

THE MEASURABLE DIFFERENCE.



DEWETRON



# OXYGEN TRAINING

- > Formulas
- > Statistics
- > Filters



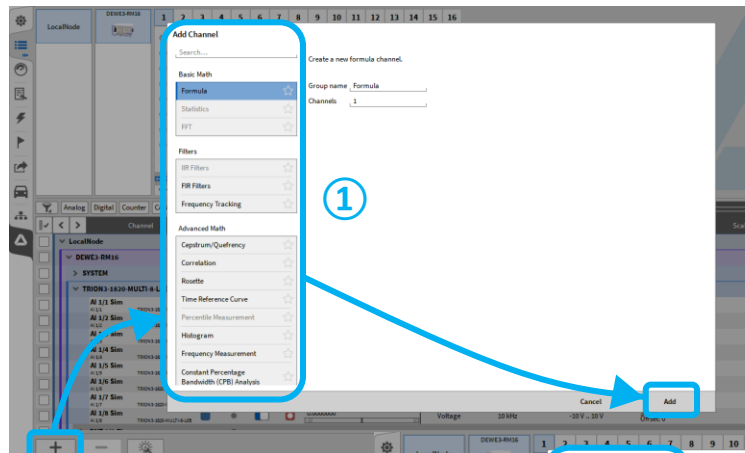


- > Adding Math Channels
- > Creating Formulas
  - > Standard Operations
  - > Trigonometric
  - > Logical
  - > Measurement
  - > Miscellaneous
  - > Creation of Reference Curves in Time Domain
  - > Array channel support for formulas
- > Creating Statistics
  - > Array channel support for statistics
- > Creating Filters
- > Offline Math

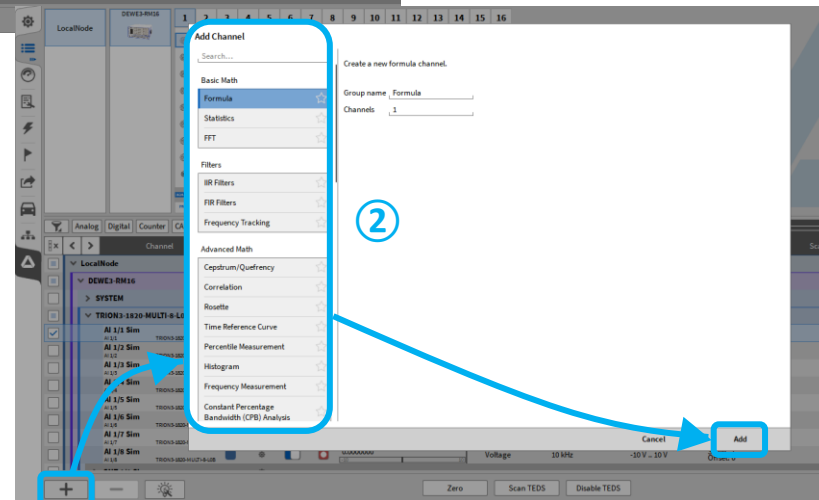


# ADD MATH CALCULATIONS TO THE MEASUREMENT SETUP

- ① To create
- > Formulas
  - > FIR Filter
  - > Frequency Tracking
  - > Cepstrum/Quefrency
  - > Correlation
  - > Rosette calculations
  - > Time Reference Curve
  - > Histogram
  - > Frequency Measurement
  - > Constant Percentage Bandwidth (CPB)
  - > Order analysis modules
  - > Power Group
  - > Sound Level
  - > Modal Test
  - > Tape Sensor
  - > Resolver
  - > Matrix Sampler
- Press the + button. Select the proper calculation and press Add



- ② Reference channels must be selected before creating
- > Statistics
  - > FFT
  - > IIR Filter
  - > Percentile Measurement
  - > Array Statistics
  - > Swept sine analysis
  - > Psophometers

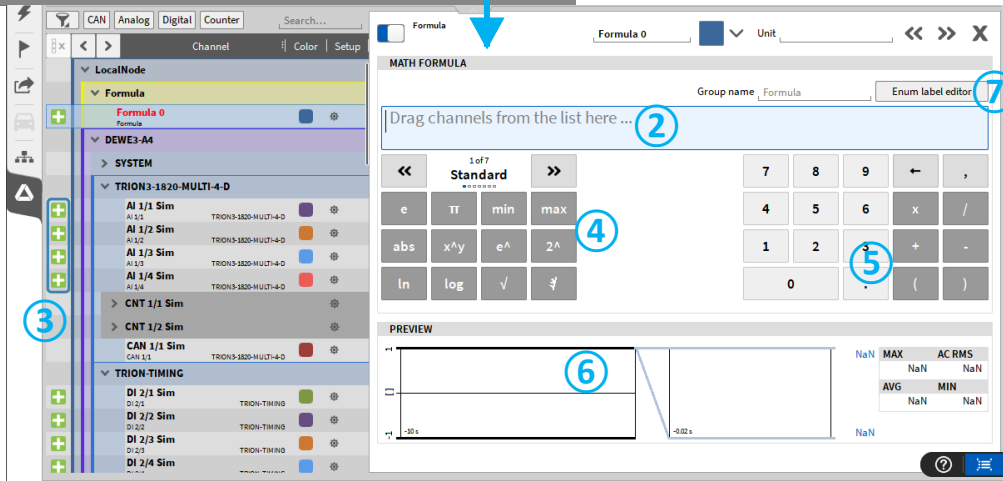
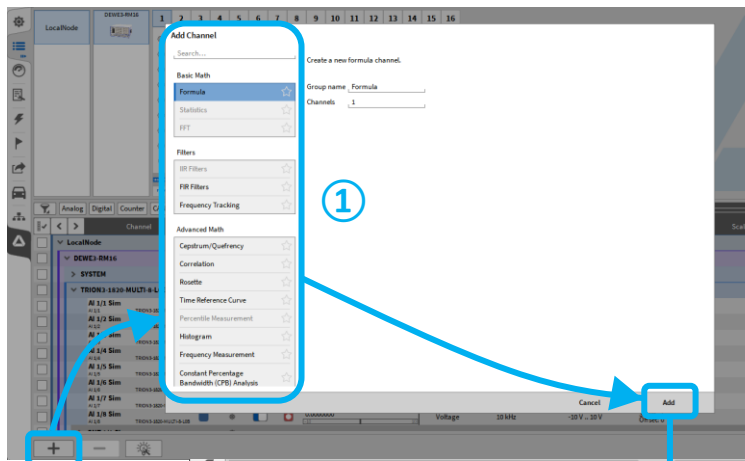




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# CREATING A FORMULA

- ① Press the + button, select *Formula* and press *Add*  
Formula editor will open afterwards
- ② Formula Input field
- ③ Press the + button to add a channel to the input field or use drag-and-drop
- ④ Selection of math functions
- ⑤ Numeric pad with basic mathematic operations
- ⑥ Preview of the formula output
- ⑦ Enum label editor  
Sets up text labels for specific values





# SIMPLE EXAMPLES

- ① Multiplication of 2 signals
- ② Mean average of 3 signals
- ③  $2 * \sin(2 * \pi * 1 * \text{time})$   
 $+ \text{ch}_x / x * 0$  required to determine the correct time base  
 Channels can have different sample rates, thus OXYGEN needs one time reference in each formula

The screenshot shows the 'Formula' editor in the DEWETRON software. The 'MATH FORMULA' field contains the expression:  $'AI\ 1/1\ Sim' * 'AI\ 1/2\ Sim'$ . The operation is set to 'Multiplication' and the unit is 'V'. A circled '1' is placed at the end of the formula.

The screenshot shows the 'Formula' editor. The 'MATH FORMULA' field contains the expression:  $('AI\ 1/1\ Sim' + 'AI\ 1/2\ Sim' + 'AI\ 1/3\ Sim') / 3$ . The operation is set to 'Mean Average' and the unit is 'V'. A circled '2' is placed at the end of the formula.

The screenshot shows the 'Formula' editor. The 'MATH FORMULA' field contains the expression:  $2 * \sin(2 * \pi * 1 * \text{time}) + 'AI\ 1/1\ Sim' * 0$ . The operation is set to 'Standard' and the unit is 'V'. A circled '3' is placed at the end of the formula.



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# MATHEMATICAL OPERATIONS – STANDARD OPERATIONS

- ① Standard operations
- ② Trigonometric operations
- ③ Logical operations
- ④ Measurement operations
- ⑤ Rolling
- ⑥ Generators
- ⑦ Misc
- ⑧ Header

1 of 8  
Standard

« »

e π min max

abs x^y e^ 2^

ln log √ ∛

abs sqrt(arg): square root of arg

ln log √ ∛

Function	Description	Syntax
e	Euler's number	e
π	Constant Pi	pi
min	Minimum of two values	min(x,y)
max	Maximum of two values	max(x,y)
abs	Absolute value	abs(value)
x^y	Exponential function with arbitrary basis	pow(x,y)
e^	Exponential function with basis e	exp(x)
2^	Exponential function with basis 2	exp2(x)
ln	Natural logarithm to basis e	ln(x)
log	Common logarithm to basis 10	log(x)
√	Square root	sqrt(x)
∛	Cube root	cbirt(x)

*Tool tips pop up when the mouse remains on one operation*

Formula Exp Unit « » X

MATH FORMULA

Group name: Formula Enum label editor

exp('AI 1/1 Sim')

« » 1 of 8 Standard

e π min max

abs x^y e^ 2^

ln log √ ∛

7 8 9 ← ( )

4 5 6 , [ ]

1 2 3 ↵ x /

0 . + -

PREVIEW

2200E6

0 0.02 0.0

2981.0 MAX AC RMS

2981.0 842.9

AVG MIN

427.6 0.0



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# MATHEMATICAL OPERATIONS – TRIGONOMETRIC

- ① Standard operations
- ② Trigonometric operations
- ③ Logical operations
- ④ Measurement operations
- ⑤ Rolling
- ⑥ Generators
- ⑦ Misc
- ⑧ Header

2 of 8

Trigonometric

sin	asin	sinh	asinh
cos	acos	cosh	acosh
tan	atan	tanh	atanh

Function	Description	Syntax
sin	Sine	sin(x)
asin	Arc sine	asin(x)
sinh	Hyperbolic sine	sinh(x)
asinh	Arc hyperbolic sine	asinh(x)
cos	Cosine	cos(x)
acos	Arc cosine	acos(x)
cosh	Hyperbolic cosine	cosh(x)
acosh	Arc hyperbolic cosine	acosh(x)
tan	Tangent	tan(x)
atan	Arc tangent	atan(x)
tanh	Hyperbolic tangent	tanh(x)
atanh	Arc hyperbolic tangent	atanh(x)

Formula

Sin Unit V

MAT FORMULA

Group name Formula Enum label editor

2\* sin(2\*pi\*1\*time) + 'Al 1/1 Sim\*0

2 of 8 Trigonometric

7	8	9	←	(	)
4	5	6	,	[	]
1	2	3	↵	x	/
0	.			+	-

PREVIEW

1.51590 V	MAX	AC RMS
2.00000 V		1.41414 V
AVG	MIN	
-0.00000 V		-2.00000 V

1.34137 V



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# MATHEMATICAL OPERATIONS – LOGIC

- ① Standard operations
- ② Trigonometric operations
- ③ Logical operations
- ④ Measurement operations
- ⑤ Rolling
- ⑥ Generators
- ⑦ Misc
- ⑧ Header

3 of 8  
**Logic**

« »

< ≤ > ≥

= ≠ and or

not if isnan

Function	Description	Syntax
<	If 'value1' is less than 'value2', the result is 1.0 else 0.0	value1 < value2
≤	If 'value1' is less than or equals 'value2', the result is 1.0 else 0.0	value1 <= value2
>	If 'value1' is greater than 'value2', the result is 1.0 else 0.0	value1 > value2
≥	If 'value 1' is greater than or equals 'value 2', the result is 1.0 else 0.0	value1 >= value2
=	If 'value 1' equals 'value 2', the result is 1.0 else 0.0 (Two NaNs do not compare equal)	value1 == value2
≠	If 'value 1' is different than 'value 2', the result is 1.0 else 0.0	value1 != value2
and	Logic and: value1 != 0.0 and value2 != 0.0 → 1.0 value1 = 0.0 and value2 != 0.0 → 0.0 value1 != 0.0 and value2 = 0.0 → 0.0 value1 = 0.0 and value2 = 0.0 → 0.0	value1 and value2
or	Logic or: value1 != 0.0 or value2 != 0.0 → 1.0 value1 = 0.0 or value2 != 0.0 → 1.0 value1 != 0.0 or value2 = 0.0 → 1.0 value1 = 0.0 or value2 = 0.0 → 0.0	value1 or value2
not	Logic negation: If value = 0.0, the result is 1.0, else 0.0	not value
if	If condition is true, the result is 'true_val', otherwise 'false_val'	if(condition,true_val,false_val)
isnan	If value is NaN, result is 1.0, 0.0 otherwise	isnan(value)

Formula

if Unit

MATH FORMULA

Group name: Formula Enum label editor

if(2\*sin(2\*pi\*1\*time)+Al 1/1 Sim\*0>0,1,0)

1 of 8 Standard

« »

e π min max

abs x^y e^ 2^

ln log √ ≠

7 8 9 ← ( )

4 5 6 , [ ]

1 2 3 ↵ x /

0 . ↵ + -

PREVIEW

1.00000 MAX AC RMS  
1.00000 1.00000 0.49998  
AVG MIN  
0.50000 0.00000

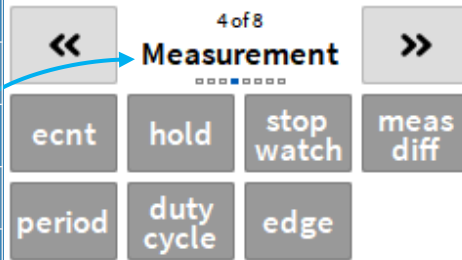


# MATHEMATICAL OPERATIONS – MEASUREMENT

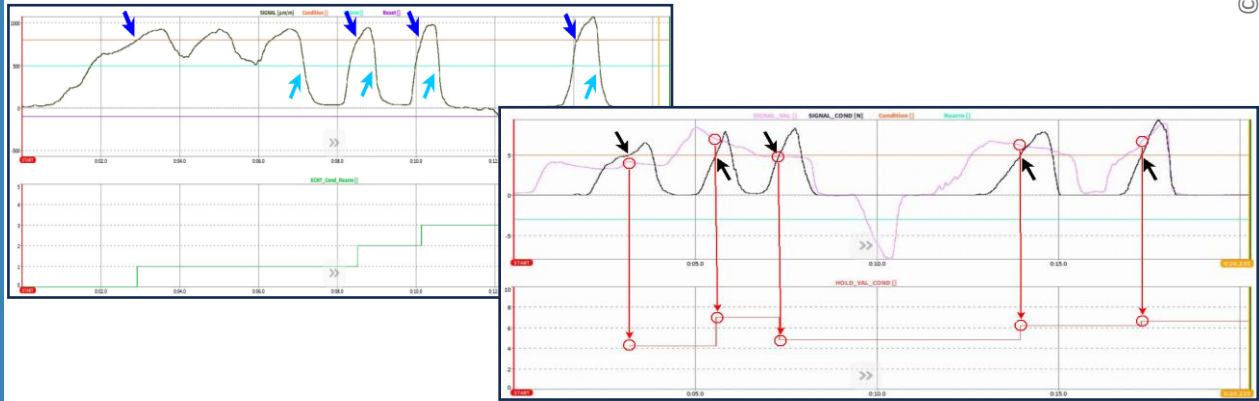


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- ① Standard operations
- ② Trigonometric operations
- ③ Logical operations
- ④ Measurement operations
- ⑤ Rolling
- ⑥ Generators
- ⑦ Misc
- ⑧ Header



Function	Description	Syntax
ecnt <sup>1</sup>	Count number of edges on condition; condition is mandatory, rearm and reset parameter optional	ecnt(cond,rearm,reset)
hold <sup>2</sup>	Hold value at trigger condition; value and condition parameters are mandatory, init and rearm optional	hold(value,cond,init,rearm)
stopwatch <sup>3</sup>	Measure the timespan between two conditions in seconds; start and stop condition is both mandatory, reset is optional	stopwatch(start_cond,stop_cond, reset)
measdiff <sup>4</sup>	Measure the value difference of one channel between two conditions	measdiff(val,cond1,cond2)
period <sup>5</sup>	Measure the period duration in seconds between consecutive conditions with optional rearm condition	Edge(cond,rearm)
dutycycle <sup>6</sup>	Measure the dutycycle (from 0 to 1) between consecutive conditions with optional rearm condition	Dutycycle(cond,rearm)
edge <sup>7</sup>	Generate positive edge on cond with rearm condition	Edge(cond,rearm)



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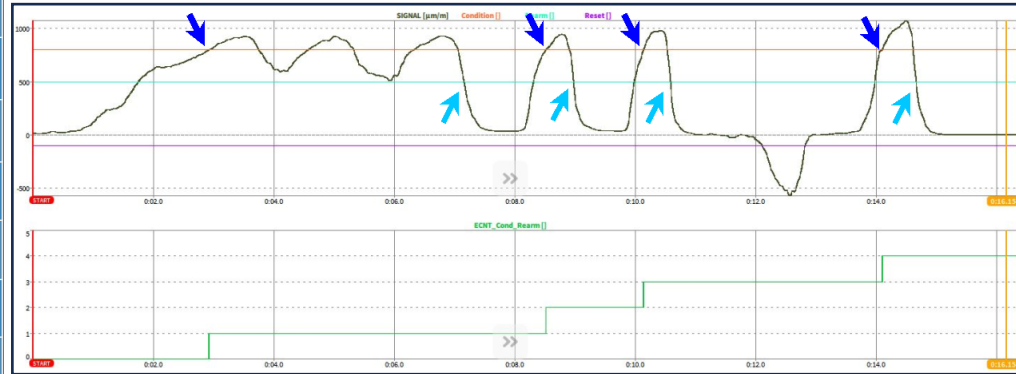
# MATHEMATICAL OPERATIONS – MEASUREMENT



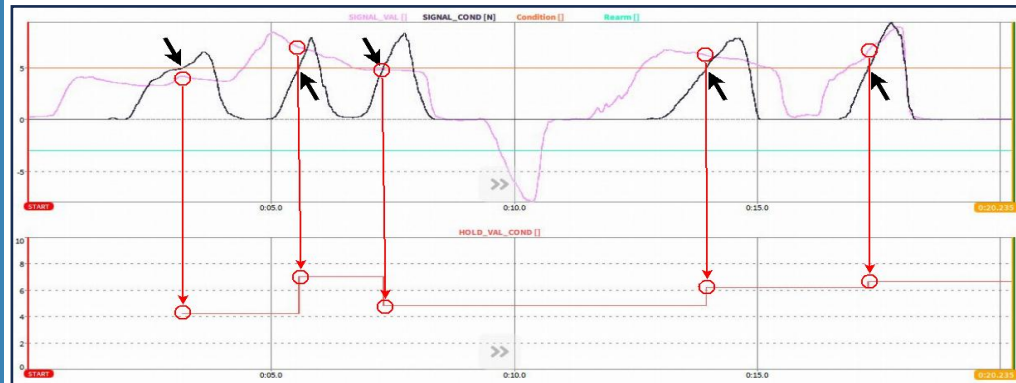
DEWETRON

- ① Standard operations
- ② Trigonometric operations
- ③ Logical operations
- ④ Measurement operations
- ⑤ Rolling
- ⑥ Generators
- ⑦ Misc
- ⑧ Header

```
ecnt('SIGNAL'>800,'SIGNAL'<500)
```



```
hold('SIGNAL_VAL','SIGNAL_COND'>5)
```





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# MATHEMATICAL OPERATIONS – ROLLING

- ① Standard operations
- ② Trigonometric operations
- ③ Logical operations
- ④ Measurement operations
- ⑤ Rolling
- ⑥ Generators
- ⑦ Misc
- ⑧ Header

5 of 8  
**Rolling**  
○○○○●○○○

<<
>>

rmin
rmax
ravg
rsum

rrms
racrms
rp2p

Function	Description	Syntax
rmin <sup>8</sup>	Measure rolling overall minimum of a channel during a measurement with optional reset condition	rmin(value,reset)
rmax <sup>8</sup>	Measure rolling overall maximum of a channel during a measurement with optional reset condition	rmax(value,reset)
ravg <sup>8</sup>	Measure rolling overall average of a channel during a measurement with optional reset condition	ravg(value,reset)
rrms <sup>8</sup>	Measure rolling overall RMS of a channel during a measurement with optional reset condition	rrms(value,reset)
rsum <sup>8</sup>	Measure rolling overall sum of a channel during a measurement with optional reset condition	rsum(value,reset)
racrms <sup>8</sup>	Measure rolling overall ACRMS of a channel during a measurement with optional reset condition; Not included in the selection and must be typed manually	racrms(value,reset)
rp2p <sup>8</sup>	Measure rolling overall Peak-to-Peak of a channel during a measurement with optional reset condition; Not included in the selection and must be typed manually	Rp2p(value,reset)

Formula  Unit

ravg

MATH FORMULA

Group name: Formula Enum label editor

ravg('Al 1/1 Sim',reset\_signal>7)

5 of 8  
**Standard**  
○○○○●○○○

<<
>>

e
π
min
max

abs
x^y
e^
2^

ln
log
√
∛

7
8
9
←
(
)

4
5
6
,
[
]

1
2
3
↵
x
/

0
.
↵
+
-

PREVIEW

7.7194 V	MAX	AC RMS
7.7194 V		3.3173 V
3.1001 V	MIN	
-0.7556 V		

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# MATHEMATICAL OPERATIONS – GENERATORS

- ① Standard operations
- ② Trigonometric operations
- ③ Logical operations
- ④ Measurement operations
- ⑤ Rolling
- ⑥ Generators
- ⑦ Misc
- ⑧ Header

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**Generators**  
○○○○○○●○

time	mtime	scnt	sr
dim	noise	chirp	sin wave
cos wave	saw wave	tri wave	pulse wave

Function	Description	Syntax
time*	Returns the elapsed time since acquisition (re)start in seconds	time
mtime*	Returns the elapsed time since measurement star in secondst	mtime
scnt*	Counts the number of samples since acquisition (re)start	scnt
sr*	Returns the Sample Rate in Hz	sr
dim	When multiplied to an array channel x * dim, the output shows the current index of the bin. [1,2...n]. For scalar the index is 0.	dim
noise	Creates Noise signal in the range [-x...+x]	noise(x)
chirp	Creates a chirp signal with frequency from f0 to f1 within d seconds.	chirp(f0,f1,d)
sinwave	Creates a sinus wave with frequency f and optional phase phi. By default, a phase shift of 0 rad is applied.	sinwave(f,phi)
coswave	Creates a cosines wave with frequency f and optional phase phi. By default, a phase shift of 0 rad is applied.	coswave(f,phi)
sawwave	Creates a saw wave with frequency f and optional phase phi. By default, a phase shift of 0 rad is applied.	sawwave(f,phi)
triwave	Creates a triangle wave with frequency f and optional phase phi. By default, a phase shift of 0 rad is applied.	triwave(f,phi)
pulsewave	Creates a rectangle wave with frequency f , duty cycle d and optional phase phi. By default a phase shift of 0 rad is applied.	pulsewave(f,d,phi)

Formula  Unit  << >> X

MATH FORMULA

Group name: Formula Enum label editor

+AI 1/1 Sim\*0

6 of 8  
**Generators**  
○○○○○○●○

time	mtime	scnt	sr
dim	noise	chirp	sin wave
cos wave	saw wave	tri wave	pulse wave

PREVIEW

0.00476 V MAX AC RMS  
0.99996 V 0.57732 V  
AVG MIN  
0.00000 V -0.99996 V  
0.00516 V

\* A channel to which the function refers must be specified, i.e. in the following manner: 'Ref\_Ch'\*0+time



# MATHEMATICAL OPERATIONS – MISC

- ① Standard operations
- ② Trigonometric operations
- ③ Logical operations
- ④ Measurement operations
- ⑤ Rolling
- ⑥ Generators
- ⑦ Misc
- ⑧ Header

7 of 8  
**Miscellaneous**  
○○○○○○○■

mod	atan2	floor	ceil
round	trunc	delay	lerp

Formula Unit: V

MATH FORMULA

Group name: Formula Enum label editor

mod(time,2) +A1 1/1 Sim\*0

7 of 8  
**Miscellaneous**  
○○○○○○○■

mod	atan2	floor	ceil
round	trunc	delay	lerp

PREVIEW

MAX	AC RMS
1.99990 V	0.28866 V
AVG	MIN
1.49995 V	1.00000 V

Function	Description	Syntax
mod	Remainder of division x/y, sign of x	mod(x,y)
atan2	Arc tangent of y/x using signs of arguments to determine the correct quadrant	atan2(y,x)
floor	Rounds x towards minus infinity	floor(x)
ceil	Rounds x towards plus infinity	ceil(x)
round	Round to nearest integer	round(x)
trunc	Round x towards zero	trunc(x)
delay	Delay a signal x for N samples with an optional initial value y0 by default 0	delay(x,N,y0)
lerp	Continue a series of values with lerp(a,b,t)=(1-t)*a+t*b. This allows you to interpolate or continue the straight line for any t values. An example is the starting value a=10, the second value is 15. lerp equals a for t=0, lerp equals b for t=1. For t values between 0 and 1, interpolation takes place between a and b.	lerp(a,b,t)



# MATHEMATICAL OPERATIONS – MEASUREMENT TIME

- ① Measurement time function can be used to generate reference curves in time domain. Create a formula determining the measurement time.
- ② Open the scaling options of this channel which are accessible in the Channel List
- ③ The table scaling can be used to define the boundary points of the reference curve
- ④ Can be displayed in a Recorder to check if the channel(s) exceeds the limit or is within the limit

Formula Measurement Time Unit

MATH FORMULA

mtime+'AI 1/I1 Sim'\*0 ①

Channel List

LocalNode	Formula	Value	Unit	Mode	Sample Rate	Range	Scaling
Multiplication	Formula	0.000000	AVG				
Mean Average	Formula	-0.653119	AVG				
2*sin(2*pi*1*time)	Formula	-1.273130	AVG				
Exp	Formula	4.308115e+2	AVG				
if	Formula	0.000400	AVG				
Sample Count	Formula	6.662500e+5	AVG				
Measurement Time	Formula	10.000000	AVG				

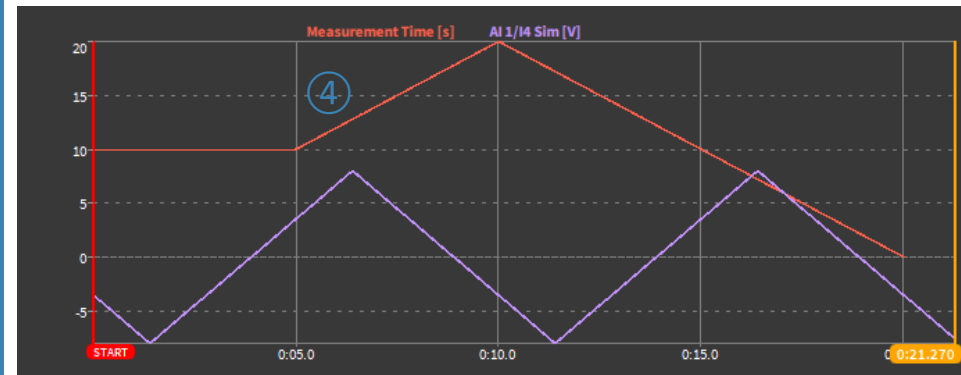
Channel Scaling ③

Scaling 2-point Table

Unit V Copy Paste

X [V]	Y [V]	+
0	10	-
5	10	-
10	20	-
20	0	-

AVG AC RMS Cancel Ok





# MATHEMATICAL OPERATIONS – MEASUREMENT TIME

① Measurement time can be easily displayed on the screen as it can be dragged and dropped to a Text instrument directly from its properties

The screenshot shows a software interface with a top status bar displaying a time scale from 0:55 to 1:30. Below this, a text instrument displays the measurement time: "Measurement Time: 1:30.236". To the right, the properties panel for the text instrument is open, showing various formatting options. Under the "SYSTEM DATA" section, the "Measurement Time" property is selected and highlighted with a circled "1". A blue arrow points from this property in the panel to the text instrument's display.

# ARRAY MATH FORMULAS



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Array channels such as Harmonics, FFT or CPB channels can be used in Formulas

① Basic math operations for arrays with same dimensions supported: + - \* /

② Operations (+ - \* /) with constants supported

Output is always a new array channel with same dimensions

Formula  Formula 0 Unit  << >> X

MATH FORMULA

Group name Formula Enum label editor

②  ①

<<	1 of 8 Standard .....	>>	7	8	9	←	(	)	
e	π	min	max	4	5	6	,	[	]
abs	x^y	e^	2^	1	2	3	↵	x	/
ln	log	√	∫	0	.			+	-

PREVIEW

2300000e+10

0 4 8 12 16 20 24 28 32 36 40 44 48



# ARRAY MATH FORMULAS



DEWETRON

Possibility to use

- ③ Standard operators
- ④ Trigonometric operators
- ⑤ Logic operators

$10 \cdot \log('U1\_hRMS@POWER\_1PH'/1)$

1 of 8  
**Standard**

<<		>>	③
e	$\pi$	min	max
abs	$x^y$	$e^x$	$2^x$
ln	log	$\sqrt{\quad}$	$\frac{\quad}{\quad}$

'U1\_hRMS@POWER\_1PH'/'I1\_hRMS@POWER\_1PH'  
\*cos('I1\_hPHI@POWER\_1PH')

2 of 8  
**Trigonometric**

<<		>>	④
sin	asin	sinh	asinh
cos	acos	cosh	acosh
tan	atan	tanh	atanh

'U1\_hRMS@POWER\_3PH' and 'U2\_hRMS@POWER\_3PH'

3 of 8  
**Logic**

<<		>>	⑤
<	is	>	is
=	$\neq$	and	or
not	if	isnan	

# ARRAY MATH FORMULAS



DEWETRON

- > Extraction of adjacent elements into a new array in C++ / Python syntax (⑥)
  - > First element of array is always 0!
  - > Optional step size definition (⑦)
- > Creation of arrays with constants (⑧)

1<sup>st</sup> Inclusive ←      → Last Exclusive

The screenshot shows a formula editor with the input `'U1_hrMS@POWER_1PH'[0:10]`. The interface includes a calculator keypad with buttons for constants (e, π, min, max), operations (x, /, +, -), and mathematical functions (abs, x^y, e^, 2^, ln, log, √, ∫). A preview window below the keypad displays a bar chart with a single orange bar at index 0, reaching a value of approximately 400 on the y-axis.

The screenshot shows a formula editor with the input `'U1_hrMS@POWER_1PH'[0:10:2]`. The interface is identical to the previous screenshot. The preview window displays a bar chart with a single orange bar at index 1, reaching a value of approximately 250 on the y-axis.

The screenshot shows a formula editor with the input `'U_1/2'*0+[1,2,3,4,5]`. The interface is identical to the previous screenshots. The preview window displays a bar chart with five orange bars at indices 1 through 5, with values increasing from approximately 200 to 500 on the y-axis.



# CREATING STATISTICS

- 1 Select one or several channels by checking their check boxes and press the + button
- 2 Select *Statistics*, choose the proper calculations (several can be selected) and the desired time window
- 3 Press *Add* afterwards to create these channels
- 4 A separate output channel for each reference channel and calculation is created
- 5 Changes can still be applied by entering the settings of the desired channel via the *Gear* button
- 6 Select if calculation (starting at acquisition start) shall be reset at recording start

The screenshot shows the DEWETRON software interface. The top part displays the 'Add Channel - Statistics' dialog box. A blue box highlights the 'Statistics' category in the left sidebar (2). The main area of the dialog shows a grid of calculation options: AVG, MAX, MIN, RMS, ACRMS, Peak-Peak, SUM, MIN Time, MAX Time, COUNT, Variance, CV, Peak, and Crest. The 'MAX' and 'MIN' options are selected. Below the grid, the 'Calculation type' is set to 'Reset on measurement start', 'Window size' is 1 s, and 'Group name' is 'Statistics 1'. The 'Add' button is highlighted with a blue box (3). The bottom part of the screenshot shows the 'Statistics Channel Options' configuration panel for 'AI 1/1 Sim\_MIN'. The 'Reference channel' is 'AI 1/1 Sim', 'Group name' is 'Statistics 1', 'Statistics mode' is 'MIN', and 'Calculation type' is 'Reset on ...ent start'. The 'WINDOW SETTINGS' section shows 'Window size' as 1 s and 'Window overlap' as 0%. The 'SCALING' section shows 'Scaling type' as 'Scaling' and 'Unit' as 'V'. The 'PREVIEW' section shows a graph with a blue box highlighting the 'MAX' and 'MIN' values in the legend (6).



# CALCULATION REMARKS

Calculation remarks can be seen on the right hand side

If rolling (overall) statistics, i.e. maximum value during the measurement are required, refer to the functions in the table below which are available in the formula setup

*These formulas are reset at measurement start*

Additionally, user defined reset events can be defined, i.e. ch1 decreases 0

*racrms* and *rp2p* are not available in the menu but can be typed into the formula editor manually

$$AVG = \frac{1}{N} \sum_{i=1}^N SignalLevel_i$$

$$MIN = MIN\{SignalLevel_i\}$$

$$MAX = MAX\{SignalLevel_i\}$$

$$ACRMS = \sqrt{\frac{1}{N} \sum_{i=1}^N (SignalLevel_i - AVG)^2}$$

$$RMS = \sqrt{\frac{1}{N} \sum_{i=1}^N (SignalLevel_i)^2} = \sqrt{AVG^2 + ACRMS^2}$$

$i = 1 \dots N$

$N = \text{Sample Rate of Input Channel} * \text{Window Size}$

<b>rmin</b>	Measure rolling overall minimum of a channel during a measurement with optional reset condition	rmin(value,reset)
<b>rmax</b>	Measure rolling overall maximum of a channel during a measurement with optional reset condition	rmax(value,reset)
<b>ravg</b>	Measure rolling overall average of a channel during a measurement with optional reset condition	ravg(value,reset)
<b>rrms</b>	Measure rolling overall RMS of a channel during a measurement with optional reset condition	rrms(value,reset)
<b>rsum</b>	Measure rolling overall sum of a channel during a measurement with optional reset condition	rsum(value,reset)
<b>racrms</b>	Measure rolling overall ACRMS of a channel during a measurement with optional reset condition; Not included in the selection and must be typed manually	racrms(value,reset)
<b>rp2p</b>	Measure rolling overall Peak-to-Peak of a channel during a measurement with optional reset condition; Not included in the selection and must be typed manually	Rp2p(value,reset)



# FURTHER STATISTICS (AVAILABLE SINCE R6.1)

- > *Peak-Peak*: Calculates the peak-peak value
- > *SUM*: Calculates the sum
- > *MIN Time*: Determines the time, where the minimum of the signal was reached
- > *MAX Time*: Determines the time, where the maximum of the signal was reached
- > *COUNT*: Counts the number of samples in one measurement block
- > *Variance*: Calculates the variance (squared ACRMS value)
- > *Coefficient of Variance (CV)*: Calculates the Coefficient of variance (division of ACRMS and AVG)
- > *Peak*: Calculates the peak value
- > *Crest*: Calculates the crest factor (division of the MAX and RMS value)

**Add Channel - Statistics**

Search...

Basic Math

- Formula ☆
- Statistics** ☆
- FFT ☆

Filters

- IIR Filters ☆
- FIR Filters ☆
- Frequency Tracking ☆

Advanced Math

- Cepstrum/Quefreny ☆
- Correlation ☆
- Rosette ☆
- Time Reference Curve ☆
- Percentile Measurement ☆
- Histogram ☆
- Frequency Measurement ☆

AVG	MAX	MIN	RMS	ACRMS	Peak-Peak	SUM
MIN Time	MAX Time	COUNT	Variance	CV	Peak	Crest

Calculation type

Window size   Overlap

Group name

Cancel Add

# OVERLAPPING STATISTICS (AVAILABLE SINCE R6.1)



DEWETRON

## > Overlapping Window size

- > 0 % (behaviour until now)
- > 50 %
- > 75 %
- > 80 %
- > 90 %
- > 95 %

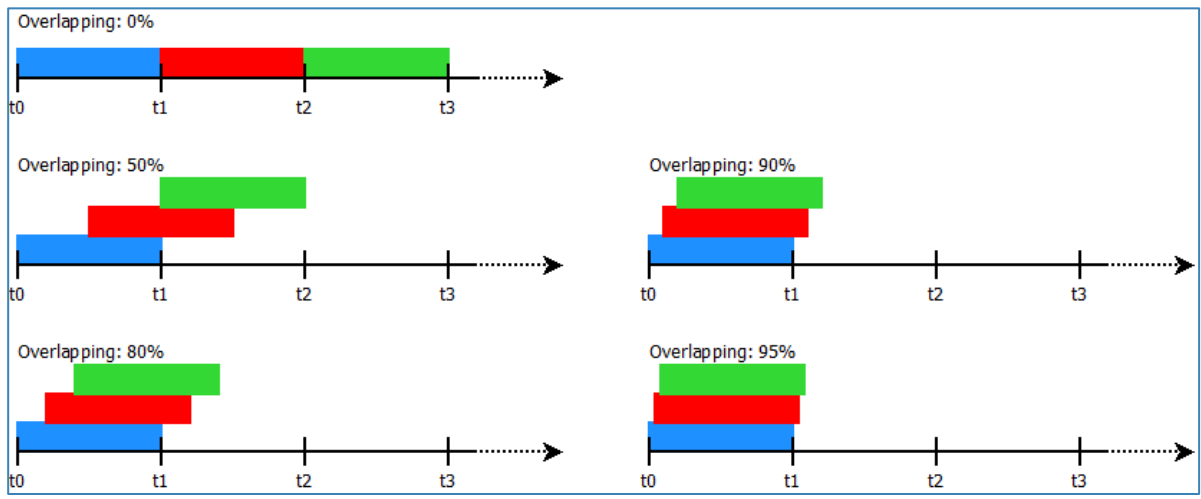
Calculation type

Window size  s

Group name

Overlap

- 0 %
- 50 %
- 75 %
- 80 %
- 90 %
- 95 %



# OVERALL STATISTICS (AVAILABLE SINCE R6.1)



DEWETRON

- > Outputs one overall value from recording start to recording end
  - Reset on measurement start
- > No time history included

**Add Channel - Statistics**

Search...

**Basic Math**

- Formula ☆
- Statistics** ☆
- FFT ☆

**Filters**

- IIR Filters ☆
- FIR Filters ☆
- Frequency Tracking ☆

**Advanced Math**

- Cepstrum/Quefrency ☆
- Correlation ☆
- Rosette ☆
- Time Reference Curve ☆
- Percentile Measurement ☆
- Histogram ☆
- Frequency Measurement ☆

AVG	MAX	MIN	RMS	ACRMS	Peak-Peak	SUM
MIN Time	MAX Time	COUNT	Variance	CV	Peak	Crest

Calculation type **Overall**

Group name **Statistics 1**

Cancel Add

# TRIGGERED STATISTICS (AVAILABLE SINCE R6.2)



DEWETRON

- > Begins statistics calculation on trigger
- > Trigger event can be on rising or falling edge
- > Stop modes:
  - Retrigger
  - Duration
  - Stop trigger

**Add Channel - Statistics**

Search...

Basic Math

- Formula
- Statistics**
- FFT

Filters

- IIR Filters
- FIR Filters
- Frequency Tracking

Advanced Math

- Cepstrum/Quefreny
- Correlation
- Rosette
- Time Reference Curve
- Percentile Measurement
- Histogram
- Frequency Measurement

AVG MAX MIN RMS ACRMS Peak-Peak SUM

MIN Time MAX Time COUNT Variance CV Peak Crest

Calculation type: Triggered

Start trigger channel: AI 1/1 Sim

Start trigger level: 0 V Rising edge  Rearm level: 0 V

Stop mode: Stop trigger

Stop trigger channel: AI 1/2 Sim

Stop trigger level: 0 V Rising edge  Rearm level: 0 V

Group name: Statistics 1

Cancel Add

Stop mode

- Stop trigger
- Retrigger
- Duration
- Stop trigger



# RUNNING STATISTICS (AVAILABLE SINCE R6.2)



- > Inherits sample rate of input channel
- > Looks back the window size on each new sample
- > Calculates statistic for this „look back“-window

Add Channel - Statistics

Search...

Basic Math

- Formula
- Statistics**
- FFT

Filters

- IIR Filters
- FIR Filters
- Frequency Tracking

Advanced Math

- Cepstrum/Quefreny
- Correlation
- Rosette
- Time Reference Curve
- Percentile Measurement
- Histogram
- Frequency Measurement

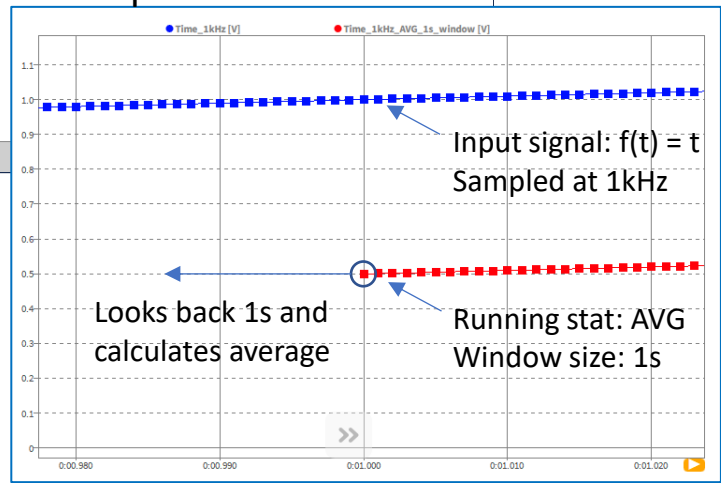
AVG	MAX	MIN	RMS	ACRMS	Peak-Peak	SUM
MIN Time	MAX Time	COUNT	Variance	CV	Peak	Crest

Calculation type: Running

Window size: 1 to 5

Group name: Statistics 1

Example:

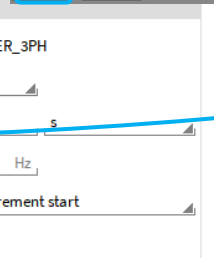
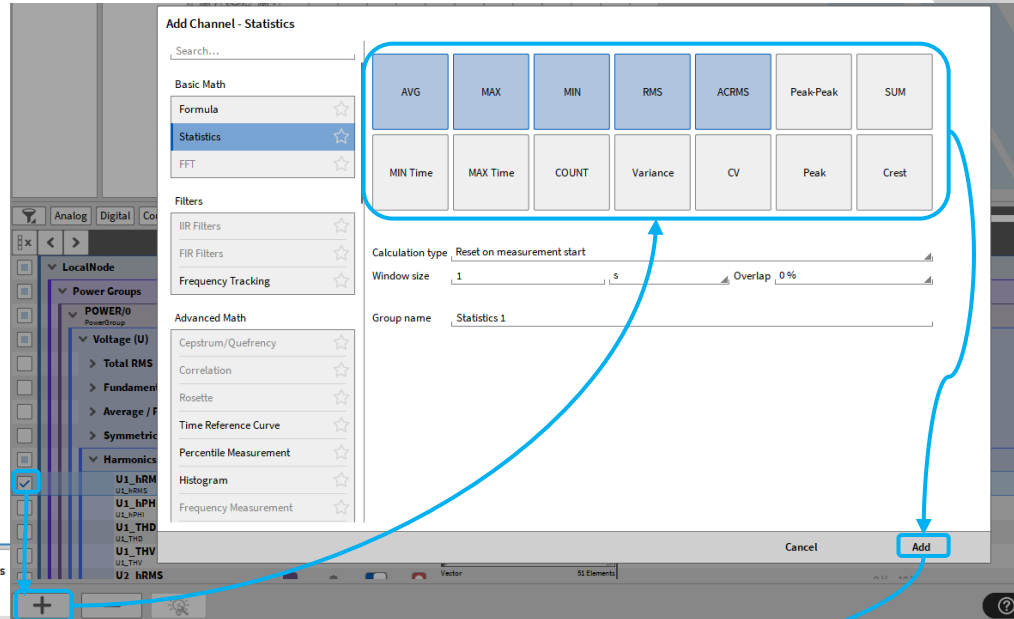


# ARRAY MATH STATISTICS



DEWETRON

- > Arrays can be assigned to Statistics
- > Output is always a new array channel with same dimensions





# CREATING IIR-FILTERS

- 1 Select one or several channels to be filtered by checking their check boxes and press the + button
- 2 Select *Filters*, choose the proper one and its settings
- 3 Press *Add* afterwards to create these channels
- 4 A separate output channel for each filtered reference channel is created
- 5 Changes can still be applied by entering the settings of the desired channel via the *Gear* button

The image shows the DEWETRON software interface for creating IIR filters. The top part displays the 'Add Channel - IIR Filters' dialog box. In this dialog, the 'Filters' category is selected in the left sidebar (1). The 'Creates an IIR Filter' section has 'Low pass' selected (2). The 'Filter frequency' is set to 2500 Hz, 'Filter characteristic' is Bessel, and 'Order' is 4. The 'Group name' is 'Filters 1'. The 'Add' button is highlighted (3).

The bottom part shows the resulting channel list. The 'Filters 1' group is expanded, showing three channels: 'AI 1/11 Sim\_LP', 'AI 1/12 Sim\_LP', and 'AI 1/13 Sim\_LP' (4). The 'AI 1/11 Sim\_LP' channel is selected, and its configuration is shown in the 'FILTER OPTIONS' panel. The 'Reference channel' is 'AI 1/11 Sim', 'Filter mode' is 'Lowpass', 'Frequency' is 2500 Hz, 'Characteristic' is 'Bessel', and 'Order' is 4 (5). The 'GAIN PREVIEW' shows a low-pass filter response, and the 'SCALING' section shows 'Scaling' selected. The 'PREVIEW' at the bottom shows a waveform.



# CREATING FIR-FILTERS

- 1 Select one or several channels to be filtered by checking their check boxes and press the + button
- 2 Select *Filters*, choose the proper one and its settings
- 3 Press *Add* afterwards to create these channels
- 4 A separate output channel for each filtered reference channel is created
- 5 Changes can still be applied by entering the settings of the desired channel via the *Gear* button
- 6 Additional channels can be added or deselected

The image illustrates the software interface for creating FIR filters. It is divided into three main sections:

- Top Section:** The 'Add Channel - FIR Filters' dialog box. It features a 'Basic Math' section with radio buttons for 'Low pass', 'High pass', 'Band pass', and 'Band stop'. The 'Low pass' option is selected. Below this, there are input fields for 'Filter frequency' (set to 2500 Hz), 'Window' (set to Kaiser), and 'Filter length' (set to 31). A 'Group name' field is set to 'FIR Filter Channels'. A blue circle '2' highlights the filter type selection area.
- Middle Section:** The main channel list interface. A blue circle '1' highlights a '+' button used to add channels. A blue circle '3' highlights the 'Add' button at the bottom right of the dialog box.
- Bottom Section:** The 'FIR\_1' configuration window. It has two main panels:
  - FIR FILTER OPTIONS:** This panel allows for further configuration. A blue circle '5' highlights the 'Filter type' dropdown, which is set to 'Lowpass'. Other settings include 'Filter length' (31), 'Window' (Kaiser), 'Filter delay' (0.0015 s), 'Compensate delay' (True), and 'Saturation detection' (False). Below this is a 'FIR STAGES' table with columns for 'Used', 'Frequency', and 'Decimation'. The first stage is checked and set to 2500 Hz and 1.
  - INPUT CHANNELS:** This panel shows a list of channels under 'LocalNode'. A blue circle '6' highlights the 'Show selected channels only' checkbox, which is checked. Below it, a tree view shows 'FIR Filter Channels' containing 'FIR\_1', and 'DEWE3-RM6' containing several channels like 'AI 1/11 Sim', 'AI 1/12 Sim', and 'AI 1/13 Sim'. Checkmarks are visible next to these channels.

At the bottom of the interface, a 'PREVIEW' graph shows a frequency response plot with a red line indicating the filter's attenuation characteristics.

# FILTER SETTINGS



DEWETRON

## Available Filters:

- > Lowpass
- > Highpass
- > Bandpass
- > Bandstop
- > Integrator (Single or Double)
- > Differentiator (Single or Double)

- > Lowpass & Highpass:
  - >  $f_{C\ max} = \frac{f_s}{2} - 50\ Hz$
  - > Bessel, Butterworth, Chebyshev I and Chebyshev II characteristic
  - > 2<sup>nd</sup>, 4<sup>th</sup>, 6<sup>th</sup>, 8<sup>th</sup> or 10<sup>th</sup> order
- > Bandpass & Bandstop
  - >  $f_l = 0 \dots f_h - 1\ Hz$
  - >  $f_h = f_l + 1\ Hz \dots \frac{f_s}{2} - 50\ Hz$
  - > Bessel, Butterworth, Chebyshev I and Chebyshev II characteristic
  - > 2<sup>nd</sup>, 4<sup>th</sup>, 6<sup>th</sup>, 8<sup>th</sup> or 10<sup>th</sup> order
- > Integrator & Differentiator
  - > Single or Double Integration/Differentiation
  - > Enable low (Integrator) or high (Differentiator) frequency component filtering
    - >  $f_{C\ max} = \frac{f_s}{2} - 50\ Hz$
    - > Bessel or Butterworth characteristic
    - > 2<sup>nd</sup>, 4<sup>th</sup>, 6<sup>th</sup>, 8<sup>th</sup> or 10<sup>th</sup> order
- > Why filter frequency components during Integration / Differentiation or not?
  - > → Integration of a velocity:
    - > With filtering enabled (no DC components), this calculation determines only the distance travelled from one data sample to the next one
    - > With filtering disabled (DC components included), this calculation determines the entire travelled distance as the determined distance from one data sample to the next is summed up



# OFFLINE MATH – ADDING CALCULATIONS TO THE DATA FILE

- ① Basic Math, Filters, Advanced Math and optional Calculations can be created offline
- ② Offline created channels are marked with a green *Stored* button
- ③ Any changes to a data file can be stored with the *Store* button

Add Channel

Search...

Basic Math

- Formula ☆
- Statistics ☆
- FFT ☆

Filters

- IIR Filters ☆
- FIR Filters ☆
- Frequency Tracking ☆

Advanced Math

- Cepstrum/Quefrency ☆
- Correlation ☆
- Rosette ☆
- Time Reference Curve ☆
- Percentile Measurement ☆
- Histogram ☆
- Frequency Measurement ☆
- Constant Percentage Bandwidth (CPB) Analysis ☆
- Array Statistics ☆

Optional Calculations

- Power Group ☆
- Order Analysis ☆
- Swept Sine Analysis ☆
- Psophometer ☆
- Sound Level ☆
- Modal Test ☆
- Tape Sensor ☆
- Shock Response Spectrum ☆
- Resolver ☆
- Matrix Sampler ☆

①

Channel

Color | Setup | Active | Stored

2 channels selected

LocalNode

Statistics 1

AI 1/1 Sim_RMS_1	AI 1/1 Sim Statistics	RM 5, 1s	⊕	5.6568534
AI 1/2 Sim_RMS_1	AI 1/2 Sim Statistics	RM 5, 1s	⊕	5.6568533

DEWE3-A4

TRION3-1820-MULTI-4-D

AI 1/1 Sim	AI 1/1	TRION3-1820-MULTI-4-D	⊕	-0.0000000
AI 1/2 Sim	AI 1/2	TRION3-1820-MULTI-4-D	⊕	0.0406598
AI 1/3 Sim	AI 1/3	TRION3-1820-MULTI-4-D	⊕	-1.9991999
AI 1/4 Sim	AI 1/4	TRION3-1820-MULTI-4-D	⊕	-0.3999999

②

PLAY SYNC 10:14:56 (UTC+2) 4/15/2020 RC

③

### Remarks:

- > Possibility to edit settings of software channels in \*.dmd-files. Function must be activated once after opening \*.dmd-file (④)
- > All existing channels and calculations created with + button can be edited if source channels are stored
- > It is also possible to edit the settings of hardware channels, but only the name and the unit.
- > Please keep in mind that the results of an offline calculated channel can differ from an online calculated channel, i.e. filters as they are oscillating at the beginning

④