

Automotive

Energy & Power Analysis

Aerospace & Defense

Transportation

General Test & Measurement

DEWETRON

User Manual



ISO9001

Test & Measurement Solutions



www.dewetron.com

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Table of contents

1 Basic knowledge	4
1.1 System overview	4
1.2 Measurement amplifiers	5
1.2.1 Single-ended-amplifiers	5
1.2.2 Differential amplifiers	6
1.2.3 Isolated amplifiers of the DAQP series.....	7
1.3 A/D-converter boards	8
1.3.1 Sampling rate and aliasing.....	8
1.3.2 Filter: high-pass/low-pass	9
1.4 Software	10
1.4.1 Basic measurement (first steps).....	10
1.4.2 Creating and managing individual measurement displays.....	15
1.4.3 Configuration of amplifier and data acquisition cards	18
1.4.4 Setup.....	20
1.4.5 Digital inputs.....	28
1.4.6 Counter inputs	29
1.4.7 CAN-bus data acquisition	34
1.4.8 CAN-bus data output	37
1.4.9 Video channel.....	40
1.4.10 Analysis, data view, zoom, print, conversion in other file formats	42
1.4.11 Storage options: continuously fast or slow, with trigger	48
1.4.12 Basic Mathematics	57
1.4.13 Storing additional information, serial number, test procedure and events with the measurement results	63
1.4.14 Scaling with data from the sensor database, non-linear scaling.....	67
1.4.15 Sensor database, storage location, merging two databases.....	73
1.4.16 Project setup.....	74

1 Basic knowledge

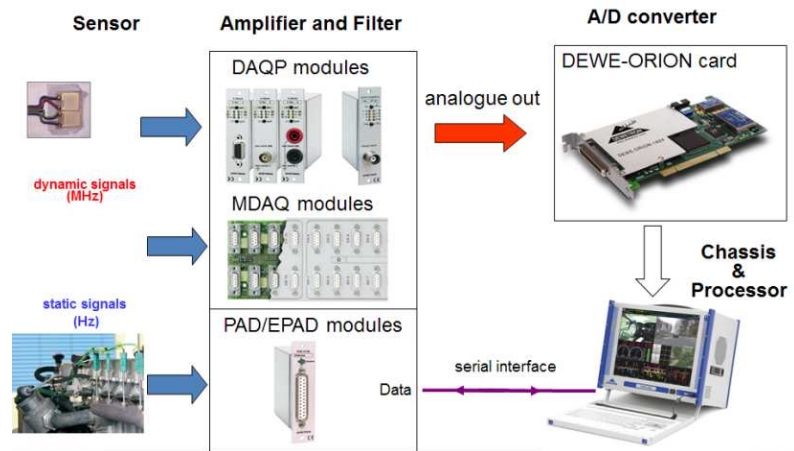
1.1 System overview

All DEWETRON systems are based on the same modular principle:

- Sensor
- Amplifier
- A/D board

The sensor is connected to a measurement amplifier (DAQP-xx). Depending on the amplifier, the input ranges and the filters can be set up individually. Amplifiers boost the signal of a sensor to provide a higher voltage for the A/D board.

Imagine the maximum output signal of a strain gauge to be 100 μ V and the smallest input range of the A/D board to be 100 mV. An amplifier is needed to increase the signal to get better resolution and less noise.



The amplifier's filters (low-pass) reduce the interfering noise, but also reduce the bandwidth. Galvanic isolation reduces the signal noise and avoids ground loops. MDAQs are amplifiers with differential inputs and a large common-mode range. They are not isolated and are mainly used in systems with high channel-density, because of their smaller size. For these measurements, galvanic isolation is often not necessary, because in most cases the sensors themselves are isolated and are supplied directly from the system.

The analog output of the DAQP or MDAQ amplifiers is connected with the A/D board. With the ORION A/D boards by DEWETRON, synchronous sampling is possible; furthermore every channel has its own A/D converter. The 16-bit ORION cards have a conversion rate of up to 1 MHz. ORION cards with 24 bit resolution have a maximum sampling rate of 200 kHz and additionally have an anti-aliasing filter.

PAD and EPAD modules are quasi-static isolation amplifiers. They are used for slowly changing values like temperature, but also voltages can be measured. The A/D converter is located directly in the module, the sampling rate of PAD and EPAD is in the range of 1 to 10 Hz. The measured data is transferred via serial interface. The serial interface is also used for the configuration of the DAQP and MDAQ amplifiers. PAD modules are used directly inside the DEWETRON instrument, whereas EPAD modules are connected externally. A bus-cable with integrated power-supply is necessary to daisy-chain all modules with the instrument.

MSI adapters (Modular Smart Interfaces) are add-ons for HSI, DAQP and MDAQ signal conditioning modules to expand their measurement functionality.

MSIs enable customers to use e.g. a bridge amplifier (DAQP-STG, DAQP-BRIDGE) for measuring also IEPE®, thermocouple, Pt100 to Pt2000, charge or voltage up to 200 V. MSI adapter are automatically detected in the software.



Additionally, every DEWETRON instrument has digital inputs/outputs and at least two counter inputs.

Optional extensions are:

- Counter
- Video input
- CAN bus
- GPS
- PCM Telemetry
- High speed video up to 500 000 frames/sec
- Thermo camera
- ARINC 429 / MIL1553
- Etc.

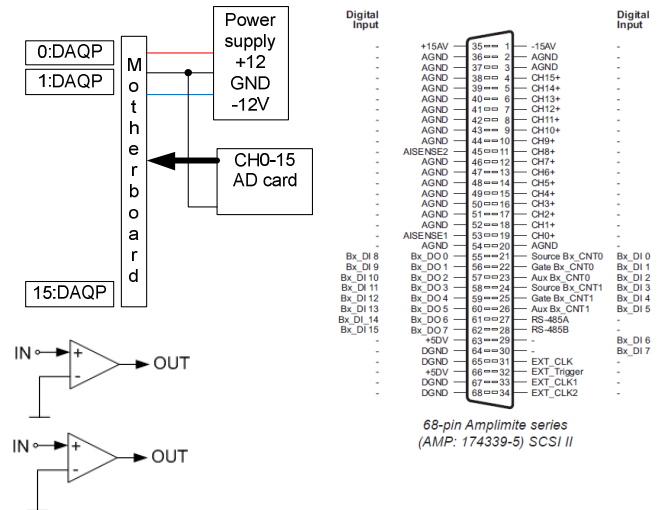
1.2 Measurement amplifiers

1.2.1 Single-ended-amplifiers

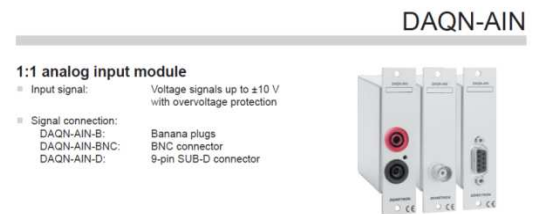
Single-ended-amplifiers have one or more inputs, but refer to one common reference voltage. All A/D boards are based on this principle. They have several inputs but refer to a common GND.

The A/D board in DEWETRON measurement systems with DAQP modules is single-ended and connected to the DAQ-motherboard (module mount).

The DAQP modules deliver the output voltage referenced to GND.



If the DEWETRON rack is equipped with DAQN-AIN, the signal is measured „single-ended“. All negative inputs of DAQN modules (-IN) are merged.

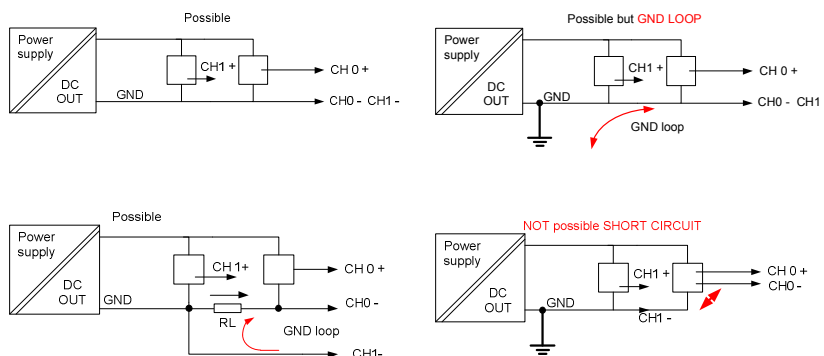
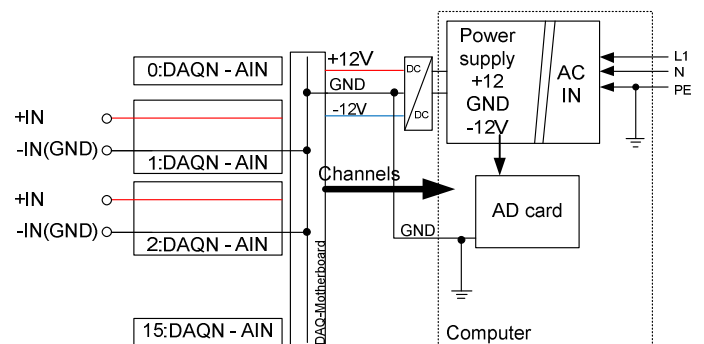


Due to the GND-connection of the power supply unit, every A/D board of measurement instruments with AC power supply is grounded, too. And also the negative inputs (-IN) of the DAQP-AIN module is grounded.

In the block diagram you can see that the inputs of AC instruments are connected to the power supply unit and to the GND. So no measurements with voltage between negative input and GND are possible.

In other words: the measured voltage must be galvanically isolated or referred to ground potential. Minor voltage differences result in compensating currents, which lead to measurement errors and signal noise.

All measured channels must refer to the same measuring point (GND).



DAQN-AIN-D module

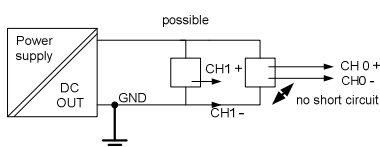
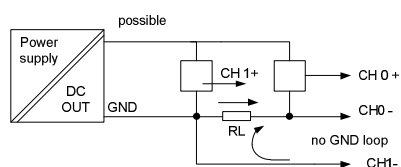
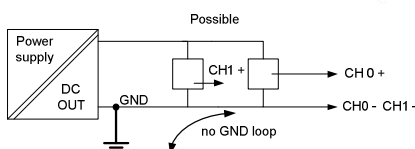
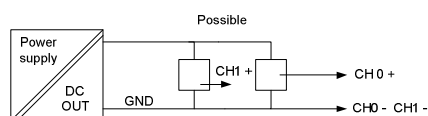
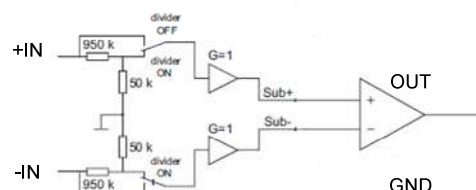
Voltage measurement via SUB-D cord



- 1 Input (+)
- 2 RS-485 A
- 3 RS-485 B
- 4 GND
- 5 +9 V power supply
- 6 +12 V power supply
- 7 Reserved
- 8 Reserved
- 9 -9 V power supply

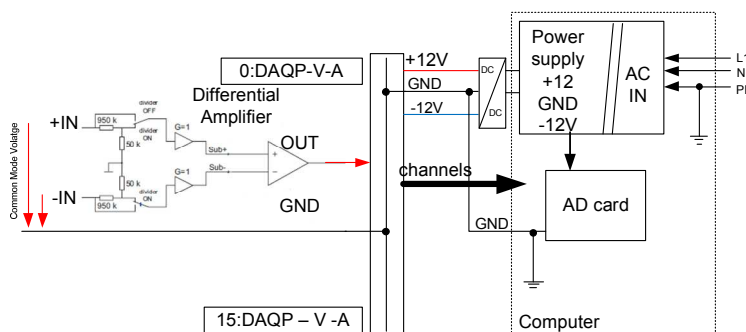
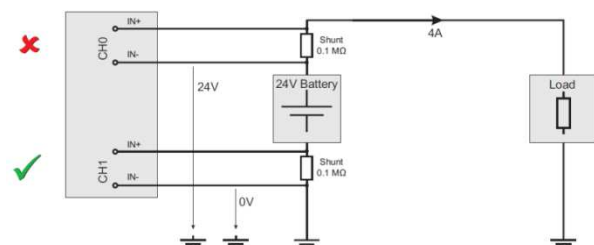
These are high-impedance inputs and don't have a direct connection to the ground (GND) of the measurement system. Due to these high-impedance inputs, the disadvantages of a single-ended amplifier are gone.

Differential Amplifier



Differential amplifiers measure the input voltage between +IN and -IN. But both inputs must stay within a certain voltage range, referenced to internal GND. Exceeding this level results in wrong measurement data. This voltage is called the **common-mode voltage**.

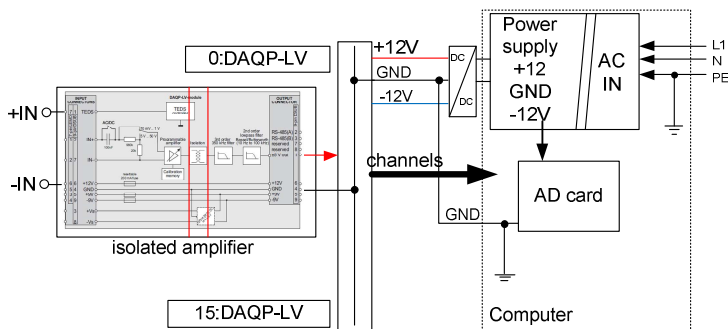
		MDAQ-SUB-V-200-xx
Input voltage range:	Divider Off Divider On	±0.125 V, 0.25 V, 0.5 V, 1 V, 1.25 V, 2.5 V, 5 V, 10 V (common mode voltage up to 12 V) ±2.5 V, 5 V, 10 V, 20 V, 25 V, 50 V, 100 V, 200 V (common mode voltage up to 250 V)
Input impedance		1 Mohm to GND 2 Mohm differential



In the example above, the perfect range of CH0 would be 0.5 V. But in this range the common mode voltage is just 12 V. Both inputs must not pass ± 12 V compared to the internal GND. Solution: Set 2.5 V range (250 V common mode voltage)

1.2.3 Isolated amplifiers of the DAQP series

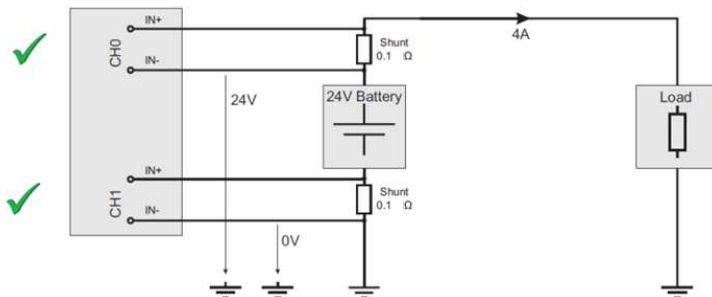
The isolated (galvanic isolation) amplifiers are also differential. For this type of amplifier just the maximum of **isolation voltage** is important (instead of common-mode voltage).



Input overvoltage protection	350 V _{DC}
Isolation voltage	350 V _{DC} (1 kV _{RMS} with banana connector)

Isolated amplifiers are more expensive than differential ones, but they are necessary for lots of applications. Because of the isolation you don't need to worry about ground loops, short-circuits or common-mode voltages. Most important: You must not exceed the maximum of isolation voltage against the chassis.

Due to the isolation and the high input resistance, the measurement signal is not disturbed. It is no problem to measure everywhere without before knowing the reference of the signal; like in a digital multimeter.



1.3 A/D-converter boards

The A/D boards convert the analog input signal into a digital one. Depending on the card type a maximum sampling rate of 100 kHz to 1 MHz is possible. So every signal can be sampled up to 1.000.000 times per second.

Each analog input of any DEWE-ORION card has its own A/D converter with a resolution of 16, 22 or 24 bit. The resolution (n bit) shows the quantification level for the input range (2^n).

No. of bits	Discrete steps	Smallest resolution for input range					
		+/- 1V		+/- 5V		+/- 10V	
		[V]	[mV]	[V]	[mV]	[V]	[mV]
8	256	0,0078125	7,8125	0,0390625	39,0625	0,078125	78,125
12	4096	0,000488281	0,48828125	0,002441406	2,44140625	0,004882813	4,8828125
14	16384	0,00012207	0,122070313	0,000610352	0,610351563	0,001220703	1,220703125
16	65536	3,05176E-05	0,030517578	0,000152588	0,152587891	0,000305176	0,305175781
24	16777216	1,19209E-07	0,000119209	5,96046E-07	0,000596046	1,19209E-06	0,001192093

1.3.1 Sampling rate and aliasing

For time measurement of a sine signal with a frequency of 105 Hz, the sampling rate should be 10 to 20 times higher. In this case: 2000 Hz (105 Hz * 20 = 2000). If this signal is sampled with e.g. just 125 Hz you will receive a sinus signal with a low frequency of 20 Hz. And this signal doesn't exist in reality; it is created artificially by undersampling. This effect is called aliasing.

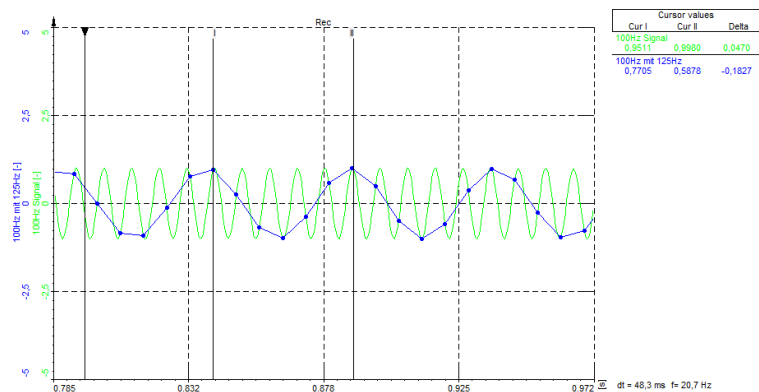
To avoid aliasing, a low-pass filter must attenuate higher frequencies before A/D conversion. The low-pass filter shouldn't pass frequencies that are higher than the half sampling rate. This guarantees that there is no aliasing. The used filter should have a high order to strongly attenuate frequencies which are above the set cut-off frequency (analog filter 4th to 8th order, attenuation of 24 to 48 dB/octave).

The A/D converter of the 24-bit card (ORION-1624-xxx series) has a built-in anti-aliasing filter. This filter is set automatically to about half the sampling rate, no aliasing effects are present.

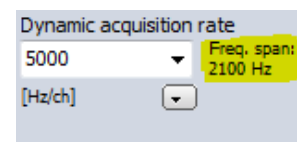
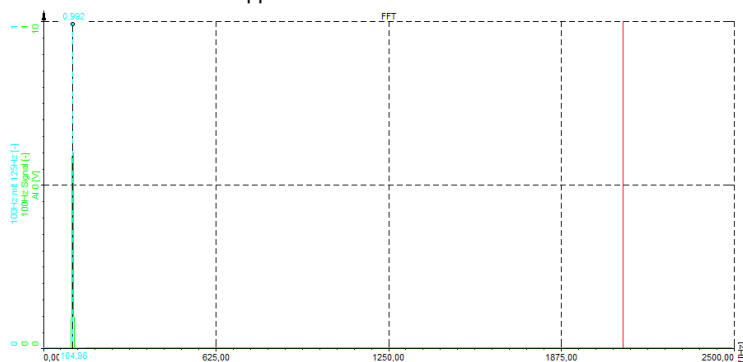
The actual frequency range with no aliasing is shown in the software besides the sampling rate.

Frequency span: If a FFT display (Fast Fourier Transform) is added to the measurement, then the frequency axis is automatically zoomed to this frequency. Between 0 to frequency span (0 Hz to red line) there are no aliasing frequencies.

Since this filter also doesn't have infinite steepness (brick-filter), the actual range is smaller than half the sampling rate. This filter is only available with 24-bit cards.



The aliasing-free measurement is especially important for vibration or modal analysis. Therefore, just 24-bit A/D cards with anti-aliasing filter should be used for these applications.



1.3.2 Filter: high-pass/low-pass

Low-pass filter:

The low frequencies pass the low-pass filter and the high frequencies are damped. For filters a cut-off frequency is specified. At this frequency the signal amplitude starts to decrease.

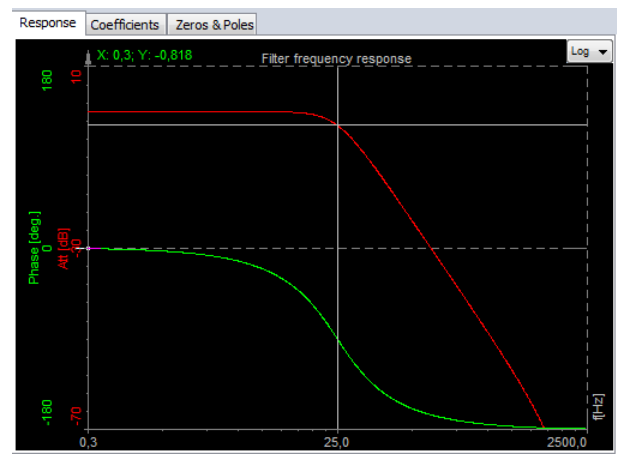
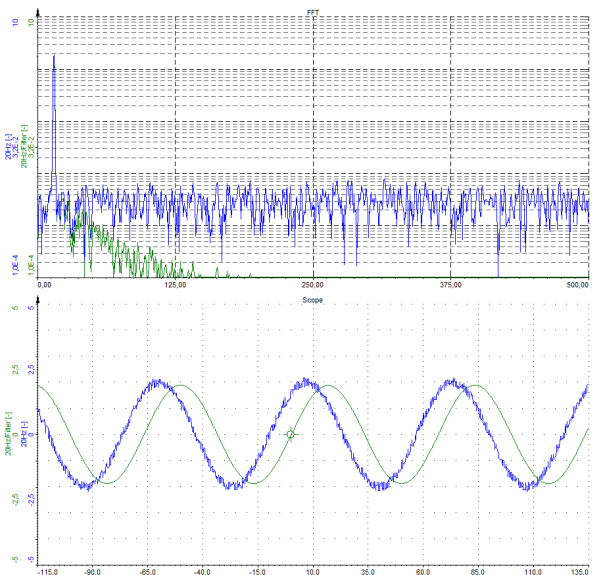
Right picture: The diagram shows a typical low-pass 2nd order filter curve. Between 0 and approx. 25 Hz all frequencies can pass but, higher signal components are filtered out.

Lower left picture: In this example you can see the noisy input signal (blue) and the filtered signal (green) in time domain. The high-frequency noise components are damped by the filter.

Upper left picture: In the FFT spectra you can see the higher frequencies that are attenuated strongly after filtering. The desired signal remains unchanged, because it is inside the passband of the filter. The phase angle of the filter (right picture, green line) depends on the signal frequency. In most of the passband, the angle is around 0 degree, but gets larger towards the cut-off frequency.

Low-pass filters are mainly used for reducing the bandwidth of a signal and thus the signal noise.

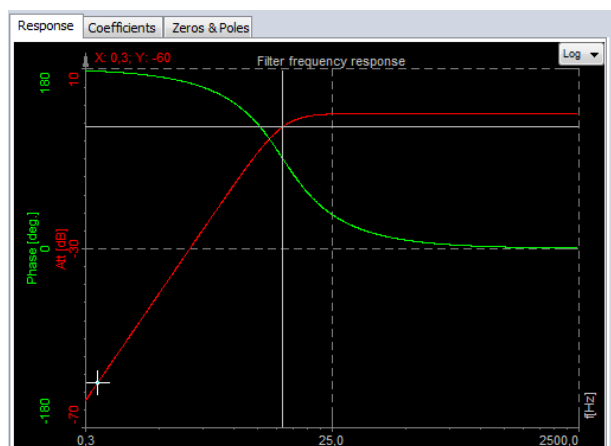
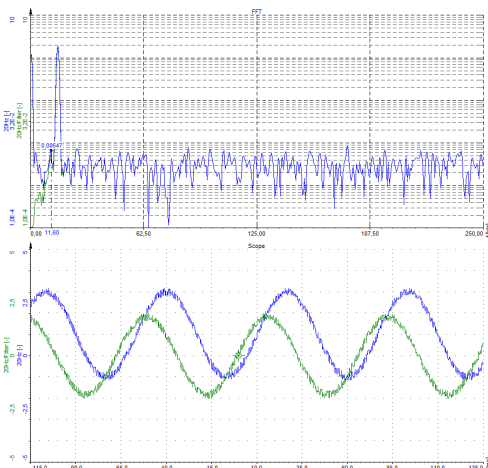
- ➔ All signals, which are used in one calculation should be used with the same filter settings
- ➔ At the cut-off frequency the filtered signal already has an amplitude attenuation of -3 dB (-30 %)



High-pass filter:

The high frequencies pass and the low frequencies are filtered out. If the cut-off frequency is 10 Hz, then all frequencies higher than 10 Hz can pass and lower frequencies are attenuated. Therefore high-pass filters are used to eliminate static components (DC-components, offsets).

You can see the high-pass filter output in the analysis below. The input signal has a DC component of 1 V, but after high-pass filtering this offset is removed. This filter results can also be seen in the FFT spectra; the frequency components are filtered below 10 Hz, but above 10 Hz they can pass.



1.4 Software

1.4.1 Basic measurement (first steps)

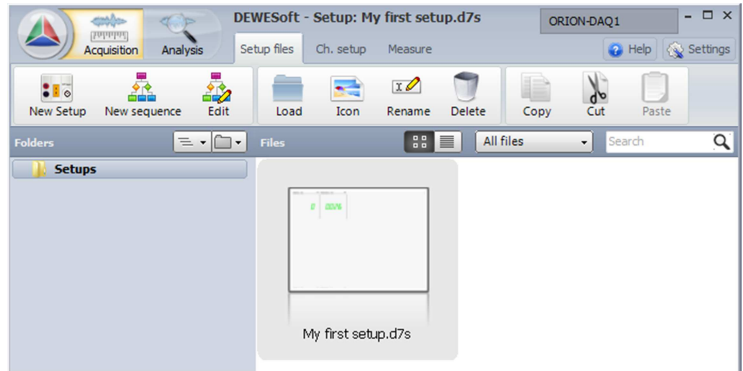
Start **DEWESoft 7** with the Icon on your desktop.



The software is divided in two main parts:
ACQUISITION and **ANALYSIS**.

They are used to switch between
ACQUISITION mode to acquire data and
ANALYSIS mode to process the data.

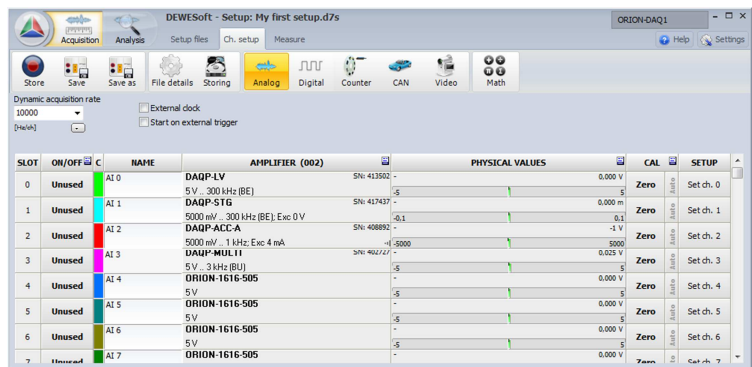
After you have started the software, you are
in **Setup mode** (Setup files).
The folder with the setups is shown in the left
menu.
Here you can load your stored setups.
If no setup is loaded, you start with a new
setup in the **Ch. Setup** (Channel setup).



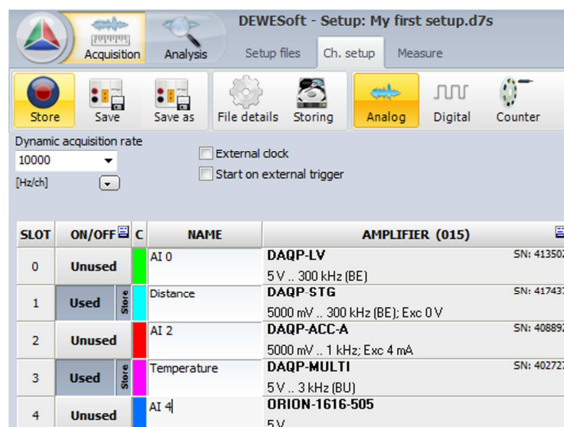
In the Channel Setup you can set your
measurement configuration for:

- Measurement channels
- Measurement amplifiers
- Sampling rate
- Storage type
- Scaling

All amplifiers are detected automatically
and displayed in the channel list.



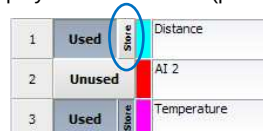
Learning by doing - A simple measurement:



At first, activate the channels 1 and 3 by clicking the **Used button**. Now
they are active, stored in the data file and displayed during the
measurement in the channel list.

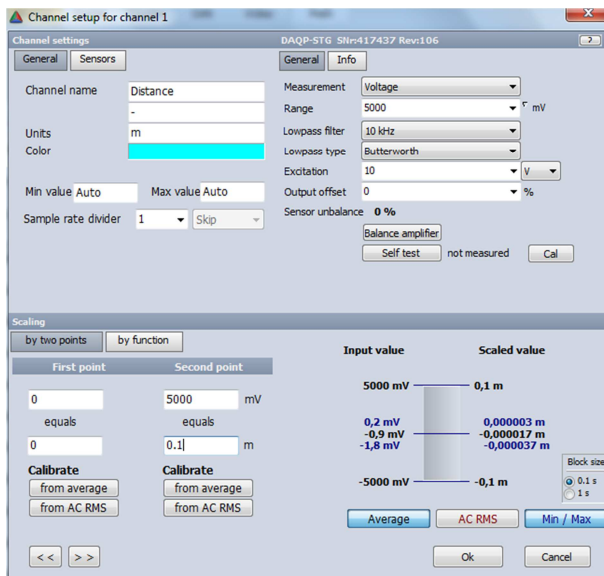
ALL channels, which are set to "Used" in setup are stored in the data
file. No matter if they are displayed during the measurement in an
instrument or not.

Channel storing can be deactivated optionally: the channel is then
displayed but not stored (picture below, channel 1).



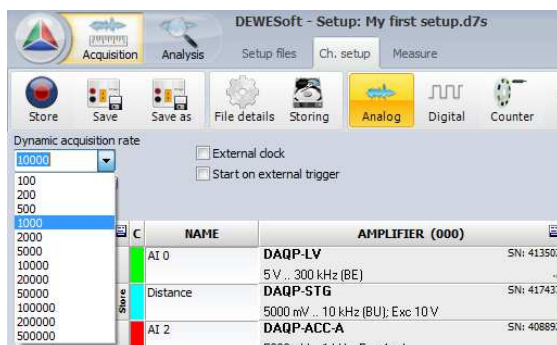
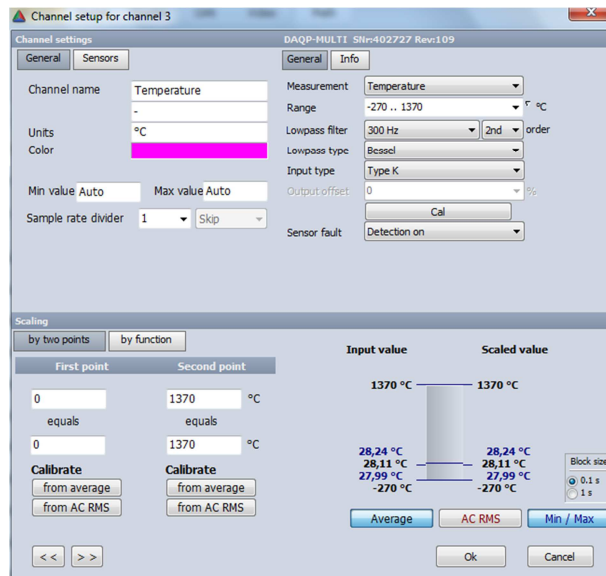
SLOT	ON/OFF	C	NAME	AMPLIFIER (006)	PHYSICAL VALUES	CAL	SETUP
0	Unused	AI 0	DAQP-LV	SN: 413502	0,000 V	Zero	Set ch. 0
1	Used	Distance	DAQP-STG	SN: 417437	-1 V	Zero	Set ch. 1
2	Unused	AI 2	DAQP-ACC-A	SN: 408892	-1 V	Zero	Set ch. 2
3	Used	Temperature	DAQP-MULTI	SN: 402727	0,025 V	Zero	Set ch. 3
		AI 4	ORION-1616-505		0,000 V		

Configure the amplifier and scaling for each channel in the **setup** menu.



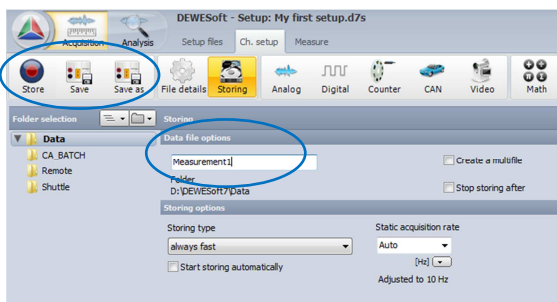
Set the DAQP-STG amplifier to **voltage** mode and scale the sensor for distance measurement.

Set channel 3 with DAQP-MULTI amplifier to **temperature** with thermocouple type K. No scaling is necessary, because the measured temperature is displayed directly.



Now the analog channels are ready for measurement.

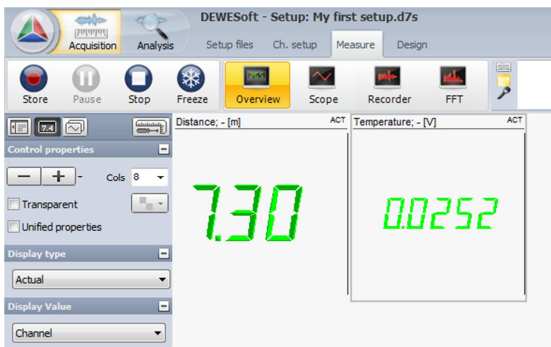
With **Dynamic acquisition rate** you can set the sampling rate for the channels.



Set the file name in the **Storing** menu. All measurement results will be saved in this data file.

You can save all your settings with **Save** or **Save as** and load them again later.

This setup was saved with the name „(My first setup“. You see the name as the window title of the software.



Now go to the **Measure** menu.

This mode has four predefined measurement views:

- **Overview:** each active channels in digital instruments
- **Scope:** oscilloscope view
- **Recorder:** recorded data vs. time
- **FFT:** frequency analysis

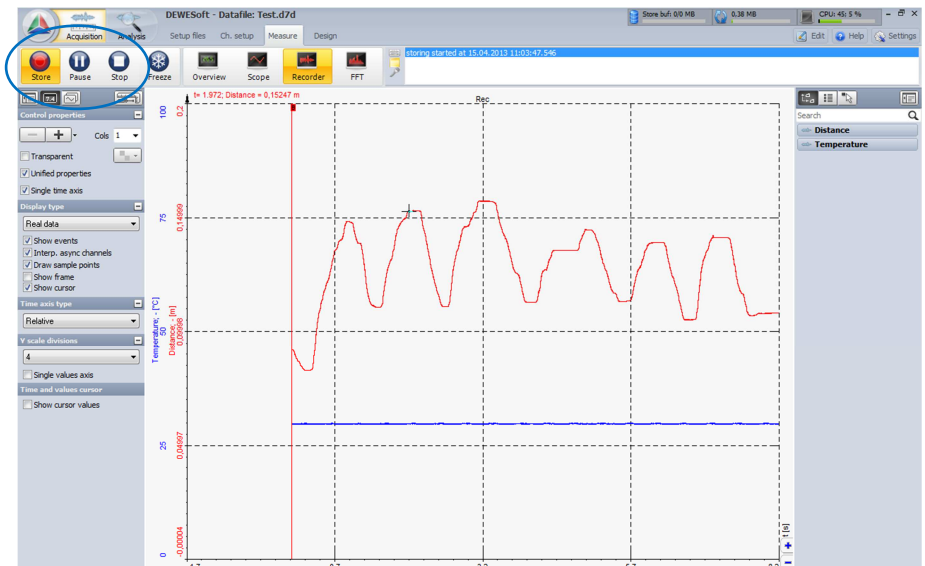


The measured data is **displayed but not stored** in the data file.

Use **store** for storing the data file. All current data in the instruments is deleted and the newly acquisitioned data is now stored in the file.

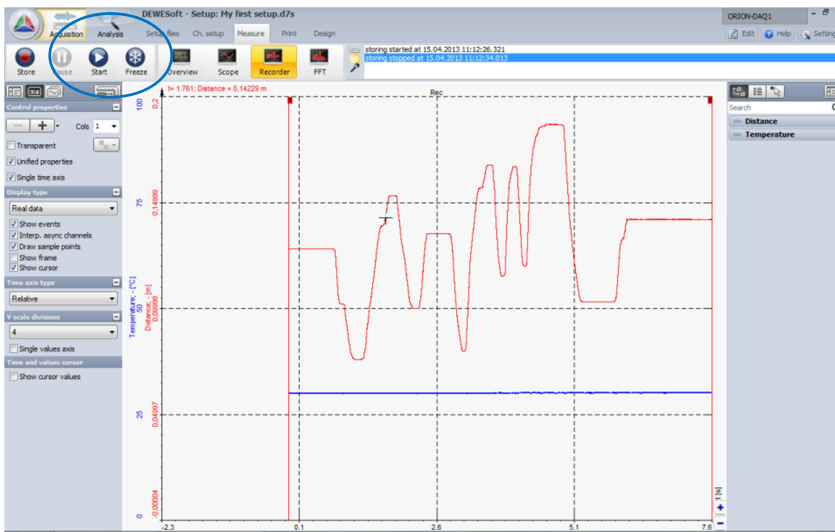
The store button is highlighted in red and the name of the current file is display in the title of the software window. A vertical red line shows the start of the new acquisition.

During the measurement you can switch between the different views. This has no impact on your saved data.



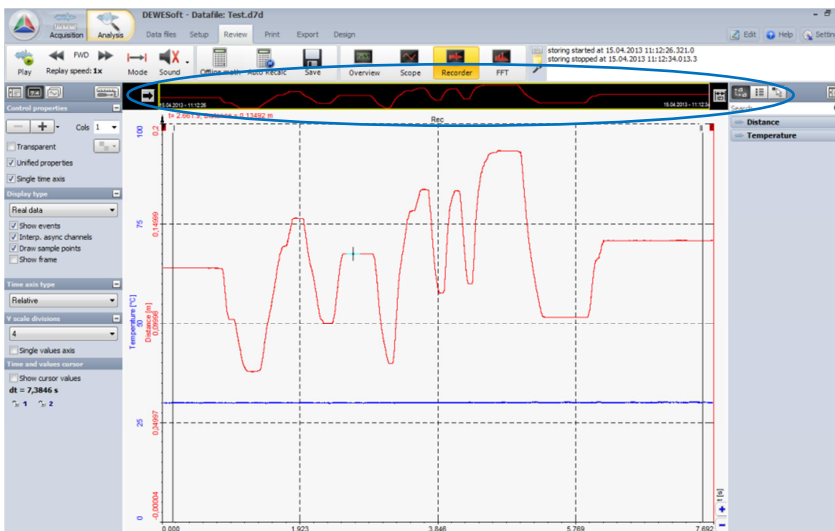
With **pause** you can take an acquisition break. The name of the button changes to **resume** then, when being pushed the measurement continues.





The **Stop** button is used to finish data acquisition.

Push **Start** again to preview the data without storing.

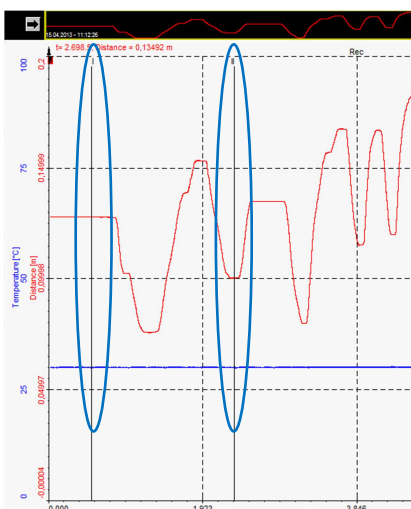


In ANALYSIS mode the recently recorded data file is loaded automatically. The navigation bar (blue) shows the same range as you can see inside the recorder.

Click once more on ANALYSIS and you see a list with all stored data files.

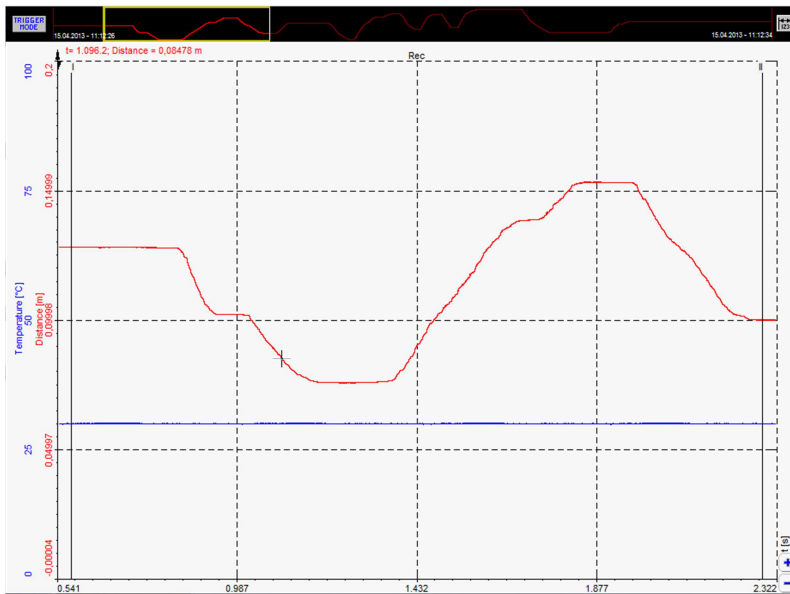
ZOOM:

Click on the start position of the view area that should be enlarged. Hold the left mouse button and release at the end of the area to be zoomed.

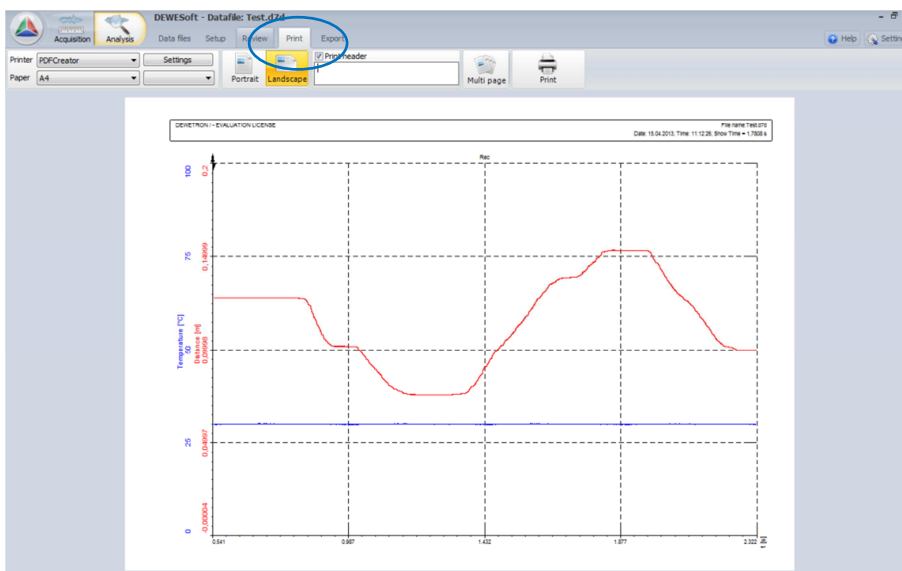


Now the zoom range is marked with two cursors. Click in the middle to zoom in. This can be done several times.

Right mouse-click to zoom out.



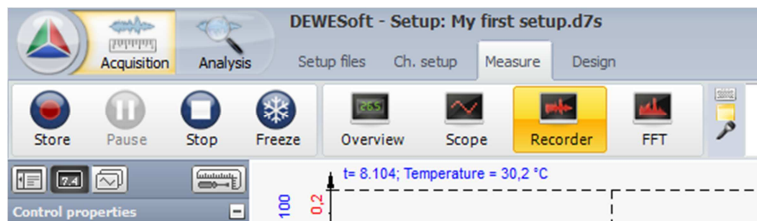
Now the recorder shows just the zoomed-in range. Also the navigation bar (black bar above) shows the same zoomed range as a yellow window.



The current view can be printed with the **print** menu.

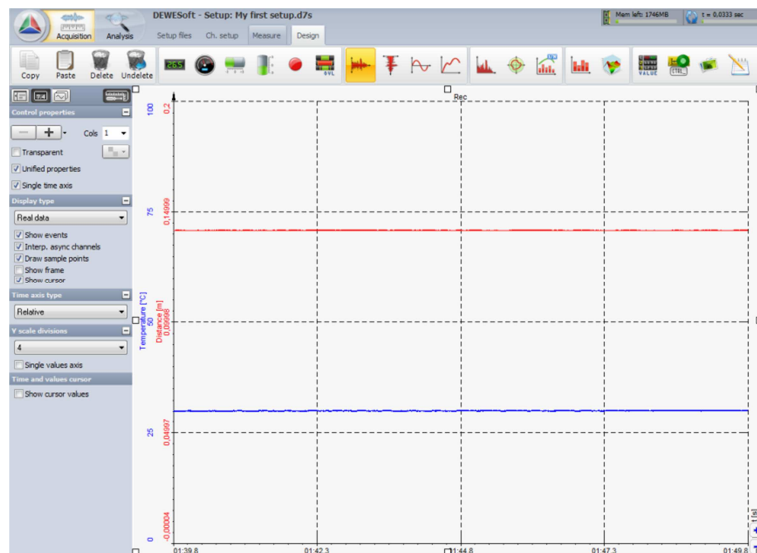
The basic measurement is now finished.

1.4.2 Creating and managing individual measurement displays



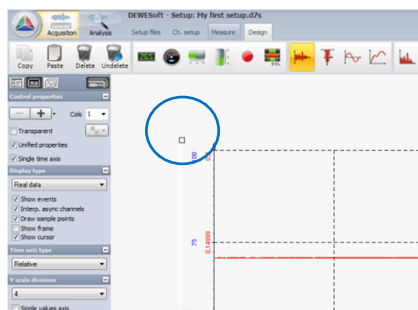
You can easily view and analyze your data with the graphical screens (Overview, Scope, Recorder, FFT) in the **Measure** menu.

Each screen can be configured individually in **Design** mode.



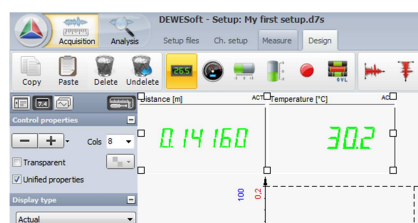
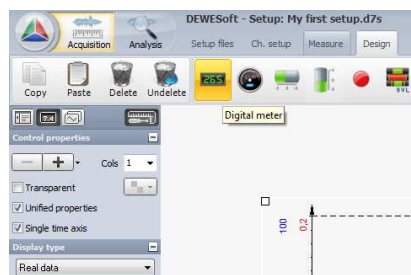
In **Design** mode several instruments are shown, e.g.:

- Digital meter
- Analog meter
- Bar graph
- Channel lists
- XY diagrams
- Rainfall diagrams
- Text fields
- Input fields



The active instrument is marked with a border.
Use the border to change the position and size of the instrument.

New instruments are simply added with a click.



Add several different instruments or with the **plus button** a group of the same instruments.



Instrument groups are sized and positioned as a whole group. Each click on the plus adds a new instrument to the group. With the columns drop-down-menu you can define how many instruments are placed in one row.
The next available channels are automatically assigned to the new instruments.



After all necessary instruments have been added, you can switch into **measure** mode.

All properties of the selected instrument (focus) are shown in the left menu.

Check **unified properties** to set parameters for the whole instrument group, or set them for each instrument individually without the check mark.

All active channels can be seen in the channel selector list on the right (red). The active channels of the focused instrument are highlighted. You can assign or unassign channels to an instrument in this menu.



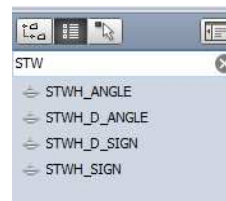
Tree view



List view



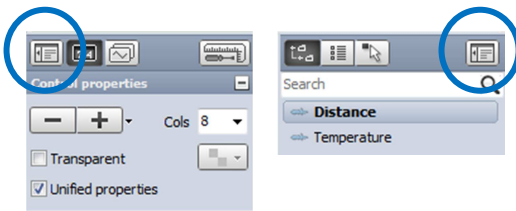
Selected view



Search view

Depending on the setting you can choose the measurement channels in tree view (sorted by category), list view, selected view (shows only channels which are shown in the current instrument) or search view (with a filter mask).

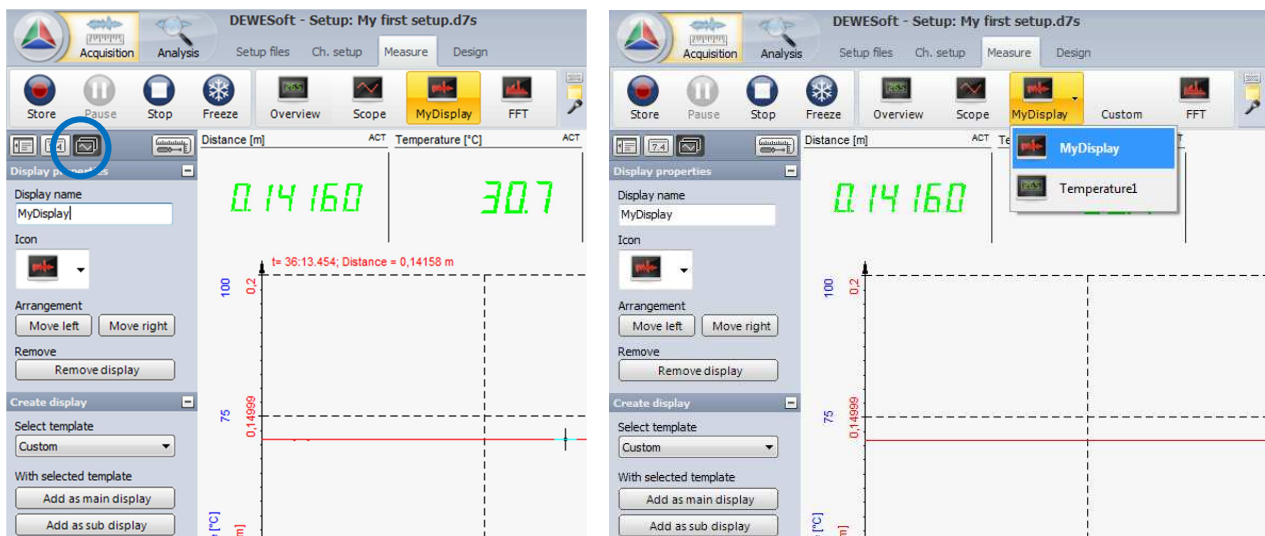
→ **Tip:** The measurement views can also be adjusted – with or without storing - during the measurement. When pushing **stop**, the last measurement view is stored in the data file.



After the setup you can hide both windows with the button in the corner. By moving the mouse the button appears again.



For high channel count applications you maybe need more measurement views (overview, recorder ...). It is easy to add further ones. Click the button **display properties** and there you can configure the displays: add or delete displays, change the name or icon, choose between sub and main display.



1.4.3 Configuration of amplifier and data acquisition cards

SLOT	ON/OFF	C	NAME	AMPLIFIER (008)	PHYSICAL VALUES	CAL	SETUP
0	Unused	AI 0	DAQP-LV	SN: 413502	0,000 V	Zero	Set ch. 0
1	Used	Distance	DAQP-STG	SN: 417437	0,142 m	Zero	Set ch. 1
2	Unused	AI 2	DAQP-ACC-A	SN: 408892	-1 mV	Zero	Set ch. 2
3	Used	Temperature	DAQP-MULTI	SN: 402727	29,2 °C	Zero	Set ch. 3
4	Unused	AI 4	ORION-1616-505		0,000 V	Zero	Set ch. 4
5	Unused	AI 5	ORION-1616-505		0,000 V	Zero	Set ch. 5
6	Unused	AI 6	ORION-1616-505		0,000 V	Zero	Set ch. 6
7	Unused	AI 7	ORION-1616-505		0,000 V	Zero	Set ch. 7
8	Unused	AI 8	ORION-1616-505		0,000 V	Zero	Set ch. 8
9	Unused	AI 9	ORION-1616-505		0,000 V	Zero	Set ch. 9
10	NA	AI 10	PAD-TH8-P	SN: 249859		NA	Set PAD 10
11	Unused	AI 11	ORION-1616-505		0,000 V	Zero	Set ch. 11
12	Unused	AI 12	ORION-1616-505		0,000 V	Zero	Set ch. 12

All measurement amplifiers are scanned and detected automatically in the software as long as the addresses of the modules correspond with the slots. Then you see them in the channel setup.

DAQP modules and MDAP amplifier are addressed via **serial interface**. The address of each DAQP modules must be consistent with the slot to show the right position. Only in this way, the software can assign the channels to the amplifiers.

To guarantee this, the DAQP modules must have the right address after every module change.

After inserting the new module, **double-click** on the amplifier ...

What should be done with the module?

Now you can decide what to do with the modules ...

Fill → just one module was installed and you address this one

Fill from #0 → several new modules were installed and you address all, starting with slot #

To insert the module in channel 0 :
- press the upper button of DAQ or PAD-P module
- insert PAD module with addr. 0

Now the upper button of the amplifier has to be pressed to set the address of the modules according to the slot they are installed in. The software assigns the address 0 (SLOT0 Channel 0). All modules „hear“ this command, but only the DAQP module on which the button has been pressed, answers with its module type.

To insert the module in channel 1 :
- press the upper button of DAQ or PAD-P module
- insert PAD module with addr. 0

After **pressing the upper button of the module**, the software will automatically go to the next module. Also here you have to press the button on the DAQP, PAD or EPAD module. If one slot is free, press **Skip** to change to next slot.

Proceed till all modules are programmed and terminate with **Cancel**.

The modules save the address internally, so you have to do this just once until you change the module(s) again. After programming the address, all modules are listed in the amplifier section. SN, range and filter are shown there.

SLOT	ON/OFF	C	NAME	AMPLIFIER (010)	PHYSICAL VALUES	CAL	SETUP
0	Unused	AI 0	DAQP-LV	SN: 413502	0,000 V	Zero	Set ch. 0
			5 V .. 300 kHz (BE)				
1	Used	Distance	DAQP-STG	SN: 417437	0,142 m	Zero	Set ch. 1
			10000 Ohm .. 300 kHz (BE)				
2	Unused	AI 2	DAQP-ACC-A	SN: 408892	0 V	Zero	Set ch. 2
			5000 mV .. 1 kHz; Exc 4 mA				
3	Used	Temperature	DAQP-MULTI	SN: 402727	26,9 °C	Zero	Set ch. 3
			-270 .. 1370 °C .. 10 Hz (BU)				
4	Unused	AI 4	ORION-1616-505		0,000 V	Zero	Set ch. 4
			5 V				

If the label is red, the amplifier can't be found. In most cases it is an address conflict with a newly installed module (it might also be a defective component). First of all try reprogramming all addresses.

To insert the module in channel 1 :
 - press the upper button of DAQ or PAD-P module
 - insert PAD module with addr. 0

Stop Finish

The **Setup** column is used to setup the amplifiers (see next chapter).

PAD modules without button (1. generation)

The first generation of PAD modules doesn't have a button for addressing the module. The new address has to be programmed with a **command** (consisting of old and new address) for these modules. The old address is always 0. When you put the module into a rack slot, the software detects it and addresses this slot.

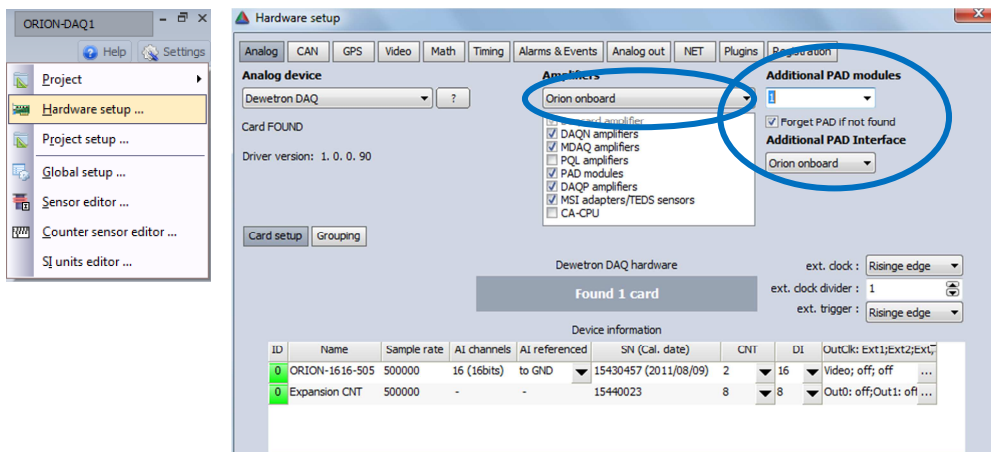
For this reason, just one new PAD module with address 0 can be in the rack. Otherwise all modules would get the same address which cause that no module can be found.

If you want to uninstall a PAD module from the rack, it has to be deleted before removing. This means to set it again to address 0 by **Double-clicking** on the module...

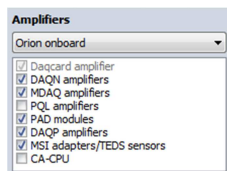
What should be done with the module?

Fill Fill from #0 Clear Cancel

The **Clear** button resets the address back to 0 and you can remove the module from the rack. This procedure has to be repeated for each module.



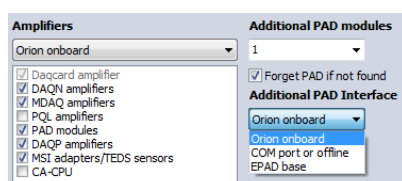
The interfaces for DAQP, PAD or EPAD modules must be activated in the **hardware setup** (Settings → Hardware setup → Analog). Select the analog device and the amplifiers. Depending on the system the amplifiers are addressed by the ORION card (ORION Onboard), serial interface (COM Port) or EPAD Base.



EPAD modules don't need a slot, because they are connected externally with the EPAD plug.

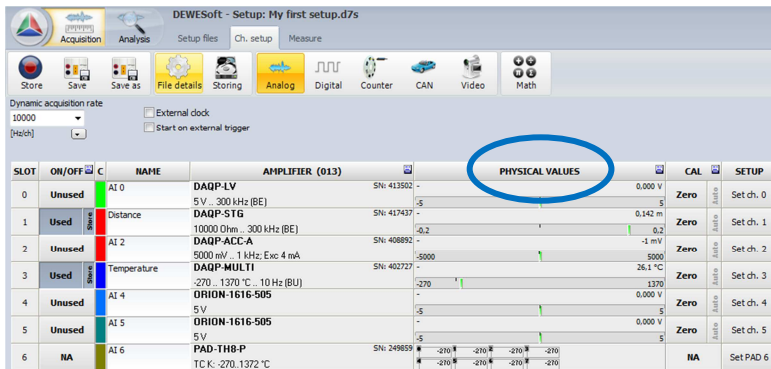
Additional virtual slots are used for EPAD modules, so no slot belonging to the A/D board input channels is overwritten.

Select the number of these slots in **Additional PAD modules** and the interface in **Additional PAD interface**. EPAD modules don't need the same interface as the DAQP modules.



DAQP and MDAQ have a (fixed) **baud rate** of 9600 bit/s. PAD and EPAD modules can be configured between 2400 Baud and 115 kBaud to achieve higher data throughputs. They can use the same interface as DAQP or MDAQ modules only if they are also configured with 9600 Baud. Otherwise you need an additional COM port or EPAD Base.

1.4.4 Setup



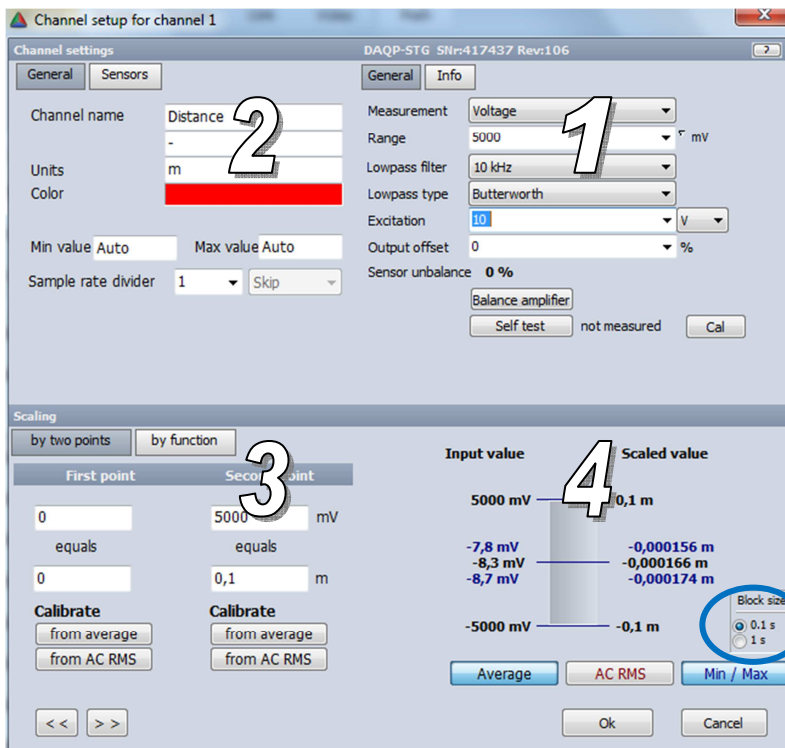
Channel setup configurations:

- Activate the channels
- Channel name
- Sampling rate per channel (with **dynamic acquisition rate** drop-down)

The current signal is previewed as a bar graph in the column titled physical values.

SLOT	ON/OFF	C	NAME	AMPLIFIER (013)	PHYSICAL VALUES	CAL	SETUP
0	Unused	AI 0	DAQP-LV	SN: 413502	0,000 V	Zero	Set ch. 0
1	Used	Distance	DAQP-STG	SN: 417437	0,142 m	Zero	Set ch. 1
2	Unused	AI 2	DAQP-ACC-A	SN: 408892	-1 mV	Zero	Set ch. 2
3	Used	Temperature	DAQP-MULTI	SN: 402727	26,1 °C	Zero	Set ch. 3
4	Unused	AI 4	ORION-1616-505		0,000 V	Zero	Set ch. 4
5	Unused	AI 5	PAD-TH8-P	SN: 249859	0,000 V	Zero	Set ch. 5
6	NA	AI 6				NA	Set PAD 6

Setup for each channel and amplifier is entered by clicking **Setup n**.



In the **channel setup** you can do the whole **configuration for the amplifier and the scaling** into physical values.

Tip: It's useful to do the settings in anti-clockwise direction, starting on top right.

- 1.) Amplifier settings: measurement type (voltage, current, ...), range, filter settings, ..
- 2.) Channel settings: name, units, color of channel
- 3.) Scaling: input value (in this case voltage) is scaled to a physical value (distance). The scaling is done in two steps: 0 mV → 0 cm and 5000 mV → 10 cm. The unit is taken from the channel settings. If you change the unit to meter, you have to change the scaling to 5000 mV → 0.1 m.
- 4.) Input and scaled values are shown. For better evaluation of the signal, you can choose between **Average**, **AC RMS**, or **Min/Max**. The calculation of these values is done with the block size time of 0.1 or 1 second.

As described above, the scaling can be done in two ways: 2-point-scaling or scaling by function.

2-point-scaling:

1. Input of first point (0 cm)
2. Press **"from average"** in the first column to set the current averaged value for the first point
3. Input of second point (7 cm)
4. Press **"from average"** to set the current averaged value for the second point

The scaling for AC-signals must be done **"from AC RMS"** because the average of this type of signal is 0.

by two points by function

☒ Scale (k factor)
☐ Sensitivity

0,02 V / V

Offset (n factor)
 0 V

Output = k * Input value + n

Sensor scaling by function:

$$y = kx + d$$

k ... Scale (k factor)

1/k ... Sensitivity

d ... Offset (n factor)

Channel setup for channel 3

General Sensors DAQP-MULTI SNr:402727 Rev:109

Channel name: Temperature Measurement: Temperature

Units: °C Range: -270 .. 1370 °C

Color: Lowpass filter: 10 Hz 2nd order

Min value: Auto Max value: Auto Lowpass type: Butterworth

Sample rate divider: 1 Skip Input type: Type K

Output offset: 0 % Sensor fault: Detection on

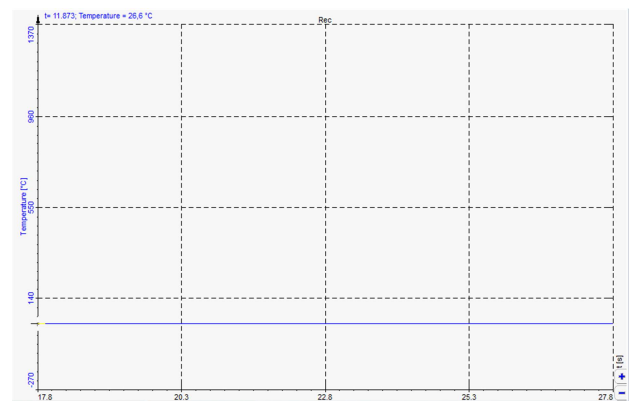
Scaling

by two points by function

First point	Second point	Input value	Scaled value
0	1370 °C	1370 °C	1370 °C
0	1370 °C	26,76 °C	26,76 °C
0	1370 °C	26,68 °C	26,68 °C
0	1370 °C	26,56 °C	26,56 °C
0	1370 °C	-270 °C	-270 °C

Calibrate: from average from AC RMS from average from AC RMS

With min and max value you can limit the displayed range in the recorder. If **Automatic** is set for the min and max values, e.g. for temperature measurement, the Y-scaling of the recorder is set to -270 to 1370°C.



Channel setup for channel 3

General Sensors DAQP-MULTI SNr:402727 Rev:109

Channel name: Temperature Measurement: Temperature

Units: °C Range: -270 .. 1370 °C

Color: Lowpass filter: 10 Hz 2nd order

Min value: 0 Max value: 30 Lowpass type: Butterworth

Sample rate divider: 1 Skip Input type: Type K

Output offset: 0 % Sensor fault: Detection on

Scaling

by two points by function

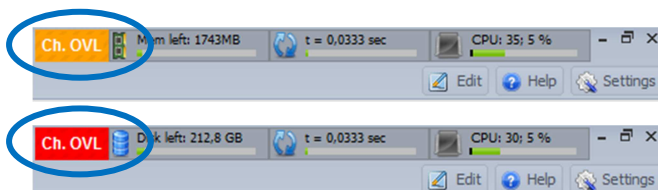
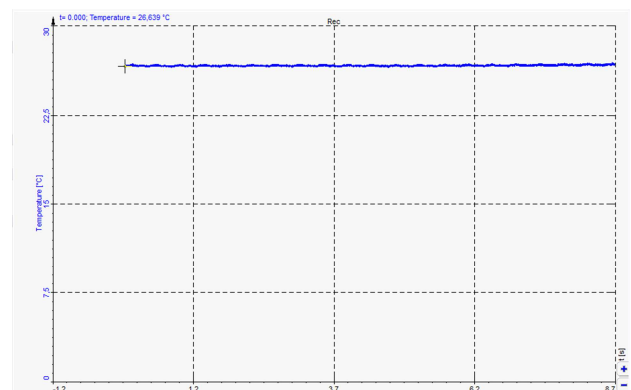
First point	Second point	Input value	Scaled value
0	1370 °C	1370 °C	1370 °C
0	1370 °C	26,66 °C	26,66 °C
0	1370 °C	26,58 °C	26,58 °C
0	1370 °C	26,49 °C	26,49 °C
0	1370 °C	-270 °C	-270 °C

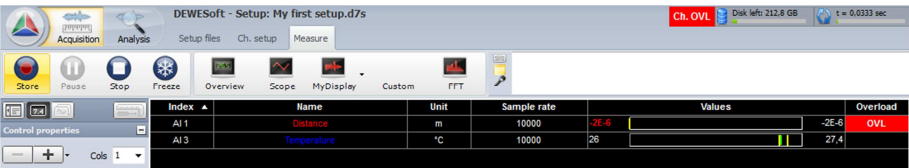
Calibrate: from average from AC RMS from average from AC RMS

If you limit the displayed range (0 to 26°C), this is also set in the recorder. But the physical measurement range remains the same.

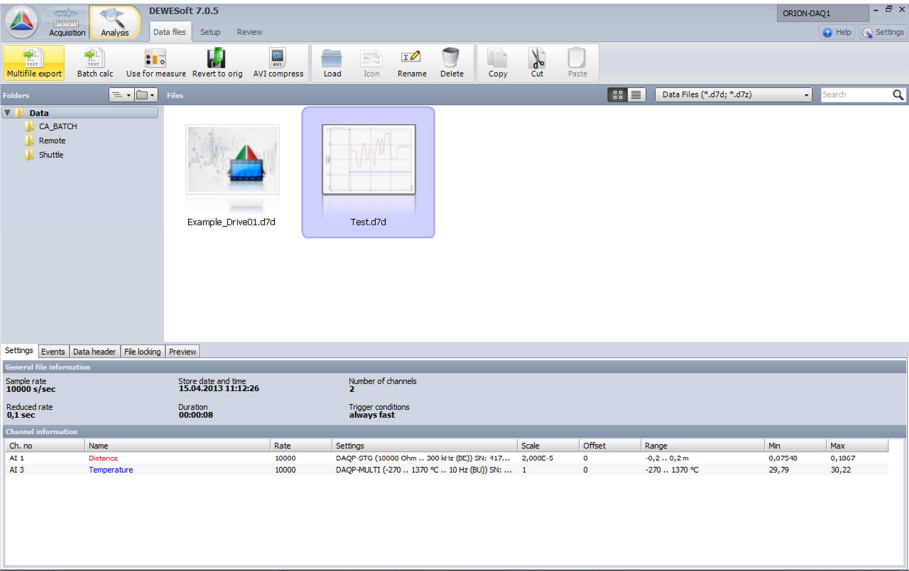
In case of exceeding the displayed range you get an **orange** overload warning (**Ch. OVL**).

In case of exceeding the physical range you get a **red** Ch. OVL.



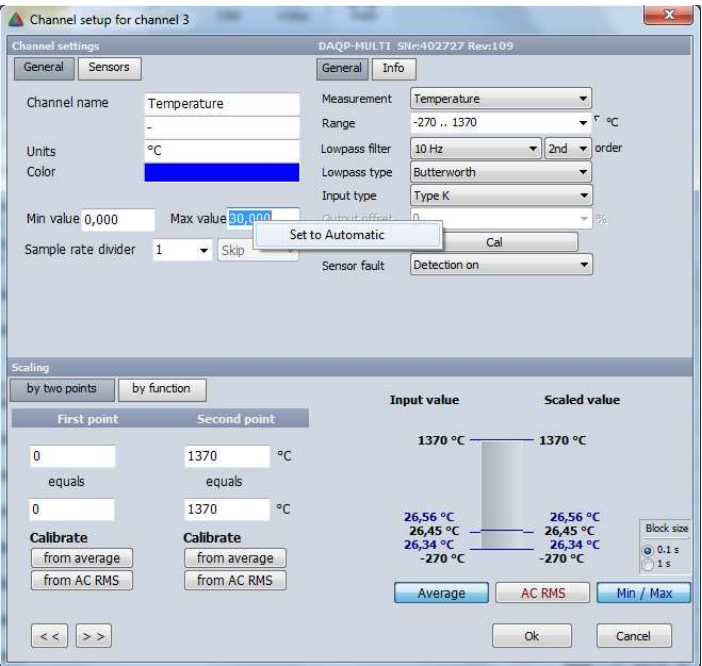


Double-click on **Ch. OVL** (right above) opens the **overload indicator instrument** showing all channels in a table. The channel where the signal exceeds the input range (clipped signal) is marked red.



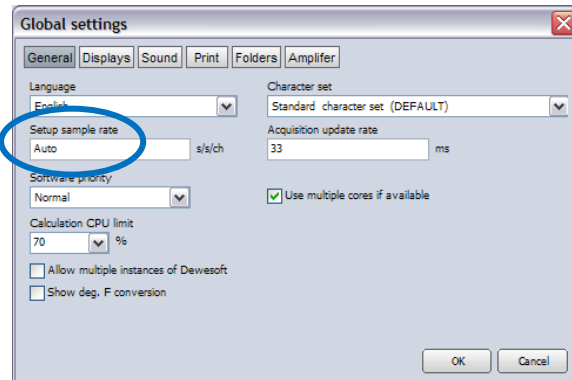
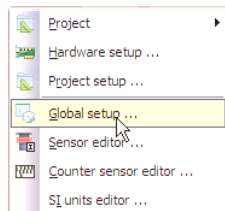
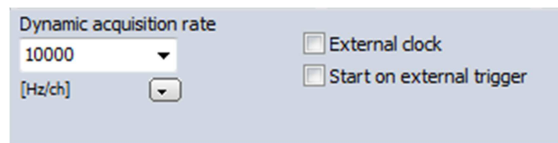
In ANALYSIS mode, all the data files are listed. Click on a file to see the details below in the channel information. The min and max values are shown over the complete measurement.

If the signal exceeds the min and max range, it is marked red.



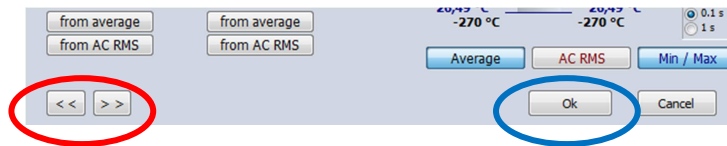
Right mouse-click on **Min** or **Max** to set back to Automatic value.

Be aware that the data shown in channel setup is not sampled with the full dynamic acquisition rate, but with a different rate called **setup sampling rate**. Data will be sampled with the full rate from the moment you change to MEASURE mode. The setup sampling rate is shown at software start or when you create a new setup.



Set the sampling rate from **AUTO** to an application specific value (Settings → Global Setup → General → Setup sample rate)

e.g.: microphone calibration at 50.000 Hz



Save your settings with **OK**.

With the **navigation buttons** (red) you can go on with the next channels.

SLOT	ON/OFF	C	NAME	AMPLIFIER (013)	PHYSICAL VALUES	CAL	SETUP
0	Unused	AI 0	DAQP-LV	SN: 413502	-	0,000 V	Zero
			5 V ... 300 kHz (BE)		-5	5	Auto
1	Used	Distance	DAQP-STG	SN: 417437	-	0,12 m	Zero
			10000 Ohm ... 300 kHz (BE)		-0,2	0,2	Auto
2	Unused	AI 2	DAQP-ACC-A	SN: 408892	-	-1 mV	Zero
			5000 mV ... 1 kHz; Exc 4 mA		-5000	5000	Auto

The channel **ZERO button** is located to the left of the "Setup n" button. If you press it, the actual offset will be subtracted (TARA function). With this function you can do a "relative" measurement or just zero out a small offset of a sensor.

SLOT	ON/OFF	C	NAME	AMPLIFIER (012)	PHYSICAL VALUES	CAL	SETUP
0	Unused	AI 0	DAQP-LV	SN: 413502	-	0,000 V	Zero
			5 V ... 300 kHz (BE)		-5	5	Auto
1	Used	Distance	DAQP-STG	SN: 417437	-	0,000 m	Zero
			10000 Ohm ... 10 kHz (BU)		-0,2365	0,1635	Auto

Scaling

by two points
by function

☒ Scale (k factor)
☐ Sensitivity

2E-5 m / Ohm

Offset (n factor)
-0,0365238 m

Set zero

Output = k * Input value + n

After the adjustment you can see that the offset is applied now to the scaling. Also note that the channel limits have changed now from ± 10 cm to $-13 \dots +7$ cm. Just the offset is corrected. If a measurement range of ± 10 cm is wanted, the input range of the amplifier (DAQP, MDAQ) has to be increased.

SLOT	ON/OFF	C	NAME	AMPLIFIER (012)	PHYSICAL VALUES	CAL	SETUP
0	Unused	AI 0	DAQP-LV	SN: 413502	-	-0,001 V	Zero
			5 V ... 300 kHz (BE)		-5	5	Auto
1	Used	Distance	DAQP-STG	SN: 417437	-	0,037 m	Zero
			10000 Ohm ... 10 kHz (BU)		-0,2	0,2	Auto
2	Unused	AI 2	DAQP-ACC-A	SN: 408892	-	-1 mV	Zero
			5000 mV ... 1 kHz; Exc 4 mA		-5000	5000	Auto
3	Used	Temperature	DAQP-MULTI	SN: 402727	-	26,66 °C	Zero
			-270 ... 1370 °C ... 10 Hz (BU)		0	30	Auto
4	Unused	AI 4	ORION-1616-505		-	0,000 V	Zero
			5 V		-5	5	Auto

If you turn selected channels into **AUTO** channels, you can afterwards (in MEASURE) use the ZERO function on them.

SLOT	ON/OFF	C	NAME	AMPLIFIER (002)	PHYSICAL VALUES	CAL	SETUP
0	Unused	AI 0	DAQP-LV	SN: 413502	-	-0,001 V	Zero
			5 V ... 300 kHz (BE)		-5	5	Auto
1	Used	Distance	DAQP-STG	SN: 417437	-	0,037 m	Zero
			10000 Ohm ... 10 kHz (BU)		-0,2	0,2	Auto
2	Unused	AI 2	DAQP-ACC-A	SN: 408892	-	-1 mV	Zero
			5000 mV ... 1 kHz; Exc 4 mA		-5000	5000	Auto
3	Used	Temperature	DAQP-MULTI	SN: 402727	-	26,66 °C	Zero
			-270 ... 1370 °C ... 10 Hz (BU)		0	30	Auto
4	Unused	AI 4	ORION-1616-505		-	0,000 V	Zero
			5 V		-5	5	Auto

Right-mouse-click to combine the channels into different groups, because it does not always make sense to SET them to ZERO all at the same time.

SLOT	ON/OFF	C	NAME	AMPLIFIER (005)	PHYSICAL VALUES	CAL	SETUP
0	Unused	AI 0	DAQP-LV	SN: 413502	-	0,000 V	Zero
			5 V ... 300 kHz (BE)		-5	5	Auto
1	Used	Distance	DAQP-STG	SN: 417437	-	0,037 m	Zero
			10000 Ohm ... 10 kHz (BU)		-0,2	0,2	Auto
2	Unused	AI 2	DAQP-ACC-A	SN: 408892	-	-1 mV	Zero
			5000 mV ... 1 kHz; Exc 4 mA		-5000	5000	Auto
3	Used	Temperature	DAQP-MULTI	SN: 402727	-	26,30 °C	Zero
			-270 ... 1370 °C ... 10 Hz (BU)		0	30	Auto
4	Unused	AI 4	ORION-1616-505		-	0,000 V	Zero
			5 V		-5	5	Auto

CAL	SETUP
Zero	Auto Set ch. 0
Zero	GR1 Set ch. 1
Zero	Auto Set ch. 2
Zero	GR1 Set ch. 3
Zero	GR2 Set ch. 4

To apply different functions to each group, **right-mouse-click** on the icon next to CAL.

There, the software ZERO for groups can be set or reset ... e.g. 2-point-calibration, filter frequencies ...

SLOT	ON/OFF	C	NAME	AMPLIFIER (012)	PHYSICAL VALUES	CAL	SETUP
0	Unused	AI 0	DAQP-LV	5 V ... 300 kHz (BE)	-0.001 V	Zero	Auto Set ch. 0
1	Used	Distance	DAQP-STG	10000 Ohm ... 10 kHz (BU)	0.037 m	Zero	GR1 Set ch. 1
2	Unused	AI 2	DAQP-ACC-A	5000 mV ... 1 kHz; Exc 4 mA	-1 mV	Zero	Auto Set ch. 2
3	Used	Temperature	DAQP-MULTI	-270 ... 1370 °C ... 10 Hz (BU)	26.61 °C	Zero	GR1 Set ch. 3
4	Unused	AI 4	ORION-1616-505	5 V	0.000 V	Zero	Auto Set ch. 4
5	Unused	AI 5	ORION-1616-505	5 V	0.000 V	Zero	Auto Set ch. 5
6	NA	AI 6	PAD-TH8-P	TC K ... -270 ... 1372 °C	-270 ... 1372 °C	NA	Set PAD 6
7	Unused	AI 7	ORION-1616-505	5 V	0.000 V	Zero	Auto Set ch. 7
8	Unused	AI 8	ORION-1616-505	5 V	0.000 V	Zero	Auto Set ch. 8
9	Unused	AI 9	ORION-1616-505	5 V	0.000 V	Zero	Auto Set ch. 9
10	Unused	AI 10	ORION-1616-505	5 V	0.000 V	Zero	Auto Set ch. 10

SLOT	ON/OFF	C	NAME	AMPLIFIER (001)	PHYSICAL VALUES	CAL	SETUP
0	Unused	AI 0	DAQP-LV	5 V ... 300 kHz (BE)	0.000 V	Zero	Auto Set ch. 0
1	Used	Distance	DAQP-STG	10000 Ohm ... 10 kHz (BU)	0.037 m	Zero	GR1 Set ch. 1
2	Unused	AI 2	DAQP-ACC-A	5000 mV ... 1 kHz; Exc 4 mA	-1 mV	Zero	Auto Set ch. 2
3	Used	Temperature	DAQP-MULTI	-270 ... 1370 °C ... 10 Hz (BU)	26.31 °C	Zero	GR1 Set ch. 3
4	Unused	AI 4	ORION-1616-505	5 V	0.000 V	Zero	GR2 Set ch. 4
5	Unused	AI 5	ORION-1616-505	5 V	0.000 V	Zero	Auto Set ch. 5
6	NA	AI 6	PAD-TH8-P	TC K ... -270 ... 1372 °C	-270 ... 1372 °C	NA	Set PAD 6

Also in the **amplifier menu** (open with click on the icon) you can find helpful functions like set highest range or filter ...

SLOT	ON/OFF	C	NAME	AMPLIFIER (006)	PHYSICAL VALUES	CAL	SETUP
0	Unused	AI 0	DAQP-LV	5 V ... 300 kHz (BE)	-0.001 V	Zero	Auto Set ch. 0
1	Used	Distance	DAQP-STG	10000 Ohm ... 10 kHz (BU)	0.037 m	Zero	GR1 Set ch. 1
2	Unused	AI 2	DAQP-ACC-A	5000 mV ... 1 kHz; Exc 4 mA	-1 mV	Zero	Auto Set ch. 2
3	Used	Temperature	DAQP-MULTI	-270 ... 1370 °C ... 10 Hz (BU)	26.32 °C	Zero	GR1 Set ch. 3

With the icon in the On/Off column you can **select or deselect** all channels at once.

SLOT	ON/OFF	C	NAME	AMPLIFIER (015)	PHYSICAL VALUES	CAL	SETUP
0	Unused	AI 0	DAQP-LV	5 V ... 300 kHz (BE)	0.000 V	Zero	Auto Set ch. 0
1	Used	Distance	DAQP-STG	10000 Ohm ... 10 kHz (BU)	0.037 m	Zero	GR1 Set ch. 1
2	Unused	AI 2	DAQP-ACC-A	5000 mV ... 1 kHz; Exc 4 mA	-1 mV	Zero	Auto Set ch. 2
3	Used	Temperature	DAQP-MULTI	-270 ... 1370 °C ... 10 Hz (BU)	26.48 °C	Zero	GR1 Set ch. 3

Right-mouse-click on the channel slot to **copy the channel's settings**.

SLOT	ON/OFF	C	NAME	AMPLIFIER (010)	PHYSICAL VALUES	CAL	SETUP
0	Unused	AI 0	DAQP-LV	5 V ... 300 kHz (BE)	0.000 V	Zero	Auto Set ch. 0
1	Used	Distance	DAQP-STG	10000 Ohm ... 10 kHz (BU)	0.037 m	Zero	GR1 Set ch. 1
2	Unused	AI 2	DAQP-ACC-A	5000 mV ... 1 kHz; Exc 4 mA	-1 mV	Zero	Auto Set ch. 2
3	Used	Temperature	DAQP-MULTI	-270 ... 1370 °C ... 10 Hz (BU)	26.45 °C	Zero	GR1 Set ch. 3
4	Unused	AI 4	ORION-1616-505	5 V	0.000 V	Zero	GR2 Set ch. 4
5	Unused	AI 5	ORION-1616-505	5 V	0.000 V	Zero	Auto Set ch. 5

Paste these settings to one single channel, to all channels or to some special ones.

Paste source (SLOT 1)

Paste from : SLOT 2 Paste to : SLOT 8

Paste	Property name	Property value
No	Used	True
No	Stored	True
Yes	Description	-
Yes	Unit	m
Yes	UserScaleMin / Max	Auto / Auto
Yes	SRDiv / SRType	1 / Skip
Yes	Scale / Offset	2E-0005 / 0
Yes	AutoGroup	Group2
No	Sensor	
Yes	MeasuredValue	RESISTANCE
Yes	Range	10000 Ohm
Yes	LPFilter_Hz	10000
Yes	LPFilter_Type	BU

Ok Cancel

If you paste the source to special slots, a window with copy options opens up:

- Paste to a range of slots: n_1 to n_2
- Options that should be pasted

SLOT	ON/OFF	C	NAME	AMPLIFIER (014)	PHYSICAL VALUES	CAL	SETUP
0	Unused	AI 0	DAQP-LV	5 V ... 300 kHz (BE) SN: 413502	0.000 V	Zero	Set ch. 0
1	Used	Distance	DAQP-STG	10000 Ohm ... 10 kHz (BU) SN: 417437	0.037 m	Zero	Set ch. 1
2	Unused	AI 2	DAQP-ACC-A	5000 mV ... 1 kHz; Exc 4 mA SN: 408892	-1 mV	Zero	Set ch. 2
3	Used	Temperature	DAQP-MULTI	-270 ... 1370 °C ... 10 Hz (BU) SN: 402727	26.10 °C	Zero	Set ch. 3
4	Unused	AI 4	ORION-1616-505	5 V	0.000 V	Zero	Set ch. 4
5	Unused	AI 5	ORION-1616-505	5 V	0.000 V	Zero	Set ch. 5
6	3 chnl	AI 6	PAD-TH8-P	TC K: -270 ... 1372 °C SN: 249859	-270 ... 1372 °C	IA	Set PAD 6

PAD and EPAD modules are addressed via serial interface (RS-485). Each of these modules has 8 channels, which are shown in the channel setup. If you open the setup of one PAD module you see its channel list.

Serial network modules setup

PAD on channel 6
PAD-TH8-P SN:249859 Rev:6.06

Module range: TC K: -270...1372 °C Averaged [values]: 1

☐ Mixed ranges

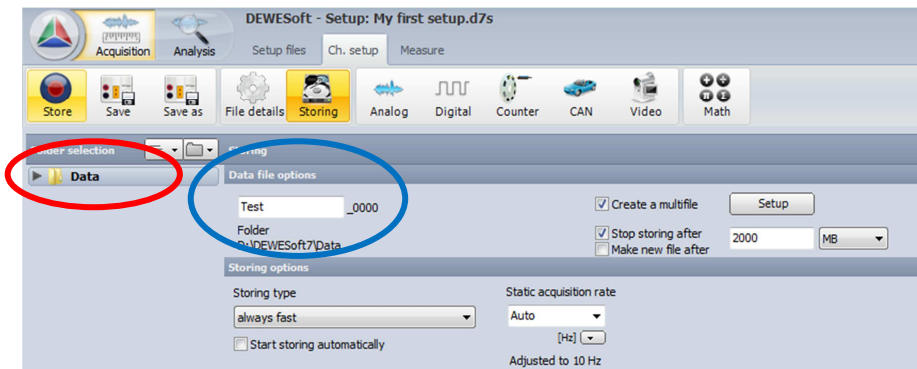
<< Back to channel setup

SLOT	ON/OFF	C	NAME	PHYSICAL VALUES	CAL	SETUP
0	Used	Slot 6 Sub 0	DVL	-270 [°C] 1372	Zero	Auto Setup
1	Used	Slot 6 Sub 1	DVL	-270 [°C] 1372	Zero	Auto Setup
2	Used	Slot 6 Sub 2	DVL	-270 [°C] 1372	Zero	Auto Setup
3	Unused	Slot 6 Sub 3	DVL	-270 [°C] 1372	Zero	Auto Setup
4	Unused	Slot 6 Sub 4	DVL	-270 [°C] 1372	Zero	Auto Setup
5	Unused	Slot 6 Sub 5	DVL	-270 [°C] 1372	Zero	Auto Setup
6	Unused	Slot 6 Sub 6	DVL	-270 [°C] 1372	Zero	Auto Setup
7	Unused	Slot 6 Sub 7	DVL	-270 [°C] 1372	Zero	Auto Setup

Further settings are the same as with the DAQP modules. "Back to channel setup" leaves the PAD sub-setup menu and returns to main channel setup.

Dynamic acquisition rate		10000		☐ External clock		☐ Start on external trigger	
[Hz/ch]							
SLOT	ON/OFF	C	NAME	AMPLIFIER (013)	PHYSICAL VALUES	CAL	SETUP
0	Unused	AI 0	DAQP-LV	SN: 413500	0.000 V	Zero	Set ch. 0
1	Used	Distance	DAQP-STG	SN: 417437	0.142 m	Zero	Set ch. 1
2	Unused	AI 2	DAQP-ACC-A	SN: 408850	-0.2	Zero	Set ch. 2
3	Used	Temperature	DAQP-MULTI	SN: 402727	26.1 °C	Zero	Set ch. 3
4	Unused	AI 4	ORION-1616-505		0.000 V	Zero	Set ch. 4
5	Unused	AI 5	ORION-1616-505		0.000 V	Zero	Set ch. 5
6	NA	AI 6	PAD-TH0-P	SN: 249859	-270.1372 °C	NA	Set PAD 6

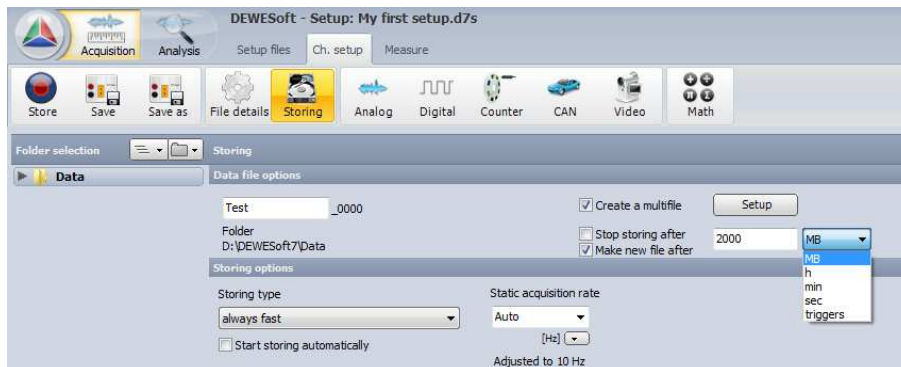
Dynamic acquisition rate: set the sampling rate of each channel there. This has no impact on the PAD or EPAD modules. They are sampled with about 10 Hz per serial bus. 2 PAD modules with about 5 Hz each, 10 PAD modules with about 1 Hz each...



Storing menu defines all storing options

If **Create Multifile** is selected, a serial number or date is added automatically to the file name. This can be defined in the **Setup**.

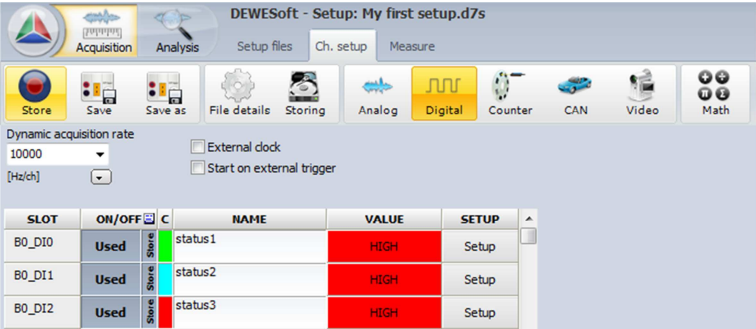
The **file name** is automatically generated every time a file is saved.



Additionally, the measurement can either be stopped when reaching a certain file size, time or amount of triggers or the measurement continues saving into a new data file.

Always fast: all analog channels are stored with the dynamic acquisition rate.

1.4.5 Digital inputs

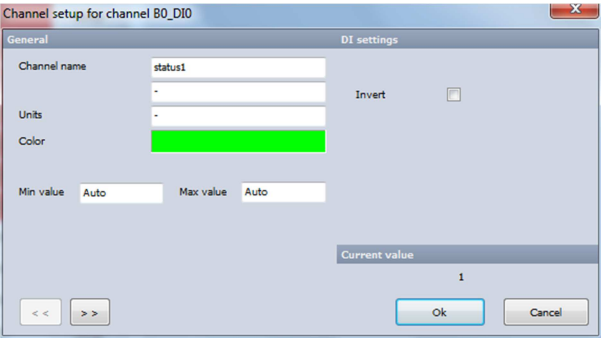


DEWETRON instruments enable measuring analog, digital, counter, video and CAN inputs.

These are different menus for these different inputs within the **channel setup**.

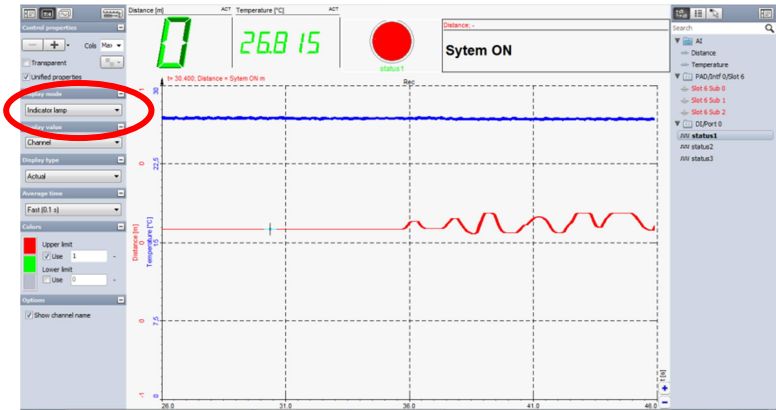
The digital inputs on the device are DIO-plugs with 37-pins. You see these inputs in the channel setup. Contrary to the analog channels, the digital signals just have the values 0 or 1; low or high.

All digital inputs are measured with the set **dynamic acquisition rate**. In the setup you can just set the name and the color.

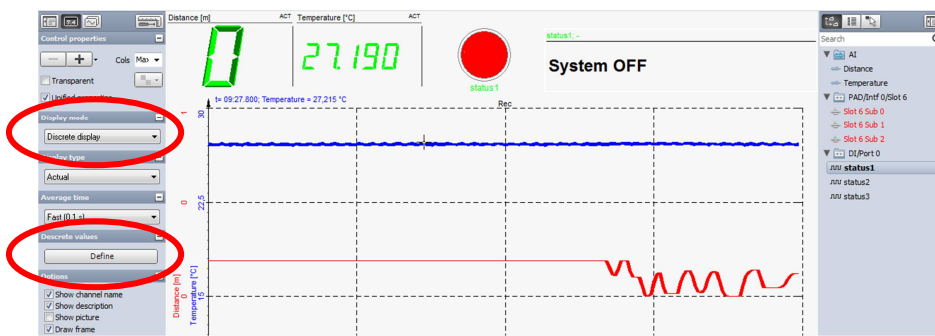


Usually digital inputs (TTL level) resume the status signals additionally to the measurement signals.

Digital inputs are shown during the measurement in the DIO/PORT group (if the group view is active). They can be shown in any instrument like recorder, digital, etc.



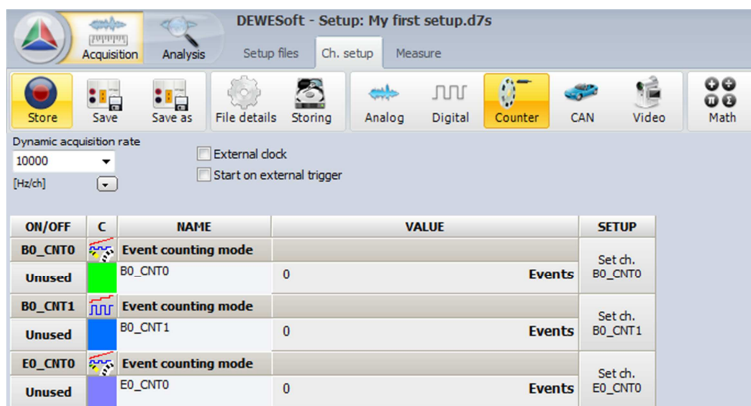
Depending on the value, the status instrument shows color, text or pictures.



Display mode: Change from indicator lamp to discrete display. Assign the values of the text or the pictures in the **Define menu**.

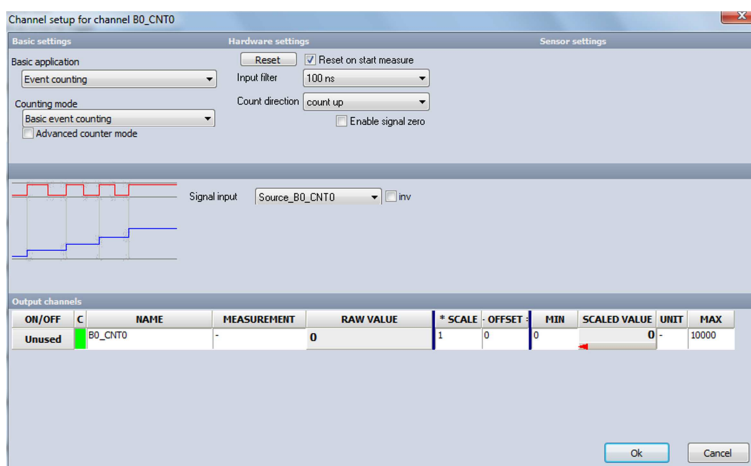
1.4.6 Counter inputs

Counter inputs are used to count fast signals (piece counter). The digital signal could be a multiple times faster than the sampling rate. Counters can process signals up to some MHz, but deliver the result (units, position) with the set sampling rate. (In comparison to this, the digital input is just sampled with the sampling rate. If the sampling rate is too low, not all changes can be observed.) Besides counting, they can also analyze quadrature-encoder-signals (A, B, Z), angles, RPM or measure the time between two edges of one or two signals with a resolution of 12 ns (80 MHz).

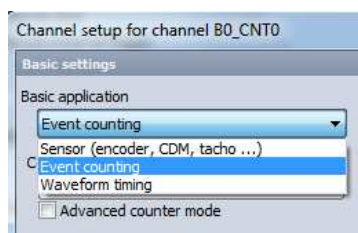


Counter inputs as well as digital inputs have their own category in the **channel setup**.

Define the measurement mode for the counter in this menu.



First of all you choose your counter application in the drop-down menu.

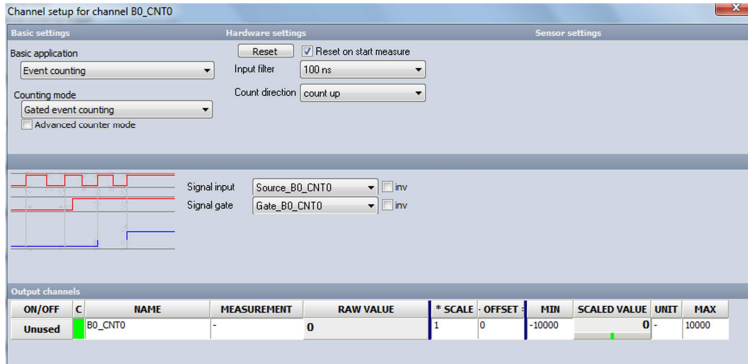


Basic counter applications are:

Sensor-mode: for encoder, length and angle measurements with RPM or speed information

Event counting: counter, up/down counter, up/down counter with control input,...

Timing mode: frequency, period time, pulse width



Depending on the basic application, there are different counter modes.

Set an input filter in the hardware settings to avoid spikes and erroneous counting.

A value of 100 ns means that the input signal must be at least 100 ns low or high to get processed. In consequence any spikes are eliminated.

It is recommended to set at least 100 ns (depending on input frequency).

Depending on the measurement mode, the counter signals are assigned to the function block.

INPUT SIGNAL: Source_B0_CNT0

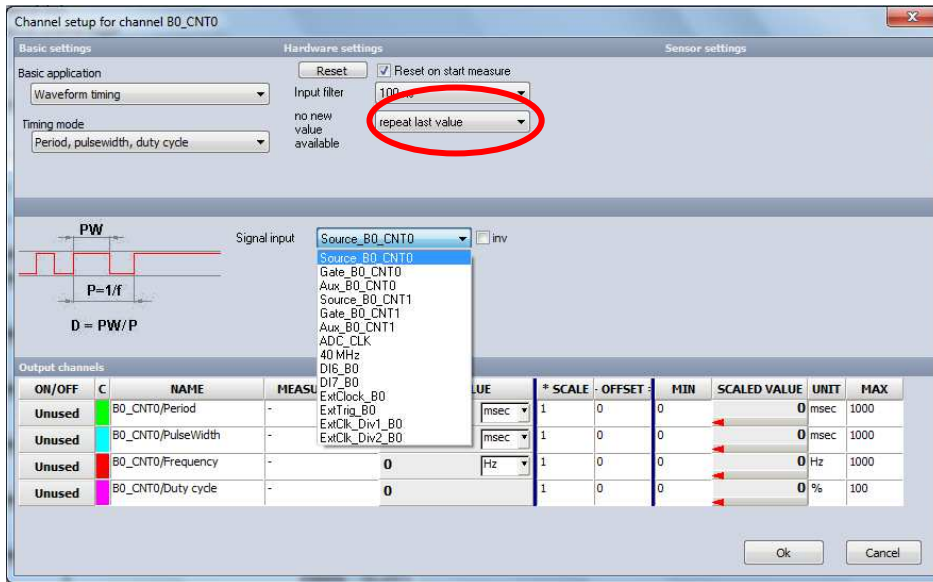
GATE SIGNAL: Gate_B0_CNT0, ..

In general, the counter channels are named: „Source“, „Gate“ and „Aux“ (A, B and Z).

Bx means basic counter of the A/D board. Each A/D board has 2 basic counters. The x (B0) stands for the A/D board, because each 32-channel system has 2 basic counters each. All in all 4 basic counters: xxxx_B0_CNT0, xxxx_B0_CNT1, xxxx_B1_CNT0, xxxx_B1_CNT1.

The A/D board could have a counter expansion. If such an expansion is installed, the first board is named xxxx_E0_CNTx; and further boards xxxx_E1_CNTx. Counters are connected via DSUB-37 or LEMO-plugs to the measurement instrument. The connectors are labeled with Bx or Ex.

In the first example you see basic event counting with gate signal. With every detected input edge (source pin) and the gate signal being high, the counter is increased by one.



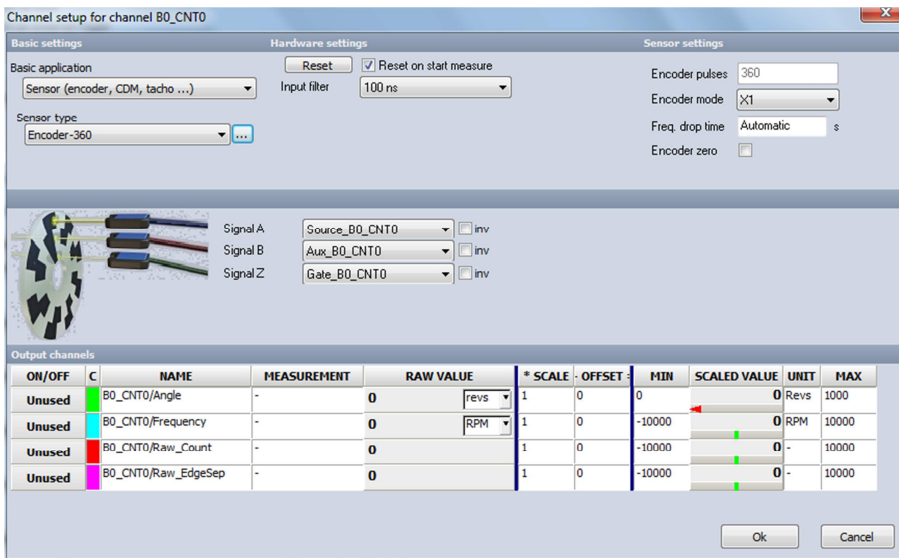
In the second example the waveform timing mode is chosen. With the timing mode: period, pulse width, duty cycle.

As you can see, it is not necessary to use a certain input signal = physical PIN. All signals of two neighbouring counters can be routed to each software input.

The results are values of period time, pulse width, frequency and duty-cycle. The unit can be modified for the first three items.

➔ All counter results are absolutely synchronous to analog and digital inputs.

The set dynamic acquisition rate does not influence the results of the counter section, the hardware works on an internal 80MHz time base. Only the output is updated with the sample rate. In case the sample rate is higher than the counter input signal, not on every sample point a new counter value is updated. Depending on the mode (red) the last value is repeated or ZERO is output instead.



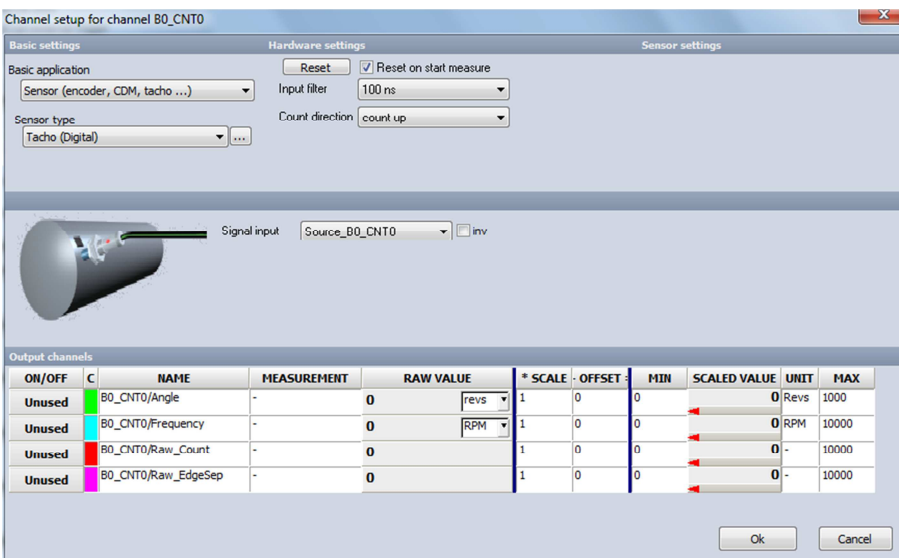
This example shows the sensor mode as basic application. One sensor must be chosen in the sensor list.

Depending on the sensor, the input and the output signals (results) change. Generally, the results of this mode are RPM or speed and angle or distance.

You can choose between

- tacho, encoder signals for RPM and angle or
- tacho and encoder for distance and speed.

Each sensor type has different settings, like X2-, X4 for encoder or resetting the encoder via Z-impulse (encoder signals A, B, Z).



In the example you can see that several sensors in the sensor list are already prepared. For each sensor the pulse and the type (tacho, encoder, CDM, ...) is stored.

Depending on pulse and type, the counter setup changes the number of signals and sensor attributes. The output signals always remain the same.

In the first example you see an encoder with 360 pulses. The counter setup provides the three input signals (they can be routed freely) and the modes X1, X2, X4.

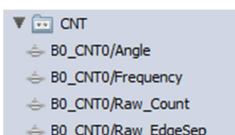
In the second example you see a tacho signal. The output signals (RMP and angle) remain and the input setup is adapted.

RAW_COUNT and RAW_EDGESEP are the raw data of the counter. Normally they are just used to calculate angle and RPM, but they should be saved to support debugging in case of error.

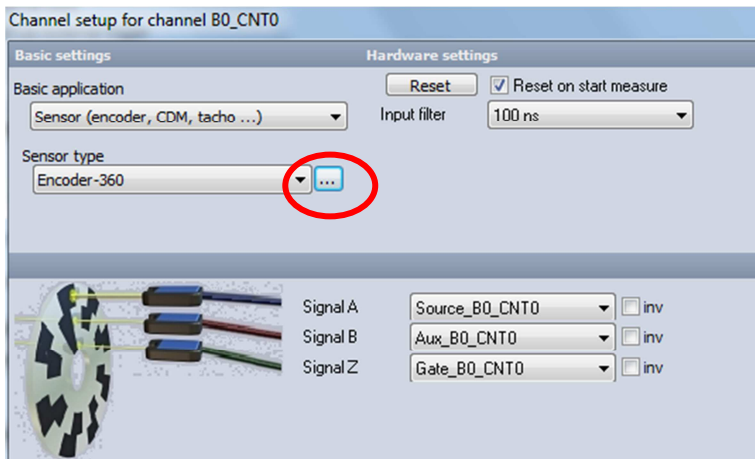
- If the encoder has the wrong rotating direction for one application, the RPM and angle values are negative then there are two possibilities:
- Change A and B signals at the counter input (A → AUX, B → source) or
 - Re-route the signals for AUX and source in the counter setup



Inverting e.g. the A signal would also invert the direction and the angle (B before A). If you then additionally enable ENCODER ZERO, the reset of the encoder would not work anymore. Therefore, if you need to change the direction, also exchange the input signals A and B.

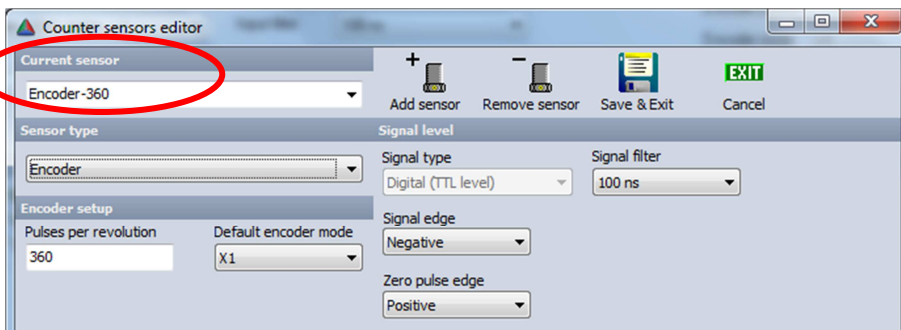


The counter output channels are listed in the measure mode in the group CNT.



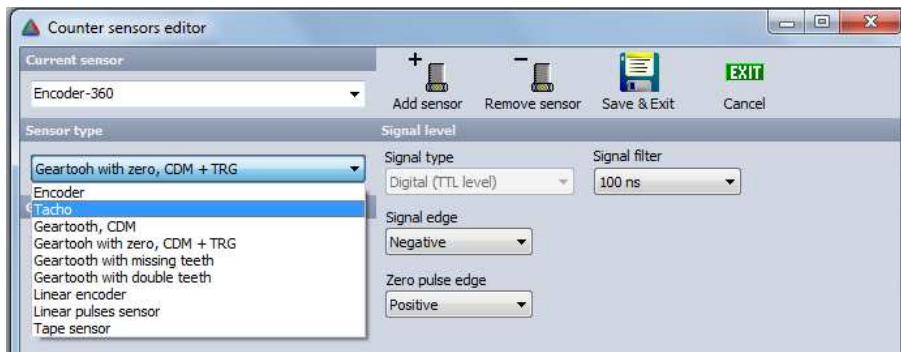
Sensor types are added with the so-called **counter sensor editor (CSE)**. Set the parameters of the chosen sensor in the CSE, or add a new sensor there.

After selecting the sensor type, the editor can be opened for modification directly by clicking the indicated button.

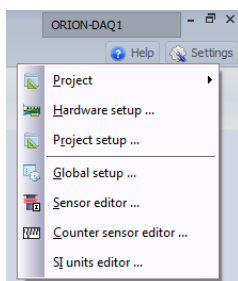


In the CSE you see the settings of the current sensors.

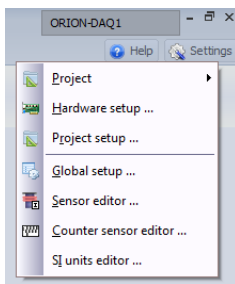
Here you can add new sensors or edit the current ones. Each sensor has a name which can be freely defined.



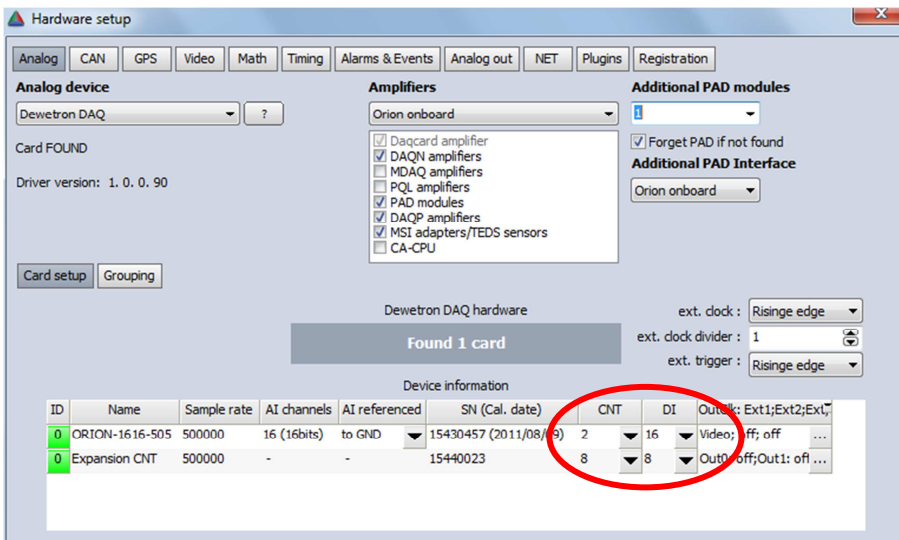
Depending on the sensor type you need additional information like pulse/rotation. The signal filter, the edge and the standard-encoder-mode of the encoder can be pre-configured.



You find the CSE in the counter setup after choosing the sensor type "encoder" (as in the example above), or in the channel setup → Setup → Counter-Sensor-Editor



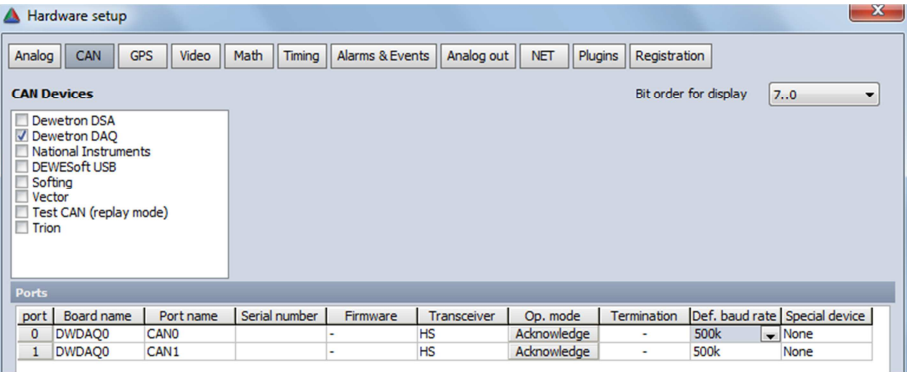
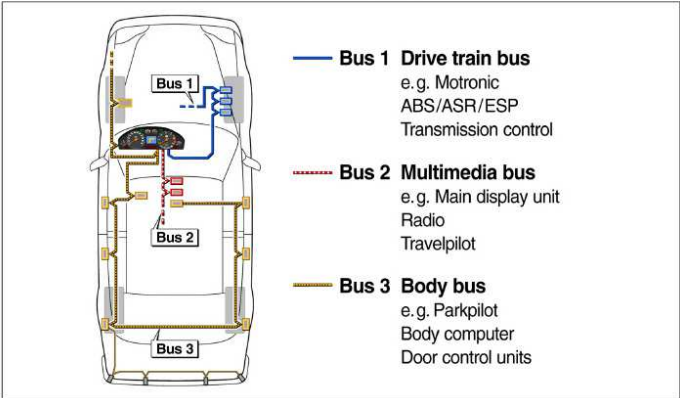
If the digital and counter inputs are not listed in the channel setup, they have to be activated (Settings → Hardware Setup → Analog)



1.4.7 CAN-bus data acquisition

DEWETRON systems acquire CAN-bus data from car or truck (J1939 standard) directly and synchronously to all other measurement data.

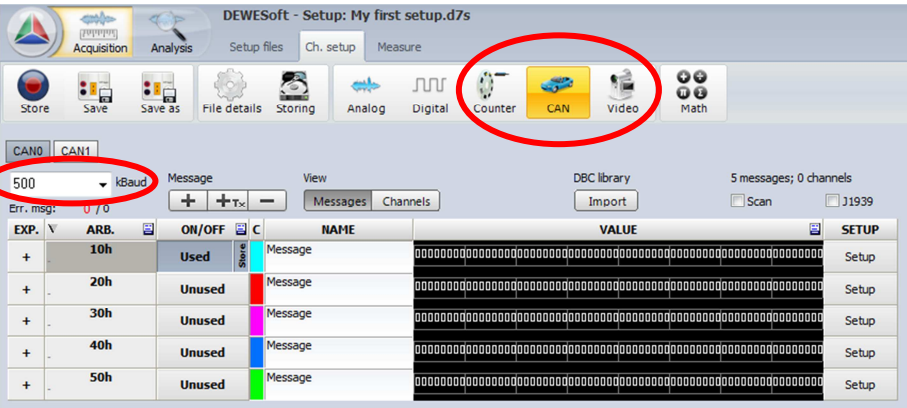
Instrument Cluster in CAN Network



CAN settings are made in the channel setup. If the CAN button is not listed, you have to activate your CAN-bus (Settings → hardware setup → CAN).

Each measurement card of the ORION series has two independent CAN ports.

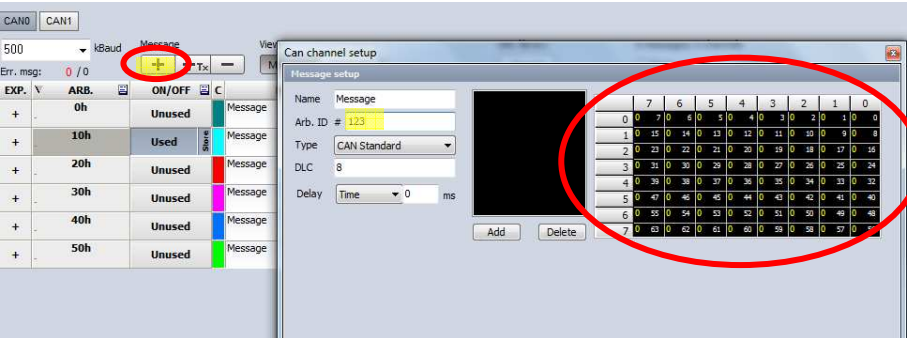
If CAN-bus data or channels are stored in the vehicle, don't use acknowledge, but listen-only mode. The receiver in the CAN net of the vehicle has to acknowledge the data.



If a sensor is connected via CAN-bus, the receiver (DEWETRON instrument) must acknowledge the data.

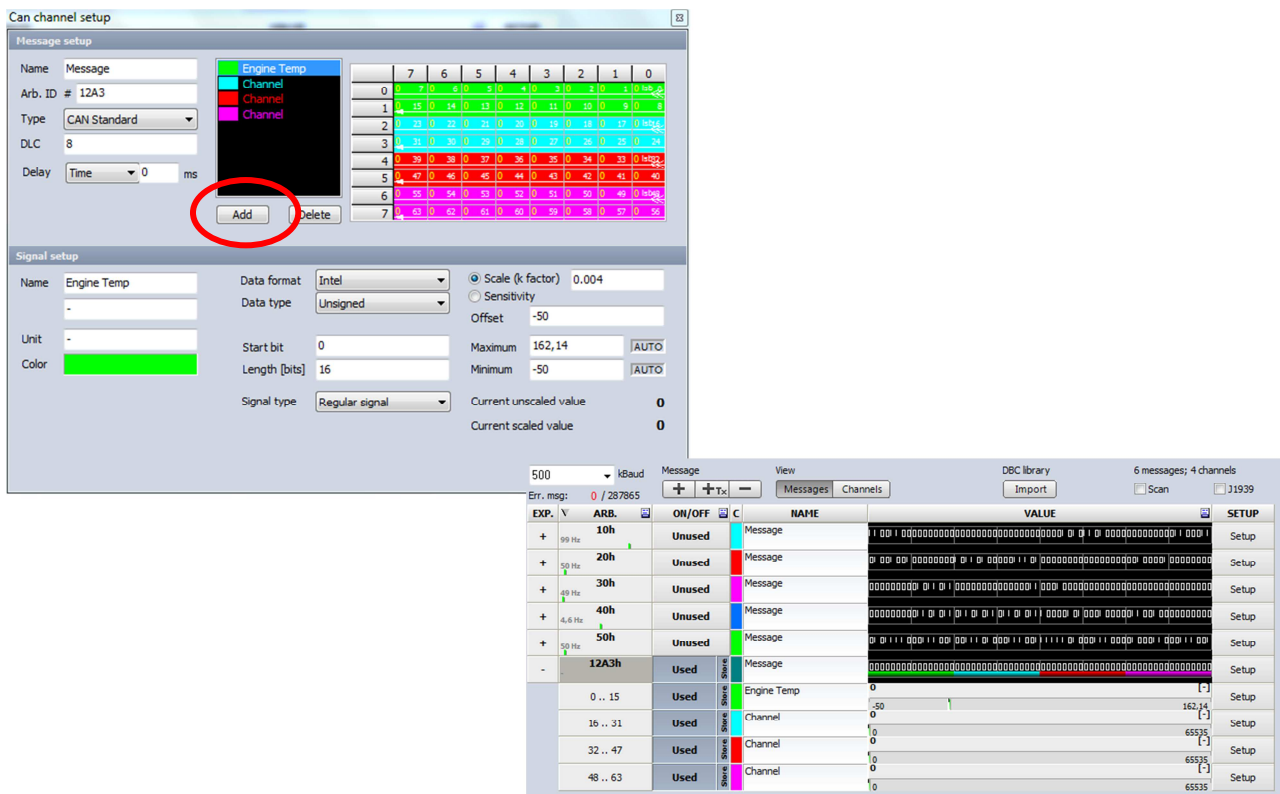
Because the CAN-bus is a serial data bus, you have to set the baud rate. The default settings can be done in the hardware setup.

In the channel setup of the CAN-bus you see both CAN nodes. Activate SCAN to display the received messages. This is just raw data without channel decoding. Before the scan you have to set the baud rate for the CAN nodes.



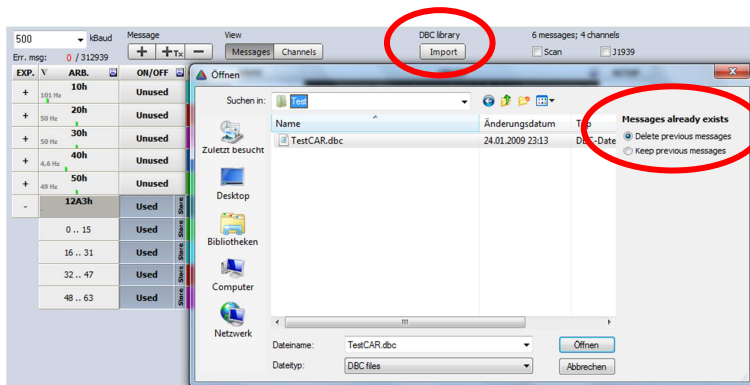
A CAN message can also be added manually. The name of the message, ID, DLC and CAN type have to be defined.

A message normally has 8 bytes. These bytes have to be decoded to channels. Each message has specific measurement channels that are just known by the vehicle manufacturer. With the ADD button channels which are decoded from the message can be added manually. All added channels are named „Channel“ by default. Rename them and set the decoding and the scaling.



When the setup is finished, the CAN channels can be used in the Measure mode.

On one CAN node hundreds of messages (thousands of channels) are possible. This high channel count can't be set manually. Therefore the vehicle manufacturers offer the so-called DBC library. In this library the messages, channels and their decoding are described.



Import the DBC library and DEWESoft generates all messages and measurement channels automatically.

Two options for already existing messages are available:

- Delete previous messages
- Keep previous messages

These options are needed if several DBC libraries use the channels of one CAN-bus. If just one library is used, select Delete.

500 500 kBaud Message View DBC library 5 messages; 17 channels

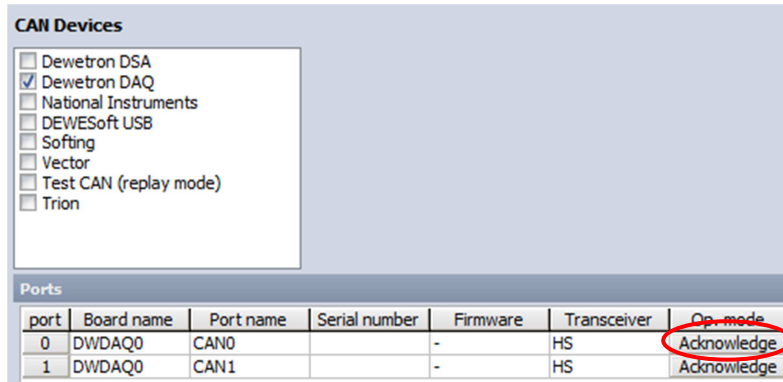
Err. msg: 0 / 415949 Messages Channels Import Scan 31939

EXP.	Y	ARB.	ON/OFF	C	NAME	VALUE	SETUP
-	100 Hz	10h	Used	SteeringWheel	0 1 00 000000000000000000000000		Setup
		0 .. 14	Used	STWH_ANGLE	3.162 [deg.]	Setup	
		15 .. 15	Used	STWH_SIGN	0 1433.56	Setup	
		16 .. 30	Used	STWH_D_ANGLE	0 14.88	Setup	
		31 .. 31	Used	STWH_D_SIGN	0 1433.56 [deg/s]	Setup	
-	50 Hz	20h	Used	Engine	0 00 00 0000000000 0 1 00000 1 1 0 0000000000000000 0000 00000000	Setup	
		0 .. 0	Unused	IDLE	1	Setup	
		3 .. 3	Unused	CLUTCH	0	Setup	
		8 .. 15	Used	ENG_TORQUE	0 [MDI]	Setup	
		16 .. 31	Unused	ENG_RPM	0 1867 99.45 [rpm]	Setup	
		56 .. 63	Used	WANTED_TORQUE	0 16256 [MDI]	Setup	
-	50 Hz	30h	Unused	GasPedal	0000000000 0 1 0 0000000000000000 1	Setup	
		16 .. 23	Unused	GAS_PEDAL	0	Setup	
-	5.5 Hz	40h	Used	Temps	0000000000 1 0 0 1 0 1 0 1 0 1 0 0000 0 000 00000 1 00 0000000000	Setup	
		8 .. 15	Unused	TEMP_OUTSIDE	3.5 [deg. C]	Setup	
		24 .. 31	Used	TEMP_OIL	-50 47 77.5 [deg. C]	Setup	
		32 .. 39	Unused	TEMP_COOL2	-50 51.75 195 [deg. C]	Setup	
+	5.5 Hz	50h	Unused	WheelSpeeds	00 1 00 000 1 1 00000000000000 1 1 000 1 1 000 1 0 1 1 000 1 0 000 1 1 000	Setup	

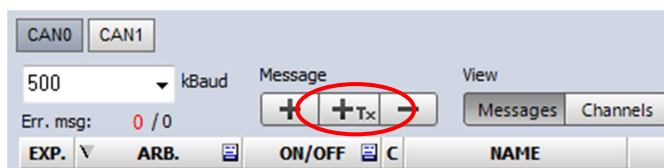
- CAN/Port 0
 - SteeringWheel
 - STWH_ANGLE
 - STWH_SIGN
 - STWH_D_ANGLE
 - STWH_D_SIGN
 - Engine
 - ENG_TORQUE
 - WANTED_TORQUE
 - Temps
 - TEMP_OIL

After loading the library, all channels are displayed in the channel list. The active channels in the measure mode are in the group CAN/Port x.

1.4.8 CAN-bus data output

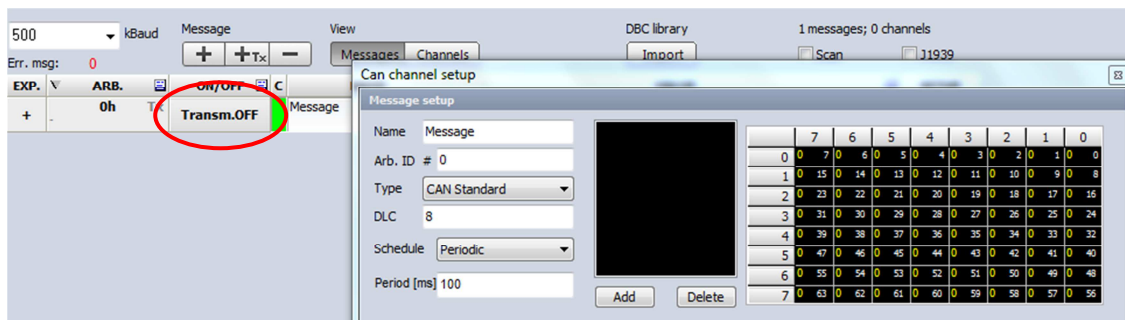


In section 1.4.7 data acquisition on the CAN bus is described. The DEWETRON measurement unit is also capable to send data via CAN bus. To enable this option the CAN mode has to be set to acknowledge, first. Settings under → Hardware Setup → CAN (see section 1.4.7)

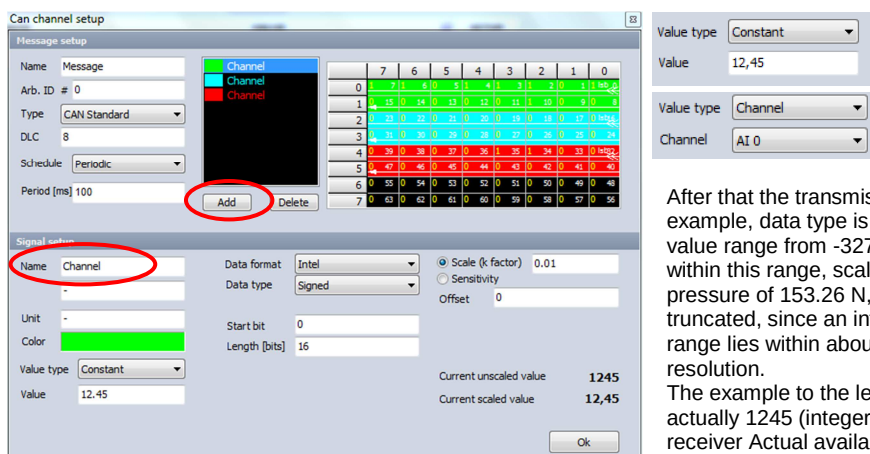


When the bus is set to acknowledge, the setup then also includes the CAN transmit block (Tx). Messages and their channels defined here are then transmitted over CAN interface. The receiver end must be set to **acknowledge** to be able to receive data, the same baud rate must also be set, of course.

By clicking **+Tx** a new message for transmitting is added and its setup opened automatically.



In setup new channels are added to the message by clicking insert.



The channel default settings can then be altered. Value type is assigned for each channel, either a constant value or a measurement channel is available.

After that the transmission format and scaling has to be defined. In this example, data type is SIGNED and 16bit length. This container has a value range from -32768 to 32767. If the values to be transmitted lie within this range, scaling can be set to 1. If the value to be transmitted is a pressure of 153.26 N, 153 is transmitted. Values after comma are truncated, since an integer data type is selected. If the physical value range lies within about ±300, scaling 0.01 should be chosen for optimal resolution. The example to the left shows the transmitted value 12.45, which is actually 1245 (integer) with a scaling factor that must be removed in the receiver. Actual available data range is now -327.68 to 327.67. Scaling settings must be setup separately for each channel.

Can channel setup

Message setup

Name CH 1-3

Arb. ID # 1245

Type CAN Standard

DLC 8

Schedule Periodic

Period [ms] 100

In the next step, the message ID is set (xxxxhex) to be able to identify it uniquely on the CAN bus again.

Now the schedule is setup, defining when and how often data is sent out via CAN, e.g.: PERIODIC with 100 ms sends out the CAN message with 10 Hz rate.

Info: If an analog channel or a math channel is defined as data source it is updated every 40-50 ms, a new value is transferred inside the CAN setup inside DEWESoft. If the output rate is set faster than this internal update rate (< 40 ms), the latest available value is transmitted until receiving the new one. Under high system load this 40-50 ms update can be multiple times higher.

Schedule OnStart

Delay [ms] OnStart

Signal Setup OnStop

Name OnChange

OnTrigger

BeforeMessage

AfterMessage

Additional Schedule options:

- OnStart, when starting the measurement
- OnStop when stopping the measurement

This can be used to transmit status messages or configure CAN devices on the bus when measurement starts.

- OnChange only if the value of the channel to be transmitted changes it is sent out

Schedule OnTrigger

Channel AI 1 > 0

- OnTrigger after a trigger condition happens on the channel selected

Schedule BeforeMessage

Message CH 4-8

- BeforeMessage before a specified message (another CAN message)
- AfterMessage after a specified message

Schedule OnButton

Button ch. Button Pressed

- OnButton when clicking a control button display element

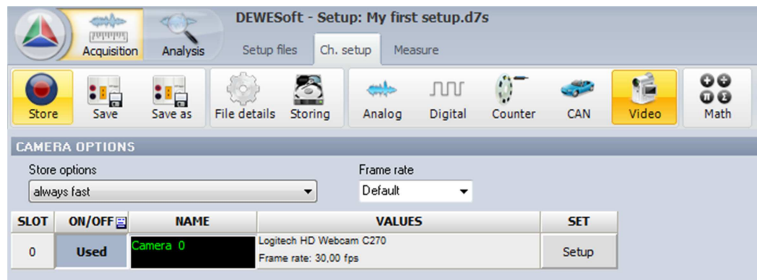


500 kBaud Message View Filter DBC library 2 messages; 3 channels

Err. msg:		0 / 610566		Messages		Channels		Rx		Tx		All		Import		Scan		11939	
EXP.	V	ARB.		ON/OFF	C	NAME										VALUE	SETUP		
-		1245h	Tx	Transm.OFF		CH 1-3	0000 0 1 0000000000000000000000000000 1 0000000000000000000000000000										Setup		
		0 .. 15	Tx	Transm.OFF		Channel 1	6.1081 [-]										Setup		
		16 .. 31	Tx	Transm.OFF		Channel 2	-327.68 327.67 [-]										Setup		
		32 .. 47	Tx	Transm.OFF		Channel 3	0 12.45 65535 [-]										Setup		
+		2345h	Tx	Transmit		CH 4-8	-327.68 327.67										Setup		

[illegible]

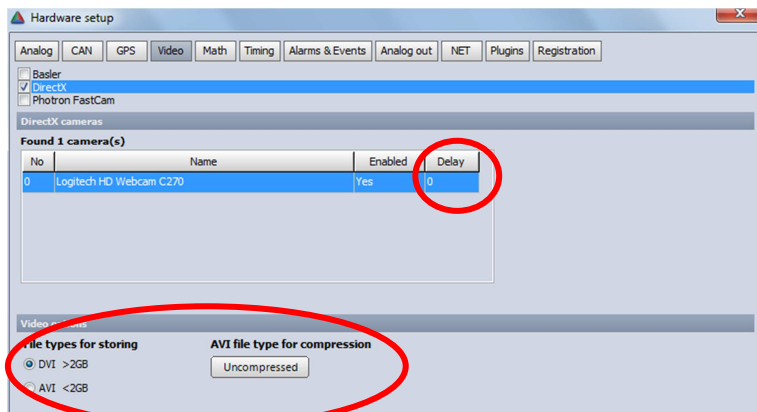
1.4.9 Video channel



Also videos are hardware-synchronized already during the measurement.

For simple documentation you can use a standard USB-webcam. For videos with higher sampling rates, clocked cameras from MARLIN, Basler or Photron are used. These cameras are clocked with the A/D converter board to ensure the synchronous acquisition of analog and video data at rates of 100 to 10.000 Hz.

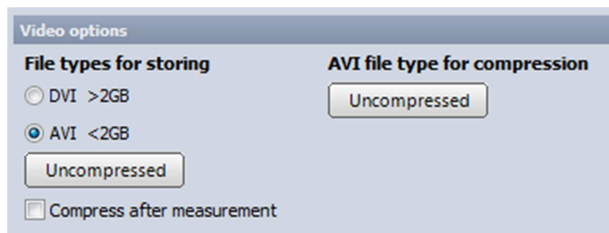
Video has its own channel setup menu. If it is not listed, you have to activate your camera (Settings → Hardware setup → Video).



Each USB-camera can be addressed via DirectX-driver. Because these cameras are free-run and the transfer speed of the frames depends on compression and driver, the delay (in [ms]) can be entered to be compensated. Cameras like Basler or Photron have no delay due to the clocking via A/D board (ext. sync cable to camera).

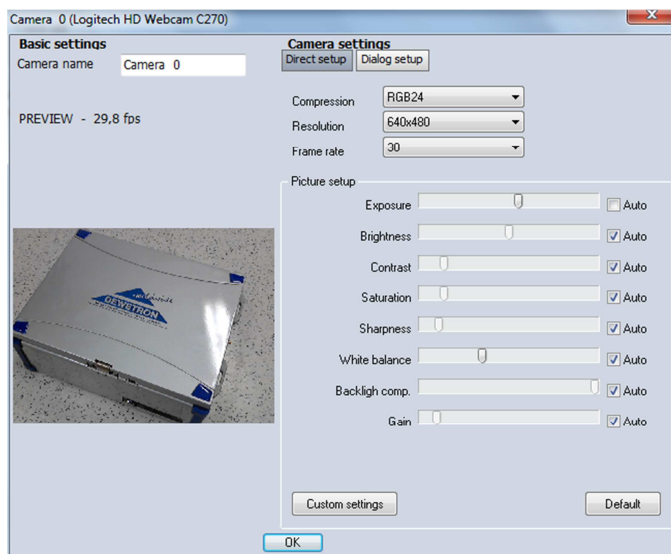
Two file types for storing are available:

- AVI files < 2 GB
- DVI files have no limited file size



DVI files can be converted with or without compression into AVI format.

Slow videos <5 Hz in AVI format can be compressed online or optional immediately after the measurement.

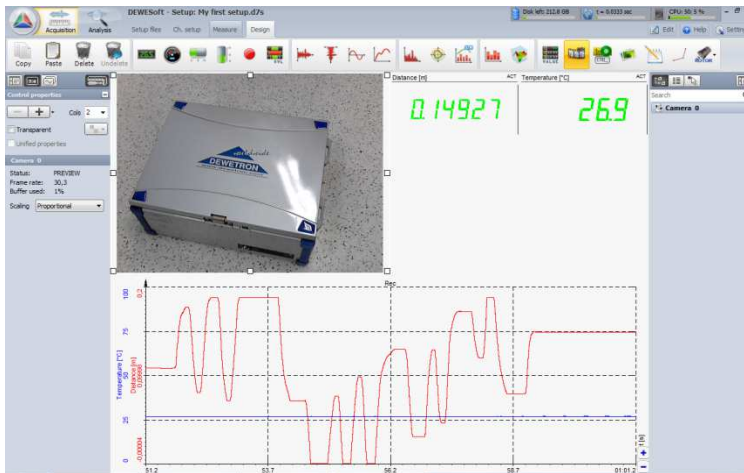


Set video parameters such as resolution in video channel setup.

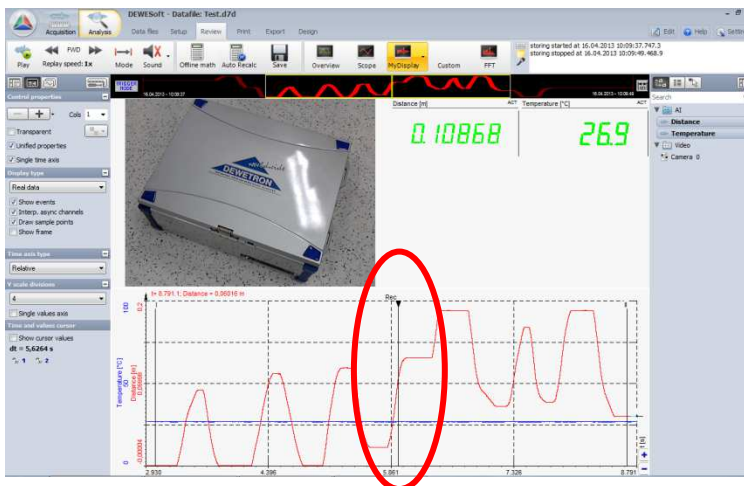
Store options: always fast Frame rate: Default

SLOT	ON/OFF	NAME	VALUES	SET
0	Used	Camera 0	Logitech HD Webcam C270 Frame rate: 30,00 fps	Setup

Frame rate: Set the default frame rate (this depends on camera type and resolution between 10 and 30 Hz).



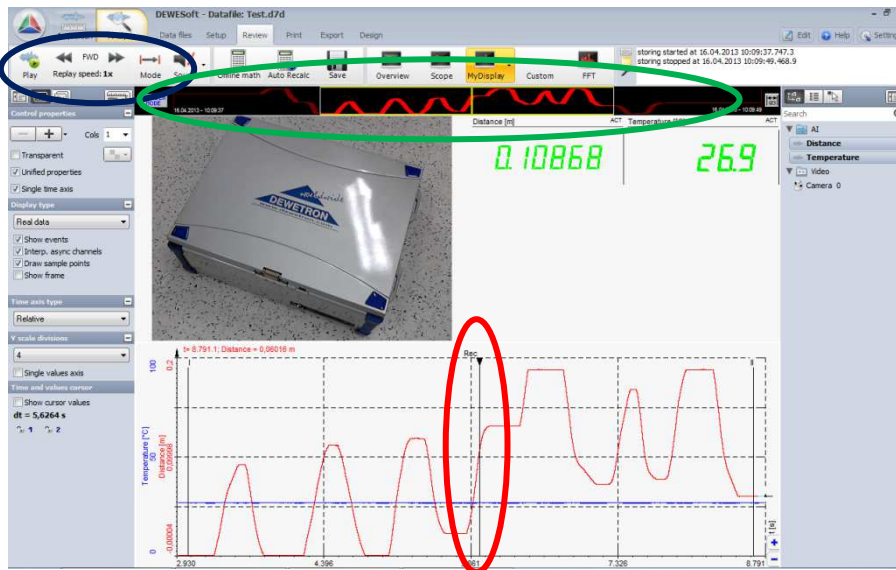
In Design mode you see the video display as instrument.



In Analysis mode the video frames are shown synchronously to the measurement data.

Moving the black cursor (default settings: black background and yellow cursor) shows all measurement data and the video frame at this particular time.

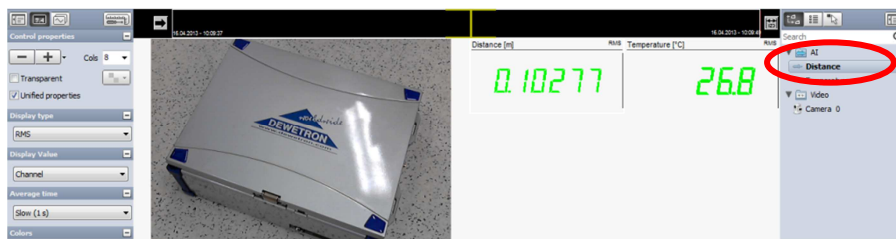
1.4.10 Analysis, data view, zoom, print, conversion in other file formats



With the black cursor (marked in red) you can navigate through data files in ANALYSIS mode. All instruments show the value at this particular time.

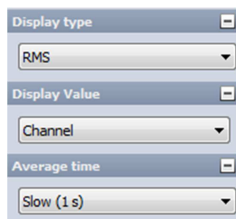
The navigation buttons are in the left upper corner (blue marking).

In the navigation bar (green marking) the whole content of the data file is shown. By default, the first channel is assigned here.



For displaying another channel in the navigation bar, the bar must be focussed. Then select the wanted channel in the right menu.

The navigation bar also informs about the time range instruments use for calculating the data (e.g. digital meter, FFT, recorder).



In this example you see that the digital instrument "Distance" is focused. This instrument has set the display type RMS and an average time of 1 second. In the navigation bar a yellow cursor marks the current average range of the digital instruments.

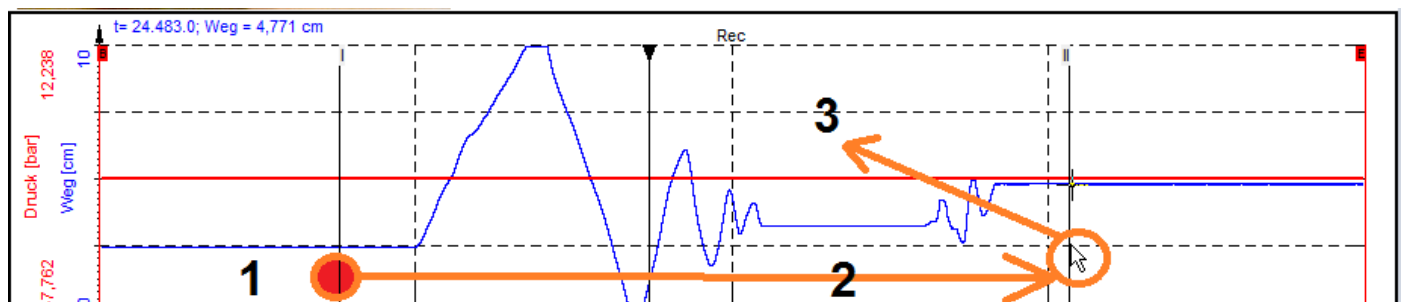
Zoom:

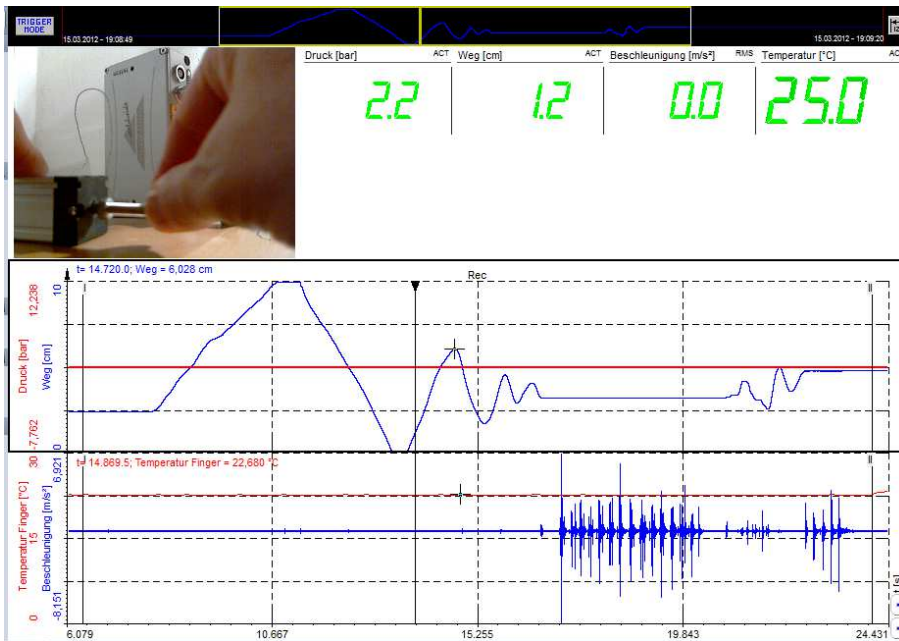
You need a recorder instrument for the zoom visualization. So zooming is just possible in the recorder, but then all channels are zoomed to the same range.

1. Click on the start position of the view area that should be enlarged.
2. Hold the left mouse button and release at the end of the zoomed area.
3. Now the zoom range is marked with two cursors. Click in the middle to zoom in.

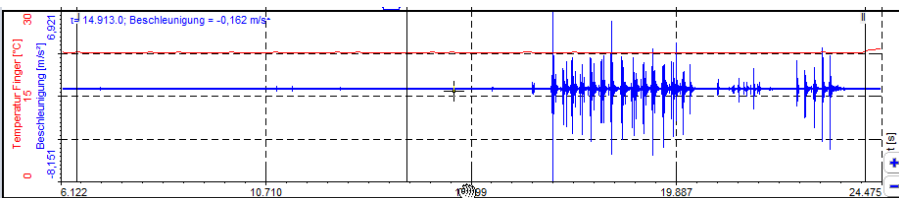
This can be done several times.

Right-mouse-click to zoom out step by step.

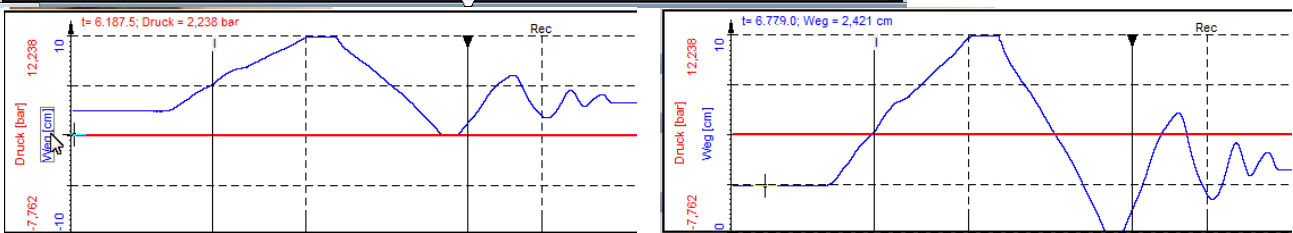




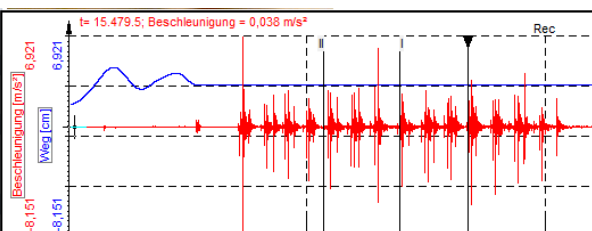
After zooming the black navigation bar shows the zoomed range as a yellow window. You can move this range by dragging it.



Or drag the range in the recorder x-axis (cursor changes to hand symbol).



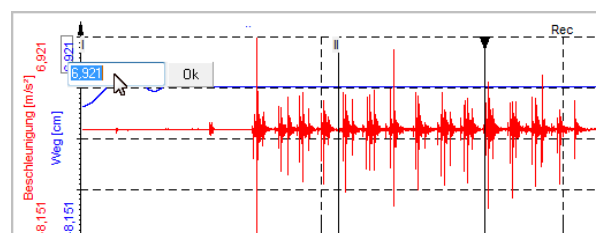
Left-mouse-click on the channel name zooms in the range (minimum and maximum measured values are the limits).

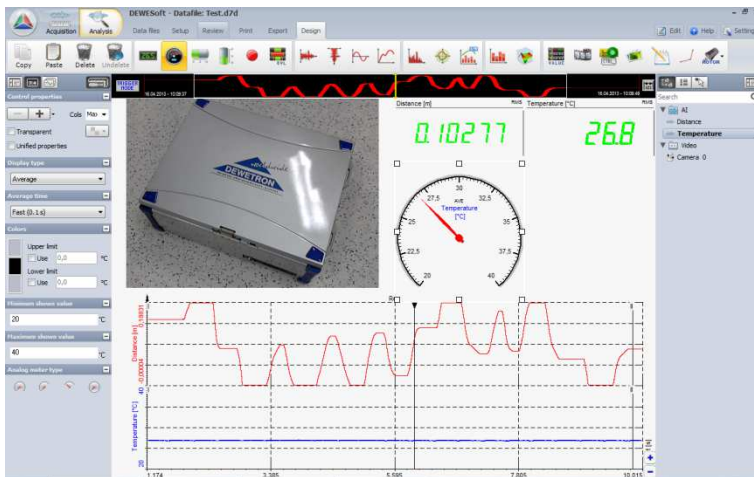


If you press the <CTRL> key while moving the mouse over the y axis labels, all assigned channels are highlighted and when clicking all channels are scaled to the overall min-/max-range. So you can easily compare them.

The Y-axis can be scaled manually, too. Left-mouse-click on MIN or MAX and enter the value; confirm with OK or press enter.

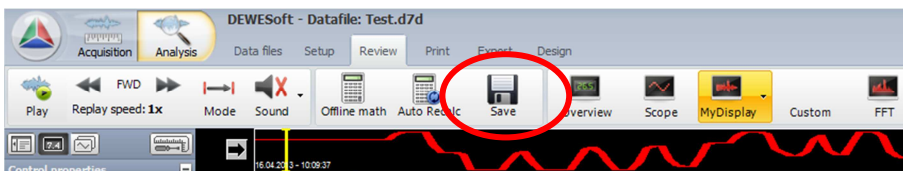
- If you click on the y-axis max or min value while holding the <CTRL> key, you can manually enter a value for min/max for all channels.



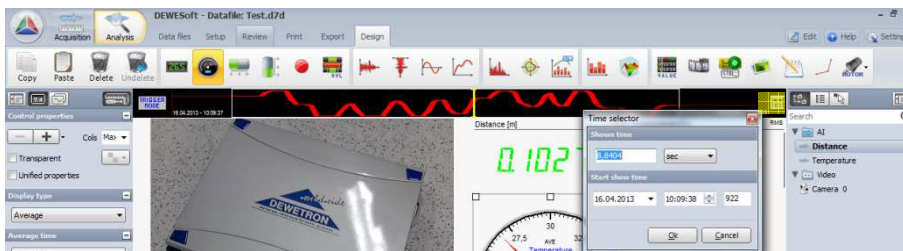


The **Design** mode is also available in ANALYSIS. In Design mode you can add or delete display instruments, even after the measurement.

This means that the arrangement of the instruments can be adapted afterwards for individual reports.



The display setup must be saved in the data file with the SAVE button.



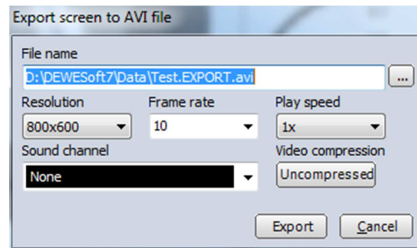
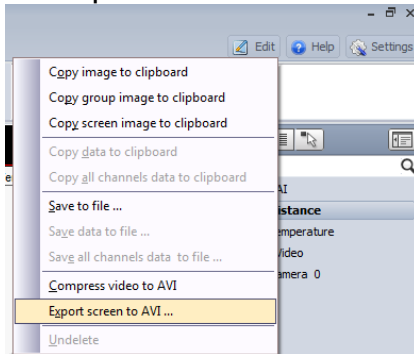
For very long data files you can set the beginning and length of the zoomed area manually. You find this menu on the right side of the navigation bar.

Screen export



Several possibilities for export are available.

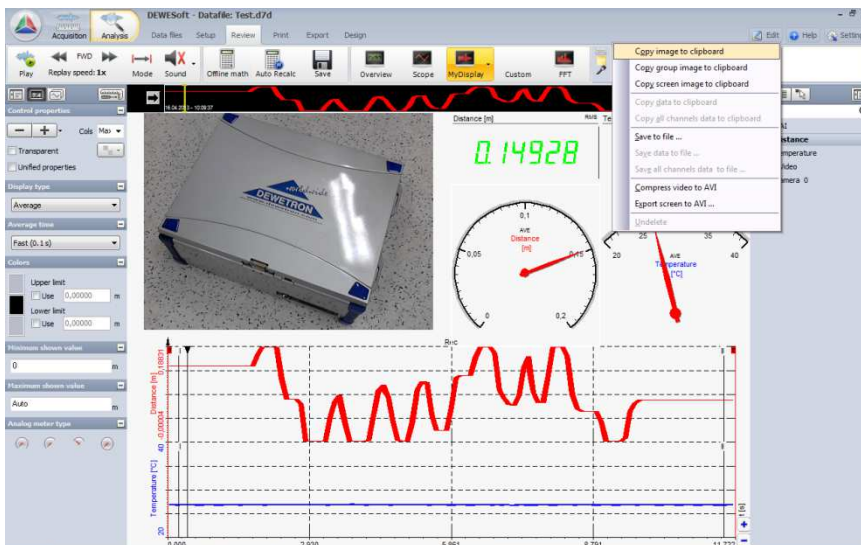
Video export



The current view is exported to an AVI file.

Set resolution, replay speed, frame rate and compression before the export.

This way the measurement data can be viewed by who don't have DEWESoft, but just the DEWESoft user has the original measurement data.



Copy image to clipboard

Focused instruments can be copied to the clipboard with the Edit menu (top right). Then they can be pasted in your other programs like Word, Excel, etc.

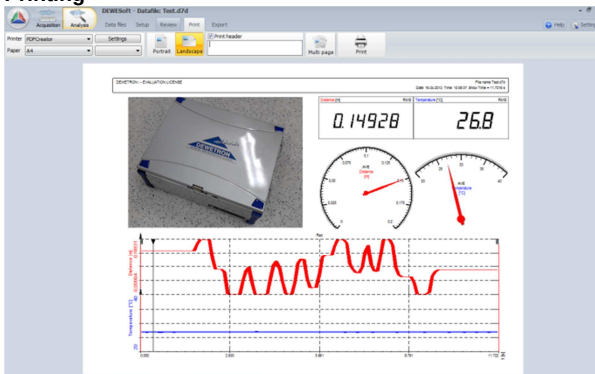
Copy group image to clipboard

Focused group of instruments (e.g. recorder group on the left) is copied to your clipboard.

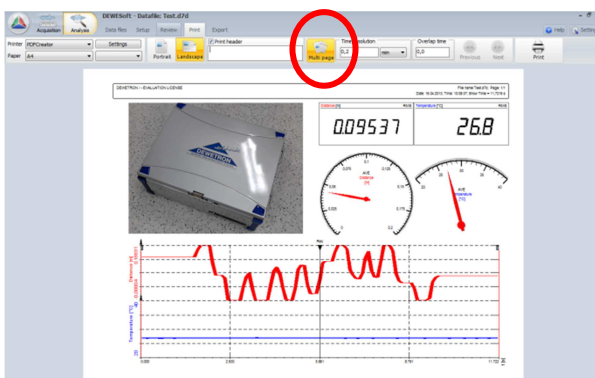
Copy screen image to clipboard

All instruments you see on your screen are copied to the clipboard.

Printing

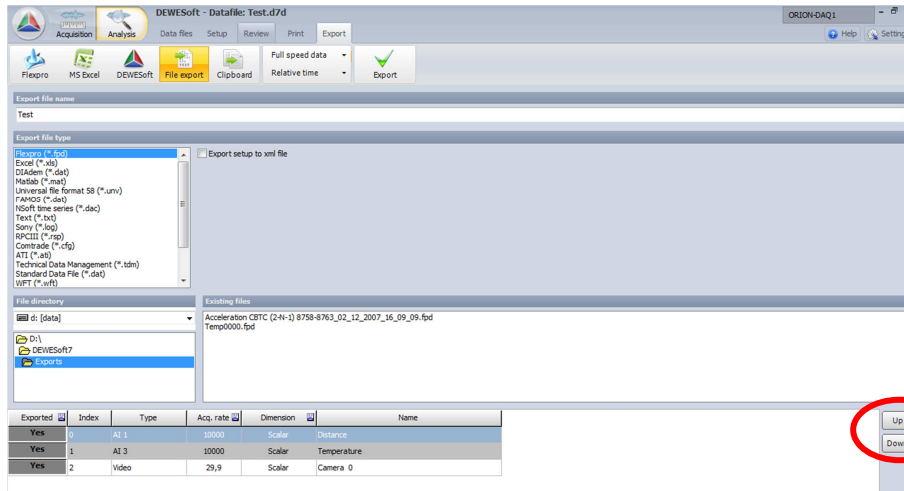


You can print the whole screen content in the **print** menu.



If the option **Multi Page** is activated, the content of one recorder is distributed automatically over several pages. Navigate through the preview with the previous/next buttons (red).

Export of measurement data



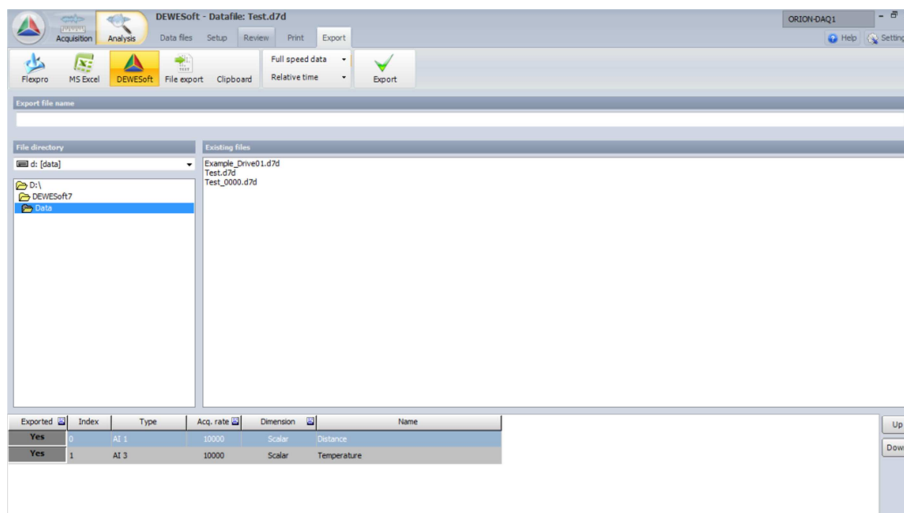
You can export your measurement results into different file formats with the **File export** menu.

Name and file type are suggested, but can be changed.

Select the channels that should be exported. Sort them with the **up/down** buttons on the right.

The currently zoomed region is exported. But if no data zoom is active, all measurement data is exported.

So you can define afterwards which part of the measurement you want to zoom and export.



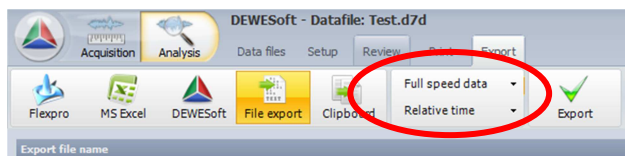
Therefore it is possible to export the data in the DEWESoft format. Additionally, all channels which you don't need can be deactivated.

Just zoom into the relevant range and save this as a new DEWESoft data file.

Thus, measurement data with reduced length and number of channels can be created.

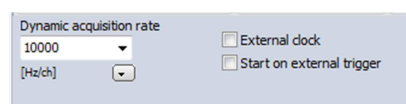
INFO: For analyzing and viewing measurement data a DEWESoft license is NOT necessary!

Simple data reduction at export



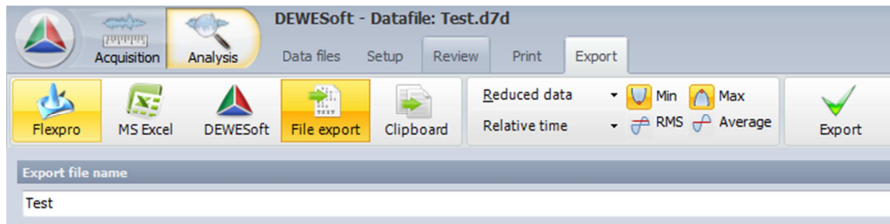
The export has different options:

- Full speed data
- Reduced data
- Relative time
- Absolute time
- Trigger time



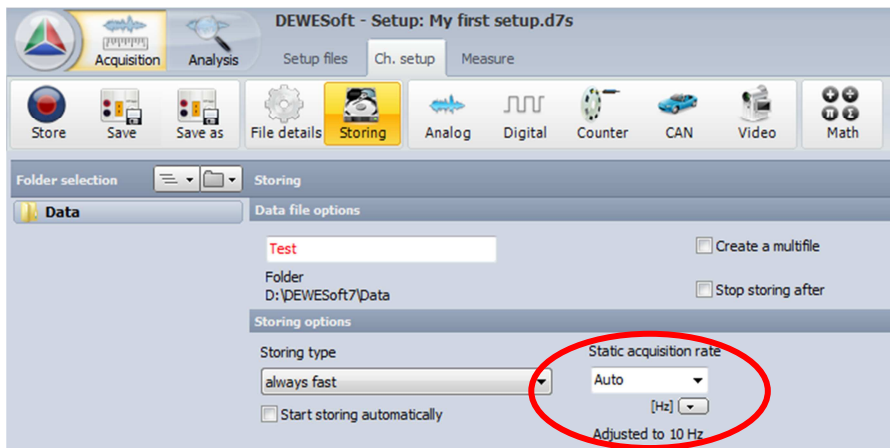
Full speed data:

All channels are exported with the full dynamic acquisition rate, which was set during measurement. All synchronous measurement channels (such as analog, digital, counter) are exported with full data rate. For asynchronous data types (such as CAN, PAD, ...), there will be gaps in time without data or interpolation will be done (depending on chosen export format).



Reduced data:

Data will be exported with reduced rate. Be aware that the reduced rate is set before the measurement and cannot be changed afterwards.



Static acquisition rate is set in the storing options in the channel setup. If AUTO is set, a ratio of 1:1000 to the dynamic acquisition rate is set automatically.

2000 Hz / 1000 = 2 Hz or 0.5 seconds. Manual setting of the reduced rate is also possible.

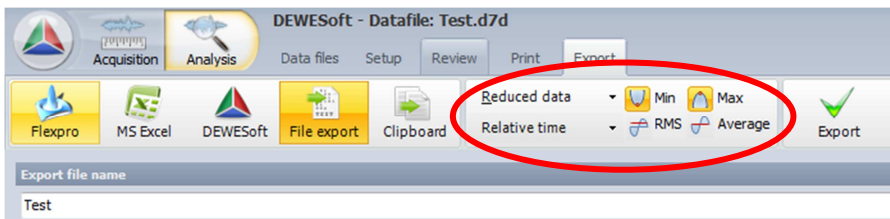
Also, if the storing type is set to ALWAYS FAST, the data is stored with the reduced rate additionally.

How to store?

Example: Set a rate of 0.5 seconds. The data is acquired and stored with the dynamic acquisition rate (because storing type is ALWAYS FAST).

For reduced data the values for min, max, RMS and average are calculated and stored for every 0.5 seconds.

For long term measurements and storing type ALWAYS FAST, this value should be adapted to the application. So in the case of too large data files, a size reduction of the exported file is possible by changing to reduced data. The reduced rate cannot be changed afterwards. In ANALYSIS mode the data can also be reduced with the statistic function, but that is the more complicated way.

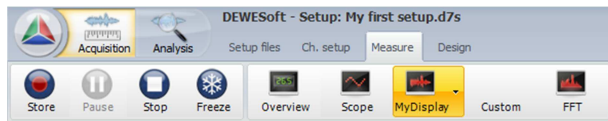


You can choose if min, max, RMS and/or average are exported.

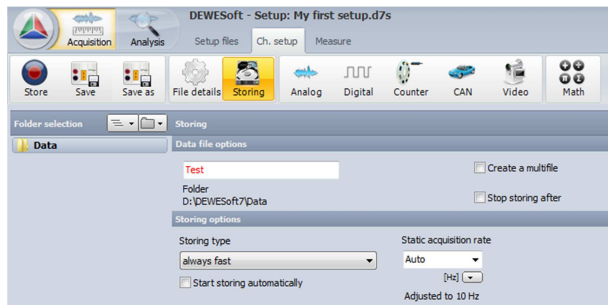
With the min-max-values you have a good overview of the signal range, even with reduced rate.

1.4.11 Storage options: continuously fast or slow, with trigger

Always fast

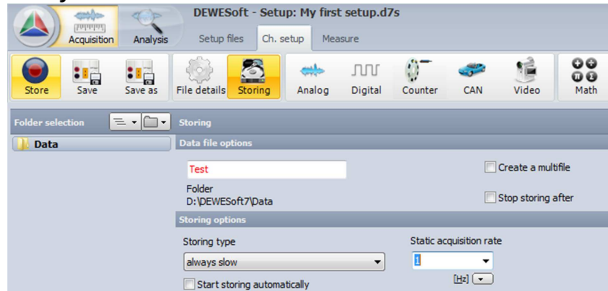


In Measure Mode the data storing can be started with the STORE and stopped using the STOP button. It's also possible to pause and resume the storing.



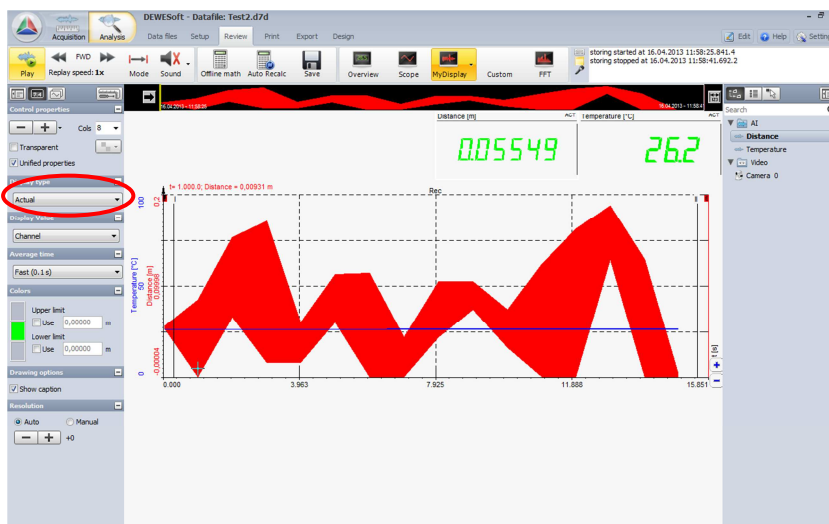
All channels are acquired with the dynamic acquisition rate in the *always fast* mode.

Always slow



Using the storing type *always slow*, data is acquisitioned with the dynamic sample rate but stored with the static reduced rate only.

The software always stores the MIN, MAX, AVERAGE and RMS values with the reduced rate (can be adjusted in the storing options).

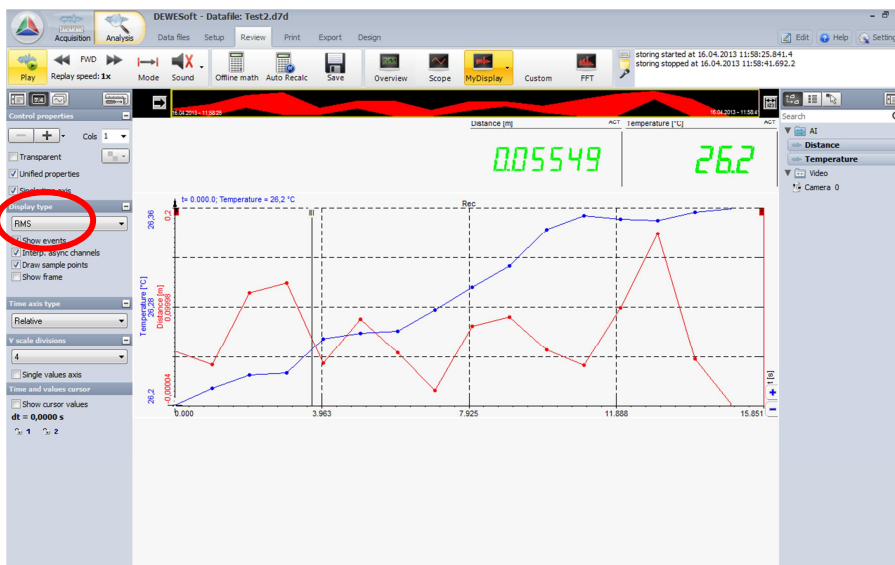


When selecting the option slow, you will not see a difference to the always fast option during measurement, except using less disk space. However, in the Analysis displayed data may look strange at first.

In the recorder (display type: REAL DATA) you see a band or area instead of a single line. The upper limit shows the MAX, the lower limit the MIN values. The values change with a rate of 1Hz.

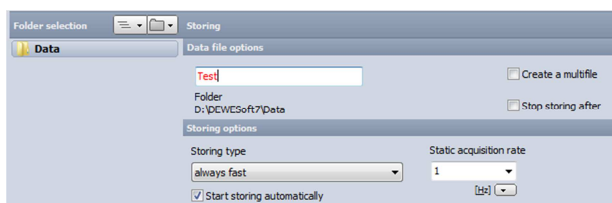
For calculating the MIN and MAX values during storing, the full sample rate is used, that is the reason you never lose information with this min/max – technology.

You can change the recorder from REAL DATA to AVERAGE or RMS in the properties on the left side.

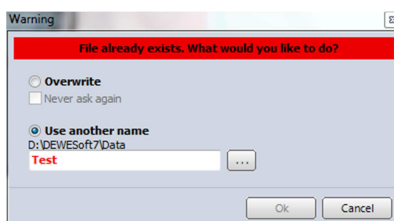
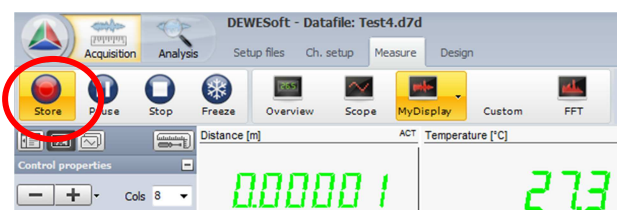


In RMS or AVG mode you can clearly see the reduced data with a rate of 1Hz.

This mode is particularly suitable for long-term measurements. Although fast signals (like acceleration or voltage monitoring with 50 Hz) require high sampling rates, you can store the data with a slow rate without losing important information.

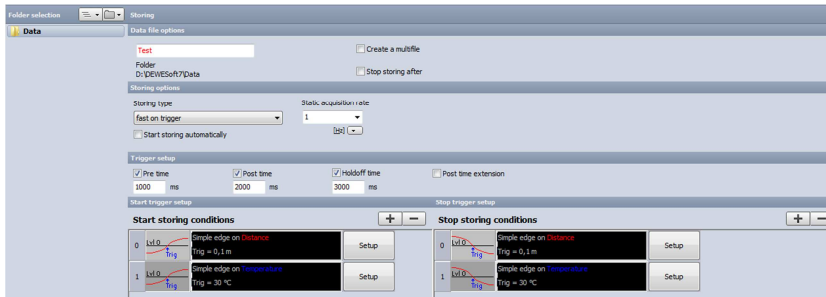


The option START STORING AUTOMATICALLY activates storing immediately after changing to Measure mode. This prevents forgetting to press the STORE button in Measure mode.



If a file name already exists, you are asked if you want to overwrite the file. If you then choose NEVER ASK AGAIN, it will be overwritten and you are not asked again until restarting the software; then this option is reset and you will be asked again.

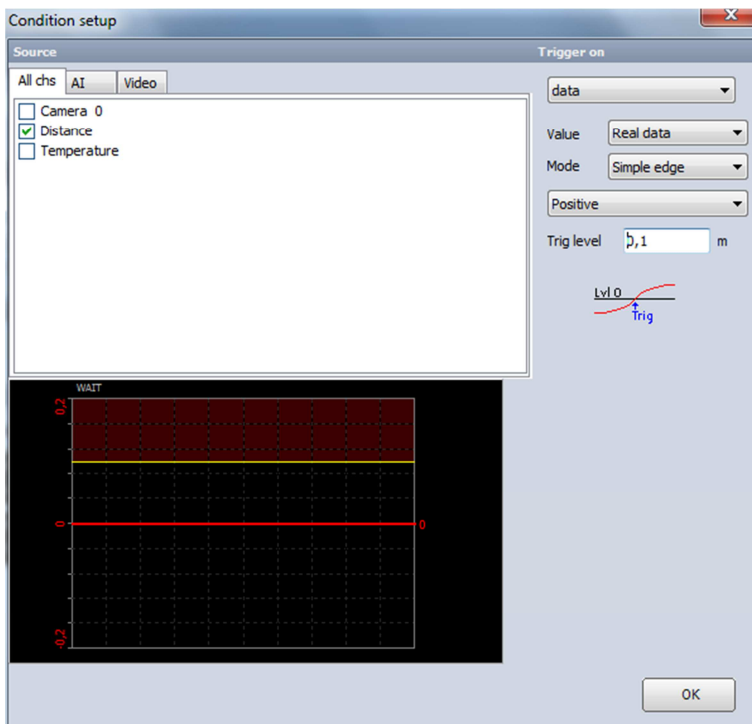
FAST on trigger



Using the storing types *always fast* and *always slow*, you have to start and stop the measurement manually.

With the storing type *fast on trigger* the software monitors pre-defined channels and starts/stops storing depending on the state/transition of them according to preset trigger conditions.

On the left side you define the start storing conditions and on the right side the stop conditions.



EXAMPLES:

The start storing condition is set when exceeding 0.1 m. This is realized with the mode "simple edge" and "positive edge".

If the value drops below 0.1 m, the storing should stop. Use the *simple edge* and *negative* to achieve this.

Another start and stop trigger monitors the temperature. Storing starts if the temperature is higher than 30°C and stops when falling below 25° C.

The store button in Acquisition mode is now labeled with ARM. If the arm button is activated (red), all start trigger channels are monitored.

If a trigger condition (or combination) is fulfilled, the measured data is stored in a file.

If the pre-trigger is active and set for a specific time, also the data before the start is stored for this time.

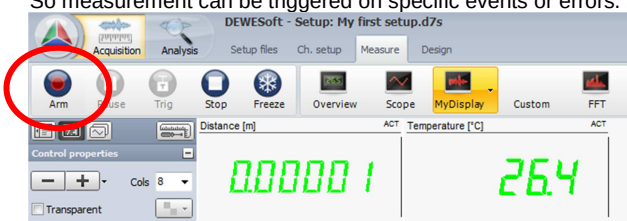
Afterwards, all stop conditions are monitored. If the post-trigger is active and set for a specific time, the data after the stop trigger is stored for this time and then storing is stopped.

Of course, the measurement continues and also the triggers are monitored. If the next start trigger condition is fulfilled, the same procedure starts over again.

If the trigger holdoff time is set, the trigger monitoring continues only after this time is over. This enables suppressing trigger events that follow too fast.

If there is no stop condition but the post-trigger is active, the measurement is stored beginning with the start trigger event till the end of the post-time. If no post-trigger is active, the storing is started but not stopped automatically.

So measurement can be triggered on specific events or errors.





After arming (start of monitoring) measurement can also be triggered manually with the TRIG button (= equals a fulfilled trigger condition).



Afterwards, the stop trigger conditions are monitored. If there is no stop trigger, the storing ends after the set post trigger time. If both are not set, the storing is not stopped automatically.

Press the TRIG button again or the STOP button to stop storing manually.

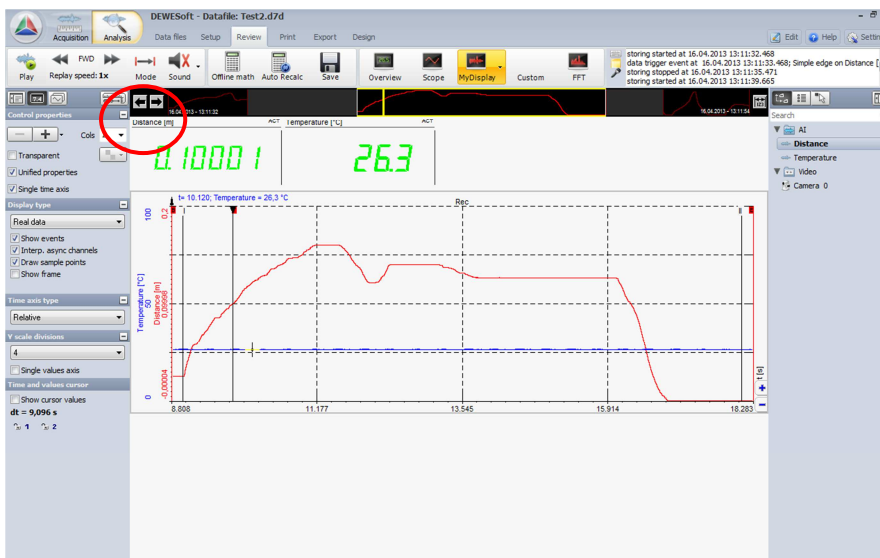


To the left you see a data file with trigger events.

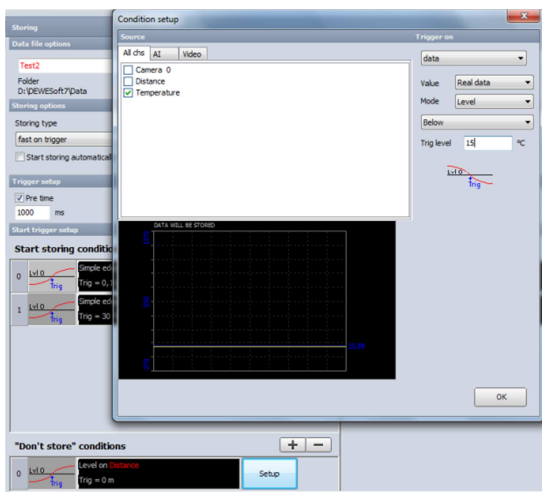
In the black navigation bar you can see clearly that the data is not stored continuously. Also in the recorder you see this gap.

When the distance signal exceeded 0.1 m, the storing started with a pre-time of 2 seconds. When the distance signal was below 0.1 m, the storing was stopped after the post-time.

Now you can zoom into the measurement data or use the TRIGGER MODE button to jump from event to event.



Jump to the next event with the navigation arrow. Each trigger event is then shown zoomed in the recorder.

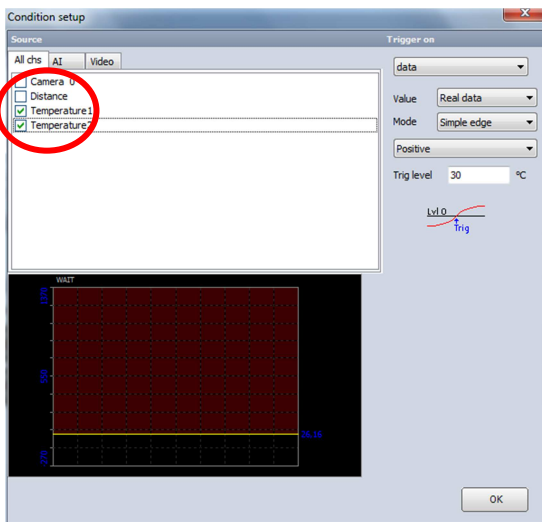


Additionally, one or several DON'T STORE conditions can be set. If the condition is fulfilled, the trigger monitoring is inactive.

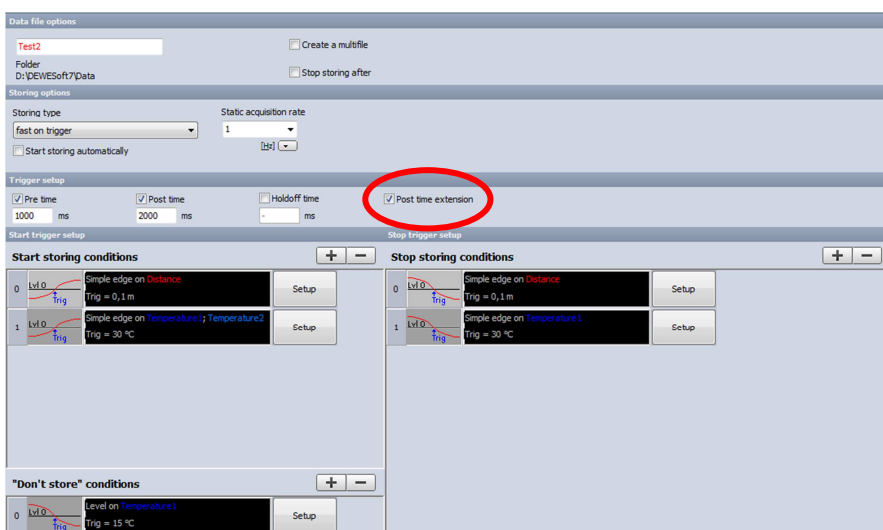
In this example the DON'T STORE condition is set for the temperature to be under 15 °C. If the temperature is under 15 °C, the START TRIGGER conditions are not monitored.

This is e.g. useful because if the temperature of a device is lower than 15 °C, it is not switched on. And when it is not working it doesn't have to be monitored.

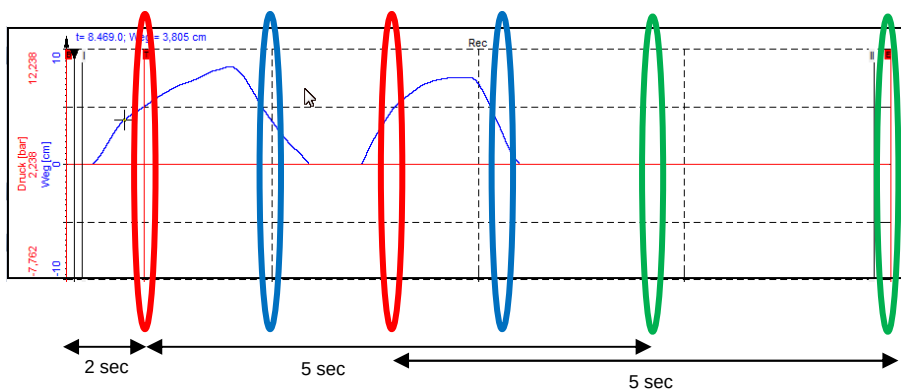
Compared to the START-STOP trigger conditions, here just the level (lower, higher) and the window (within, without) triggers are available.



→ Press the CTRL key to select several channels at the same time (for the same trigger conditions).



If **post time extension** is active, another fulfilled start trigger condition within the post time extends the storing.



Example with a distance channel:
Start trigger: more than 5 cm
Stop trigger: less than 3 cm
Post trigger time: 5 seconds

Additionally, the **post time extension** option was active.

Here you see clearly that the storing time was extended due to a new start trigger within the post time.

Red (1): More than 5 cm → Start of storing with pre-time of 2 seconds

Blue (1): Less than 3 cm → post-time (= 5 sec) starts running and storing would stop after 5 seconds (Green 1)

Red (2): New start trigger (more than 5 cm) within the post-time → first post-time stop is not valid anymore; the storing continues

Blue (2): Again less than 3 cm → post-time starts again, storing stops after 5 seconds (Green 2) because no start trigger condition was again fulfilled within the post-time

Trigger Condition Setup:

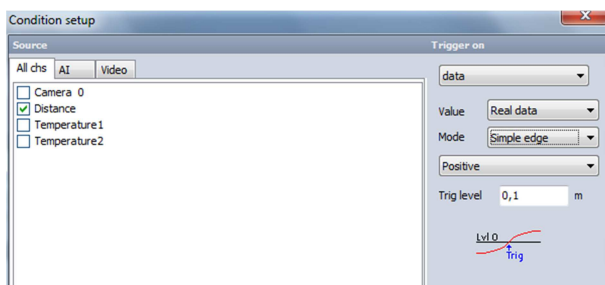
The following trigger types are supported: data, time and FFT.

1.) Trigger on data



Trigger on REAL DATA (full sampling rate of channel) or on RMS, MAX, MIN or AVERAGE (=REDUCED DATA)

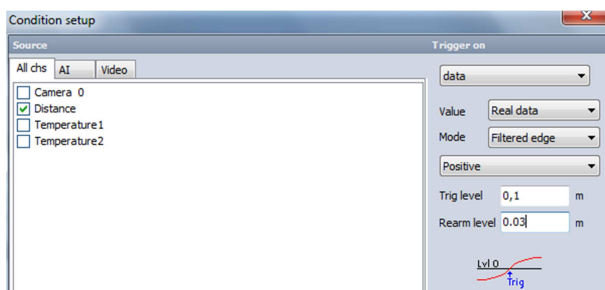
With an edge trigger each value is monitored. Therefore it is recommended for high sampling rates and a high number of triggers to trigger on reduced data.



Simple edge:

This is the most used trigger condition in data acquisition systems. The trigger event is a rising or falling edge, which crosses a defined level.

Example: Temperature is higher than 30 °C or distance exceeds 0.1 m.



Filtered edge (with REARM-level):

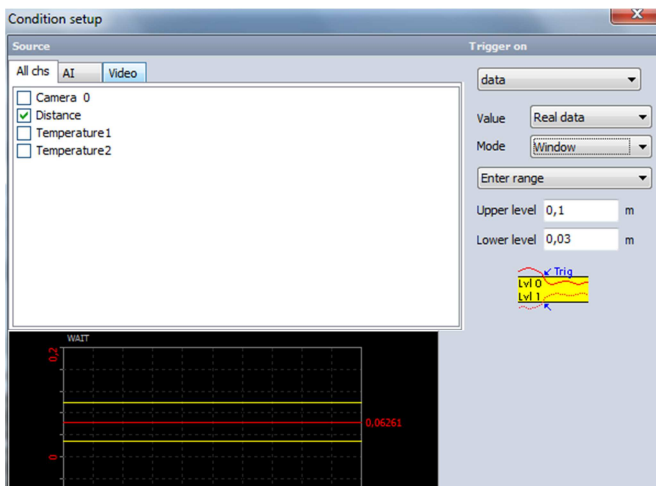
This is basically the same as the simple edge trigger, except for the **rearm** level.

Using the standard edge trigger, measurement could be started unintentionally because of signal noise. When using positive edge, it could also trigger on negative edge and vice versa.

Reason: If the signal is lower than the trigger value, no trigger is initiated because of the positive edge. Due to signal noise a sample underruns the limit and the next sample exceeds it. The trigger is initiated, although all following samples are below the trigger limit.

Using the filtered edge trigger (= edge trigger with REARM), first the rearm-level has to be crossed, then the status is armed and will trigger when trigger level is exceeded. For the next trigger event the signal must fall below the rearm level first.

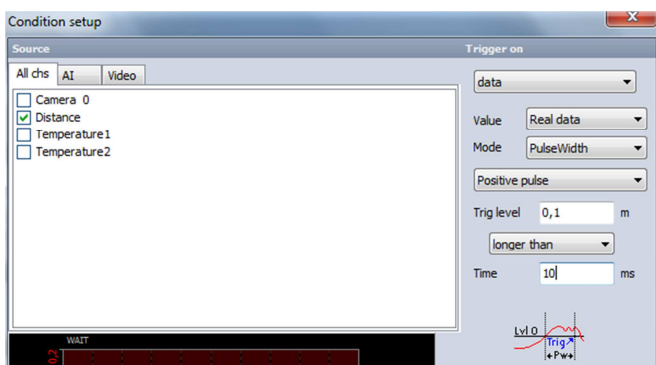
At positive edge the trigger-level is always higher than the REARM-level. It is opposite for the negative edge.



Window:

For the Window mode, you have to set two independent values, one upper and one lower limit. The trigger condition can become true when the signal enters or leaves this window.

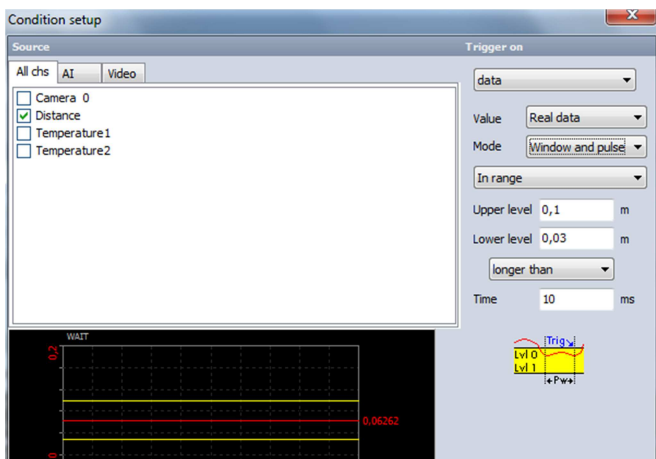
Example: The normal temperature is between 50 and 100° C. You want to know when this temperature is out of range and set the trigger for entering and leaving this range.



PulseWidth:

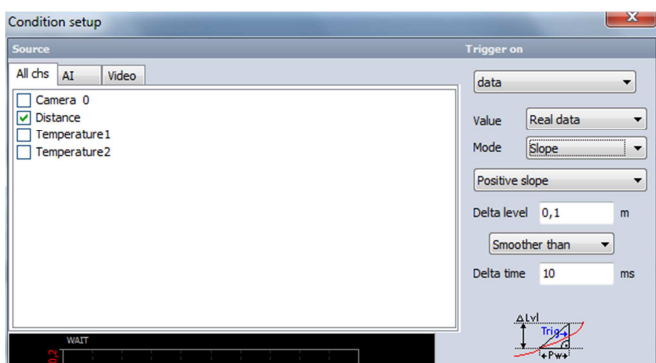
In this mode the duration Time of the event is checked in addition to the level (like the simple edge trigger) and the trigger is initiated only if the event is longer/shorter above the selected level. Time can be set for **longer than** or **shorter than**.

Example: Temperature exceeds 100° C for longer than 20.000 ms.



Window and PulseWidth:

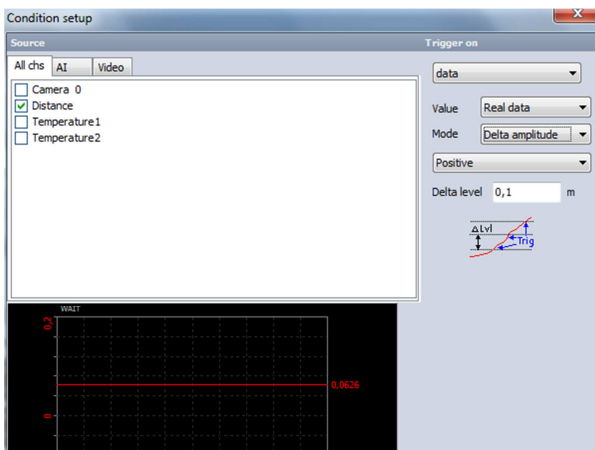
This is a combination of both options. A time for leaving or entering the range can be set in ms.



Slope:

If a signal rises or falls faster or slower in a defined time, the trigger will be set.

Example: Pressure raises by 20 bar within 1 second.

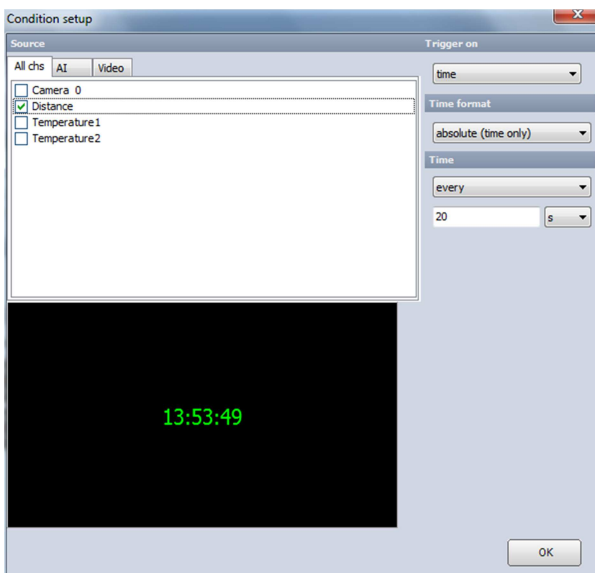


Delta amplitude:

If the amplitude changes by the set value (delta), the storing is triggered. Reference value is the current value when arming the measurement.

Example: When starting the measurement (trigger is armed), the distance is 2 cm. The trigger will start when the distance is higher than 7 cm. New reference distance is 7 cm so the next trigger will start at 12 cm.

2.) Trigger on time



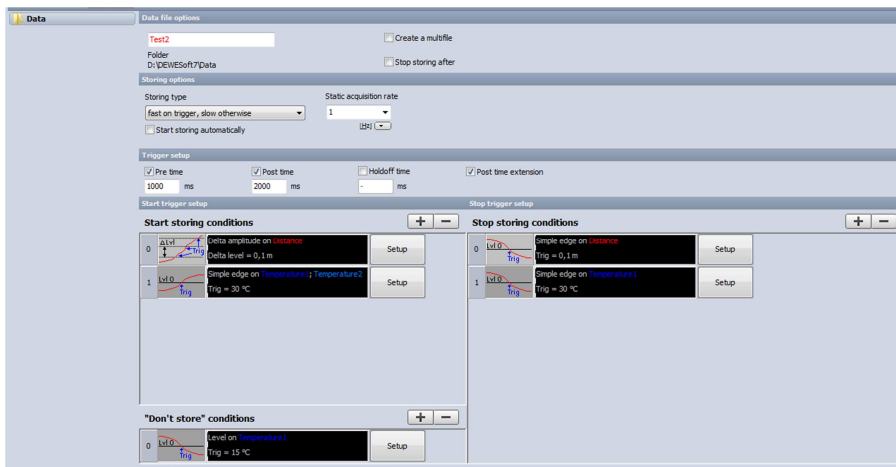
Two time formats: relative or absolute (time only).

Example with setting EVERY 20 seconds:

- Relative: Every 20 s relative means: 20 seconds after ARMING first trigger, after further 20 s second trigger, etc.
- Absolute (time only): This trigger references on the absolute time. Trigger event at 0 s, 20 s, 40 s, etc.

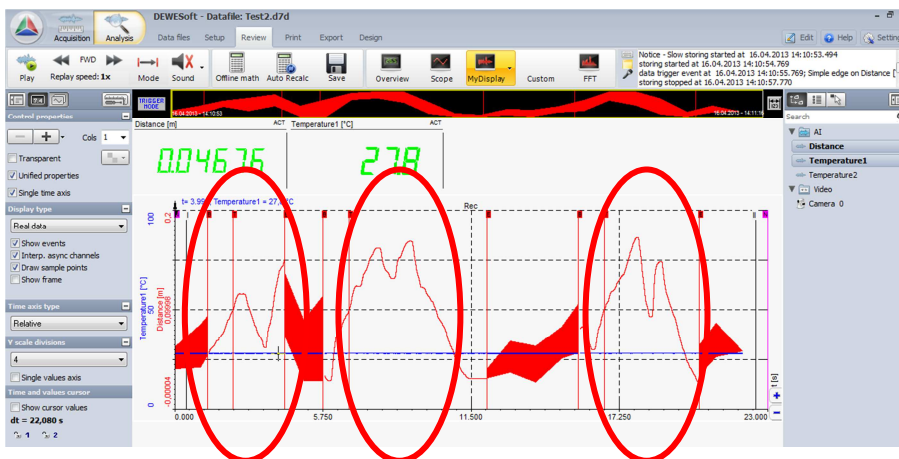
Set the time **EQUAL TO** instead of **every to** release just one trigger relatively or absolutely to a special time.

FAST on trigger, slow otherwise

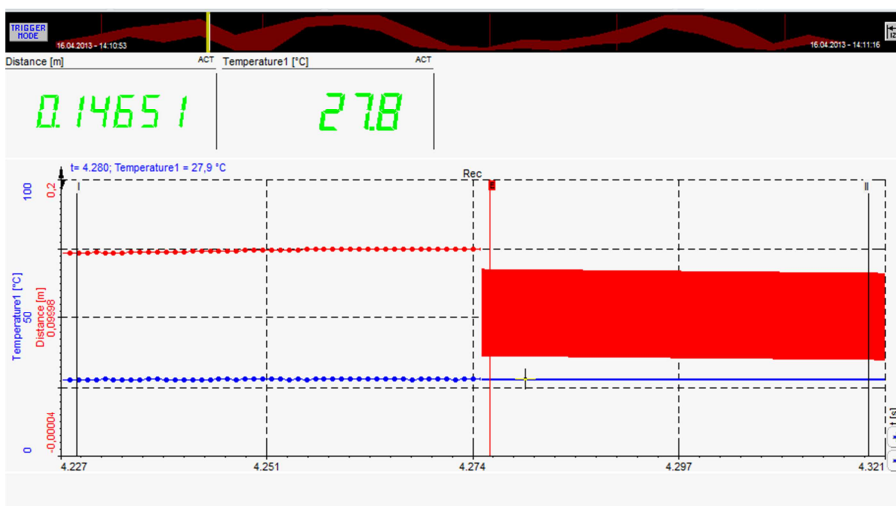


This storing type is a combination of slow and fast measurement.

Data is stored with two speeds: data is stored with slow (static, reduced) rate until the trigger condition becomes true. If the trigger condition is true, it is stored with full acquisition rate.



Here you can see that a trigger condition is true two times. When triggered, the storing is done with full acquisition rate.



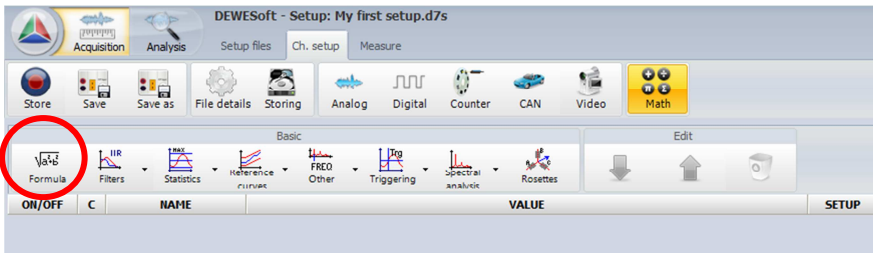
Zoom into the first triggered part to see the difference between reduced and fast storing clearly.

This mode is perfect to store all details in case of error.

If there is no error, the reduced data offer enough information for a good signal overview.

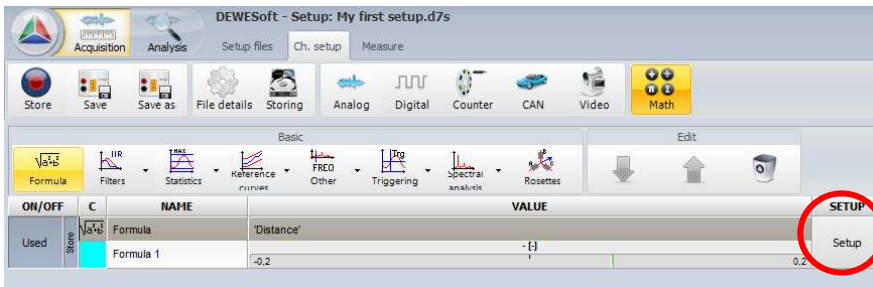
You do not lose information with the MIN-MAX technology.

1.4.12 Basic Mathematics

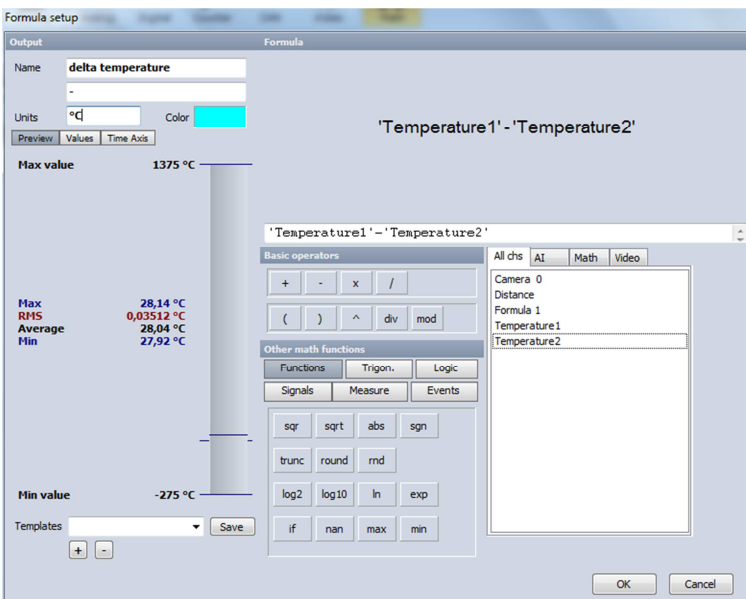


In addition to the input channels you can add calculated channels, statistic values or filters via mathematic functions → **MATH**.

The functions are divided into groups, such as formula, filters, statistics, reference curves...



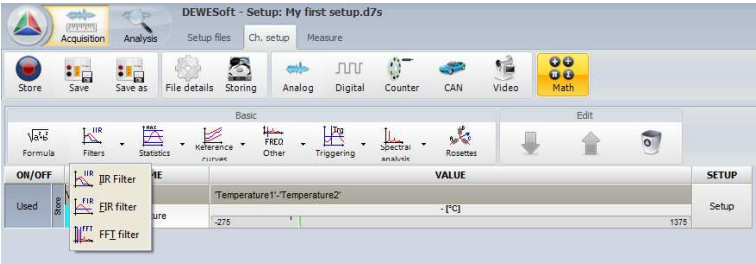
All added math functions are listed below.



Set the required mathematical function in the **formula setup**.

In the left example, two temperatures with the names "temperature1" and "temperature2" are subtracted and result in the difference temperature in °C.

Any number of math objects can be added. The result of a math objects can be processed again in other math objects.



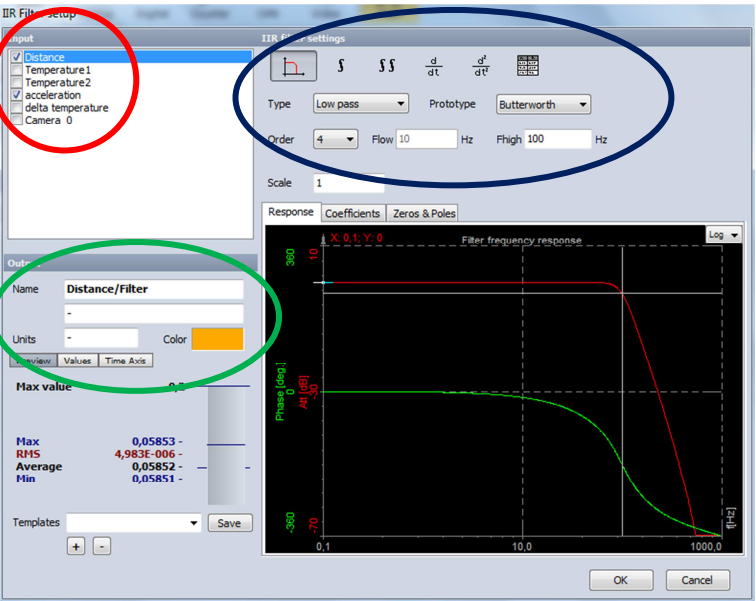
Each math object is shown in the list below.

A formula always has just one output channel, but other math objects can use the same function on multiple channels at the same time.

One of these functions is the *signal filter*.

Signal Filter

4 filters in Math setup are available: IIR Filter, FIR Filter, FFT Filter and Envelope.



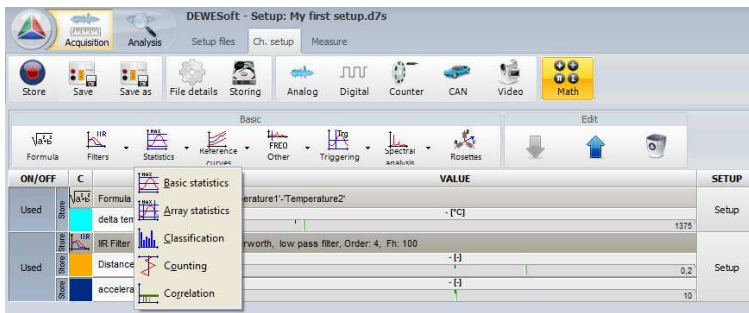
The filter module supports multiple input channels; all available channels are shown on the left. Set all properties (e.g. type, prototype, order, ...) in the filter settings. These settings are valid for all selected inputs.

All filtered signals are output with a default name (channel name/filter). Unit and name can also be changed.

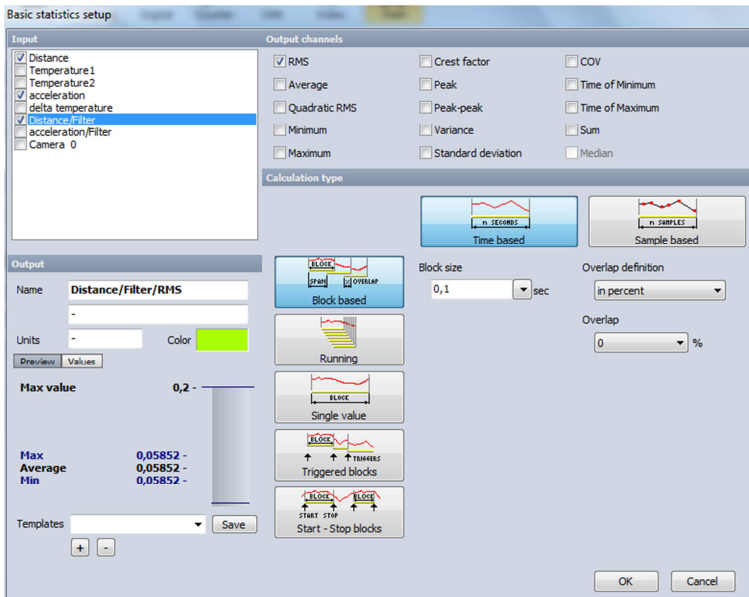
The currently selected channel is displayed in the output preview section on the bottom left hand side.

ON/OFF	C	NAME	VALUE	SETUP
Used	Formula	Temperature1-Temperature2	- [°C]	Setup
Used	IIR Filter	Butterworth, low pass filter, Order: 4, Fh: 100	- [Hz]	Setup
Used	Distance/Filter	-0.2	- [m]	Setup
Used	acceleration/Filter	-10	- [m/s²]	Setup

When the filter module has been set up, the filtered signals are added to the match channel list.



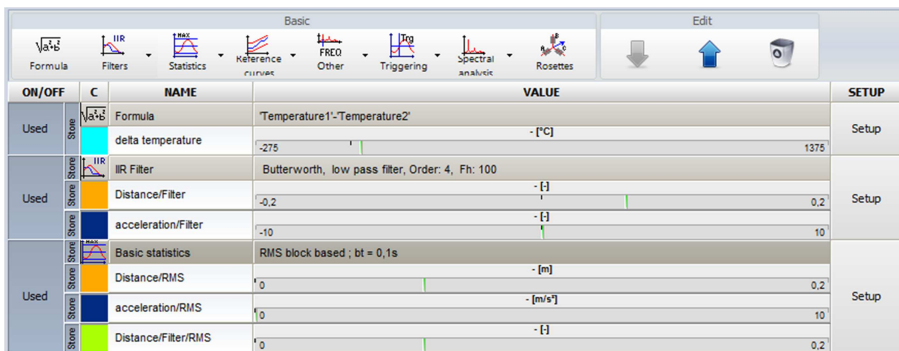
The statistic module is setup in a similar way.



Upper left: input channels

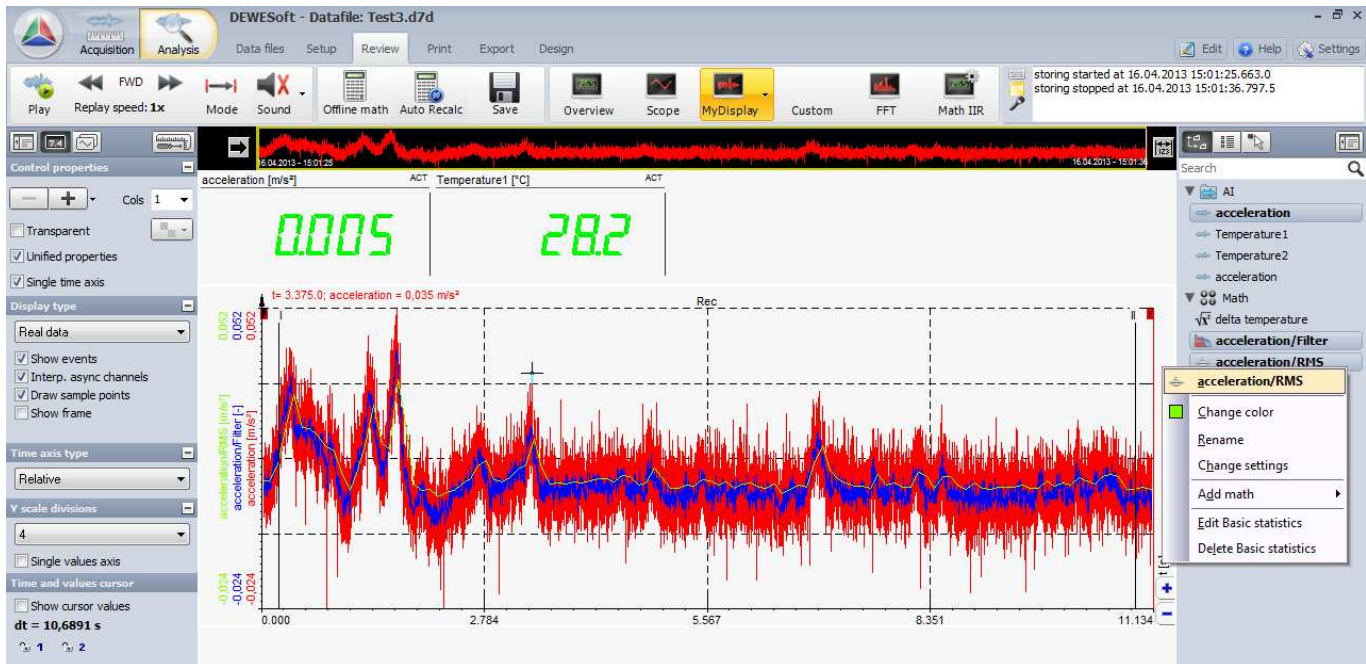
Lower left: output channels; again with default names

Right hand side: properties settings



Again, after setup the resulting channels are visible in the channel list.

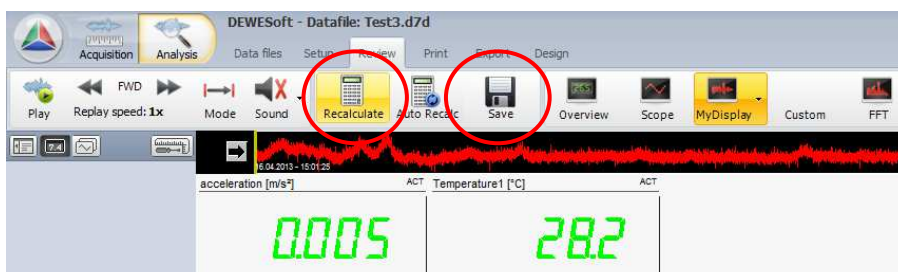
In Measure mode the mathematic channels are available in the Math group.



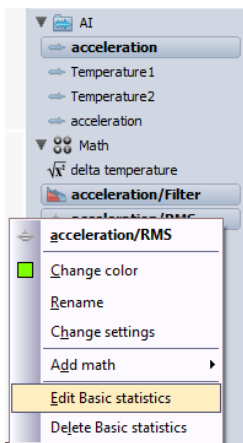
Right-mouse-click on the channel in the list to open a window to change parameters.

ON/OFF	C	NAME	VALUE	SETUP
Used	Formula	Formula	"Temperature1"-Temperature2	Setup
		delta temperature	- [°C]	
			-275	1375
Calculated	IIR Filter	Butterworth, low pass filter, Order: 4, Fh: 100		Setup
		acceleration/Filter	-10	10
Calculated	Basic statistics	RMS block based ; bt = 0,1s		Setup
		acceleration/RMS	10	10
Offline	Formula	Temperature1*5		Setup
		new formula	Waiting calculation	

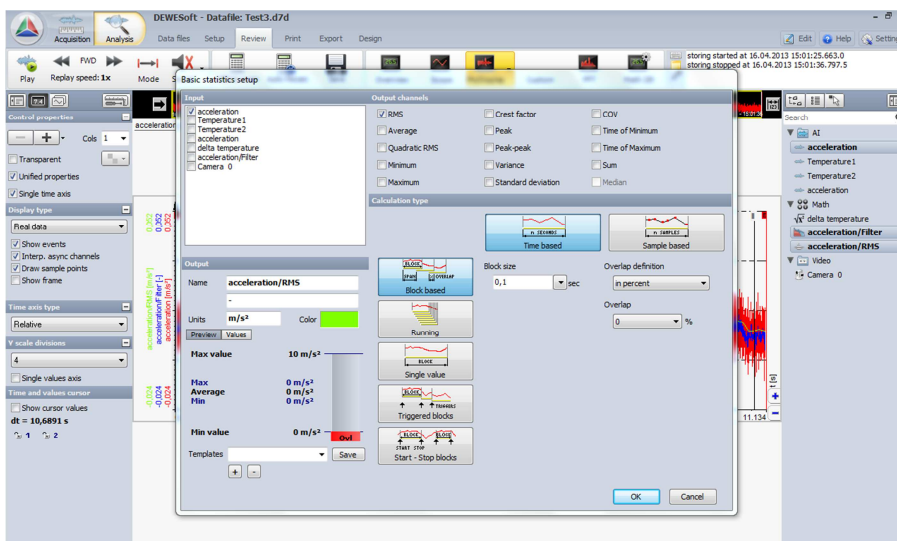
Also, in Analysis mode new mathematic functions can be added and calculated (offline-maths). Furthermore, settings of existing objects can be changed and recalculated.



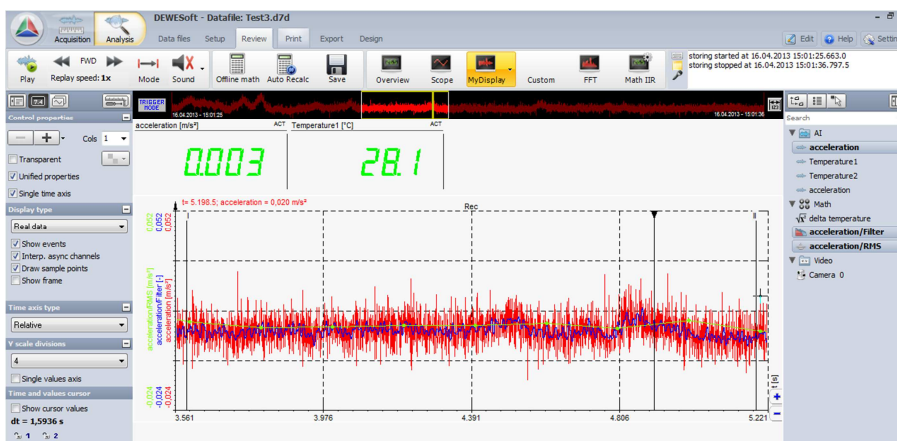
If a mathematic object has been changed, it must be recalculated in the analysis mode. Press Save to save the changed mathematic channels into the data file.



In Analysis mode the settings for the mathematic functions for recalculation can be done with right-mouse-click on the measurement channel.

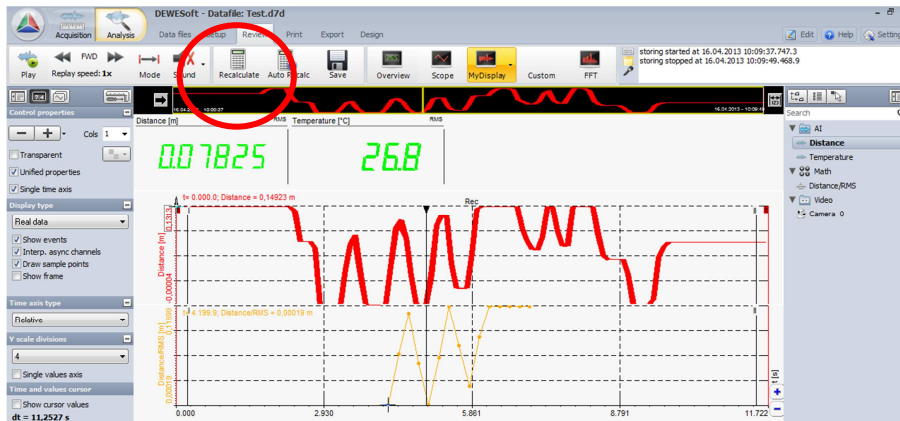


Edit the mathematic functions in the window. Confirm with OK, then all recalculations will be done immediately.



If a zoomed range is selected, the recalculation is just done for this selection.

There is no data outside the zoomed range.



Zoom out to see the recalculated part. Press Offline math to recalculate the new range or the whole data file.

1.4.13 Storing additional information, serial number, test procedure and events with the measurement results

EVENTS

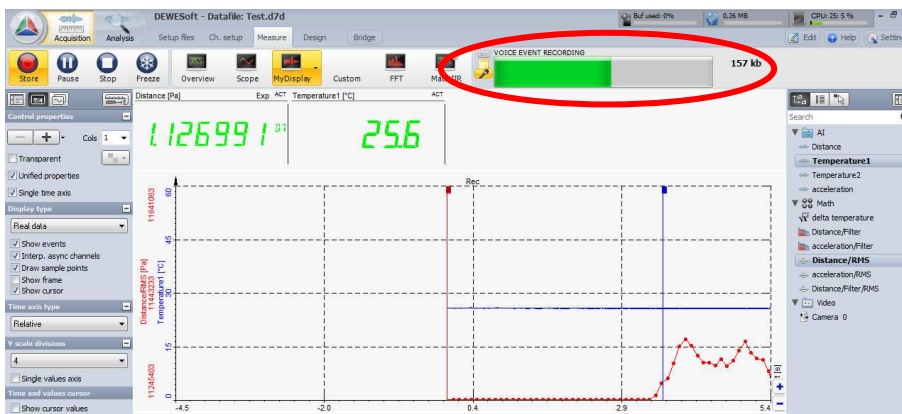


Mark with [space-bar]

Press the space-bar during storing to create a marking in the data file. You see your marking in the recorder instrument (red).

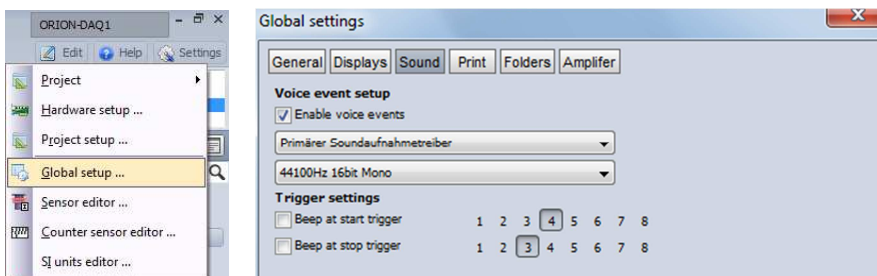
Notice with key [N]

Press the N-key during storing to add a notice in the data file. Then write your notice in the **enter event notice** field. Press enter to close the notice.



Voice input with key [V]

Press and hold the V-key during storing to record a voice notice of 15 seconds.

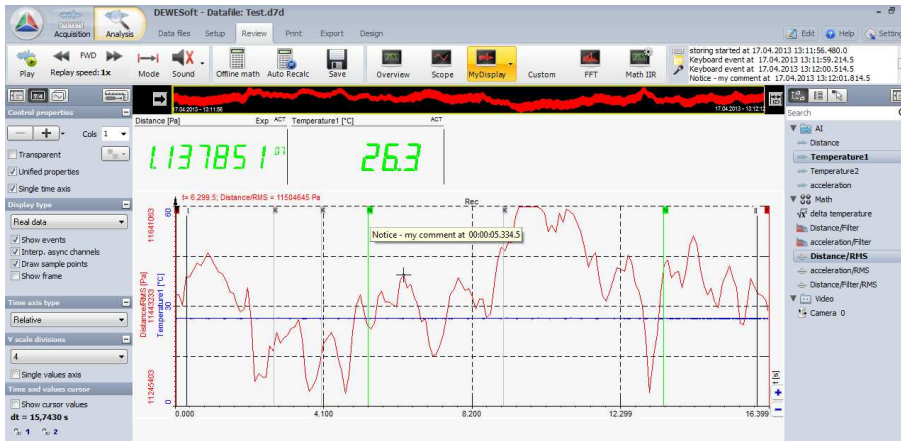


Maybe your voice input is not active; have a look if your soundcard is activated in the sound settings (settings → global setup → sounds).

For all three events you could of course use the icons in DEWESoft instead of the keys.



During the measurement all events are shown in the information text box.



In ANALYSIS all events are shown in the recorder and the information text box.

Move the cursor on the text notice to see its content. Double-click on a voice notice to hear it.

Ch. no.	Name	Rate	Settings	Scale	Offset	Range	Min	Max
AI 1	Distance	2000	DAQP-STG (2000 mV/V ... 10 kHz (BU); Exc 5 V) S...	9996	0	-1,999E7 .. 1,999E7 Pa	-1,18E7	-1,11E7
AI 3	Temperature1	2000	DAQP-MULTI (-270 ... 1370 °C ... 10 Hz (BU)) SN: ...	1	0	-270 ... 1370 °C	26,21	26,51
AI 4	Temperature2	2000	ORION-1616-505 (5 V)	1	0	-5 ... 5 V	-0,001068	3,052E-4
AI 5	acceleration	2000	ORION-1616-505 (10 V)	1	0	-10 ... 10 m/s²	-6,104E-4	0,001526
Math 1 (Formula)	delta temperature	2000	Temperature1-Temperature2	1	0	-275 ... 1375 °C	26,21	26,51
Math 2 (IR Filter)	Distance/Filter	2000	Butterworth, low pass filter, Order: 4, Fc: 100	1	0	-1,999E7 .. 1,999E7	-1,18E7	-1,11E7
Math 2 (IR Filter)	acceleration/Filter	2000	Butterworth, low pass filter, Order: 4, Fc: 100	1	0	-10 ... 10	-4,547E-5	6,082E-4
Math 3 (Basic stat...)	Distance/RMS	10,0	RMS block based; bt = 0,1s	1	0	0 ... 1,999E7 Pa	1,127E7	1,171E7
Math 3 (Basic stat...)	acceleration/RMS	10,0	RMS block based; bt = 0,1s	1	0	0 ... 10 m/s²	3,357E-4	4,316E-4
Math 3 (Basic stat...)	Distance/Filter/RMS	10,0	RMS block based; bt = 0,1s	1	0	0 ... 1,999E7	1,127E7	1,171E7
Video	Camera 0	29,9	AVI: 640x480 (RGB24); 490 frames	1	0	0 ... 18000	28	489

List all stored channels and events in ANALYSIS → Setup → Channels/Events.

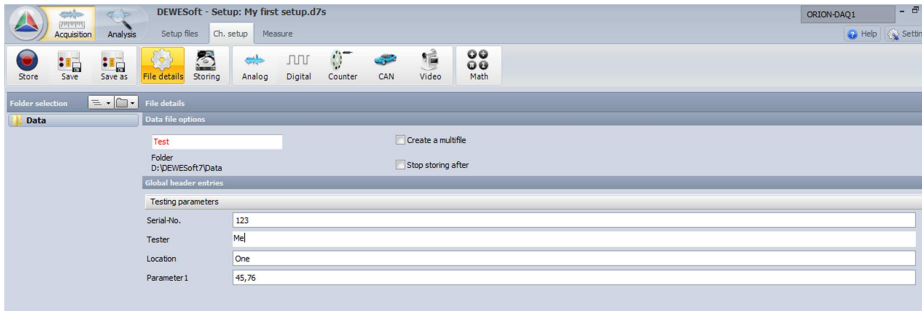
Event list
storing started at 17.04.2013 13:11:56.480.0 (0, 0)
Keyboard event at: 17.04.2013 13:11:59.214.5 (2, 1469)
Keyboard event at: 17.04.2013 13:12:00.514.5 (4, 669)
Notice - my comment at: 17.04.2013 13:12:01.814.5 (5, 669)
Keyboard event at: 17.04.2013 13:12:05.550.0 (9, 140)
Notice - my comment at: 17.04.2013 13:12:09.979.0 (13, 998)
storing stopped at 17.04.2013 13:12:12.879.0 (17, -1202)

Both lists can then be printed.

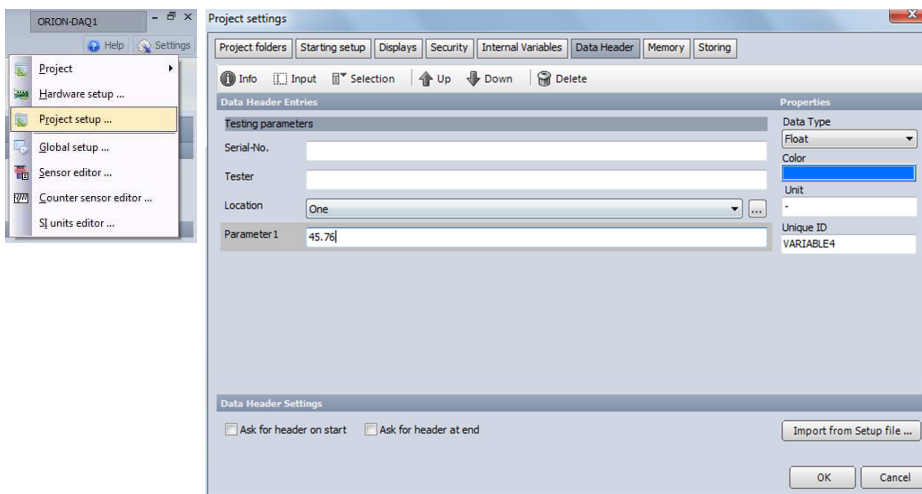
Printer	PDFCreator	Settings	Print header	Time resolution	Overlap time	Print
Paper	A4	Portrait	Landscape	0,3 min	0,0	Print

DEWETRON /		File name: Test.d7d
Trigger conditions: always fast		Date: 17.04.2013, Time: 13:11:56
Sample rate: 2000 s/sec		Number of channels: 11
Channels		
Ch. no.	Rate	Channel name
AI 1	2000	Distance
AI 3	2000	Temperature1
AI 4	2000	Temperature2
AI 5	2000	acceleration
Math 1 (Formula)	2000	delta temperature
Math 2 (IR Filter)	2000	Distance/Filter
Math 2 (IR Filter)	2000	acceleration/Filter
Math 3 (Basic sta...)	10,0	Distance/RMS
Math 3 (Basic sta...)	10,0	acceleration/RMS
Math 3 (Basic sta...)	10,0	Distance/Filter/RMS
Video	29,9	Camera 0
Events		
storing started at 17.04.2013 13:11:56.480.0		
Keyboard event at: 17.04.2013 13:11:59.214.5		
Keyboard event at: 17.04.2013 13:12:00.514.5		
Notice - my comment at: 17.04.2013 13:12:01.814.5		
Keyboard event at: 17.04.2013 13:12:05.550.0		
Notice - my comment at: 17.04.2013 13:12:09.979.0		
storing stopped at 17.04.2013 13:12:12.879.0		

Enter additional information before or after measurement → Data Header



Additional information can be stored in the data header of the file. This info can be set before the measurement, via prompt or in the project setup (header).



Define the header information in Settings → project setup → data header.

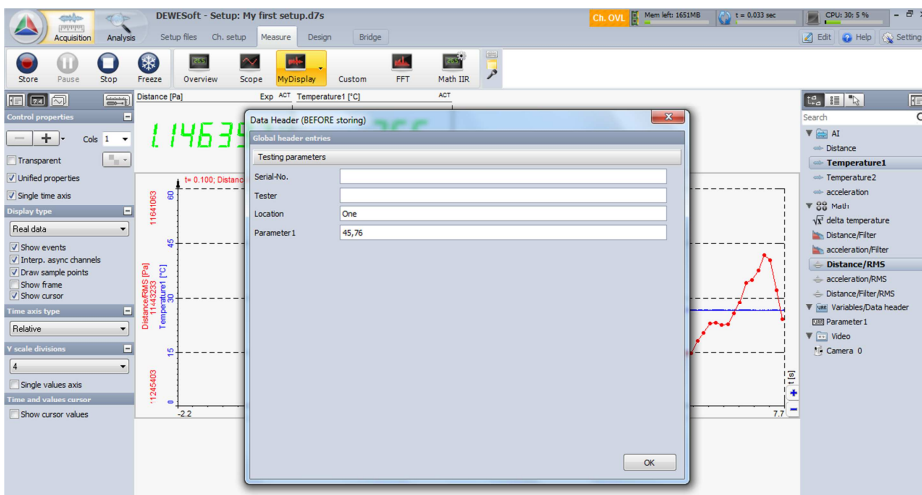
Three field types are available:

- Info
- Input
- Selection

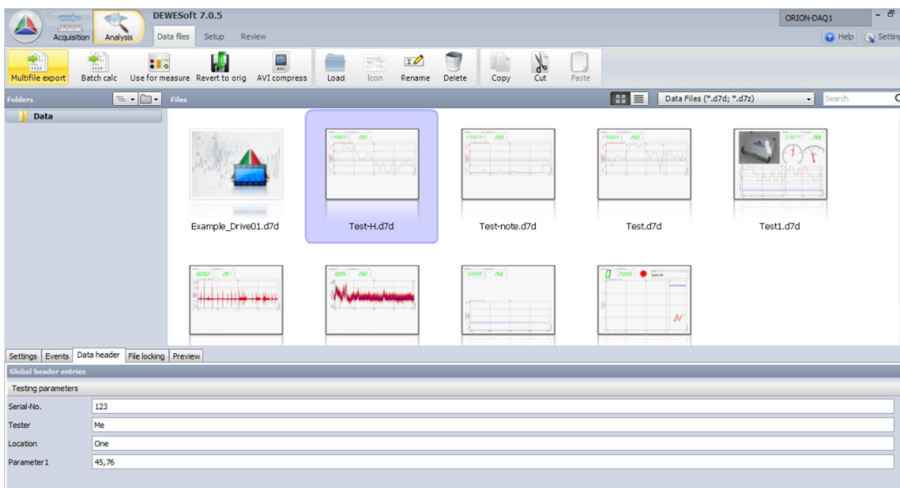
Info: Contains text and is mainly used for headlines or to separate different parts.

Input: Set any alphanumeric value in Text mode, integer or floating-point numbers in their respective modes

Selection: Values can be freely pre-defined as custom drop-down lists. Each of these fields can be used several times, so each header can be defined individually. Optionally, a prompt for defining header info can be configured.

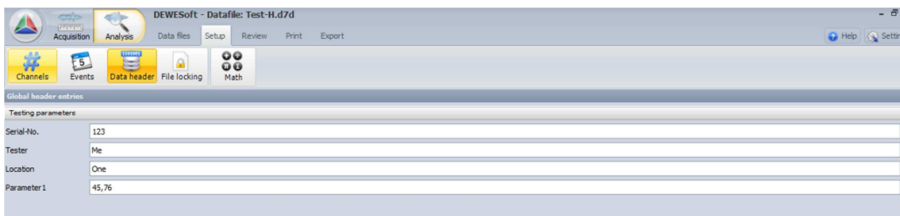


Choose between two possibilities: **Ask for header on start** or **Ask for header at end**, or both.

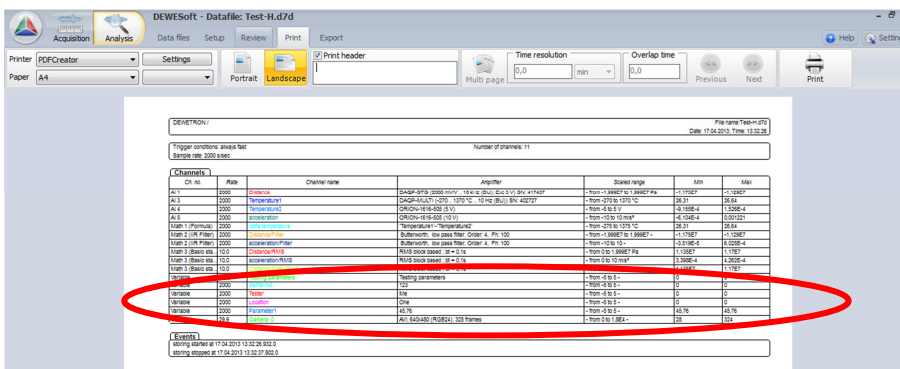


The global header information is already displayed before the file is loaded (in ANALYSIS → Data files).

For serial measurements it might be an advantage to store in multi-files and define the measurement parameters and the test attributes in the header.



Also in ANALYSIS mode → Setup you can enter the header information.



The header information is also available in the channel list.

You can print the channel setup with header info.

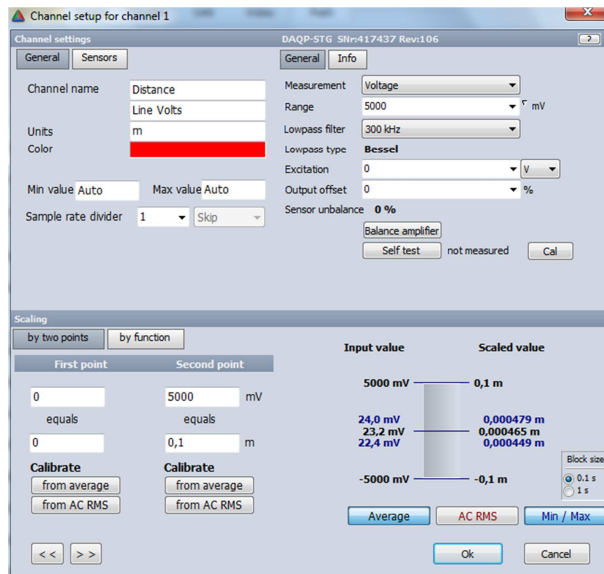


In ANALYSIS mode the header information is listed as channels in the group **variables/data header** and can be displayed in the digital instrument. In this form, they can be added to a report print.

This information is exported with the measurement data additionally.

	A	B	C	D	E
1	Data info				
2	File name D:\DEWESoft7\Data\Test-H.d7d				
3	Start time ##### 13:32:26				
4	Number o 11				
5	Sample ra 2000				
6	Store type always fast				
7	Testing pa Testing parameters				
8	Serial-No. 123				
9	Tester Me				
10	Location One				
11	Paramete 45.76				
12					

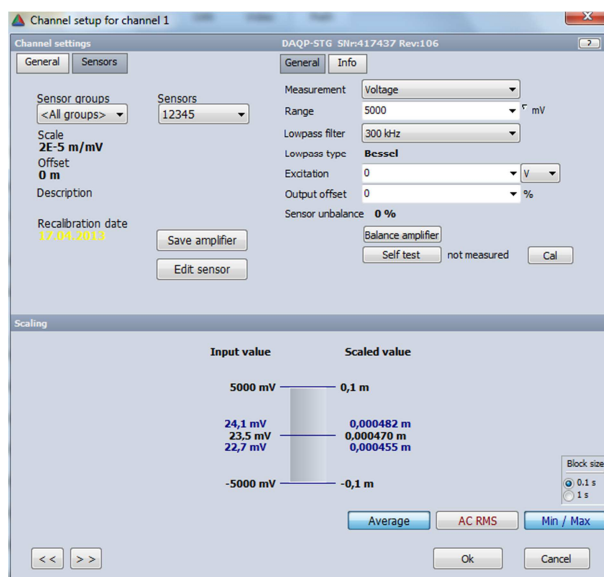
1.4.14 Scaling with data from the sensor database, non-linear scaling



As described before (chapter 1.4), a sensor can be scaled to the physical value via 2-point-scaling or with the function $y=k*x+d$.

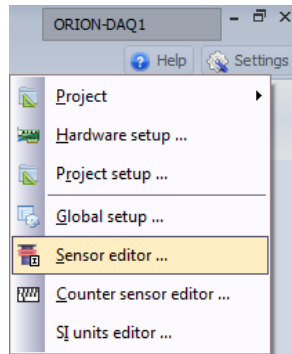
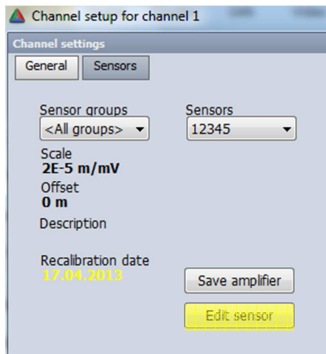
If a non-linear scaling is required – which is only described with support points or polynomial – the sensor has to be set in the sensor database.

Also if a 2-point-scaling is enough, the sensor can be selected in the database. Since all data is stored in the sensor database, you do not have to search for the scaling values.



In the channel setup, in **sensors**, you can add all the sensor of the sensor database for the scaling.

For a better overview of the sensors in the database, they are divided into groups. A sensor is selected by its serial number. In channel setup, the scaling is taken from the database automatically.



The **Sensor Editor** adds or changes sensors.

You find it in the **Settings** menu

#	Group	Sensor type	Serial number	Scale type	Transfer curve	Recal. date
1	Current	Transfer		Linear	No	31.12.2010
2	Current	R10777		Linear	No	31.12.2008
3	Current	R10778		Linear	No	31.12.2008
4	Current	R10779		Linear	No	31.12.2008
5	Current	R10780		Linear	No	31.12.2008
6	Current	R10781		Linear	No	31.12.2008
7	Current	R10782		Linear	No	31.12.2008
8	Current	R10783		Linear	No	31.12.2008
9	Current	R10784		Linear	No	31.12.2008
10	Current	Dummy1		Polynom	No	03.12.2012
11	Current	Dummy2		Table	Yes	04.12.2012
12	Current	Dummy3		Table	No	05.12.2012
13	Others	R10785		Linear	No	31.12.2008
14	Others	R10786		Linear	No	31.12.2008
15	Voltage	R9803		Linear	No	31.12.2008
16	Voltage	R9704		Linear	No	31.12.2008
17	Voltage	R10787		Linear	No	31.12.2008
18	Voltage	my distance sensor	12345	Linear	No	17.04.2013

In the sensor editor all sensors which are available in the database are listed.

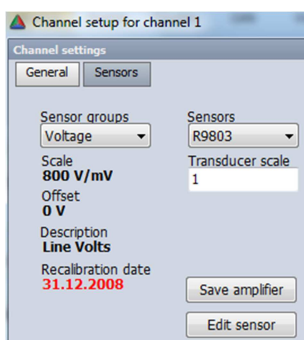
Each sensor belongs to a **group** that describes its physical attributes.

Add type or attributes of the sensors optionally in the **sensor type**. This is helpful to differ between similar sensors. The **serial number** identifies the sensor and is used in the channel setup to select the sensor.

For **scale type**, three settings are possible: linear, polynom or table.

The **transfer curve** is optional (amplitude or phase).

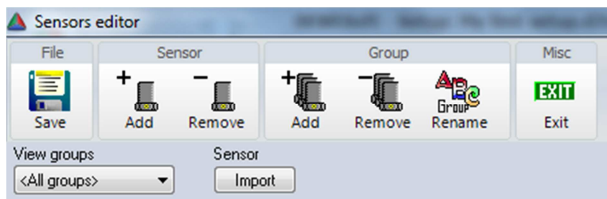
If such a sensor is selected, the frequency spectrum in the FFT is corrected with this transfer curve. So the sensor can be used for a wider frequency range. Especially for power applications the correction of amplitude and phase is significant, because higher frequency components (amplitude and particularly phase) are important for the calculation.



Finally, you can set a **recalibration date**. If the date has passed, you get informed in the channel setup. The chosen sensor and the serial number are stored in the data file.

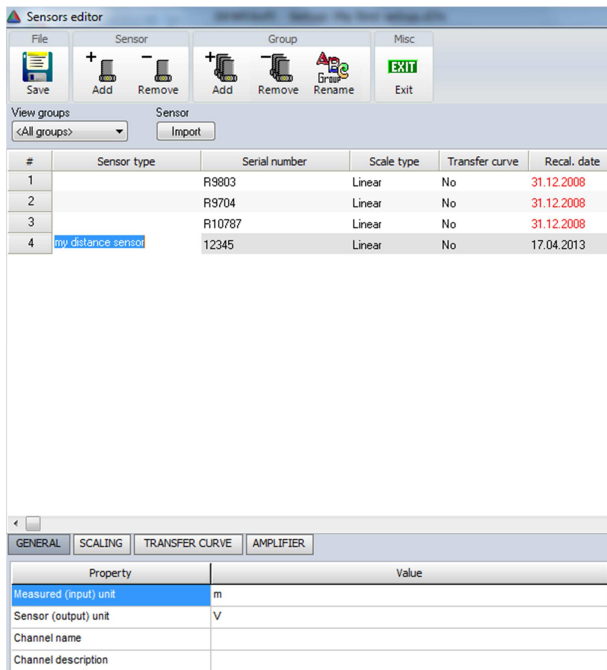
1	Used	Distance	DAQP-STG	SN: 417437	Line Volts	0,000 m	Zero	Auto	Set ch. 1
			my distance sensor (Voltage)	CAL SN:12345	-0,1	0,1			

General file information							
Sample rate 2000 s/sec		Store date and time 17.04.2013 14:23:55		Number of channels 11			
Reduced rate 1 sec		Duration 00:00:02		Trigger conditions always fast			
Channel information							
Ch. no	Name	Rate	Settings	Offset	Range	Min	Max
AI 1	Distance ; Line Volts	2000	12345; DAOP-STG (5000 mV .. 300 kHz (BE); Exc 0 V) SN: 417437	0	-0.1 .. 0.1 m	4.456E-4	4.761E-4



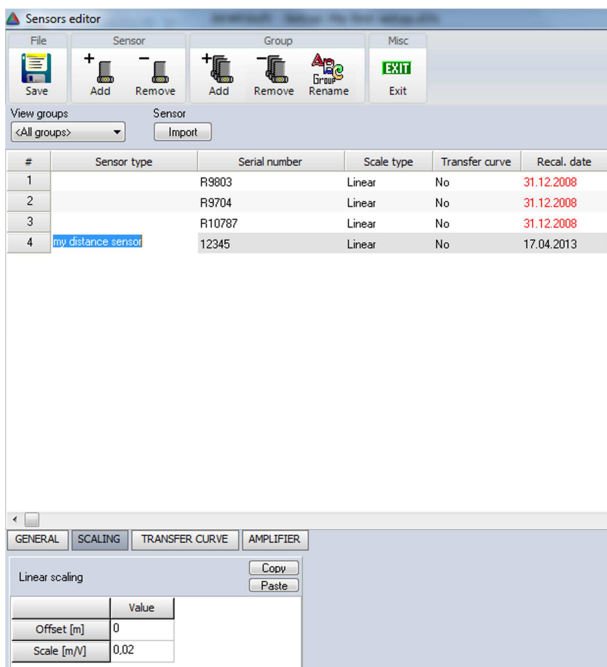
Add, delete or edit new sensors or groups in the menu.

The shown list of sensors can be narrowed down by using the group filter *view groups*.



Select a sensor to define its properties.

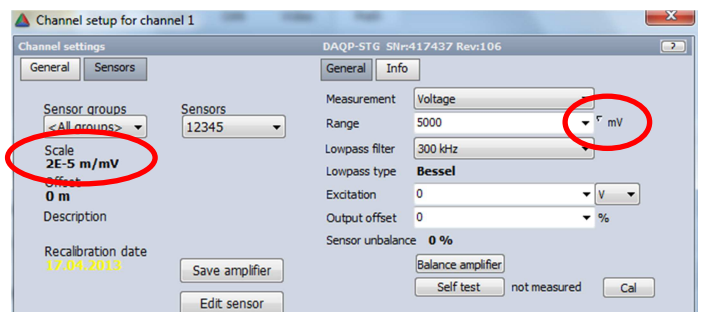
Define the physical input and the electrical output in the *general* menu. Channel name and description can be set optionally.



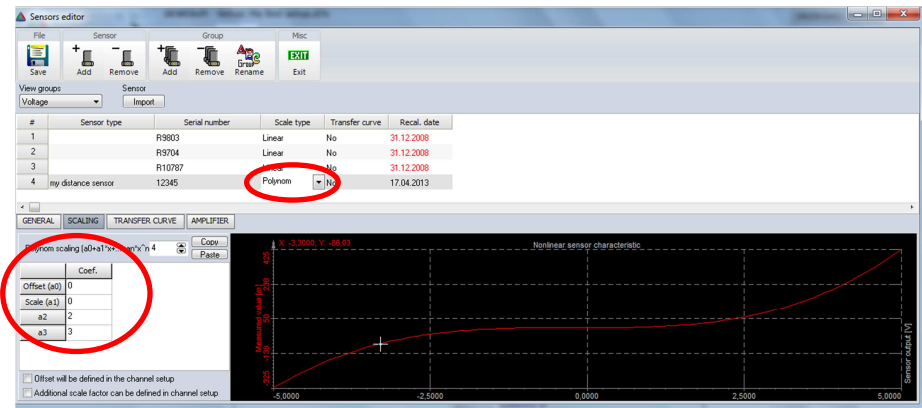
Define the *scaling* of the sensor, depending on the type.

For linear scaling $y=k*x+d$, set the scaling factor k [cm/V] and the offset of the physical size [cm]. The conversion from [mV] to [V] is considered in the channel setup.

E.g. if the scaling of the database input is set in [cm/V] and the module input range is set in [mV], the software takes care about this conversion.



Currently just the scaling [cm/V], but not the sensitivity [V/cm], can be set. If you just have the sensitivity value, use the following formula to convert: **Scaling = 1 / Sensitivity**

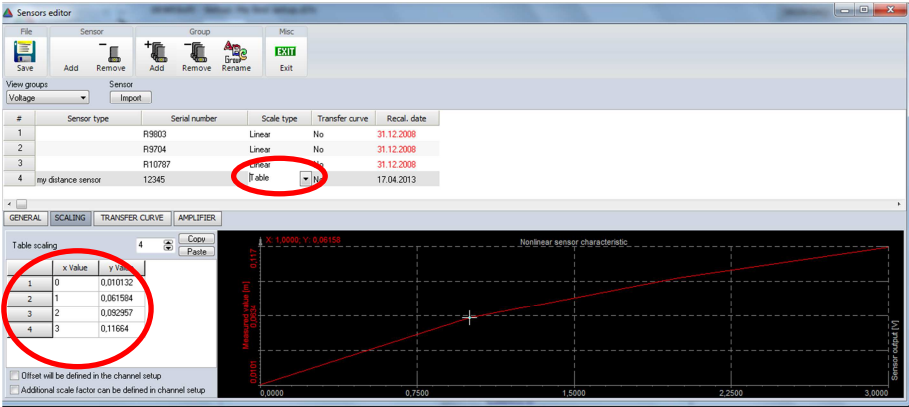


If you change the scaling from *linear* to *polynom*, the polynom object can be modified by setting its parameters. For verification, the result is previewed in the diagram to the right.

If the polynom-coefficients are in another program, you can import or export them with *copy* and *paste*.

	A	B	C
1	Polynom		Polynom
2		0	0,56
3		0	0,56
4		2	5,16
5		3	7,46

For importing data, it has to be converted into the shown format first.



If you select *table* scaling, the table object can be modified in the scaling properties.

After entering the supporting points, the result is again shown in the right diagram.

If the X-Y-values are in another program, you can import or export them with *copy* and *paste*.

	A	B
1	x	y
2	0	0,010132
3	1	0,061584
4	2	0,092957
5	3	0,11664

For importing data, it has to be converted into the shown format first.

Some applications require another scaling, even after the sensor scaling.
Example: A current clamp measures the current of a current transformer. The transfer ratio must also be considered here, thus this option is necessary.
Also, the sensor offset can be changed inside channel setup, if this option is active. Since the offset is entered in the channel setup, it is not included in the database and will disappear.

Sensor scaling and offset are available in channel setup.

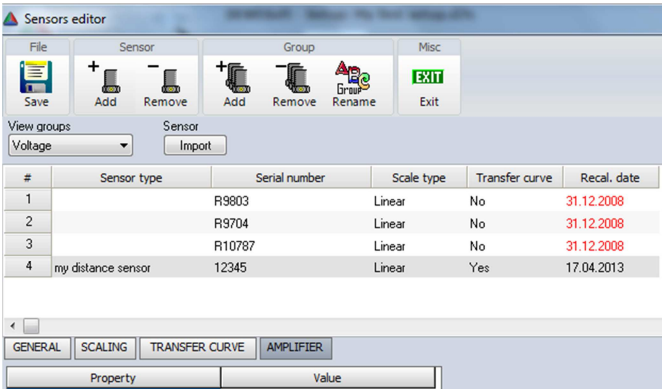
The transfer function, amplitude and phase of a sensor can be stored in a list.

Use **copy** and **paste** for import and export data.

	A	B	C
1	Freq	Re	Im
2	0	0,707946	0
3	10	0,906308	-0,422618
4	100	1,36224	-1,14306
5	1000	5,46E-17	-0,891251
6			

For importing data, it has to be converted into the shown format first (Freq, Re, Im).

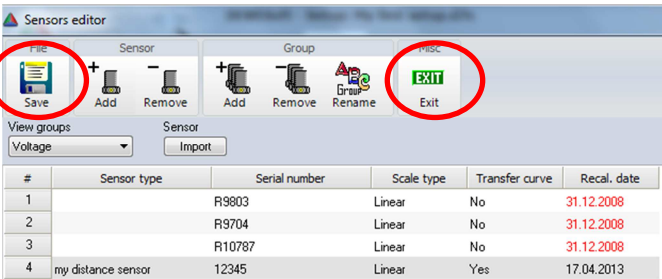
→Info : The amplitude and phase corrections are only considered in the FFT and in the power plugin.



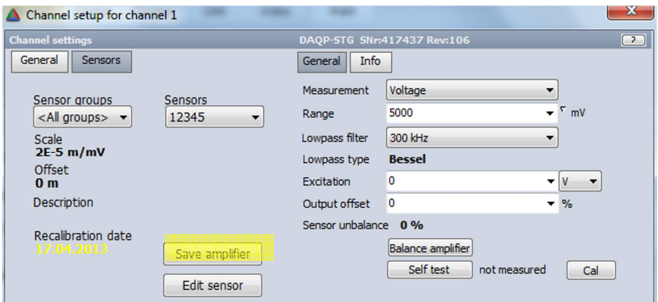
You can also save the amplifier settings in the sensor database.

They are stored in the amplifier properties of a certain sensors. They are empty for a newly installed sensor.

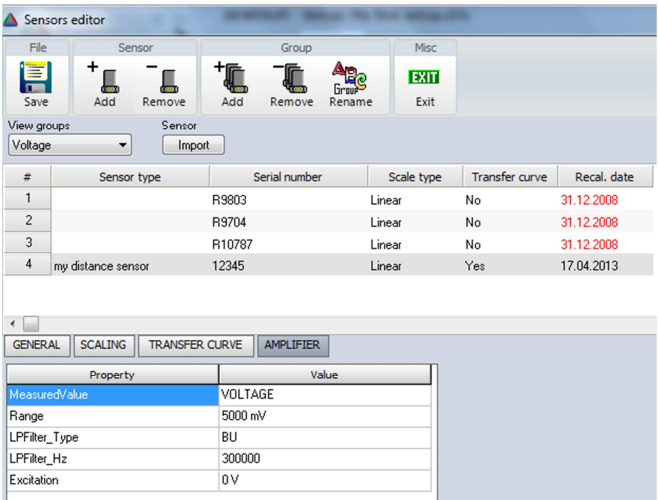
These settings can be done in the channel setup.



Save your sensor settings before exit.



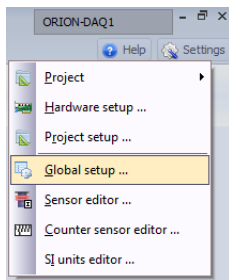
Choose a sensor from the database. After setting of the measurement amplifier, those values can be written in the sensor database for that selected sensor.



If the sensor is selected inside a new setup, the amplifier settings of the sensor are copied from the database to the settings of the amplifier in the channel setup.

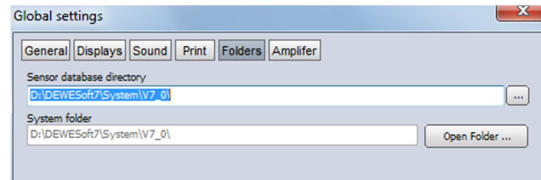
If another type of amplifier is present (inside a new setup), only the values belonging to the same property are copied to the new amplifier.

1.4.15 Sensor database, storage location, merging two databases



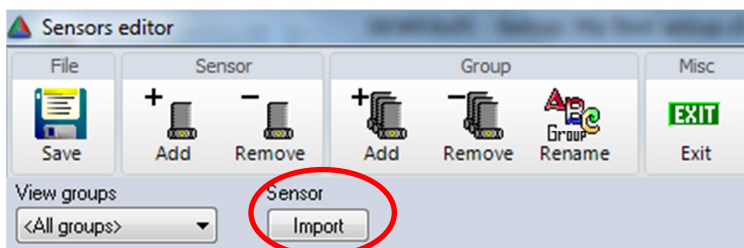
All information of the sensor database is stored in an XML file.

Sensors.xml is stored at \\Dewesoft7\System\\V7_0\\ by default. But you could change this path (Settings → General Setup → Sensors).



Due to the XML structure, the **Sensors.xml** can be generated from an existing corporate sensor database. Open the **Sensors.xml** file with an editor to see its structure.

```
<?xml version="1.0" encoding="UTF-8" ?>
<Sensor ID="12345">
  <PhUnitIn>m</PhUnitIn>
  <PhUnitOut>V</PhUnitOut>
  <Group>Voltage</Group>
  <SensorType>my distance sensor</SensorType>
  <Scale>0.0199999995529652</Scale>
  <RecalibDate>2013-04-17</RecalibDate>
  <Scaling>
    <CoeffNum>4</CoeffNum>
    <PolyCoef>4;0;0;2;3</PolyCoef>
    <TableX>4;0;1;2;3</TableX>
    <TableY>4;0.0101318359375;0.06158447265625;0.09295654296875;0.11663818359375</TableY>
  </Scaling>
  <TransferCurveUsed>True</TransferCurveUsed>
  <TransferCurve>
    <CurveF>4;0;10;100;1000</CurveF>
    <CurveAmpldB>4;3;0;5;-1</CurveAmpldB>
    <CurvePhase>4;0;-25;-40;-90</CurvePhase>
  </TransferCurve>
  <UseCustomOffset>True</UseCustomOffset>
  <UseCustomScale>True</UseCustomScale>
  <Amplifier>
    <MeasuredValue>VOLTAGE</MeasuredValue>
    <Range>5000 mV</Range>
    <LPFilter_Type>BU</LPFilter_Type>
    <LPFilter_Hz>300000</LPFilter_Hz>
    <Excitation>0 V</Excitation>
  </Amplifier>
</Sensor>
```

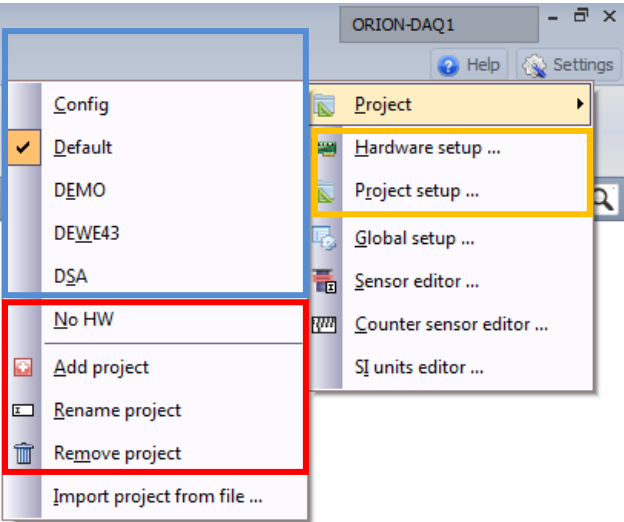


To merge sensor databases of different DEWETRON systems, copy all Sensors.xml file to a local temporary directory and import all the sensors into the local database by clicking Import.

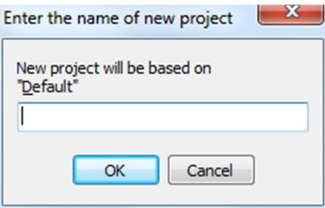
The newly created merged Sensors.xml file can then be distributed to all systems again.

1.4.16 Project setup

The software has a so-called project setup. Here you can do project-related settings like hardware setup (A/D board, mathematics, plugins ...) as well as define storage paths for data, setups and export. Also additional information (global header, internal variables ...) can be stored in a project setup. So it is very easy to quickly configure the measurement instrument according to your needs.



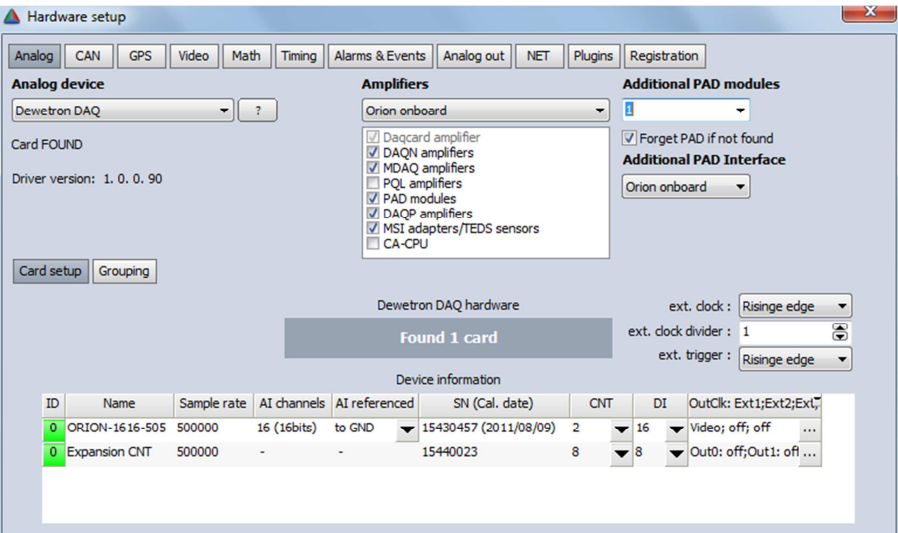
BLUE → Projects
RED → Project settings
YELLOW → General settings



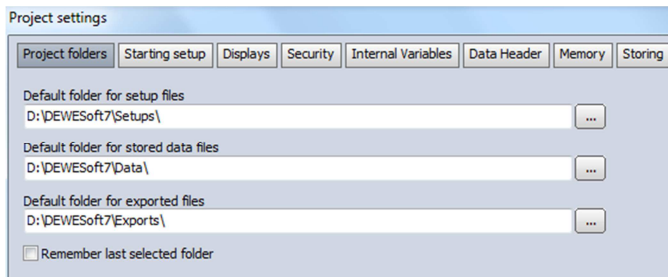
In the project settings (Settings → Project ...) you can add, rename or remove projects. At first, select the project you want to rename or delete.

Every new project is based on the currently selected project.

The projects store all configurations from the hardware and the project setups.

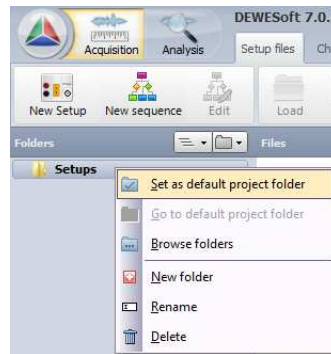
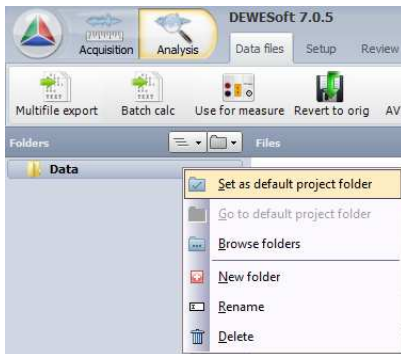


For the currently active project, hardware settings can be adapted to project-related needs. When projects are switched, all these settings are changed, too.



In the **project setup** → **project folders** you can define default folder for setup files, for stored data files and for exported files.

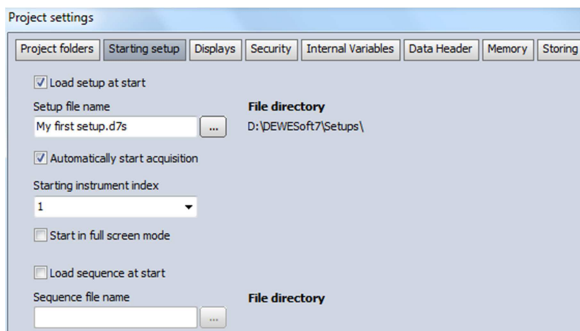
Select the option **remember last selected folder** to recall the last folder path.



To **Set as default project folder**, there are three possibilities:

- Project folder in Project settings
- Channel setup → storing → Right-mouse-click on folder
- Setup files → Right-mouse-click on folder

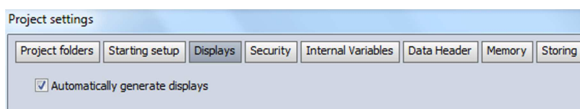
With the last two possibilities it is not necessary to open the project setup.



Load setup at start:

Define a setup that is loaded at the start of DEWESoft in Project settings → Starting setup. Optionally, a defined display (index 1 to n) in full screen can be used.

Hence users without DEWESoft knowledge can also do a measurement.

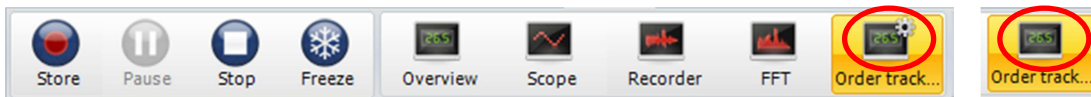


Displays:

Automatically generate displays creates additional measurement views like modal, order tracking, etc. where applicable.

Displays are only **generated automatically** when you use this software option during measuring.

In the picture below you see the order tracking screen that was automatically generated. You see this by the gear inside the icon.



If you assign other channels to this display and change back to the channel setup, then back again to measure mode, the former settings are overwritten with the automatic ones. To configure the display individually, design mode must be active once. Only then user settings remain present while changing between measure and channel setup modes. And then the gear disappears.

Project settings

Project folders Starting setup Displays Security Internal Variables Data Header Memory Storing

User access code

☐ Use for stop of measurement
☐ Use for changing the setup
☐ Use for changing the sequence
☐ Use for leaving full screen

Code for entering hardware and general setup

File locking (prevent modifying data in analysis)
With password
Password

Security:

Set security levels with password for:

- Measurement process (blue)
- Hardware and general setup (red)
- Data files (yellow)

Project settings

Project folders Starting setup Displays Security Internal Variables Data Header Memory Storing

Info Input Selection Up Down Delete

Data Header Entries

Testing parameters

Serial-No.

Tester

Location One

Parameter1 45.76

Properties

Data Type Float

Color Blue

Unit -

Unique ID VARIABLE4

Data Header Settings

☐ Ask for header on start ☐ Ask for header at end

Import from Setup file ...

OK Cancel

Data header:

Data header allows defining input fields, in which operators can enter additional not measured parameters at start or end of measurement.

Project settings

Project folders Starting setup Displays Security Internal Variables Data Header Memory Storing

Buffer size

Sync DB 2 seconds Video memory 64 Mb

Async DB 50 seconds

☒ Enable Freeze buffers

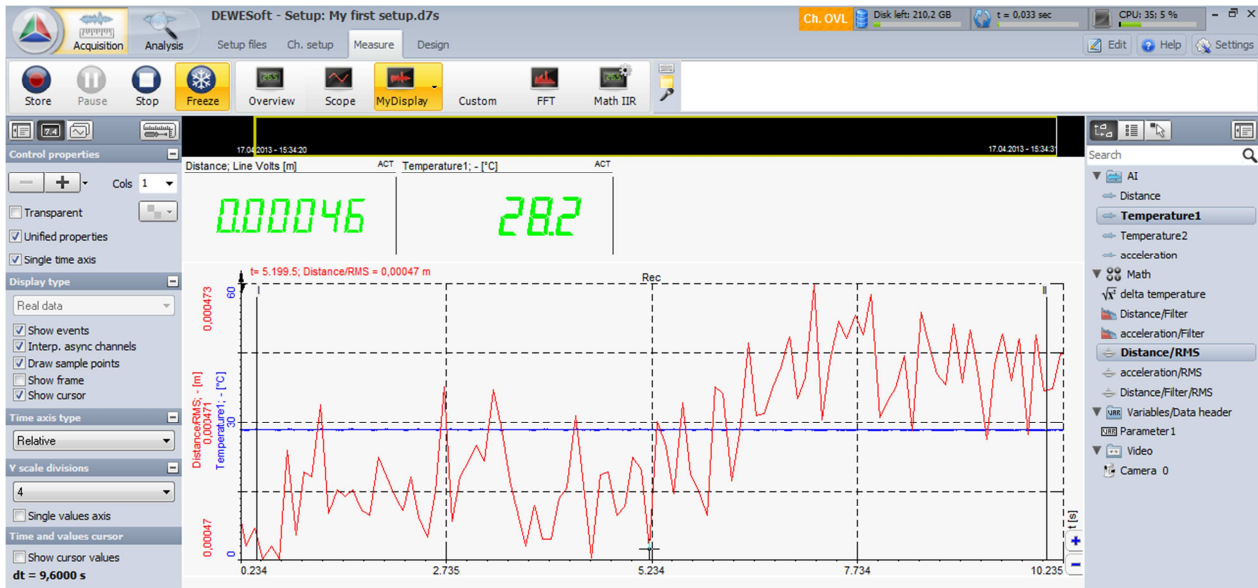
Memory:

Change system memory settings.

Normally you shouldn't change this, but in special cases it might be necessary. E.g. for very high or very low sampling rates or you need more memory for pretrigger.

For PRETRIGGER the SYNC DB must be increased.

If the **Freeze buffer** is enabled, you can freeze the last section of the recorder during the measurement. When it is frozen you can analyze it already during the measurement, which has no impact on measurement or storing.



When you press **Freeze**, you can analyze the last part of the signal as in analysis mode already during measurement.