

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
 - > Phase-locked statistics
- > Creating Filters
- > Offline Math



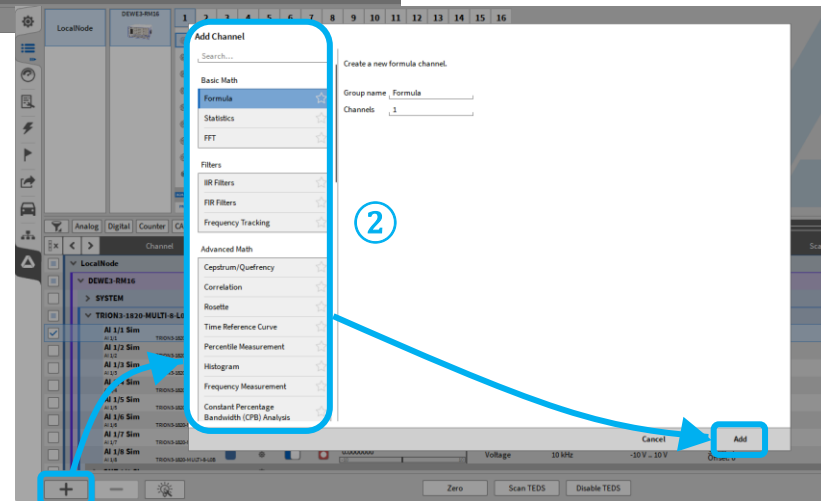
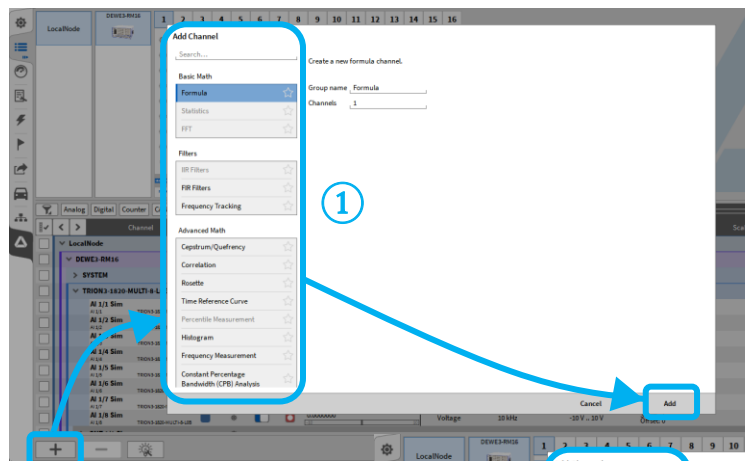
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ADD MATH CALCULATIONS TO THE MEASUREMENT SETUP

- 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

The screenshot illustrates the steps for creating a formula in the DEWETRON software. The top window shows the 'Add Channel' dialog with 'Formula' selected. The bottom window shows the 'Formula 0' editor with a list of channels on the left and a formula input field on the right. The 'Formula 0' editor also shows a numeric keypad and a preview section.

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



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SIMPLE EXAMPLES

① Multiplication of 2 signals

② Mean average of 3 signals

③ $2 \cdot \sin(2 \cdot \pi \cdot 1 \cdot \text{time})$

+chx/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 image displays three screenshots of the DEWETRON software interface, specifically the 'Formula' configuration window. Each screenshot shows a different mathematical operation being configured for a signal.

- Screenshot 1 (Top):** The 'Multiplication' operation is selected. The formula field contains $'AI\ 1/1\ Sim' * 'AI\ 1/2\ Sim'$. A circled '1' is next to the formula.
- Screenshot 2 (Middle):** The 'Mean Average' operation is selected. The formula field contains $('AI\ 1/1\ Sim' + 'AI\ 1/2\ Sim' + 'AI\ 1/3\ Sim') / 3$. A circled '2' is next to the formula.
- Screenshot 3 (Bottom):** The formula $2 \cdot \sin(2 \cdot \pi \cdot 1 \cdot \text{time})$ is entered in the top field. The bottom formula field contains $2 \cdot \sin(2 \cdot \pi \cdot 1 \cdot \text{time}) + 'AI\ 1/1\ Sim' * 0$. A circled '3' is next to the formula.

Arrows from the text 'Channels can have different sample rates, thus OXYGEN needs one time reference in each formula' point to the 'time' variable in the formulas of the middle and bottom screenshots.

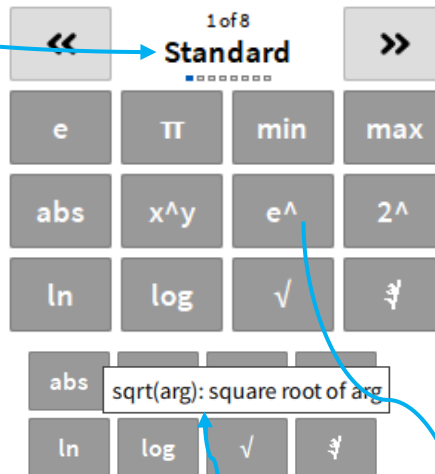


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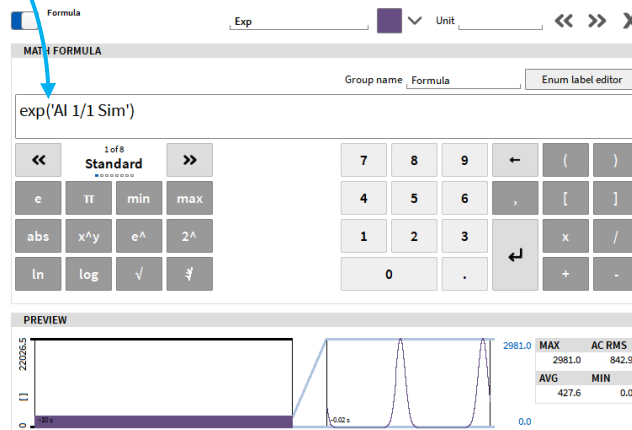
MATHEMATICAL OPERATIONS – STANDARD OPERATIONS

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



Tool tips pop up when the mouse remains on one operation

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^x	Exponential function with basis e	exp(x)
2^x	Exponential function with basis 2	exp2(x)
ln	Natural logarithm to basis e	ln(x)
log	Common logarithm to basis 10	log(x)
$\sqrt{}$	Square root	sqrt(x)
$\sqrt[3]{}$	Cube root	cbtr(x)



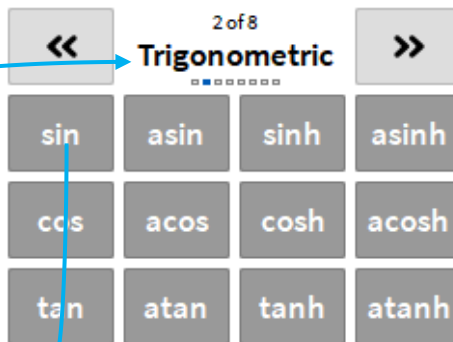


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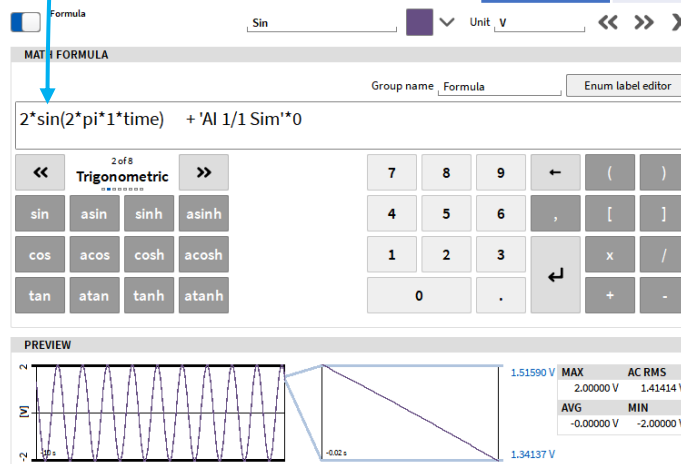
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MATHEMATICAL OPERATIONS – TRIGONOMETRIC

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



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)



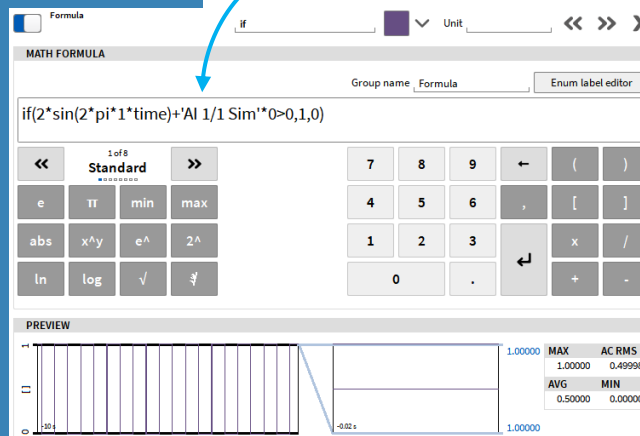
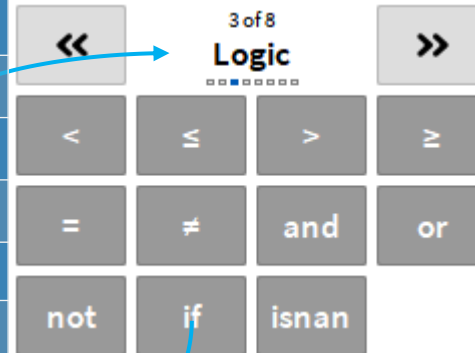


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MATHEMATICAL OPERATIONS – LOGIC

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



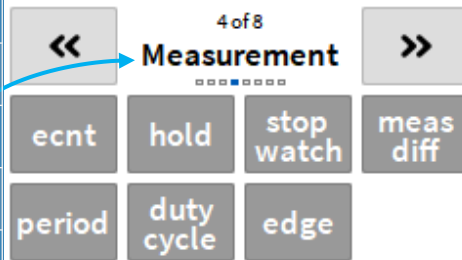
Function	Description	Syntax
<	If 'value1' is less than 'value2', the result is 1.0 else 0.0	value1 < value2
≤	If 'value1' is less than or equals 'value2', the result is 1.0 else 0.0	value1 ≤ value2
>	If 'value1' is greater than 'value2', the result is 1.0 else 0.0	value1 > value2
≥	If 'value 1' is greater 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)

MATHEMATICAL OPERATIONS – MEASUREMENT

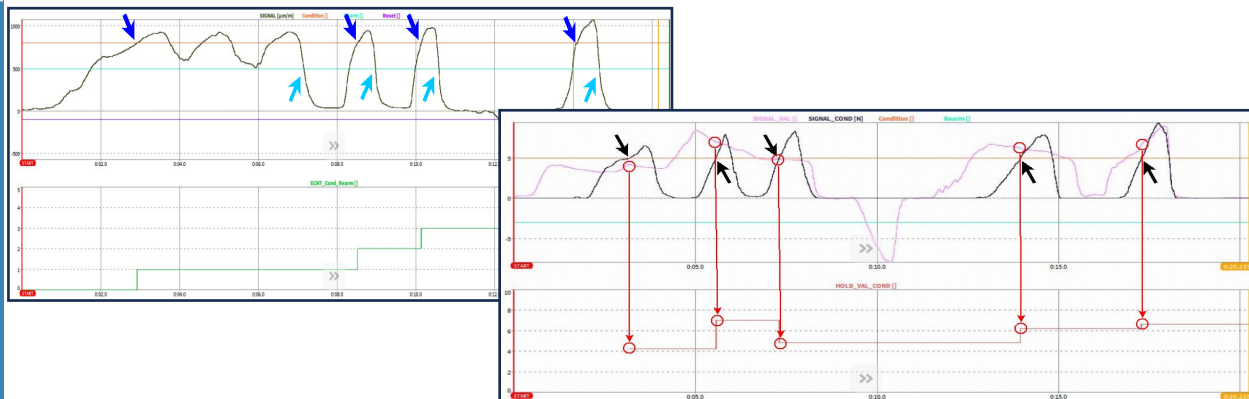


DEWETRON

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



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



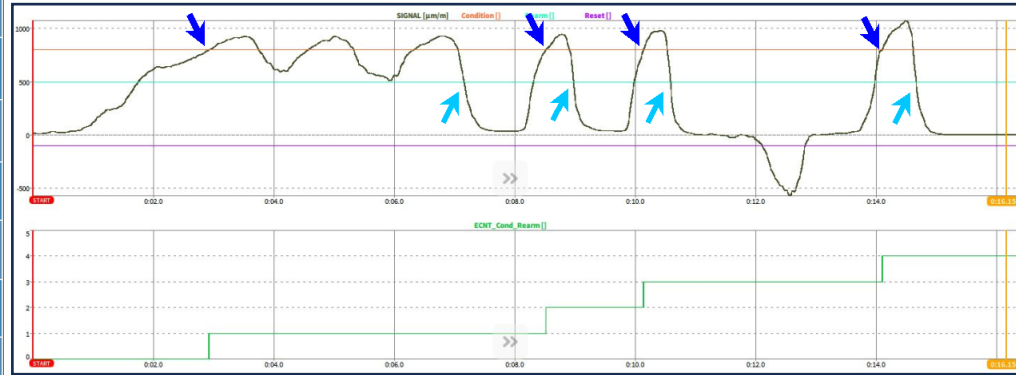
MATHEMATICAL OPERATIONS – MEASUREMENT



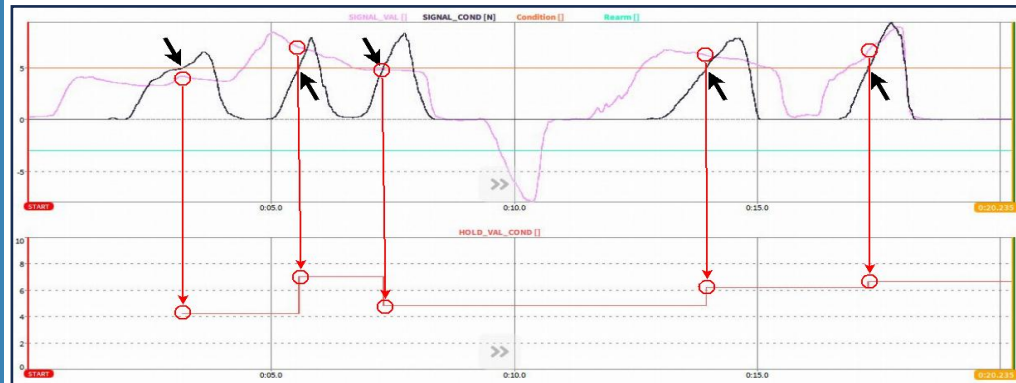
DEWETRON

- 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)
```



MATHEMATICAL OPERATIONS – ROLLING



DEWETRON

- 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 ⁸	Measure rolling overall minimum of a channel during a measurement with optional reset condition	rmin(value,reset)
rmax ⁸	Measure rolling overall maximum of a channel during a measurement with optional reset condition	rmax(value,reset)
ravg ⁸	Measure rolling overall average of a channel during a measurement with optional reset condition	ravg(value,reset)
rrms ⁸	Measure rolling overall RMS of a channel during a measurement with optional reset condition	rrms(value,reset)
rsum ⁸	Measure rolling overall sum of a channel during a measurement with optional reset condition	rsum(value,reset)
racrms ⁸	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 ⁸	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 ravg Unit

MATH FORMULA

Group name: Formula Enum label editor

ravg('AI 1/1 Sim',reset_signal>7)

1 of 8
Standard

« »

e π min max

abs x^y e^ 2^

ln log √ ∛

7 8 9 ← ()

4 5 6 , []

1 2 3 ↵ × /

0 . ↵ + -

PREVIEW

SI

7.7194 V MAX AC RMS

7.7194 V 3.3173 V

AVG MIN

3.1001 V -0.7556 V

-10 s

0.02 s

-0.7556 V

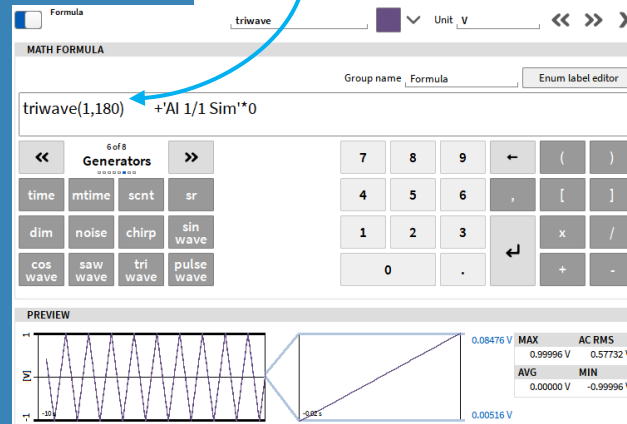
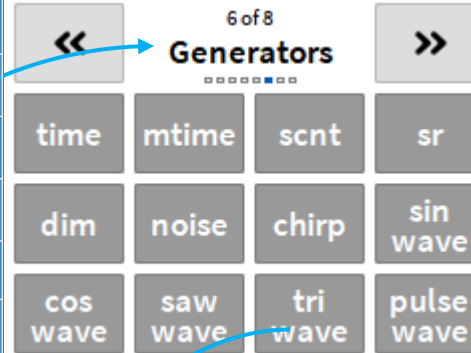


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MATHEMATICAL OPERATIONS – GENERATORS

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



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)

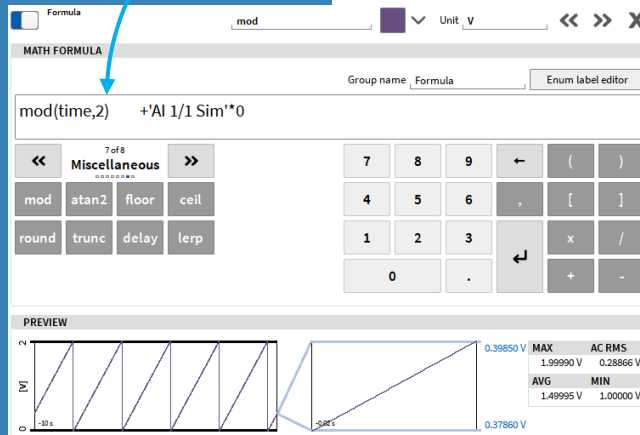
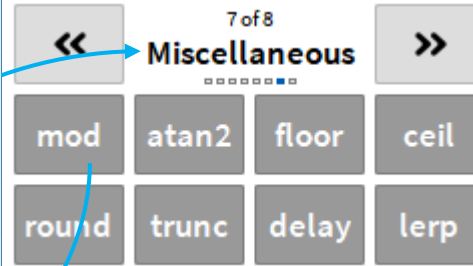
* A channel to which the function refers must be specified, i.e. in the following manner:
"Ref_Ch"*0+time



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MATHEMATICAL OPERATIONS – MISC

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



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)



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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 Scaling ③

Scaling 2-point Table

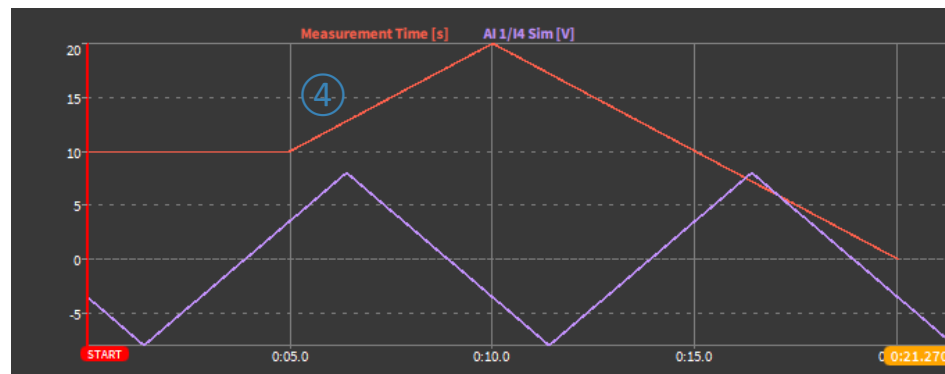
Unit V Copy Paste

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

AVG AC RMS

Cancel Ok

Table scaled Unit ②



MATHEMATICAL OPERATIONS – MEASUREMENT TIME



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- 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 the DEWETRON software interface. At the top, a timeline bar displays time intervals from 0:55 to 1:30. Below it, a large white box contains the text "Measurement Time: 1:30.236". To the right, the "Properties" panel is open, showing the "Text" instrument settings. The "TEXT" section displays the text "Measurement Time: #[Measurement Time]". The "FORMAT" section includes options for Size (Auto), Color, and checkboxes for "Allow advanced formatting", "Bold", and "Italic". The "SYSTEM DATA" section lists "Time", "Date", "Measurement Time" (circled with a blue '1'), "Measurement Start", and "Measurement Stop". The "STYLE" section has a checked checkbox for "Transparent background". A blue arrow points from the "Measurement Time" property in the SYSTEM DATA section to the text box on the screen.

ARRAY MATH FORMULAS



DEWETRON

	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

②

①

MATH FORMULA

Group name

Formula

Enum label editor

$10^{**}U1_hRMS@3\ Phase\ Motor'/'I1_hRMS@3\ Phase\ Motor'$

<<

1 of 8

>>

Standard

e

π

min

max

abs

x^y

e^x

2^x

ln

log

$\sqrt{\quad}$

$\frac{\Box}{\Box}$

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PREVIEW

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0

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8

12

16

20

24

28

32

36

40

44

48

ARRAY MATH FORMULAS



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Possibility to use

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

10*log('U1_hRMS@POWER_1PH'/1)

1 of 8
Standard

<<	Standard	>>	③
e	π	min	max
abs	x^y	e^	2^
ln	log	√	1/x

'U1_hRMS@POWER_1PH'/'I1_hRMS@POWER_1PH'
*cos('I1_hPHI@POWER_1PH')

2 of 8
Trigonometric

<<	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

<<	Logic	>>	⑤
<	≠	>	≥
=	≠	and	or
not	if	isnan	

ARRAY MATH FORMULAS

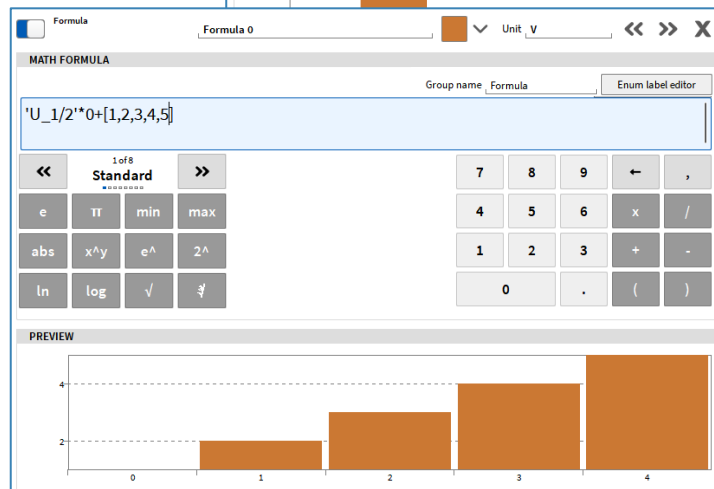
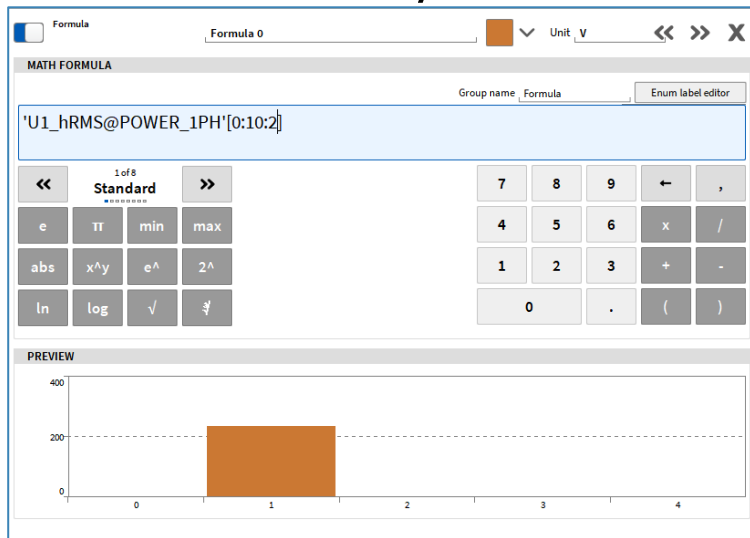
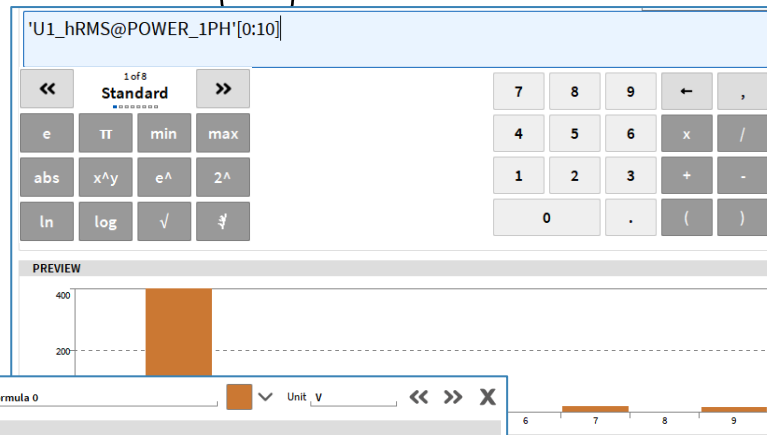


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- > Extraction of adjacent elements into a new array in C++ / Python syntax (⑥)
 - > First element of array is always 0!
 - > Optional step size definition (⑦)
- > Creation of arrays with constants (⑧)

1st Inclusive

Last Exclusive



CREATING STATISTICS



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- 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 illustrates the process of creating statistics channels in the DEWETRON software. The main window shows a list of channels on the left, with 'Statistics 1' highlighted. The 'Add Channel - Statistics' dialog is open, showing a grid of calculation options (AVG, MAX, MIN, RMS, ACRMS, Peak-Peak, SUM, MIN Time, MAX Time, COUNT, Variance, CV, Peak, Crest) and settings for calculation type, window size, and group name. The 'Add' button is highlighted. Below the dialog, the 'Statistics Channel Options' for 'AI 1/1 Sim_MIN' are shown, including settings for reference channel, group name, statistics mode, and calculation type. The 'PREVIEW' section at the bottom shows a graph of the calculated statistics over time.



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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

$$\begin{aligned}
 AVG &= \frac{1}{N} \sum_{i=1}^N SignalLevel_i & ACRMS &= \sqrt{\frac{1}{N} \sum_{i=1}^N (SignalLevel_i - AVG)^2} \\
 MIN &= MIN\{SignalLevel_i\} \\
 MAX &= MAX\{SignalLevel_i\} & RMS &= \sqrt{\frac{1}{N} \sum_{i=1}^N (SignalLevel_i)^2} = \sqrt{AVG^2 + ACRMS^2}
 \end{aligned}$$

$i = 1 \dots N$
 $N = \text{Sample Rate of Input Channel} * \text{Window Size}$

rmin	Measure rolling overall minimum of a channel during a measurement with optional reset condition	rmin(value,reset)
rmax	Measure rolling overall maximum of a channel during a measurement with optional reset condition	rmax(value,reset)
ravg	Measure rolling overall average of a channel during a measurement with optional reset condition	ravg(value,reset)
rrms	Measure rolling overall RMS of a channel during a measurement with optional reset condition	rrms(value,reset)
rsum	Measure rolling overall sum of a channel during a measurement with optional reset condition	rsum(value,reset)
racrms	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	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)



DEWETRON

- > **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)



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> Overlapping Window size

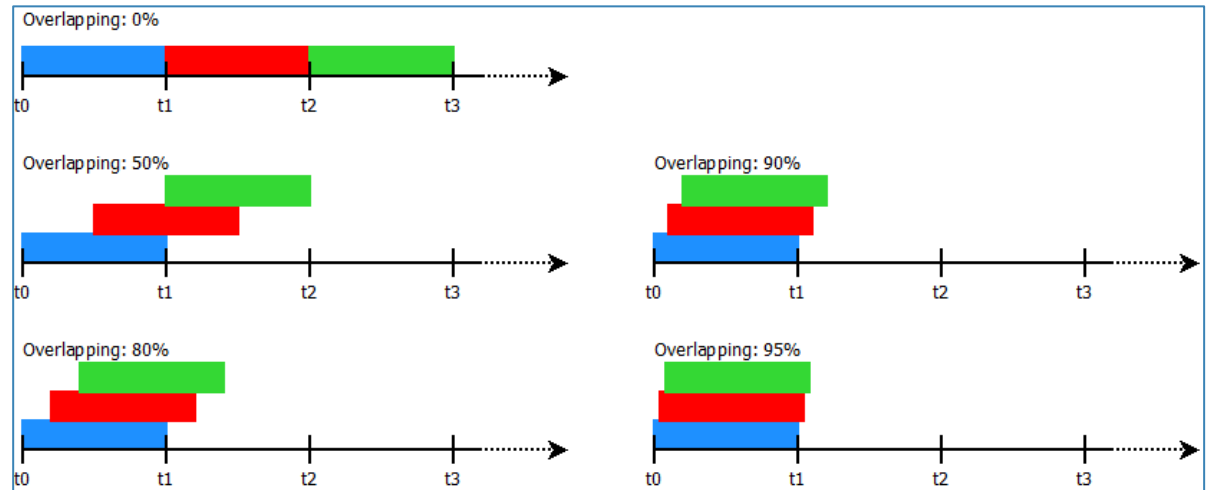
- > 0 % (behaviour until now)
- > 50 %
- > 75 %
- > 80 %
- > 90 %
- > 95 %

Calculation type

Window size s

Group name

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



OVERALL STATISTICS (AVAILABLE SINCE R6.1)



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- > 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)

- > 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/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: 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

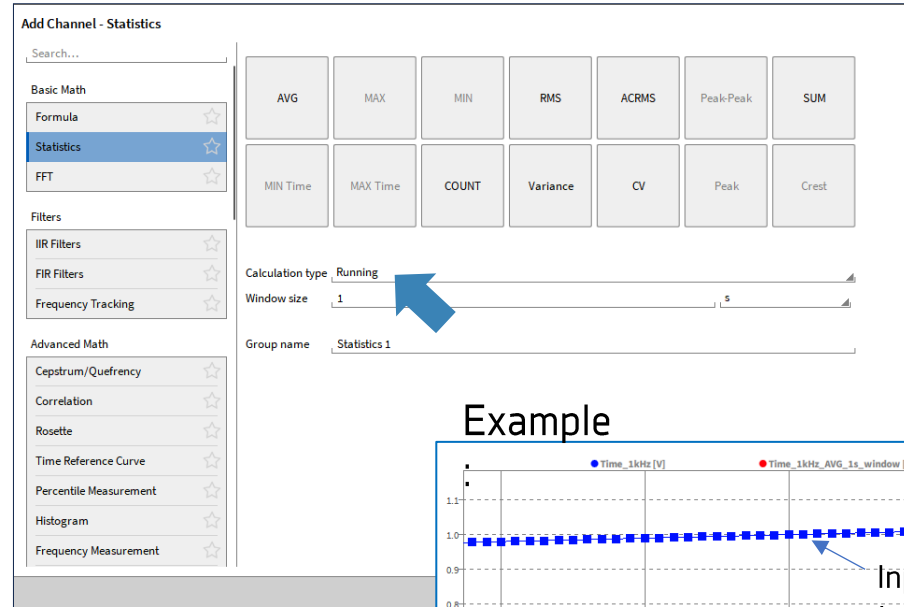
RUNNING STATISTICS (AVAILABLE SINCE R6.2)



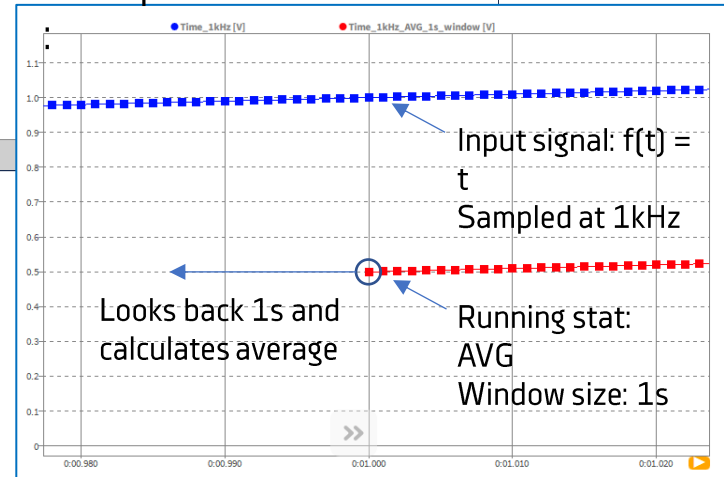
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- > Inherits sample rate of input channel
- > Looks back the window size on each new sample
- > Calculates statistic for this „look back“-window



Example

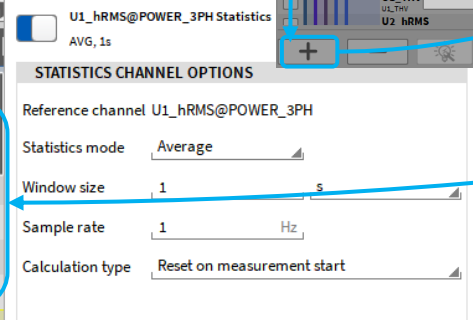
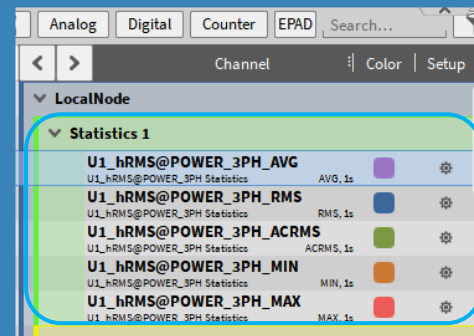
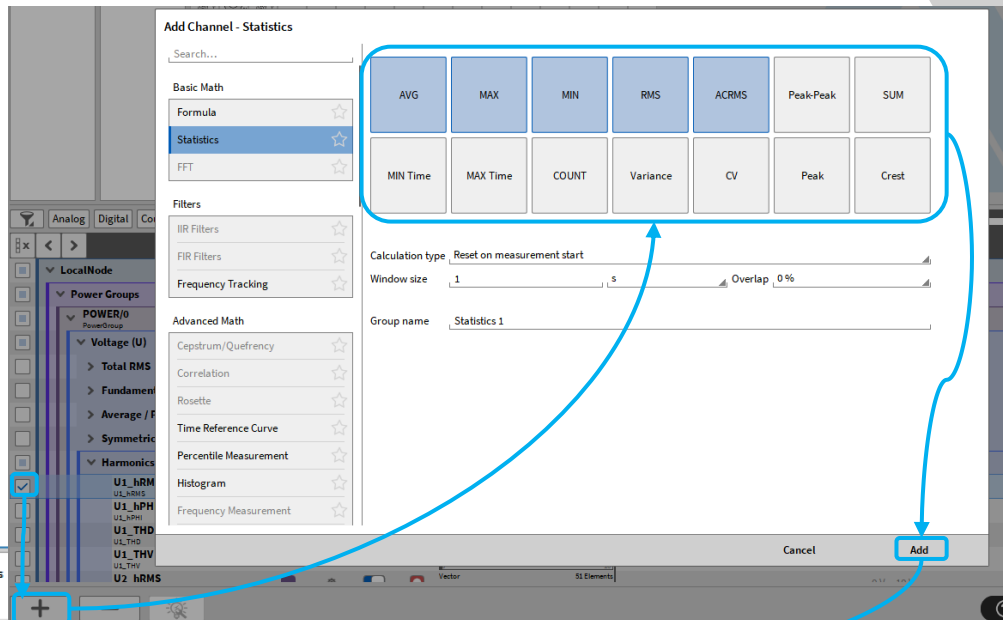




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ARRAY MATH STATISTICS

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



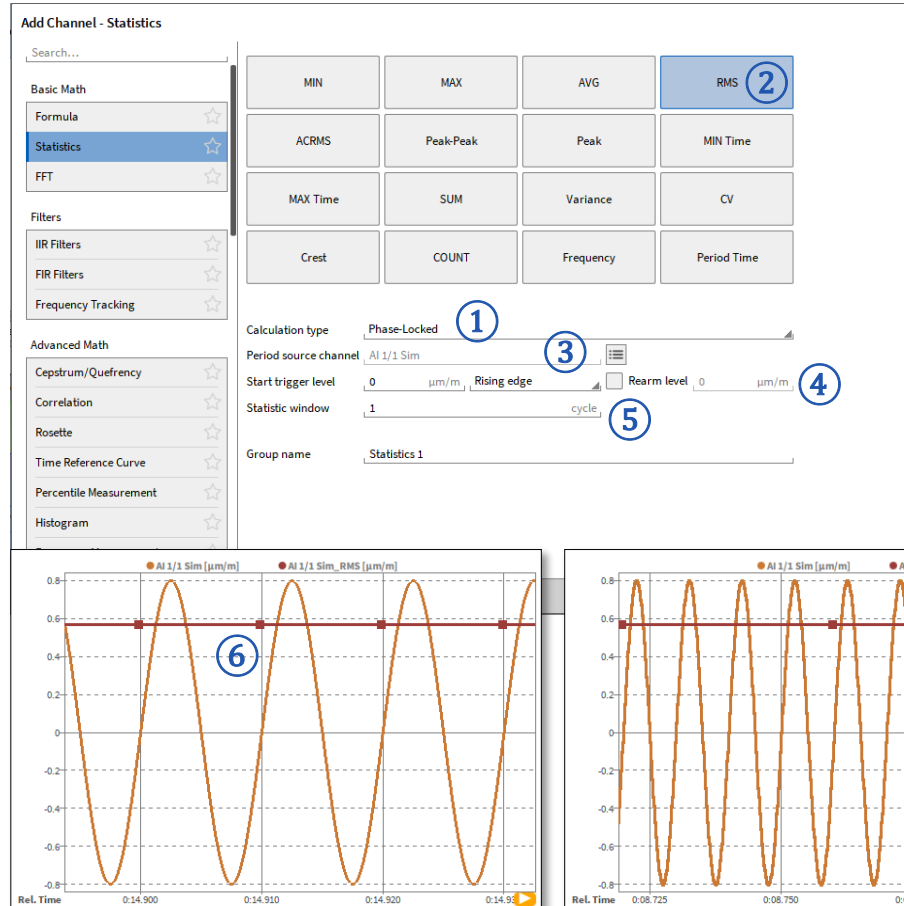
Phase-Locked Statistics



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- 1 Phase-Locked Calculation type allows to calculate statistics quantities for one or multiple periods of a signal
- 2 Select a statistics calculation e.g. RMS
- 3 The period source channel is the same as the initial selected channel by default, this means the period is detected by AI 1/1 Sim and the RMS is also Calculated for AI 1/1 Sim
- 4 The period detection can be set like for the triggered calculation type
- 5 The window for, in this case, RMS calculation is set to 1 cycle.
- 6 RMS every cycle (statistics window = 1)
- 7 RMS every 4 cycles (statistics window = 4)





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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

CREATING FIR-FILTERS



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- 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 screenshot illustrates the steps for creating FIR filters in the DEWETRON software:

- Step 1:** In the 'Add Channel - FIR Filters' dialog, the 'FIR Filters' option is selected in the 'Filters' list.
- Step 2:** The 'Creates a multi-stage FIR filter' section shows settings for 'Low pass' filter type, 'Filter frequency' of 2500 Hz, 'Window' of Kaiser, and 'Filter length' of 31.
- Step 3:** The 'Add' button is pressed to create the filter channels.
- Step 4:** The 'FIR Filter Channels' panel shows the newly created channels, such as 'AI 1/I1 Sim_filtered'.
- Step 5:** The 'FIR FILTER OPTIONS' panel allows for further configuration of the filter, including 'Filter type' (Lowpass), 'Filter length' (31), 'Window' (Kaiser), and 'Filter delay' (0.0015 s).
- Step 6:** The 'INPUT CHANNELS' panel shows the list of channels, including the filtered channels, which can be added or deselected.

A frequency response graph is displayed at the bottom, showing the filter's performance across a range of frequencies from 0 Hz to 1000 Hz.

FILTER SETTINGS



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Available Filters:

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

- > Lowpass & Highpass:
 - > $f_{C\max} = \frac{f_s}{2} - 50\text{ Hz}$
 - > Bessel, Butterworth, Chebyshev I and Chebyshev II characteristic
 - > 2nd, 4th, 6th, 8th or 10th order
- > Bandpass & Bandstop
 - > $f_l = 0 \dots f_h - 1\text{ Hz}$
 - > $f_h = f_l + 1\text{ Hz} \dots \frac{f_s}{2} - 50\text{ Hz}$
 - > Bessel, Butterworth, Chebyshev I and Chebyshev II characteristic
 - > 2nd, 4th, 6th, 8th or 10th order
- > Integrator & Differentiator
 - > Single or Double Integration/Differentiation
 - > Enable low (Integrator) or high (Differentiator) frequency component filtering
 - > $f_{C\max} = \frac{f_s}{2} - 50\text{ Hz}$
 - > Bessel or Butterworth characteristic
 - > 2nd, 4th, 6th, 8th or 10th 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



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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

