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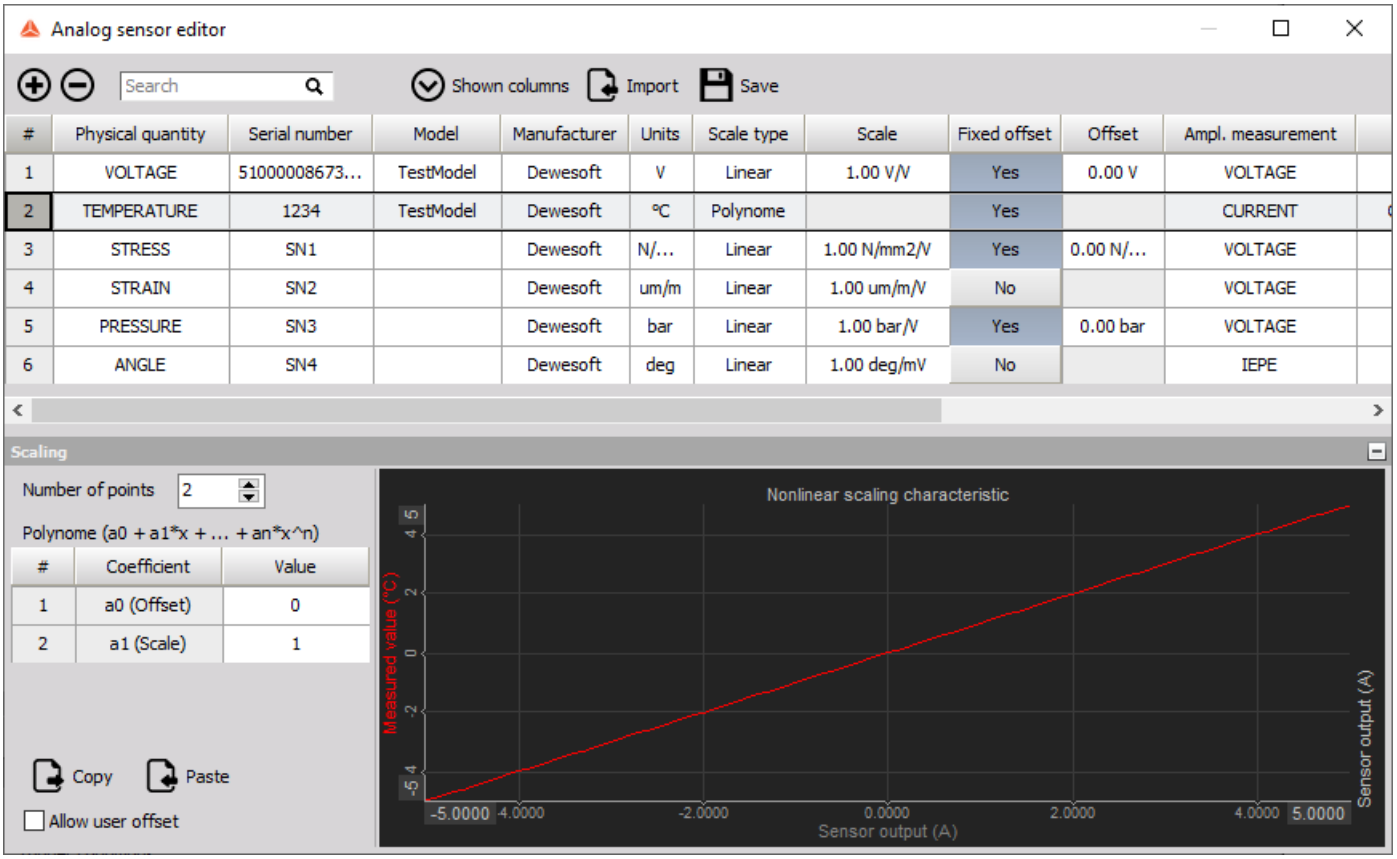
Analog and Digital Counter Sensors Editor



Analog Sensor editor

Dewesoft X offers a Analog sensor database that holds the list and the properties of all sensors which will be used. In addition to the linear scaling, which can also be done in the input channel setup, the sensor database also offers to scale by table or by a polynomial and even transfer curves can be defined.

To enter the sensor editor go to Options -> Editors -> Analog sensors

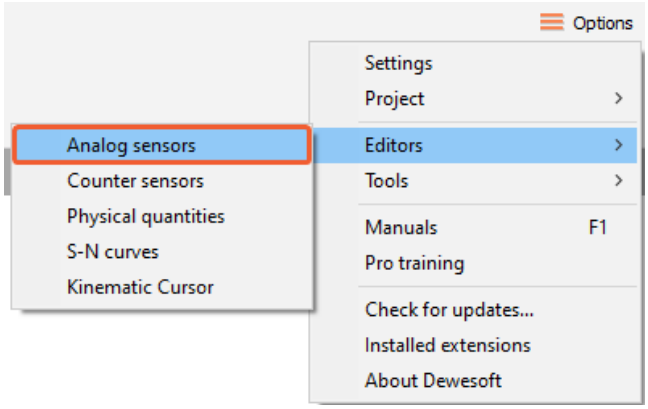


Image1: Path to analog sensor editor

The sensor database can be created and adapted according to your requirements (used measurement hardware). The sensor (database) editor offers several functions for creation, editing, and managing sensors:

- **Add sensor** (creates a new sensor in the sensor database)
- **Remove sensor** (removes the sensor from the sensor database)
- **Shown Columns** (show or hide different columns in sensor database)
- **Import** (import existing *.xml, *.dxb sensor databases or custom XML files *.e2x)
- **Save** (store the sensor database to file)

Image 2: Options in Analog sensor editor

Each sensor is defined with the information in the database:

- **Physical quantity**, **serial number**, **calibration date**, **calibration period**
- **General sensor information**
- **Scaling type** (linear, polynomial, table)
- **Transfer curve** (used for sensor correction)

Analog sensor editor

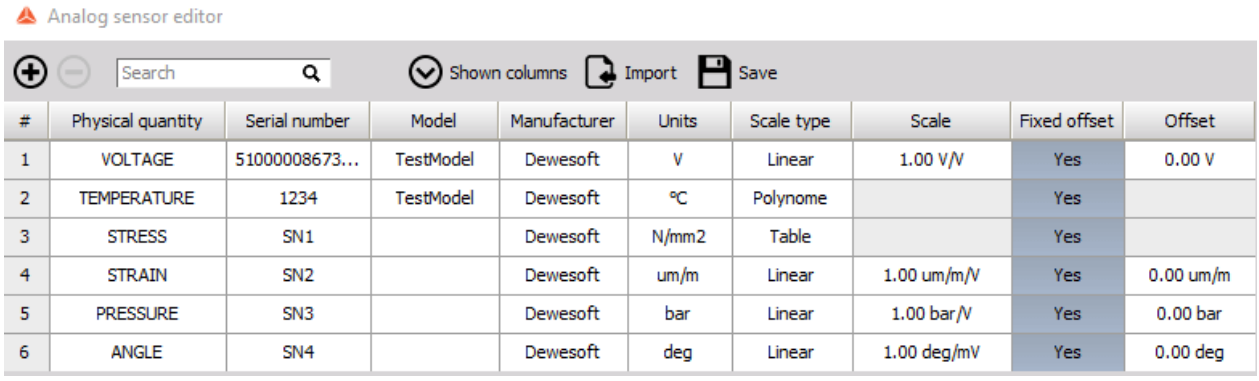
Search | Shown columns | Import | Save

#	Physical quantity	Serial number	Model	Manufacturer	Units	Scale type	Scale	Fixed offset	Offset
1	VOLTAGE	51000008673...	TestModel	Dewesoft	V	Linear	1.00 V/V	Yes	0.00 V
2	TEMPERATURE	1234	TestModel	Dewesoft	°C	Polynome		Yes	
3	STRESS	SN1		Dewesoft	N/mm2	Table		Yes	
4	STRAIN	SN2		Dewesoft	um/m	Linear	1.00 um/m/V	Yes	0.00 um/m
5	PRESSURE	SN3		Dewesoft	bar	Linear	1.00 bar/V	Yes	0.00 bar
6	ANGLE	SN4		Dewesoft	deg	Linear	1.00 deg/mV	Yes	0.00 deg

Image 3: Defined sensors in the Analog sensor editor

How to edit analog sensors?

After you enter the Sensor editor a list of all available sensors will open. Any already defined (and pre-defined) sensors and connected TEDS sensors will be listed automatically.



#	Physical quantity	Serial number	Model	Manufacturer	Units	Scale type	Scale	Fixed offset	Offset
1	VOLTAGE	51000008673...	TestModel	Dewesoft	V	Linear	1.00 V/V	Yes	0.00 V
2	TEMPERATURE	1234	TestModel	Dewesoft	°C	Polynome		Yes	
3	STRESS	SN1		Dewesoft	N/mm2	Table		Yes	
4	STRAIN	SN2		Dewesoft	um/m	Linear	1.00 um/m/V	Yes	0.00 um/m
5	PRESSURE	SN3		Dewesoft	bar	Linear	1.00 bar/V	Yes	0.00 bar
6	ANGLE	SN4		Dewesoft	deg	Linear	1.00 deg/mV	Yes	0.00 deg

Image 4: Defined sensors in Analog sensor editor

In the table of sensors, a lot of different properties are available. You can manage shown properties with the Shown columns option. Some of the available properties are defined in the following list:

- **Sensor type** - the sensor type should contain the name or type of the sensor but can contain any text desired
- **Serial number** - the serial number has to be unique! It is not allowed to use the same serial number because this information is used for sensor identification.
- **Scale type** - the sensors editor differs between linear, polynomial and table scaling
- **Transfer curve** - can be used for sensors with phase characteristics like current clamps, geophones, ...
- **Recalibration data** - enter the date when the sensor has to be recalibrated. When the date expires, the Recal. date will change to red color.

Editing sensor properties is simple, just click on the desired field of the table and you can start editing.

At the bottom of the sensor editor there is additional information about the scaling or transfer cure for the selected sensor:

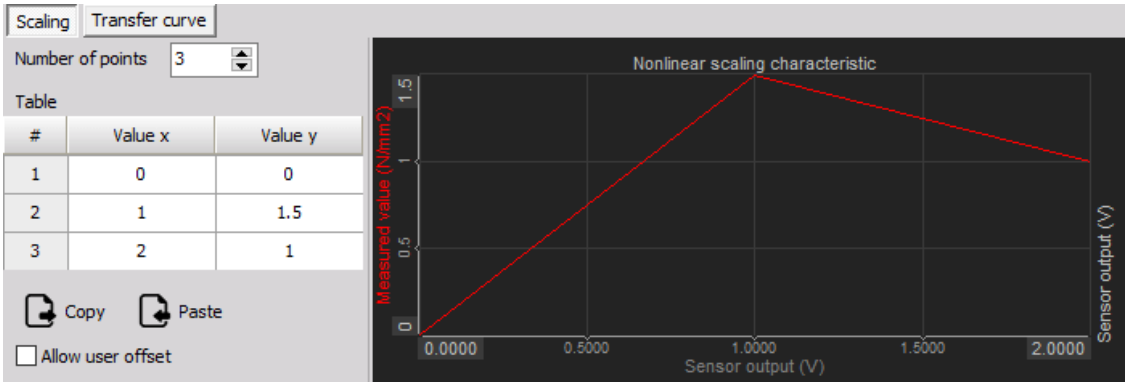


Image 5: Additional information about the selected sensor - scaling and transfer curve

- **Scaling** - contains the scaling information of the selected sensor
- **Transfer curve** - is only available if the transfer curve is enabled

General sensor information

The general information about the sensor:

- **Physical (input) unit** - the physical unit of the sensor, e.g.V, A, Â°C, mm, psi, %,...
- **Electrical (output) unit** - the electrical output unit of the sensor, most times V or A
- **Channel name** - use this field to pre-define the channel name for the setup
- **Channel description** - additional information about the sensor, helps to select the right sensor in the input setup

#	Physical quantity	Units	Ampl. measurement	Input type	Ch. description
1	VOLTAGE	V	VOLTAGE	SE	Channel description
2	TEMPERATURE	°C	CURRENT	CURRSHUNT	

Image 6: General sensor information

Sensor scaling options

Dewesoft X supports different scaling types within the sensor database. When we select the **Scaling** type field, the scaling type selection list appears in this field and the **Scaling** tab is selected automatically. After selecting desired scaling types from the selection list in the Scaling tab, scaling information appears automatically.

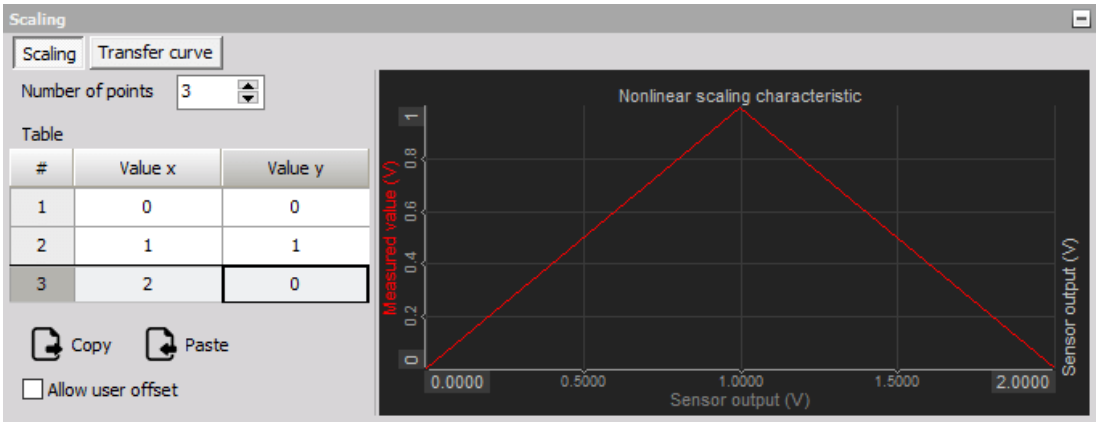


Image 7: Scaling options

Dewesoft X supports three different scaling types within the sensor database.

Linear

Linear scaling is used for linear sensors. It is calculated by the formula:

$$y=k*x+d$$

- **y** = physical value
- **k** = scale
- **x** = measured value
- **d** = offset

The Scale and Offset factors are defined manually in the columns:

#	Physical quantity	Units	Scale type	Scale	Fixed offset	Offset
1	TEMPERATURE	°C	Linear	1.00 °C/V	Yes	0.00 °C

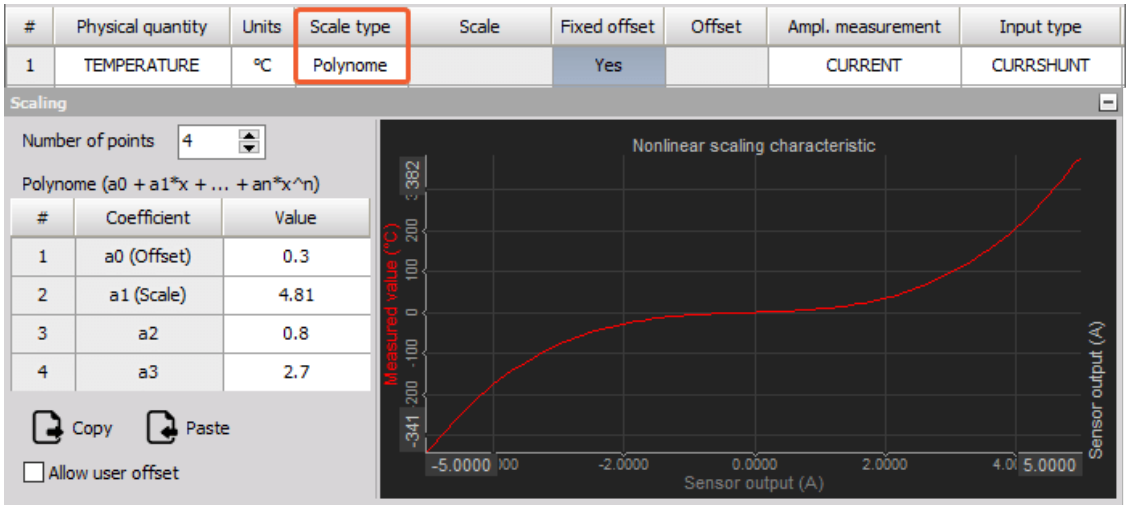
Image 8: Linear scale type

Polynomial

Polynomial scaling is used for nonlinear sensors, calculated by the equation:

$$y = (a0 + a1*x + a2*x2 + ... + an*xn)$$

Example: Polynom scaling **($a_0 + a_1*x + ... + a_n*x^n$)** enter the **n** number and the coefficients in the **Coef.** column (coefficient a_0 defines the offset).



#	Physical quantity	Units	Scale type	Scale	Fixed offset	Offset	Ampl. measurement	Input type
1	TEMPERATURE	°C	Polynome		Yes		CURRENT	CURRSHUNT

#	Coefficient	Value
1	a0 (Offset)	0.3
2	a1 (Scale)	4.81
3	a2	0.8
4	a3	2.7

Image 9: Polynome scale type

The Scaling values can also be copied from an external source, with the Copy/ Paste buttons.

Table

Table scaling is also used for nonlinear sensors, but it is normally easier to enter because most calibration information contains several calibration points.

Enter the number of points (rows of the table) and in the table below, enter the X and Y values.

#	Physical quantity	Units	Scale type	Scale	Fixed offset	Offset	Ampl. measurement	Input type
1	STRESS	N/mm2	Table		Yes		VOLTAGE	DIFF

#	Value x	Value y
1	0	0
2	1	1.5
3	2	1

Image 10: Table scale type

The Scaling values can also be copied from an external source, with the Copy/ Paste buttons.

NOTE: As these three scaling types can't compensate phase errors, they are used for time-domain or angle based

acquisitions. For frequency domain applications a **transfer curve** will deliver more accurate results.

Transfer curve settings

The **transfer curve** calibration can be used when the frequency behavior of the sensor is known:

- transfer curves for most common sensors are already measured,
- copy it from the calibration sheet of the sensor (if the calibration sheet includes the transfer curve),
- the third option is to measure it with Dewesoft X FRF modal test, but this requires some additional equipment.

Some companies offer calibration reports for sensors also in the frequency domain, for example for current clamps. The transfer curve compensates amplitude and phase, both in relation to the signal frequency. In the table under the **Transfer curve** column, we need to enter the points of the curve.

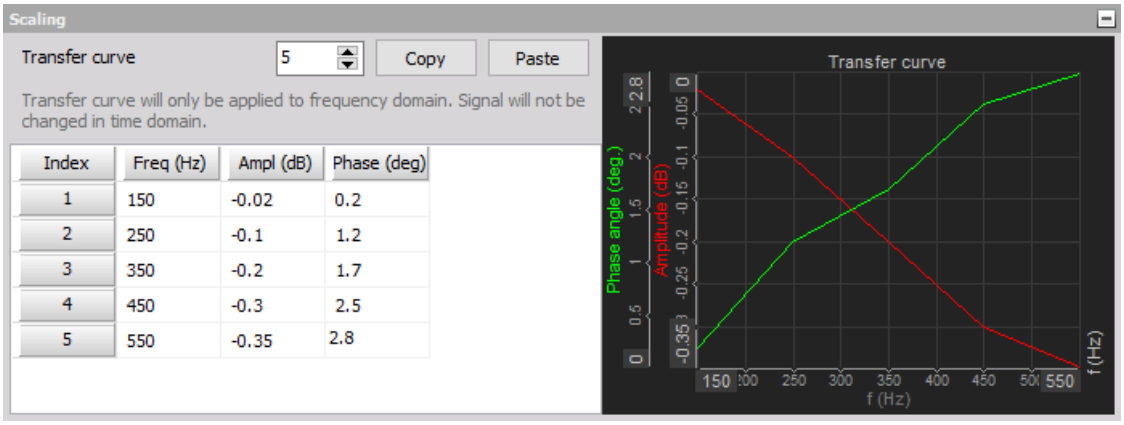


Image 11: Transfer curve

We can enter the sensors transfer curve in two ways:

- Manually enter the number of points (rows of the table) and in the numbers below the columns **Freq[Hz]** (signal frequency), **Ampl[dB]** (amplitude deviation), and **Phase[deg]** (phase angle).

Index	Freq (Hz)	Ampl (dB)	Phase (deg)
1	150	-0.02	0.2
2	250	-0.1	1.2
3	350	-0.2	1.7
4	450	-0.3	2.5
5	550	-0.35	2.8

Image 12: Transfer curve options

- Using the Windows **copy and paste** the values from a table created in the external program (e.g. Excel, ...). You can choose between two options: **Copy Re/ Im to clipboard** and **Copy Ampl/ Phase to clipboard.**

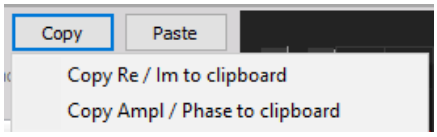


Image 13: Copy/ Paste option

When you copy the data from external programs such as Excel, the column names must be the same as in Dewesoft.

	A	B	C
1	**Freq (Hz)**	**Ampl (dB)**	**Phase (deg)**
2	100	-0.02	0.2
3	200	-0.1	2.6
4	300	1	2.3
5	400	2	1
6	500	-0.35	0

Index	Freq (Hz)	Ampl (dB)	Phase (deg)
1	100	-0.02	0.2
2	200	-0.1	2.6
3	300	1	2.3
4	400	2	1
5	500	-0.35	0

Image 14: Example of copying data from Excel to Dewesoft

NOTE: Please keep in mind that the transfer curve is only helpful in frequency domain application (FFT, harmonics, octave analysis, ...). You will not see the effect of sensors transfer curve in the time domain data - for that it is best to use a filter with similar characteristics like the transfer curve.

Save the sensors with the **Save** button and close the sensor editor with the **Exit (X)** button.

How to manage sensors?

Add sensor

If you want to add new sensors, press the **plus** button and new row - the sensor is added to the table.

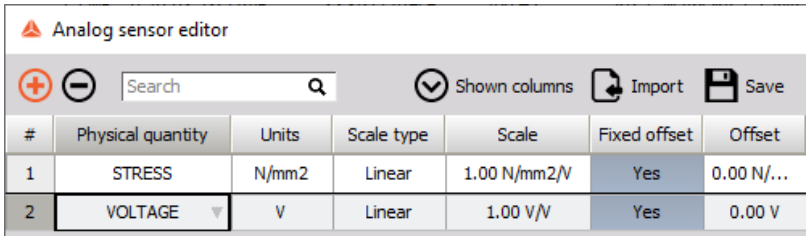


Image 15: Add sensor

Remove sensor

To remove a sensor just click on it - the whole line in the table will receive a grey background - and press the **minus** button.

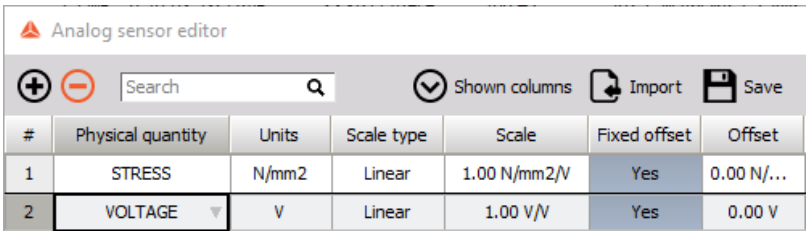


Image 16: Remove the sensor

Warning: Removing a sensor will remove a sensor without a warning. It is not possible to restore deleted sensors.

Import sensor database

You can also import the existing sensor database from the supported formats, standard **XML files (*.dxb, *.xml)** and **Custom XML files (*.e2x)**.

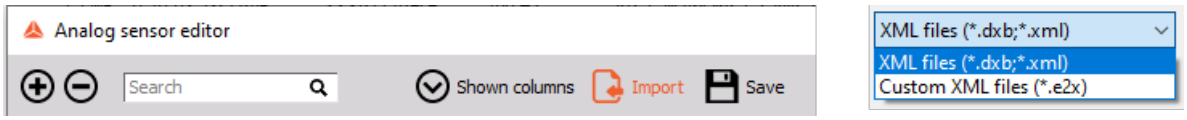


Image 17: Import existing sensor database

Save file

To save all changes in the sensors database just click on the Save file icon.

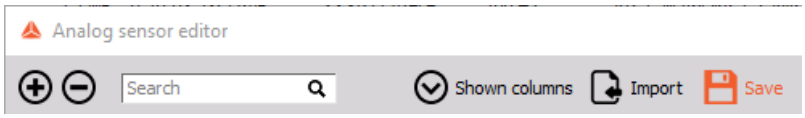


Image 18: Save sensor database

The data will be stored immediately in an XML styled file called **AnalogSensors.dxb** (the file AnalogSensors.dxb can be found in the Dewesoft X installation folder).

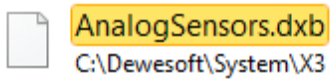


Image 19: Path to AnalogSensor.dxb file

Warning: Do not change anything directly in the XML file, this may cause errors and unusable files!

Exit sensor database editor

To exit the sensors database editor simply press the **X button**. If you have not already stored changes, you will be asked if you want to store changes or leave without changes.

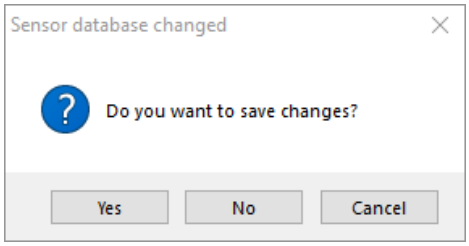


Image 20: Save settings before exiting the sensor editor

Warning: If you leave the sensor editor without storing changes, data will be lost!

Counter sensor editor

Dewesoft X offers a **counter sensor** database that holds the list and the properties of the counter sensors which can be used in order tracking, combustion analysis, and angle sensor math. We can define encoders, geartooth, and other angle sensors.

The Counter sensor editor can be accessed under Options -> Editors -> Counter sensors .

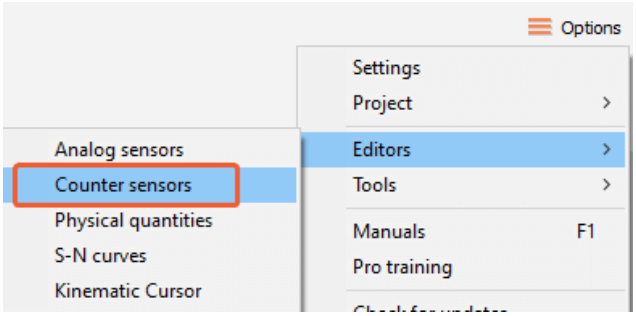


Image 21: Path to Counter sensors editor

When we enter the editor, the following window appears where we define the counter sensors:

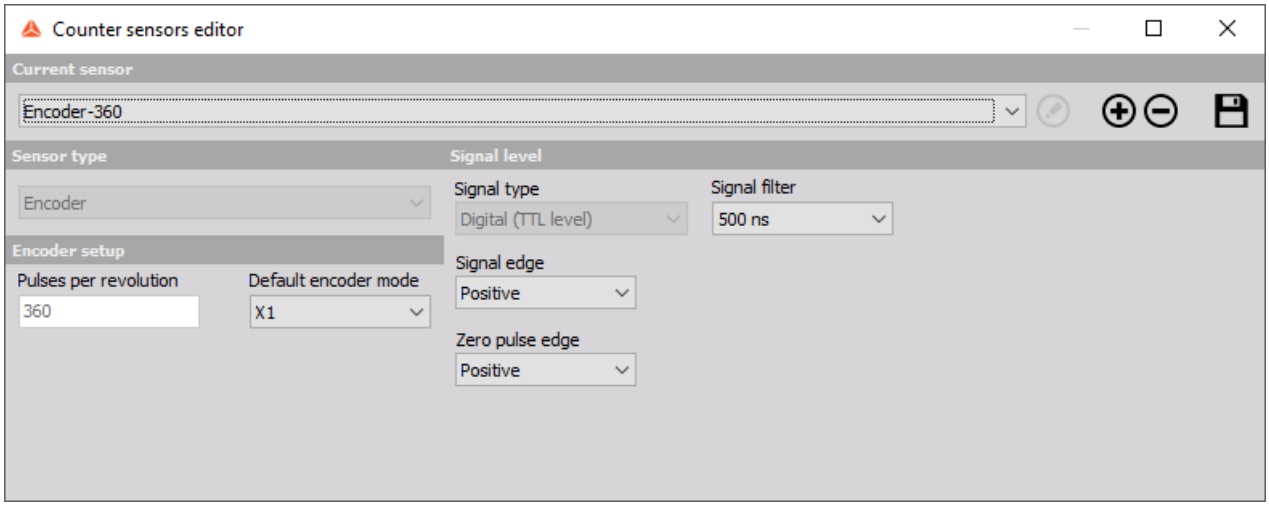


Image 22: Counter sensors editor

Several predefined sensors are already in the editor list; these sensors are installed with Dewesoft X. We can always add new ones, modify existing ones, or delete the sensors. On the upper right side of the Counter sensor editor, the window common command icons appear:

Rename sensor - rename the newly created sensors.

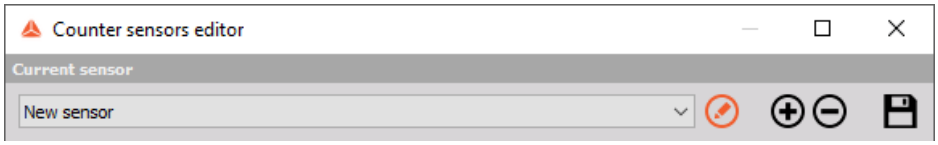


Image 23: Rename sensor

Add sensor - button will add a new sensor. The sensor will be named 'New sensor', but we can rename it.

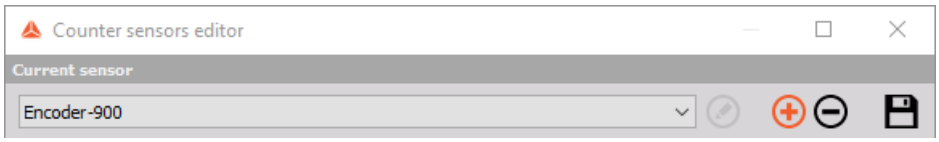


Image 24: Add sensor

Remove sensor - button will remove the currently selected sensor.

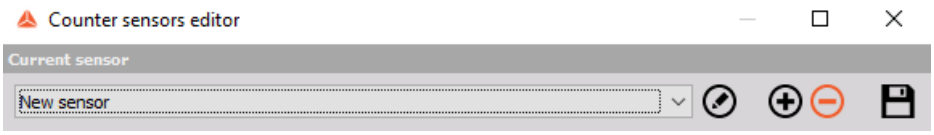


Image 25: Remove the sensor

Save and exit - button will save the counter sensor database and close the editor.

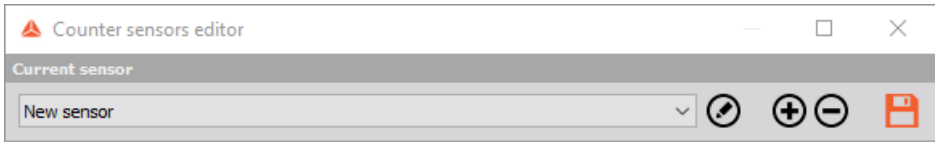


Image 26: Save and exit editor

Exit (X) - button will leave the editor without saving the data, so please be sure to use Save & Exit if you make any changes to the sensors or confirm you want to save the changes when you exit the editor.

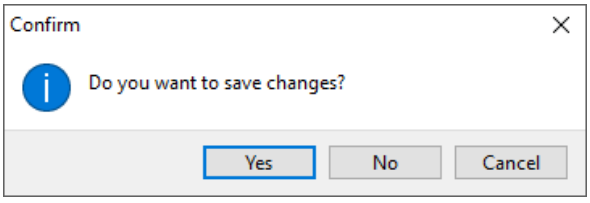


Image 27: Saving database when leaving

In the counter sensor editor window we can choose any sensor from the current sensor drop-down list for viewing and editing.

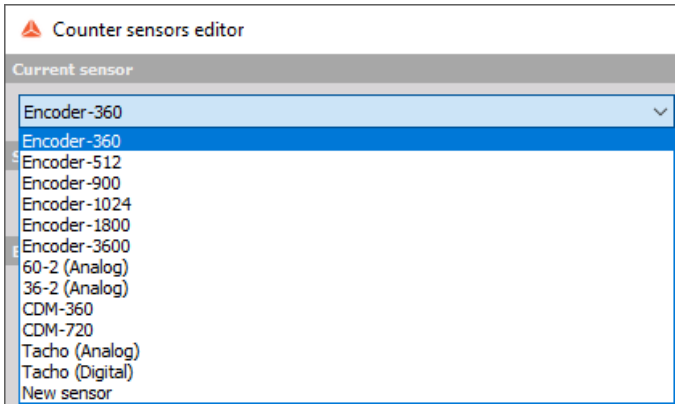


Image 28: Counter sensor drop-down list

Settings and entered values for Counter sensor are divided into the following sections:

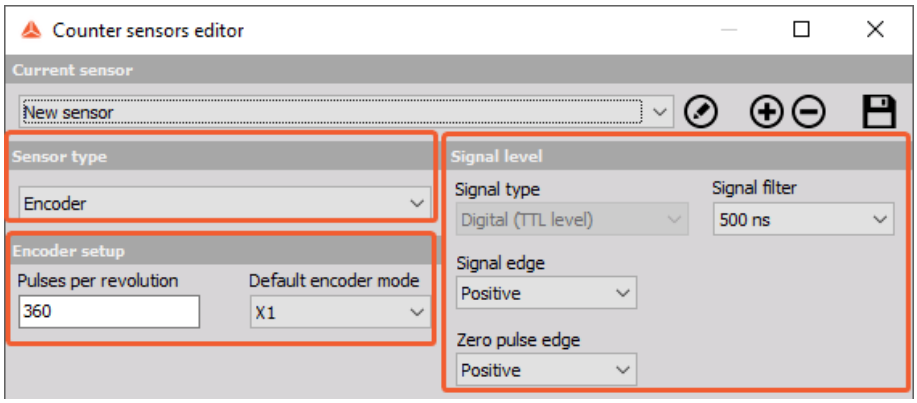


Image 29: Counter sensor settings

- **Sensor type**
- **Signal level**
- **Encoder setup** or **Geartooth setup** (depend on selected sensor type)

Counter sensor type

There are several basic sensor types available which can be selected from the **Sensor type** drop-down list :

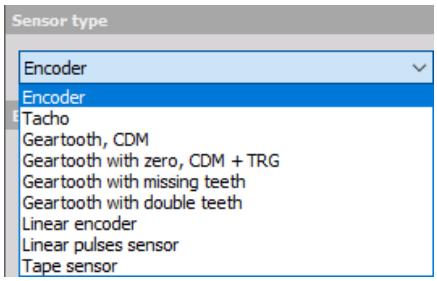


Image 30: Counter sensor types

- **Encoder** - classic angle encoder with A, B, and Z signals. The signal can be only digital.
- **Tacho** - sensor with one pulse per revolution. The signal can be either analog or digital.
- **Geartooth, CDM** - sensor with a defined number of pulses per revolution, but without any zero pulses.
- **Geartooth with zero, CDM + TRG** - sensor with a defined number of pulses per revolution with zero pulses.
- **Geartooth with missing teeth** - a classic in-vehicle sensor with any number of pulses where one tooth is missing for zero pulse recognition. A typical example is a 36+1 sensor.
- **Geartooth with double teeth** - an in-vehicle sensor with any number of pulses per revolution with some double teeth missing. A typical example is the geartooth with 60 teeth where two of them are missing, so in fact there are 58 teeth and there is a gap for two teeth.
- **Linear encoder** - sensor measuring displacement with any number of pulses per millimeter and pulses per revolution.
- **Linear pulses sensor** - a linear sensor, measuring displacement with any number of pulses per millimeter.
- **Tape sensor** - an angle sensor with white tape and black stripes attached to the rotating disc.

Counter signal level

There are several signal level settings.

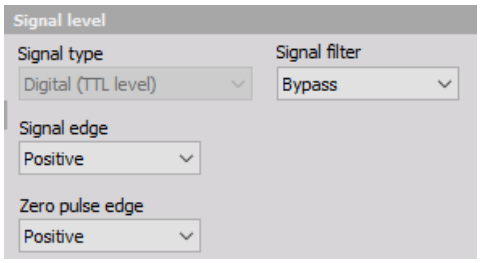


Image 31: Signal level settings

Signal type

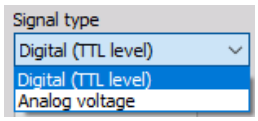


Image 32: Signal type

Encoder and geartooth signal type can be only defined as **digital (TTL level)** and therefore used with counters while all other sensors can be also **analog**, which means that we need to define the trigger level.

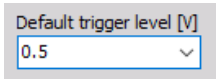


Image 33: Default trigger level

Signal filter

A signal filter is a debounce filter, used to prevent glitches in the signal. A signal must be present for the defined amount of time before the logic accepts it as a valid signal. This also inserts a delay for the signals!

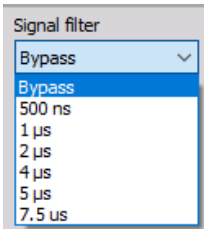


Image 34: Signal filter

Signal edge

Signal edge can be either positive or negative.

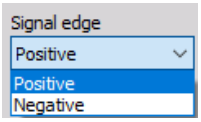


Image 35: Signal edge

Zero pulse edge

When Encoder or geertooth with zero, CDM +TRIG is chosen additional Zero pulse setting is enabled.

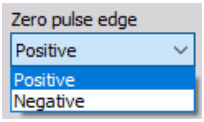


Image 36: Zero pulse edge

Adjust encoder setup

When selecting the **Encoder** sensor type the Encoder setup will appear:

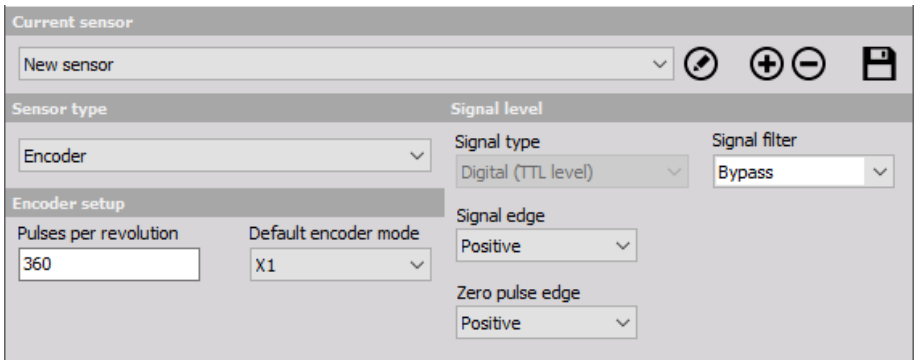


Image 37: Whole encoder setting

To prepare the encoder for the measurement, we have to define:

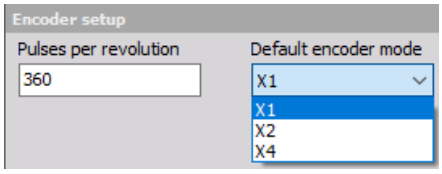


Image 38: Encoder setup

- **Number of pulses per revolution** - Standard values are multiples of 2 (256, 512,1024). These sensors are mainly used for external clocking so that we can have the frequency spectrum as a direct multiple of the number of revolutions to easily see the harmonic components. Other standard values are related to degrees (360, 720, 1800, 3600) where the reason is a nice angle resolution.
- **Default encoder modes** - Exact description of encoder modes can be found in the Counters PRO training course.

Adjust geartooth sensor setup

Geartooth sensor settings

For these sensors, we need to define the number of pulses per revolution **#Teeth**

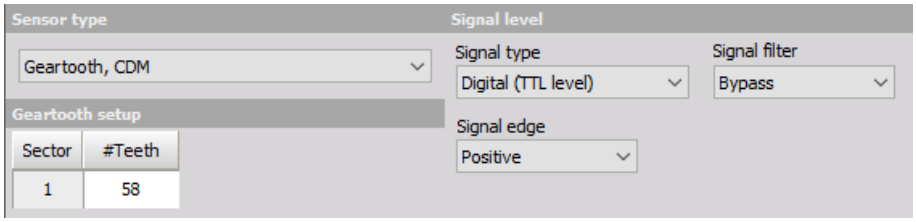


Image 39: Geartooth, CDM sensor settings

Geartooth with zero sensor settings

For these sensors, we need to define the number of pulses per revolution **#Teeth** and the direction of the **zero pulse edge** (Positive/ Negative).

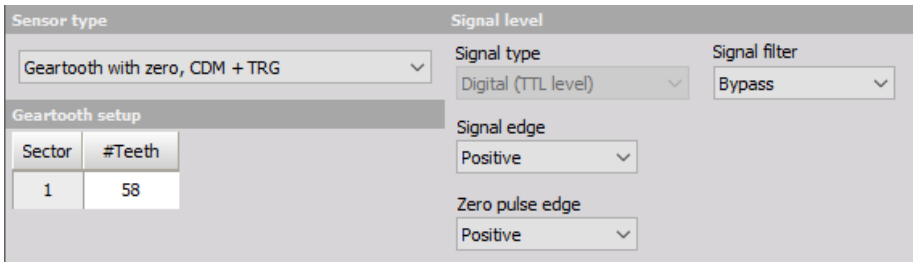


Image 40: Geartooth with zero sensor settings

Geartooth with missing teeth sensor settings

We also define the number of teeth **#Teeth** and the gap lengths **#Gap** for custom sectors of the sensor. We add a new sector by clicking on the plus button. There is also an additional **Angle[Â°]** column where the sector degrees are presented. For the number of teeth, we need to enter the number of teeth that exist. The example in the picture below shows the settings for the **60-2 sensor**. If the gap would not be there, there would be 60 teeth, but two of them are missing to create a gap, so there are only 58 teeth existing.

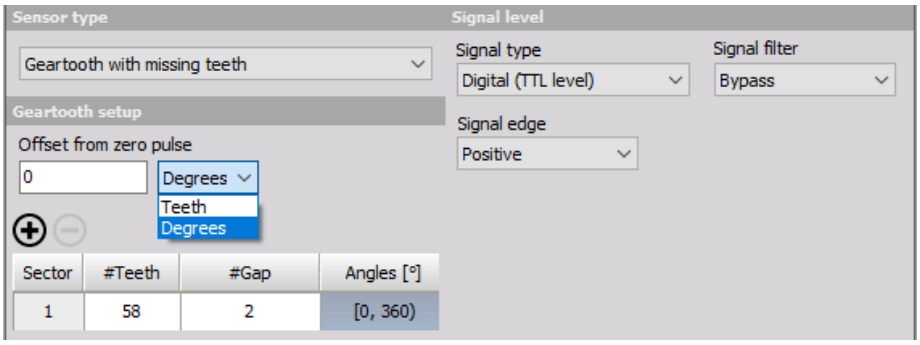


Image 41: Geartooth with missing teeth sensor settings 60-2

If we would like to enter the **60-2-2 sensor**, we need to enter 28-2-28-2, so the whole sum of the numbers must always be the total number of teeth.

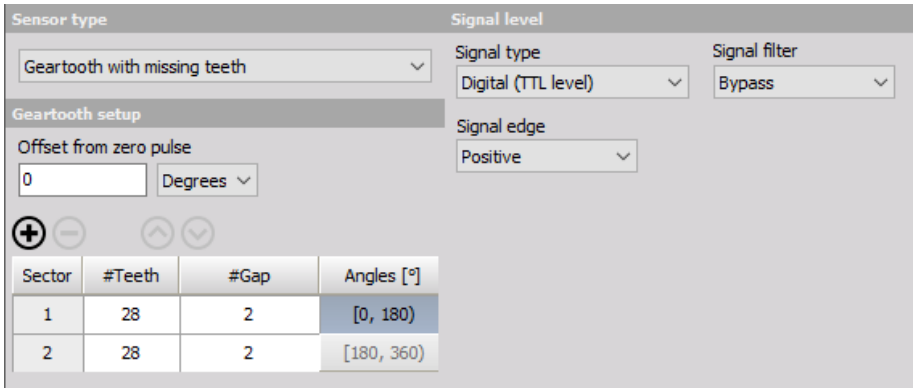


Image 42: Geartooth with missing teeth sensor settings 60-2-2

Geartooth with double teeth sensor settings

For these sensors, we define the number of teeth **#Teeth** and the number of double teeth **#Double teeth**. The example below shows the settings for **36+1 sensor**, a geartooth with 36 teeth, and one double tooth.

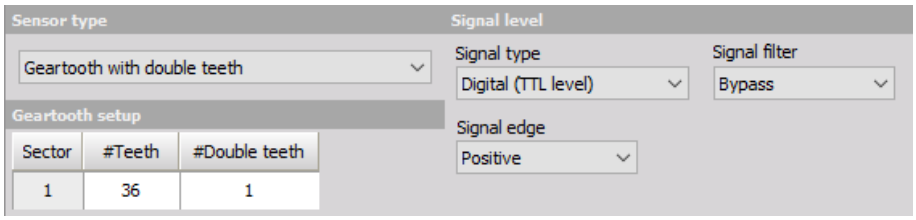


Image 43: Geartooth with double teeth sensor settings