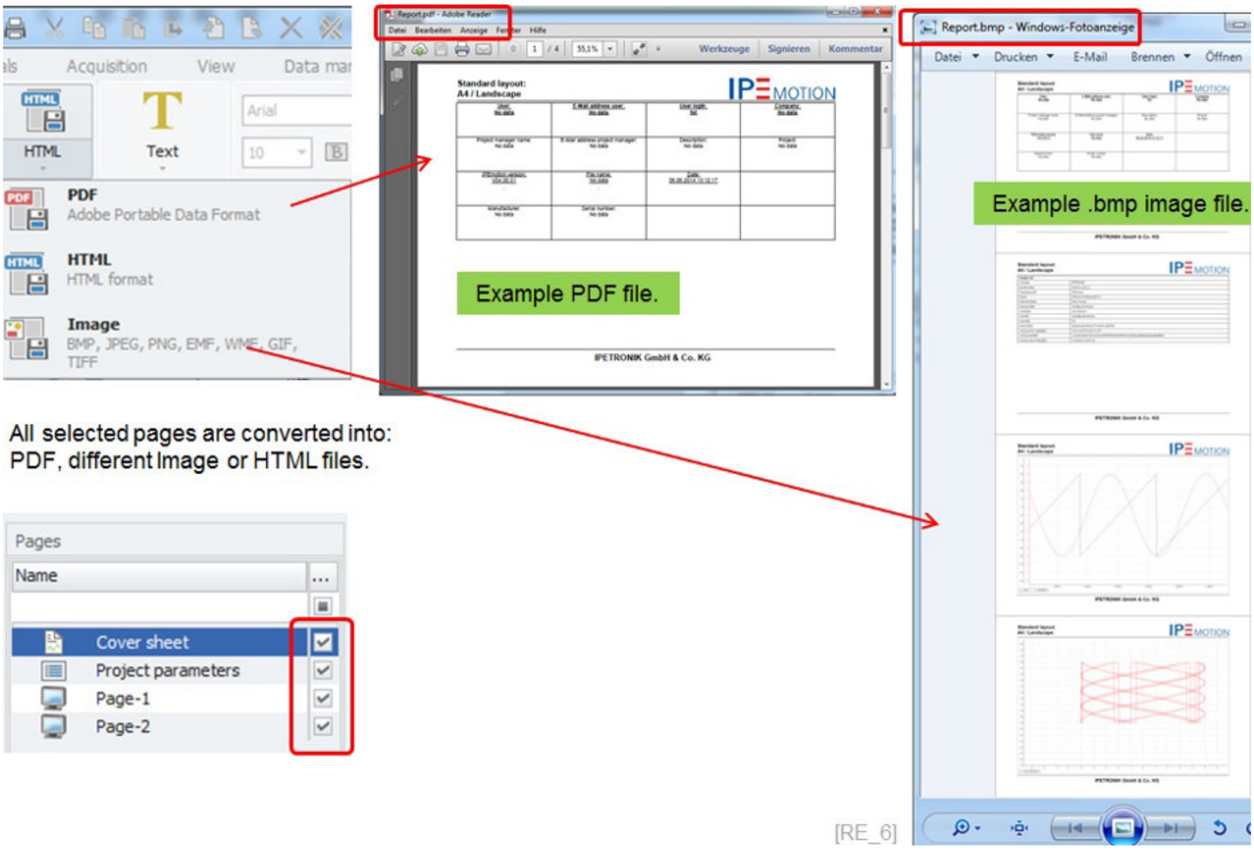
► Review	If you hit the preview button all selected report pages are converted to a preview document.
► Print	Using print the printer selection dialog opens up.
► Quick Print	Is directly printing to the default printer.



[RE_5]

20.2.2 PDF / Image / HTML

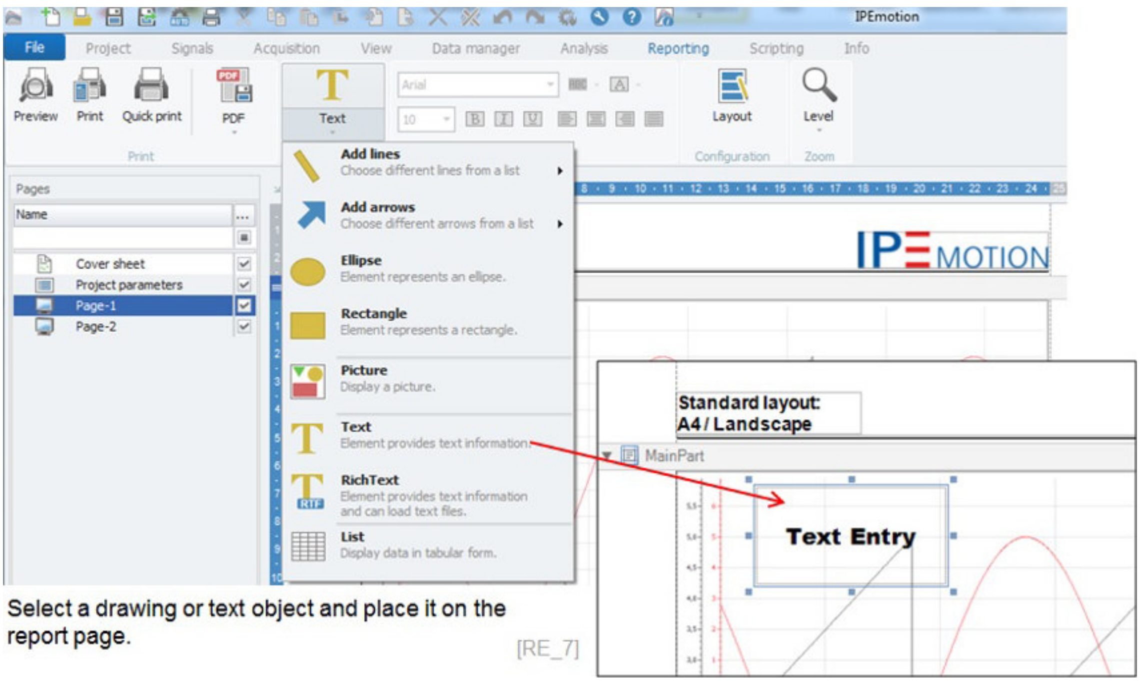
► PDF / Image / HTML Export selected report pages into pdf, image or HTML files.



[RE_6]

20.2.3 Add drawing elements text to the report

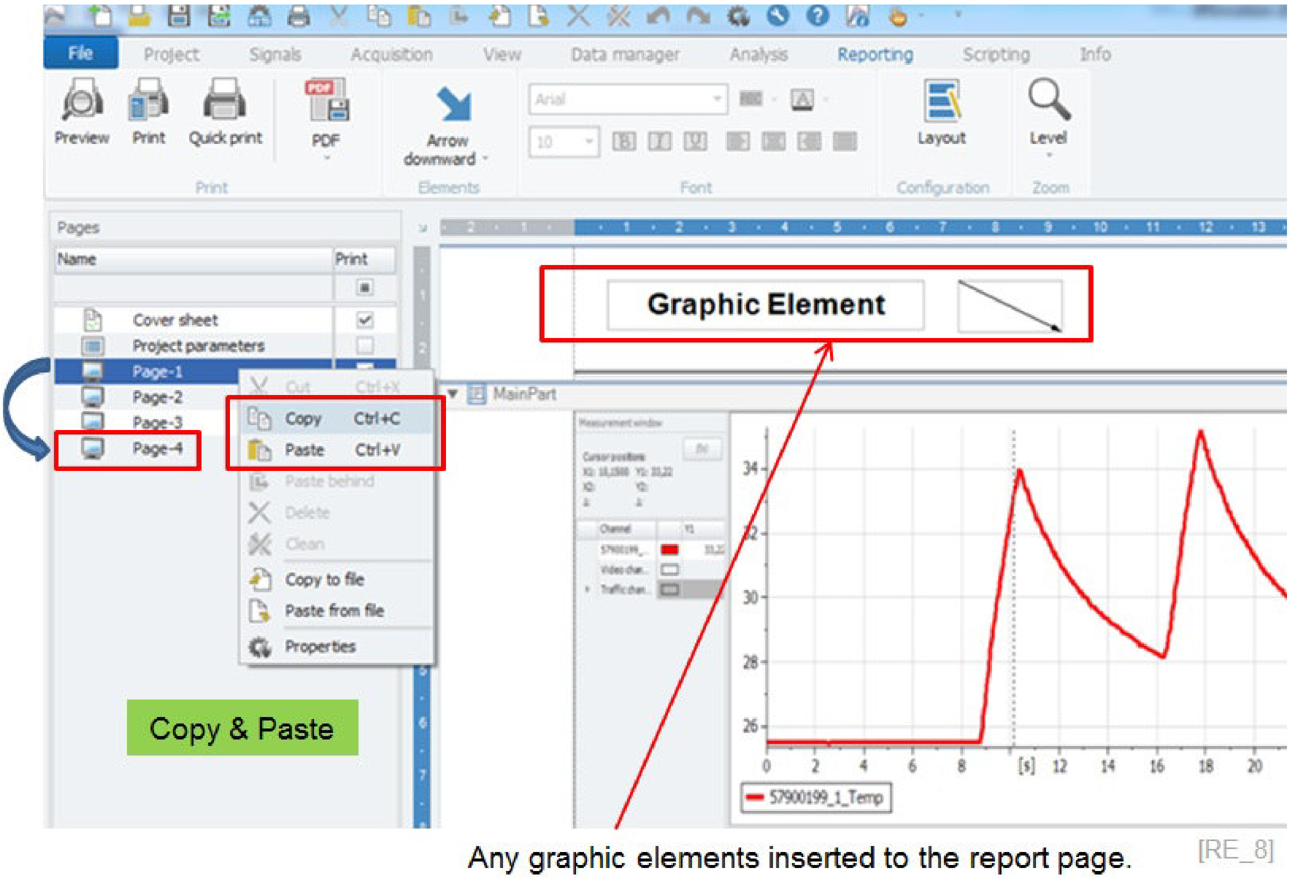
You can add specific text and drawing elements to every report page. If you select a text element you can define font and size as well. This graphical modifications are saved to the IWF project file. Whenever you create a new report with this project file the graphical elements show up.



[RE_7]

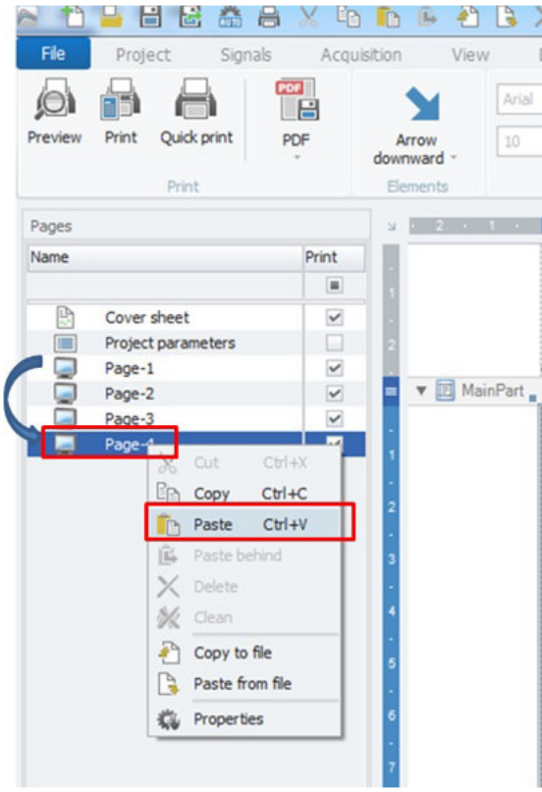
20.2.4 Page copy & paste operation

On the report pages you can copy and paste the report page individual layout modifications to other pages.



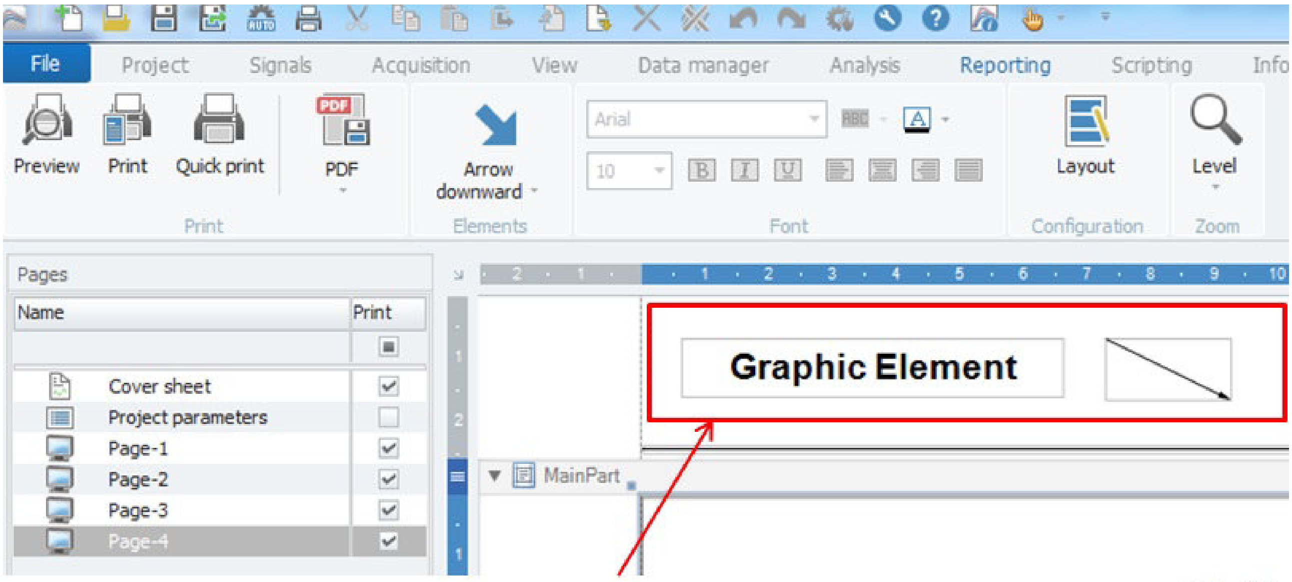
[RE_8]

Copy page 1 layout and paste to page 4.



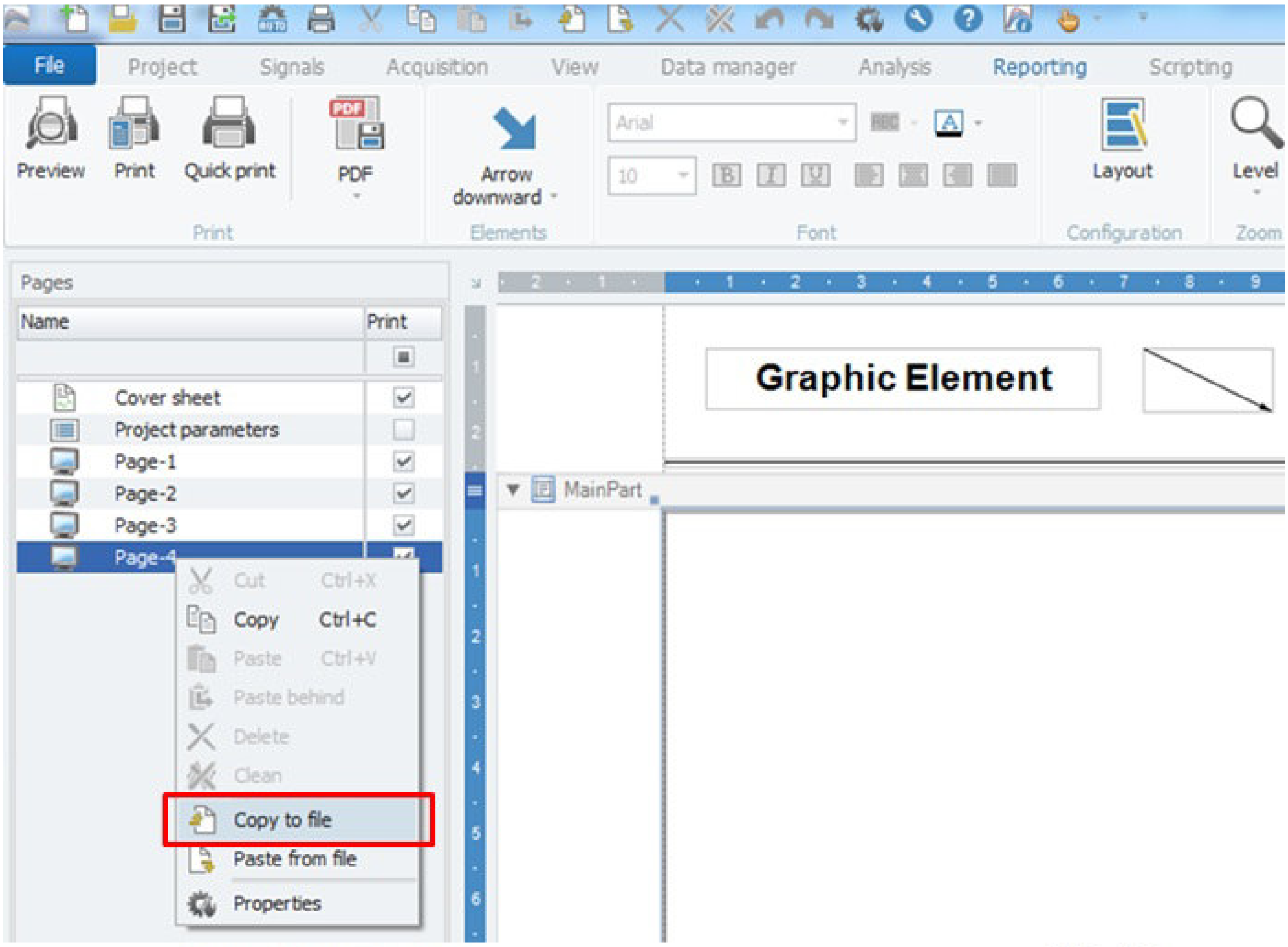
[RE_9]

Graphic element are transferred.



Graphic elements from page 1 is inserted to report page 4. [RE_10]

Apart from the copy and paste function you can save the report layout in the ITF file format.



Copy to file (ITF). [RE_11]

20.3 Report Layout configuration

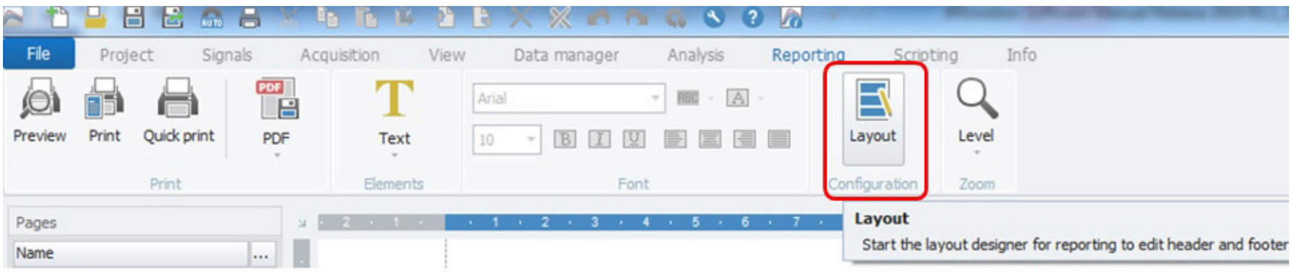
20.3.1 Introduction

Converting the layout of the analysis into a report is easy. However, if you like to build a customized report which shows individual cover sheets, header or footer sections you need to switch to the layout designer. With the layout designer you can define your own report template (IRL) file which includes all individually defined settings.
On many reports the following information is included:

- Time when report is created
- Name of the data file
- Start or stop of measurement
- Information about the project parameters saved to the data file
- Project parameters of the current IWF file
- Statistic functions like min, max average of a channel displayed in a table
- and many more

20.3.2 Layout designer

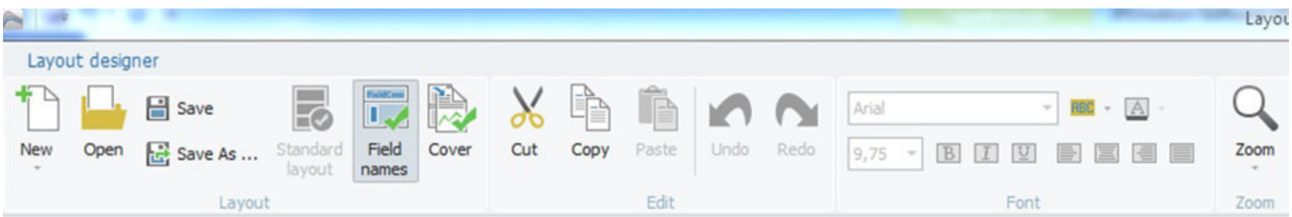
With the layout designer you can create your own report templates with your specific layout. The difference to the drawing elements mentioned above 20.2.3 is that the changes are saved in a seperate IRL report file.



[RE_12]

⚠ ***Attention!*** *When you share a IWF project file with your colleague, the IPEmotion Report template (IRL) file is not included. In this case, you have to include the IRL file manually to the project and install it in the default directory. Report templates are stored in: Win7: C:/Users/Public/Documents/IPETRONIK/IPEmotion/Reports*

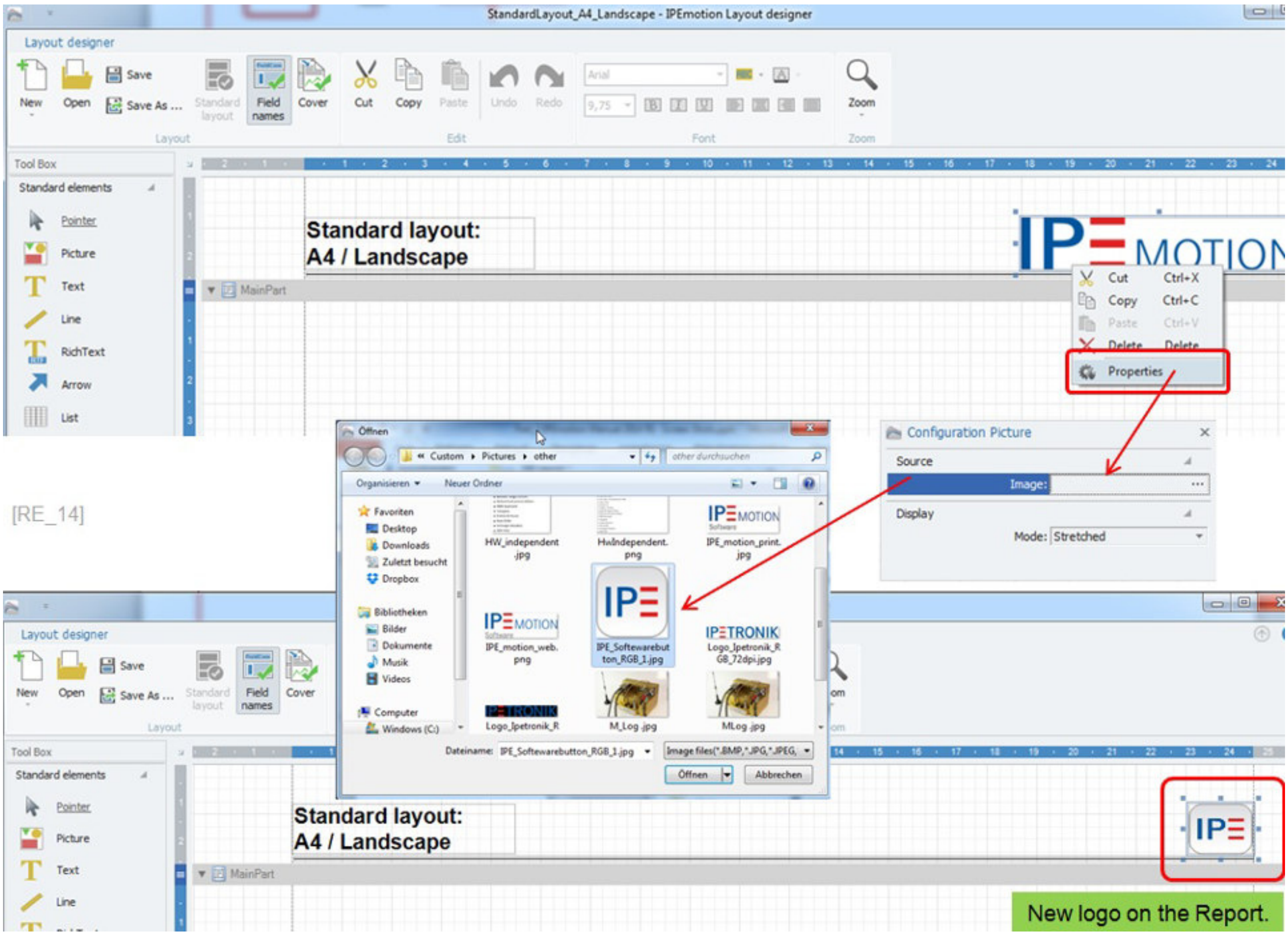
20.3.3 Ribbon of the layout designer:



[RE_13]

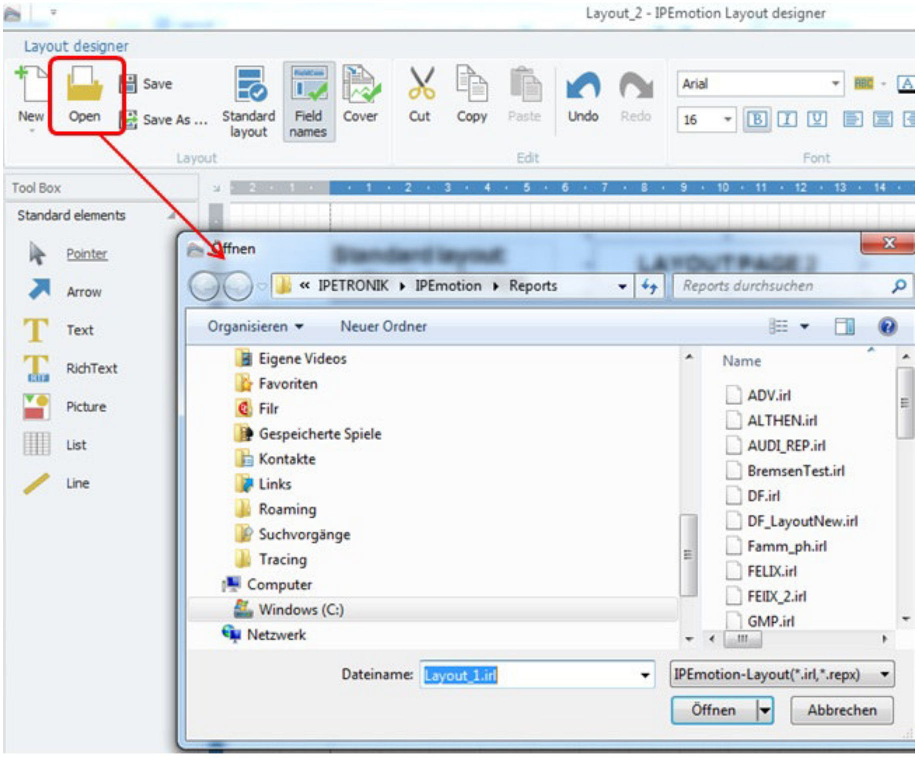
20.3.4 Change Report Logo

You can replace the IPEmotion logo permanently by another logo if you have started the layout designer. Select the logo and open the properties of the logo. The default search directory of the logo is:
Win7: C:\Users\Public\Documents\IPETRONIK\IPEmotion\Custom\Pictures\



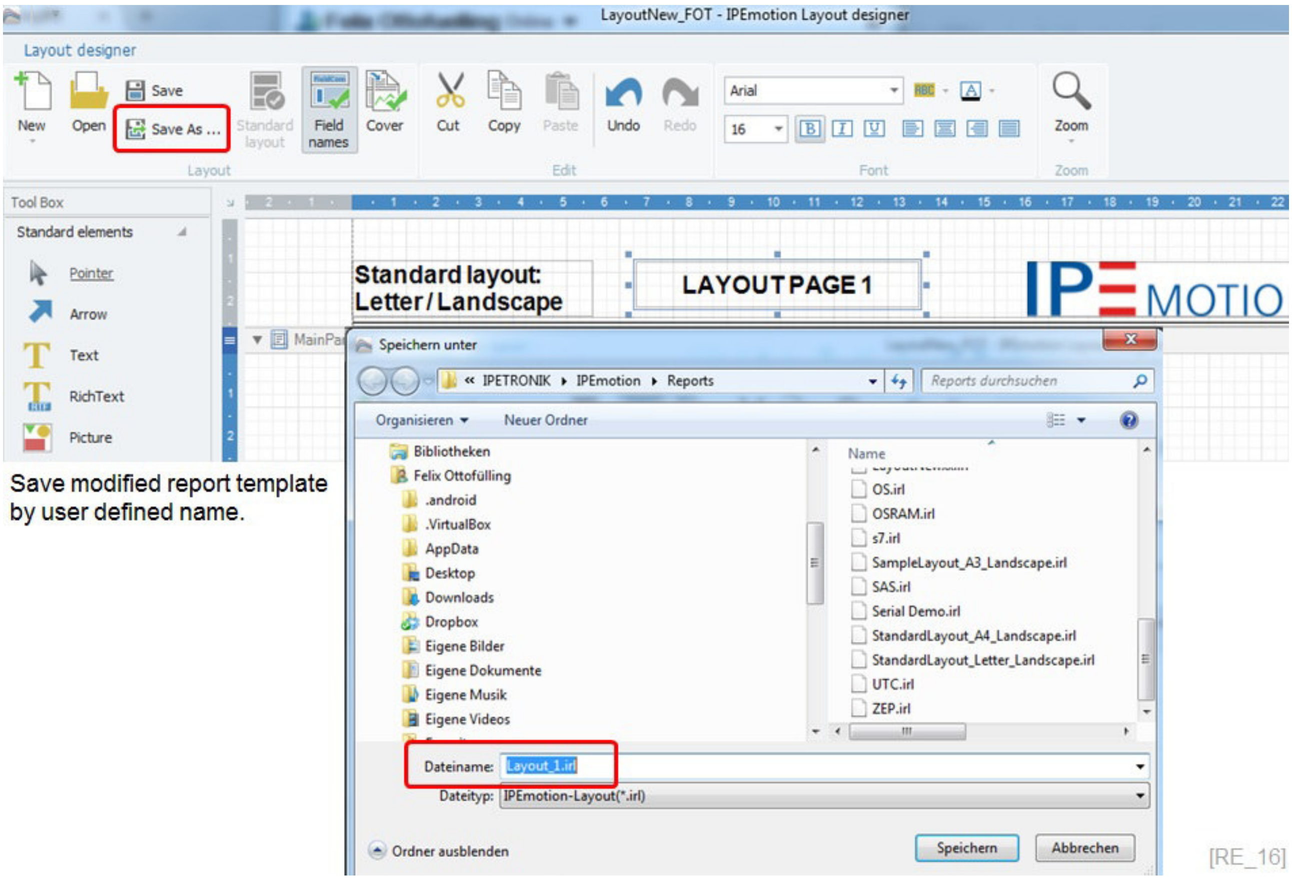
20.3.5 Individual report templates for each page

You can define individual report templates for each page of the report. In the first step you start the layout designer and create your individual page layout.



Open report layout templates and modify according to your needs. [RE_15]

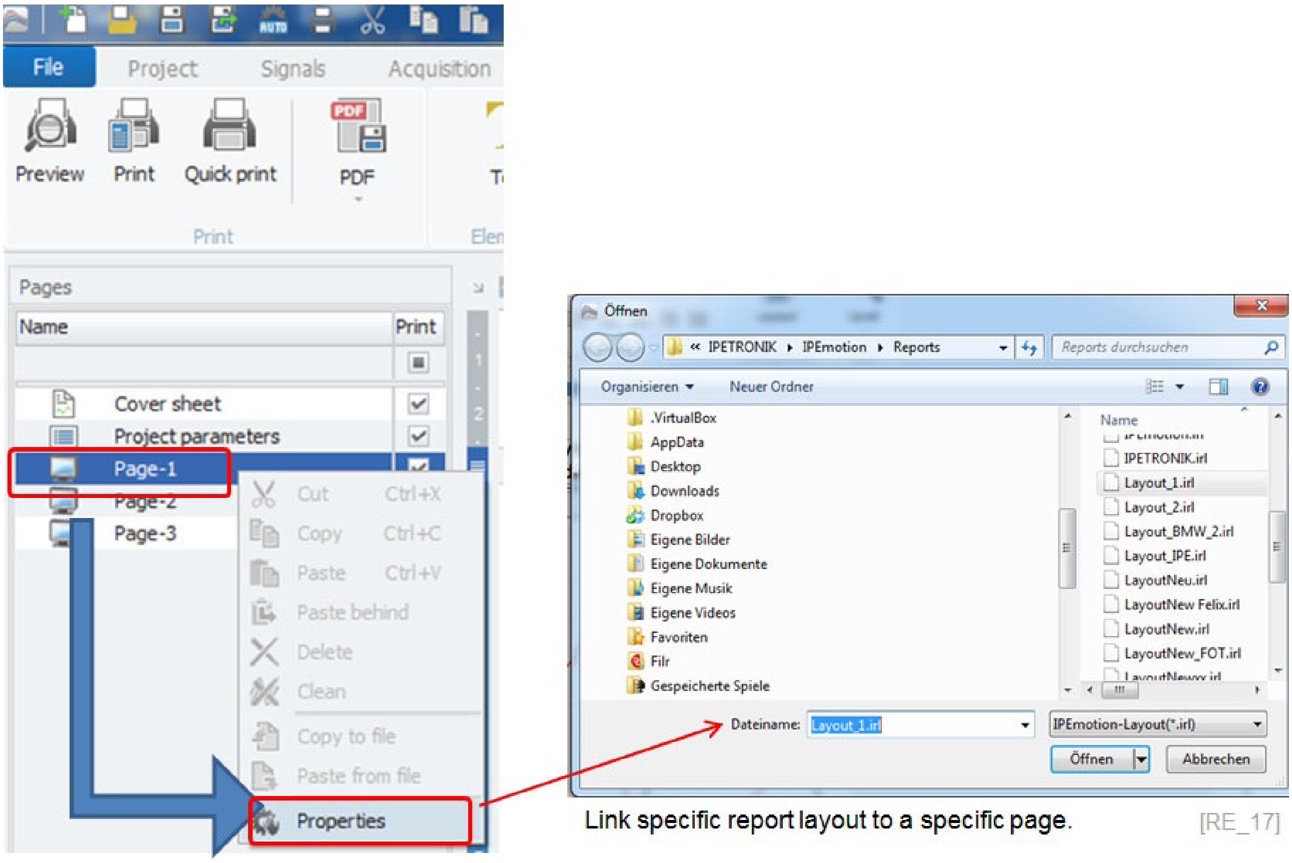
Your preferred layout will be saved with a specific name.



Save modified report template by user defined name.

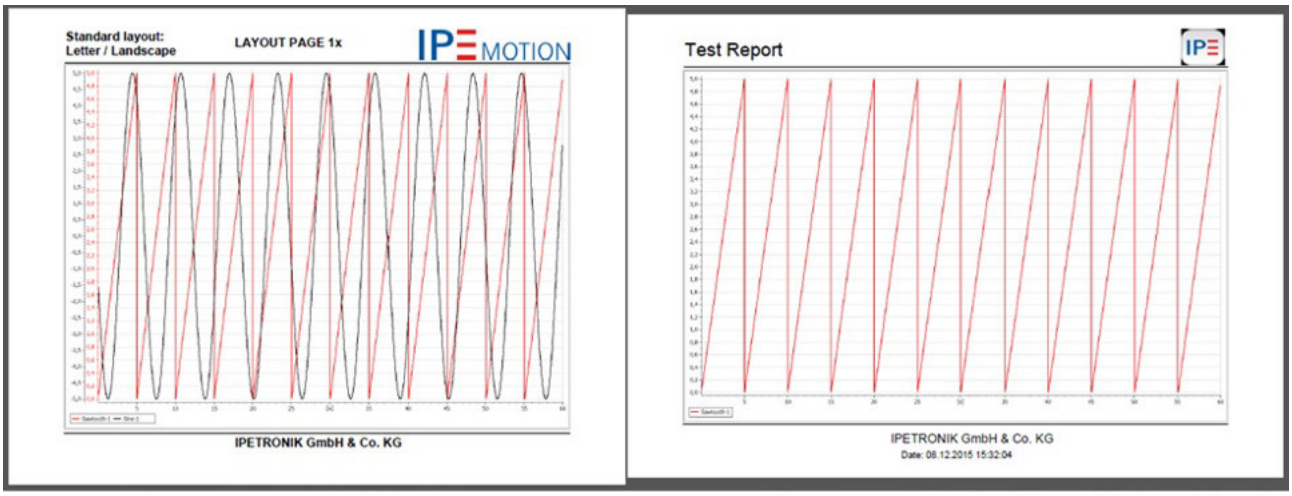
[RE_16]

This individual layout can be linked to a specific page.



Link specific report layout to a specific page. [RE_17]

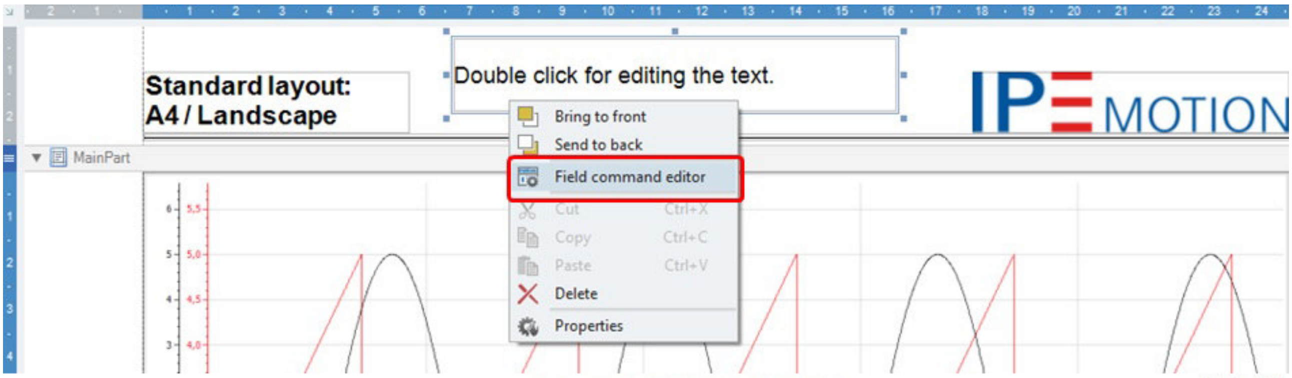
An example of the different report templates is shown below.



Example: Report with IRL template 1. Example: Report with IRL template 2. [RE_18]

20.4 Field command editor

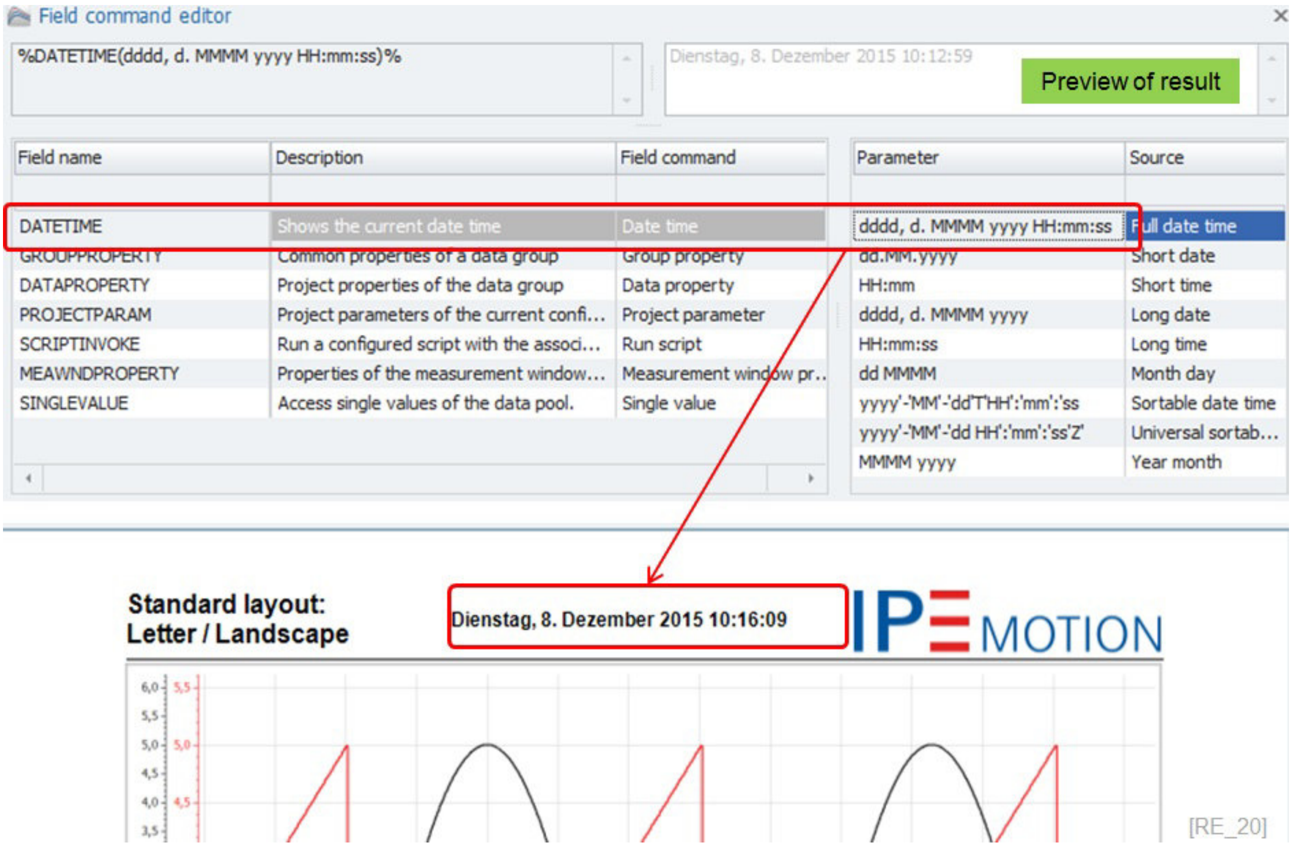
With the field command editor you can define the synthax to show individual information on the report. The editor gives you access to several field function categories which will be discussed in turn.



Start the field command editor. [RE_19]

20.4.1 Field command DATETIME

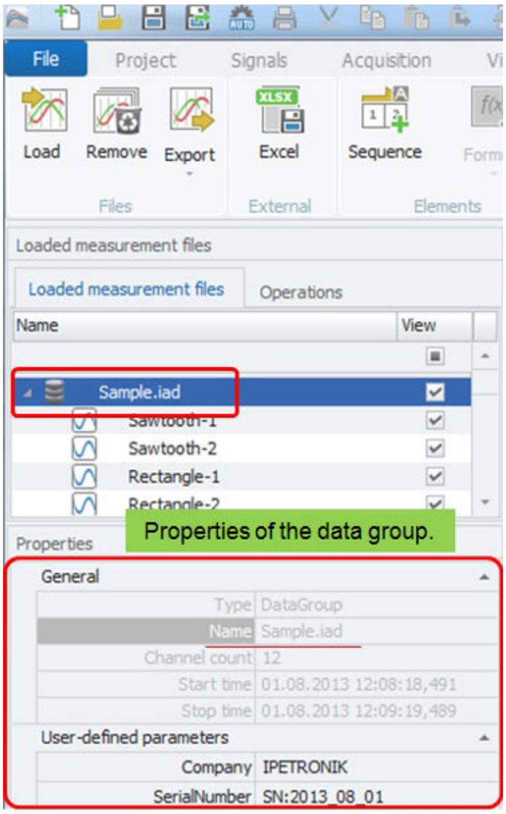
Using the function DATETIME, you can add different time formats to the report to indicate when the report was created.



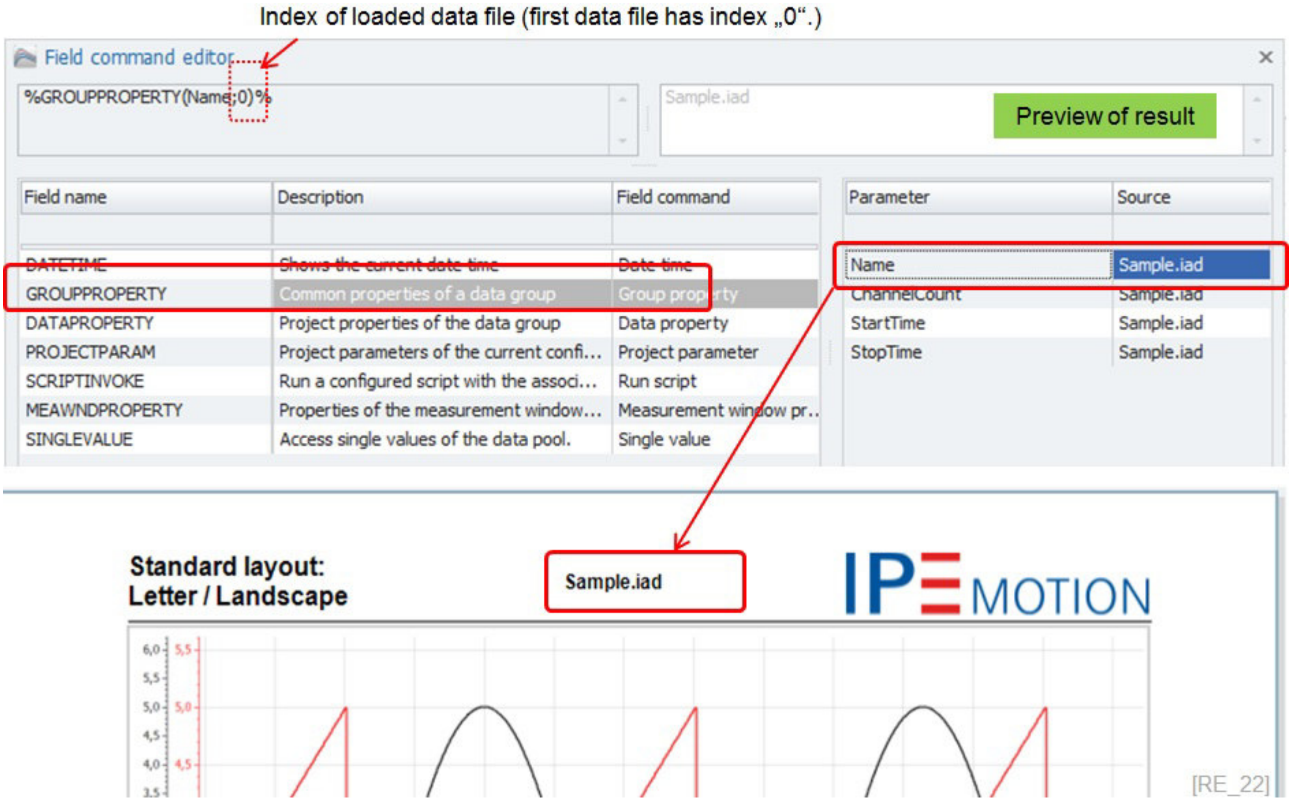
[RE_20]

20.4.2 Field command GROUPPROPERTY

You have access to the header information of a data group with the field command GROUPPROPERTY. You can see all data group properties in the DATA MANAGER when you select the IAD data file.



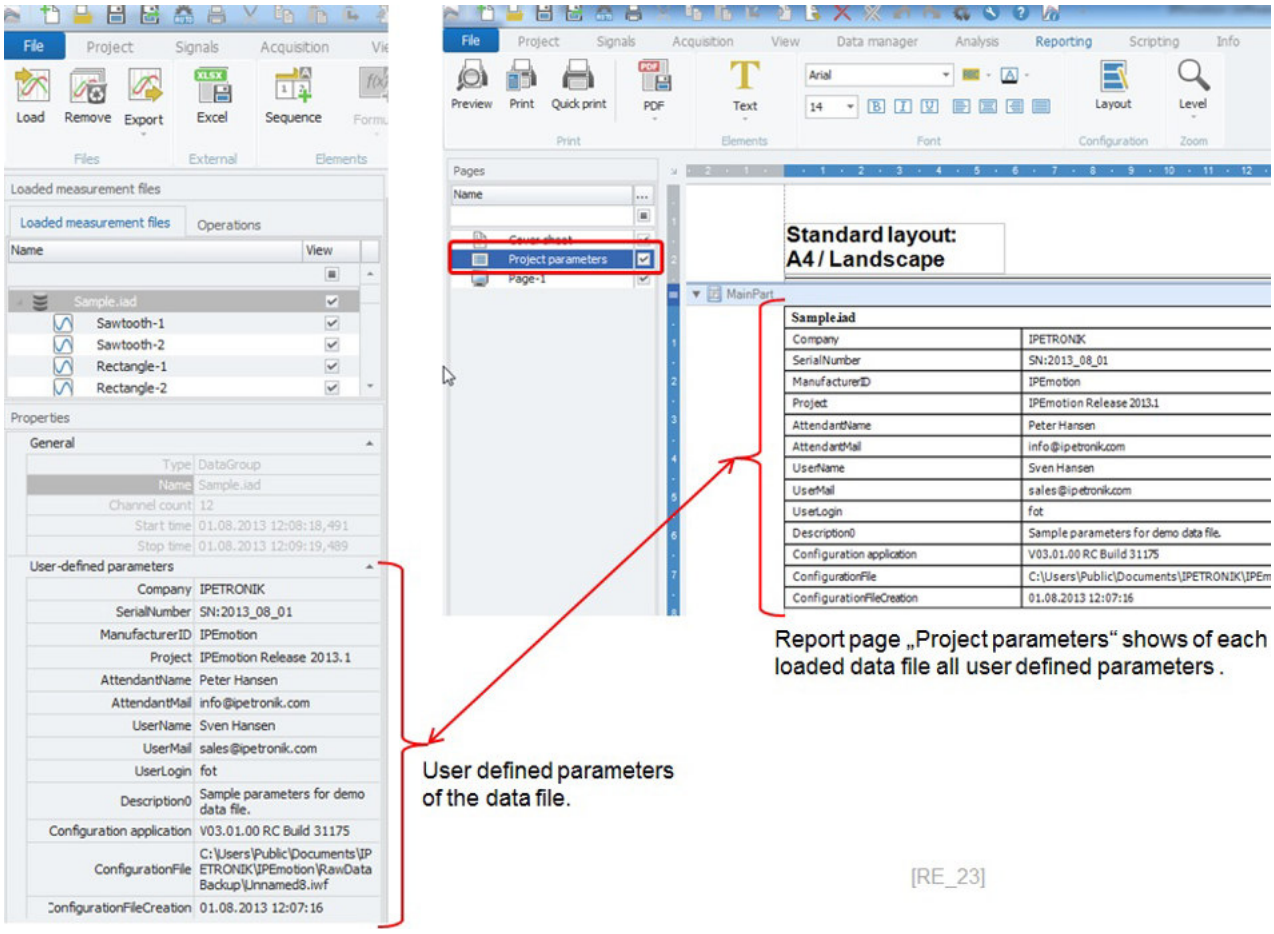
[RE_21]



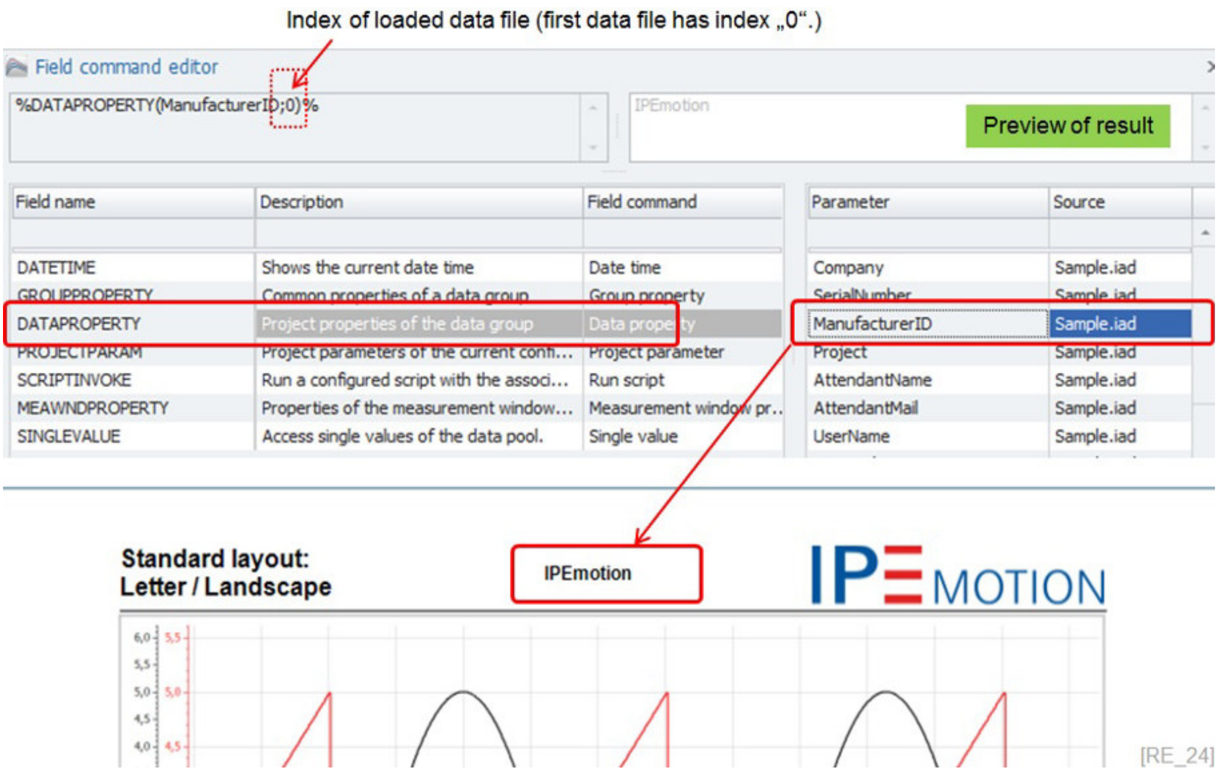
[RE_22]

20.4.3 Field command DATAPROPERTY

With the field command DATAPROPERTY you have access to all user defined parameters saved to the data file when the recording is finished. These project parameters are also visible on the specified parameter sheet of the report. You will find more information about the data file and user defined properties in chapter DATA MANAGER 18.2.1.



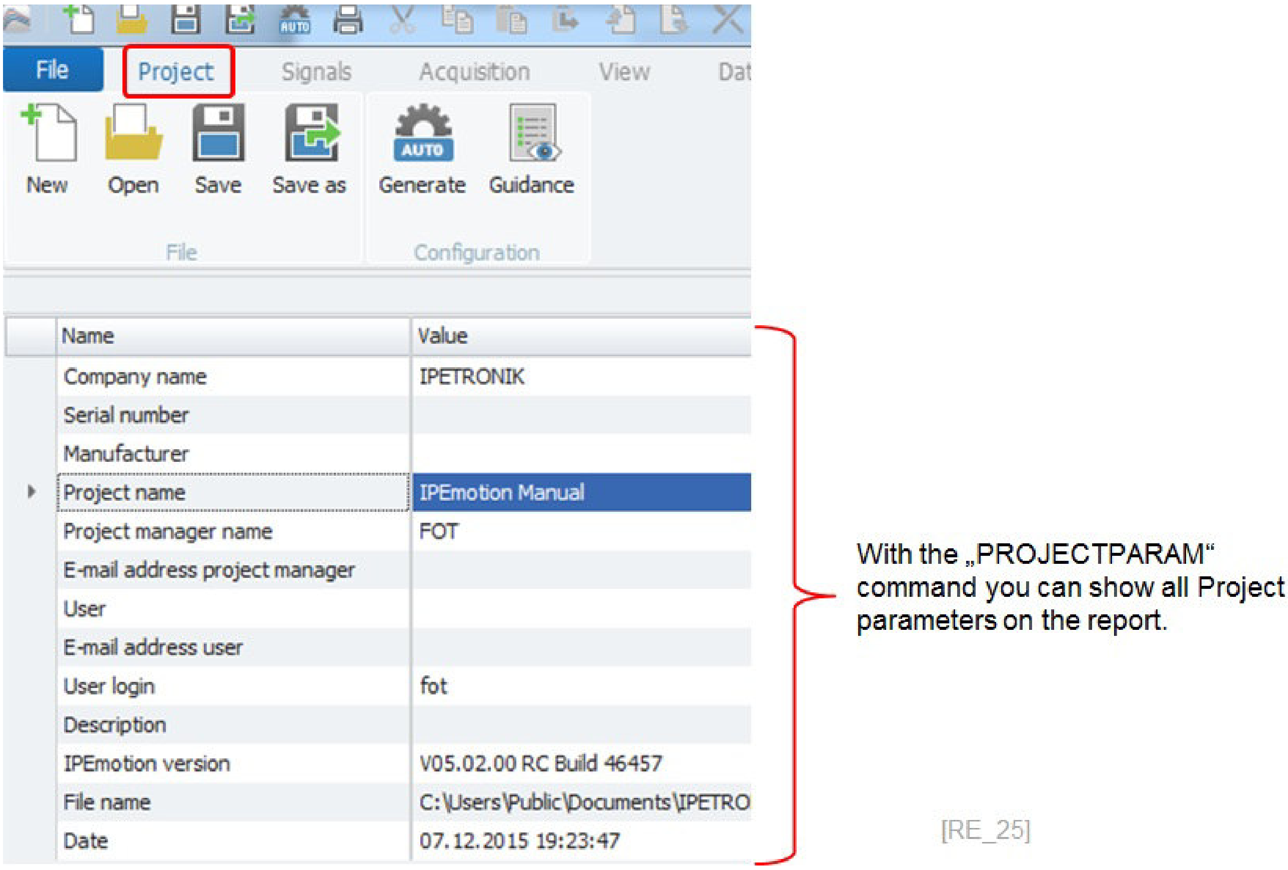
[RE_23]



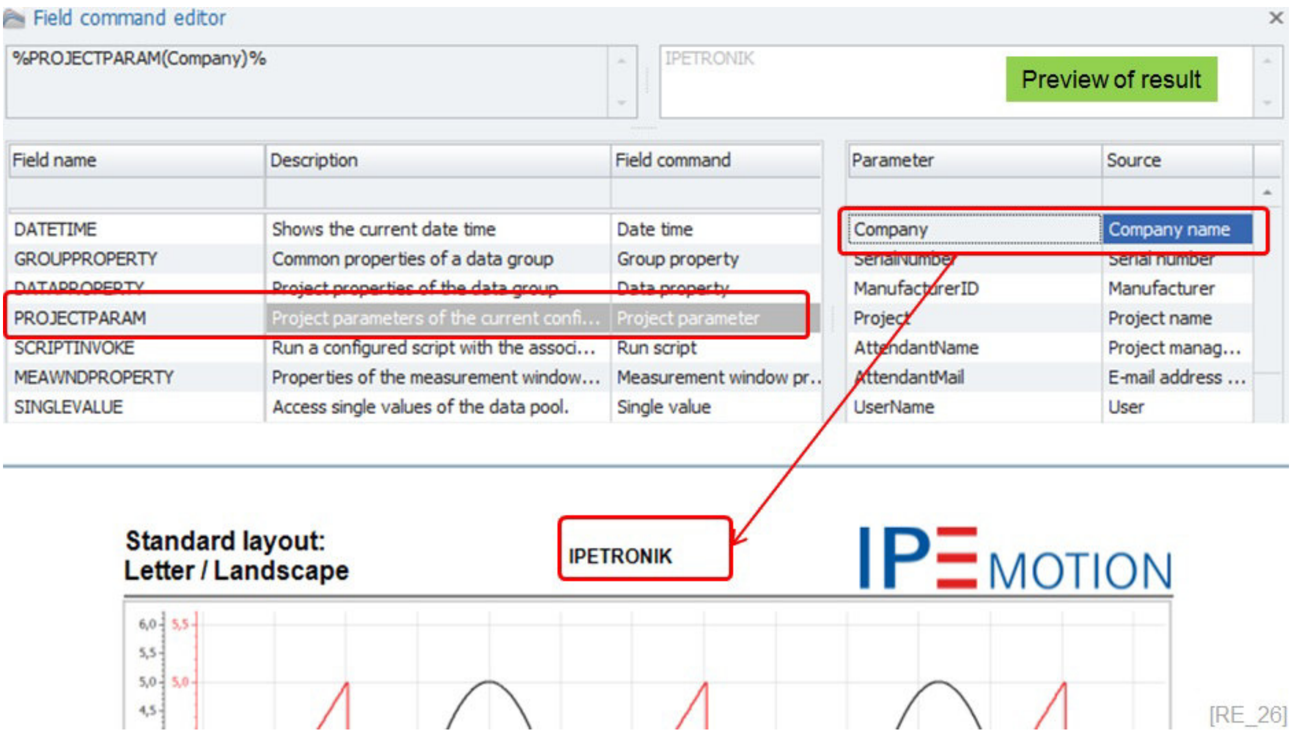
[RE_24]

20.4.4 Field command PROJECTPARAM

With the field command PROJETCTPARAM you can display user-defined project parameters of this project file (IWF) on the report. The user-defined project parameters are not necessarily the same as the ones included in the IAD data file. However, if you save a data file, it saves the user-defined project parameters by default. In chapter PROJECT you can get more information how to modify the project parameters 10.



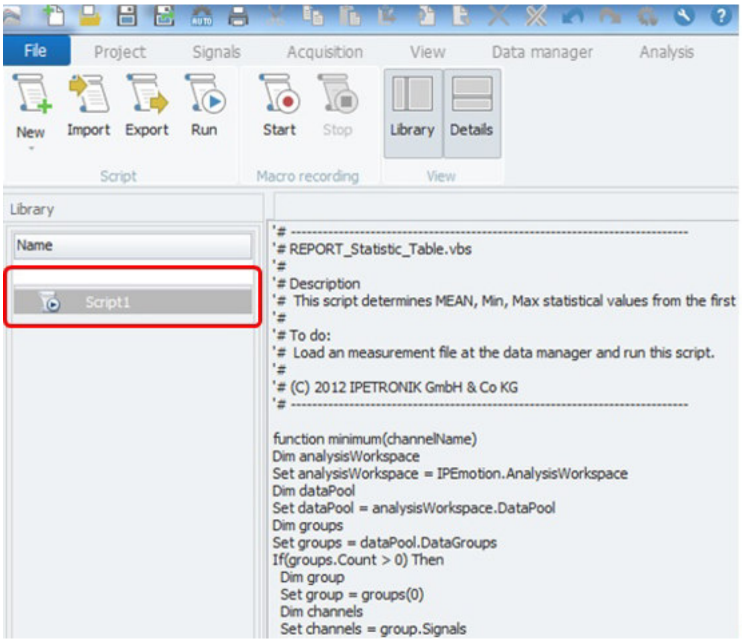
[RE_25]



[RE_26]

20.4.5 Field command SCRIPTINVOKE

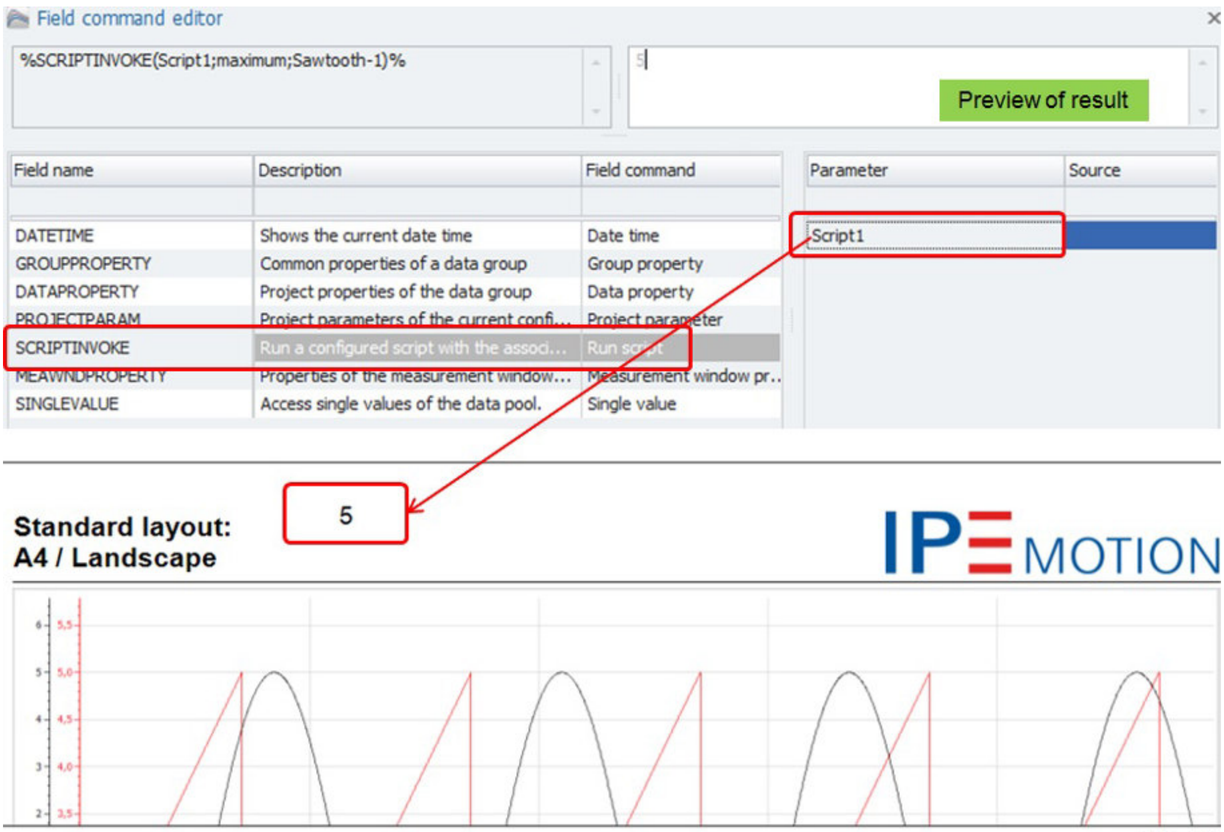
This field function is useful to run scripts inside the report. In order to invoke the script, you need to define the scripts in the SCRIPTING work space of IPEmotion. The Scripting workspace is only supported in the Professional Edition. See chapter EDITIONS for more information 4.1.



[RE_27]

In this example, the script is calculating a MIN, MAX and AVERAGE value of the selected channel. The script needs to be programmed in a suitable structure so that the result can be integrated to the report. You will have at least 3 elements in the functions:

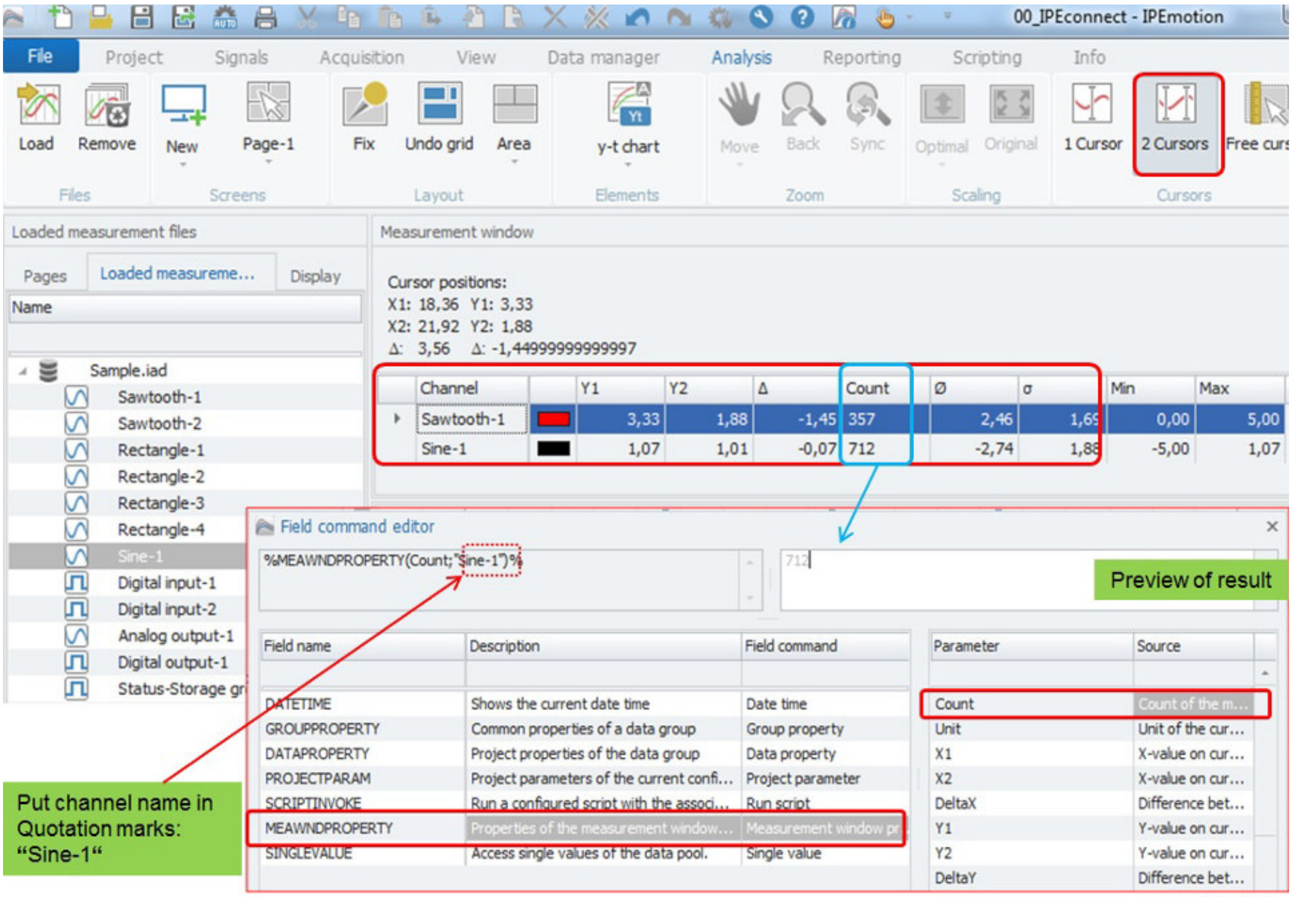
- Name of the Script which has to be integrated to the Project through the SCRIPTING work space.
- Name of the math calculation function.
- Name of the channel included in the data file which is subjected to the calculation.



[RE_28]

20.4.6 Field command MEAWINDPROPERTY

Use this field function to show all data from the measurement window on the report. You need to activate at least one cursor in the ANALYSIS work space in order to bring up the measurement window. In this example the number of samples between the cursor lines of channel “Sine-1” is displayed on the report.

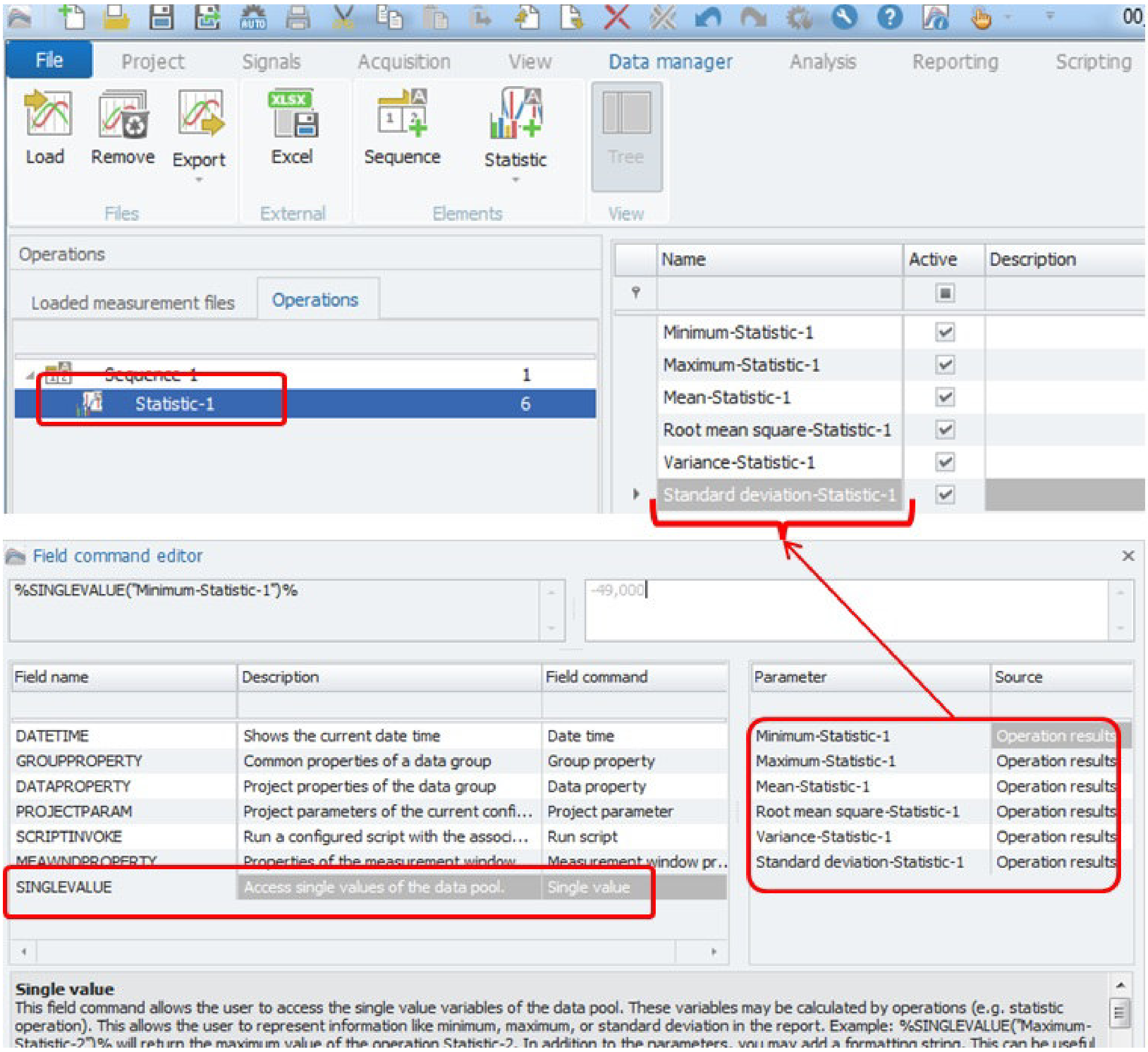


[RE_29]

20.4.7 Field command SINGLEVALUE

Use this field function to access single values post processing results. When you have a post processing operation with a single value result these results can be integrated to the report.
Single value output operations are:

- Statistic operation
- Find condition by Time & Index



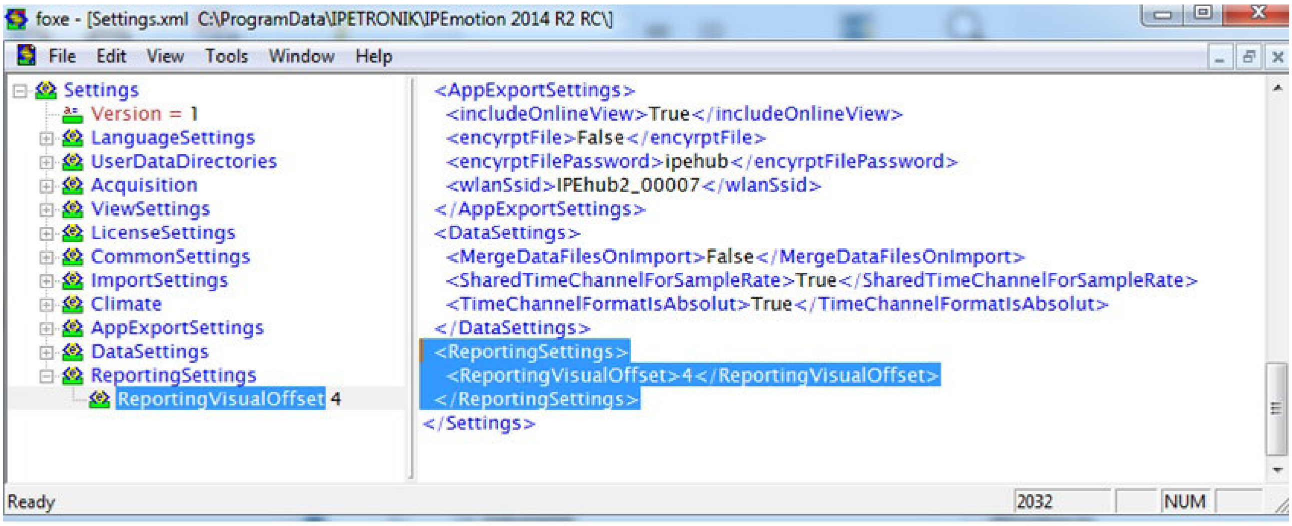
[RE_30]

20.5 Report font and line size for Yt and XY diagrams

You can increase on the report for Yt-, XY diagram the sickness of lines in the graph, legend and axis. You need to update the **Settings.XML** file. The file is located in Program Data directory.

- Win 7: C:\ProgramData\IPETRONIK\IPEmotion 2016 R2

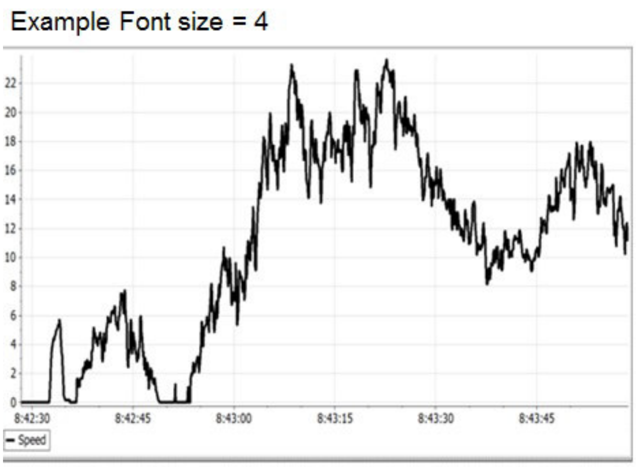
The new entry in the file should be:
<ReportingSettings>
<ReportingVisualOffset>4</ReportingVisualOffset>
</ReportingSettings>

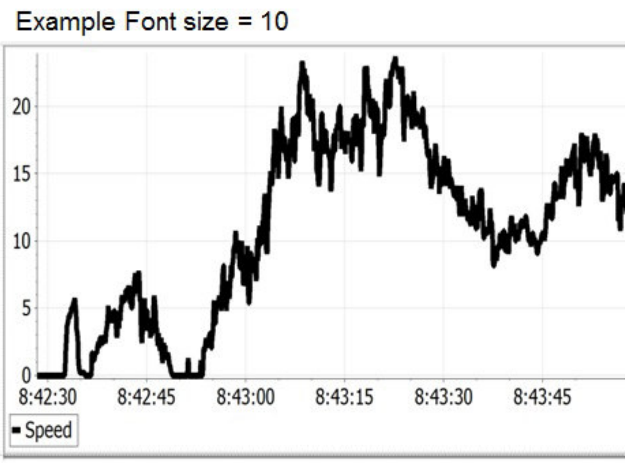


[RE_31]

Close IPEmotion before you modify the Setting.XML file . If you edit the file and close IPEmotion afterwards your changes will not be saved and overwritten by the IPEmotion settings.
The Visual Offset should be in the Range:

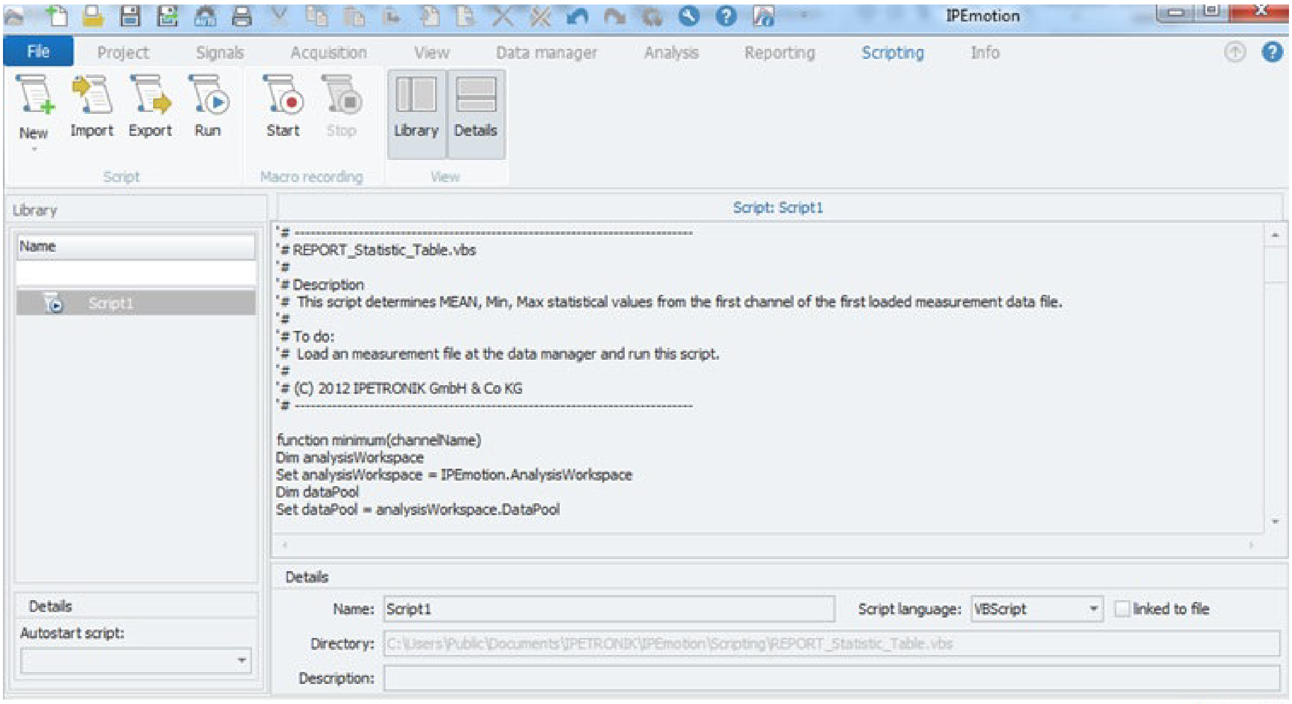
- 0 = default
- 4 = larger
- 10 = large
- Not recommended: You can add also very large numbers. There is no control in the Settings.XML.





[RE_32]

21 SCRIPTING work space



[SC_1]

Information *The SCRIPTING interface is only available in the Professional and Developer Edition. For more details see chapter EDITIONS 4.1.*

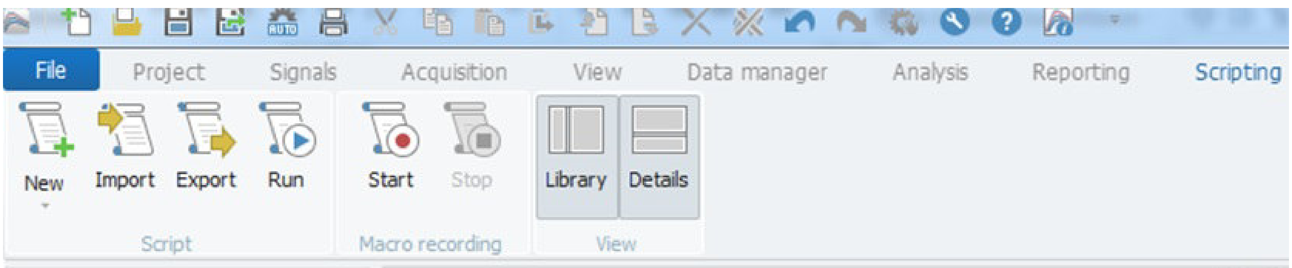
21.1 COM interface

With the COM interface of IPEmotion you can run scripts inside the application but you can also access IPEmotion from other 3rd party programs.

The documentation of the COM interface (**IPEmotionCOM.chm & PDF**) is available in:

Win7: C:\Program Files (x86)\IPETRONIK\IPEmotion 2016 R2.1\Help

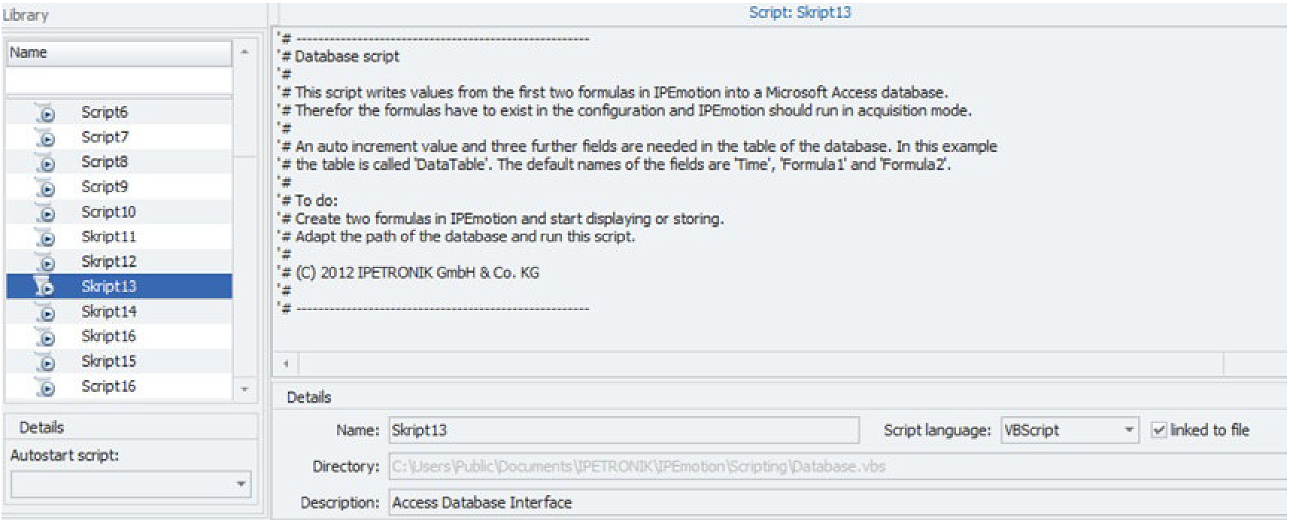
21.2 Ribbon



[SC_2]

- **New** — Here you can program Visual Basic (VBS) and Python (PY) scripts. The default directory for the storage of the scripts is:
  Win7: C:/Users/Public/Documents/IPETRONIK/IPEmotion/Scripting/
  You can program scripts directly in IPEmotion and the script is part of the IWF project file. However, the software provides no syntax help or debugging functions which makes the programming more difficult.
- **Import / Export** — Here you can import and export scripts from your directory.
- **Run** — When you hit the run button the script is executed.
- **Start/Stop Macro recording** — With the Start/Stop Button you can activate a macro recording function. When you activate the Start recording function all steps you perform are recorded. This is a very useful way to identify the work spaces and commands to develop your own scripts. See the COM interface manual to get an overview of the available functions.

21.3 Details



[SC_3]

- **Autostart**: Here you can define the Autostart script. The pull down list gives you access to all scripts defined in this project file. The Autostart script is like all other scripts part of the IWF project file. When you configure IPEmotion in the OPTIONS and start with the last configuration you will automatically invoke the project file with IPEmotion and then the related autostart script will be executed. See chapter OPTIONS for more details how to set up the automatic start of the last project file 22.1.1.
- **Name**: Here you can define a specific name for your script.
- **Directory**: Here you will see where the script is located.
- **Description**: Here you can define a complementary description for the script.
- **Script language**: As discussed above you can link Visual Basic (VBS) and Python (PY) scripts to your application. The syntax of both scripting languages is different. It is likely when you change a VBS script to a PY script or vice a versa it will not be functioning correctly.
- **Link to file**: When you activate this check box the script is integrated to the IWF project as a separate scripting file. When you share a project with your colleagues the scripts are transferred as separate (PY or VBS) files as well. They are installed on the receiving computer in the default directory. For information of the included files functions see chapter OPTIONS 22.1.2.

Information *Take care that the scripting language fits to the syntax used in the programming and do not change the language during exports.*

21.4 Demo Scripting examples of the Setup

The following demo scripts are included in the standard setup of this IPEmotion release. The scripting PDF includes a detailed description of the demo scripts.

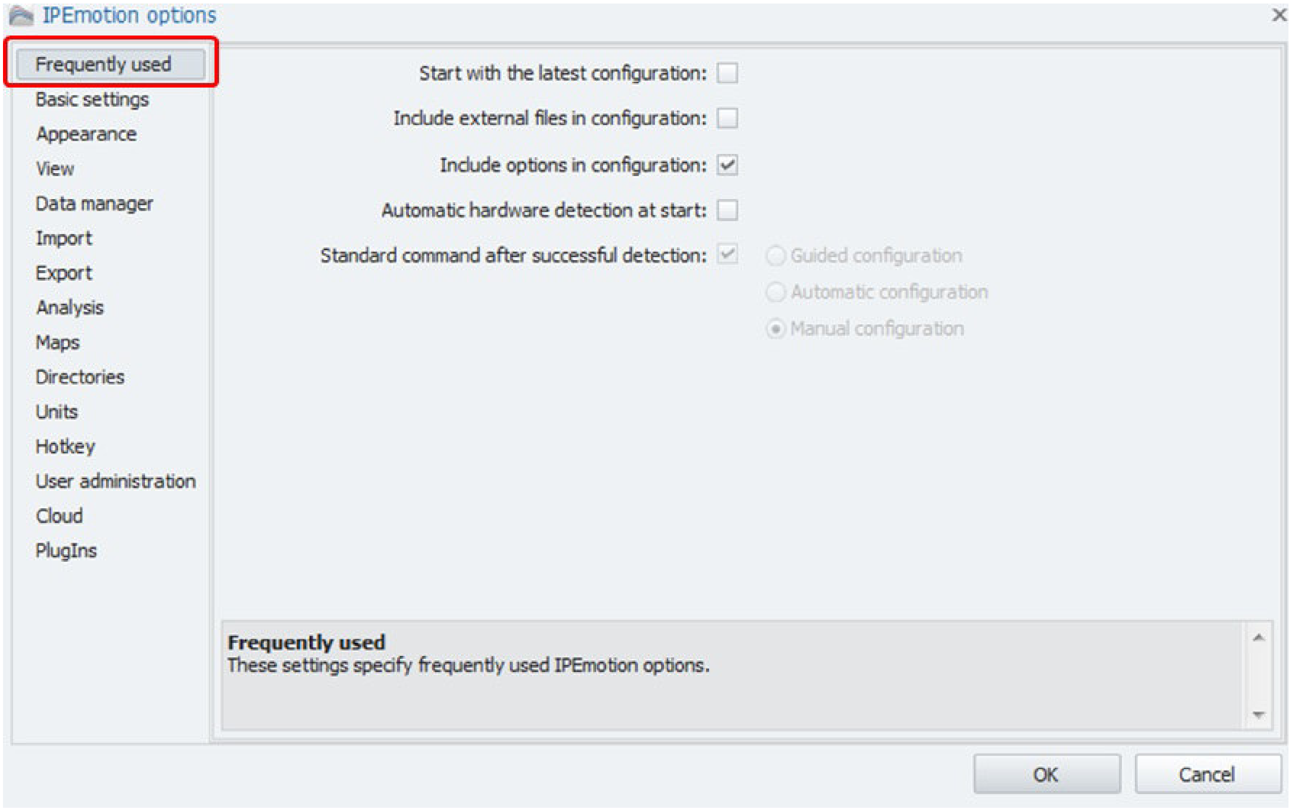
AppExport.py	24.04.2014 16:11	PY-Datei	11 KB
ChangePage.VBS	24.04.2014 16:11	VBS-Datei	1 KB
Classification.vbs	24.04.2014 16:11	VBS-Datei	4 KB
Database.vbs	24.04.2014 16:11	VBS-Datei	2 KB
database1.mdb	24.04.2014 16:11	MDB-Datei	124 KB
InputQuery.py	24.04.2014 16:11	PY-Datei	2 KB
Interop.IPETRONIK.dll	24.04.2014 16:11	Anwendungserwe...	294 KB
Ionic.Zip.dll	24.04.2014 16:11	Anwendungserwe...	452 KB
LoadMeasurementDataFile.vbs	24.04.2014 16:11	VBS-Datei	1 KB
LoggerDataImport.vbs	24.04.2014 16:11	VBS-Datei	4 KB
LoggerStorageGroup.vbs	24.04.2014 16:11	VBS-Datei	2 KB
MeasurementDataStatistic.vbs	24.04.2014 16:11	VBS-Datei	2 KB
PidControl.py	24.04.2014 16:11	PY-Datei	4 KB
Scripting.pdf	24.04.2014 16:11	Adobe Acrobat D...	36 KB
SendMail.py	24.04.2014 16:11	PY-Datei	2 KB
StartDisplay.vbs	24.04.2014 16:11	VBS-Datei	1 KB
StartStorage.vbs	24.04.2014 16:11	VBS-Datei	1 KB
StopDisplayOrStorage.vbs	24.04.2014 16:11	VBS-Datei	1 KB
storagePrefix.py	24.04.2014 16:11	PY-Datei	2 KB
TestSequence.vbs	24.04.2014 16:11	VBS-Datei	7 KB
UserButtonDemo.exe	24.04.2014 16:11	Anwendung	175 KB
UserButtonsDemo.xml	24.04.2014 16:11	XML-Dokument	79 KB

[SC_4]

22 APPENDIX: Options – many important settings

OPTIONS are a very important part of the program because many settings can be defined in this part of the program which has various impacts on the IPEmotion application and the projects. Most of the setting with its impacts is dicussed below.

22.1 Frequently used



[OP_1]

22.1.1 Start with the latest IWF configuration

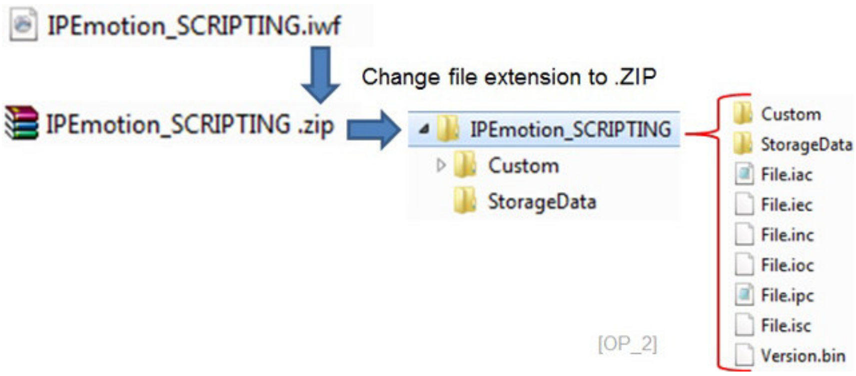
This checkbox will automatically load the last IWF file you worked with. This function is automatically starting the last project file (IWF). This can be useful if you like to give a quick demo and like to start IPEmotion directly with the last project file.

22.1.2 Include external files in the IWF configuration

This check box makes the transfer of project files (IWF) easier. Activating this check box, all page and instrument picture and GPX guidance track and MAP tiles from the VIEW are included. Data files IAD and ASCII linked to function and traffic generators from ACQUISITION are included in the IWF too. Also STL files for the 3D view instrument in ANALYSIS are included in the IWF configuration. Description files of the Traffic Analyzer 17.25.8 are not included due to security reasons. The included files are located in:

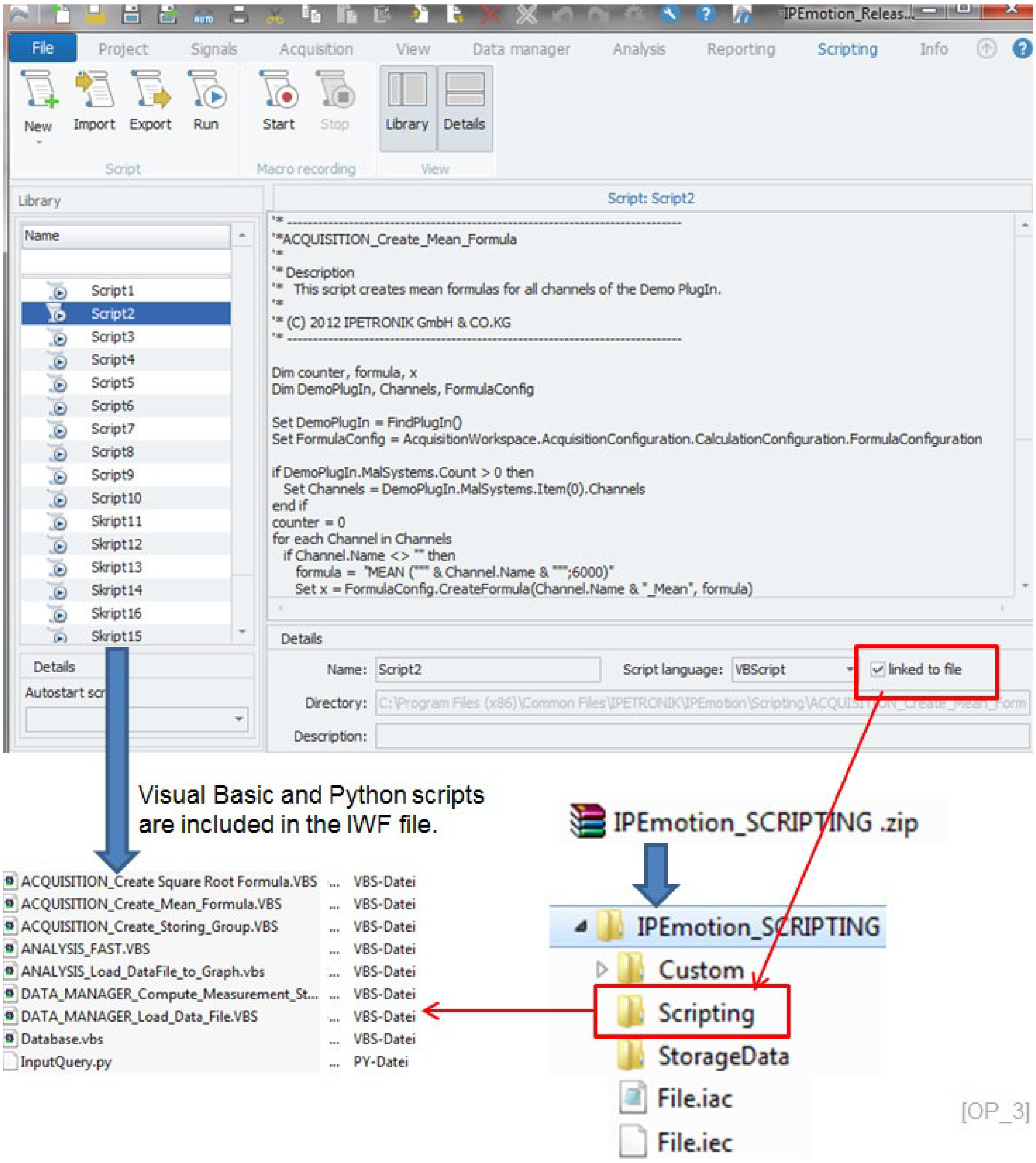
► Folder Custom	C:/Users/Public/Documents/IPETRONIK/IPEmotion/Custom/3DModels C:/Users/Public/Documents/IPETRONIK/IPEmotion/Custom/Map C:/Users/Public/Documents/IPETRONIK/IPEmotion/Custom/Pictures
► Folder StorageData	Data files (IAD) linked to random function generators or GPX files linked to a Map instrument for the guidance track.
► Folder Scripting	VBS and PYTHON scripts are only linked when separately activated in the Scripting tab sheet which is only available for Professional and Developer Editions.

To find out which files are included you can rename the .IWF and change it to .ZIP. Then you can extract the zip file and see all included external files. When opening an IWF file on another computer all external files are copied on the new computer into the default installation directories. The screenshot below shows how to extract the content of an IWF file by converting to ZIP and extracting it.



[OP_2]

You can include VBS and Python scripts in the IWF project file to transfer them to another computer. In this case you need to activate the check box “linked to file” in the SCRIPTING tab sheet. See chapter SCRIPTING for more details 21.3.



[OP_3]

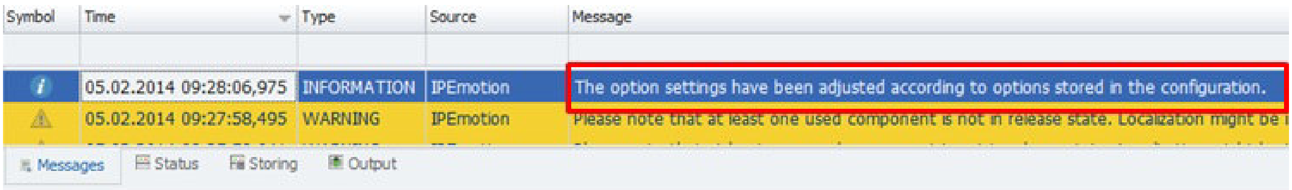
	Attention!	*It is important to know that the external scripting files are only transferred to the Scripting folder on the new computer provided that the scripts are not existing there yet. If a script file with the same name is already on this computer it will not be overwritten nor the user will get a notification that the files are not transferred.*
	Information	*The SCRIPTING tab sheet is only visible in the Professional and Developer and Analysis Edition.*

22.1.3 Include some OPTIONS settings in the configuration

This checkbox will affect IPEmotion configurations (IWF) files and PlugIn configurations which are stored in IPEmotion System Files (ISF). The ISF files can currently only be generated for the IPETRONIK Logger PlugIn.
The use case for this check box is that configuration files (IWF or ISF) which are shared with other users are enriched with some important settings from OPTIONS. OPTIONS are configured individually on each computer. Due to the different option configurations from PC to PC the same IWF or ISF file could look differently. With an active check box you will ensure that the key configuration functions look the same on each computer.
With the check box the following 4 settings are included in the configuration file. The functions of these settings are discussed in the next sections.

- Automatic Service Administration (from the Basic Settings)
- Ignore Verbal Tables (from the Expert Mode)
- Max Polling List (from the Expert Mode)
- Use Characteristics (from the Expert Mode)

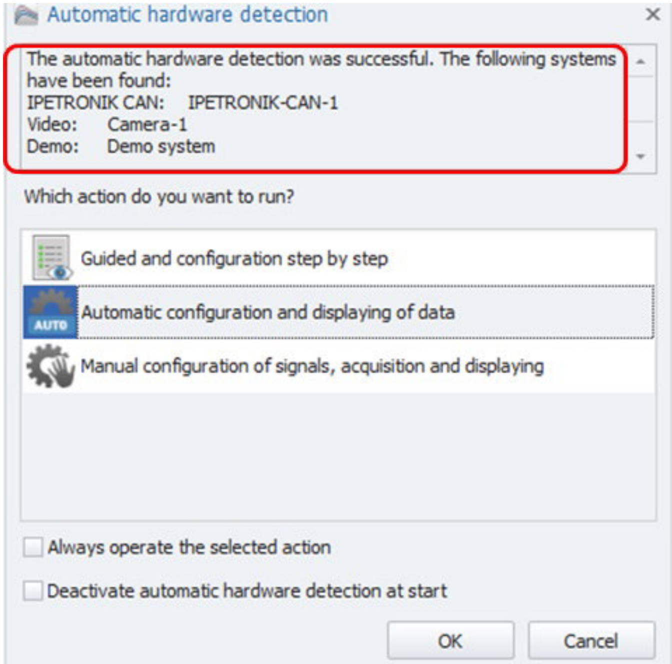
When you load an IWF file which includes different OPTION settings compared to the settings on your computer you will get an information message. “The options settings have been adjusted. . . ”



[OP_4]

22.1.4 Automatic hardware detection at start

IPEmotion OneClick Data Acquisition: http://youtu.be/bl1p1EY5d6k
This function is related to the OneClick acquisition feature of IPEmotion. When this check box is activated the IPEmotion software is automatically executing hardware detection for all active PlugIns and tries to establish a connection to the devices. The hardware detection works well for USB devices and Ethernet devices provided the PlugIn supports an automatic IP-address scan function. For serial devices the hardware detection is usually not working as the serial interface parameters are not known by IPEmotion. After hardware detection a dialog comes up indicating which devices were detected and you have several choices. Apart from the automatic configuration you can use the guided configuration or carry out a manual configuration.



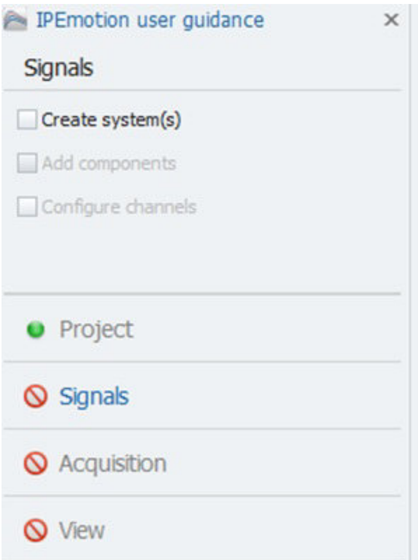
List of detected devices.

[OP_5]

22.1.5 Standard command after successful detection

When the hardware detection was successful you can specify which action will be the next one. As indicated in the screenshot above you can choose from 3 actions.

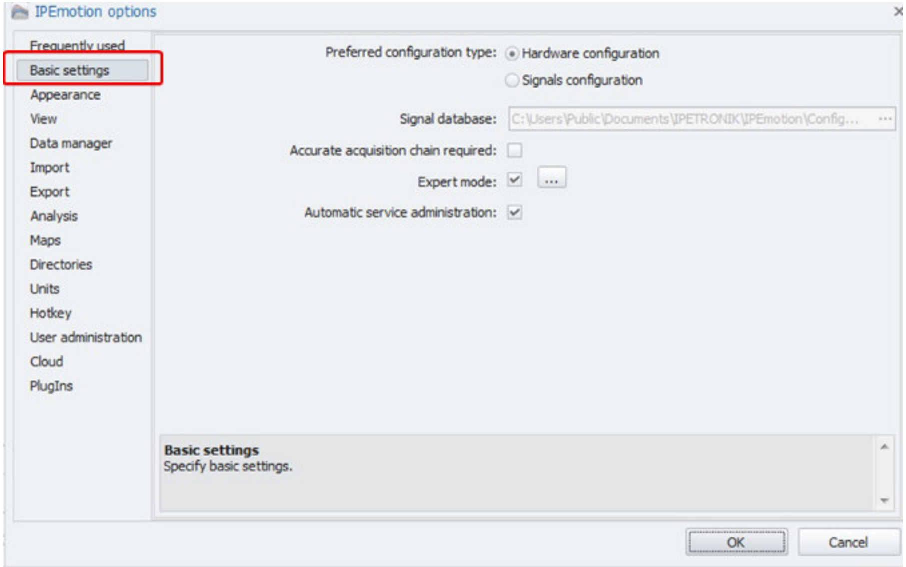
- Guided configuration — The guided configuration takes you like a wizard in several steps systematically through a complete configuration procedure.



[OP_6]

- **Automatic configuration** The automatic configuration is creating screen pages in the VIEW work area automatically and creating up to 3 Yt- charts per page. On each Yt- chart are at most 4 channels linked to. All channels are also linked to a store group so that you can directly activate the data storage.
- **Manual configuration** The manual configuration is the best solution for you if you like to create your individual application from scratch.

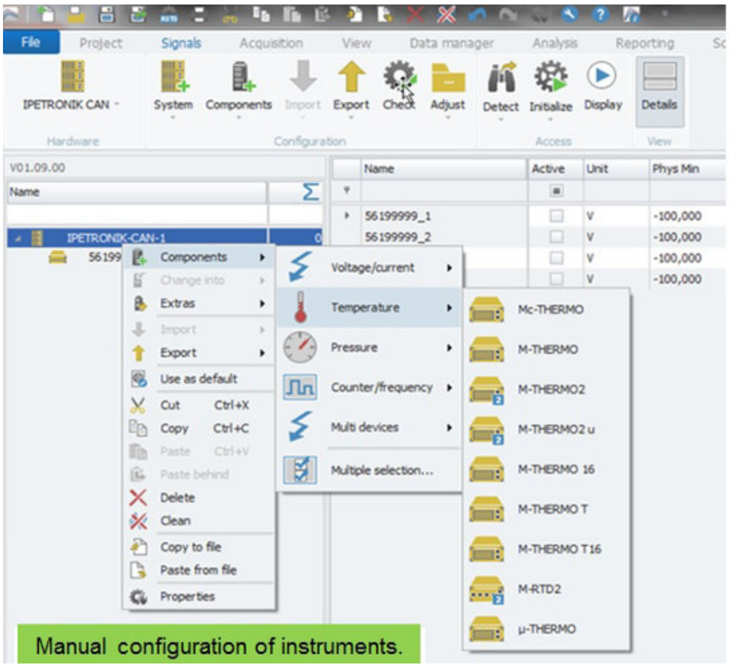
22.2 Basic Settings



[OP_7]

22.2.1 Preferred configuration type

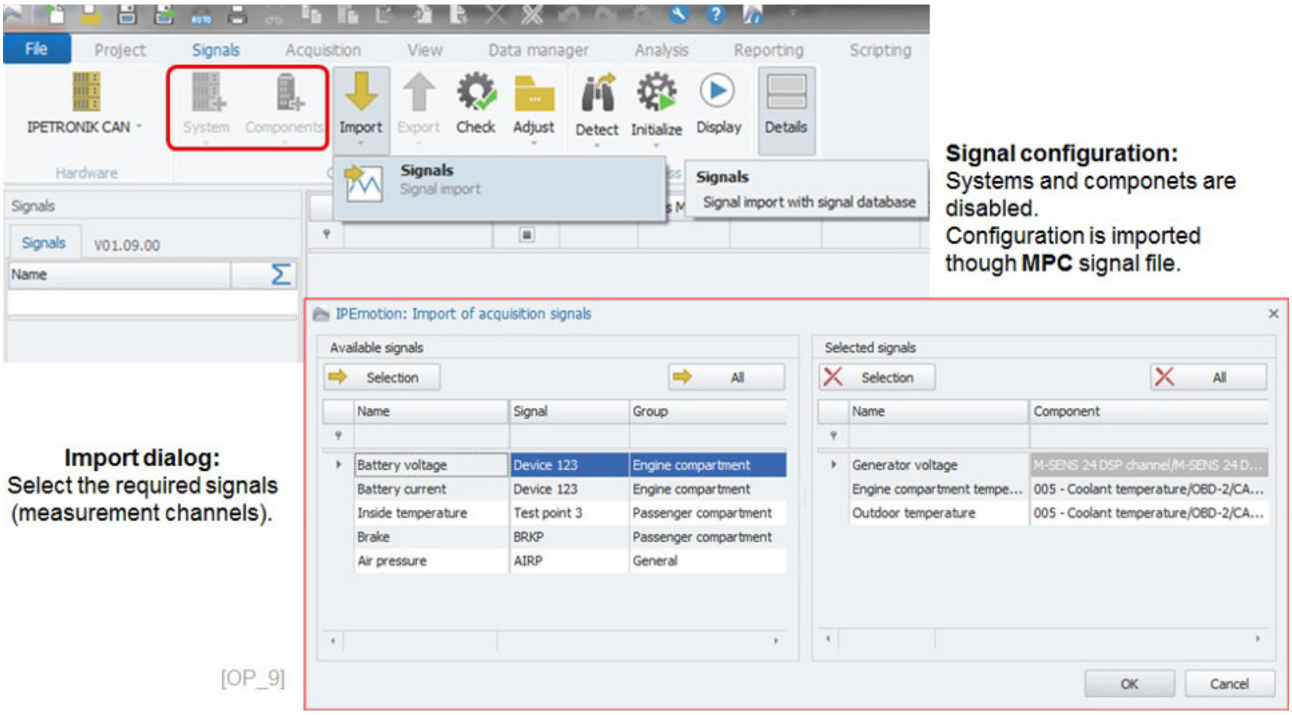
- **Hardware configuration** The hardware configuration refers to the SIGNALS work spaces where you can manually define systems and create your measurement application. This is the most flexible configuration approach as you can decide which systems to configure, which modules to create and how to scale the IO channels.



[OP_8]

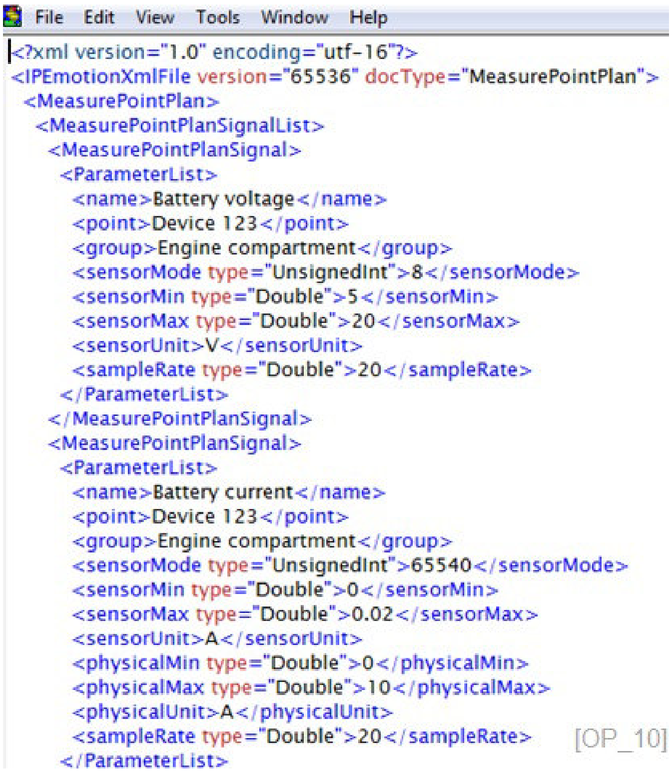
- ▶ Signals configuration

The signals configuration is based entirely on the signal import function of an MPC (Measurement Point Catalog) data file. You only need to select which signals should be measured. The MPC file is an XML file which is created through specific software packages by each customer individually. IPETRONIK does not offer any software tool to create MPC files.



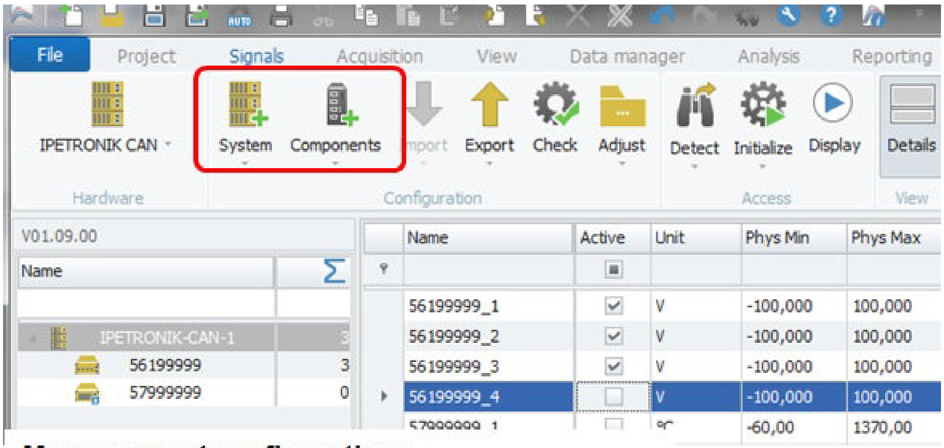
[OP_9]

Overview of the XML structure of an MPC data file.

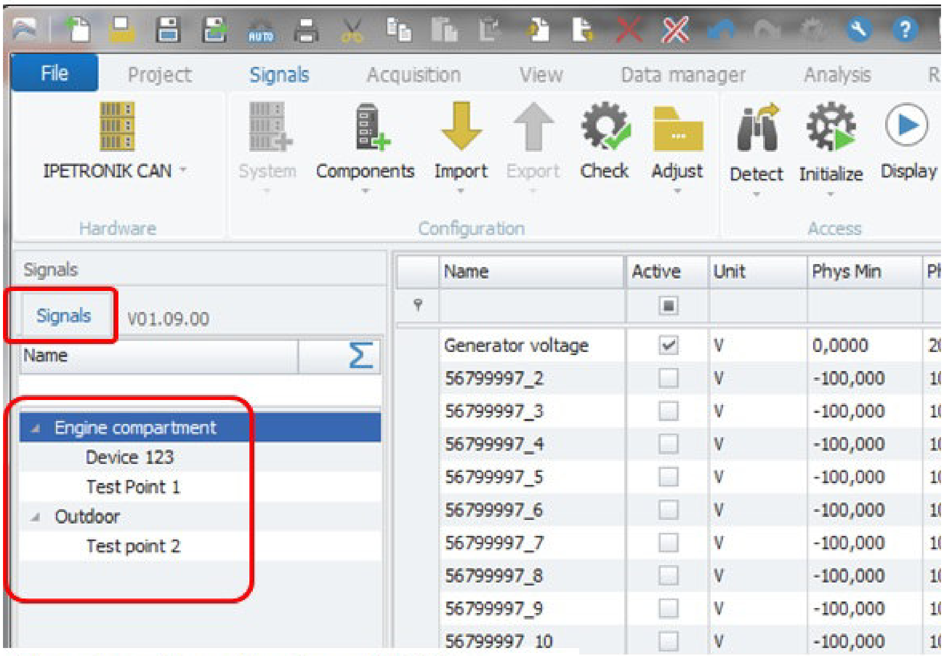



```
<?xml version="1.0" encoding="utf-16"?>
<IPEmotionXmlFile version="65536" docType="MeasurePointPlan">
 <MeasurePointPlan>
  <MeasurePointPlanSignalList>
   <MeasurePointPlanSignal>
    <ParameterList>
     <name>Battery voltage</name>
     <point>Device 123</point>
     <group>Engine compartment</group>
     <sensorMode type="UnsignedInt">8</sensorMode>
     <sensorMin type="Double">5</sensorMin>
     <sensorMax type="Double">20</sensorMax>
     <sensorUnit>V</sensorUnit>
     <sampleRate type="Double">20</sampleRate>
    </ParameterList>
   </MeasurePointPlanSignal>
   <MeasurePointPlanSignal>
    <ParameterList>
     <name>Battery current</name>
     <point>Device 123</point>
     <group>Engine compartment</group>
     <sensorMode type="UnsignedInt">65540</sensorMode>
     <sensorMin type="Double">0</sensorMin>
     <sensorMax type="Double">0.02</sensorMax>
     <sensorUnit>A</sensorUnit>
     <physicalMin type="Double">0</physicalMin>
     <physicalMax type="Double">10</physicalMax>
     <physicalUnit>A</physicalUnit>
     <sampleRate type="Double">20</sampleRate>
    </ParameterList>
```

[OP_10]



Measurement configuration:
Systems and componets can be created manually.
IO modules are listed.

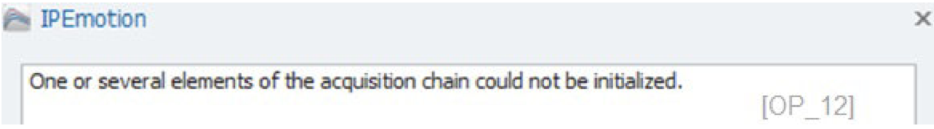


Signal configuration from MPC file:
Signal list – no IO modules are visible.

[OP_11]

22.2.2 Accurate acquisition chain required

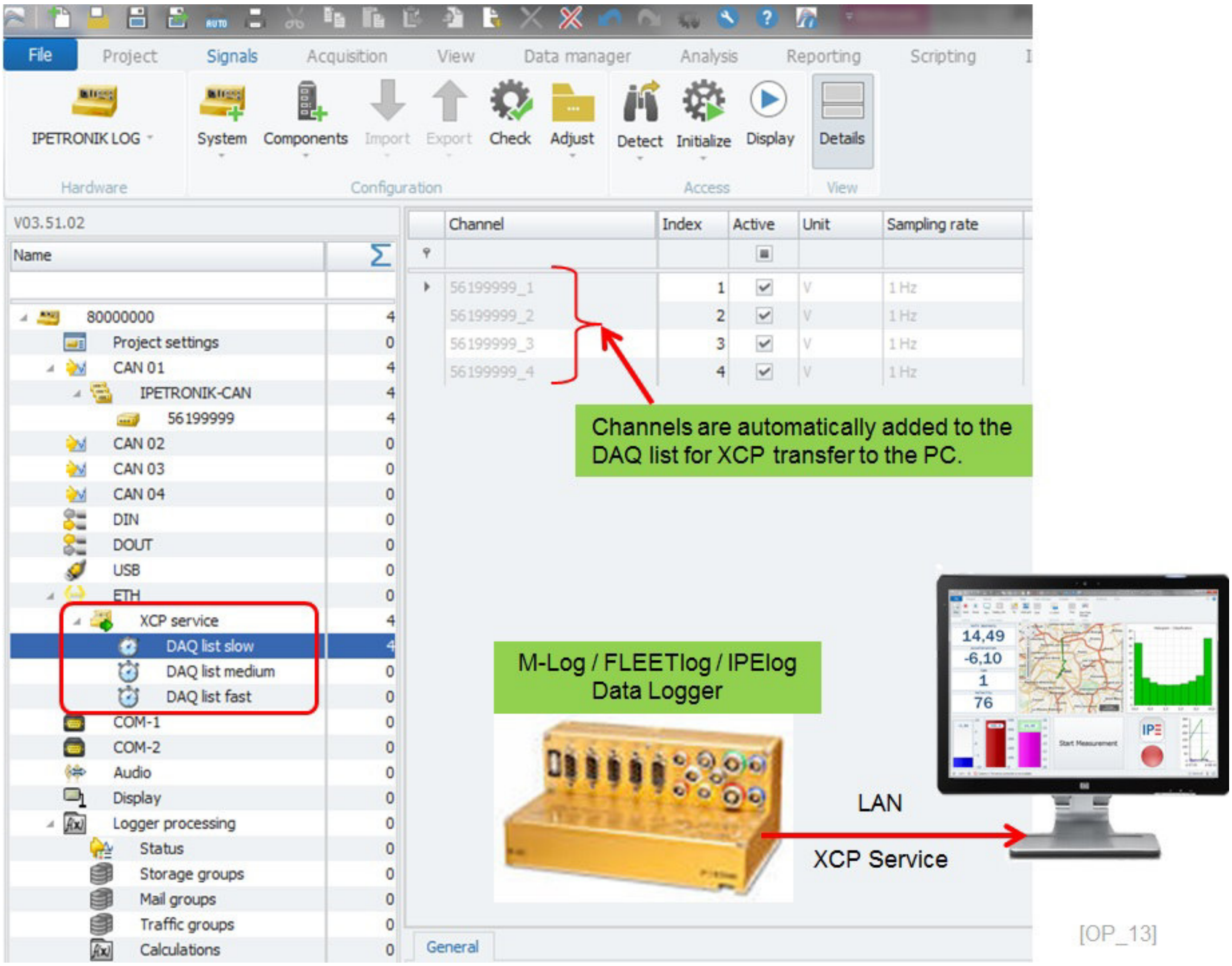
The accurate acquisition change is a setting which will require that all modules and PlugIns specified in the SIGNALS work area are working correctly and well connected to the application. If one system of the configuration is not connected the whole measurement will not start.



[OP_12]

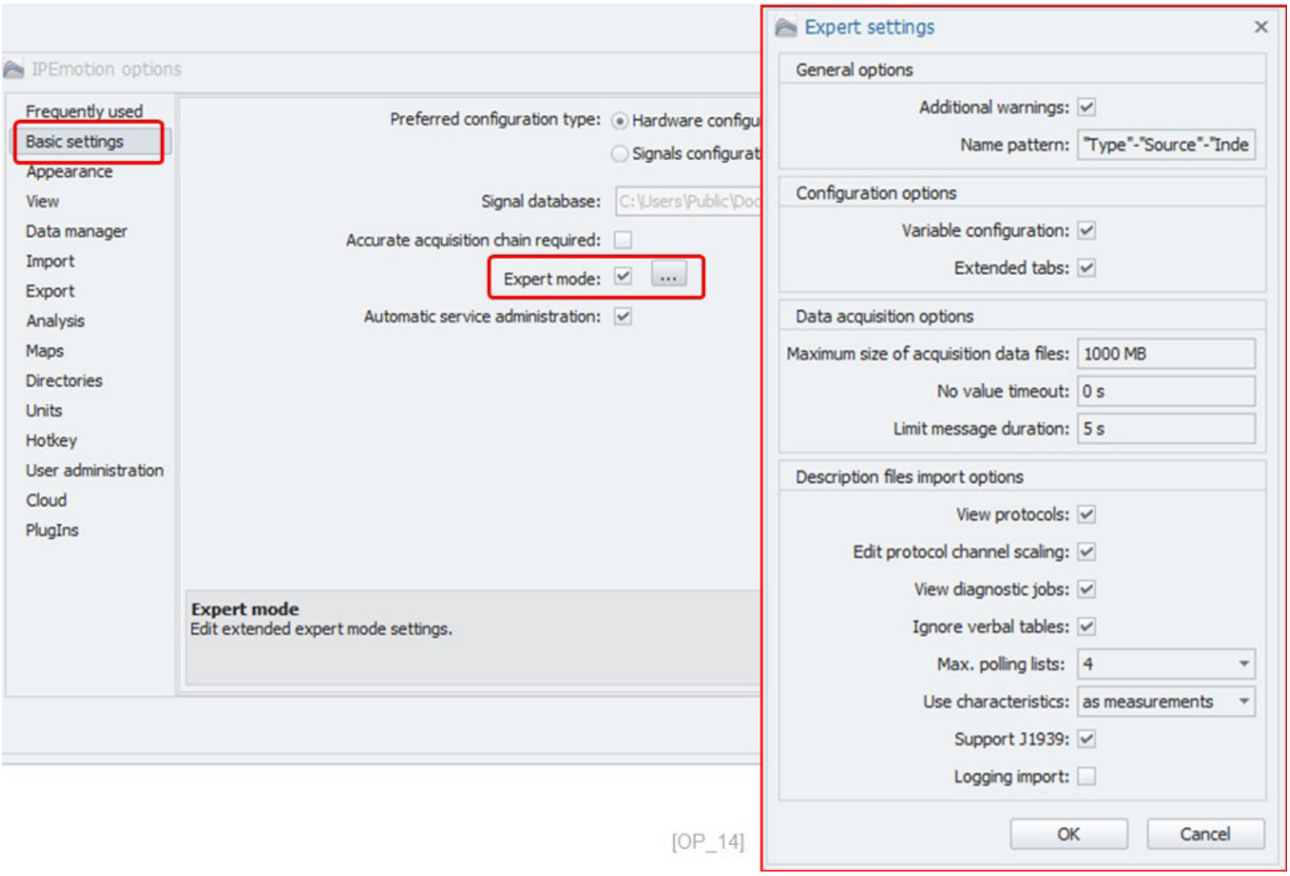
22.2.3 Automatic service administration

The automatic service administration is a function dedicated to IPETRONIK data loggers. The automatic service administration only is working in cooperation with an active Expert mode and activated check box for “view Protocols”. The function of the automatic service administration is that the signals of IPETRONIK data loggers are automatically included on XCP DAQ list which is streaming the data to the PC. With this function you can see the measurement signals of the logger in IPEmotion provided you have a TCP/IP LAN or WLAN connection between your computer and the data logger.



[OP_13]

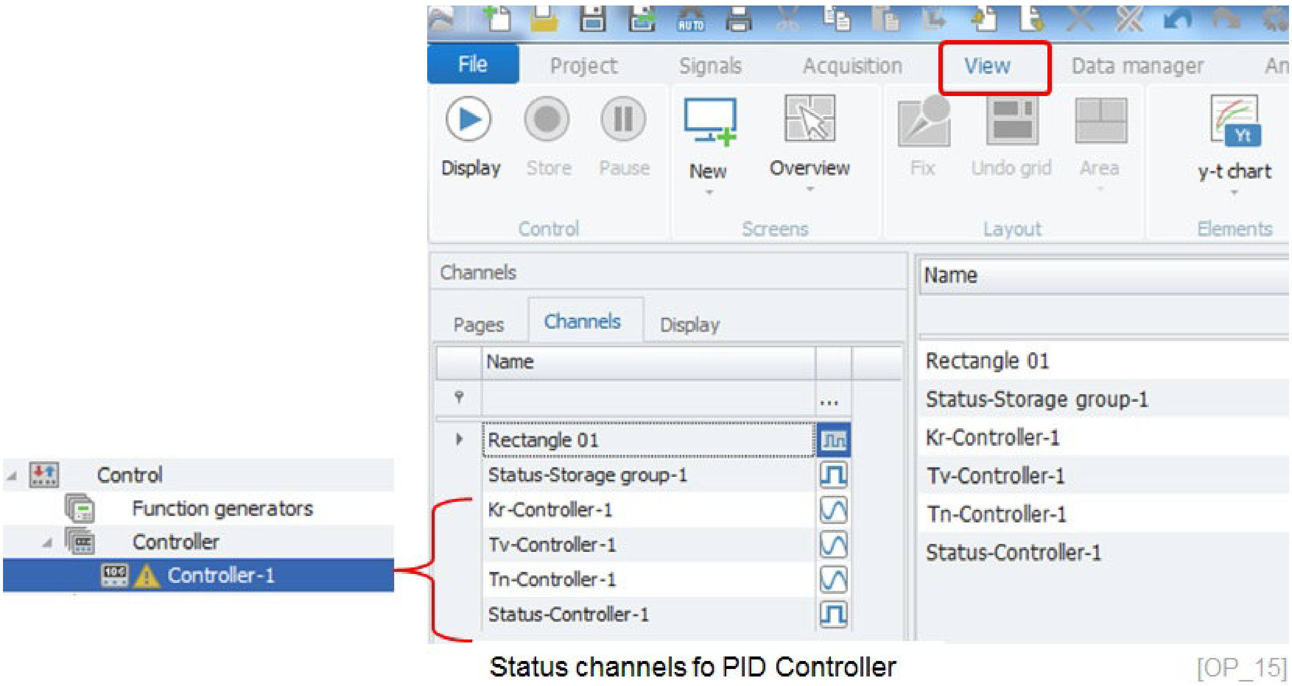
22.3 Expert mode



[OP_14]

22.3.1 Impact of the Export mode check box

When this check box is enabled it will show status channels of the following channels which are created in the ACQUISITION work space. The status channels are visible in the channel list of the VIEW work space.

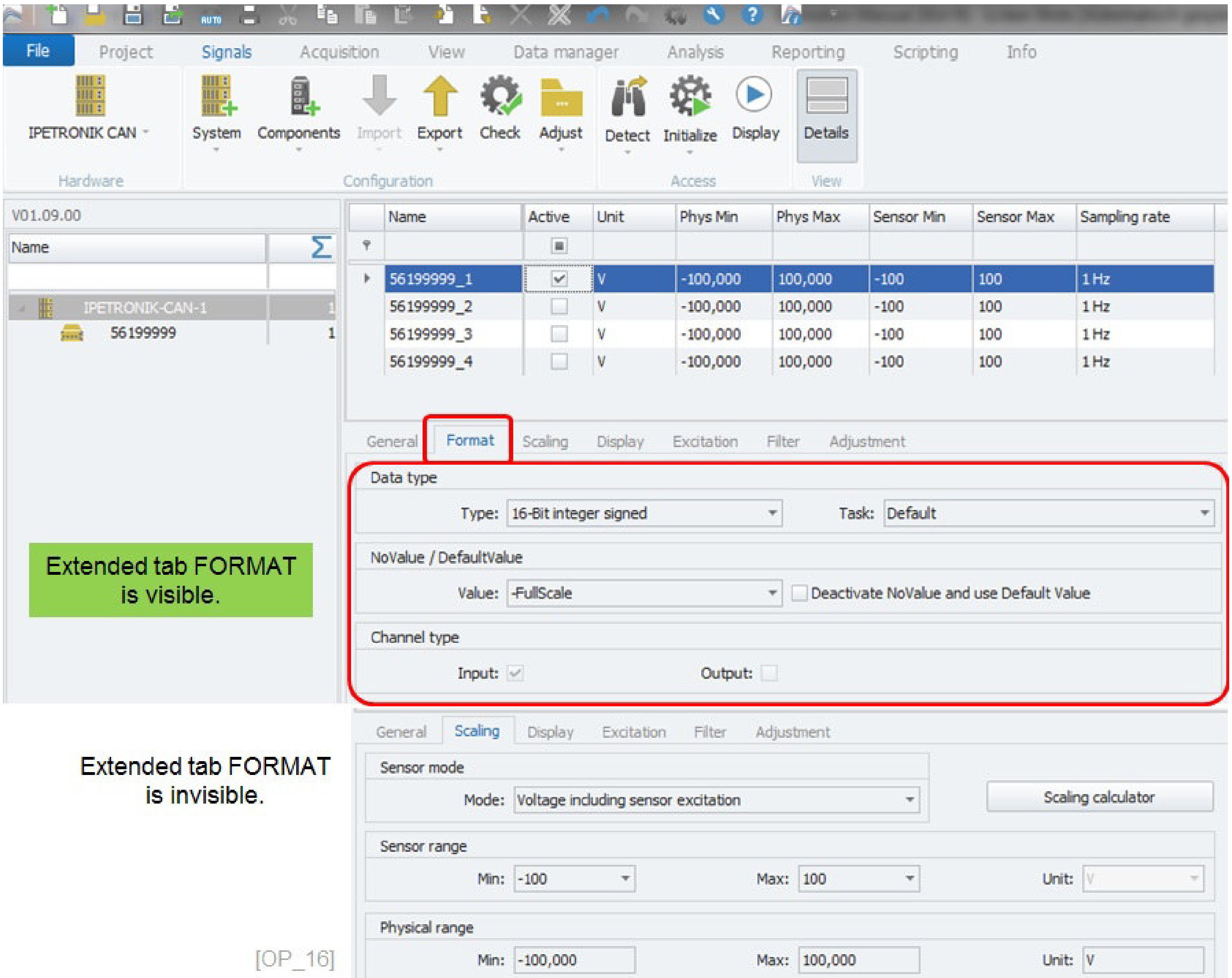


[OP_15]

- Function Generators
- Controller

- Router
- Sequence Control
- Profile generator
- Classification Operations

With this check box you can also activate the tab sheet “Format” in the SIGNALS work areas. In this tab sheet you can see the data direction INPUT / OUTPUT and you can define the no VALUE output and some other expert settings which are discussed in the SIGNALS chapter 11.6.4.

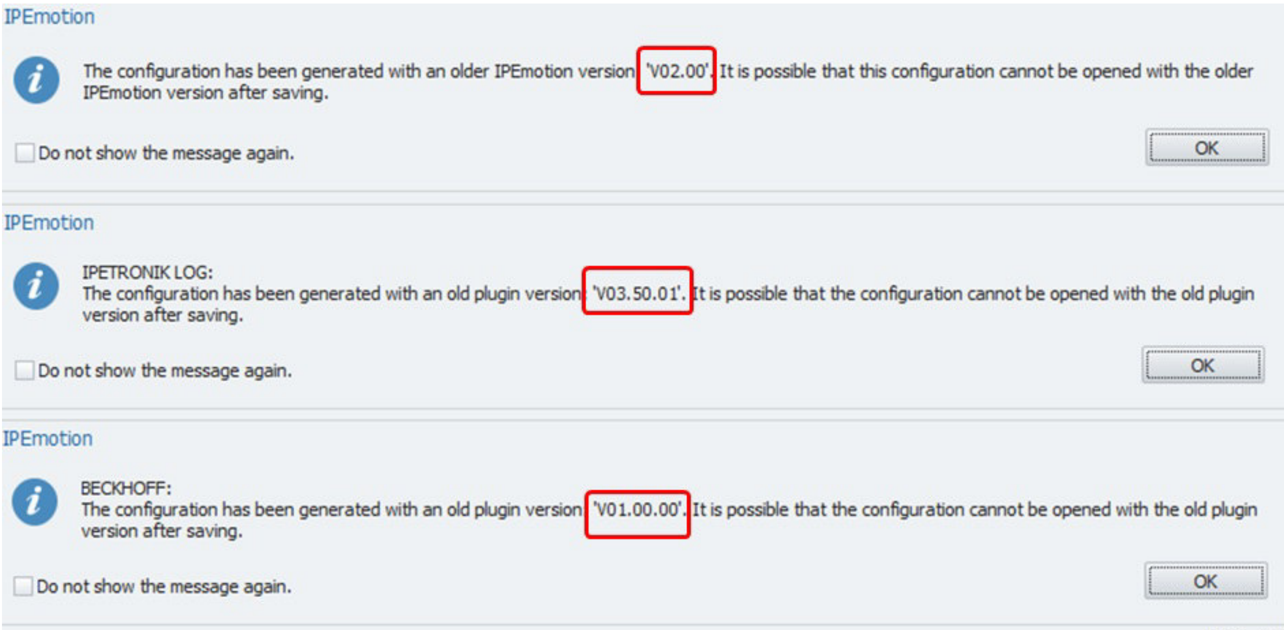


[OP_16]

22.3.2 Additional warnings

The additional warnings refer to a message window which is indicating that the configuration IWF file you are loading was created with a previous IPEmotion release and may also contain previous versions of PlugIns if included. This message should make you aware that any modifications saved to this IWF file has irreversible effects and that you cannot open this project file with previous IPEmotion releases and PlugIn releases. Example:

- Basis configuration — New IPEmotion Software release
- IPEmotion V02.00.06 — IPEmotion 2015 R3
- Logger PlugIn V03.50.01 — Logger PlugIn V03.52.00
- Beckhoff PlugIn V01.00.00 — Beckhoff PlugIn V01.04.00



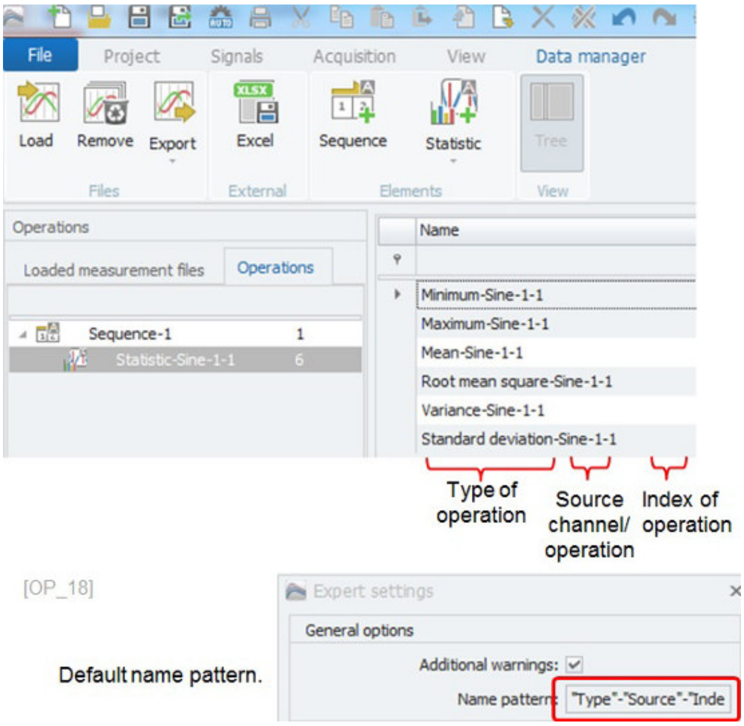
[OP_17]

22.3.3 Name pattern for post processing operations

When you create post processing operations you can define how the channels names are generated. The names patterns can be composed of the following 4 elements:

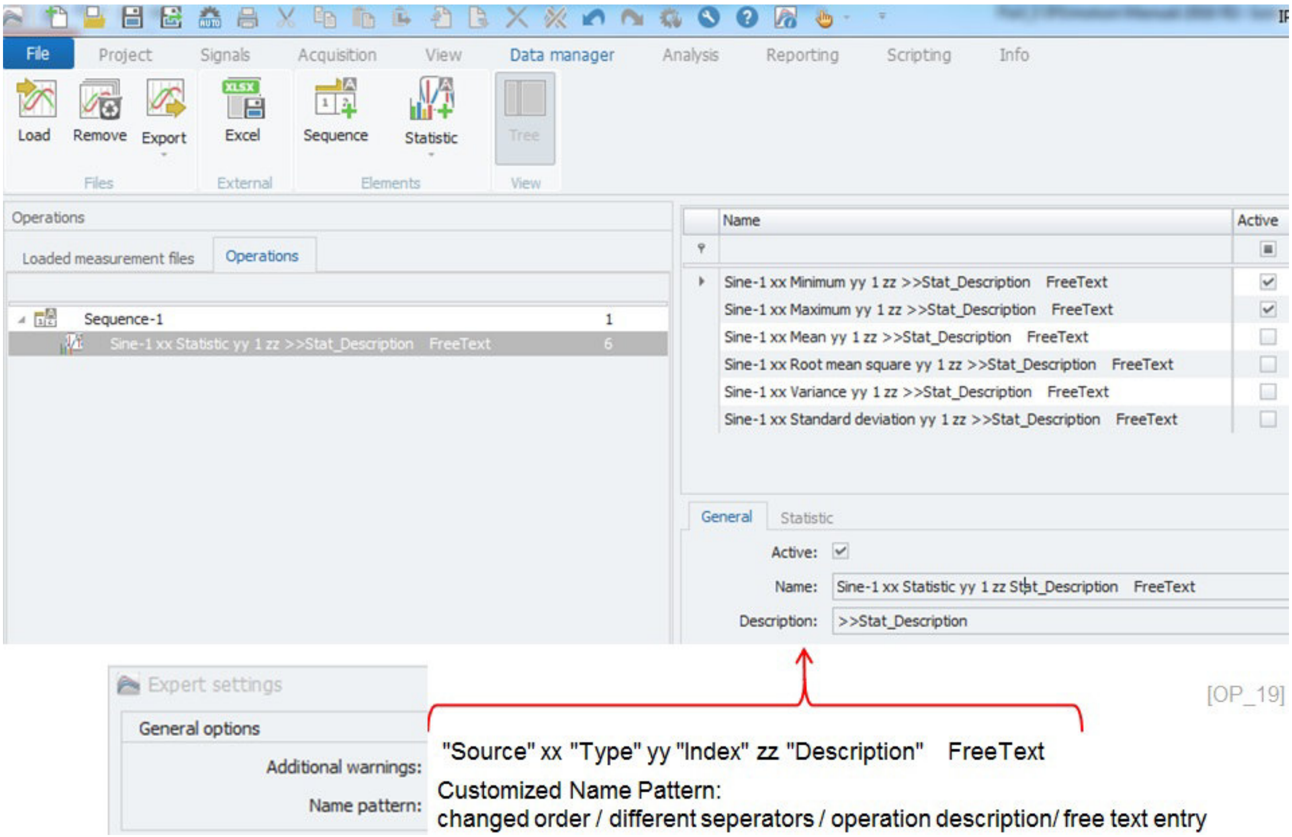
- Type — Type of operation (Statics, Filter, Classification,...)
- Source — Name of source channel
- Description — Description of the operation
- Index — Index or number count of the operation
- Free Text — Add any default text descriptions

The default name pattern is: “Type” – “Source” – “Index”



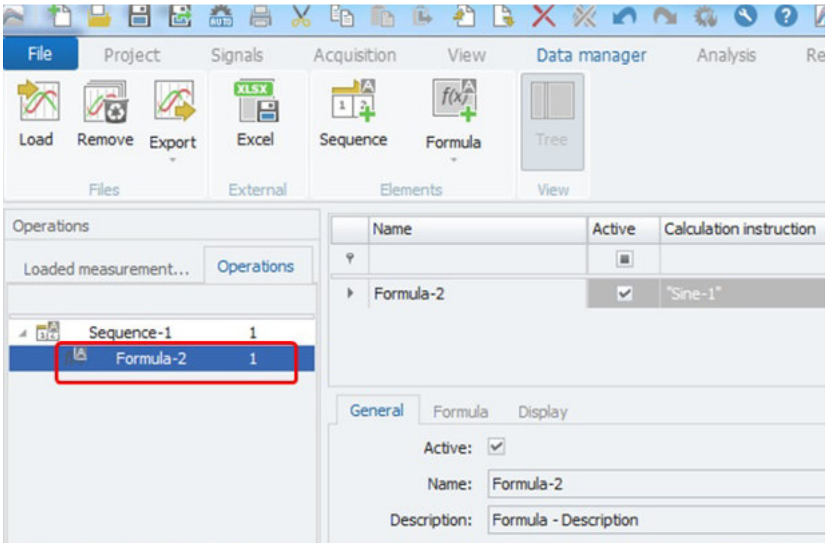
[OP_18]

When you modify the name pattern entry in the options the post processing operation names are created accordingly as indicated in the example below. The benefit is that you can define how the operation names and the output channel names are created. In the example blow the operation name and channel names are modified.



[OP_19]

Information *The name patter function is not applied to formula channels.*



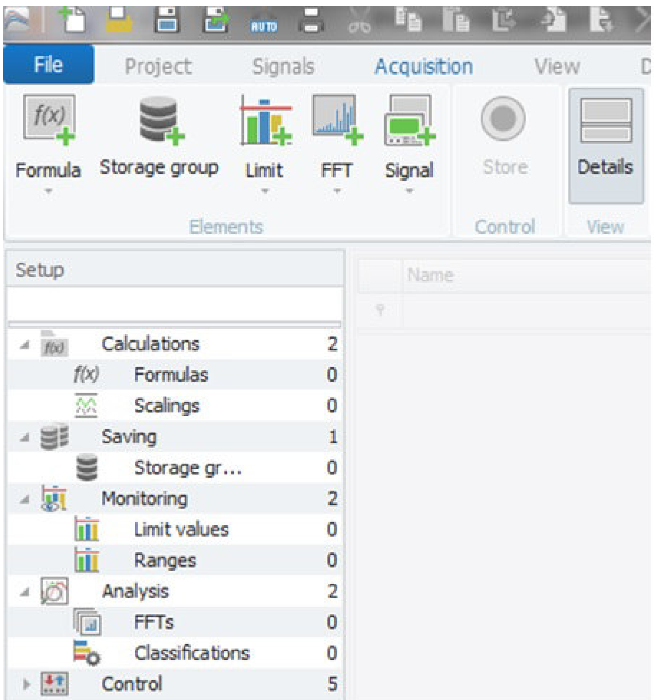
Customized name pattern function is not affecting the FORMULA operation. [OP_20]

22.3.4 Variable configuration

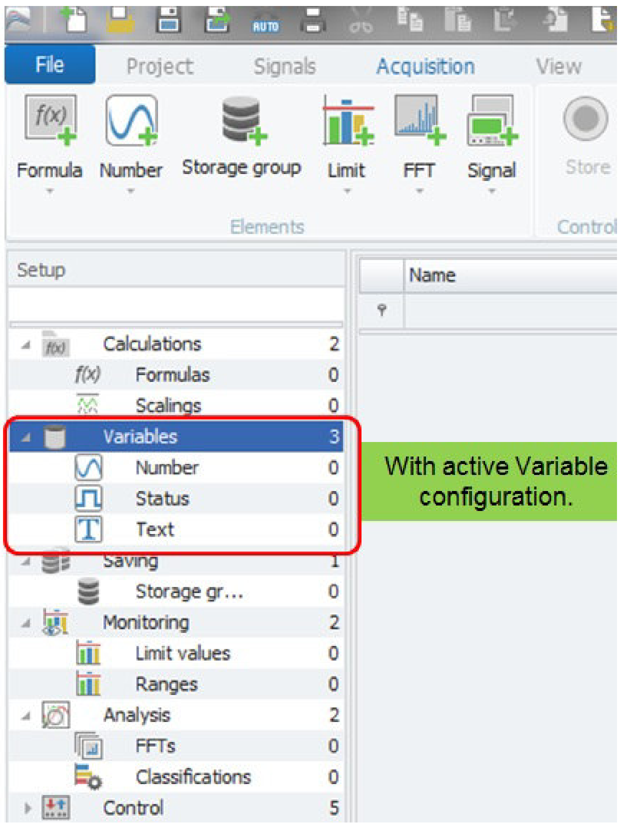
In the acquisition work space you can define 3 types of variables:

- Number (Float 32 bit)
- Status (Bool 0 or 1)
- Text (text, comment input e.g. for marker channels)

With this check box you influence whether the variables are visible or not. However, if you hide the variables and you load an IWF configuration which includes variables in the configuration, they are made visible. If you like to find out more about variables refer to chapter ACQUISITION 13.7.



Without (deselected) Variable configuration in the options. They are invisible.



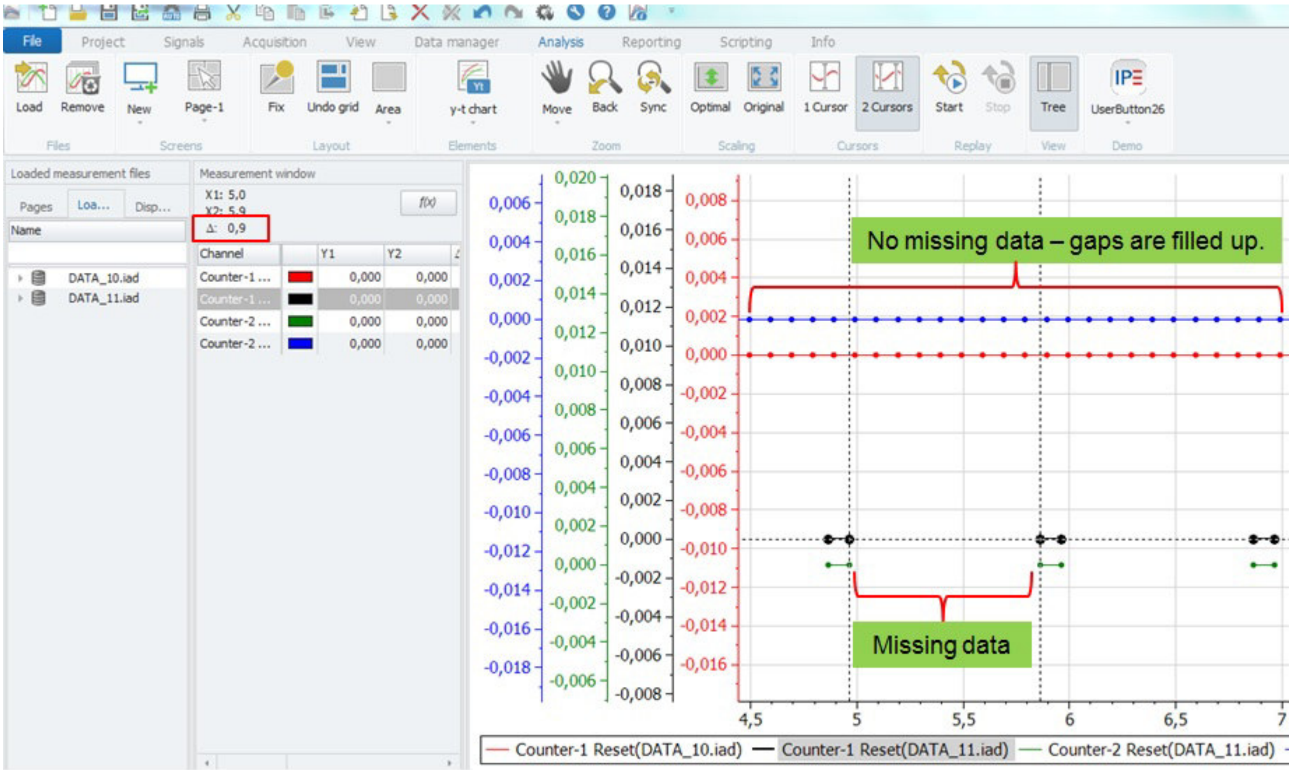
[OP_21]

22.3.5 Maximum size of acquisition file

Here you can define the maximum size of the data file in MB (Mega Byte). When you record data, IPEmotion will split the files when the file size is reached. The maximum file size is 1000 MB (1 GB). If you have several files from the recording you can specify in OPTIONS >Data manager to connect all the files to one common file during the loading process into the ANALYSIS work area. See chapter ANALYSIS for more details. There is also a setting in the OPTIONS >Data Manager called “Merge data at loading” 22.6.3.
The file split size is specified only for the IAD IPEmotin format. If your final output file is CSV the size could be much larger than the IPEmotion IAD format.

22.3.6 No value time out

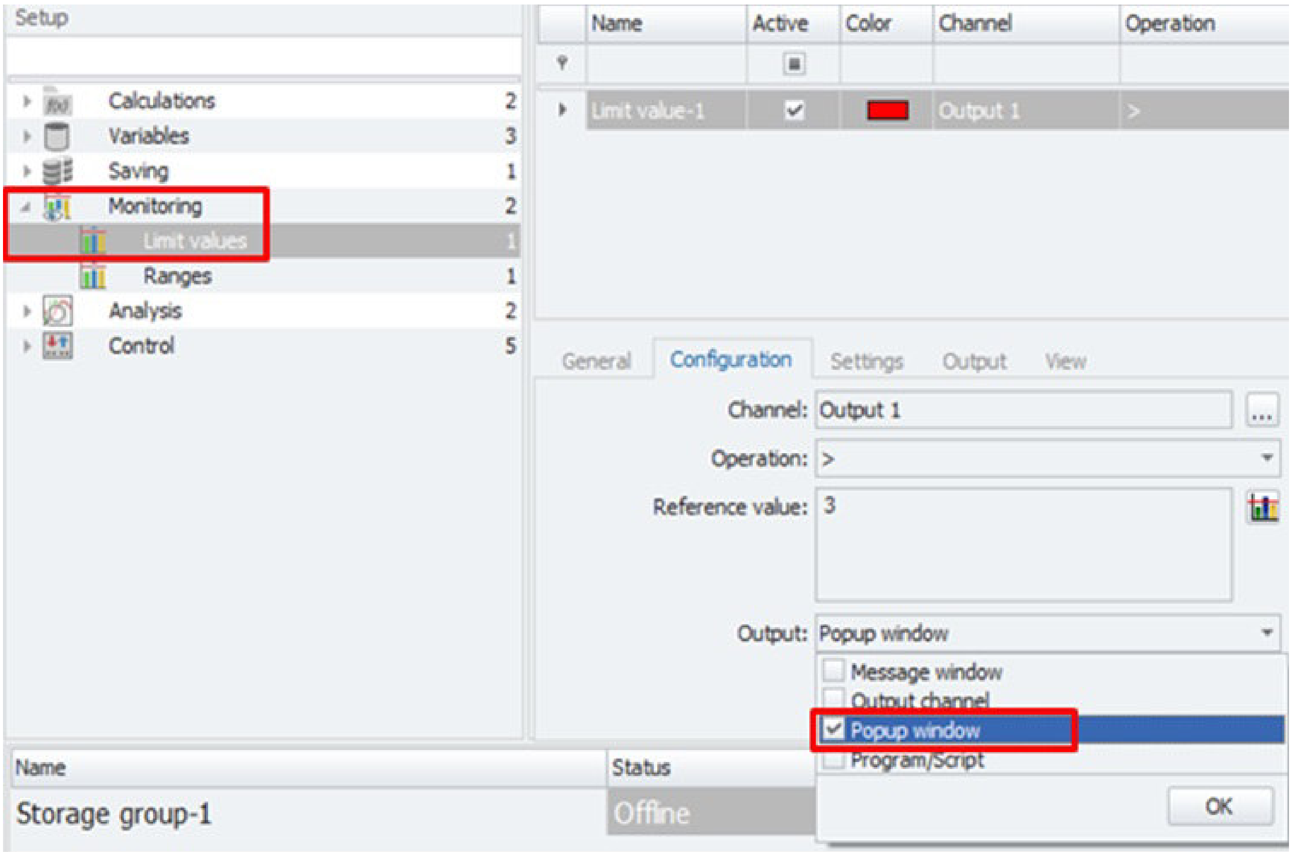
IPEmotion is recording NO VALUE data in the data file when the PlugIn is sending no data. That can cause problems on graph plotting and mathematical calculations. In order to overcome this problem you can activate the NO VALUE TIME OUT function. This function avoids that missing data points are recorded with “NO Value”. Instead the last valid measurement is stored. The maximum time frame you can configure is 5 seconds. The default configuration is 0 seconds. In this case the tolerance is zero and NO VALUEs are recorded immediately.



[OP_22]

22.3.7 Limit message duration

For limit channels you can configure a pop-up window notifying when the limit condition is true.

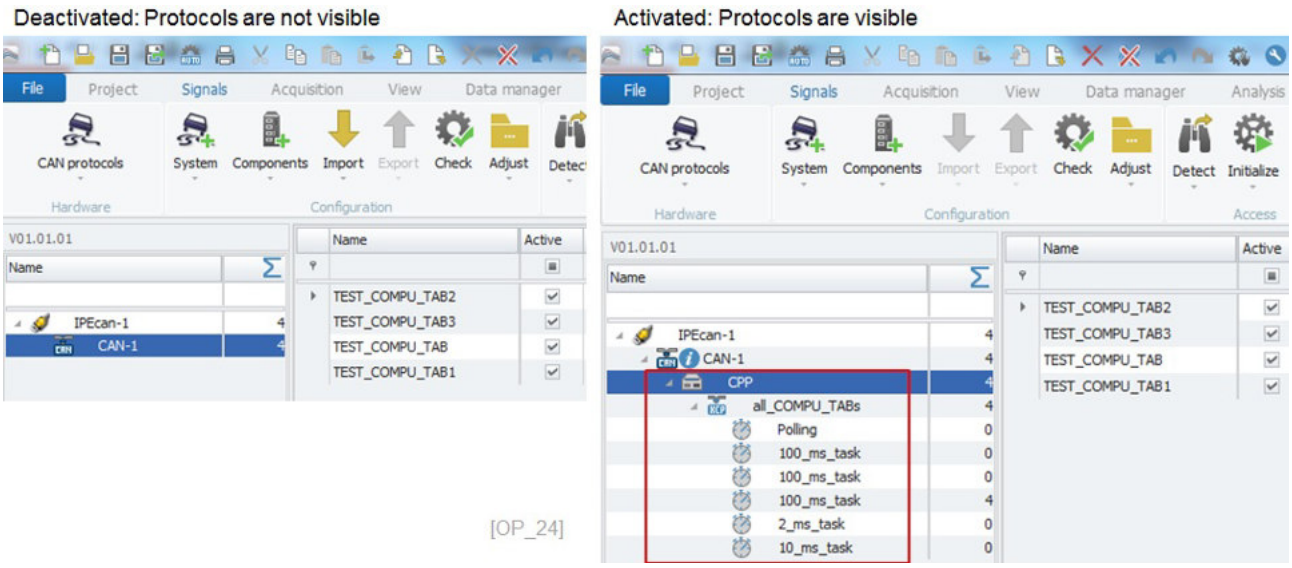


[OP_23]

The duration for how long this window will stay on the screen can be configured in OPTIONS of the Expert mode. The default configuration is 5 seconds. After 5 seconds the message window will disappear automatically. If you set the time to 0 Sec the window will stay on the screen until it gets acknowledged by the user.

22.3.8 View protocols

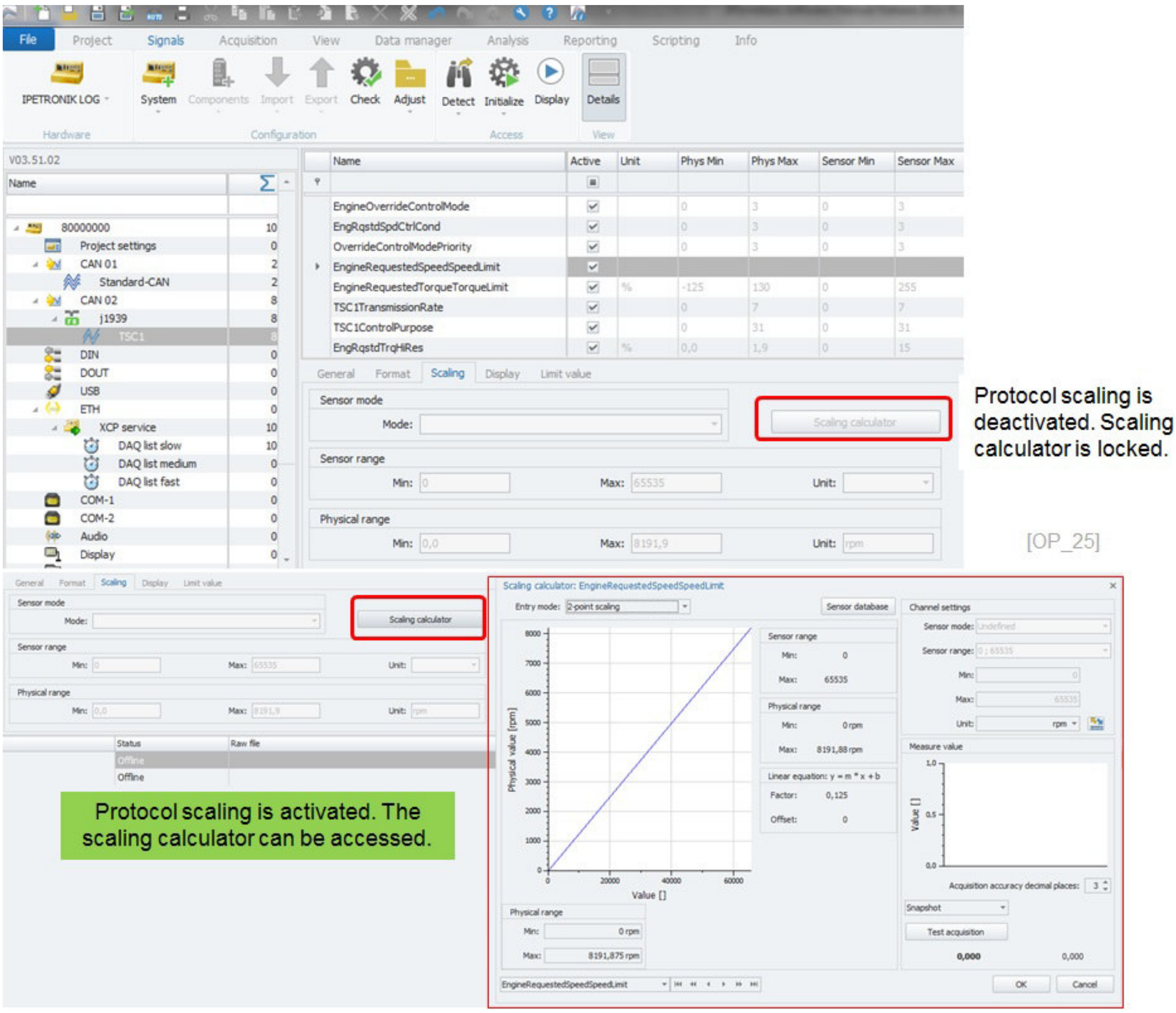
Certain PlugIns like the CAN Protocols PlugIn or the IPETRONIK Logger PlugIn support the measurement of XCP, CCP and other protocols. The protocols can take measurements from ECUs which are organized in different tabs.



[OP_24]

22.3.9 Editing protocol scaling

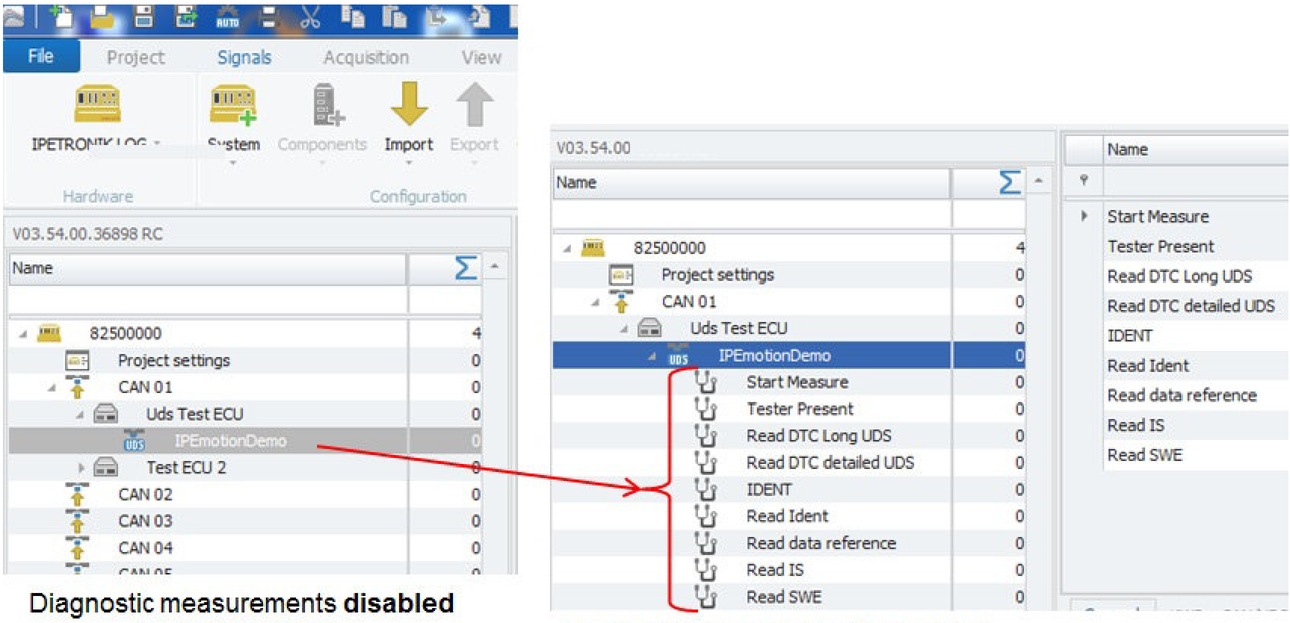
The protocol scaling check box refers to any description files (DBC or A2L etc..) which will either give the user access to the scaling calculator or will be blocked.



[OP_25]

22.3.10 View diagnostic jobs

Diagnostic measurement based (.idf) description files can be triggered. Without this setting (active check box) the diagnostic channels are not visible in the interface tree of the IPETRONIK LOG PlugIn V03.54.00 or higher, and cannot be configured.



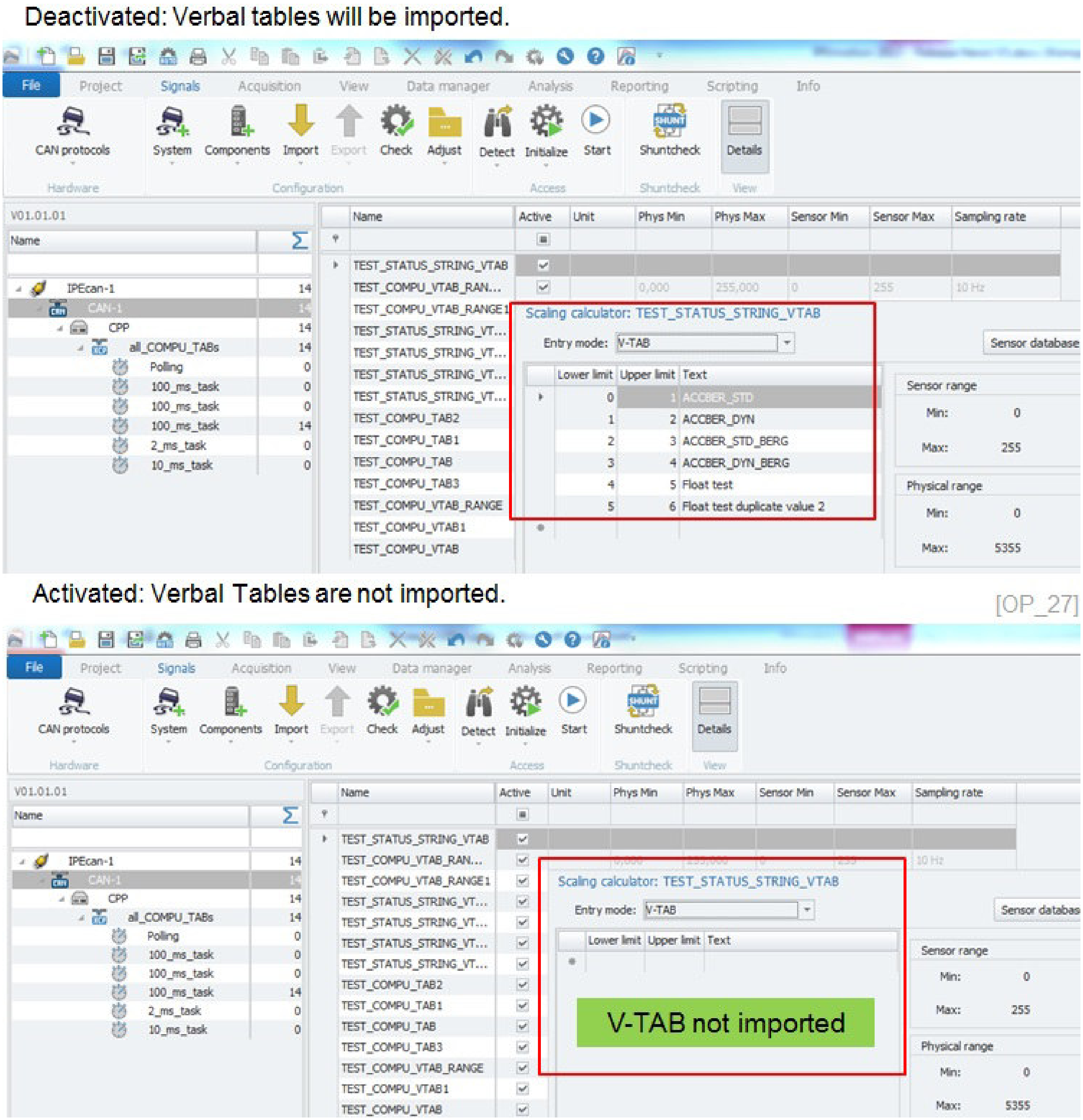
Diagnostic measurements **disabled** in the OPTIONS.

Diagnostic measurements **enabled** in the OPTIONS.

[OP_26]

22.3.11 Ignoring verbal tables - during import

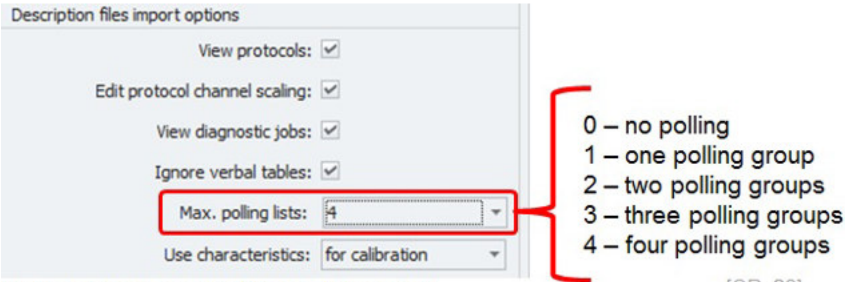
Verbal tables (V-TAB) is a special input scaling mode. With Verbal Tables you can scale numerical values into text expressions. This is very useful when a numeric value should be translated into meaningful text messages. When this check box is activated, verbal tables from description files like A2L, DBC will **not** be imported.



[OP_27]

22.3.12 Max Polling List

In the Expert mode two important configuration functions were added. First of all you can define up to 4 DAQ polling lists. During the A2L import you can allocate the signals to different polling groups. The main benefit is that each polling list can be triggered individually and that the polling load is balanced. A2L imports for ECU measurement are supported by the IPETRONIK LOG PlugIn and the CAN Protocols PlugIn. See chapter SIGANLS description files import for more information 11.1.3.



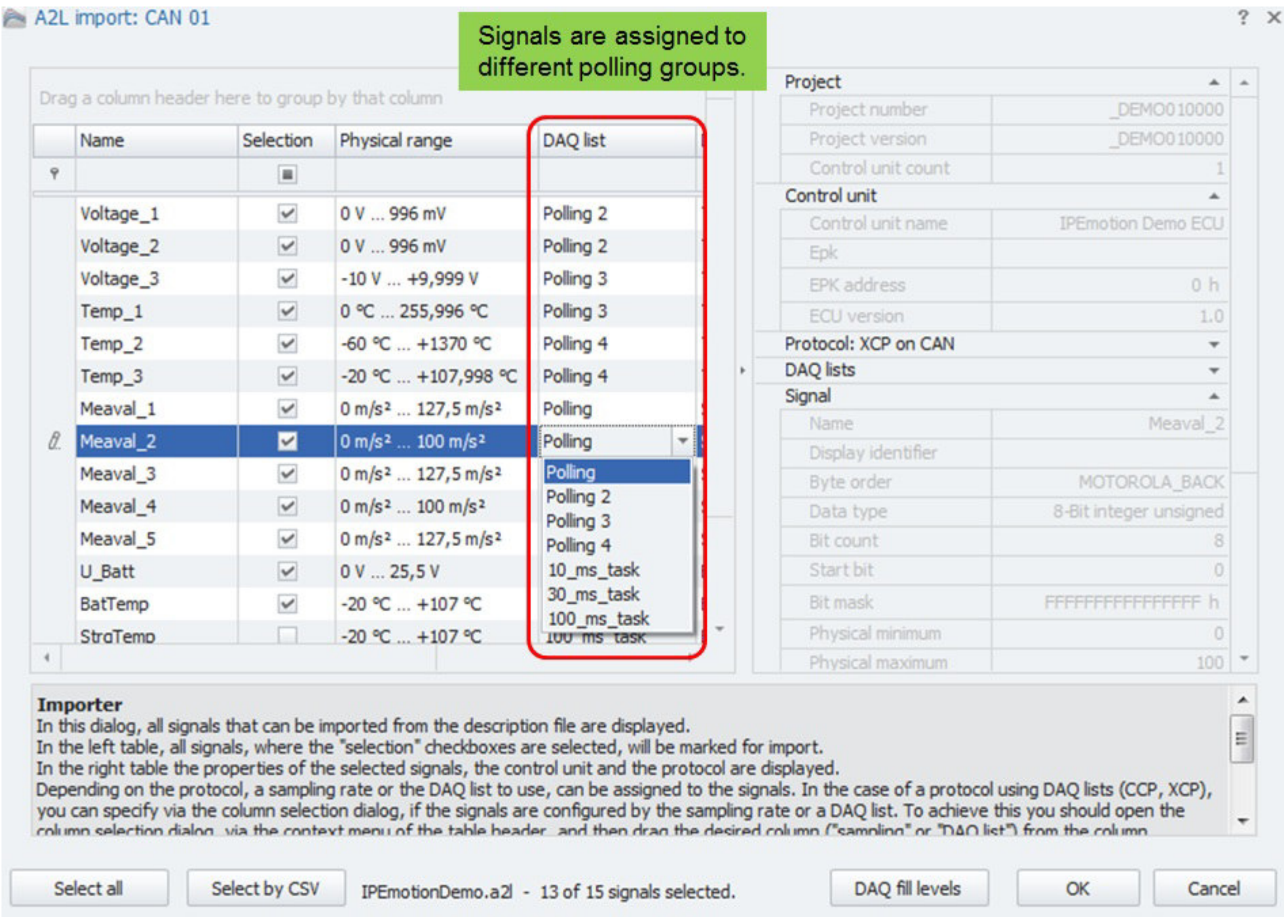
Define polling groups for the A2L import.

[OP_28]

Information *This function is implemented in the PlugIn interface and will become effective with the new IPETRONIK LOG PlugIn V03.54.00 and the new CAN Protocols PlugIn V01.03.00 release schedule in Q3 2014.*

The screenshot below shows the A2L import dialog where you can assign to each signal a polling group. Polling groups can be currently defined for the following XCP and CAN interfaces:

- XCPonUDP / XCPonCAN / XCPonTCP / XCPonFlexRay
- CCPonCAN



[OP_29]

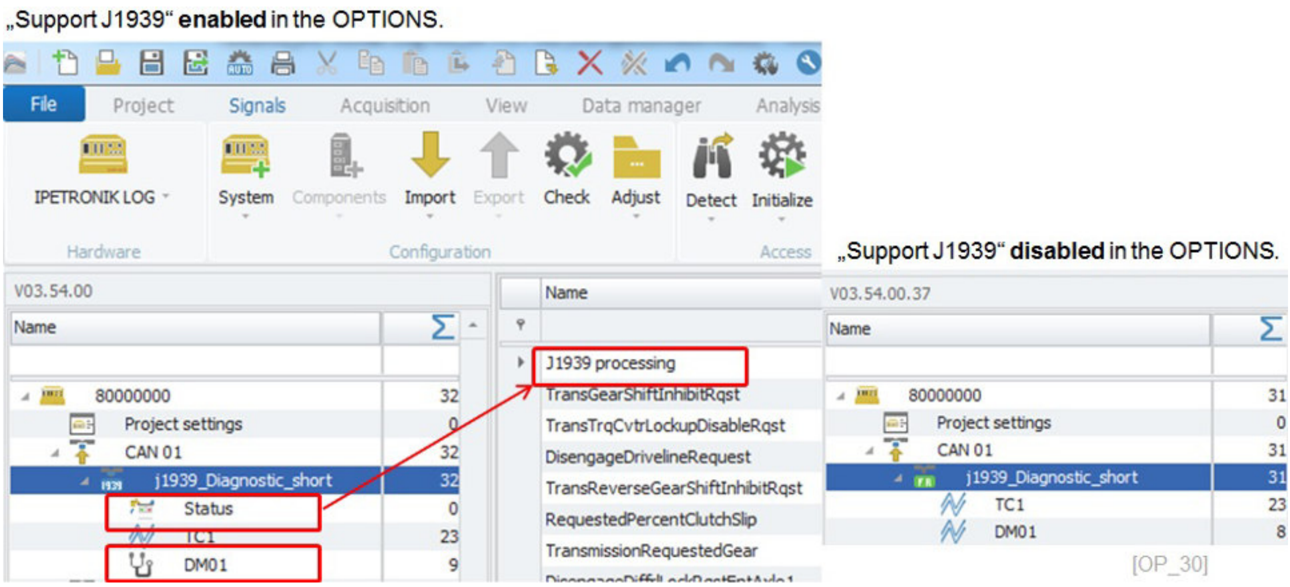
22.3.13 Use characteristics (for ECU calibration)

There have been increasing requests to change parameters on the ECU. Provided the A2L file includes characteristics, it is possible to address these characteristics in IPEmotion to change the parameters.

- **For calibration** — In the calibration mode you can initialize calibration command to the ECU and change ECU parameters
- **As measurement** — This is the normal measurement mode which supports no calibration functions, only measurements. However, some A2L files also use calibration for measurement and therefore this mode was implemented.
- **No characteristics** — In this setting the calibration functionality is disabled.

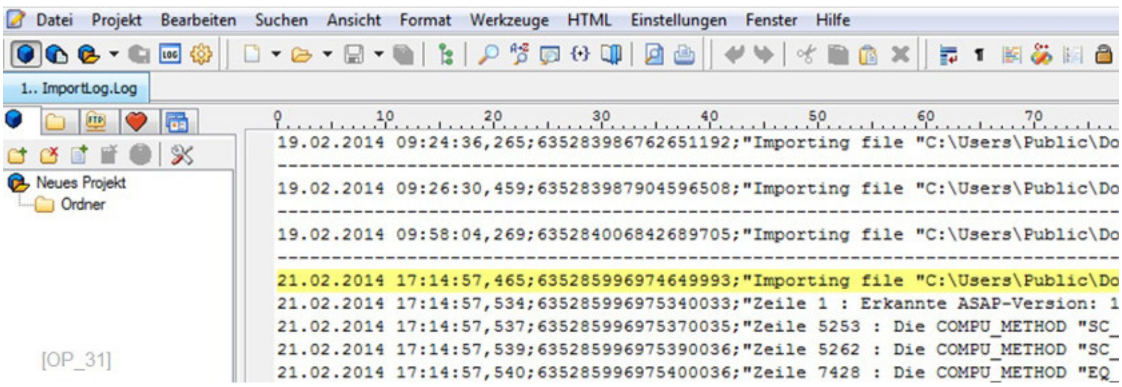
22.3.14 Support J1939

If the check box is enabled you will see a J1939 processing channel after the import and you can change DM01 messages conversion methods.

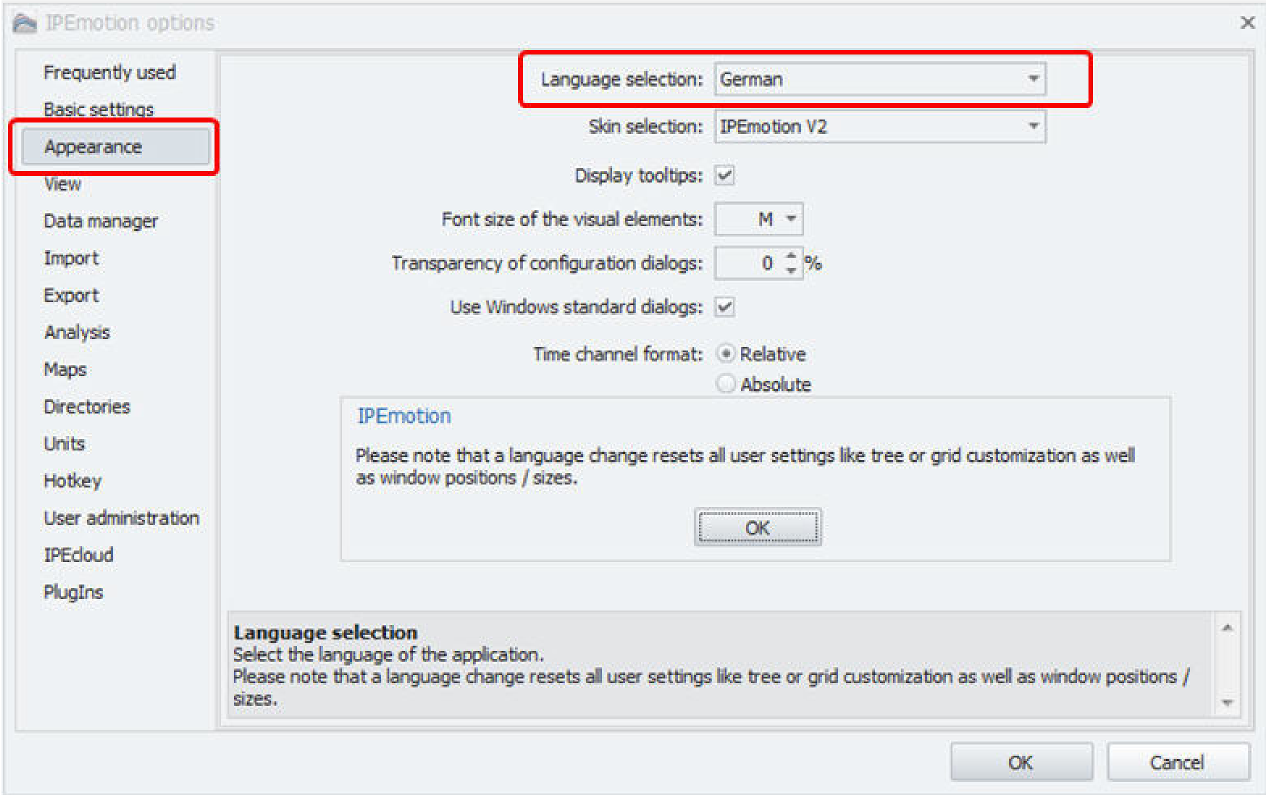


22.3.15 Logging import

The standard import messages are displayed in the Message window which was discussed in the APPLICATION MENU >View in chapter 6.7.
When you active the import logging function a spate data base file is created which stores all import messages. The file is called: **ImportLog.Log** and located in:
Win7 c:\ProgramData\IPETRONIK\IPEmotion 2016 R2.1\Trace\
All PlugIn using import functions (DBC, A2L, S7P, etc. . .) store the import protocol with all messages in this common file when the check box is enabled.



22.4 Appearance



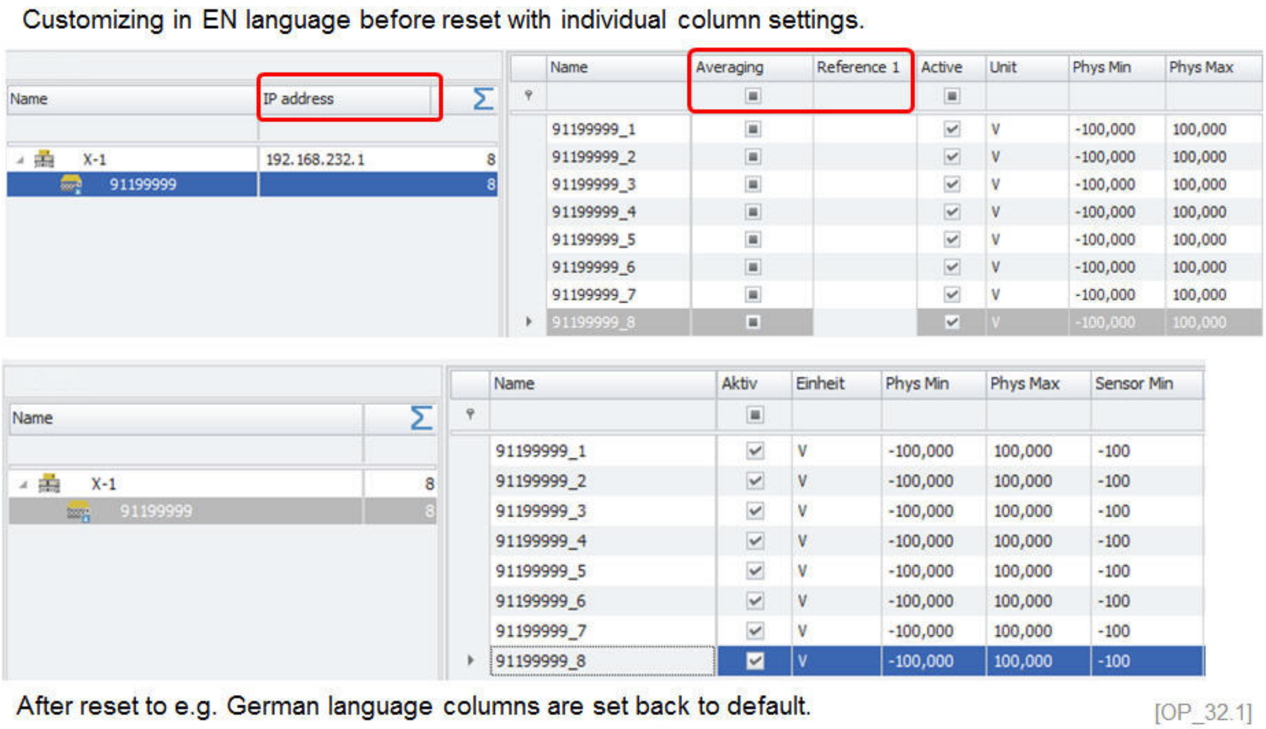
Message box is indicating which settings are effected. [OP_32]

22.4.1 Language Selection

You can select from 8 different languages. The supported languages are:

- English
- German
- French
- Italian
- Korean
- Chinese simplified
- Japanese

The first major release only includes German and English language. The other languages are translated after that and will be included in the corresponding hotfix. You can switch to any language after restart of the software.
When you switch the language the some customizing settings are set back to default. This is impacting individually selected columns, docking windows like message windows or measurement cursor windows.



[OP_32.1]

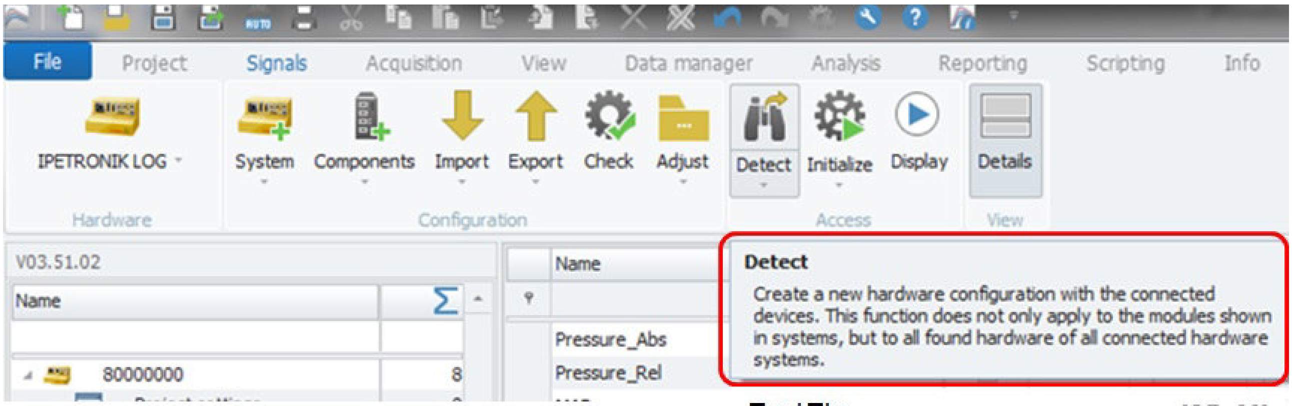
22.4.2 Skin Selection

IPEmotion offers 6 different Skins. You can directly switch between the skins without restarting the software.

- IPEmotion V2
- Light Blue
- Dark Blue
- Blue
- Grey
- Black

22.4.3 Display tool tips

Many labels and buttons in IPEmotion support tool tip information with some additional explanation about the function.

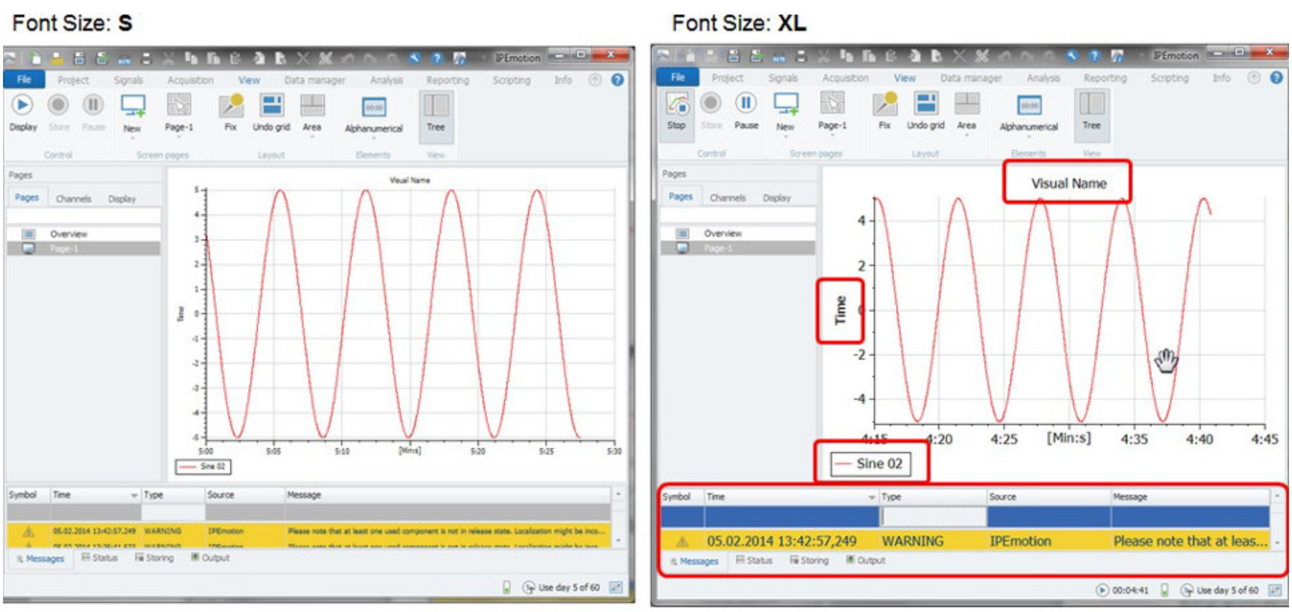


Tool Tip [OP_33]

22.4.4 Font size of visual elements

The font size range of the event messages and display objects is extended to 4 size levels: S, M, L, XL. With the font size you influence the following graphical elements:

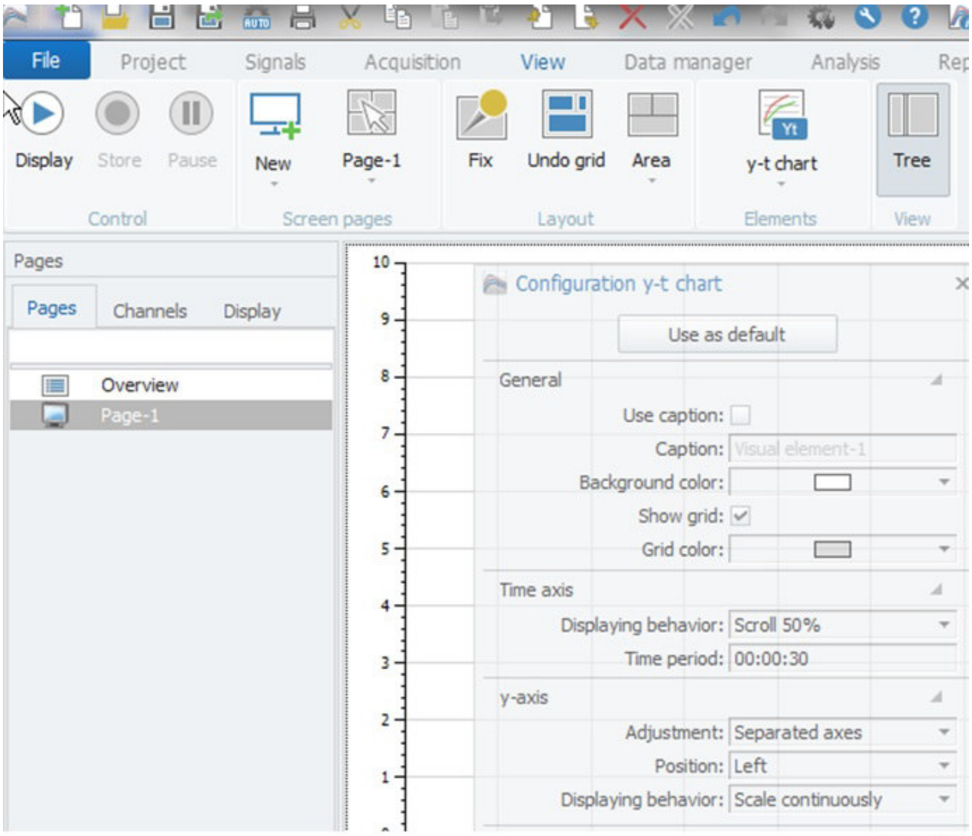
- Channel names in charts
- Name of instruments and alphanumerical instruments in the analog displays (e.g. Tachometer)
- Y-axis
- All entries in Message, Status, Storage, Output and PC tab sheets



[OP_34]

22.4.5 Transparency of configuration dialogs

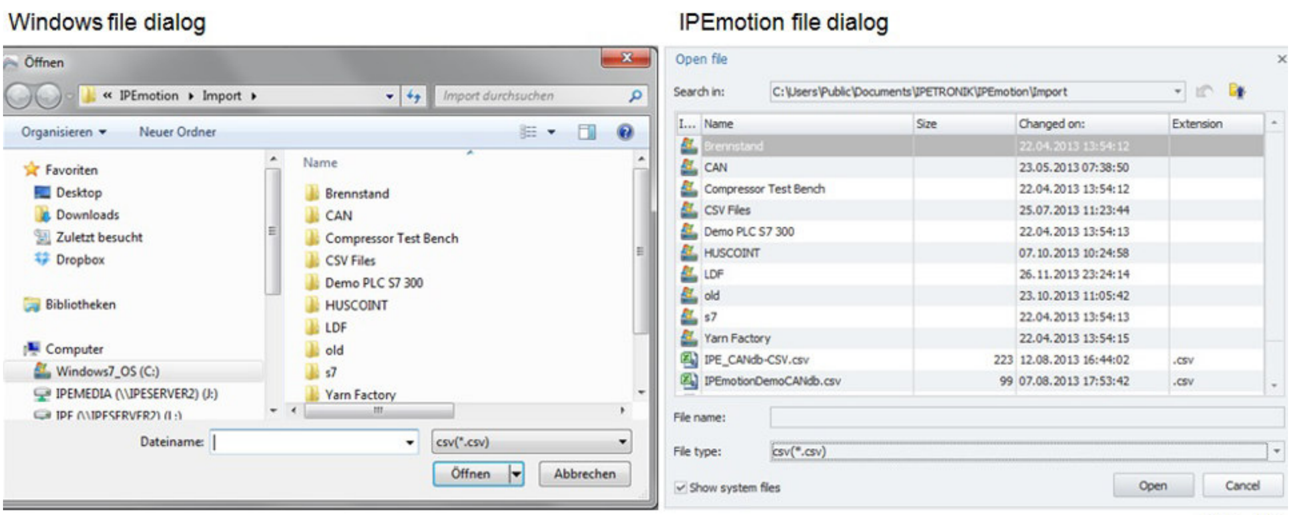
The transparency can go from 0% (no transparency) up to 30% where parts of the background elements are shining through.



[OP_35]

22.4.6 Use Windows standard dialogs

On all file open and file export dialogs you can either choose the familiar windows dialogs or the IPEmotion dialogs.

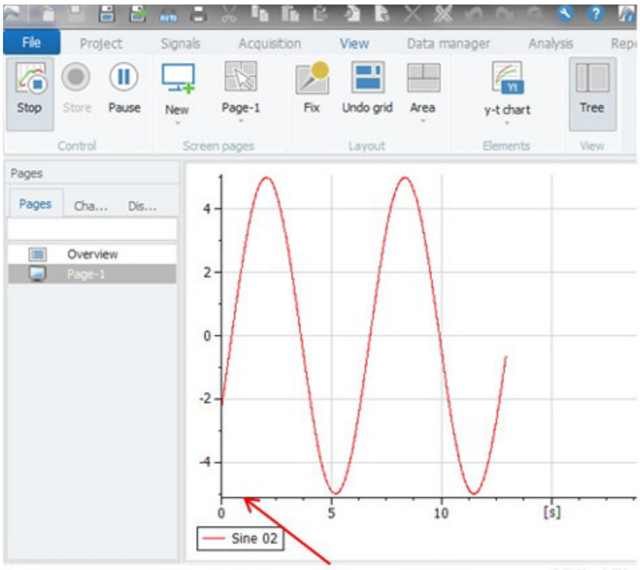


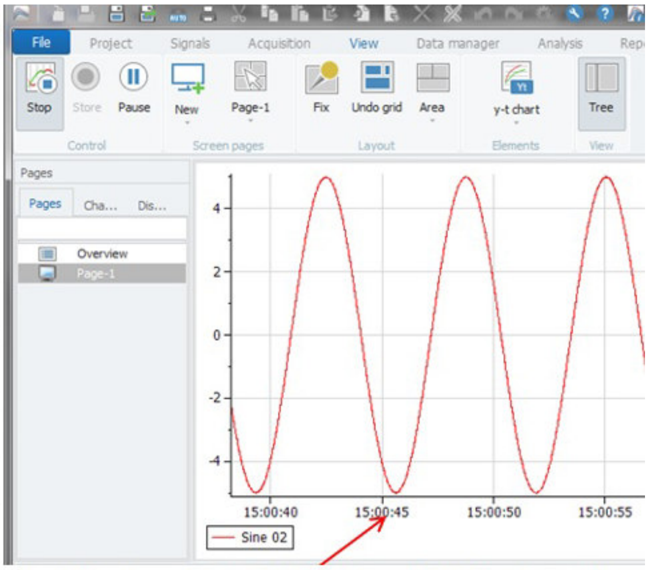
[OP_36]

22.4.7 Time channel format (relative vs. absolute)

This time channel format affects the analysis and the graphical presentation of the time axis in the Yt- chart plotting online data in the VIEW work space and in the ANALYSIS work space. You can switch the time axis during the recording and live data display.

- Absolute — This refers to a time axis where the time of recording is indicated.
- Relative — This refers to a time axis where all graphs are starting with the first time stamp at ZERO seconds.
- VIEW — Relative and absolute as impact on the x-axis format as indicated below.

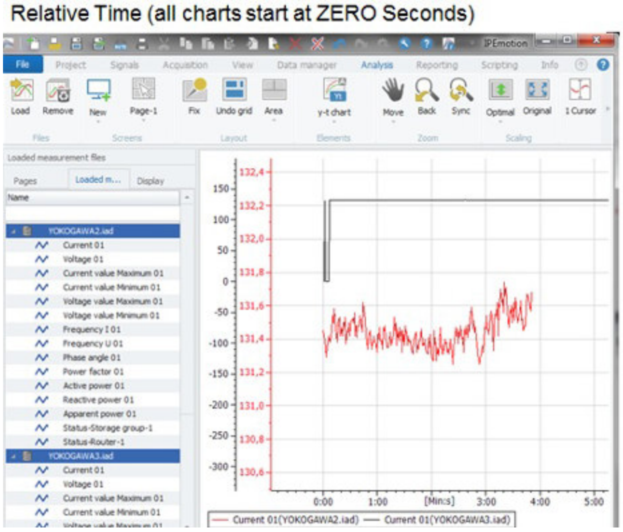




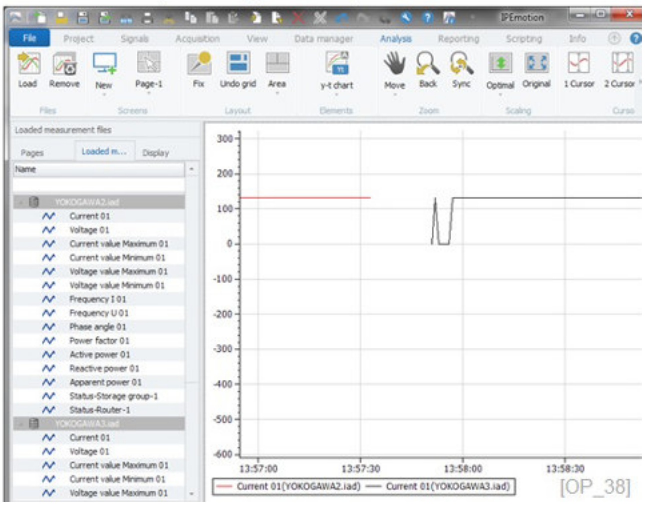
Relative: Time axis starts the plotting at ZERO. [OP_37] Absolute: Time axis starts the plotting at NOW = absolute time.

- DATA MANAGER — Depending on the setting relative and absolute the time format in the data manger is affected too 18.2.4.
- ANALYSIS — In the ANALYSIS the Yt-chart offers different graphical presentations depending on the time scale setting. In relative time all charts of all data files are starting at a common point ZERO seconds. When you have the total setting e the graphs are presented in a chronological order.

Relative Time (all charts start at ZERO Seconds)

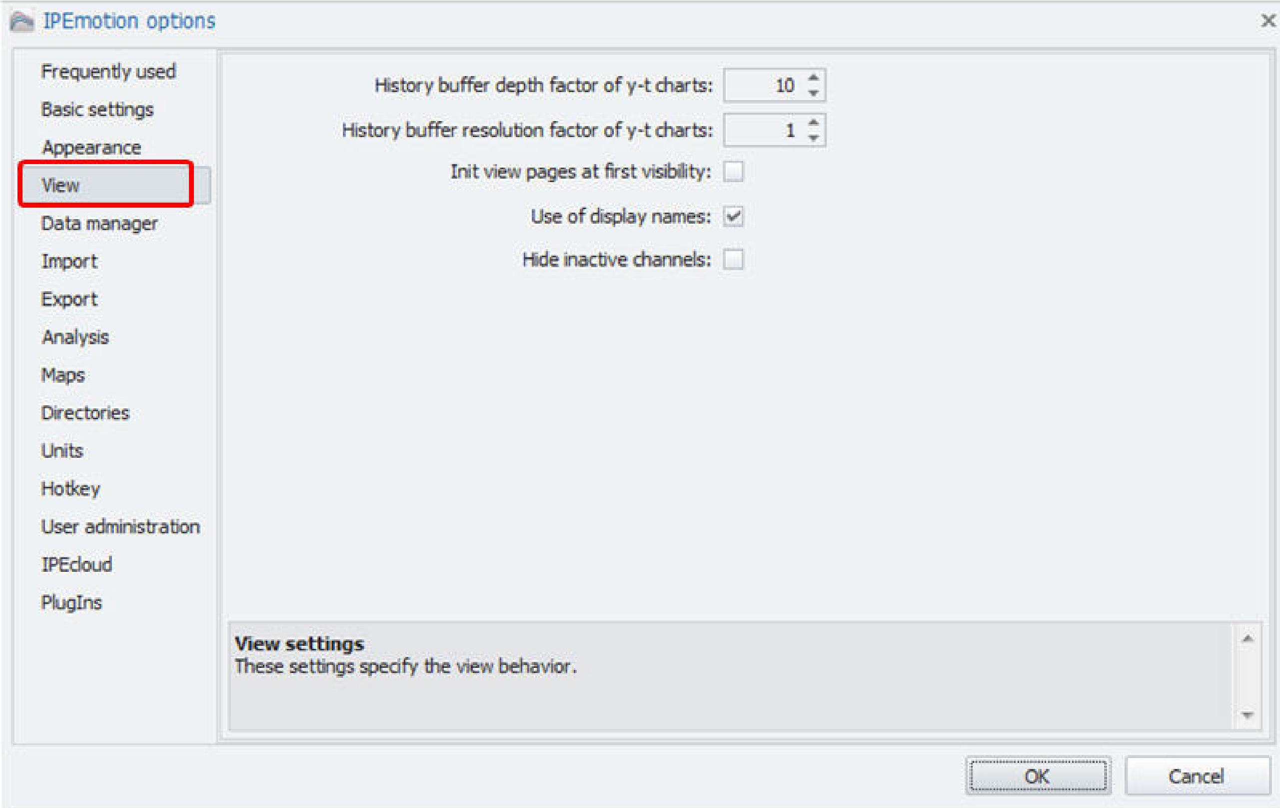


Absolute Time (chronological order)



[OP_38]

22.5 View



[OP_39]

22.5.1 History buffer depth factor

The history buffer for the Yt- chart in the VIEW work area gives you the ability to scroll back in time to perform some chart analysis functions. The depth factor can be set up to 50. That enables users to scroll back on the configured time axis of the Yt- chart 50 times. If the time axis is set to 1 minute, the user can scroll back up to 50 minutes. The zoom function is explained in the VIEW work space Yt-diagram 17.7.1.

22.5.2 History buffer resolution

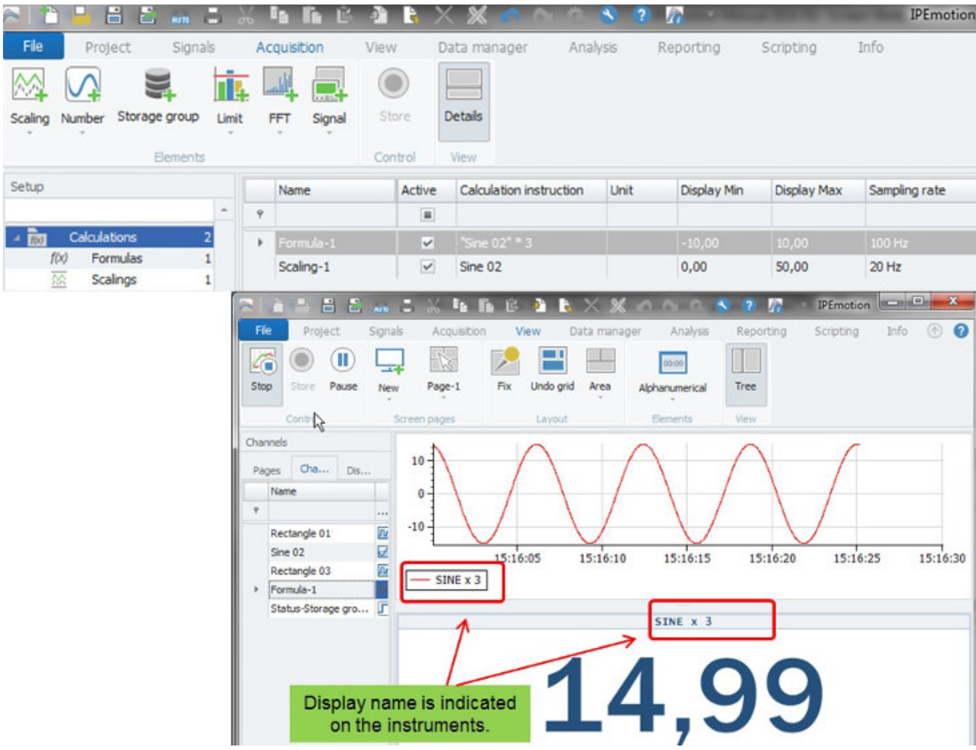
The resolution can be set to a maximum factor of 10. This defines how deep users can zoom into the graph. The zoom function is explained in the VIEW work space Yt-diagram 17.7.1.

22.5.3 Initialization of VIEW pages at first visibility

This new setting was introduced to improve and reduce the loading time of large applications with many VIEW pages and instruments. With this check box activated, the VEW pages are initialized only when they are access for the first time.

22.5.4 Use of display names

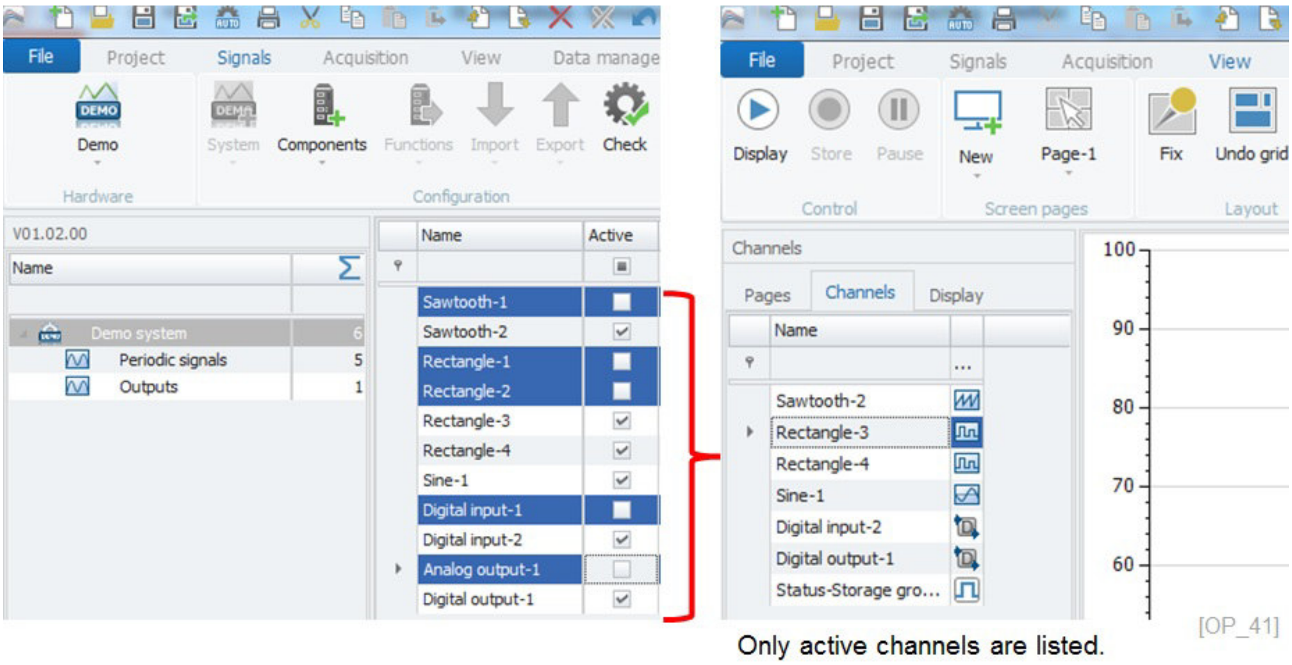
For input channels in the SIGNALS 11, formulas and scaling channels in ACQUISITION 13.3.2 you can display different channels name on the VIEW instruments. When the check box is activated the display name will be shown on the instrument. The display name has no impact on the storage. The channel is stored with the channel name and not the display name.



[OP_40]

22.5.5 Hide inactive channels

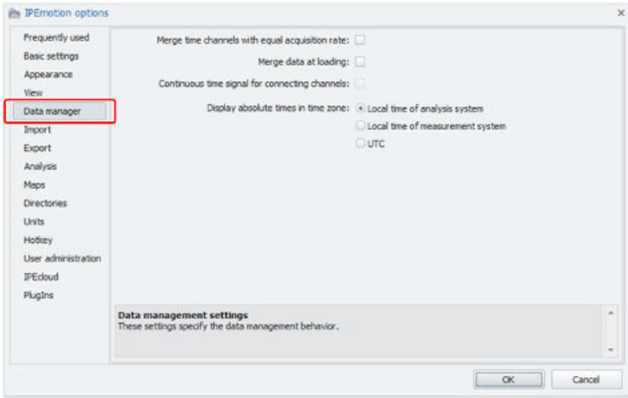
If you activate the check box, all inactive channels from SIGNALS and ACQUISITION will not be visible in VIEW work space.



[OP_41]

This checkbox has impact on the ACQUISITION and will hide inactive formulas, scaling, variable channels (number, status, text) FFT and classification as well. The check box has no impact on the Control module (function generators, controllers, and test sequencing).

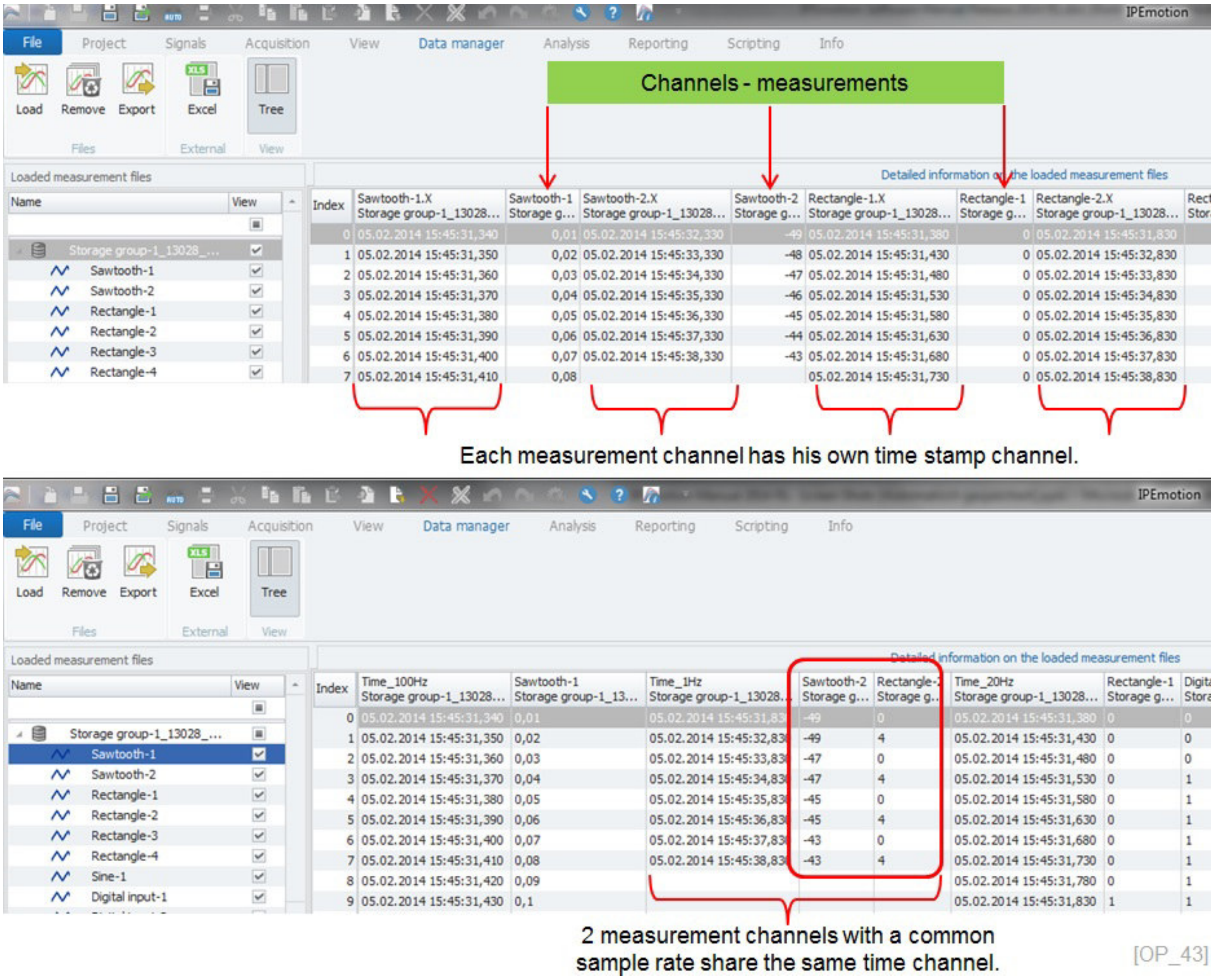
22.6 Data manager



[OP_42]

22.6.1 Merging time channels with equal acquisition rates

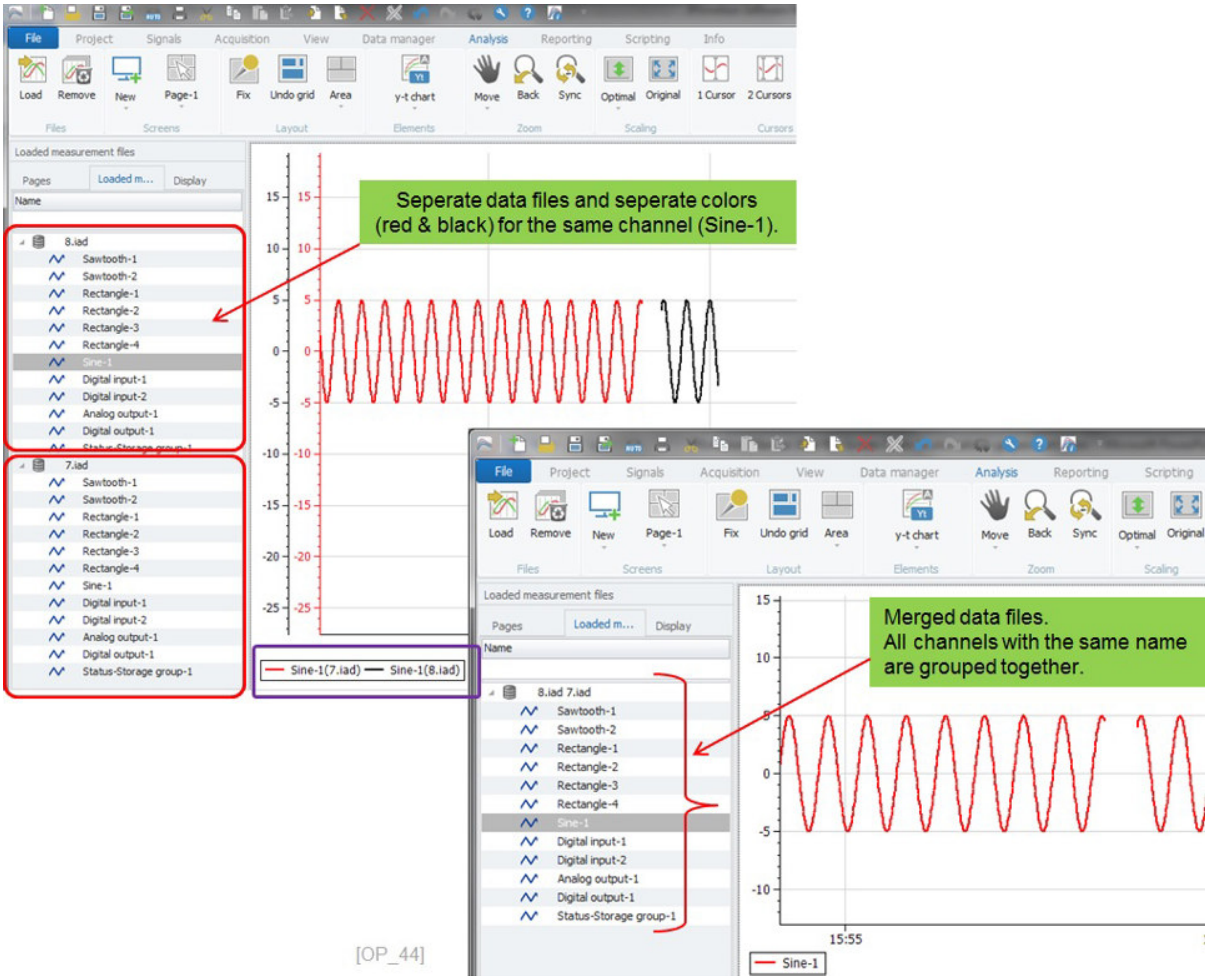
Every measurement channel in the data file has its own time channel. This is related to the storage concept where you can store every channel at an individual storage rate. However, many time channels will make it more difficult to read data presentation in the DATA MANAGER and in the exports to Excel or CSV. Therefore you can merge all time channels with the same sample rate.



[OP_43]

22.6.2 Merge data at loading

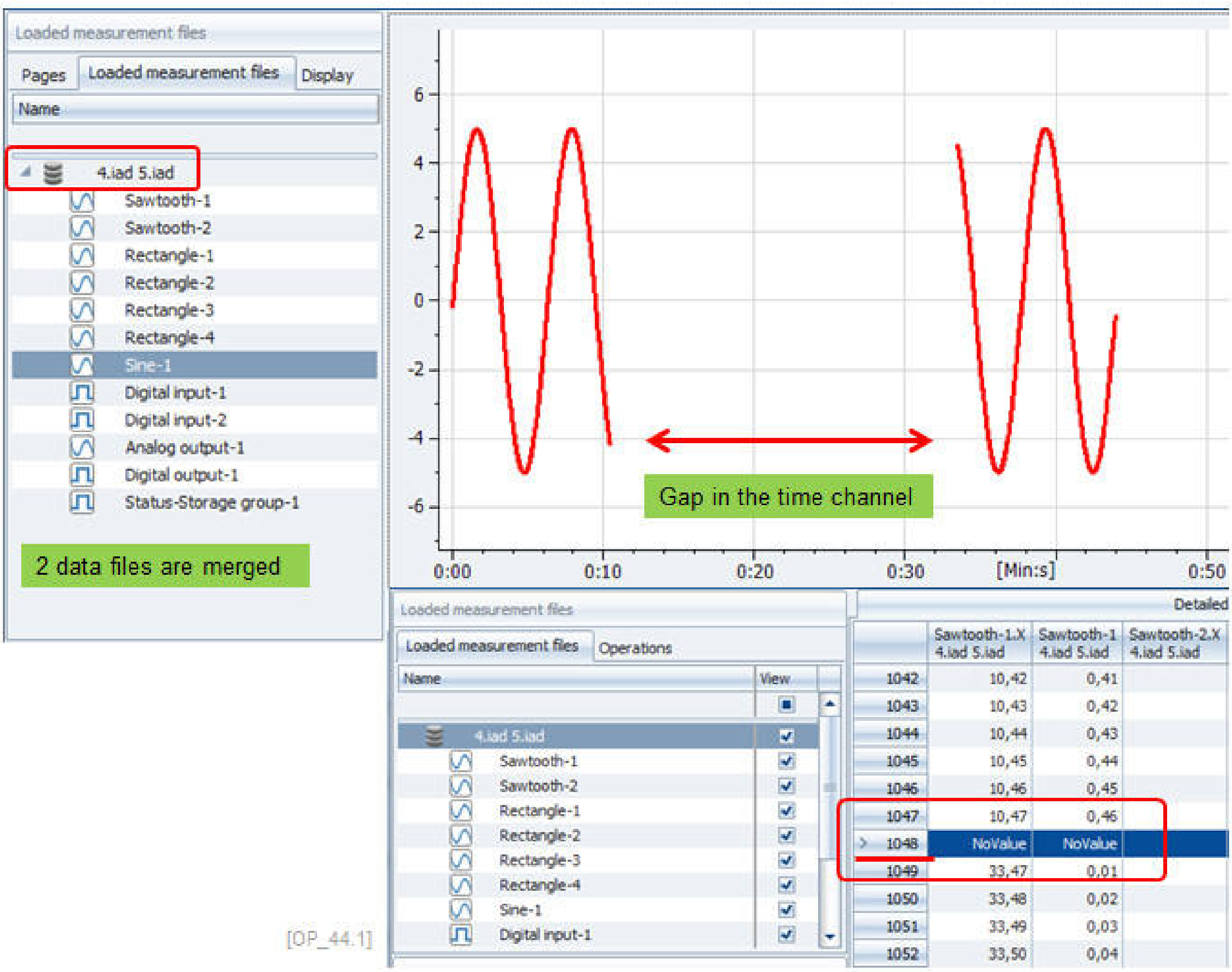
This function is important for the ANALYSIS and DATA MANAGER work space. If you have several data files and you like to merge them, this function is the right approach. You can merge data files which include the same channels or data files that have no channels in common. This function is most effective if you need to merge data files which contain the same measurement channels because the graph is plotted for one channel in one common color. See more details in chapter DATA MANAGER 18.2.


Seperate data files and seperate colors
(red & black) for the same channel (Sine-1).
Sine-1(7.iad) Sine-1(8.iad)
Merged data files.
All channels with the same name
are grouped together.
8.iad 7.iad
Sine-1

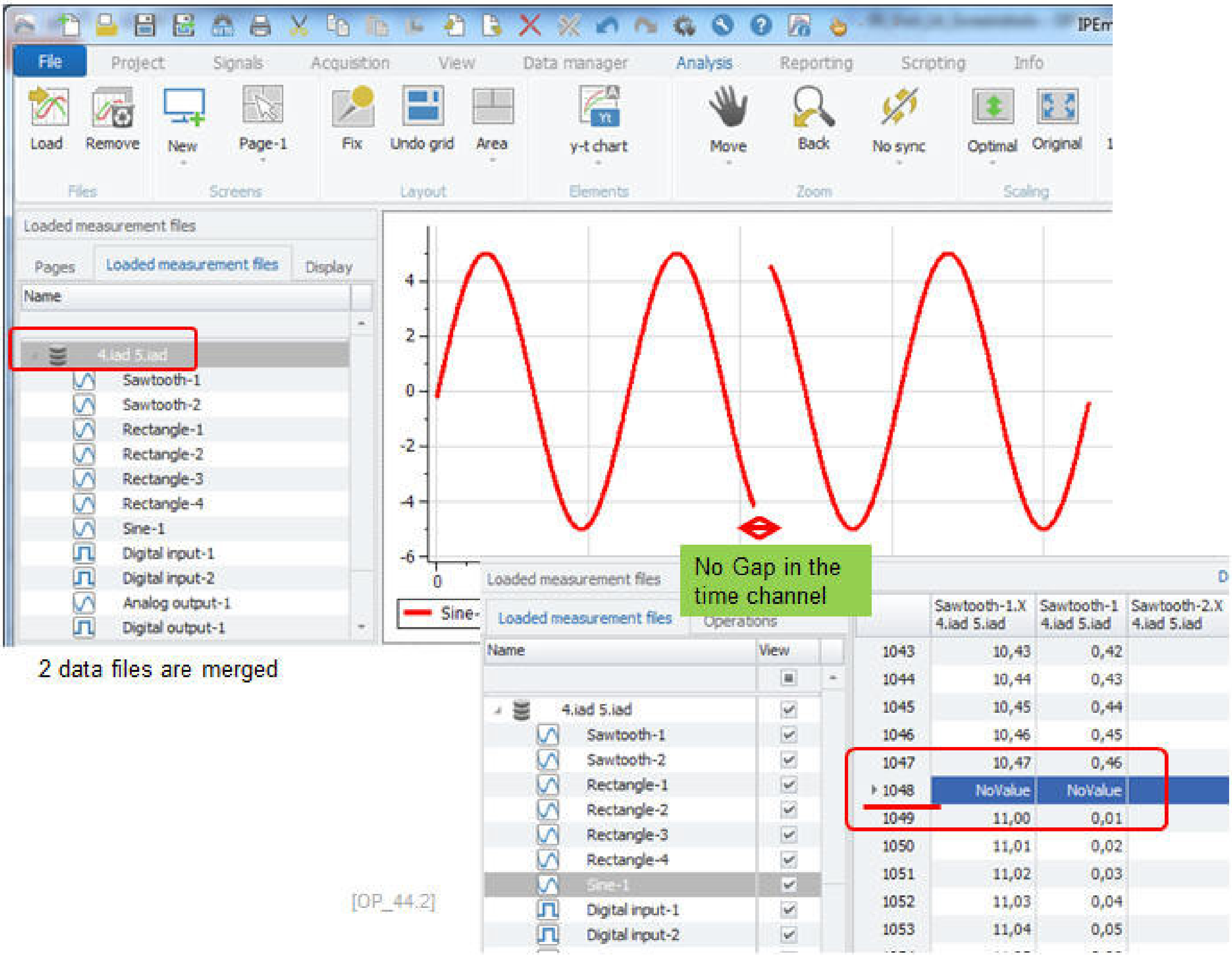
[OP_44]

22.6.3 Continuous time signal for connecting channels

In the setting of the data manger a new check box "continuous time signal for connecting channels" is available which is working only in combination with the checkbox "merge data at loading" discussed above.When you merge your data file at loading the absolute time offset between the different data file is presented in the diagrams as indicated low.

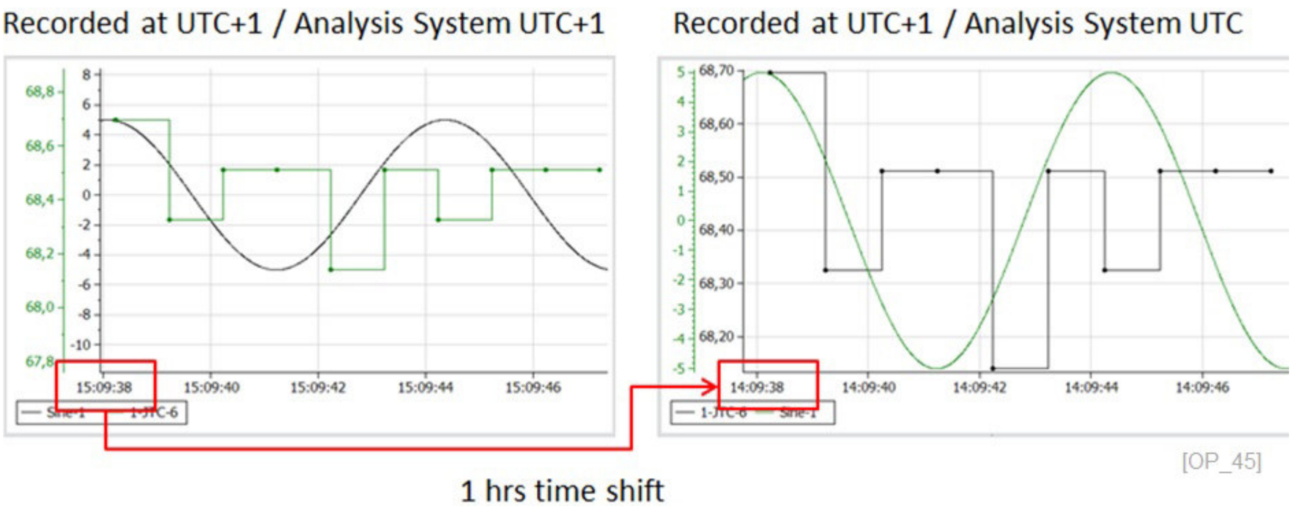


With the new check box you have now the ability cut out the absolute time difference between the different recording events as indicated below.


No Gap in the time channel
2 data files are merged
[OP_44.2]

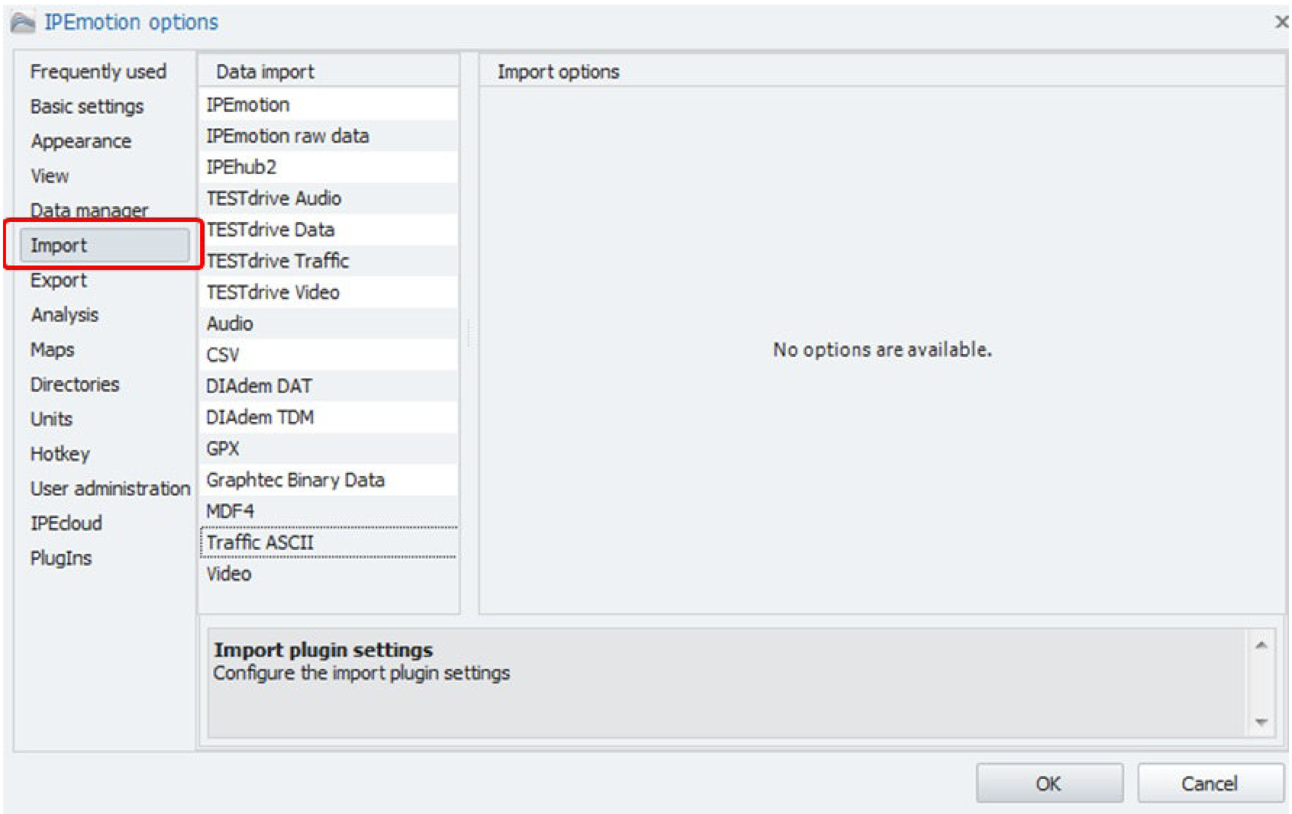
22.6.4 Displaying absolute time in zones

With the new time zone setting it is easier to analyze data files which were recorded in different time zones. For the time line you can select different settings. You can show the data with the time of your analysis system (time of the PC), or you can show the data with the time of recording. Or you can relate the time to the UTC (Universal Time Coordinate). The example below shows how a data file is related to UTC+1 or UTC time.



[OP_45]

22.7 Import



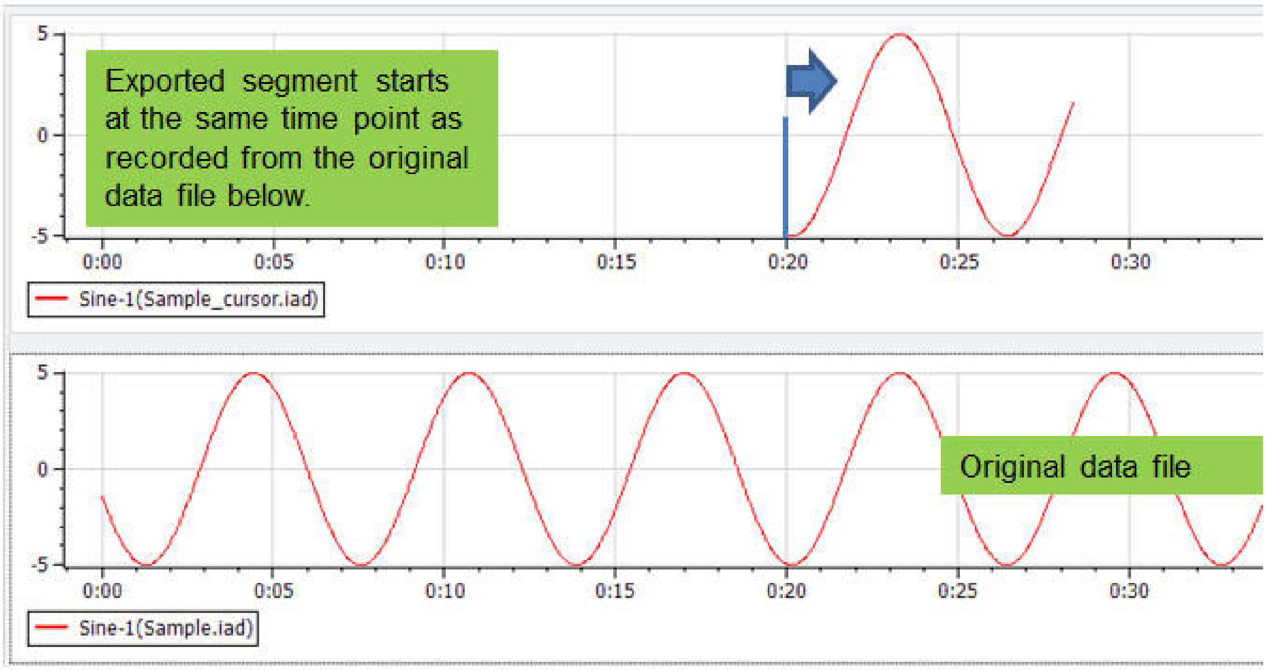
[OP_46]

22.7.1 IPEmotion

IPEmotion imports refer to the proprietary format of the IPEmotion software. All data is originally recorded in the raw data format (IRD). After recording is finished the data is converted into the defined data format. The IAD format is the standard file format.

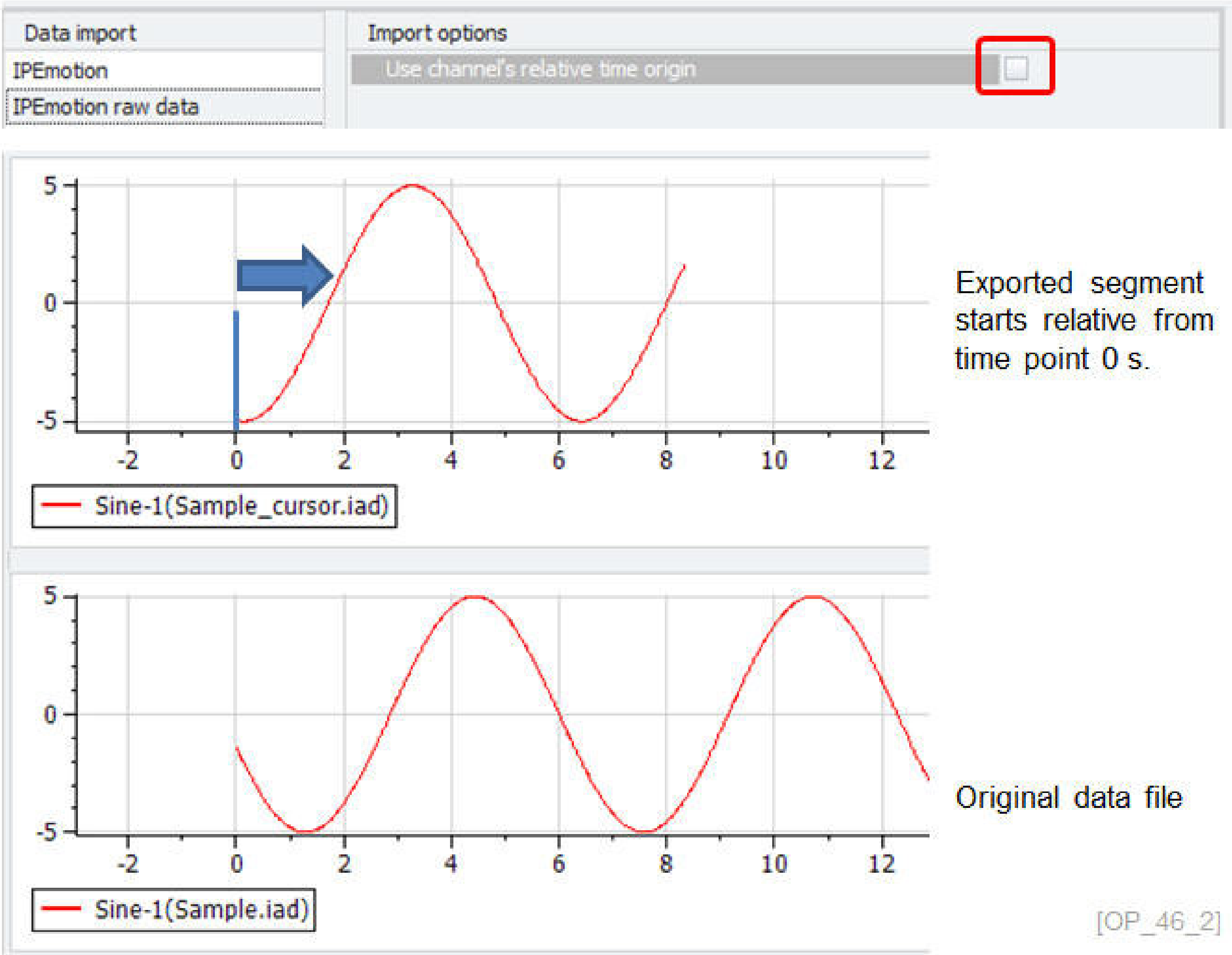
22.7.2 IPEmotion raw data

When you activate data storage all data is initial saved in the raw data format (IRD) files. When the storage process is finished the data is converted to its final format as defined in the file format options of the ACQUISITION work space >Storage groups 13.8.5.
The IRD files are saved to the RawDataBackup directory located in:
Win 7: C:\Users\Public\Documents\IPETRONIK\IPEmotion\RawDataBackup
When you save data in a non IPEmotion (.IAD) format e.g. MDF4, TDM, etc . . . the original raw data file stays in the RawDataBackup directory in case the conversion was not successfully executed. The raw data directory is monitored automatically to ensure that not too many old IRD files remain undeleted. The folder has a active monitoring according to the parameters as defined in chapter 22.11.
The checkbox "Use Channel relative time original" has the following impact during data import. When the check box is activated and you import only a section from your total recording the imported segment will start at the time point of the cursor setting of the export.



[OP_46_1]

However of you deavtivate the chelck box and you reimport the same segment you will see that the segment will start at Zero and ingone the time stamps of the cursor position when thw export was made.



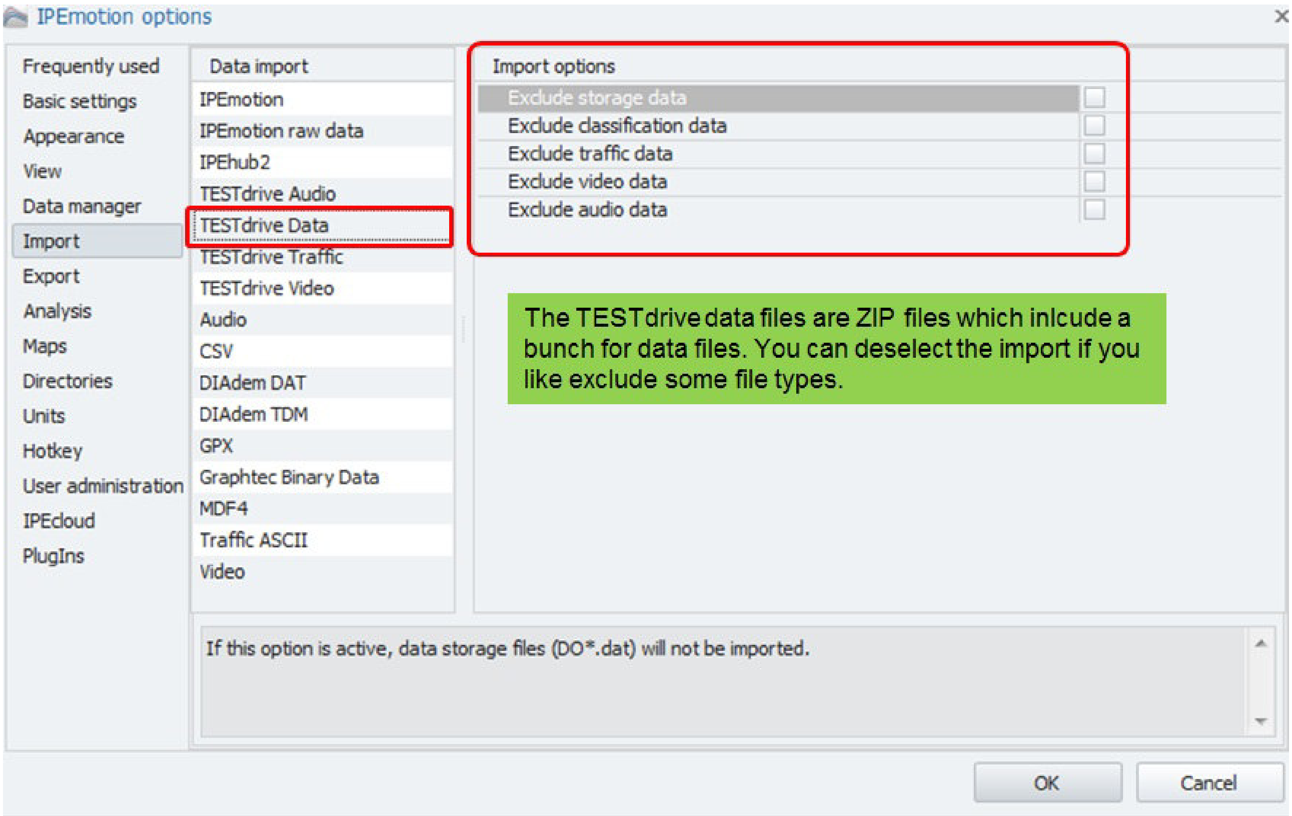
[OP_46_2]

22.7.3 IPEhub2

IPEhub2 is a 2-CAN channel LAN and WLAN interface with internal CAN traffic storage capabilities. The data files are stored in .hrd (Hub Raw Data) format on a removable SD card. These .hrd files can be imported from the CAN card interface through the Protocols PlugIn. For more information about IPEhub2 see chapter 6.3.

22.7.4 TESTdrive

TESTdrive import refers to data files stored on IPETRONIK data loggers. On the logger you will find different file formats and they can be loaded directly to IPEmotion. The overall encompassing data file is TESTdrive Data.



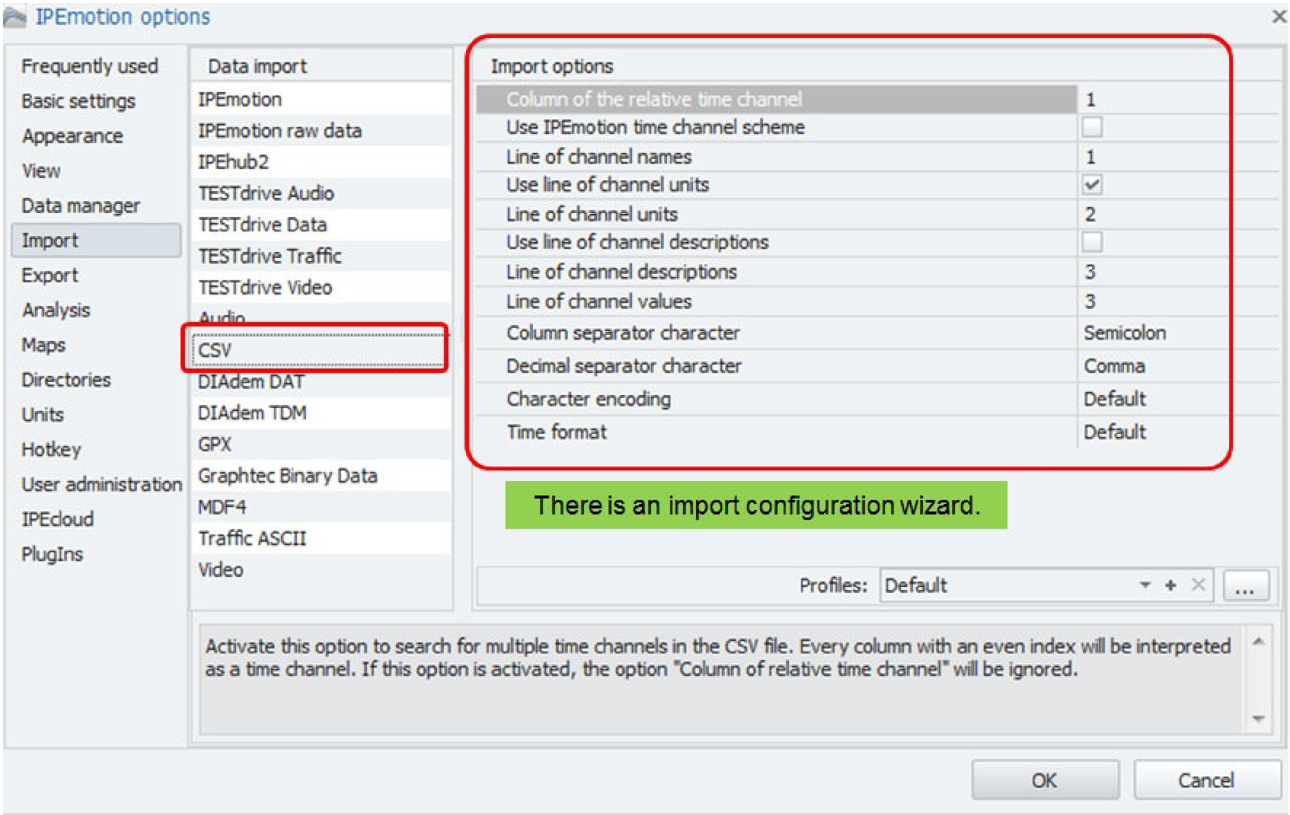
[OP_47]

22.7.5 Audio

The Audio import refers to .WAV files. There are no import settings available.

22.7.6 CSV

For a CSV import you need to define the file structure. The import settings for each individual CSV file are saved as separate individually named templates.

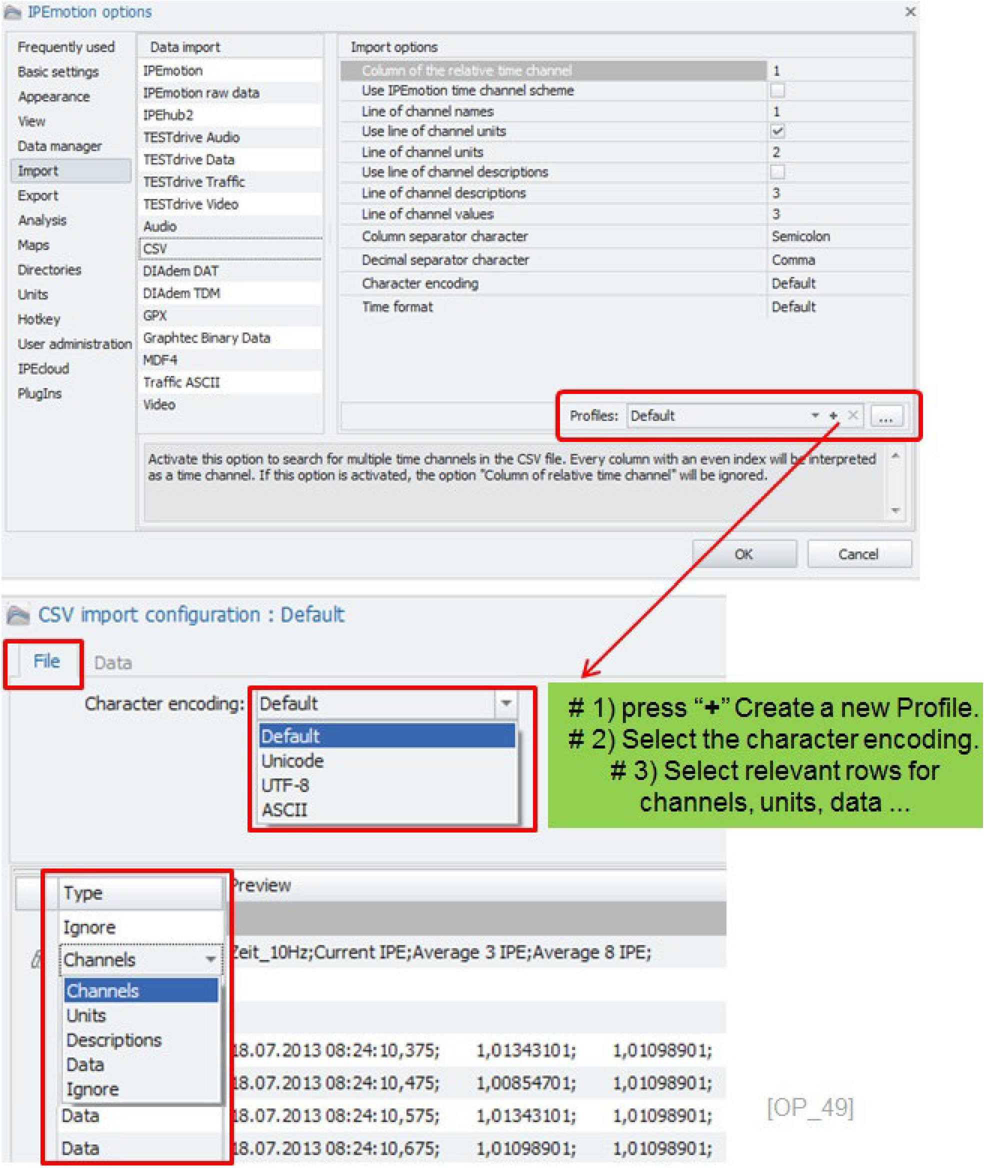


[OP_48]

Defining File Structure:

- Character Encoding — Here users can define the supported data format: UNICODE / UTF-8 / ASCII
- Classifying rows — Channel / Channel Description / Data / Units / Ignore

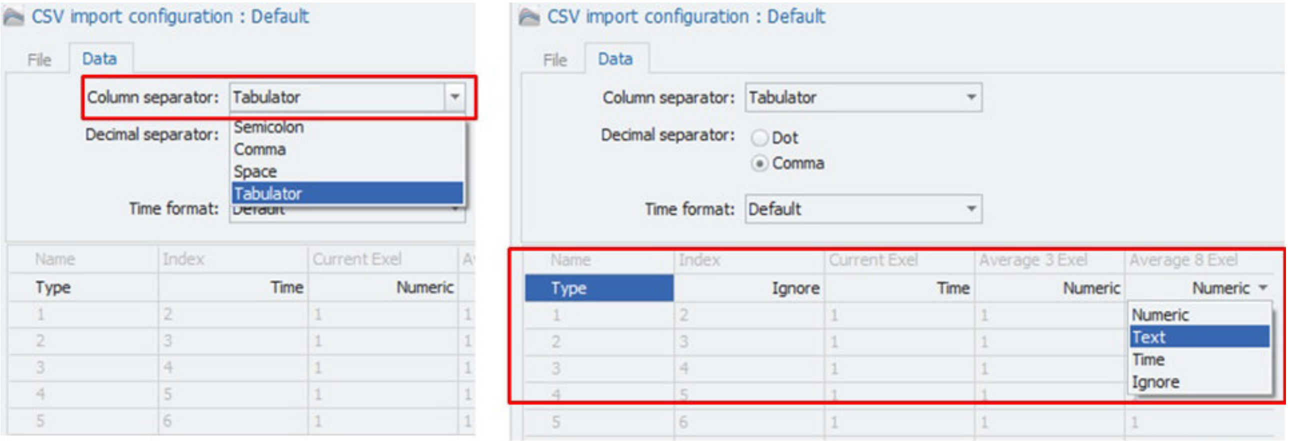
This is an important setting to specify relevant channels which should be considered for the import. It can be specified in which row the channel names or units etc. are included and in what sequence the measurement data display is carried out. Rows which should not be imported can be classified with the ignore status.



[OP_49]

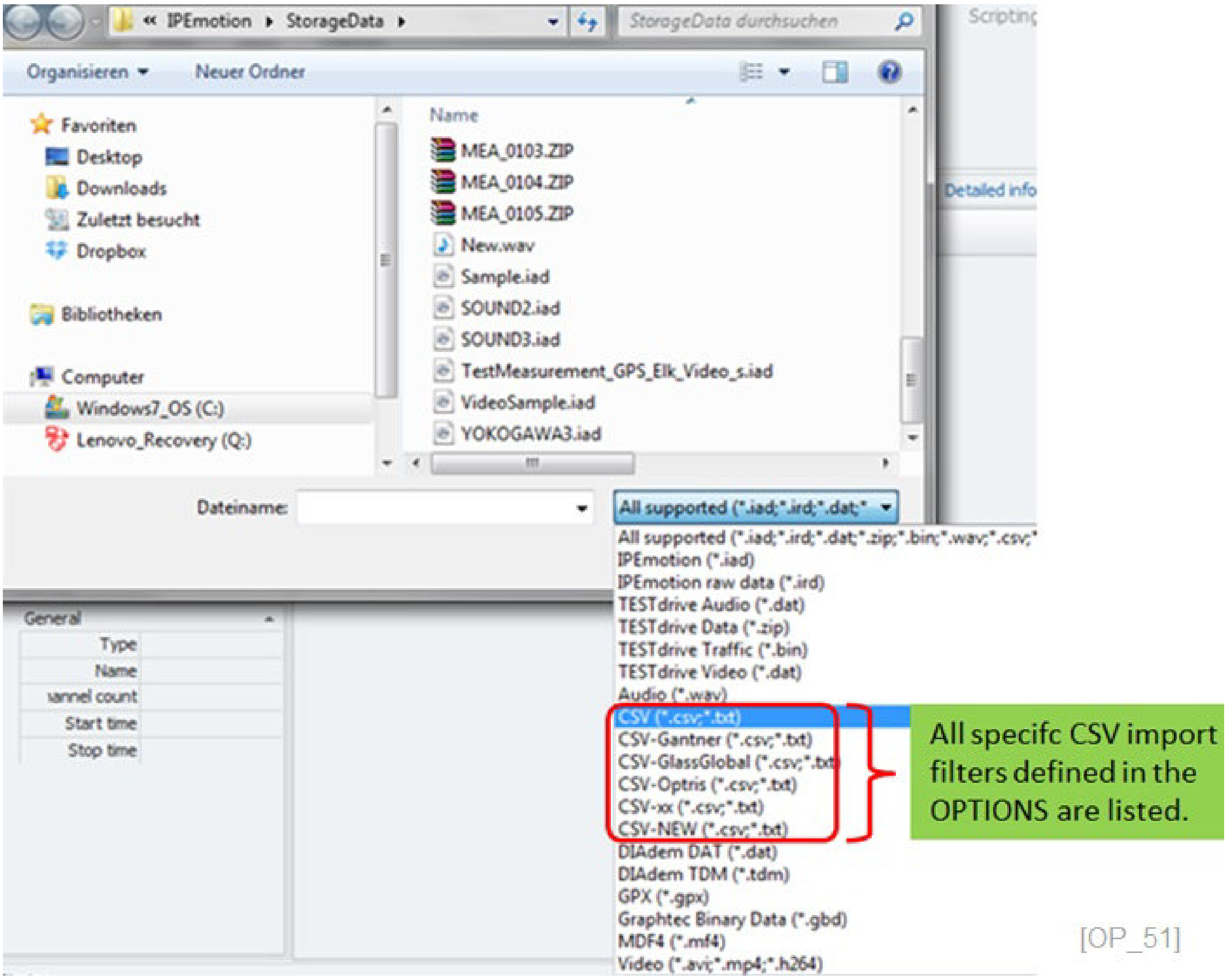
In the data tab sheet, specific settings to the data sets can be configured.

- **Column separator** — Users specify how the columns are to be separated: Tabulator; Semicolon; Comma; Space
- **Decimal separator** — This is important to different EN and non-EN Windows operating systems since comma and dot are used differently. 1,000.00 >EN format; 1.000,00 >non-EN format
- **Channel Grid** — In the channel grid you can define for each column whether it is data or time or it should be ignored during the import.



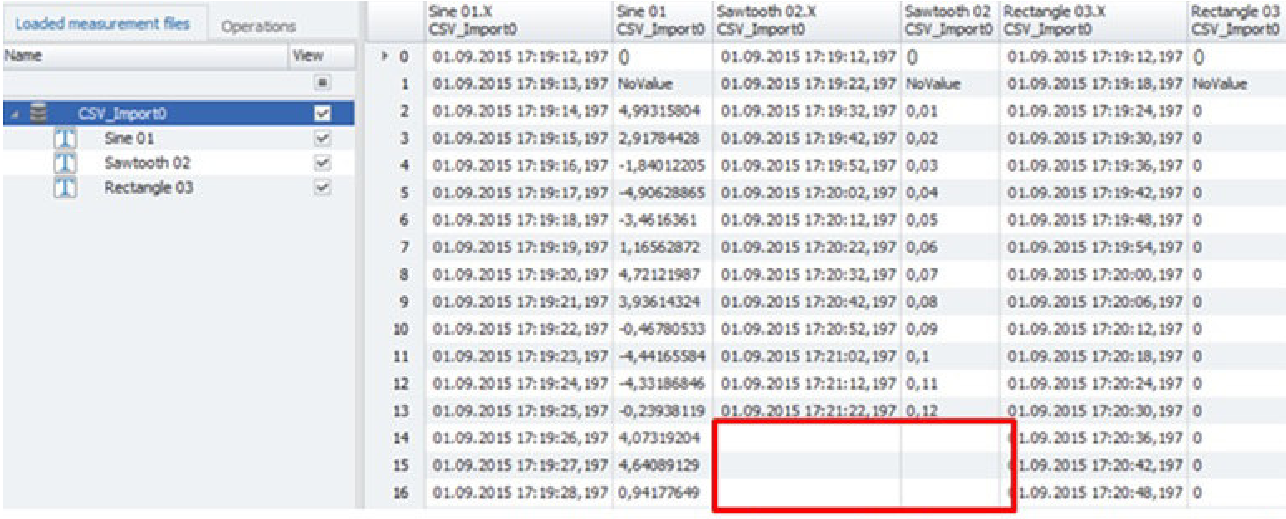
[OP_50]

All CSV specific import templates you have created are listed in the ANALYSIS or DATA MANAGER import dialogs.



[OP_51]

When you import CSV files which include channels with different sample rates the data column length is different for each channel. The empty cells which do not include any time stamps and measurement values are displayed as empty cells.



	Sine 01.X CSV_Import0	Sine 01 CSV_Import0	Sawtooth 02.X CSV_Import0	Sawtooth 02 CSV_Import0	Rectangle 03.X CSV_Import0	Rectangle 03 CSV_Import0
0	01.09.2015 17:19:12,197	0	01.09.2015 17:19:12,197	0	01.09.2015 17:19:12,197	0
1	01.09.2015 17:19:13,197	NoValue	01.09.2015 17:19:22,197	NoValue	01.09.2015 17:19:18,197	NoValue
2	01.09.2015 17:19:14,197	4,99315804	01.09.2015 17:19:32,197	0,01	01.09.2015 17:19:24,197	0
3	01.09.2015 17:19:15,197	2,91784428	01.09.2015 17:19:42,197	0,02	01.09.2015 17:19:30,197	0
4	01.09.2015 17:19:16,197	-1,84012205	01.09.2015 17:19:52,197	0,03	01.09.2015 17:19:36,197	0
5	01.09.2015 17:19:17,197	-4,90628865	01.09.2015 17:20:02,197	0,04	01.09.2015 17:19:42,197	0
6	01.09.2015 17:19:18,197	-3,4616361	01.09.2015 17:20:12,197	0,05	01.09.2015 17:19:48,197	0
7	01.09.2015 17:19:19,197	1,16562872	01.09.2015 17:20:22,197	0,06	01.09.2015 17:19:54,197	0
8	01.09.2015 17:19:20,197	4,72121987	01.09.2015 17:20:32,197	0,07	01.09.2015 17:20:00,197	0
9	01.09.2015 17:19:21,197	3,93614324	01.09.2015 17:20:42,197	0,08	01.09.2015 17:20:06,197	0
10	01.09.2015 17:19:22,197	-0,46780533	01.09.2015 17:20:52,197	0,09	01.09.2015 17:20:12,197	0
11	01.09.2015 17:19:23,197	-4,44165584	01.09.2015 17:21:02,197	0,1	01.09.2015 17:20:18,197	0
12	01.09.2015 17:19:24,197	-4,33186846	01.09.2015 17:21:12,197	0,11	01.09.2015 17:20:24,197	0
13	01.09.2015 17:19:25,197	-0,23938119	01.09.2015 17:21:22,197	0,12	01.09.2015 17:20:30,197	0
14	01.09.2015 17:19:26,197	4,07319204			01.09.2015 17:20:36,197	0
15	01.09.2015 17:19:27,197	4,64089129			01.09.2015 17:20:42,197	0
16	01.09.2015 17:19:28,197	0,94177649			01.09.2015 17:20:48,197	0

Empty lines are interpreted by empty cells. [OP_52]

22.7.7 DIAdem DAT

This import refers to the import to data files created with the DIAdem software. No import settings are defined.

22.7.8 DIAdem TDM

This import refers to the import to data files created with the DIAdem software. No import settings are defined.

22.7.9 GPX

The GPX import refers to files which include GPS data (Longitude, Latitude, Speed, Time and Altitude)

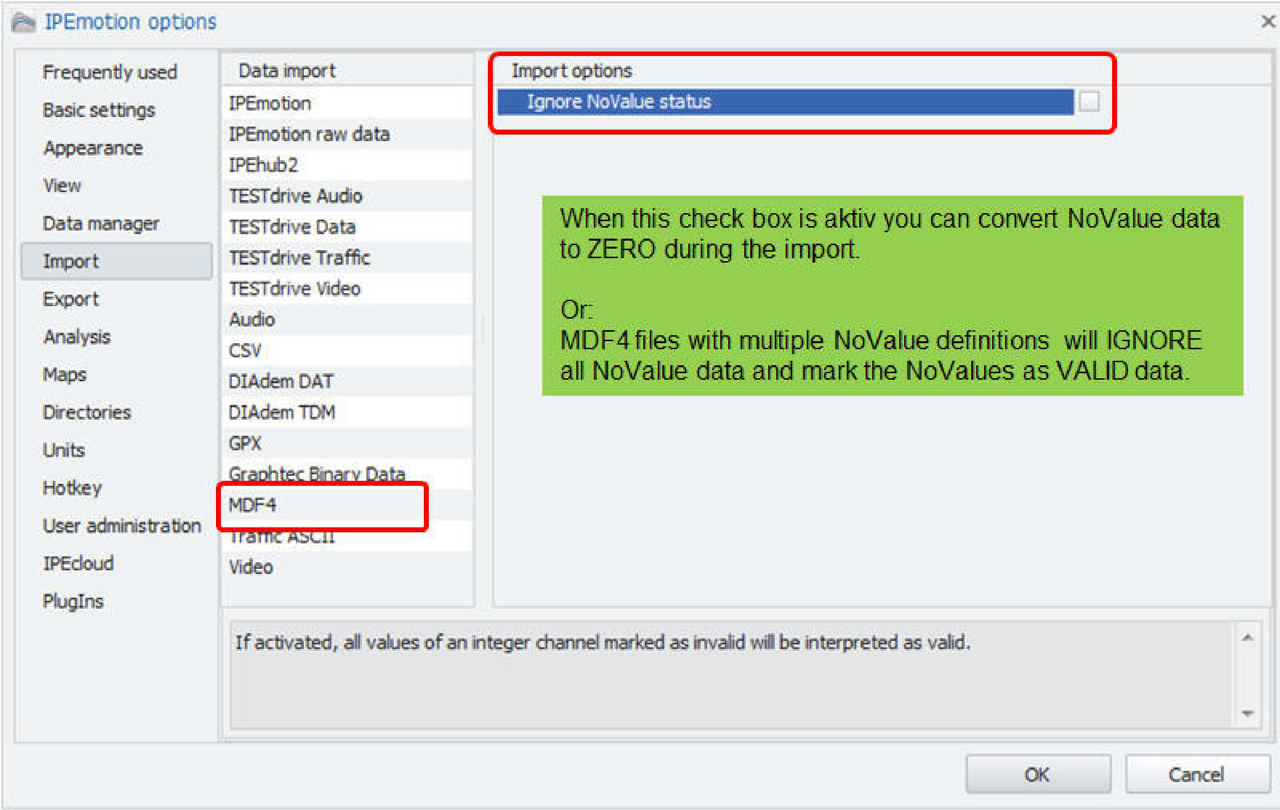
22.7.10 Graphtec data

Graphtec import refers to binary data files (.gbd) from Graphtec loggers GL820-, GL 900-, GL7000-Series.

22.7.11 MDF4

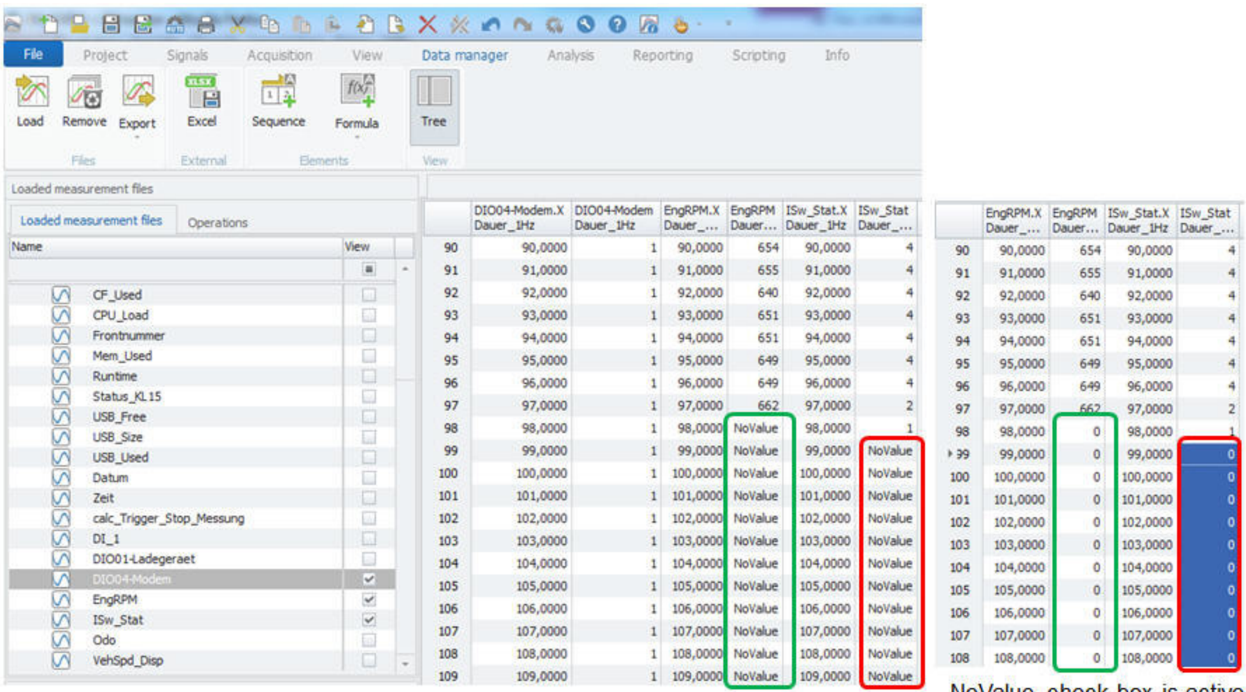
The IPETRONIK data loggers support with TESTdrive V03.54.00 event based measurements. The event measurements are stored in the TESTdrive MEA.ZIP file in the MDF4 format and can now be analyzed in IPEmotion.
The MDF import supports MDF 4.1 format as well.
The import setting for MDF4 support a check box for a dedicated NoValue treatment. MDF4 can support different NoValue entries. The new checkbox âĂIJignore no value statusâĂİ has to impacts.

- Importing MDF4 files with one NoValue definition the NoValue data is converted to ZERO (screens below)
- Importing MDF4 files with multiple NoValue definitions will ignore all NoValues and mark them as VALID data.



[OP_52.1]

The example below is indicating how one no value definition "NoValue" can be converted to ZERO.



NoValue check box is disabled in the import setings.

NoValue check box is active
NoValue = 0

[OP_52.2]

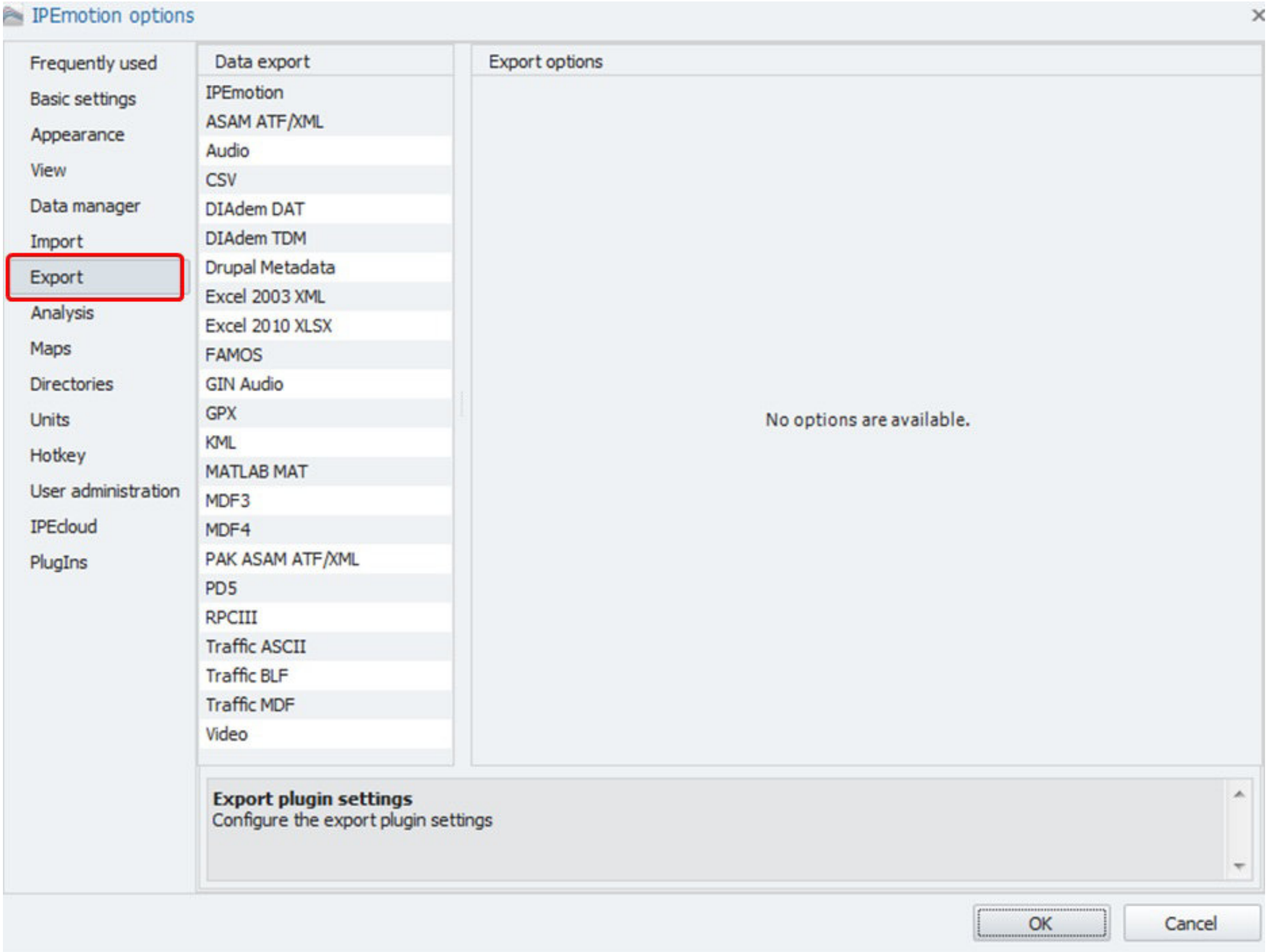
22.7.12 Traffic ASCII

Refers to CAN and FlexRay traffic ASCII files. The ASCII traffic files can be used in the traffic generator and in the traffic analyzer instrument in the ANALYSIS work space 19.17.1.

22.7.13 Video

Refers to AVI video files.

22.8 Export



[OP_53]

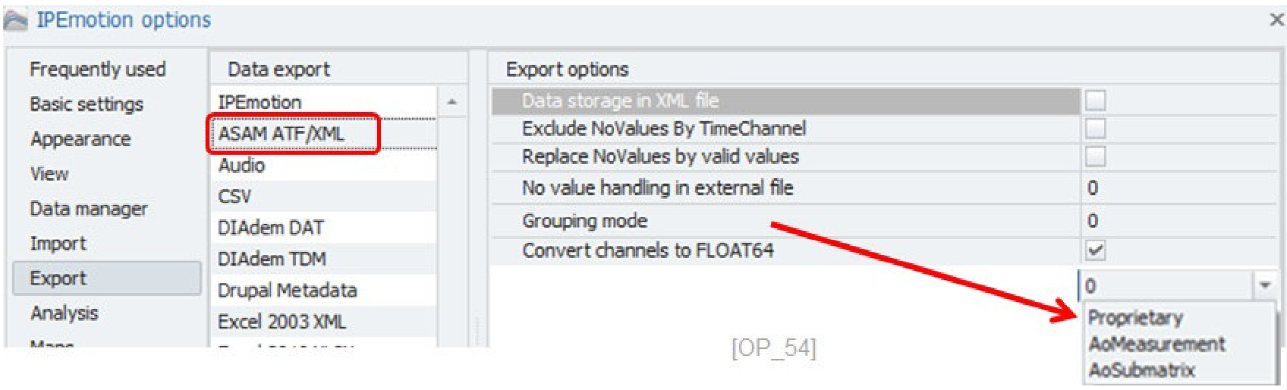
22.8.1 IPEmotion

Any file loaded into IPEmotion can be exported to the IPEmotion IAD format.

22.8.2 ASAM / ATFX

Configuration options:

- No value handling — Select: Proprietary or Flags
- Grouping mode — Select: Proprietary or AoMeasurement or AoSubmatrix
- Convert to FLOAT 64 — When this check box is deactivated the values are exported in the native format.



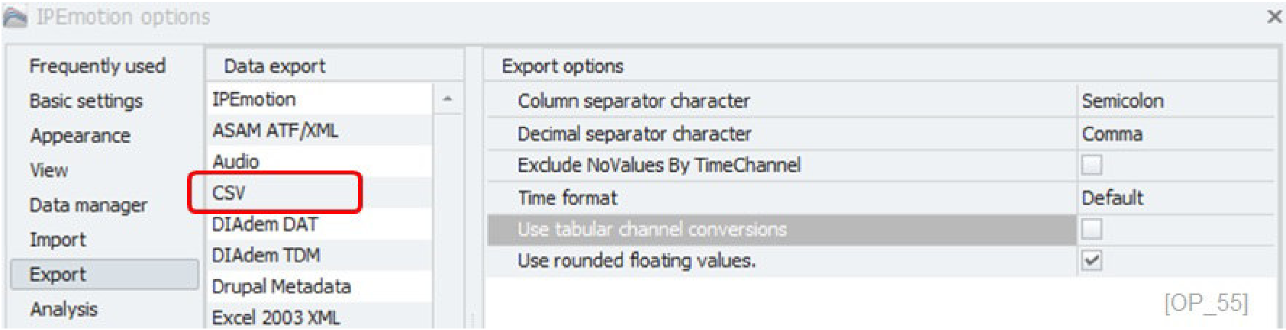
[OP_54]

22.8.3 Audio

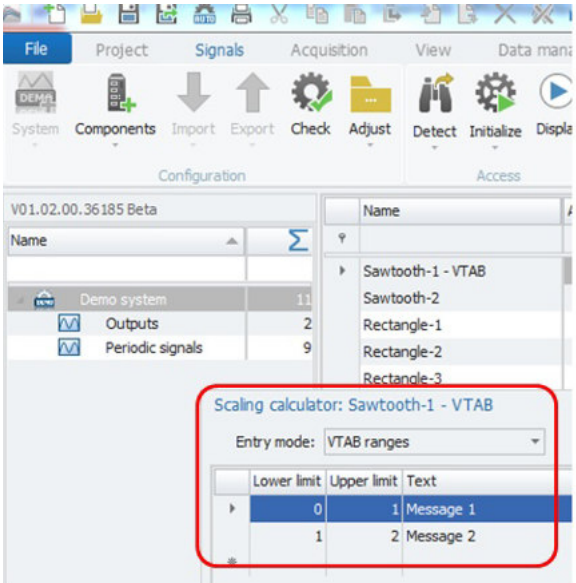
No configuration options. See chapter SIGNALS for additional information about the task settings in the Format tab sheet for Audio recording 11.6.4.

22.8.4 CSV

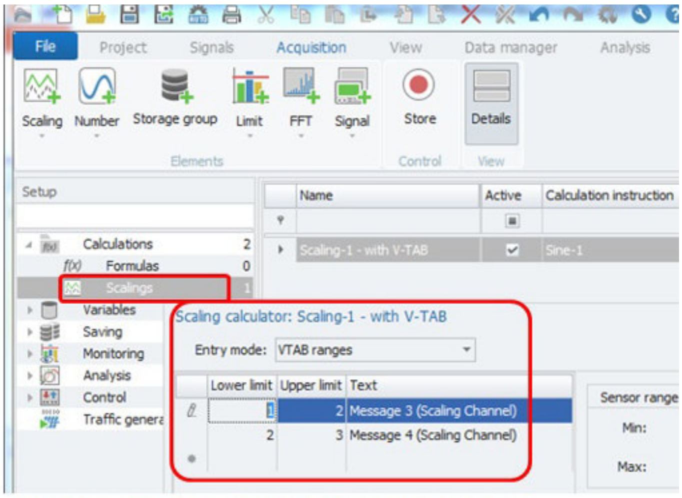
Configuration options



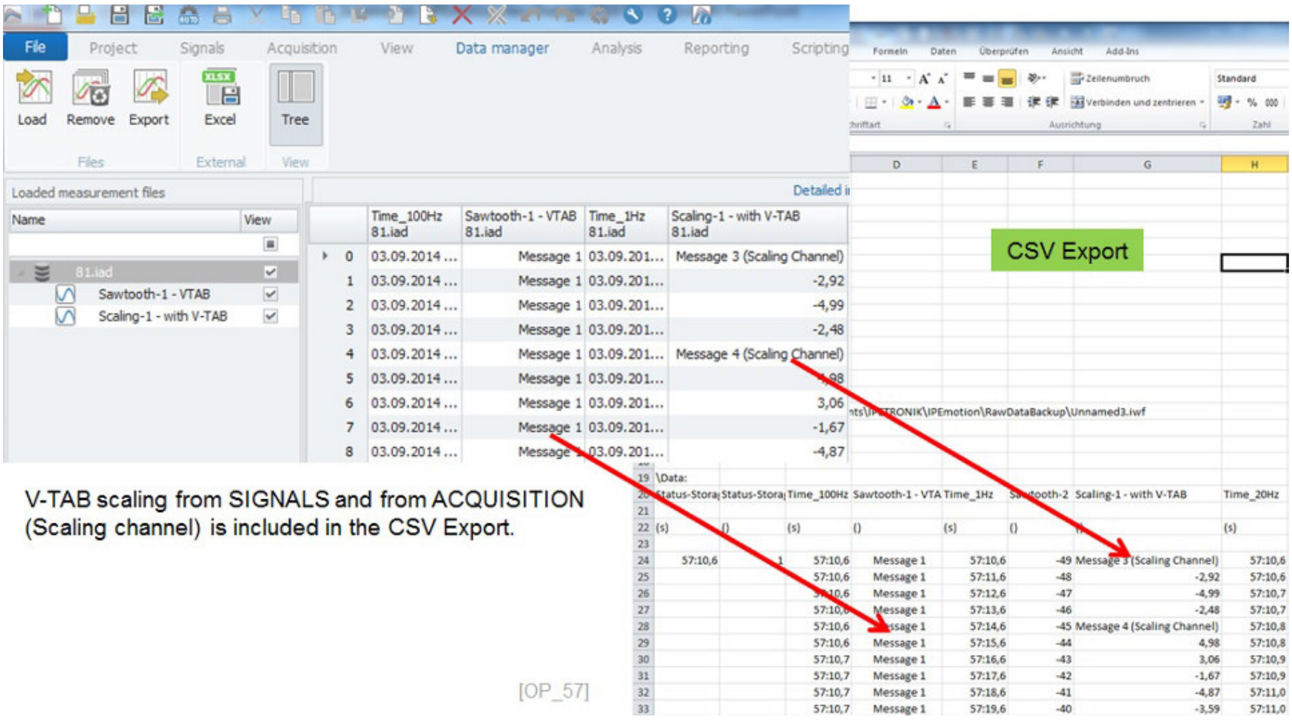
- ► Use tabulator channel conversion — When this check box is activated the CSV Export includes the V-TAB scaling from the scaling calculator.



V-TAB scalings from SIGNALS work space (Channels).



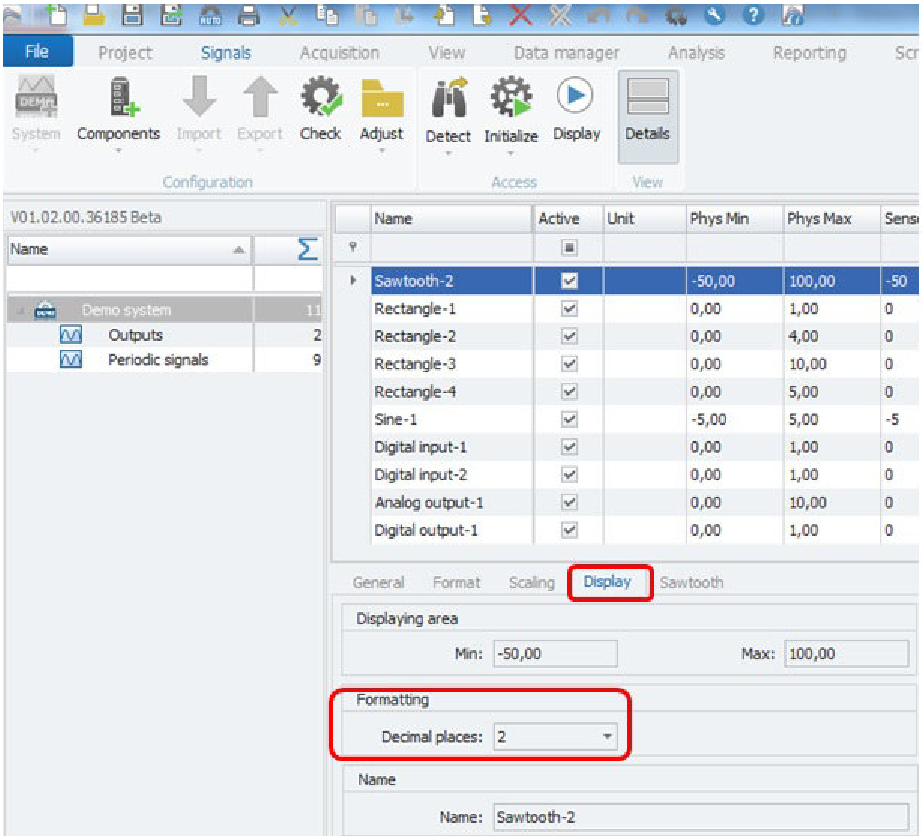
V-TAB scaling from ACQUISITION work space (CALCULATION > Scaling channel) [OP_56]



V-TAB scaling from SIGNALS and from ACQUISITION (Scaling channel) is included in the CSV Export.

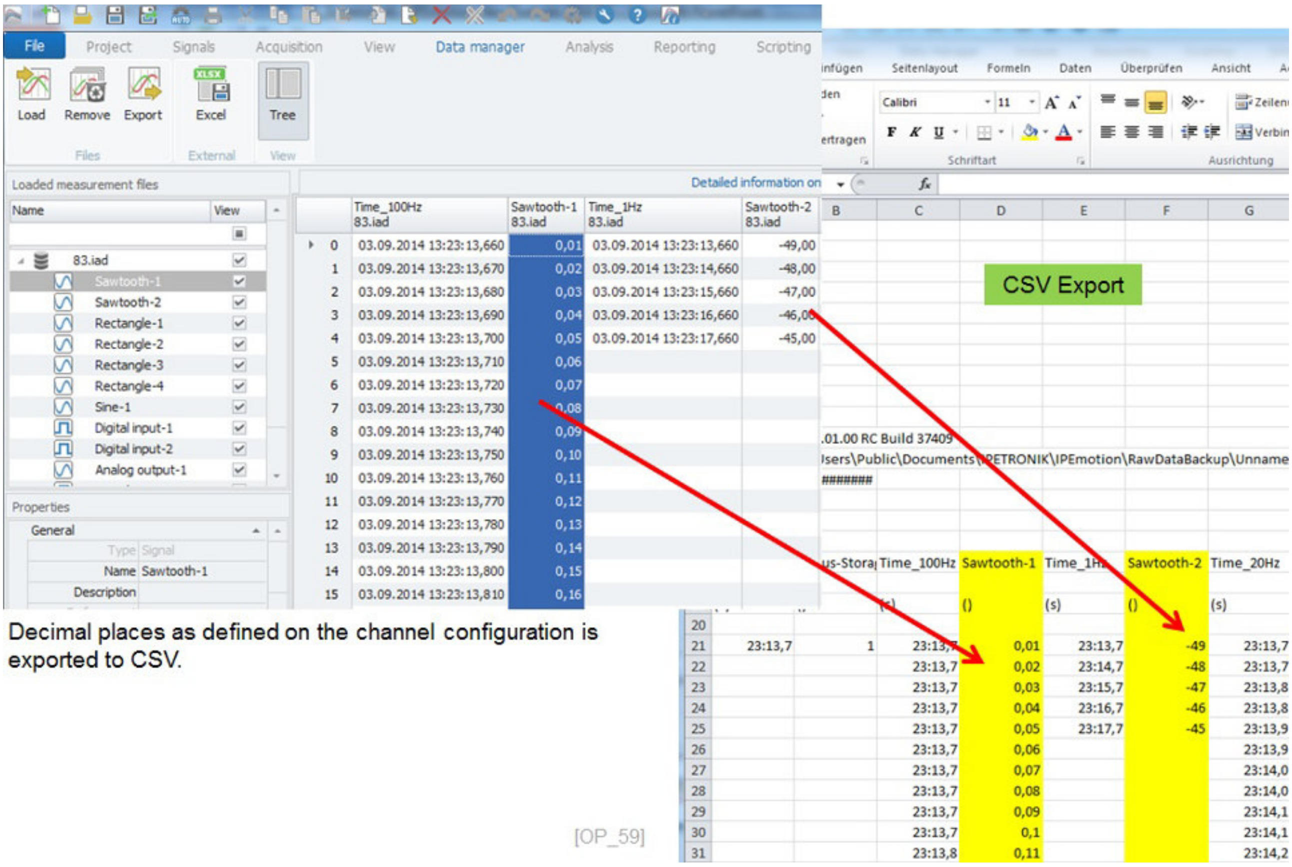
[OP_57]

- Use rounded floating values — This checkbox is by default activated. When the checkbox is activated a rounded value is exported. You can define the decimal places in SIGNALS on the Display tab sheet. In ACQUISITION you can define on Formulas, Scaling channels and Number and Status variables the decimal place format.



[OP_58]

DATA MANAGER and the CSV Export show the same number of decimal places.



Decimal places as defined on the channel configuration is exported to CSV.

[OP_59]

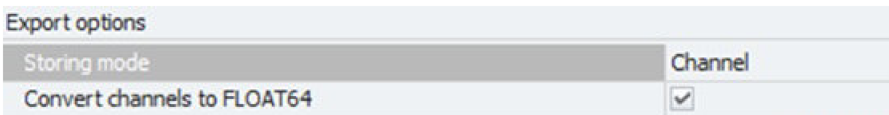
22.8.5 DIAdem DAT

Configuration options

[OP_60]

22.8.6 DIAdem TDM

Configuration options



[OP_61]

The DIAdem TDM Export supports now the following data formats when the check box is deactivated:

- UInt8, UInt16, UInt32, UInt64
- Int8, Int16, Int32, Int64
- Float
- Other TDM native data formats will be exported as Double.

When you activate the check box “Convert channel to FLOAT 64” all channels will be exported with this format.

22.8.7 Drupal Metadata

No configuration options. This is a specific XML export for the IPETRONIK website.

22.8.8 Excel 2003 XML and XLS

Configuration options

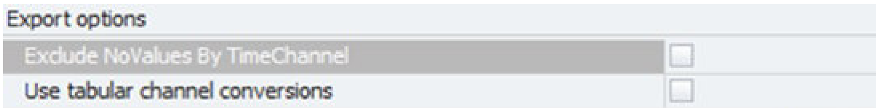
[OP_62]

The Export is supporting two additional configuration options.

- Use rounded floating values — See chapter CSV Export 22.8.4.
- Use tabulator channel conversion — See chapter CSV Export 22.8.4.

22.8.9 Excel 2010 XLSX

Configuration options

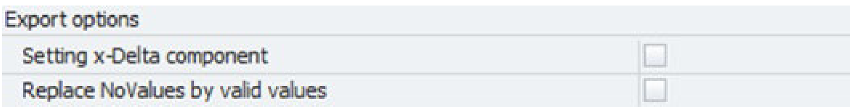


[OP_63]

- Use tabulator channel conversion — See chapter CSV Export22.8.4.

22.8.10 FAMOS

Configuration options



[OP_64]

22.8.11 GIN Audio

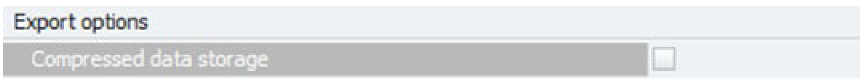
No configuration options.
The GIN Audio export considers only TESTdrive audio recording based on CAN traffic. For more details see 18.7.4.

22.8.12 GPX

No configuration options. See chapter SIGNALS for additional information about the task settings in the Format tab sheet when GPX (GPS position) data is recorded 11.6.4.

22.8.13 Matlab

Configuration options:



[OP_65]

22.8.14 MDF 3

Configuration options:

Export options	
Exclude NoValues By TimeChannel	☐
Use tabular channel conversions	☐
Use reference as channel name	☐
Replace NoValues by valid values	☐

[OP_66]

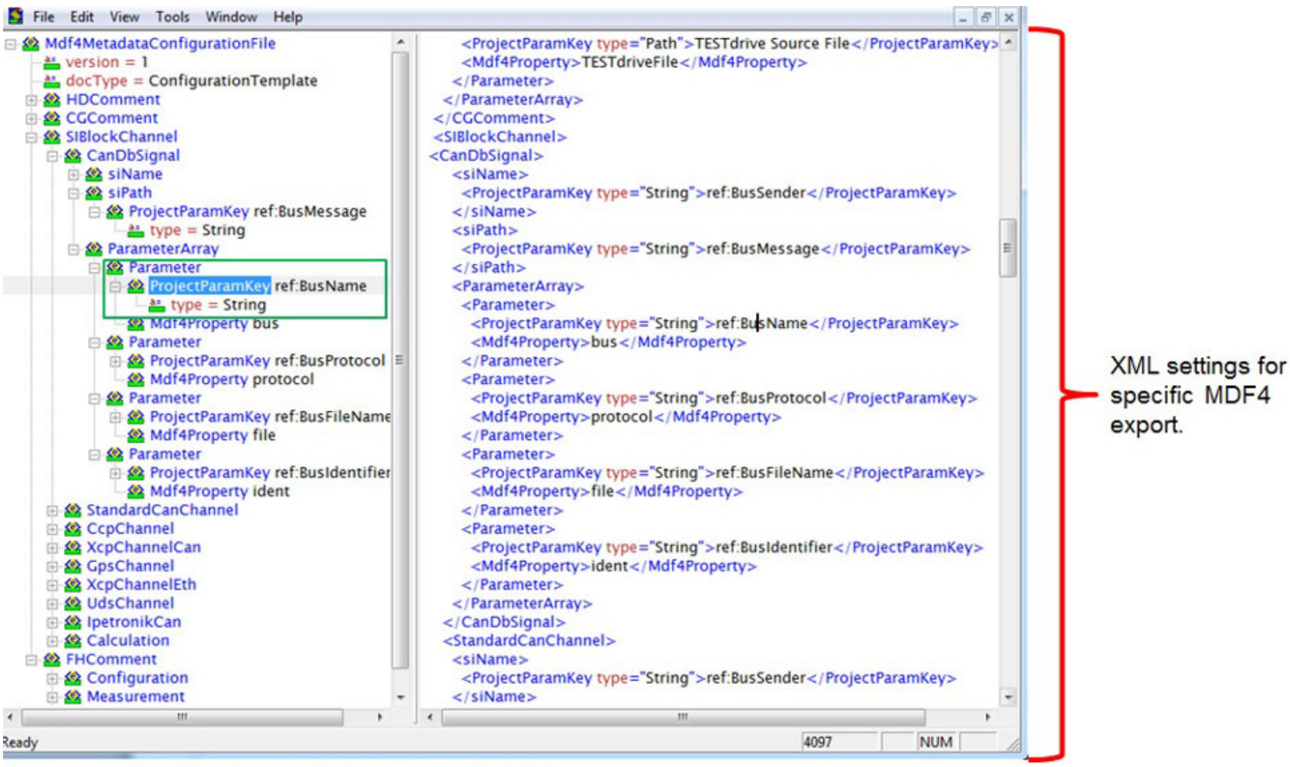
22.8.15 MDF 4

Configuration options:

Export options	
Use tabular channel conversions	☐
Use event blocks	☐
Write data as zipped block	☐
Minimum block size to zip data	10000
Uncompressed data block size	1048576
Compression level	1
Write source reduction block	☐
Factor to the minimum sample interval's length	50
First source reduction block's samples	1000000
Second source reduction block's samples	100000
Third source reduction block's samples	10000

[OP_67]

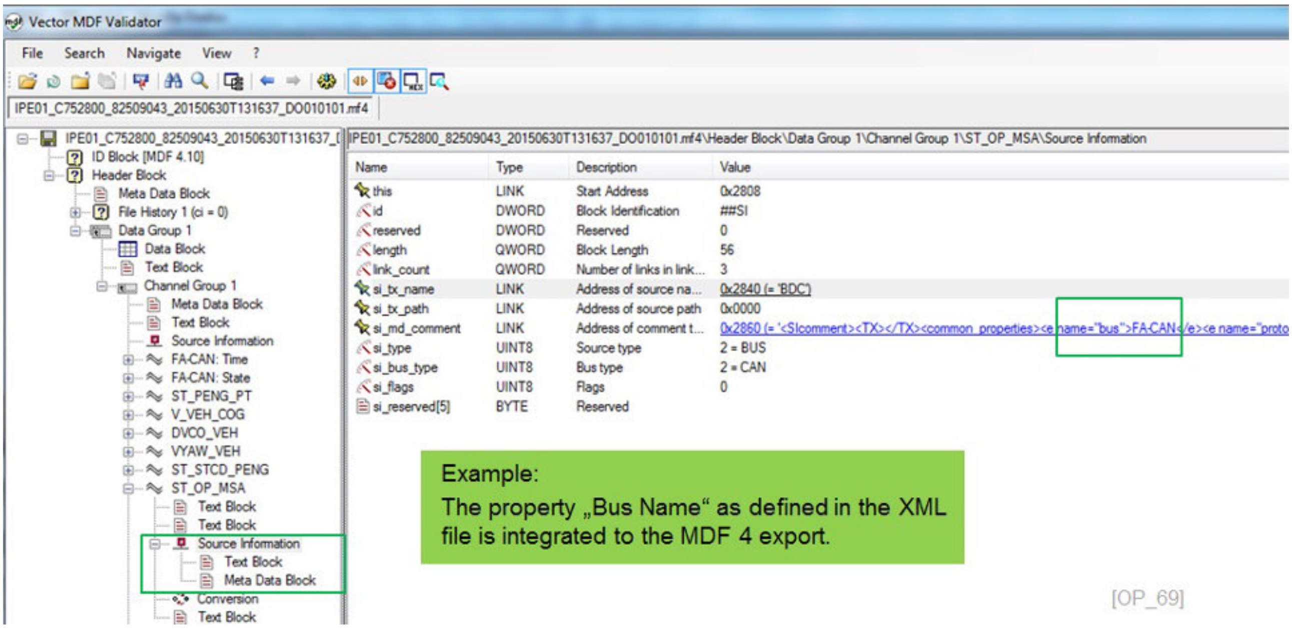
The MDF4 export is supporting text channels too.
With a specific **Mdf4MetadataConfigurationFile.XML** file you can define how the data is converted into the MDF format. The XML file has to be stored in the following directory:
C:\ProgramData\IPETRONIK\IPEmotion 2016 R1 RC\ DataPluginSettings\ **Mdf4MetadataConfigurationFile.xml**



Example of **Mdf4MetadataConfigurationFile.XML** [OP_68]

The MDF4 validator software shows show as an example how one parameter “Bus Name” of the XML file are integrated into the MDF4 data file structure.

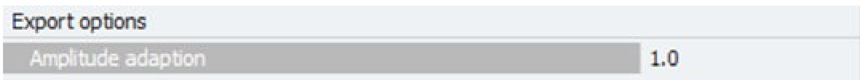
MDF file structure – MDF validator software



[OP_69]

22.8.16 PAK ASAM ATF/XML (license in Acoustic Module)

Configuration options



[OP_70]

This storage format especially supports data post processing in the Müller BBM PAK acoustic software package. The PAK ATFX export was developed to export data in the file format of the PAK acoustic software system from Müller BBM. The export considers all measurement signals in the data file with a sample rate below or equal to 1 kHz sample rate as a reference signal for the Campbell instrument in the PAK software. With a reference signal the Campbell diagram can display the results along other measurement parameters than time for example along engine RPM. This export is licensed together with the Acoustic module 4.2.3. When you store or export the data into PAK ASAM ATFX/XML format you need to consider the amplitude adaption (damping) factor. The default damping factor is 1.0. This factor must be adapted for data recordings of the **IPEaudio/M-LOG** / **M-LOG V3** measurement system. In this case the damping factor has to be adjusted according to the gain settings and microphone sensitivity as indicated in the table below.

IPEmotion / Options settings ATFX-Export for PAK

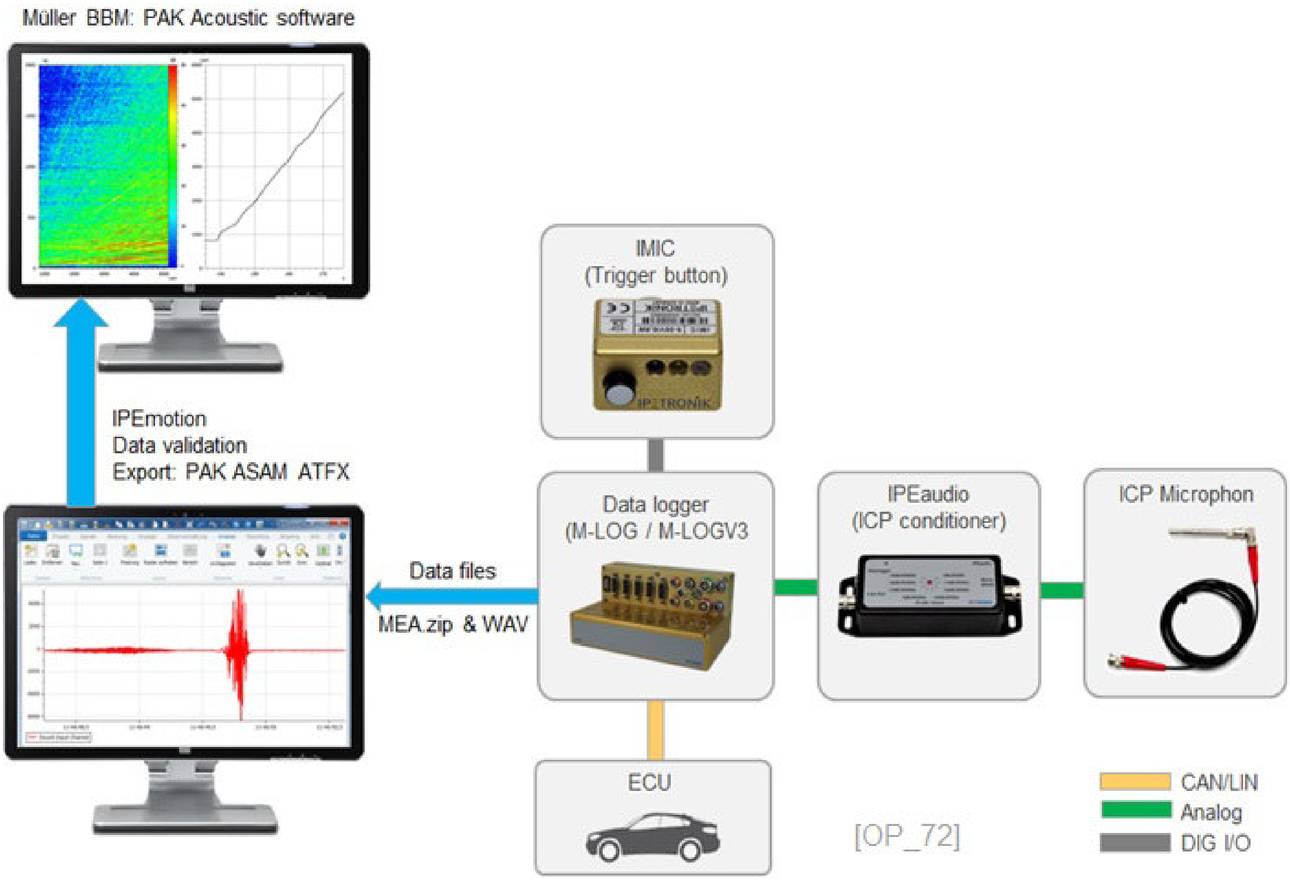
Amplitude Adaptation factors related on the IPEadio gain factor and microphon sensitivity.

		Gain IPEaudio	Gain IPEaudio	Gain IPEaudio	Gain IPEaudio
		0 dB	**10 dB**	**20 dB**	**30 dB**
Microphon sensitivity	10 mV/Pa	0,00557032	0,00176149	0,00055703	0,00017615
Microphon sensitivity	40 mV/Pa	0,00111406	0,00035230	0,00011141	0,00003523
Microphon sensitivity	50 mV/Pa	0,00089125	0,00028184	0,00008913	0,00002818

[OP_71]

In general the factor should be defined for every microphone / signal conditioner device individually.

Below is an overview of the IPEaudio/M-Log measurement chain. If you use the **IPEaudio/M-LOG** / **M-LOG V3** measurement chain the factor is depending on the sensitivity of the microphone and the gain factor of the IPEaudio signal conditioner. Refer also to chapter DATA MANAGER >PAK ASAM ATF/XML 18.7.3.
The following diagram shows the IPEaudio measurement setup.



[OP_72]

22.8.17 RPCIII

Configuration options

[OP_73]

22.8.18 TRAFFIC ASCII

No configuration options

22.8.19 TRAFFIC BLF

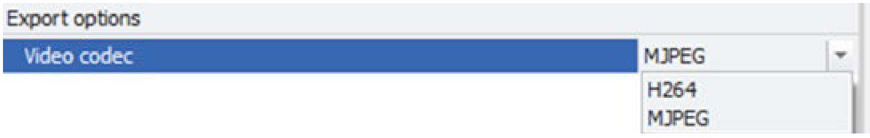
No configuration options

22.8.20 TRAFFIC MDF

No configuration options

22.8.21 VIDEO

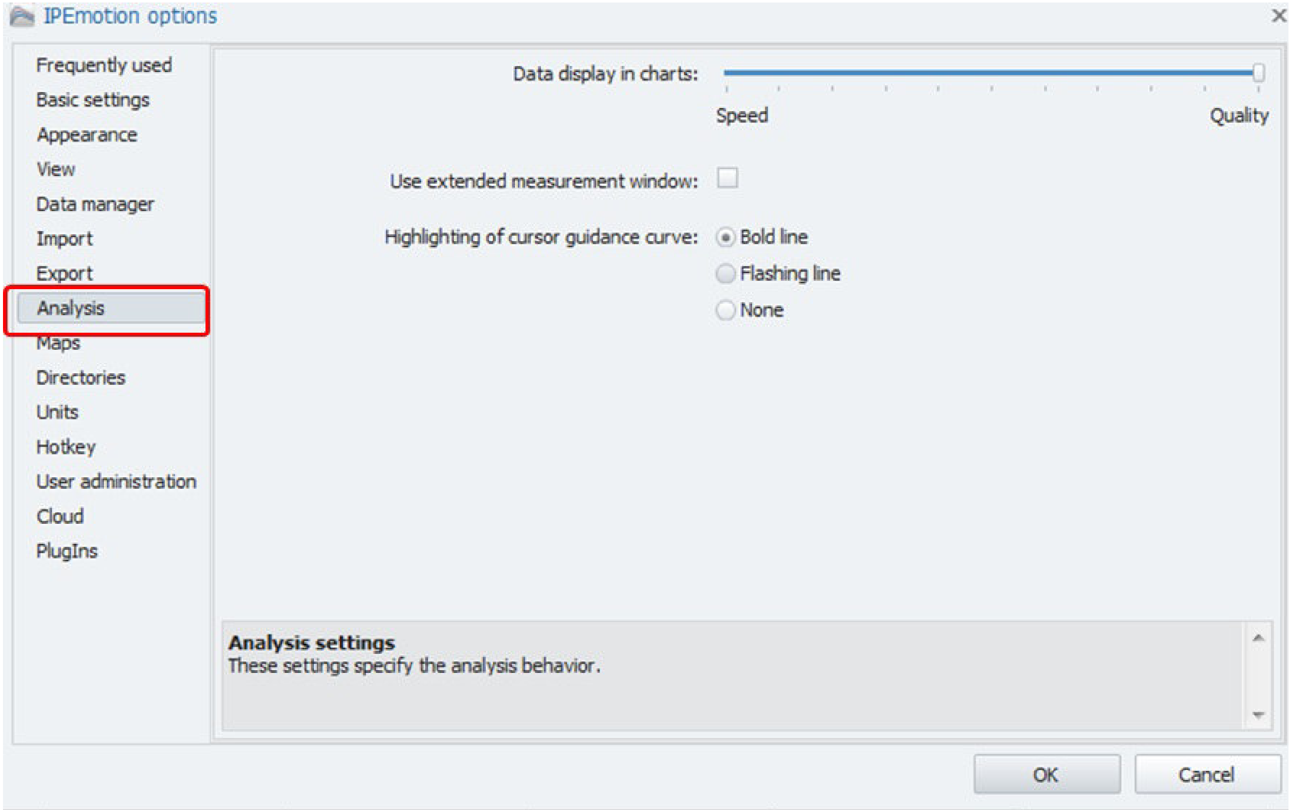
Configuration options



[OP_74]

For the AVI export it can be specified in the options if the data is compressed in the MJPEG (Motion JPEG) format or the h264 format. See more details chapter DATA MANAGER 18.7.2.

22.9 Analysis



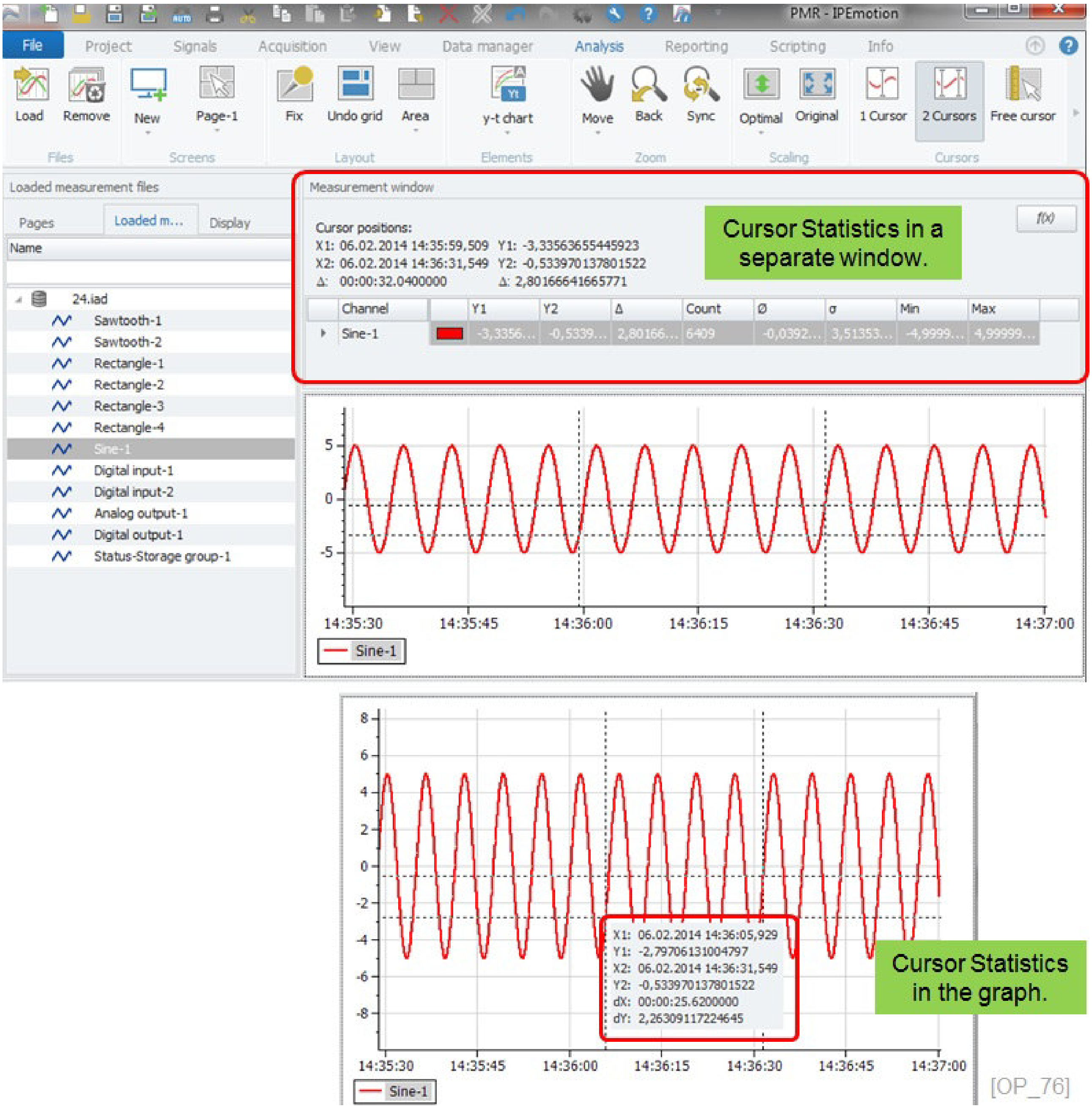
[OP_75]

22.9.1 Slide controller - data display in charts

With the slide controller you influence the speed and resolution of imported data files. When importing large data files of several GB, data loading can take some time. If you move the slider to the left side (Speed) the data files are loaded considerably faster. However, the software will not load all data points. They will be loaded in a post processing step when you start to move and zoom into the graph.

22.9.2 Using the extended measurement window

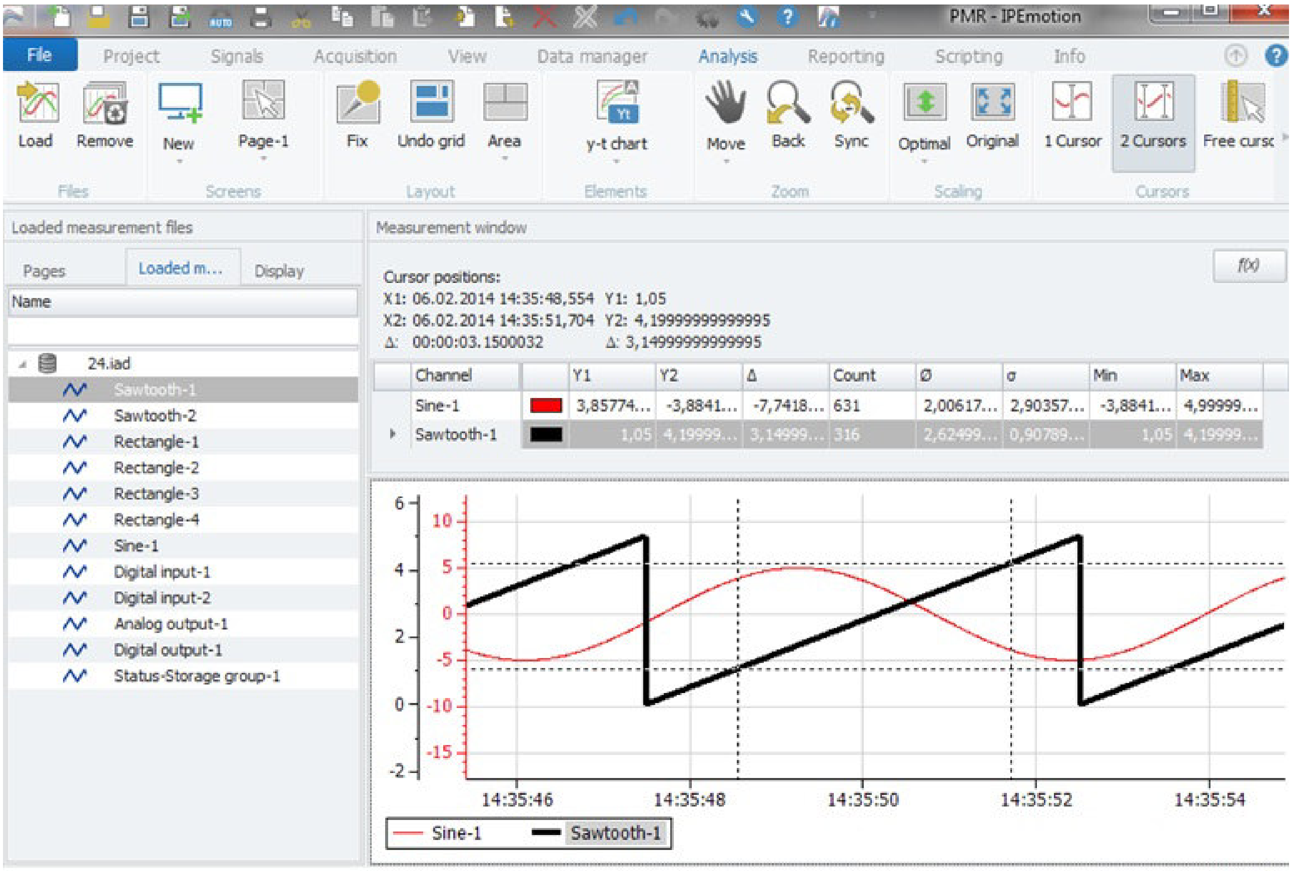
The extended measurement window shows the cursor statistics on the Yt- chart and xy-chart in a separate window in the ANALYSIS work space.



[OP_76]

22.9.3 Highlighting of cursor

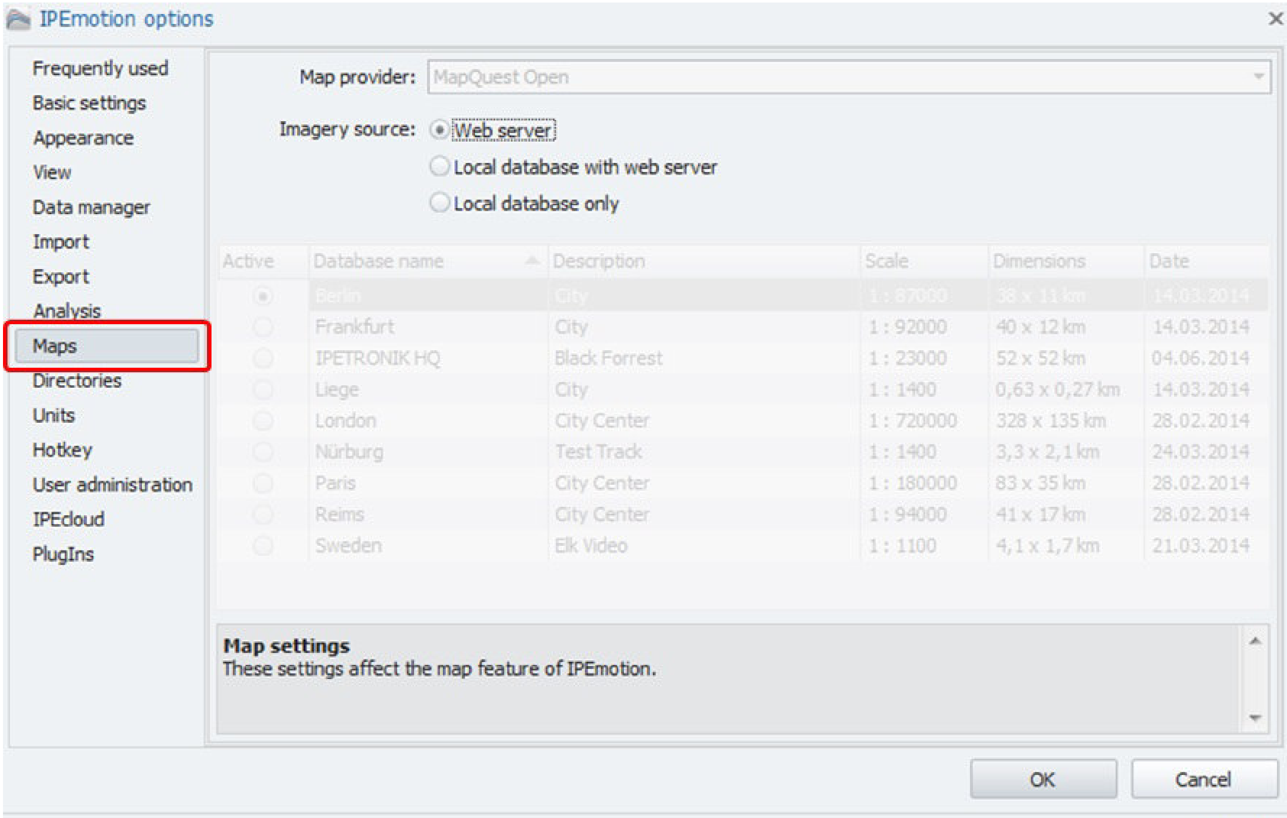
You can define how a graph is displayed in a chart in the ANALYSIS work area when a channel is selected in the extended measurement window.



Example for BOLD line.

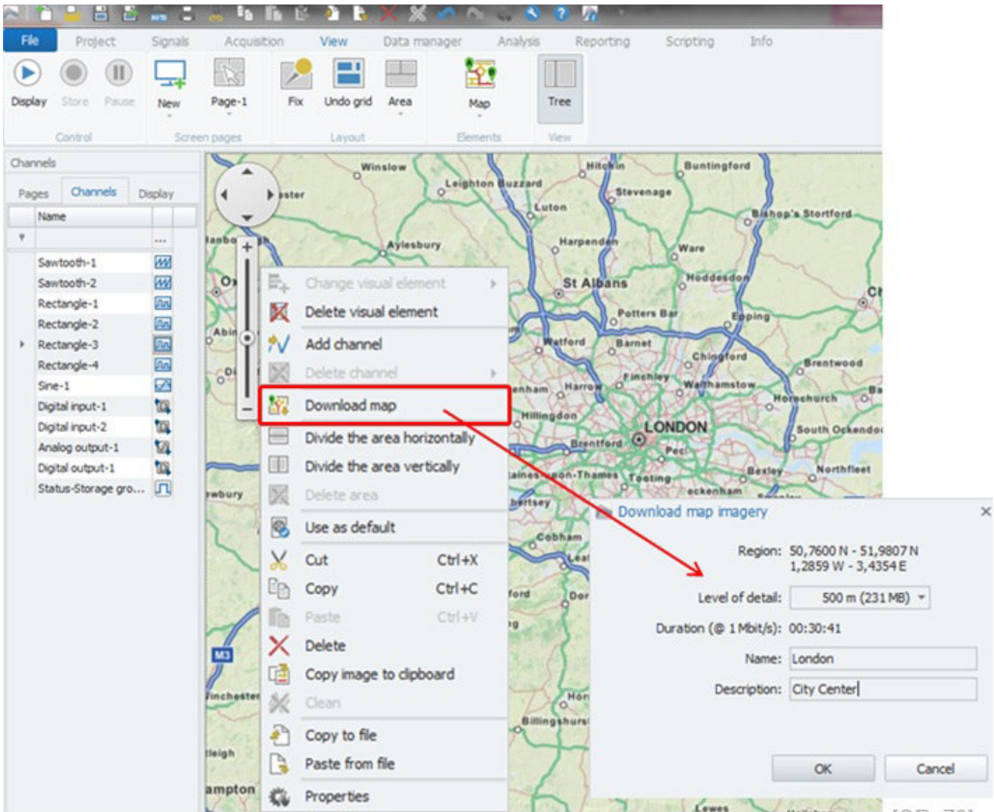
[OP_77]

22.10 Map



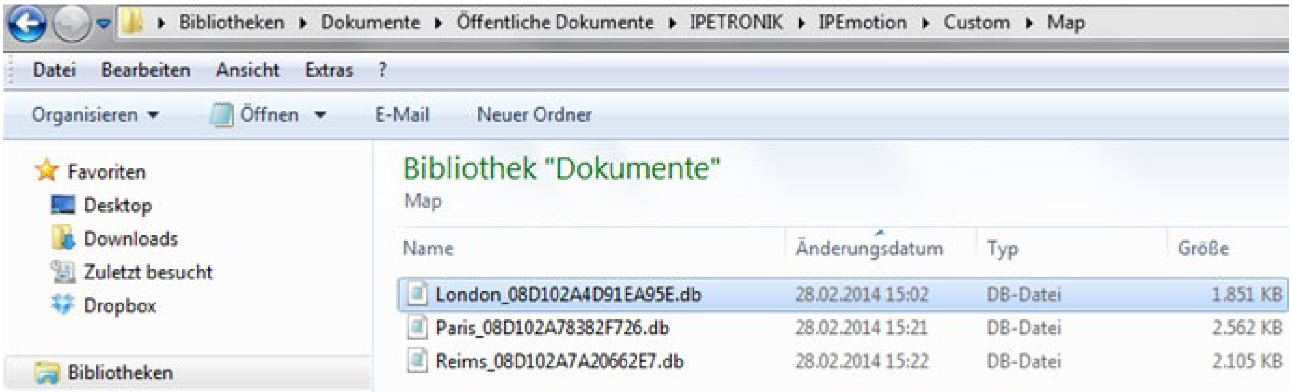
[OP_78]

When you download tiles though the Map instrument in the VIEW or ANALYSIS work space you can define a dedicated data file. When you download tiles into one file and the download is finished the file is fixed and cannot be changed in that sense that you may add some more tiles / geographic areas later on. This is not possible.



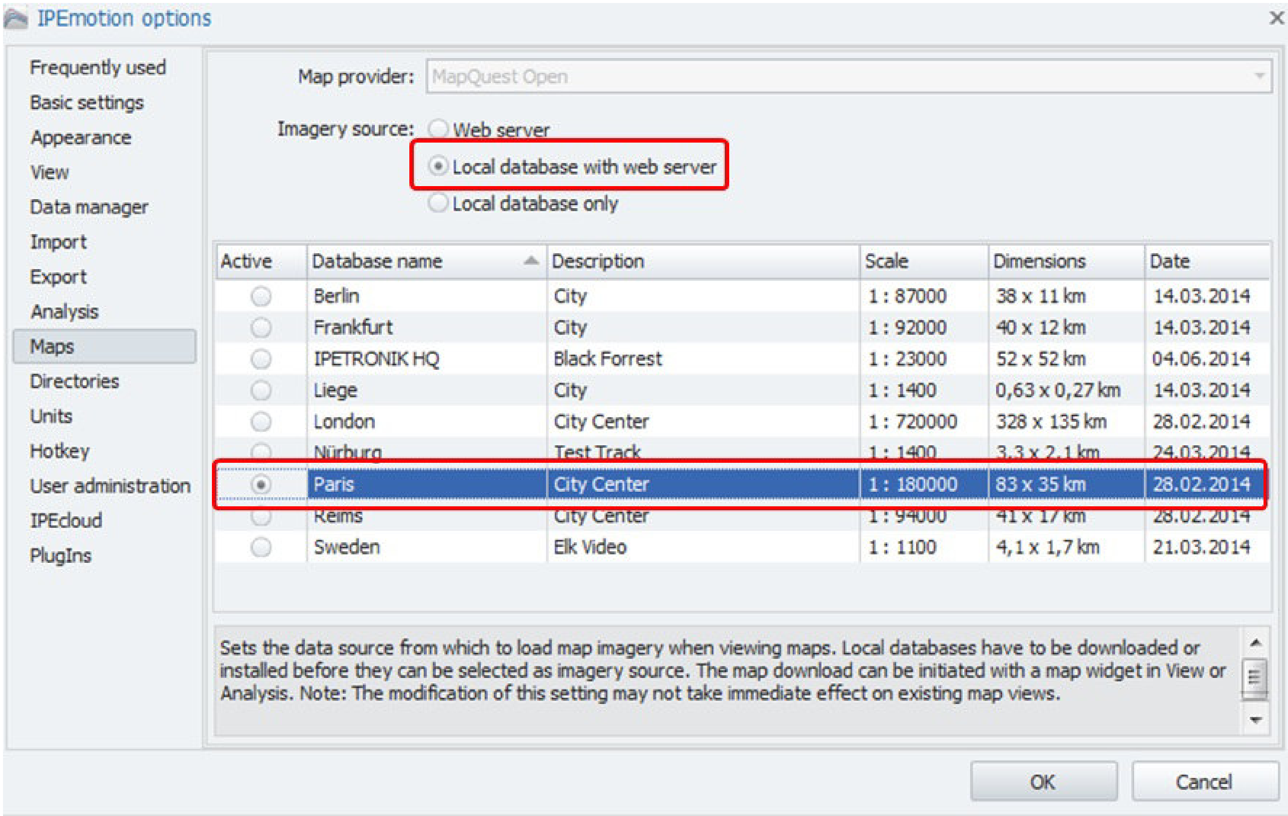
[OP_79]

The tiles are stored in a file called **name-xyz.db** located in the following directory.
Win 7 C:\Users\Public\Documents\IPETRONIK\IPEmotion\Custom\Map



[OP_80]

All downloaded map files are listed. You can only activate one database of your choice.



Select your data base of map tiles. [OP_81]

Information

The selected data base is a global setting. That means it applies to all map instruments in VIEW and ANALYSIS. If you like to change the MAP data base file you need to delete and reinsert the all map instrument after changing to a new âĂIJdefaultâĂİ map database file.

22.10.1 Map provider

The default map provider is Geofabrik (https://www.geofabrik.de/en/index.html). However IPEmotion is supporting custom map providers to. To implement a custom map provider get in touch with the support team.

22.10.2 Web server

This check enables or disables the download of map tiles to your computer. When this check box is not active you cannot download any map tiles. When you activate this check box you always retrieve map tiles from the internet. You are not taking any data from your local data base.

22.10.3 Local data base + Web server

This check box is a good compromise if you like to combine already downloaded tiles together with the option to reload new tiles provided you have internet access.

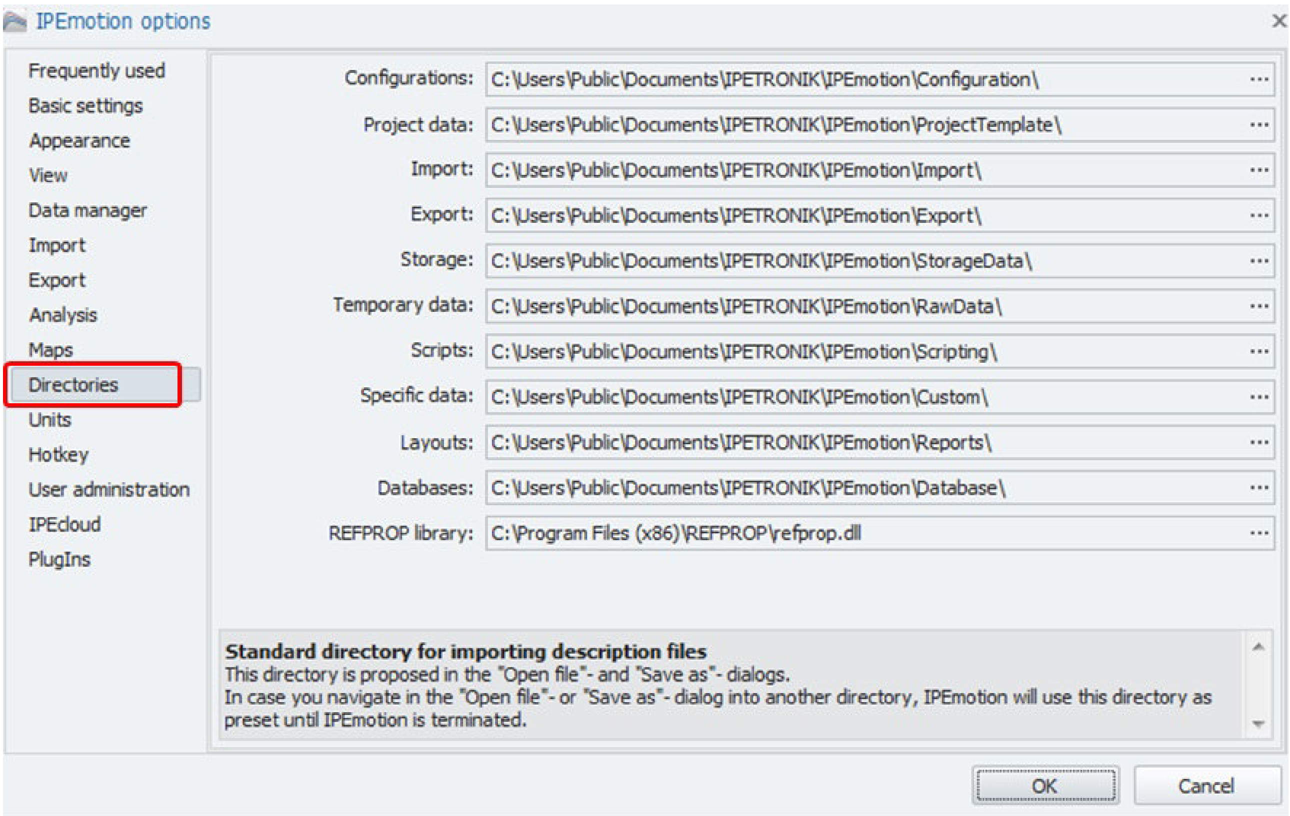
22.10.4 Local data base only

This check box is retrieving the data from the data base file only. This is a useful setting to check which area exactly is stored in the data file.

Information *The tab sheet Map is only visible in the OPTIONS dialog when you have a Professional or Developer license. See chapter EDITIONS for more details about the functions of each edition 4.1.*

22.11 Directories

Here you can define where all types of files are to be stored and loaded by default.

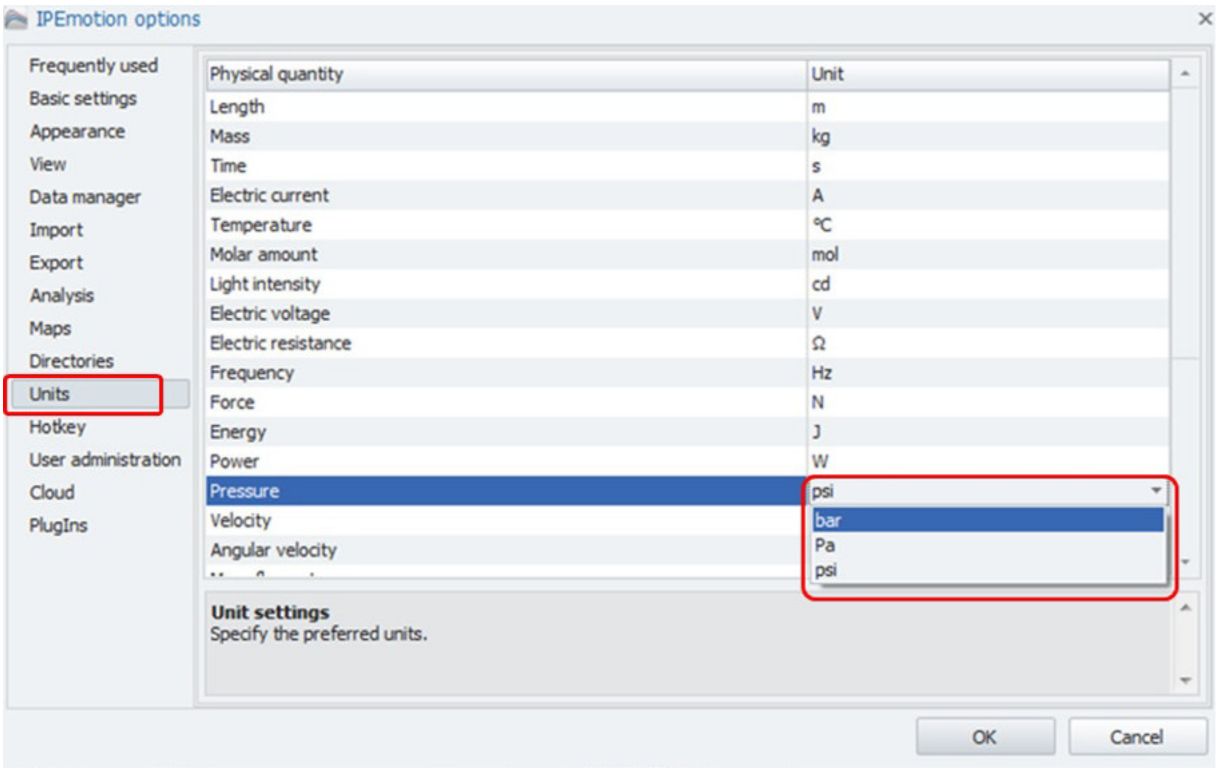


Default directories [OP_82]

The directory is referring to the following file types:

- **Configuration** — IWF project files
- **Project data** — GlobalPar and GlobalData to manage project parameters of IPEmotion. For the IPETRONIK LOG PlugIn (ProjectPar and ProjectData) are relative.
- **Import** — Refers to all file imports supported by any PlugIn: DBC, A2L, Autosar, etc.
- **Export** — Covers all exports supported by PlugIns.
- **Storage** — Is the location of the data files created by the storage group.
- **Temporary data** — Location of IRD raw data measurement files from the storage process. In the raw data directory a copy of the original data file is maintained before export conversion is executed. The folder is automatically monitored and is keeping files according to the following criteria. See also chapter 13.8.5:
  Maximum single file size: 10 GB
  Minimum free disk space of the partition: 20 GB
  Oldest measurement file: 6 weeks
  Maximum number of measurement files: 1000
- **Specific data** — This covers specific files like pictures, map tiles, etc. See 22.1.2
- **Layouts** — Refers to individual report templates.
- **Database** — Covers the sensor data base of the scaling calculator.
- **REFPROP library** — Link to REFPROP data base for your climate formulas. This data base is needed when you use the climate module 4.2.2.

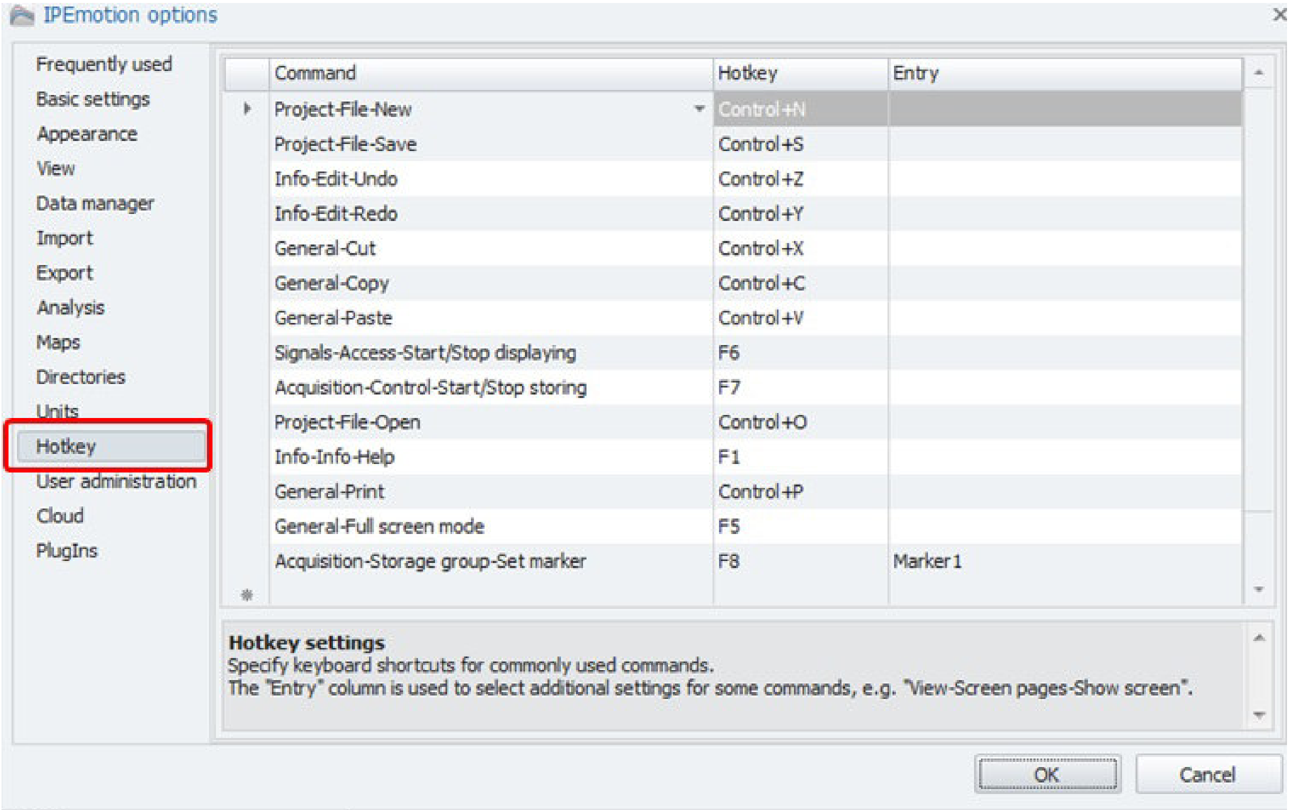
22.12 Units



[OP_83]

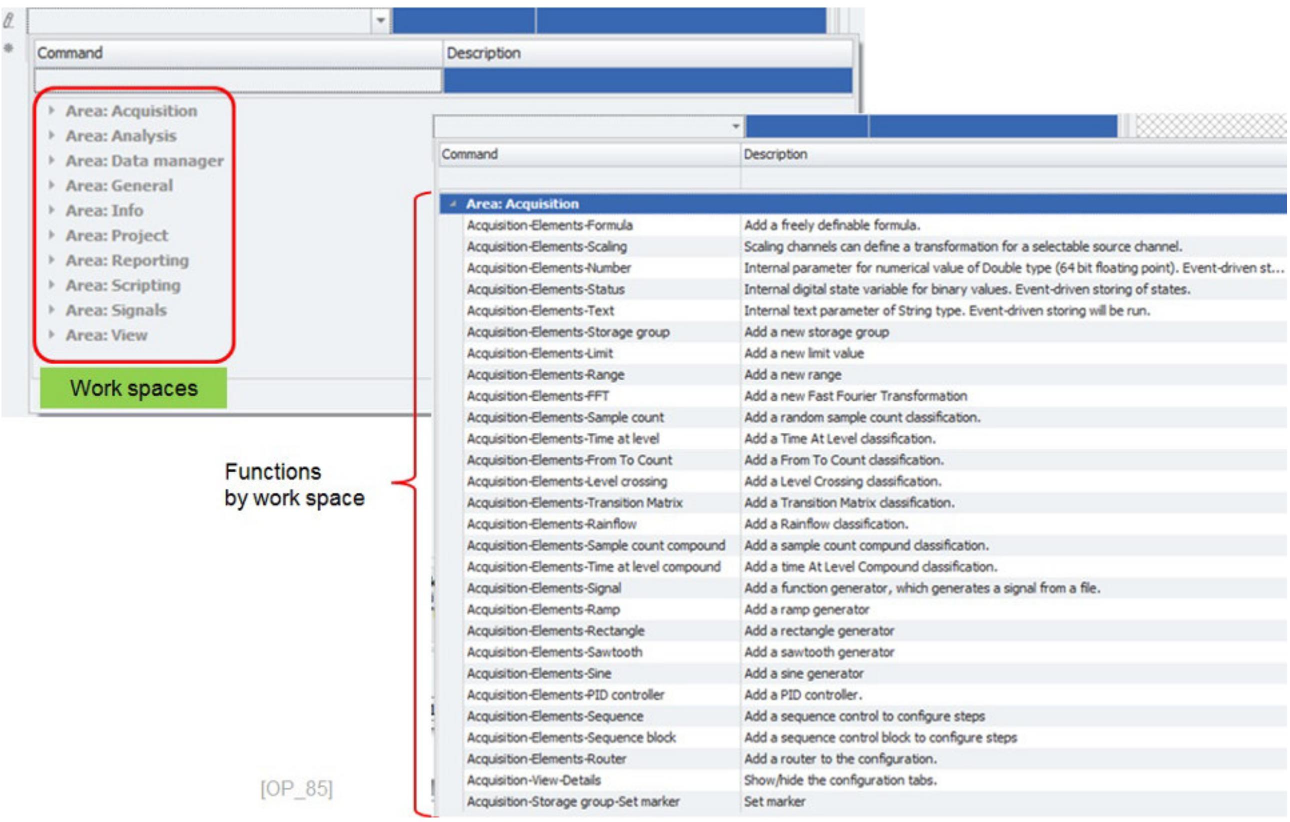
List of engineering units.
Here you see all supported engineering units also supported by the Scaling calculator if you like to change engineering units. For this function see chapter SIGNALS 11.8.
You cannot enter new units by your own. If you require a new unit please contact support@ipetronik.com.

22.13 Hotkey



[OP_84]

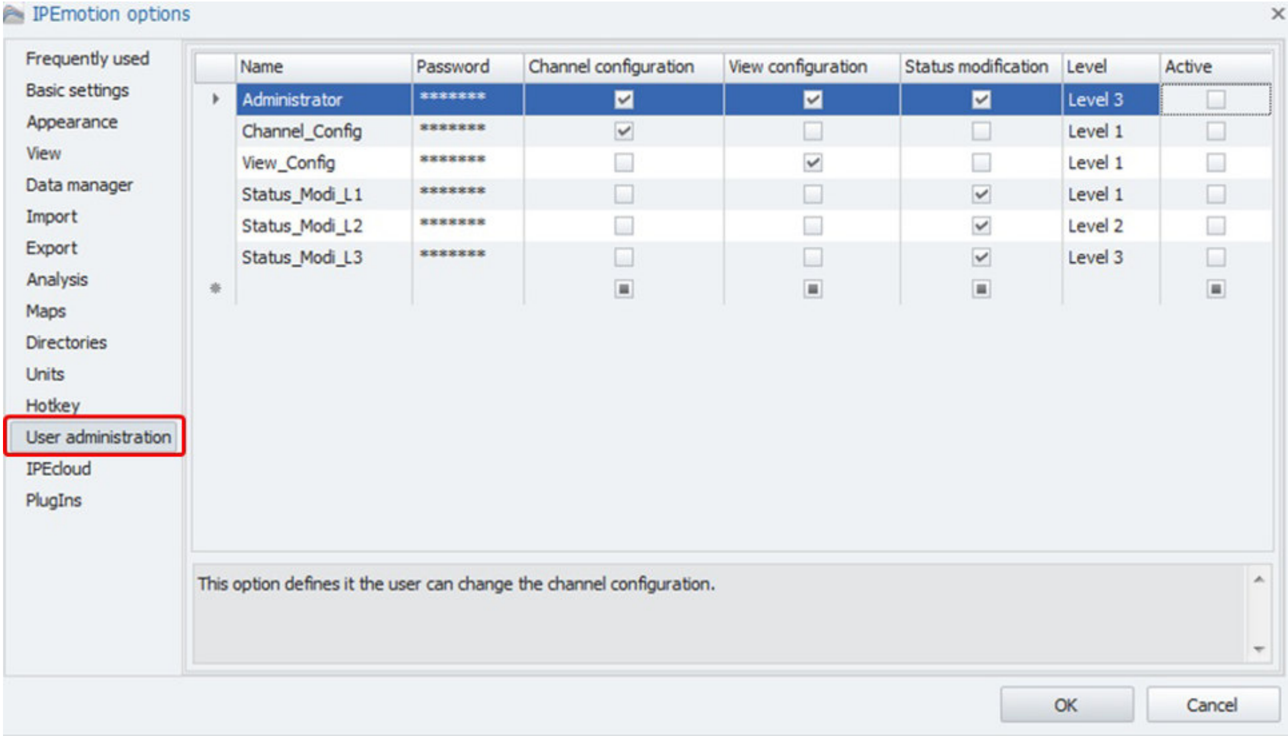
You can operate IPEmotion through hot keys. This is particularly practical for reoccurring operations in situations where manual navigation with a mouse is too difficult. In the list box Command you select the a specific function from a work space. Then you define the key combination to execute this command. Valid hot key combinations are those which do not create any characters (letters, numbers or special signs).



[OP_85]

Example above: You can only operate the marker channel of the storage group through a hotkey function. The operation of the marker is explained in the ACQUISITION work space in chapter 13.8.5.

22.14 User Administration



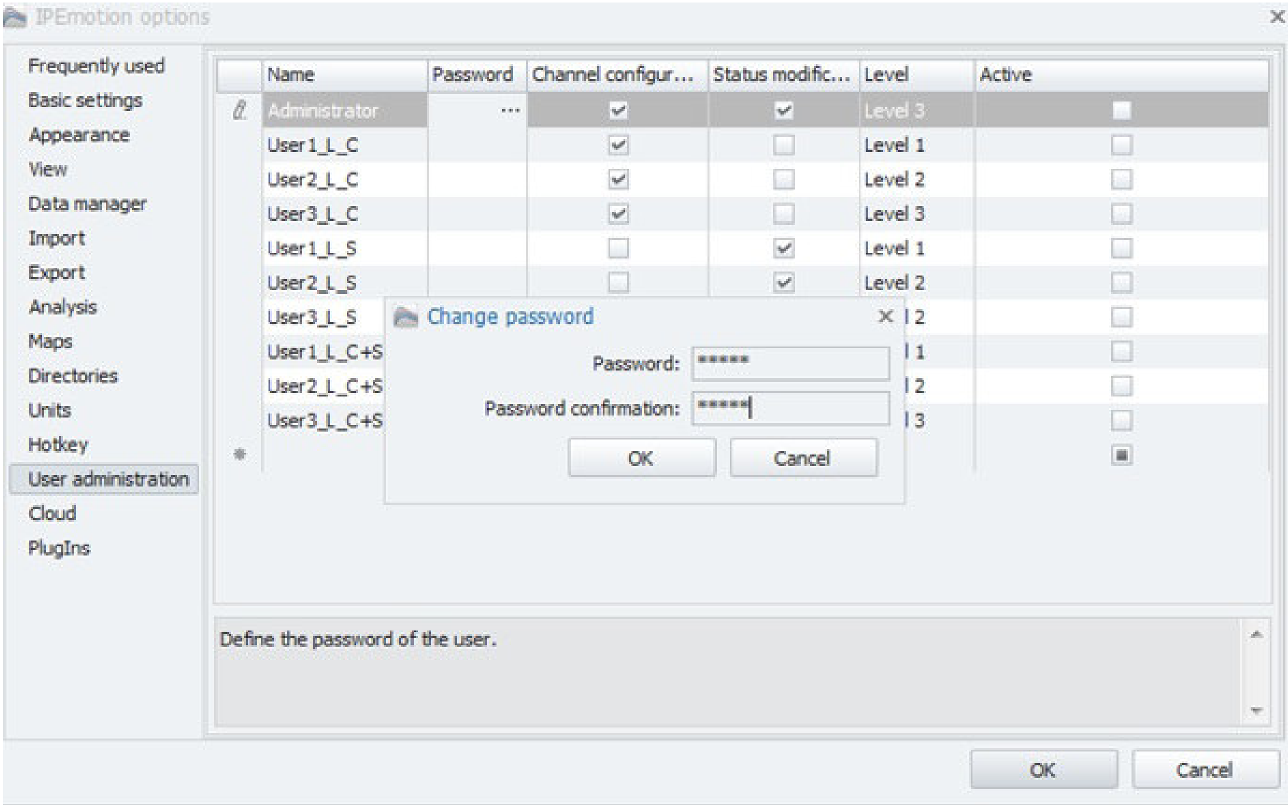
[OP_86]

An activated user administration requires a login before you can start IPEmotion. The user can be allocated to different levels (1, 2, 3) (1= low / 2 = middle / 3 = high). A higher level means more access rights. With the user administration you can basically limit two aspects of the software:

- Channel configuration — Refers to the operation of any type of output channels.
- View configuration — Refers to a profile for configuration the functions in VIEW and ACQUISITION workspace only, except to start a measurement.
- Status modification — Refers to the status of IPEmotion in regard to data display and storage and user buttons visibility. The configuration of user buttons is explained in 7.2.

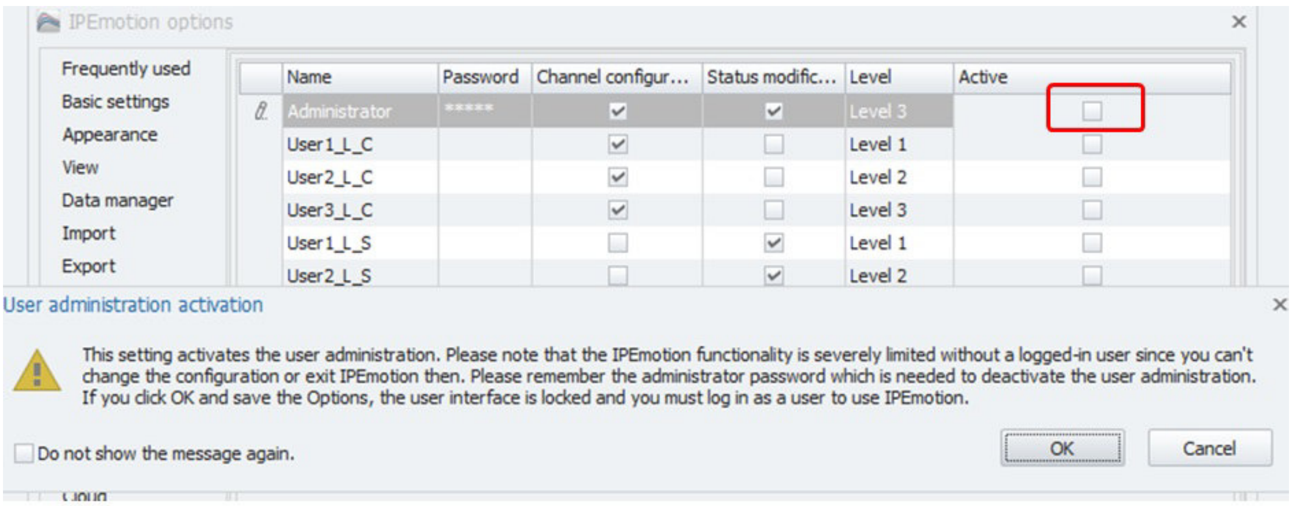
22.14.1 Defining the Administrator password

In the first step you define the password for the administrator. It is not mandatory to set a password for the administrator login.



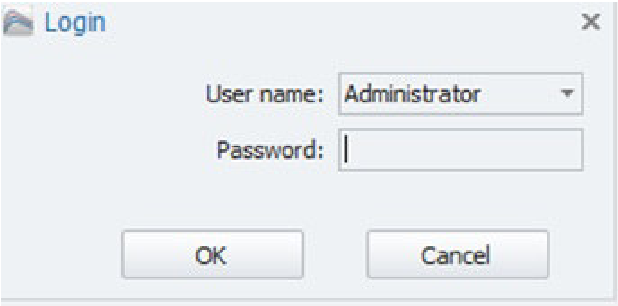
[OP_87]

After that you need to activate the administrator. After password activation, every software start requires a login.

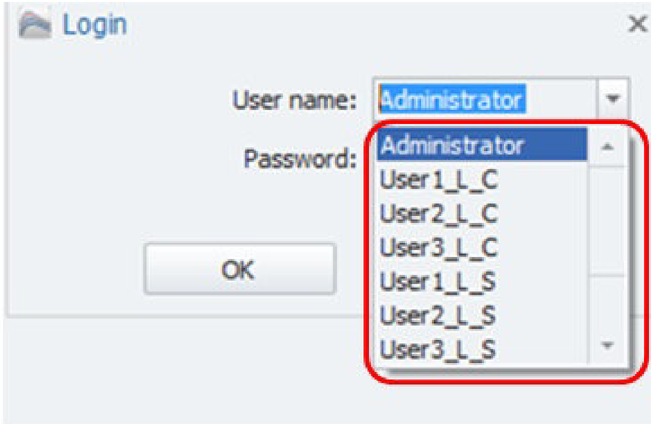


[OP_88]

All active users are available from a drop down list.



Login window.

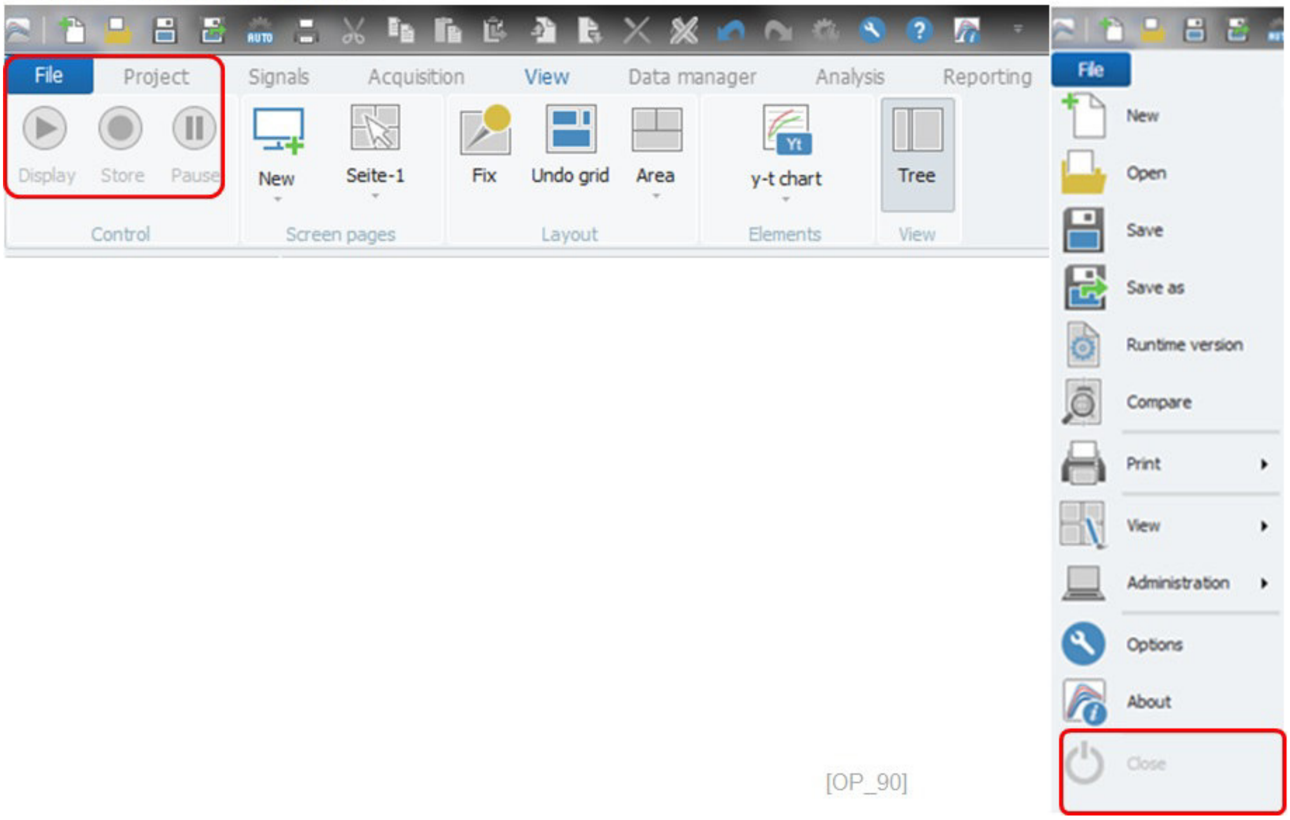


List of all active users. [OP_89]

22.14.2 Channel configuration profile

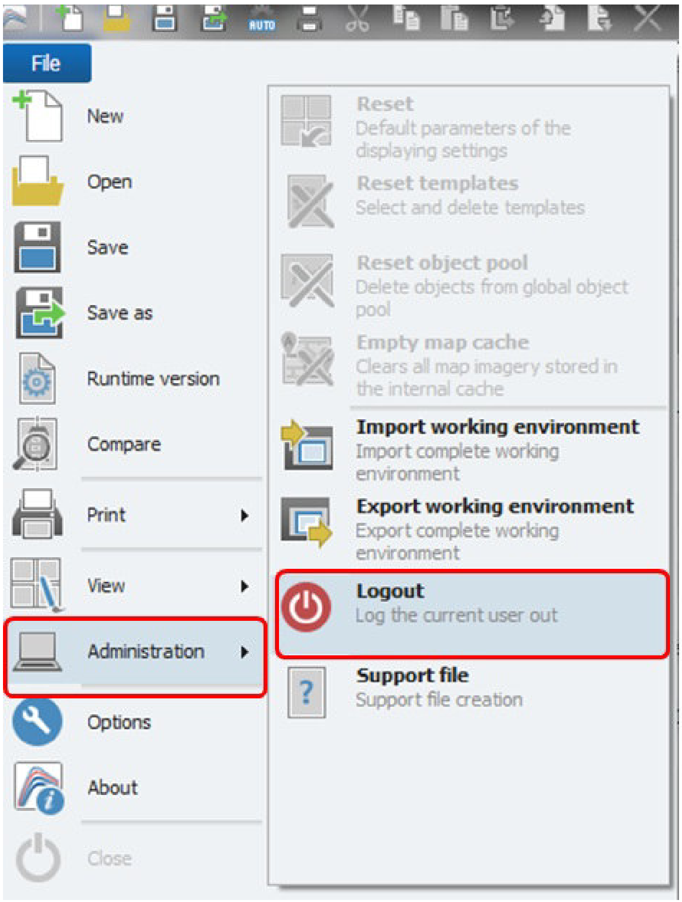
This profile mainly serves to build configurations. Using this profile, channels can be configured, hardware detection can be run, etc. . . and the GUI can be modified in the VIEW work area but neither measurement nor data storage can be started. These Icons are deactivated. Furthermore, IPEmotion applications cannot be closed using this profile.

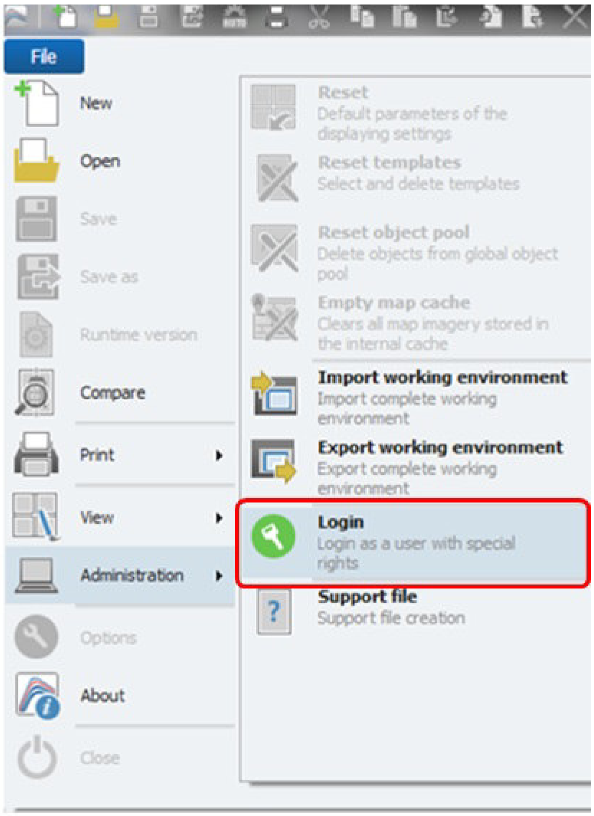
Level 1 – Channel Configuration



[OP_90]

To change the user you need to navigate to the logout button. With "login" you can access the application with a new user.





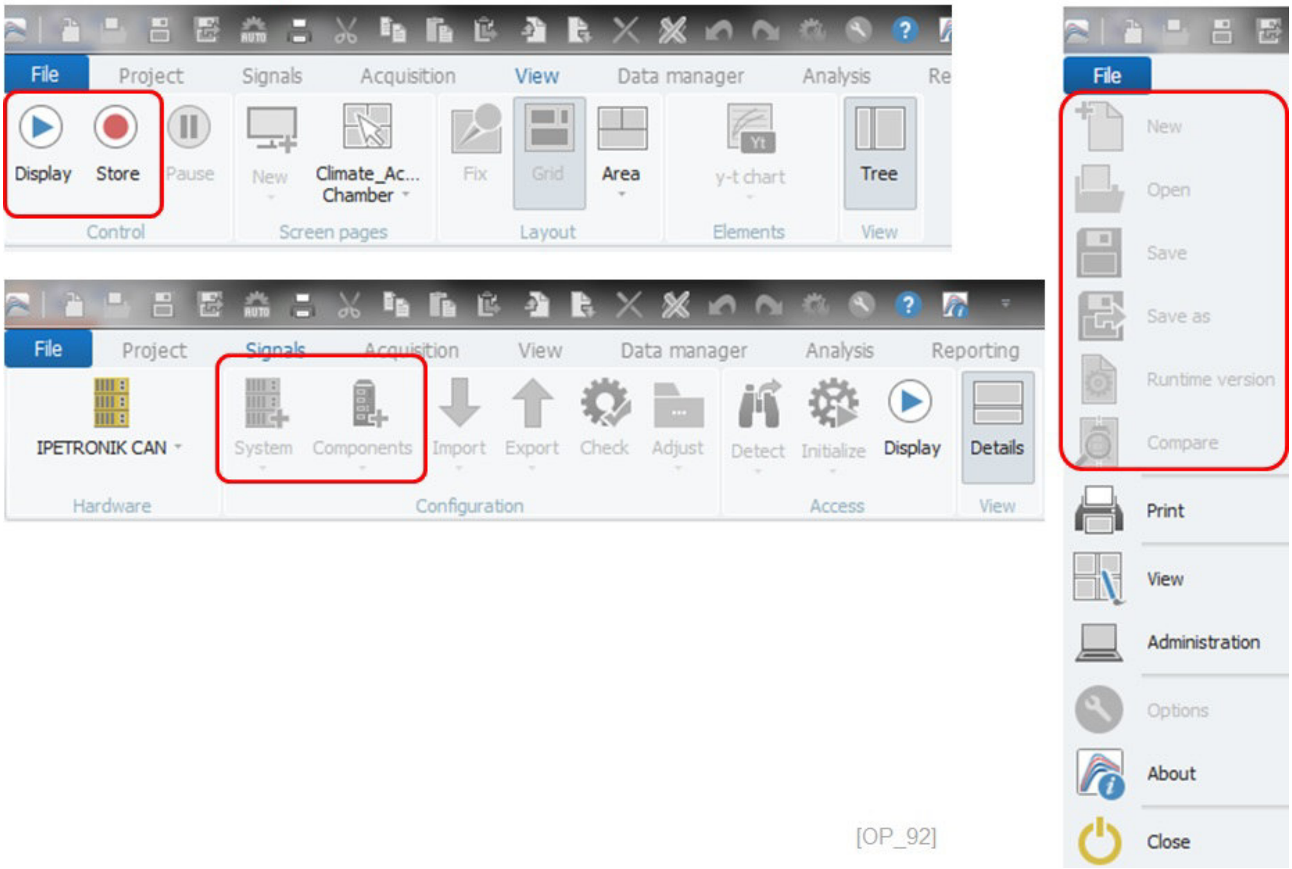
[OP_91]

22.14.3 Status modification profile

► User level 1 for status configuration

This user is meant to operate a configuration but not to change it. This user can start and stop the data display and storage but he cannot make changes to the channel configuration nor can he modify the GUI in the VIEW work area. He can also not load any new configurations but he can close the software.

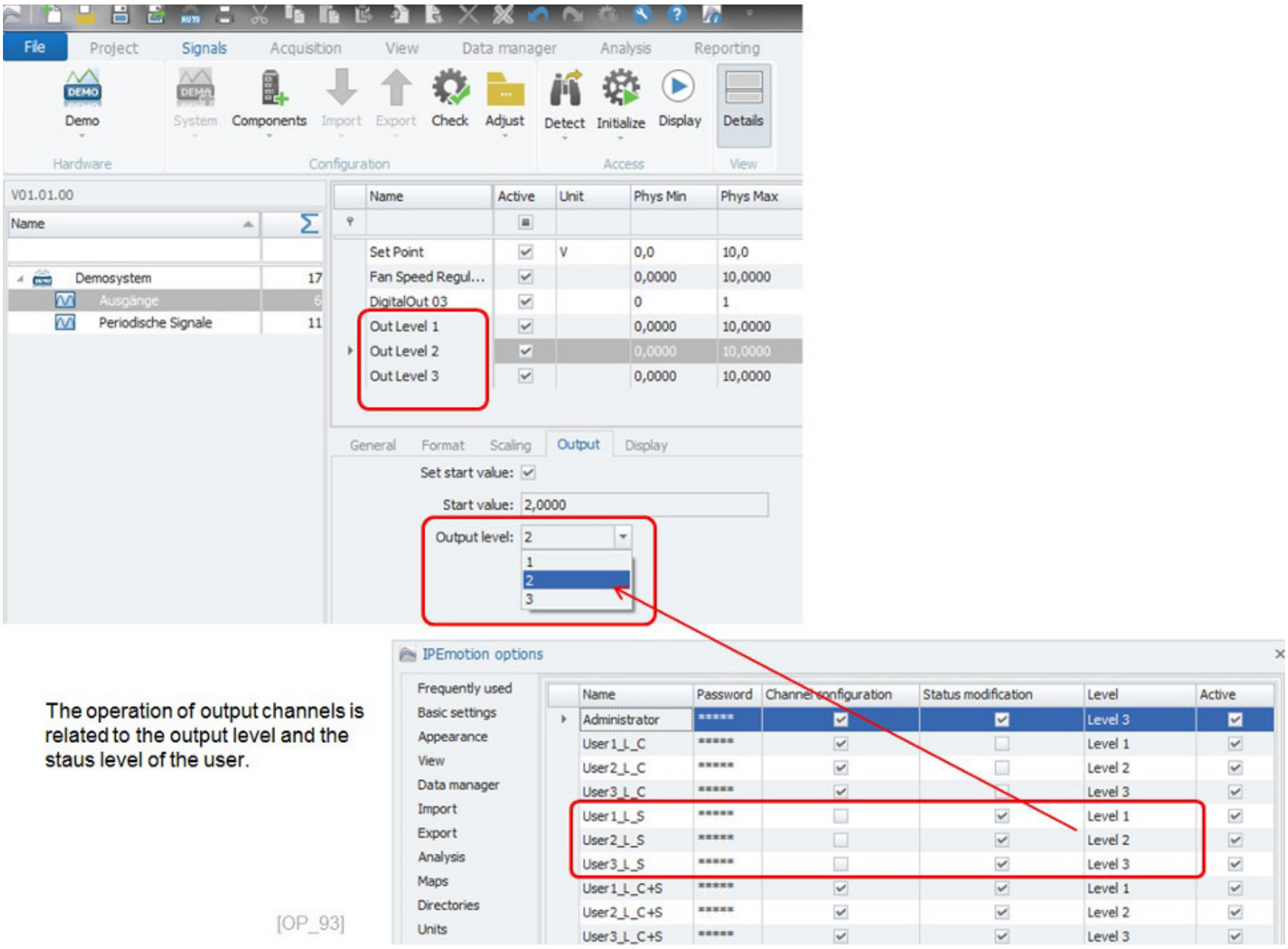
User L 1 – Status Configuration



[OP_92]

► User level 2 for status configuration

With status level 2, users can operate output channels with the output status 1 and 2.

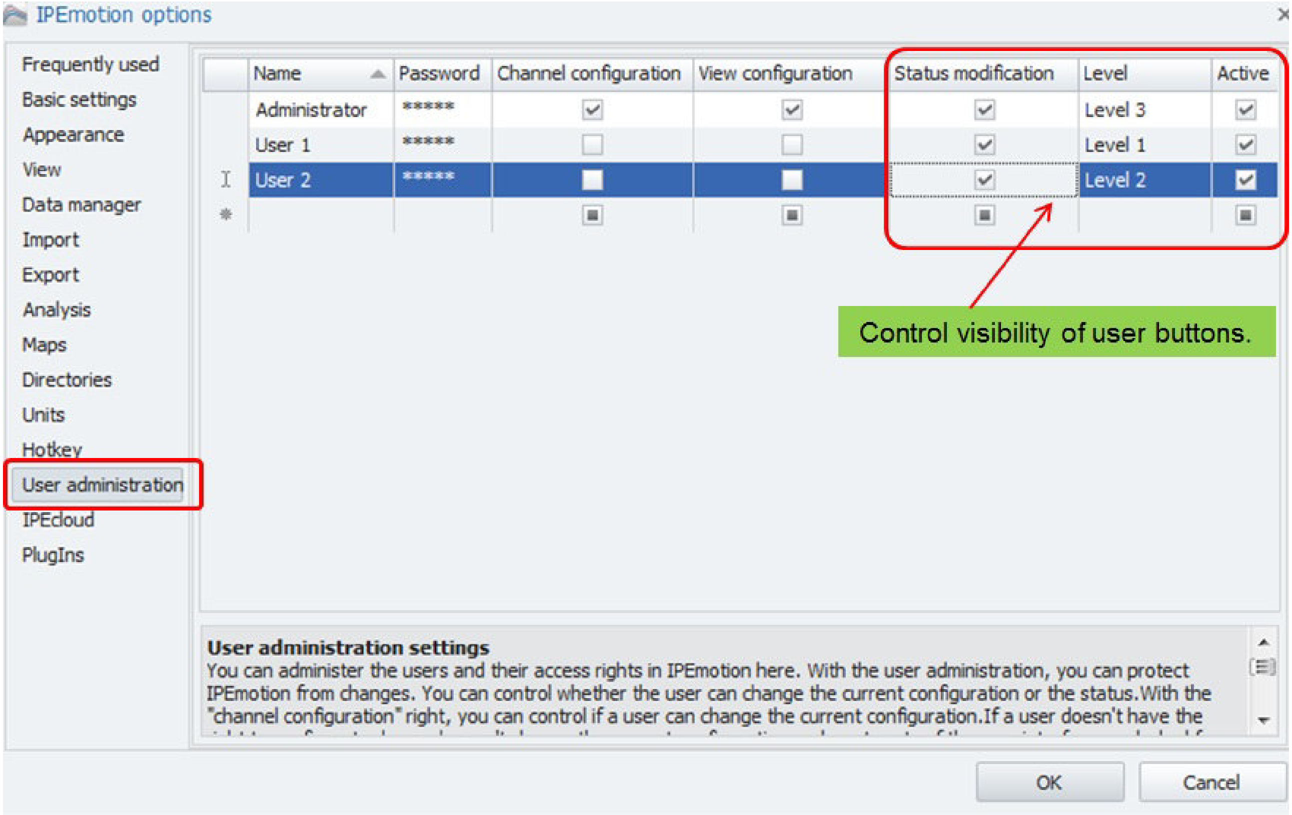


[OP_93]

► User level 3 for status configuration

With status level 3, users can operate output channels with the output status 1, 2 and 3.

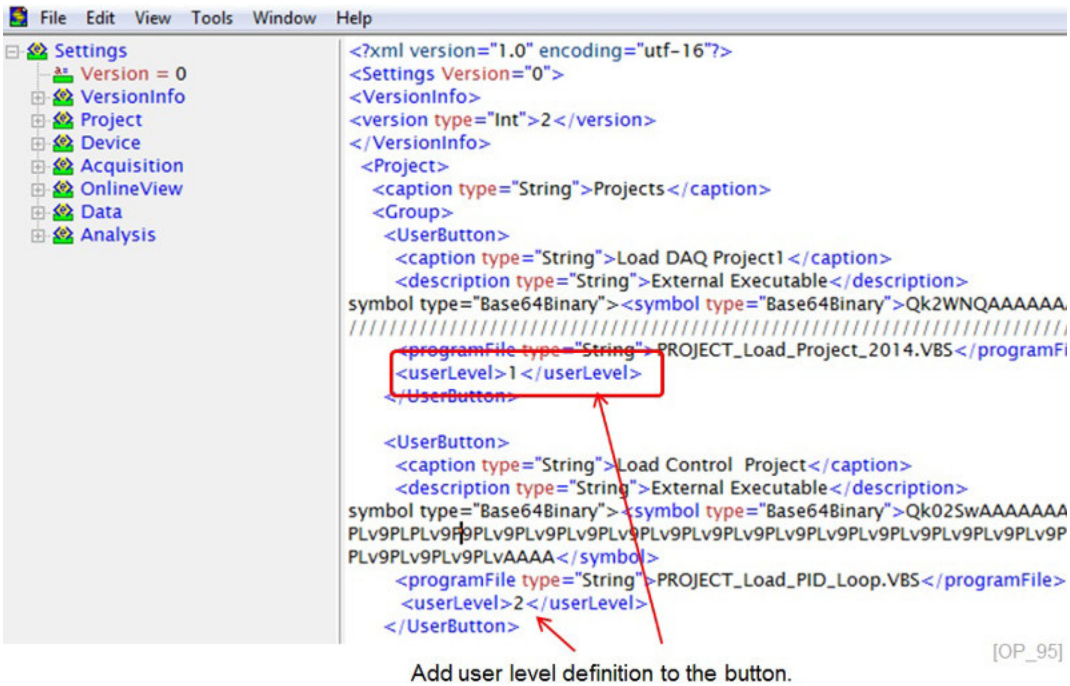
With status modification profile you can also control the visibility of the user buttons. To use this function you have to activate the user administration as indicated below.



[OP_94]

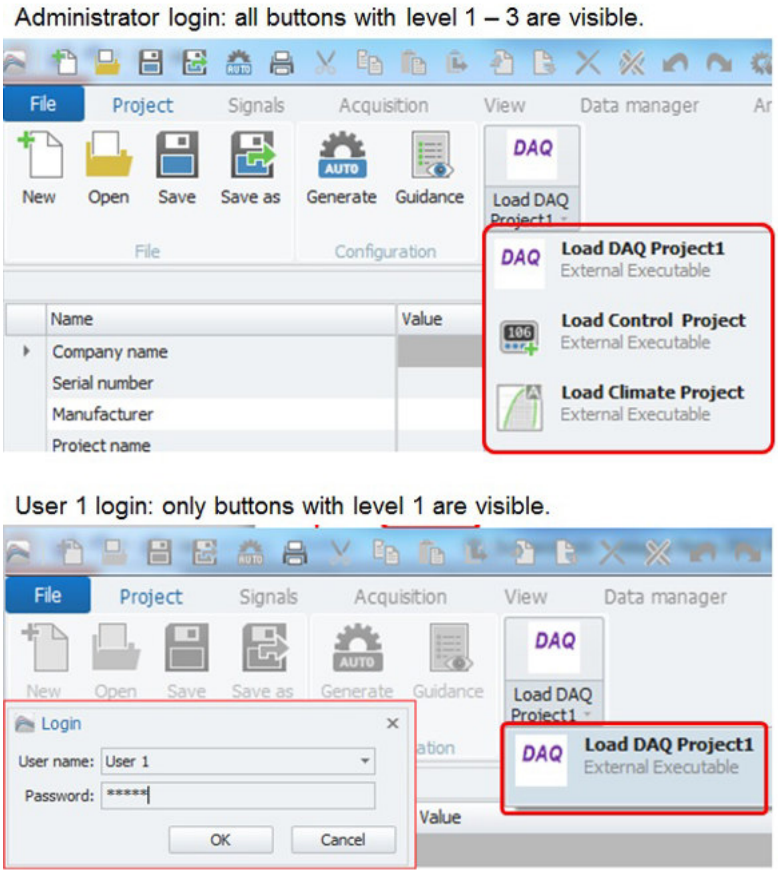
- **Level** With level in the range of (1, 2 3) you define which user buttons will be made available

To enable the control of the visibility you have to add the user level definition into the user button XML file.



[OP_95]

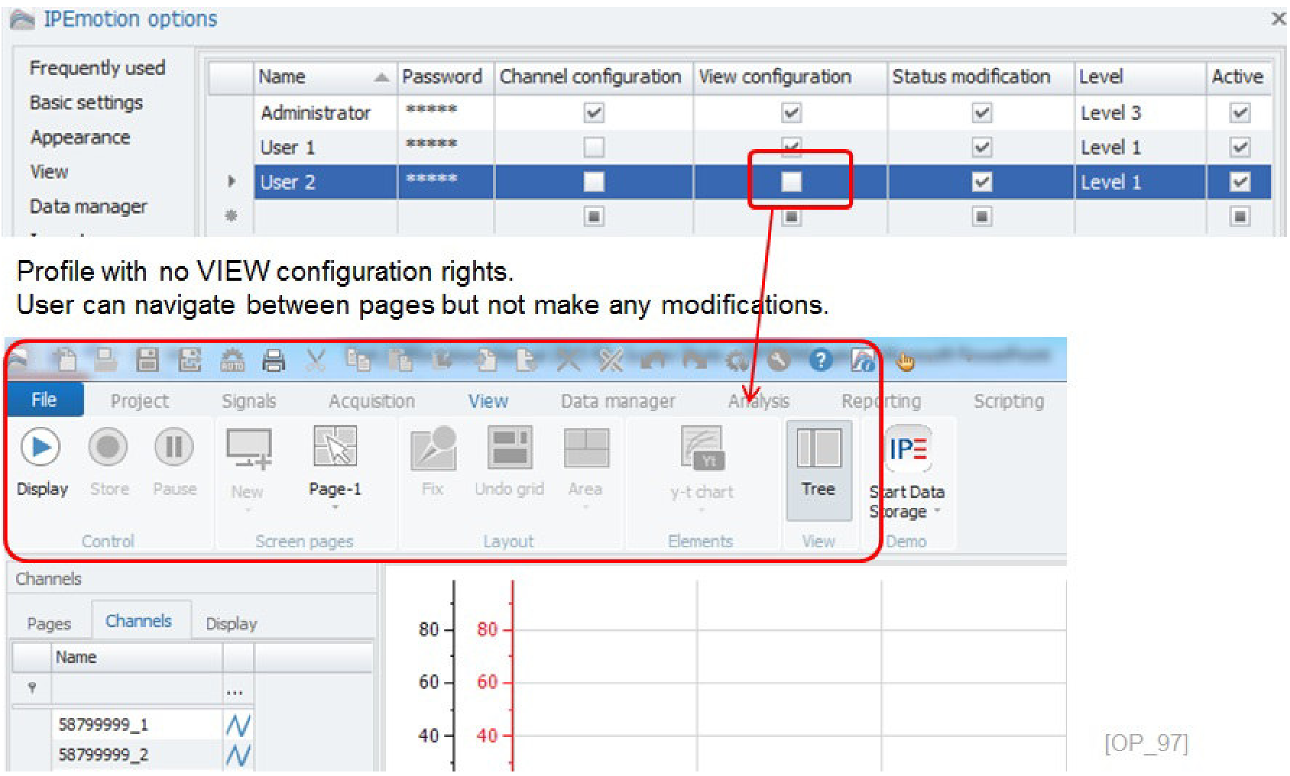
Depending on the login the following user buttons will be visible



[OP_96]

22.14.4 View configuration profile

With the view configuration profile you can control the configuration access rights in the VIEW work space. In the example below a user with

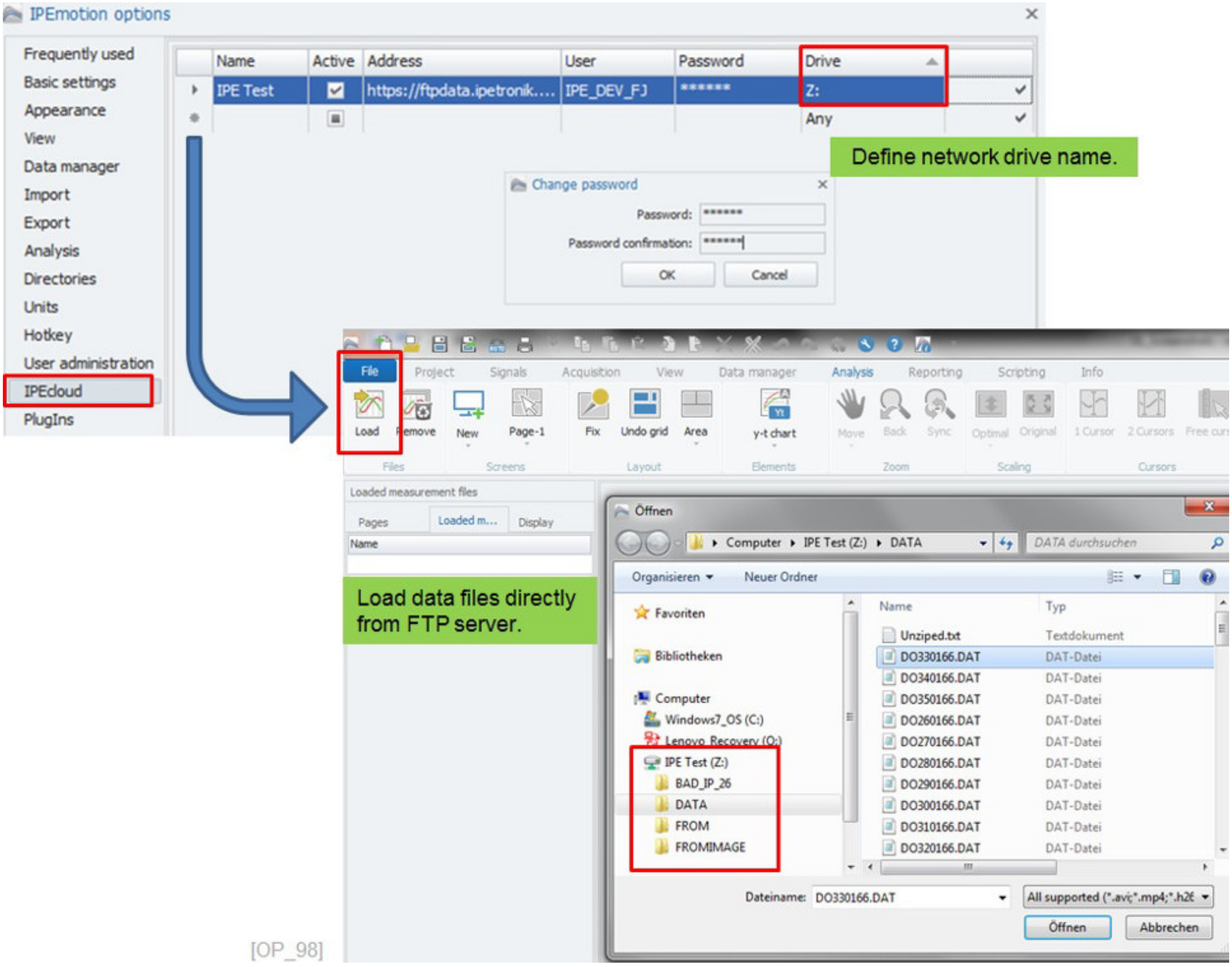


[OP_97]

22.15 Cloud

In the options of IPEmotion you can define the parameters for connections to FTP servers. IPETRONIK data loggers e.g. can support an automatic FTP file transfer to collect data files in certain intervals from the loggers, automatically. The data files are transferred to an IPETRONK FTP server of the fleet management system. The FTP access works with any FTP server. In order to easily access the data files on the FTP server you need to define:

- Name of connection
- Check box to activate FTP connection
- FTP Link (Server Address)
- User name
- Password
- and the name (Letter) of the network drive

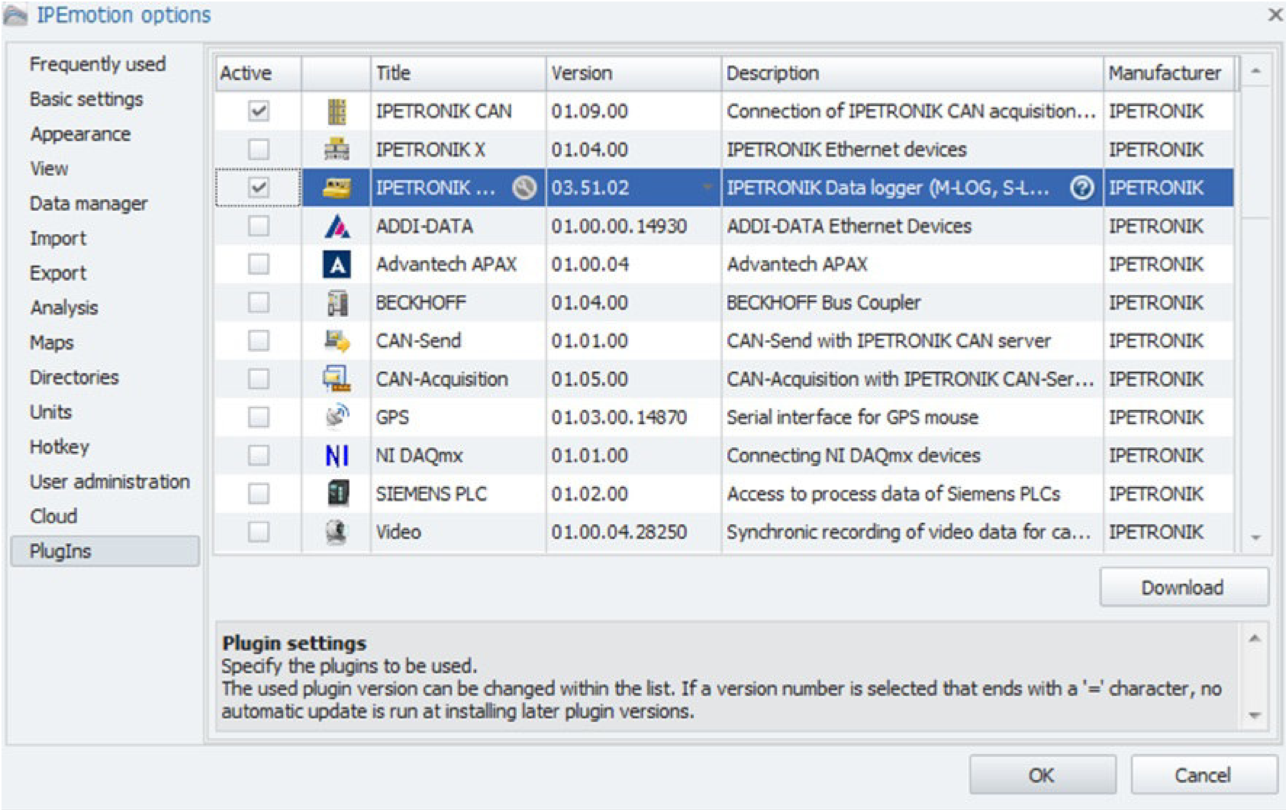


[OP_98]

When the FTP connection is activated, IPEmotion is mapping the FTP server as an additional network drive to the windows Explorer overview. You can directly load the data from the FTP server to your data analysis or data manager work spaces of IPEmotion for reporting and analysis purposes.

22.16 PlugIns

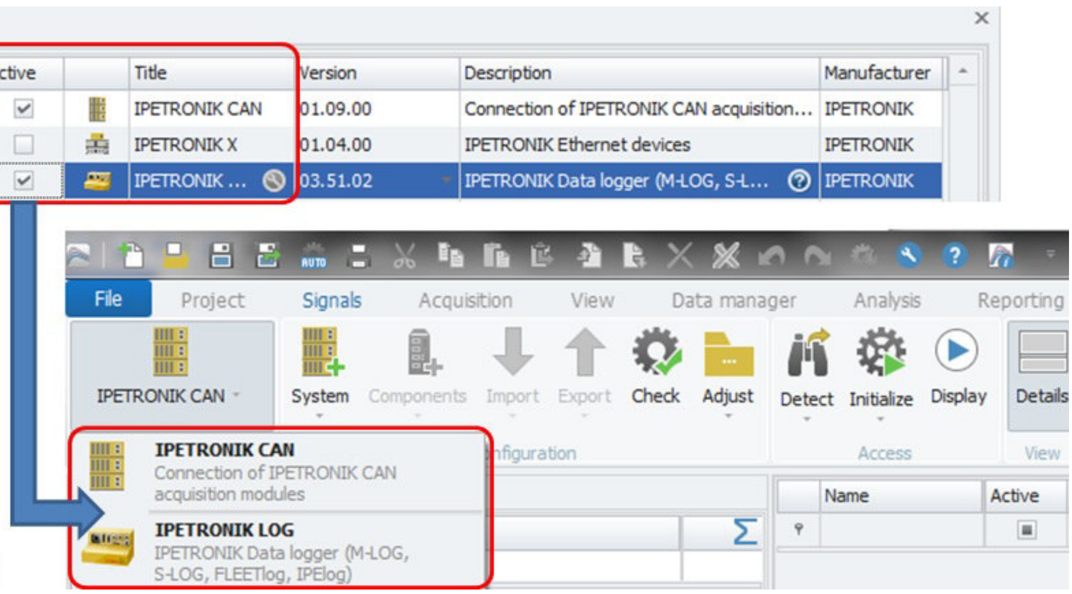
As discussed in chapter 3.3, a PlugIn is a program supporting the communication between IPEmotion and a specific hardware. A PlugIn only works in combination with IPEmotion. In this list you will see all PlugIns installed on your computer.



[OP_99]

22.16.1 PlugIn Activation

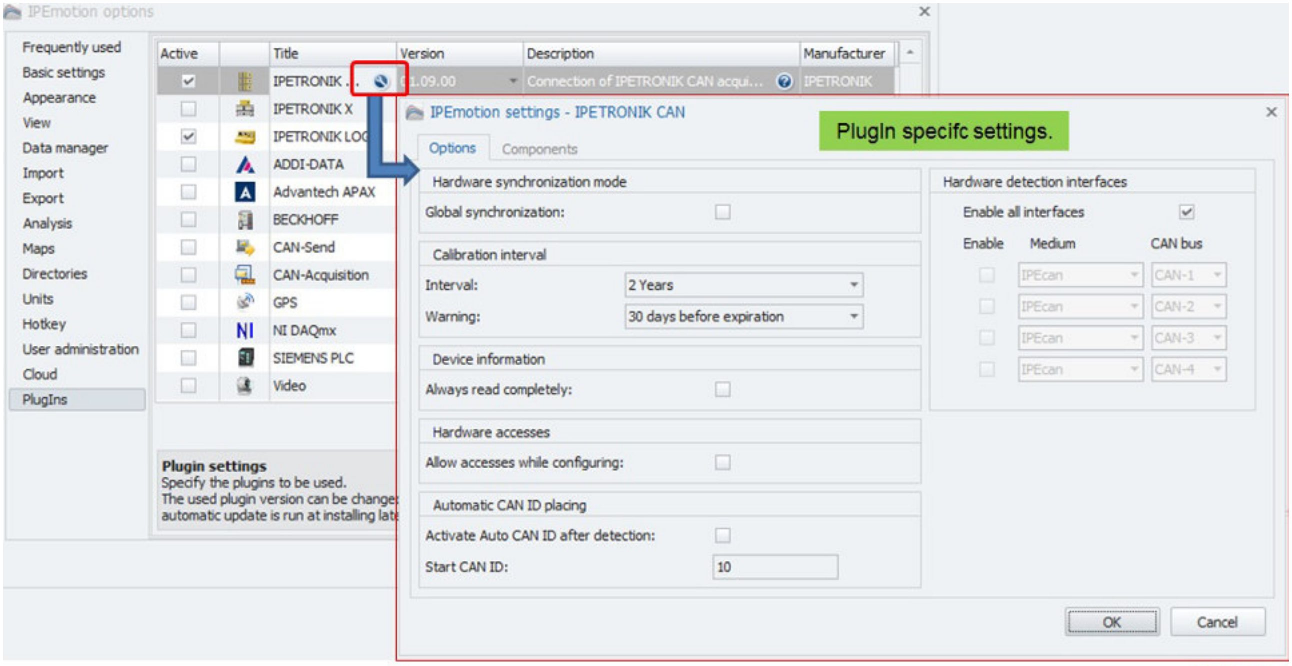
With the check box active, you are loading the PlugIn and it can be used in the SIGNALS work space.



[OP_100]

22.16.2 PlugIn Configuration

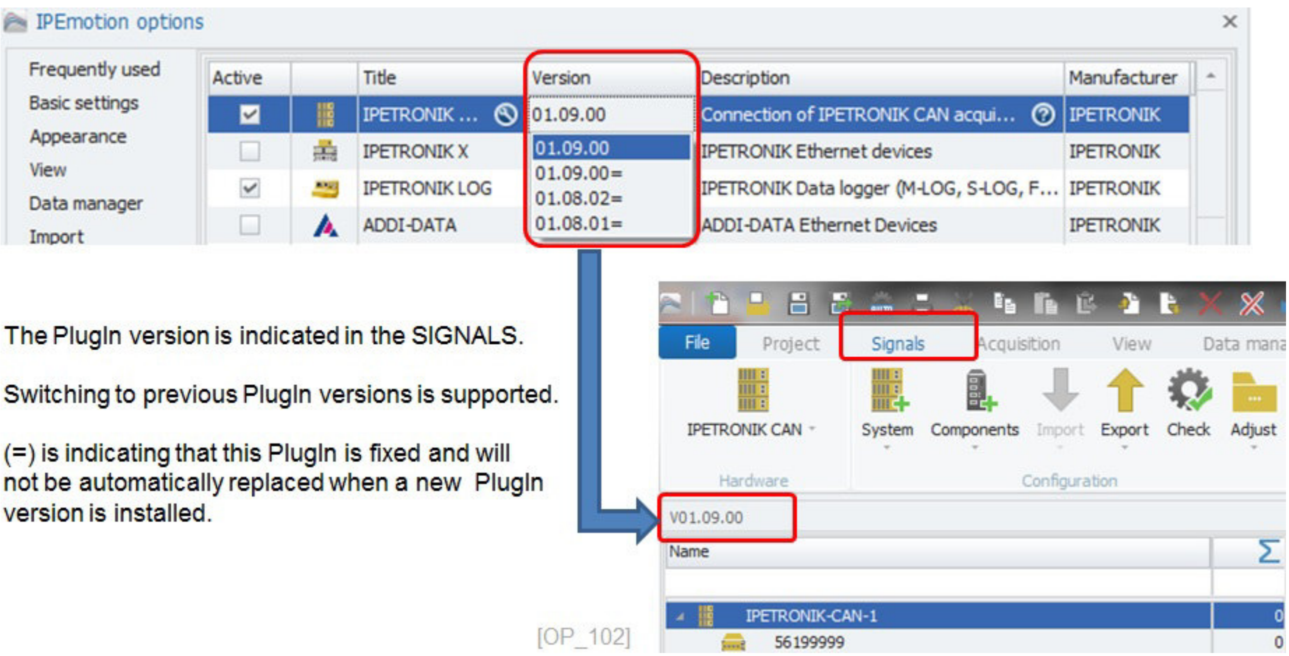
Some PlugIns offer substantial additional configuration settings. Below, you can see the example of the IPETRONIK CAN PlugIn. Details of how these settings work are explained in the PlugIn's Help file. Not all PlugIns have additional configuration options.



[OP_101]

22.16.3 PlugIn Versions

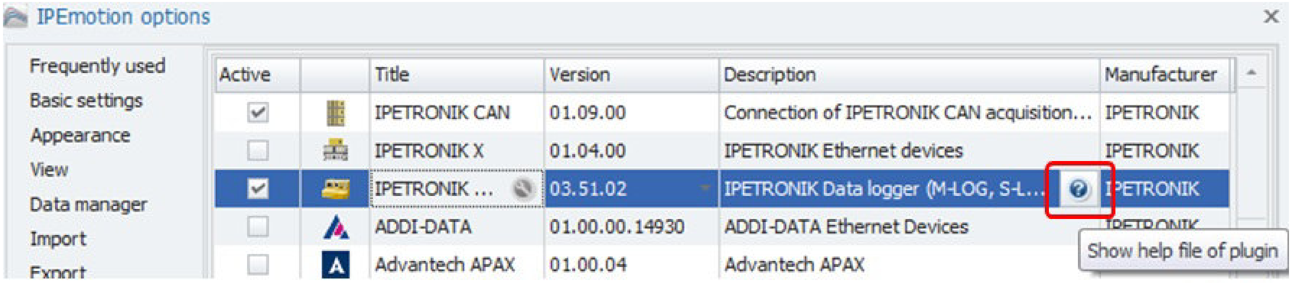
In the column "Version" you will see the selected PlugIn version. If desired, you can switch to previous PlugIn versions in the drop down box. If you select a PlugIn with an equal sign (=) you define this PlugIn as your standard PlugIn and newer PlugIn versions will be ignored. If you use a PlugIn without an Equal sign and you install a more recent version, it will automatically load to the SIGNALS work space 11.5.1.



[OP_102]

22.16.4 PlugIn Help Manual

Many PlugIn include a HELP file. You can access the help file from here.



[OP_103]

23 List of terms and abbreviations

23.1 Abbreviations

DAQ	Data acquisition
ICP	Integrated circuit supply (used for accelerometer sensors)
GUI	Graphical user interface
PID	Proportional, integral derivative controller. See chapter PID Control 14.6.1
CAN	Controller are network
Sensor	Is a probe to measure pressure, temperatures, digital signals like pulse etc...
PWM	Pulse width modulation. See chapter function generators 14.4
PlugIn	Software program to enable a communication with a vendor-specific measurement instrument and IPEmotion.
TESTdrive	Operating system of IPETRONIK data loggers
DBC	CAN bus description file
LDF	LIN bus description file
A2L	Description files for ECUâĂŹs
ECU	Electronic control unit operating electronic components like engine in a vehicle
XCP	Universal calibration Protocol
CCP	CAN calibration Protocol
J1939	CAN bus protocol applied for diesel engines (Truck, Ship, Construction Machines, ...)
UDS	Unified Diagnostic Services
GM-LAN	GM specific protocol
KWP	Key word protocol - Diagnostic protocol
OBD	Also called OBD2 - Diagnostic protocol
ODT	Object Descriptor Table
DTO	Data Transfer Objects
CWT	Climatic Wind Channel
TEDS	Transducer Electronic Data Sheet 11.2.3
RPM	Revolutions per Minute 18.24.3

23.2 IPEmotion specific file formats

.iwf	IPEmotion Workspace File 6.2
.ipc	IPEmotion Project Configuration
.iac	IPEmotion Acquisition Configuration
.ioc	IPEmotion Online-View Configuration
.icc	IPEmotion Analysis Operation Configuration
.inc	IPEmotion Analysis View Configuration
.isc	IPEmotion Script Configuration
.idf	IPETRONIK Diagnostic File
.isf	IPEmotion System File
.irc	IPEmotion Runtime Configuration 4.1.9
.mpc	Measure Point Catalog 22.2.1
.ird	IPEmotion Raw Data
.iad	IPEmotion Acquisition Data
.lic	License File for server license management 5.9
.irl	IPEmotion Reporting Layout
.iec	IPEmotion Reporting Configuration
.imd	IPEmotion MAL Definition
.imt	IPEmotion MAL Template
.iaw	IPEmotion App Workspace 6.3
.itf	IPEmotion Template File
.ief	IPEmotion Environment File
.luf	License Update File 5.8.4
.hrd	IPEhub2 raw data file to store CAN traffic trace files on SD card 6.3 and 22.7.3
.idf	IPEmotion diagnostic file used for diagnostic measurements
.pdx	Diagnostic file for UDS measurement
.odx	Diagnostic file

24 Keyboard handling

This page offers an overview about the keyboard navigation within the **View** and **Analysis** tabs.

24.1 View

General

- **Page Up**/**Page Down**: Change between the first and last entries from a list
- **Tab**: Focus the next element
- **Tab+Shift**: Focus the previous element
- **Ctrl+C**: Copy the focused element
- **Ctrl+V**: Paste the focused element
- **Ctrl+X**: Cut the focused element
- **Delete**: Delete the focused element

Content tree

- **Ctrl** →/←: Show/hide subnodes
- ↑/↓: Select previous/next node
- **Shift** ↑/↓: Add previous/next node to selection
- **Ctrl+A**: Select all
- **Ctrl+move node with mouse**: Cut node and add to destination node
- **Shift+move node with mouse**: Cut node and add above destination node
- **Alt Gr+move node with mouse**: Cut node and add below destination node
- **Page Up**/**Page Down**: Select first/last node

List of channels

- ↑/↓: Select previous/next node
- **Shift** ↑/↓: Add previous/next node
- **Ctrl+A**: Select all
- **Page Up**/**Page Down**: Select first/last node

List of pages

- ↑/↓: Select previous/next node
- **Shift** ↑/↓: Add previous/next node to selection
- **Ctrl+A**: Select all
- **Page Up**/**Page Down**: Select first/last node

yt-chart

- **+/-**: Zoom in/zoom out the x-axis
- **Shift**: Mode “Select”
- **Shift +/-**: Zoom in/zoom out all y-axes
- **Shift** →/←: Move the x-axis by one axis sclaing to the right/left
- **Ctrl** →/←: Move the x-axis by the total length to the right/left
- **Shift** ↑/↓: Move all y-axes by one axis scaling up/down
- **Ctrl**: Mode “Stretch/Compress”

Alphanumerical

- **Enter**: Open the input field only if the measuring is running
- **Enter (input field open)**: Set value and close input field
- **Esc (input field open)**: Close input field and do not set value
- **+/- (spin buttons active)**: Increase/decrease the value
- ↑/↓ **(spin buttons active)**: Increase/decrease the value

Slide control

- **+/-**: Increase/decrease the value
- →/←: Increase/decrease the value of a horizontal slider
- ↑/↓: Increase/decrease the value of a vertical slider

Switch

- **Space bar**: Change between the status “On” and “Off” of the output

Traffic Analyzer

- ↑/↓: Select previous/next row
- →/←: Focus next/previous column to the right/left
- **Ctrl +/-**: Show/hide signals of a message, if possible
- **Page Up**/**Page Down**: Switch to first/last row from the current page
- **Home**/**End**: The first/last column "Time"/"Description" is focused
- **Delete**: The marked value is deleted
- **Statistic Frame**: **+/- [NumBlock]**: Drop down list is open/closed
- **Statistic Frame**: **Ctrl +/-**: Drop down list is open/closed

Message generator

- ↑/↓: Select previous/next message
- →/←: Select next/previous slot

Table

- ↑/↓: Select previous/next line
- →/←: Select next/previous slot

Map

- **+/-**: Zoom in/zoom out the map
- ↑/↓: Move the map up/down
- →/←: Move the map to the right/left

Action

- **Enter**: Execute program/script

24.2 Analysis

General

- **Page Up**/**Page Down**: Change between the first and last entries from a list
- **Tab**: Focus the next element
- **Tab+Shift**: Focus the previous element
- **Ctrl+C**: Copy the focused element
- **Ctrl+V**: Paste the focused element
- **Ctrl+X**: Cut the focused element
- **Delete**: Delete the focused element

Content tree

- **Ctrl** →/←: Show/hide subnodes
- ↑/↓: Select previous/next node
- **Shift** ↑/↓: Add previous/next node to selection
- **Ctrl+A**: Select all
- **Ctrl+move node with mouse**: Cut node and add to destination node
- **Shift+move node with mouse**: Cut node and add above destination node
- **Alt Gr+move node with mouse**: Cut node and add below destination node
- **Page Up**/**Page Down**: Select first/last node

List of loaded measurement files

- ↑/↓: Select previous/next node
- **Shift** ↑/↓: Add previous/next node to selection
- **Ctrl+A**: Select all
- **Page Up**/**Page Down**: Select first/last node

List of pages

- ↑/↓: Select previous/next node
- **Shift** ↑/↓: Add previous/next node to selection
- **Ctrl+A**: Select all
- **Page Up**/**Page Down**: Select first/last node

Extended measurement window

- ↑/↓: Select previous/next node

yt-chart

- **Space bar**: Change the active measuring cursor
- →/←: Move the measuring cursor on the active graph by exactly one value
- ↑/↓: Move the active measuring cursor by 0.5 % of the x-axis range to the right/left
- **Home**/**End**: Move the active measuring cursor to the point, which is the colsest to the upper/lower limit oft the x-axis range
- **+**/**-**: Zoom in/zoom out the x-axis
- **Shift**: Mode “Select”
- **Shift +**/**-**: Zoom in/zoom out all y-axes
- **Ctrl +**/**-**: Zoom in/zoom out the active y-axis
- **Shift** →/←: Move the x-axis by one axis scaling to the right/left
- **Ctrl** →/←: Move the x-axis by the total length to the rigth/left
- **Shift** ↑/↓: Move all y-axes by one axis scaling up/down
- **Ctrl** ↑/↓: Move the active y-axis by one axis scaling up/down
- **Ctrl**/**Alt**: Mode “Stretch/Compress”

xy-chart

- **Space bar**: Change the active measuring cursor
- →/←: Move the measuring cursor on the active graph by exactly one value
- ↑/↓: Move the active measuring cursor by 0.5% of the time channel range back/forth
- **Home**/**End**: Move the active measuring cursor to the first/last point
- **+**/**-**: Zoom in/zoom out the x-axis
- **Alt +**/**-**: Zoom in/zoom out the active x-axis
- **Shift**: Mode “Select”
- **Shift +**/**-**: Zoom in/zoom out all y-axis
- **Ctrl +**/**-**: Zoom in/zoom out the active y-axis
- **Shift** →/←: Move the x-axis by one axis scaling to the right/left
- **Ctrl** →/←: Move the x-axis by one axis scaling to the right/left
- **Shift** ↑/↓: Move all y-axes by one axis scaling up/down
- **Ctrl** ↑/↓: Move the active y-axis by one axis scaling up/down
- **Ctrl**/**Alt**: Mode “Stretch/Compress”

Polar diagram

- **Space bar**: Change the active measuring cursor
- →/←: Move the measuring cursor on the active graph by exactly one value
- **Page Up**/**Page Down**: Move the measuring cursor on the active graph by 60 steps
- **Home**/**End**: Move the active measuring cursor to the point which is the closest to the upper/lower limit of the angle range
- **+/-**: Boths graphs are zooming in/zooming out
- **Ctrl +/-**: Only the selected graph is zooming in/zooming out
- **Alt +/-**: Zoom in/out the current curve by one tenth of the currently displayed scale
- **Shift** →/←: The whole polar diagram is rotating clockwise/counterclockwise
- **Ctrl** →/←: The whole polar diagram is rotating clockwise/counterclockwise
- **Shift** ↑/↓: The range of amplitude axises from both graphs decreased/increased
- **Ctrl** ↑/↓: The selected graph is zooming in/zooming out

Campell diagram

- **Delete**: Delete the instrument
- **Tab**: Switch to next panel
- →/←: Move the measuring cursor to the right/left
- ↑/↓: Move the measuring cursor up/down
- **Page Up**/**Page Down**: Move measuring cursor for many steps
- **Home**/**End**: Move the measuring cursor to the first/last point
- **Space**: Switch between cursor 1 and 2
- **Shift** →/←: Panning
- **Ctrl** →/←: Panning, active curve
- **Shift** ↑/↓: Turn the diagram
- **+/-**: Zoom in/zoom out
- **Ctrl +/-**: Zoom in/zoom out the active curve

Classification grid

- **Delete**: Delete the instrument
- **Tab**: Switch to next panel
- →/←: Move the measuring cursor to the right/left
- ↑/↓: Move the measuring cursor up/down
- **Page Up**/**Page Down**: Move measuring cursor for many steps
- **Home**/**End**: Move the measuring cursor to the first/last point
- **Space**: Switch between cursor 1 and 2
- **Shift** →/←: Panning
- **Ctrl** →/←: Panning, active curve
- **Shift** ↑/↓: Turn the diagram

- **+**/**-**: Zoom in/zoom out
- **Ctrl +**/**-**: Zoom in/zoom out the active curve

Log p-h diagram

- →/←: Move the slider to the next/previous position
- **Home**/**End**: Move the slider to the start/end position

Traffic Analyzer

- ↑/↓: Select previous/next row
- →/←: Focus next/previous column to the right/left
- **Ctrl +**/**-**: Show/hide signals of a message, if possible
- **Page Up**/**Page Down**: Switch to first/last row from the current page
- **Home**/**End**: The first/last column "Time"/"Description" is focused
- **Delete**: The marked value is deleted
- **Statistic Frame**: **+**/**- [NumBlock]**: Drop down list is open/closed
- **Statistic Frame**: **Ctrl +**/**-**: Drop down list is open/closed

Table

- ↑/↓: Select previous/next line
- →/←: Select next/previous slot

Map

- **+**/**-**: Zoom in/zoom out the map
- ↑/↓: Move the map up/down
- →/←: Move the map to the right/left

Video

- →/←: Move the slider to the next/previous position
- **Home**/**End**: Move the slider to the start/end position

3D-View

- ↑/↓ / →/←: Rotate the camera
- **Page Up**/**Page Down**: Zoom in/zoom out the camera
- **Shift** ↑/↓: The 3D model is moving up/down
- **Shift** →/←: The 3D model is moving right/left
- **Home**: The 3D model is moved back to the central position
- **W**/**S**: Move the camera in/out
- **A**/**D**: Move the camera to the left/right

Action

- **Enter**: Execute program/script