Getting Tuned In to DewesoftX Math

DEWESoft®

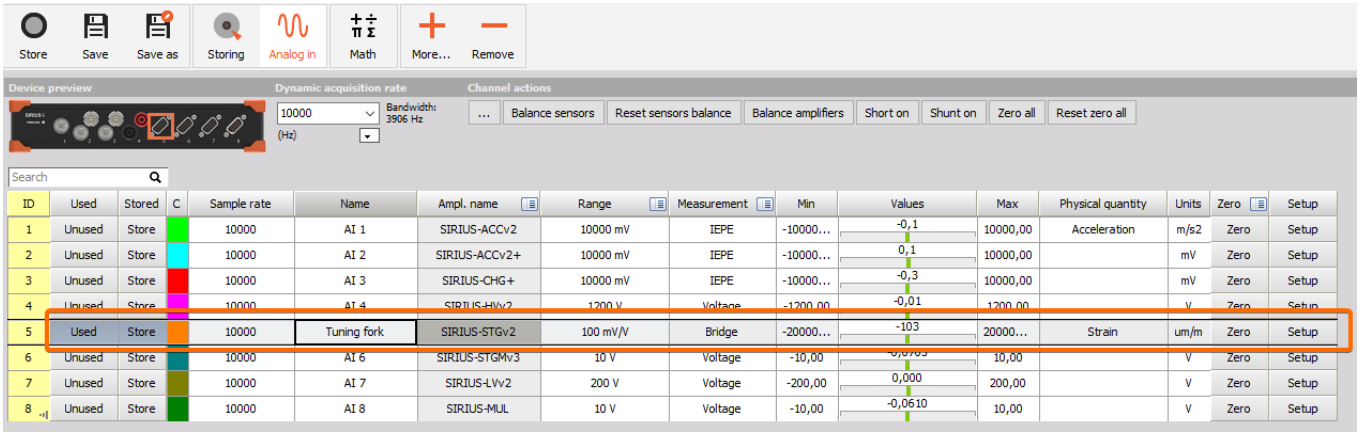
How-to guide

DewesoftX Math V21-1

1. Table of contents

2. Sensor and channel setup

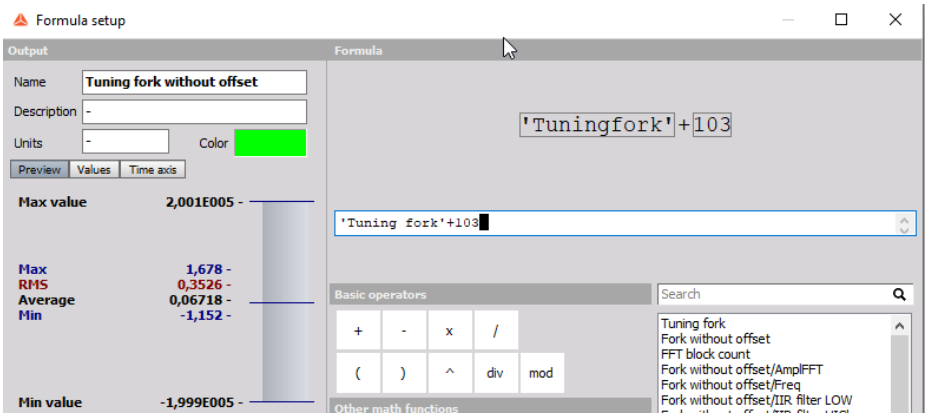
We suggest using DewesoftX ® and a SIRIUS device with a bridge amplifier (or a DEWE-43 / MINITAUR with bridge completion adapter). A tuning fork is connected to channel 5.

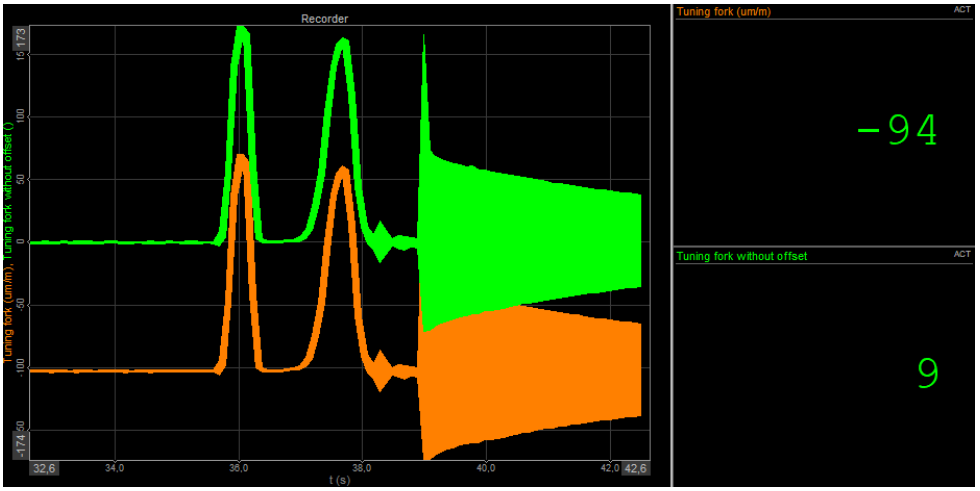


ID	Used	Stored	C	Sample rate	Name	Ampl. name	Range	Measurement	Min	Values	Max	Physical quantity	Units	Zero	Setup
1	Unused	Store		10000	AI 1	SIRIUS-ACCv2	10000 mV	IEPE	-10000...	-0,1	10000,00	Acceleration	m/s2	Zero	Setup
2	Unused	Store		10000	AI 2	SIRIUS-ACCv2+	10000 mV	IEPE	-10000...	0,1	10000,00		mV	Zero	Setup
3	Unused	Store		10000	AI 3	SIRIUS-CHG+	10000 mV	IEPE	-10000...	-0,3	10000,00		mV	Zero	Setup
4	Unused	Store		10000	AI 4	SIRIUS-HVv2	1200 V	Voltage	-1200,00	-0,01	1200,00		V	Zero	Setup
5	Used	Store		10000	Tuning fork	SIRIUS-STGv2	100 mV/V	Bridge	-20000...	-103	20000...	Strain	um/m	Zero	Setup
6	Unused	Store		10000	AI 6	SIRIUS-STGMv3	10 V	Voltage	-10,00		10,00		V	Zero	Setup
7	Unused	Store		10000	AI 7	SIRIUS-LVv2	200 V	Voltage	-200,00	0,000	200,00		V	Zero	Setup
8	Unused	Store		10000	AI 8	SIRIUS-MUL	10 V	Voltage	-10,00	-0,0610	10,00		V	Zero	Setup

3. Subtract offset

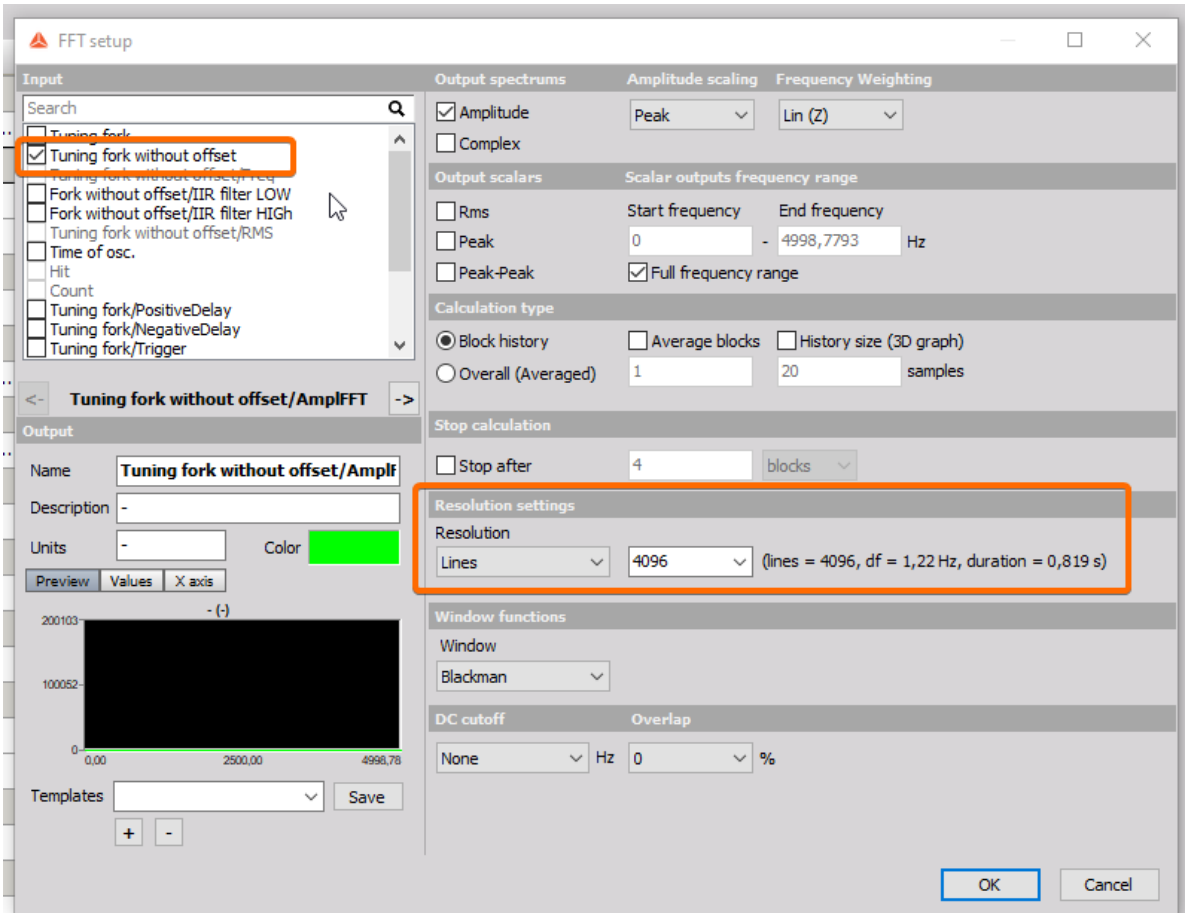
The easiest example is to use a formula to subtract a fix offset from the input signal



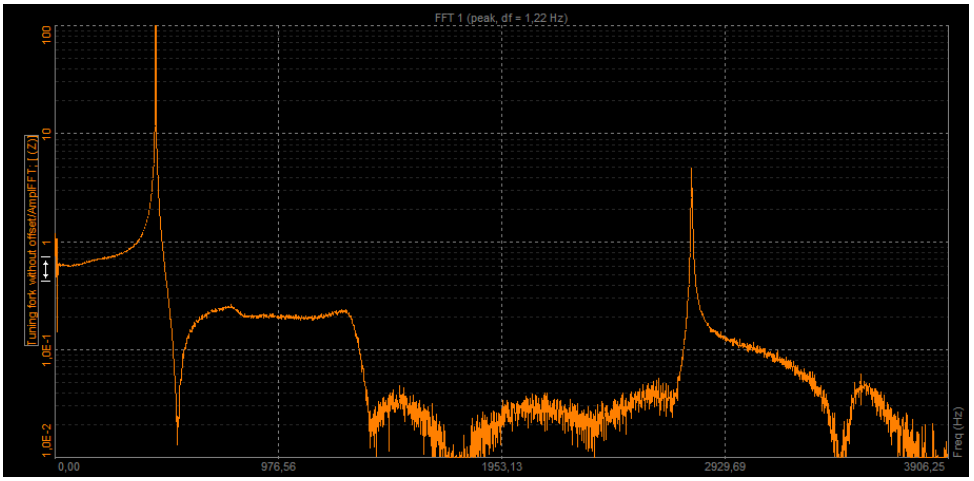


4. Calculate frequency components of the signal

In order to calculate the frequency component of the signal, we will add a FFT setup.

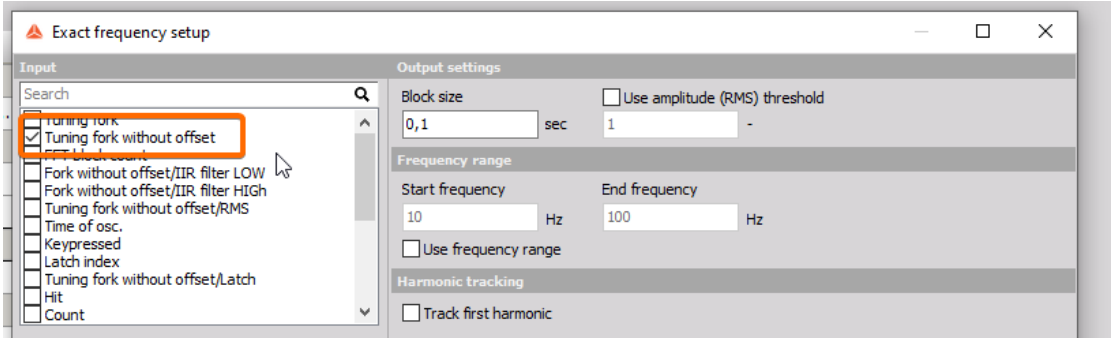


Display the results on a 2D graph.

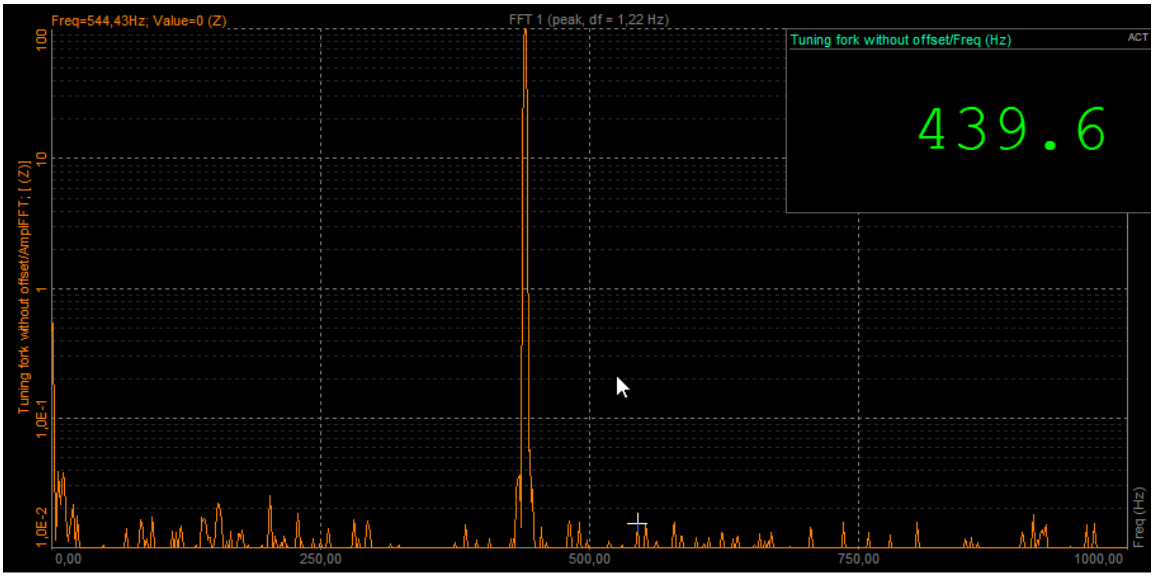


5. Measure resonance frequency

To measure the resonance frequency we will use the Exact frequency math.

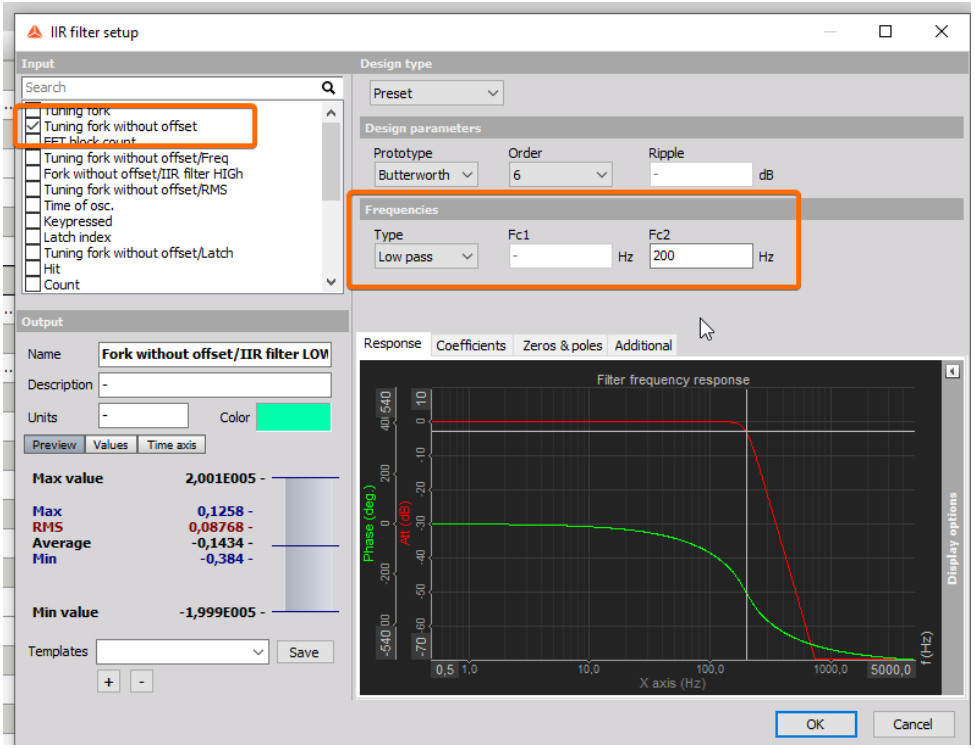


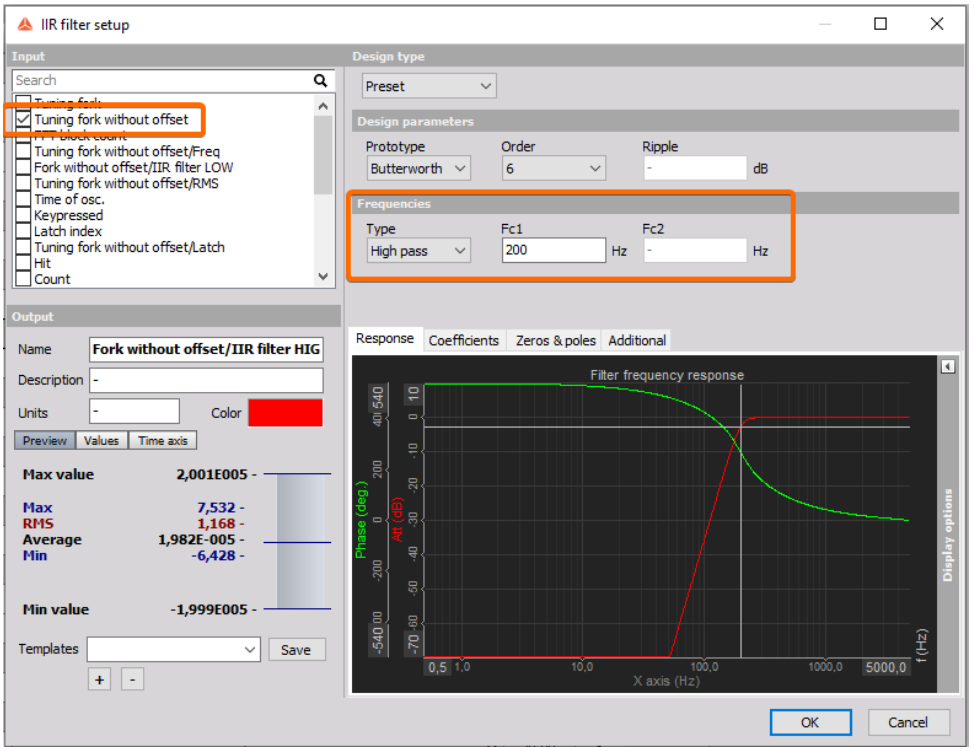
The exact frequency math will show the frequency of the maximum peak in frequency domain signal.



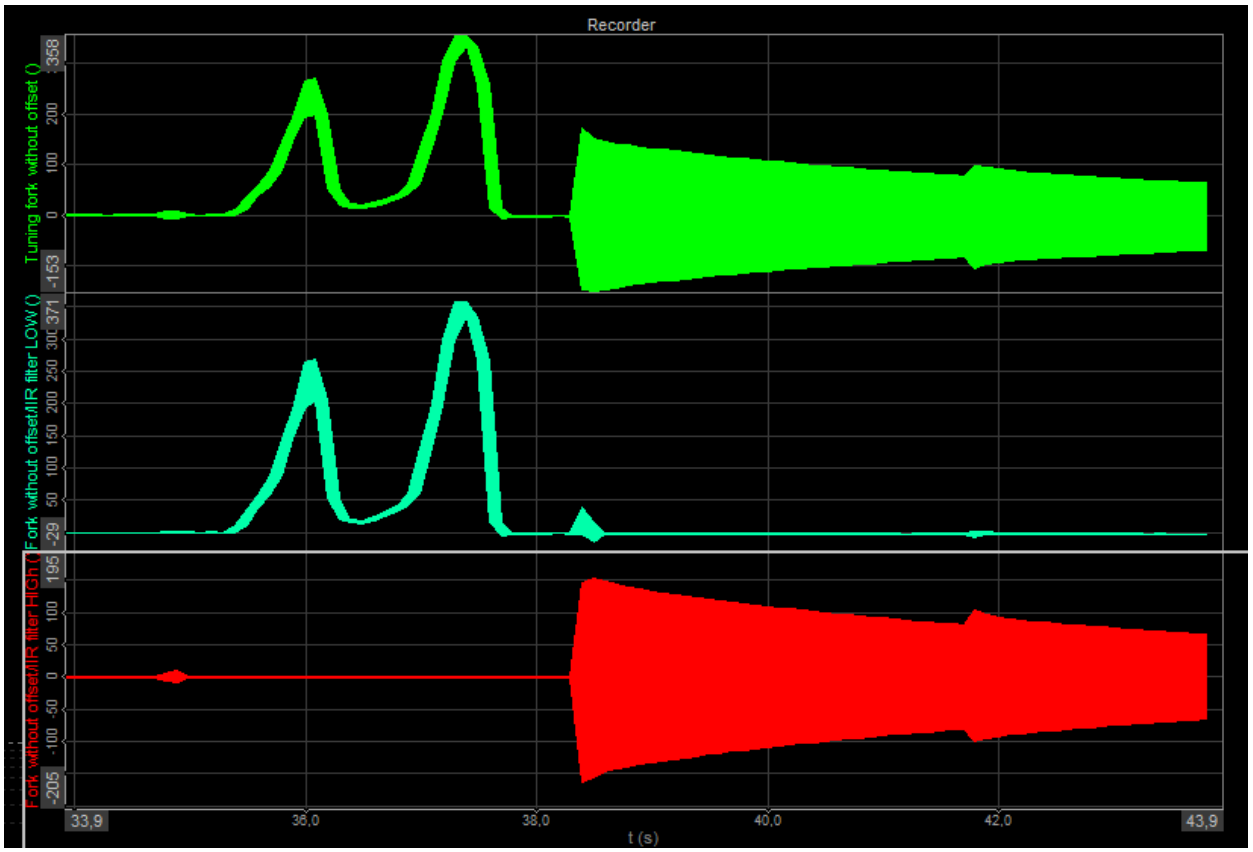
6. Filtering the signal

Now we know that the resonance frequency of the tuning fork is around 440 Hz. We will use the Low pass and High pass filter to see the effect of filtering.



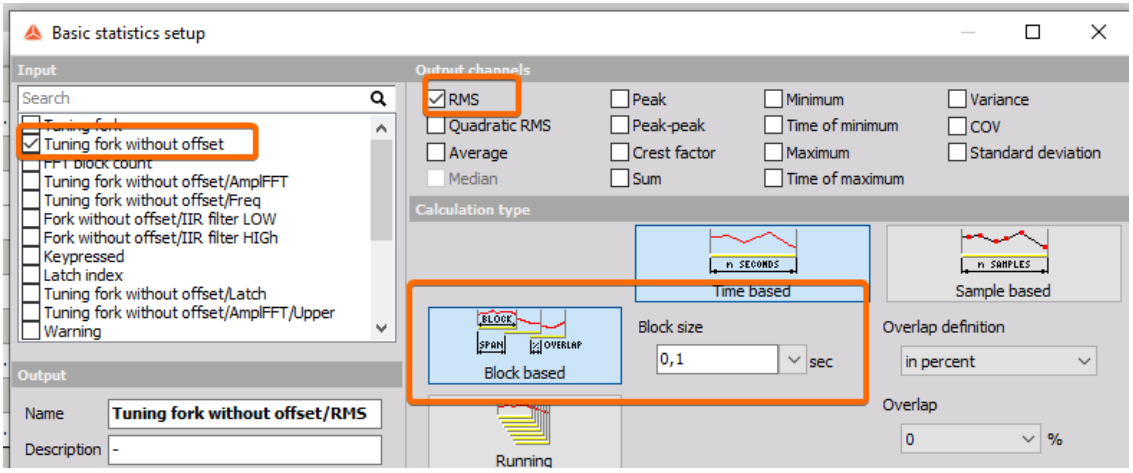


Low pass filter only passes the signal with low frequency component (second graph) while the high pass filter passes the signal with higher frequencies (red signal).

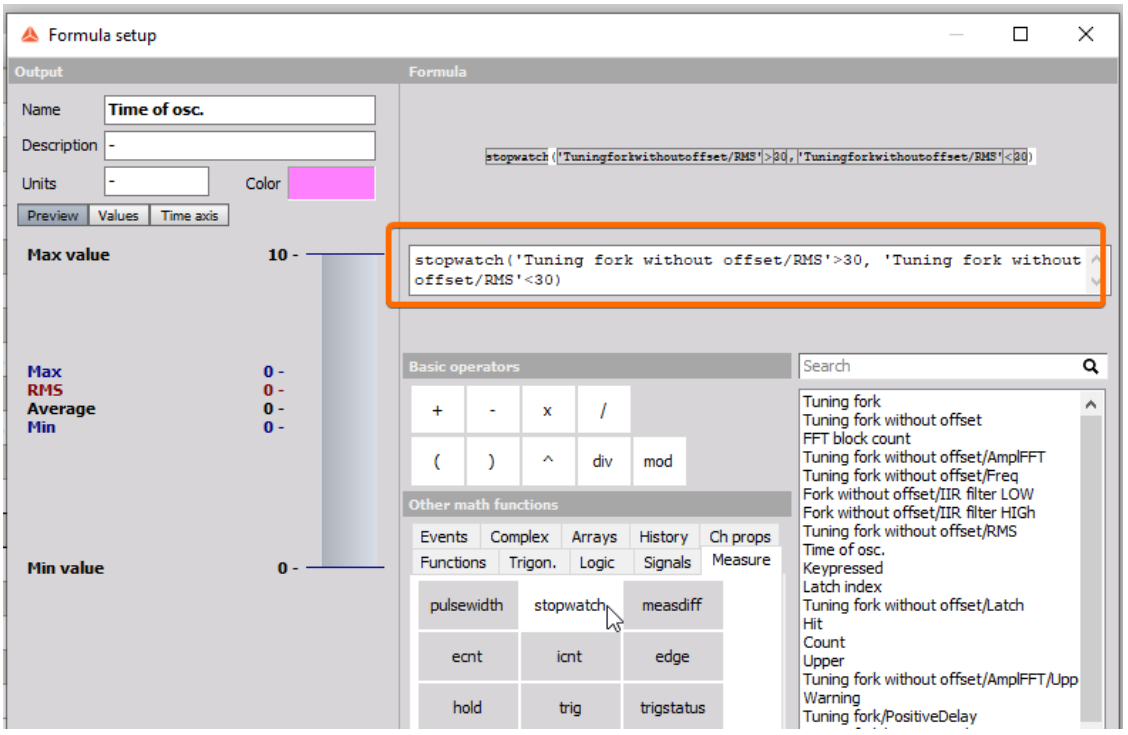


7. Measure time of oscillation

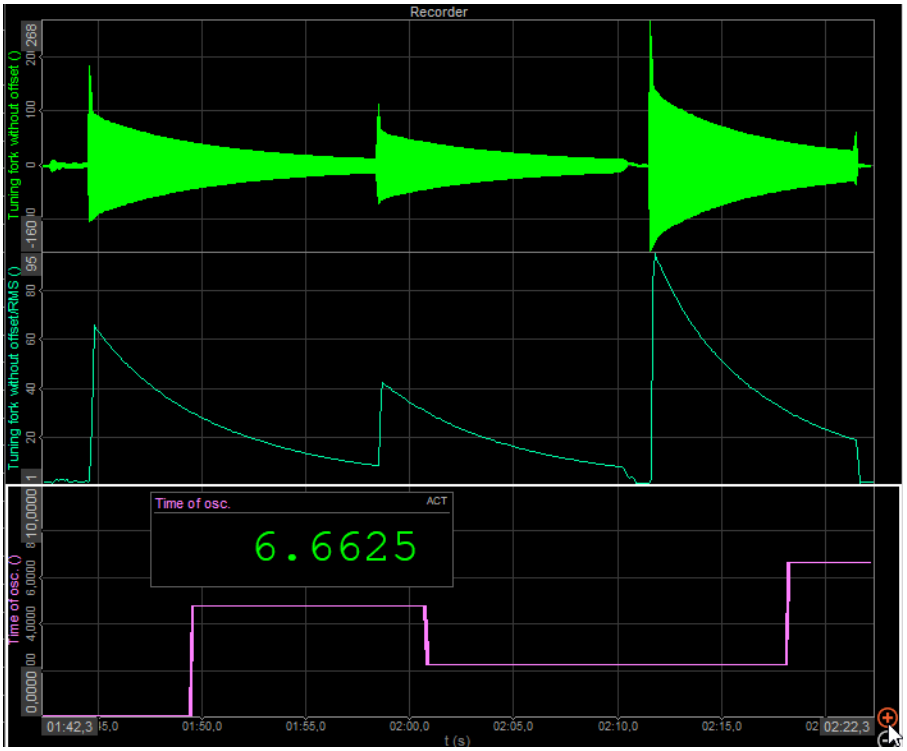
The first step is to add a Basic statistics math. Calculate RMS value with 0.1 second calculation block.



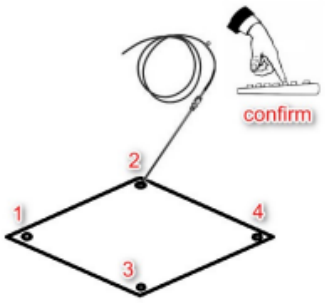
In Formula, use the Stopwatch function in order to calculate the time between two events.



Tuning fork hits with different durations; The upper signal (green) is the input signal; next is the RMS signal; the time (pink) measurement is done from RMS crossing e.g. 30 um/m (positive edge=start, negative edge=stop).



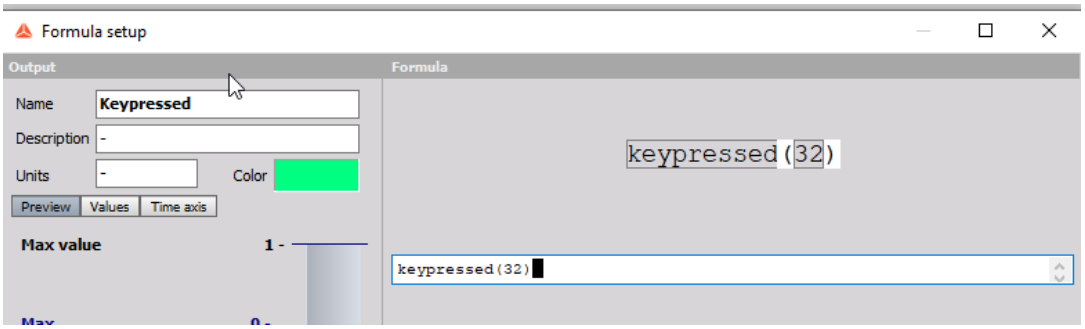
8. Hold/latch actual value when key is pressed



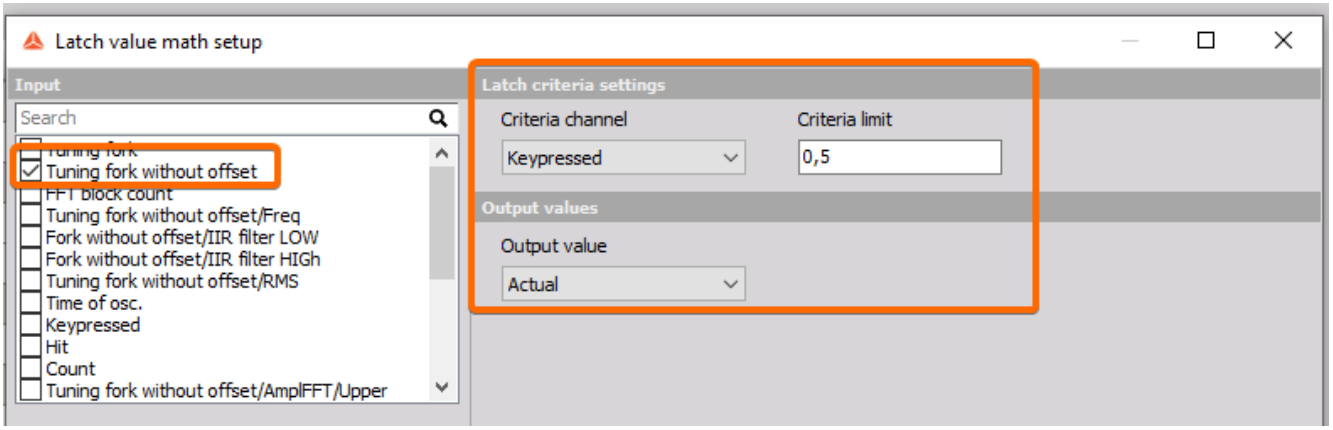
	A	B
1	1	0.784
2	2	0.335
3	3	...
4	4	

Sometimes you have to do a measurement by moving the sensor to e.g. 4 different points; on each position you press a key to confirm the value when it's stable; the output should be a table.

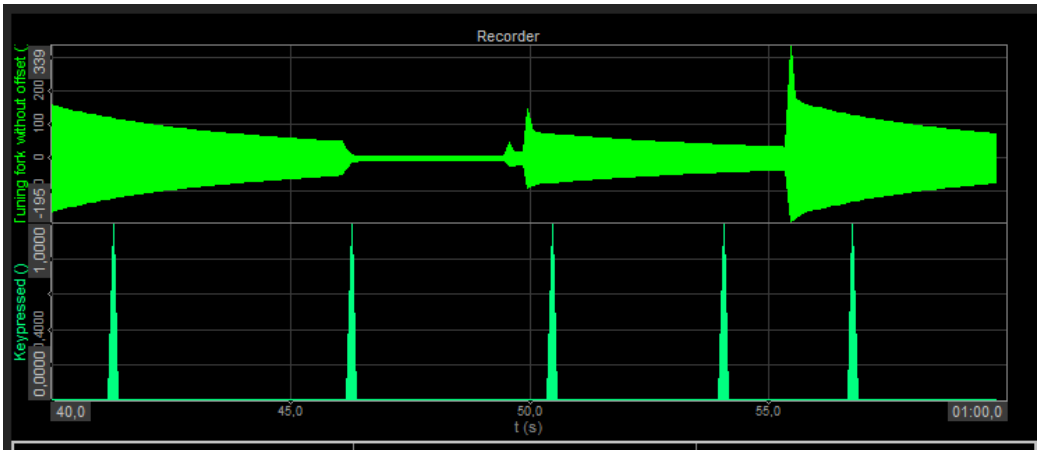
At first we add a formula for the keyboard input: the e.g. “keypressed(32)” function returns “1” for the duration of one sample if the key with the ASCII code of 32 (space bar) is pressed on the keyboard.



Add a Latch value math. Select “Tuning fork” as input, which will be latched, if the criterial channel “Keypressd” reaches the criteria limit “0,5” (transition 0 → 1); an average is done on the output over 0.1 sec before the keypress.



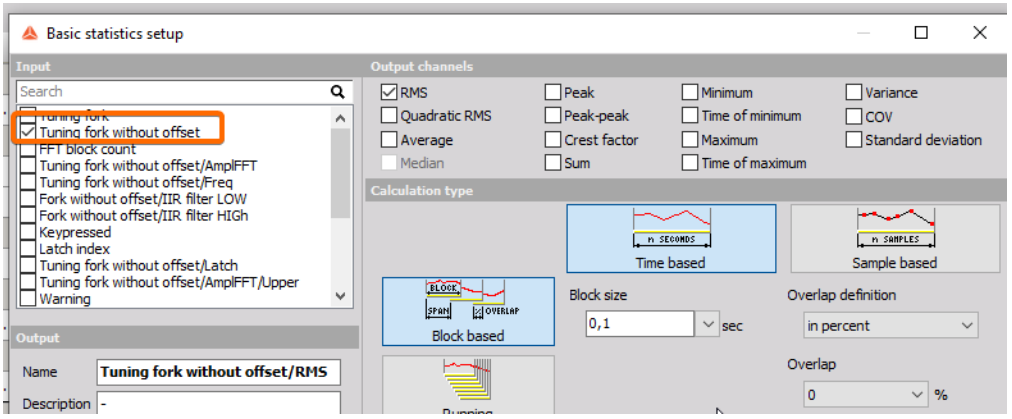
Smoothly press the tuning fork to get stable values; while you keep it pressed, hit the spacebar on the keyboard; the value will be averaged and latched and you go on to the next point



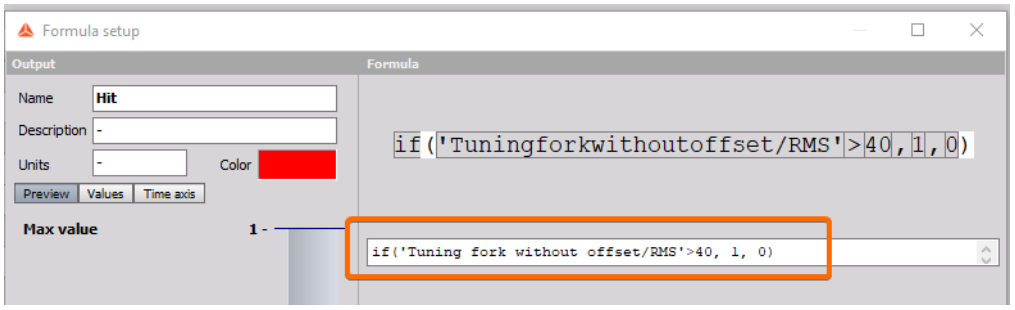
Time	Latch index	Tuning fork without offset/Latch
56,8693	5	-65,6907
54,1173	4	33,7501
50,5205	3	58,0986
46,3349	2	7,5026
41,3173	1	54,8764

9. Count how often the tuning fork is hit

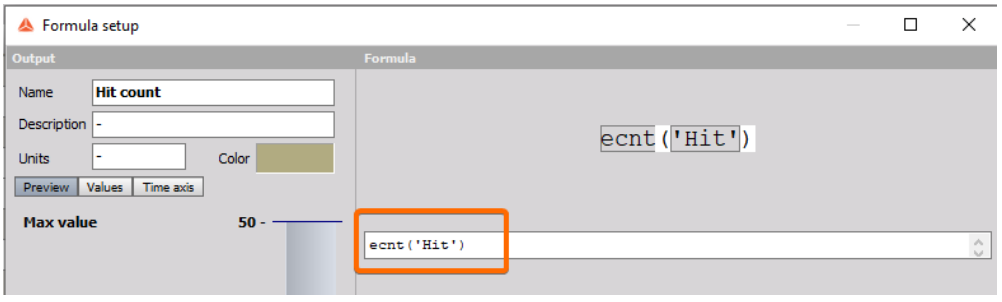
Add a basic statistics, RMS value of tuning fork, 0.1 second block.



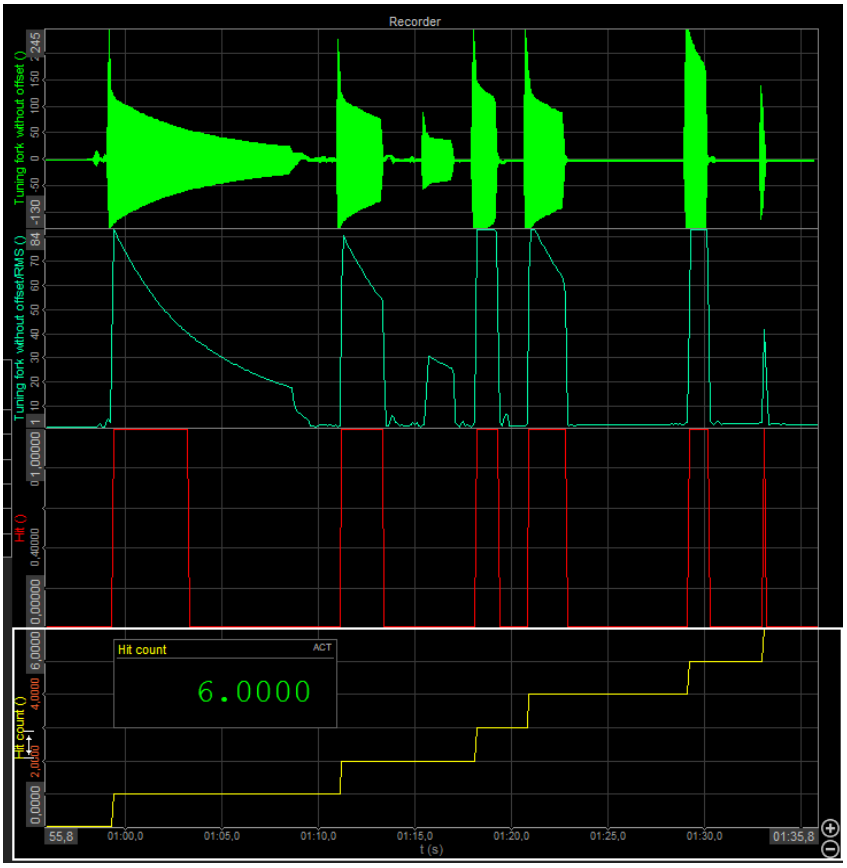
Add a formula to generate something similar to a hull curve; the output of the formula will be “1” as long as the RMS value is bigger than a level of 40 um/m (fork is oscillating).



Add a formula to count the number of rising edges of the previous formula (transition from 0 → 1).



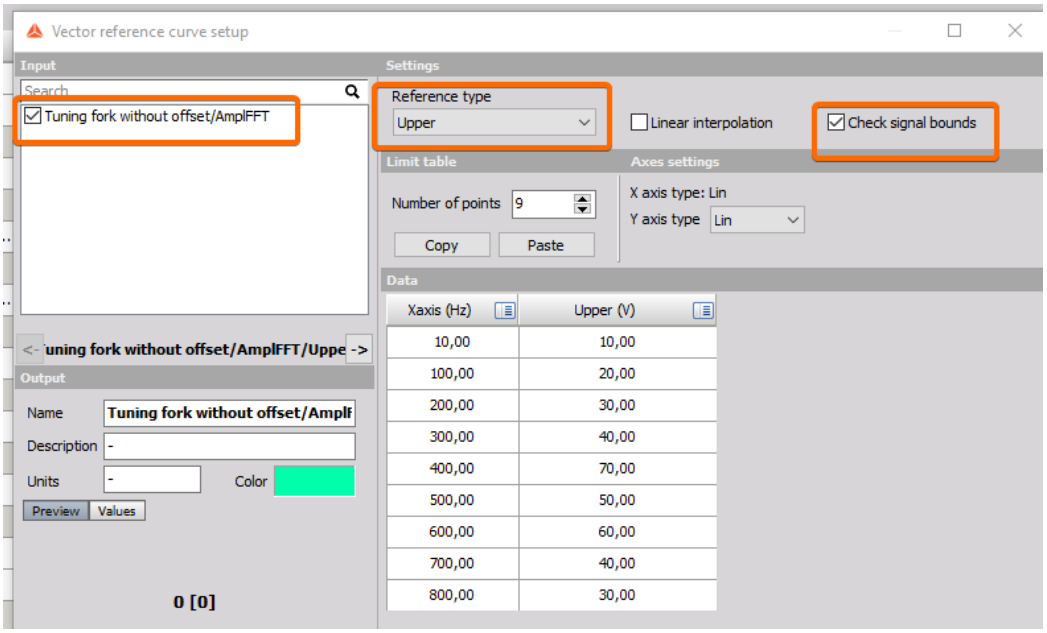
Input signal and the three math function outputs; the RMS of the input signal is first converted into a rectangular signal, then the rising edges are counted.



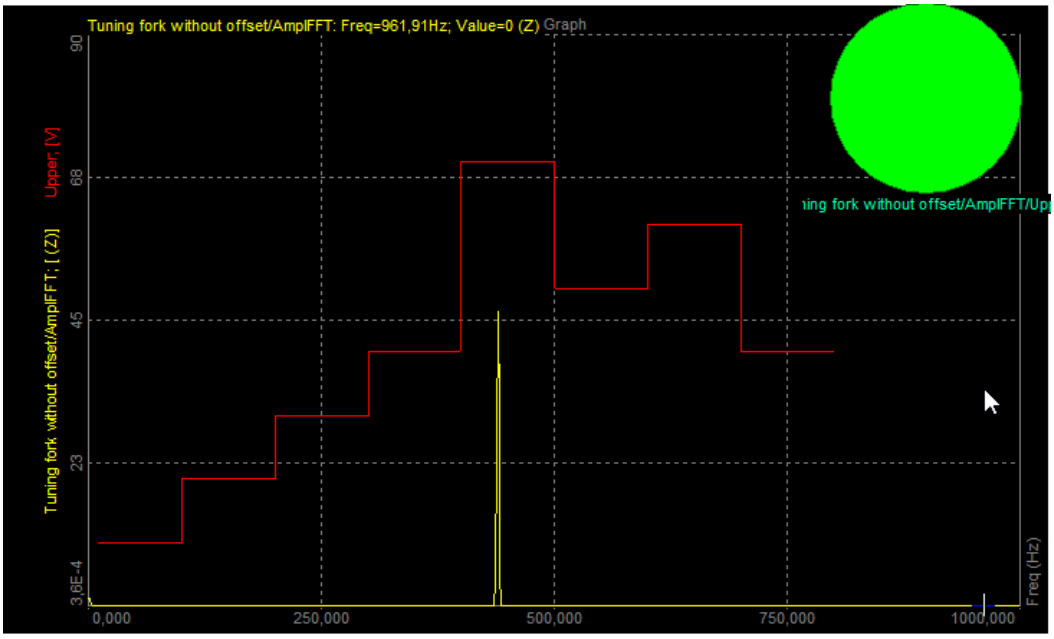
10. Vector reference curve

In machine monitoring it is very useful to observe the FFT of the vibration signal and to see if the vibration level has crossed a limit that is defined for each frequency range.

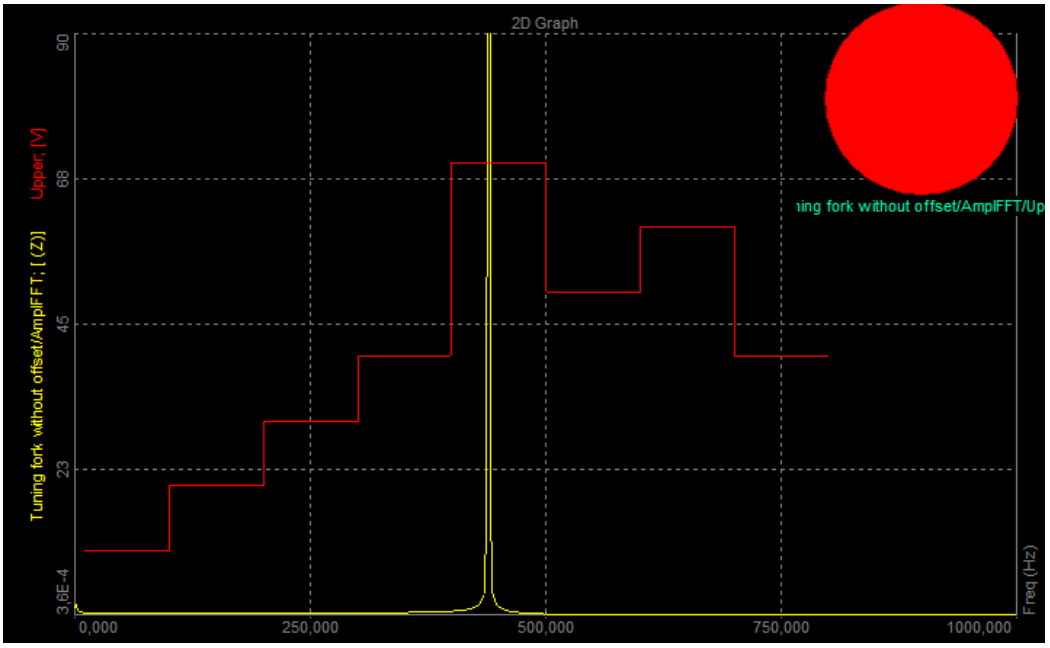
Add a Vector reference curve and define the Limit curve. You can copy/paste values from eg. Excel.
The option Check signal bounds, will output 0 if the limit is not crossed and will output 1 when our input signal crosses the limit.



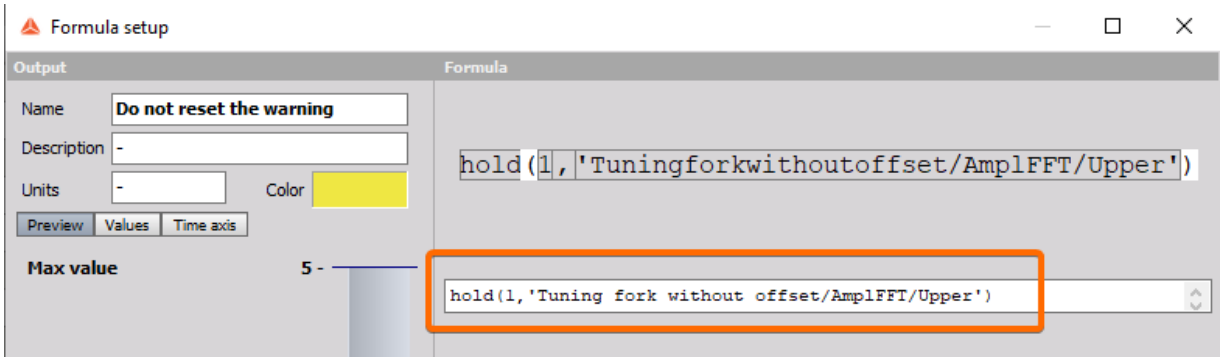
When the FFT of the signal is below the limit curve, the light is green.



When the signal exceeds the limit curve, the value of the Check signal bounds jumps to 1 and the lamp turn to red color.



The channel “FFTReference” is automatically reset, if the input signal goes under the limit again. If you want to keep the channel “1” - once exceeded - , add a simple math formula for latching the “exceeded” state; hold the value “1” on the first rising edge of the input signal.



About this document

This is the user's manual for the Math module.

Legend

The following symbols and formats will be used throughout the document.

Important
It gives you important information about the subject.
Please read carefully!

Hint
It gives you a hint or provides additional information about a subject.

Example
Gives you an example of a specific subject.

Warranty information

Notice
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The copy of the specific warranty terms applicable to your Dewesoft product and replacement parts can be obtained from your local sales and service office. To find a local dealer for your country, please visit https://dewesoft.com/support/distributors.

Calibration

Every instrument needs to be calibrated at regular intervals. The standard norm across nearly every industry is annual calibration. Before your Dewesoft data acquisition system is delivered, it is calibrated. Detailed calibration reports for your Dewesoft system can be requested. We retain them for at least one year, after system delivery.

Support

Dewesoft has a team of people ready to assist you if you have any questions or any technical difficulties regarding the system. For any support please contact your local distributor first or Dewesoft directly.

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Europe Tel.: +386 356 25 300
Web: http://www.dewesoft.com
Email: Support@dewesoft.com
The telephone hotline is available Monday to Friday from 07:00 to 16:00 CET (GMT +1:00)

Service/repair

The team of Dewesoft also performs any kinds of repairs to your system to assure a safe and proper operation in the future. For information regarding service and repairs please contact your local distributor first or Dewesoft directly on https://dewesoft.com/support/rma-service.

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Printing History

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Copyright

Trademarks

We take pride in our products and we take care that all key products and technologies are registered as trademarks all over the world. The Dewesoft name is a registered trademark. Product families (KRYPTON, SIRIUS, DSI, DS-NET) and technologies (DualCoreADC, SuperCounter, GrandView) are registered trademarks as well. When used as the logo or as part of any graphic material, the registered trademark sign is used as a part of the logo. When used in text representing the company, product or technology name, the ® sign is not used. The Dewesoft triangle logo is a registered trademark but the ® sign is not used in the visual representation of the triangle logo.

Safety instructions

Your safety is our primary concern! Please be safe!

Safety symbols in the manual

Warning
Calls attention to a procedure, practice, or condition that could cause the body injury or death

Caution
Calls attention to a procedure, practice, or condition that could possibly cause damage to equipment or permanent loss of data.

General Safety Instructions

Warning

The following general safety precautions must be observed during all phases of operation, service, and repair of this product. Failure to comply with these precautions or with specific warnings elsewhere in this manual violates safety standards of design, manufacture, and intended use of the product. Dewesoft d.o.o. assumes no liability for the customer's failure to comply with these requirements.

All accessories shown in this document are available as an option and will not be shipped as standard parts.

Environmental Considerations

Information about the environmental impact of the product.

Product End-of-Life Handling

Observe the following guidelines when recycling a Dewesoft system:

System and Components Recycling

Production of these components required the extraction and use of natural resources. The substances contained in the system could be harmful to your health and to the environment if the system is improperly handled at its end of life! Please recycle this product in an appropriate way to avoid unnecessary pollution of the environment and to keep natural resources.

This symbol indicates that this system complies with the European Union's requirements according to Directive 2002/96/EC on waste electrical and electronic equipment (WEEE). Please find further information about recycling on the Dewesoft web site www.dewesoft.com

Restriction of Hazardous Substances
This product has been classified as Monitoring and Control equipment and is outside the scope of the 2002/95/EC RoHS Directive. However, we take care of our environment and the product is lead-free.

General safety and hazard warnings for all Dewesoft systems

Safety of the operator and the unit depend on following these rules.

- Use this system under the terms of the specifications only to avoid any possible danger.
- Read your manual before operating the system.
- Observe local laws when using the instrument.
- DO NOT touch internal wiring!
- DO NOT use higher supply voltage than specified!
- Use only original plugs and cables for harnessing.
- You may not connect higher voltages than rated to any connectors.
- The power cable and connector serve as Power-Breaker. The cable must not exceed 3 meters, the disconnect function must be possible without tools.
- Maintenance must be executed by qualified staff only.
- During the use of the system, it might be possible to access other parts of a more comprehensive system. Please read and follow the safety instructions provided in the manuals of all other components regarding warning and security advice for using the system.
- With this product, only use the power cable delivered or defined for the host country.
- DO NOT connect or disconnect sensors, probes or test leads, as these parts are connected to a voltage supply unit.
- Ground the equipment: For Safety Class 1 equipment (equipment having a protective earth terminal), a non-interruptible safety earth ground must be provided from the mains power source to the product input wiring terminals.
- Please note the characteristics and indicators on the system to avoid fire or electric shocks. Before connecting the system, please read the corresponding specifications in the product manual carefully.
- The inputs must not, unless otherwise noted (CATx identification), be connected to the main circuit of category II, III and IV.
- The power cord separates the system from the power supply. Do not block the power cord, since it has to be accessible for the users.
- DO NOT use the system if equipment covers or shields are removed.
- If you assume the system is damaged, get it examined by authorized personnel only.
- Adverse environmental conditions are Moisture or high humidity Dust, flammable gases, fumes or dissolver Thunderstorm or thunderstorm conditions (except assembly PNA) Electrostatic fields, etc.
- The measurement category can be adjusted depending on module configuration.
- Any other use than described above may damage your system and is attended with dangers like short-circuiting, fire or electric shocks.
- The whole system must not be changed, rebuilt or opened.
- DO NOT operate damaged equipment: Whenever it is possible that the safety protection features built into this product have been impaired, either through physical damage, excessive moisture, or any other reason, REMOVE POWER and do not use the product until the safe operation can be verified by service-trained personnel. If necessary, return the product to Dewesoft sales and service office for service and repair to ensure that safety features are maintained.
- If you assume a more riskless use is not provided anymore, the system has to be rendered inoperative and should be protected against inadvertent operation. It is assumed that a more riskless operation is not possible anymore if the system is damaged obviously or causes strange noises. The system does not work anymore. The system has been exposed to long storage in adverse environments. The system has been exposed to heavy shipment strain.

- Warranty void if damages caused by disregarding this manual. For consequential damages, NO liability will be assumed!
- Warranty void if damage to property or persons caused by improper use or disregarding the safety instructions.
- Unauthorized changing or rebuilding the system is prohibited due to safety and permission reasons (CE).
- Be careful with voltages >25 VAC or >35 VDC! These voltages are already high enough in order to get a perilous electric shock by touching the wiring.
- The product heats during operation. Make sure there is adequate ventilation. Ventilation slots must not be covered!
- Only fuses of the specified type and nominal current may be used. The use of patched fuses is prohibited.
- Prevent using metal bare wires! Risk of short circuit and fire hazard!
- DO NOT use the system before, during or shortly after a thunderstorm (risk of lightning and high energy over-voltage). An advanced range of application under certain conditions is allowed with therefore designed products only. For details please refer to the specifications.
- Make sure that your hands, shoes, clothes, the floor, the system or measuring leads, integrated circuits and so on, are dry.
- DO NOT use the system in rooms with flammable gases, fumes or dust or in adverse environmental conditions.
- Avoid operation in the immediate vicinity of high magnetic or electromagnetic fields, transmitting antennas or high-frequency generators, for exact values please refer to enclosed specifications.
- Use measurement leads or measurement accessories aligned with the specification of the system only. Fire hazard in case of overload!
- Lithium ion batteries are classified as not hazardous when used according to the recommendations of the manufacturer described in Battery Safety Data Sheet, which is available for download from this link.
- Do not switch on the system after transporting it from a cold into a warm room and vice versa. The thereby created condensation may damage your system. Acclimatise the system unpowered to room temperature.
- Do not disassemble the system! There is a high risk of getting a perilous electric shock. Capacitors still might be charged, even if the system has been removed from the power supply.
- The electrical installations and equipment in industrial facilities must be observed by the security regulations and insurance institutions.
- The use of the measuring system in schools and other training facilities must be observed by skilled personnel.
- The measuring systems are not designed for use in humans and animals.
- Please contact a professional if you have doubts about the method of operation, safety or the connection of the system.
- Please be careful with the product. Shocks, hits and dropping it from already- lower level may damage your system.
- Please also consider the detailed technical reference manual as well as the security advice of the connected systems.
- This product has left the factory in safety-related flawlessness and in proper condition. In order to maintain this condition and guarantee safety use, the user has to consider the security advice and warnings in this manual.

EN 61326-3-1:2008

IEC 61326-1 applies to this part of IEC 61326 but is limited to systems and equipment for industrial applications intended to perform safety functions as defined in IEC 61508 with SIL 1-3.

The electromagnetic environments encompassed by this product family standard are industrial, both indoor and outdoor, as described for industrial locations in IEC 61000-6-2 or defined in 3.7 of IEC 61326-1.

Equipment and systems intended for use in other electromagnetic environments, for example, in the process industry or in environments with potentially explosive atmospheres, are excluded from the scope of this product family standard, IEC 61326-3-1.

Devices and systems according to IEC 61508 or IEC 61511 which are considered as “operationally well-tried”, are excluded from the scope of IEC 61326-3-1.

Fire-alarm and safety-alarm systems, intended for the protection of buildings, are excluded from the scope of IEC 61326-3-1.

Documentation version history

Version	Date	Notes
1.0		
V21-1	22/09/2021	New template