ARTEMES

measurement competence centre
www.artemes.org

ARTEMES Software

Table of Contents

1 Introduction

ARTEMES POWER is a web-based software for data recording and includes some strong toolboxes for calculations in the field of power measurement, power quality, power fault analysis, phasor measurement and power efficiency.

It's currently **version 3**.

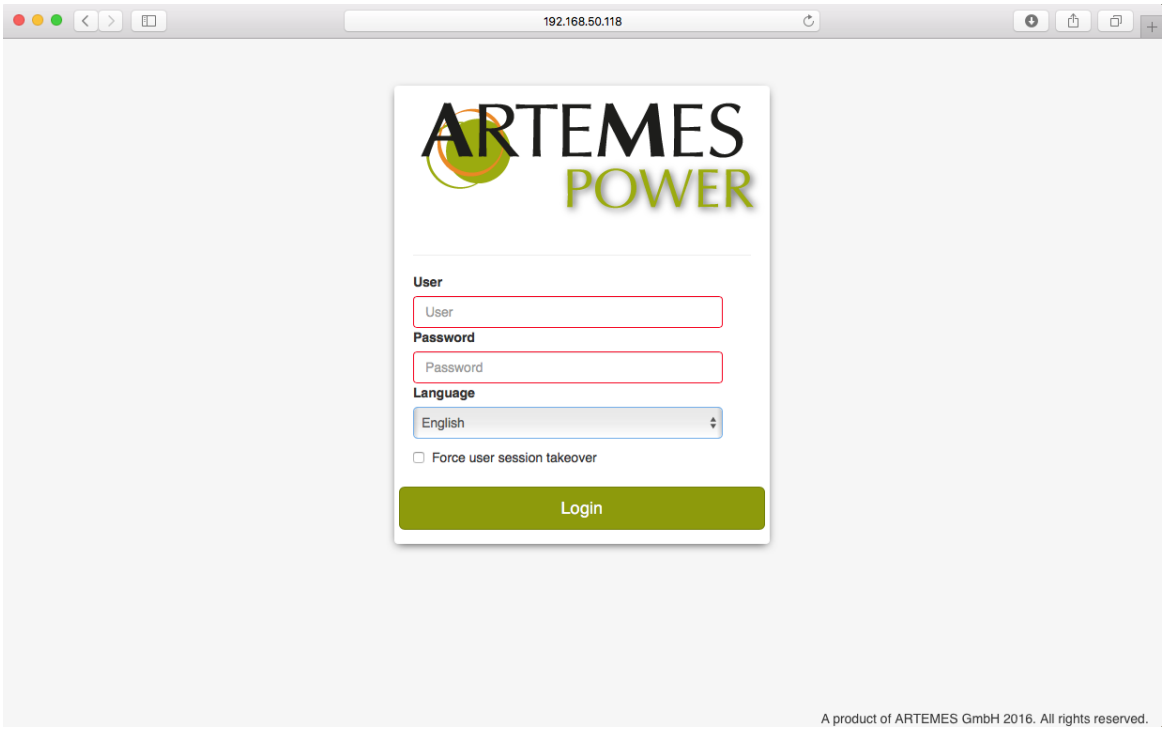
The basic architecture contains a windows service task which is the measurement kernel. Due to its operation in the background it obtains its unique stability and performance.
Above this, kernel is the web interface which communicates directly with the web browser using web sockets - the state of the art technology for really quick data communication. With the help of this technology the system is able to transfer even scope data on time to the clients' devices. Client devices can be any browser based instruments such as a computer and notebook, tablet or smartphone.

2 How to start

To run the programme you need NO additional software. Just start your web browser and type in the IP address of the instrument or data server to which you want to connect to.

Example: 192.168.50.118

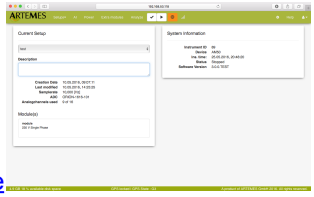
You will get a log on screen as the following:

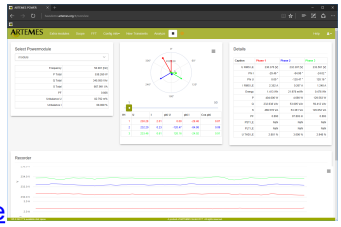


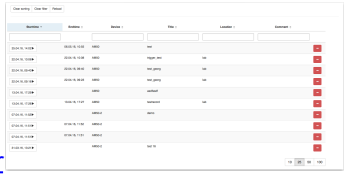
After filling in the user name and password you get the start screen of the instrument or server.

"Force user session takeover" ... in the case that two users with the same name are logging on at the same time you can kill the other session. Otherwise you do not have writing but only reading permission.

Possible start screens:

Measurement instrument in setup mode 

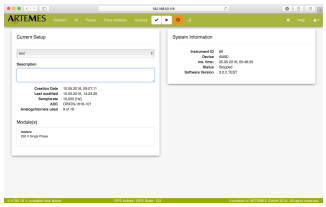
Measurement instrument in running mode 

Server 

3 Measurement instrument

After logging on to the measurement instrument the home screen appears.

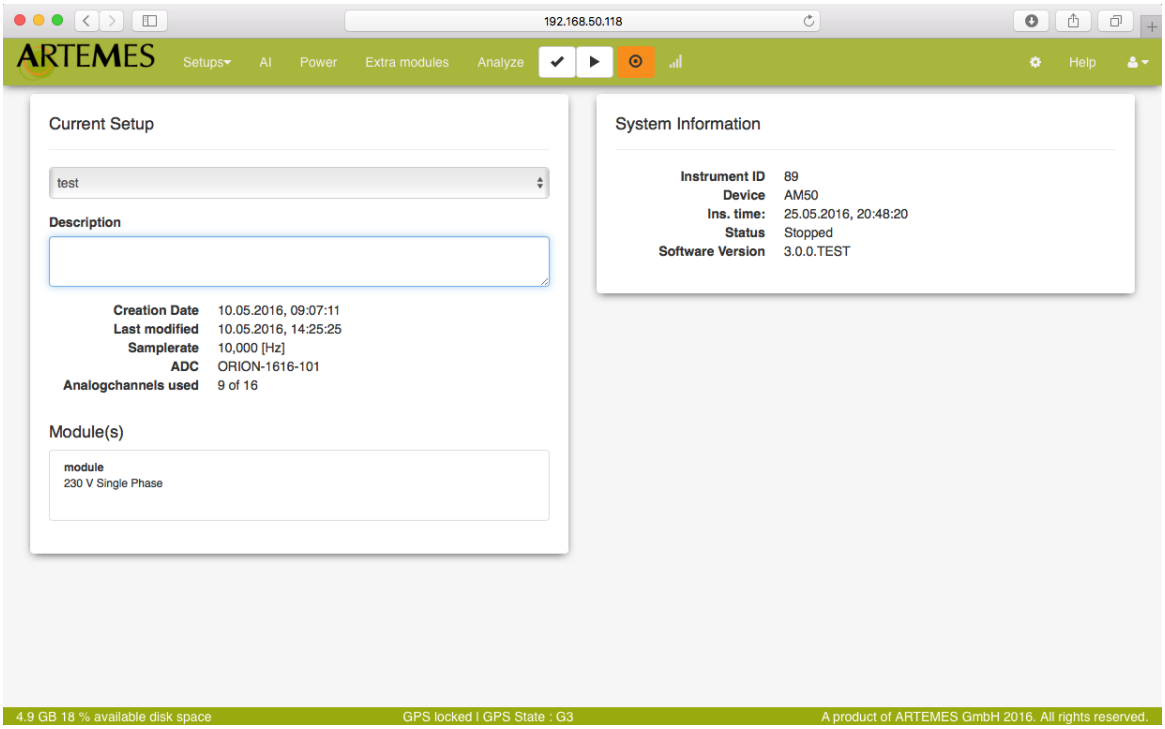
The home screen can be either the setup mode or the measurement mode.

Setup mode 

Measurement mode 

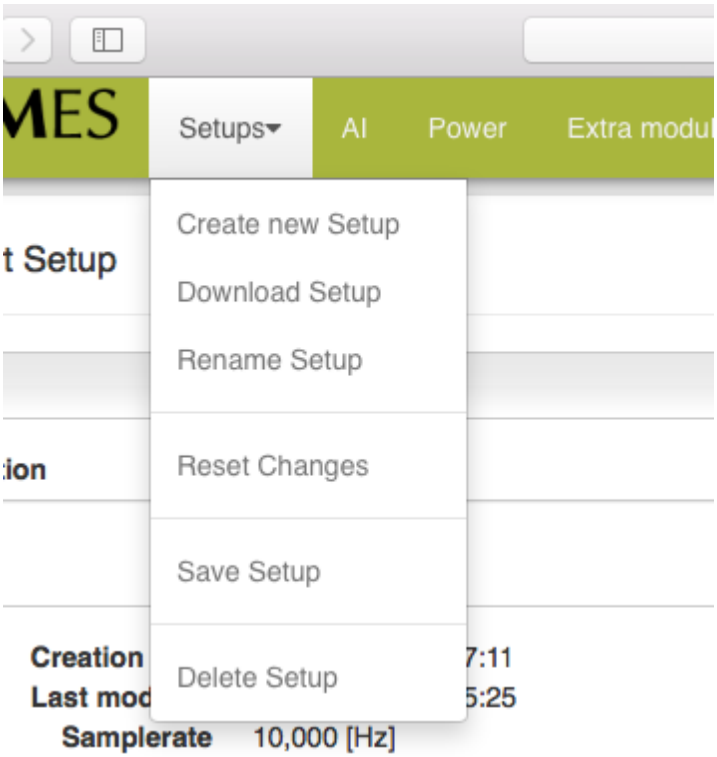
3.1 Setup a measurement

In the setup mode the first screen looks the following:



On the left side you see:
Current setup... the selected setup - in our example it is "test"

If the list is empty create a new one by using the menu **Setups - > Create new Setup**



Other actions:
Download the setup to a local drive
Rename a setup
Reset changes (reloads the last stored Version)

Saves the current settings - same as 
Delete setup

Other menu topics:
AI...to set up the analogue input channels
Power...to set up power modules
Extra Module...to define additional modules (groups of measurement channels)
Analyze...to start data processing - either during setup up or even during the running measurement task

 **...to start the measurement (without storing)**

 **...to start storing (red blinking button indicates, that storing has already been started)**

 **...???**

 **...system settings**

Help...open this help

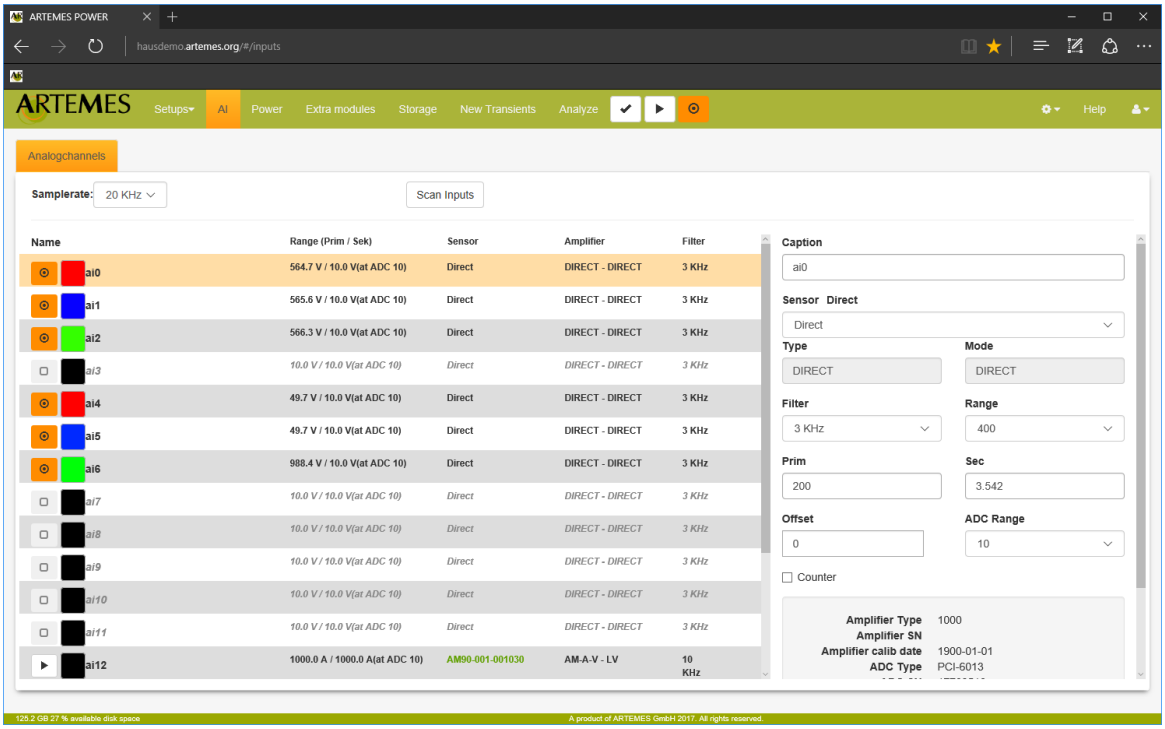
...log out

3.1.1 Input Channels

All means all Input channels-

You can choose from different pages now like:

Analogue Inputs
CAN Inputs (Option)
Others (if available - depending on hardw are)

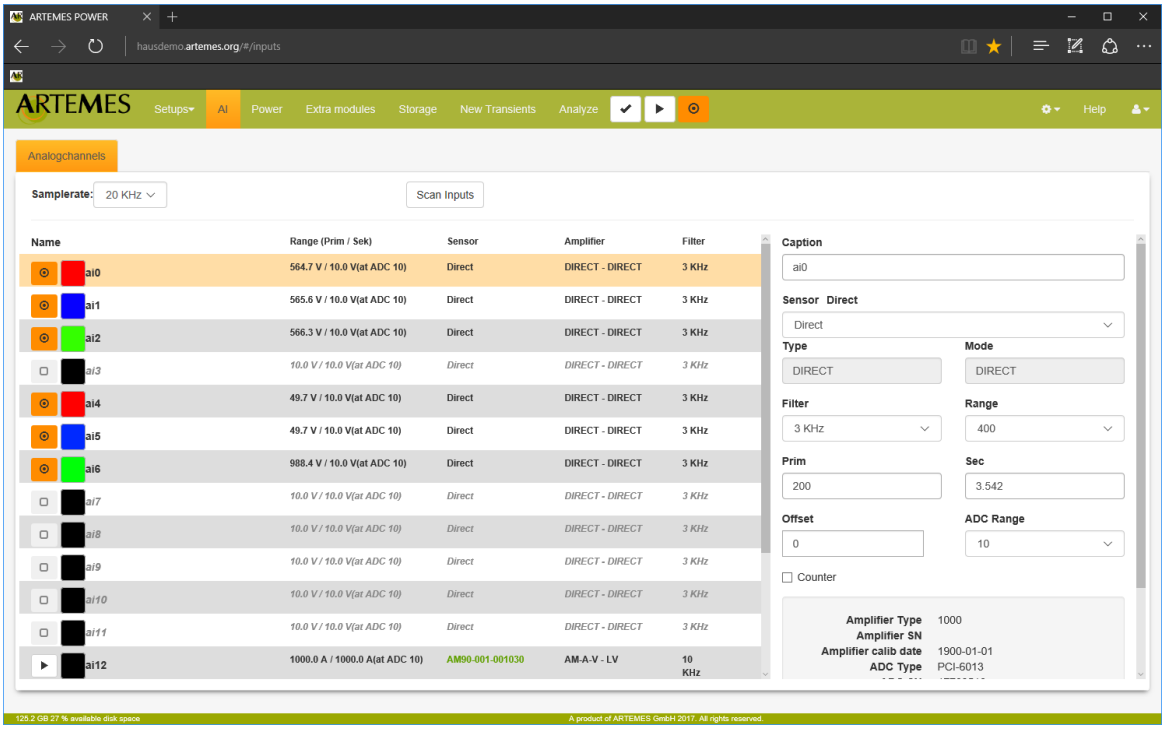


3.1.1.1 Analogue Channel Setup

The list of analogue channels shows all analogue input channels - independent from their physical value or size.

Depending on the instrument type this list can be very short (example 4 channels of AM10-CLOG) or very large (example: AM50-128 channel systems)

If the hardware has changed or the setup comes from a different instrument then wrong channels are indicated in orange.



Sample rate...the common sample rate of the analogue channels (can be limited for each channel individually by setting sample rate divider in the channel setup itself)
The suggested values are depending on the used hardware (for example 100 Hz for CLOG, 2 MHz for AM10-PA2)

Scan inputs...to scan all inputs for the connected sensor (If the connected sensor supports our TEDS interface it will be detected automatically and the input is set according to the sensor)

 ...to activate/deactivate the channel

 ...channel is active and gets stored

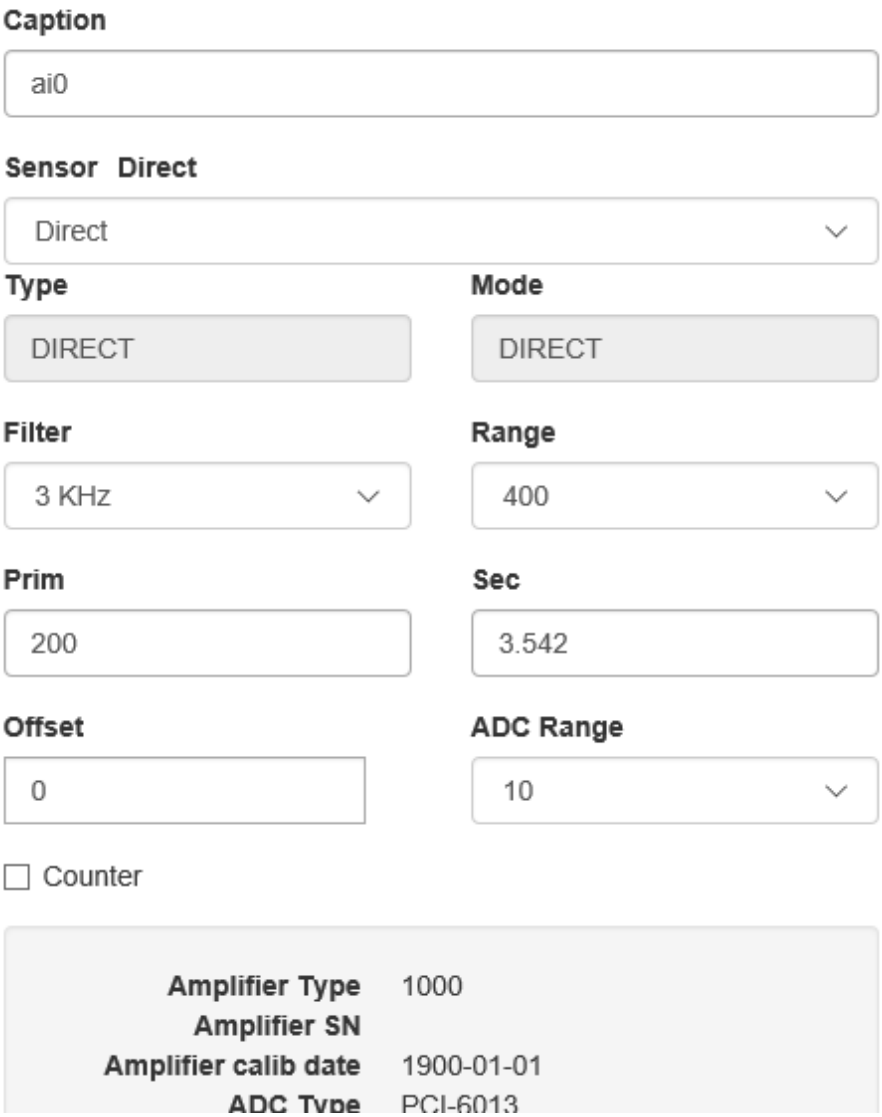
 ...channel is active but not stored (only to show the value or to use in MATH)

 ...channel is not used

 ...Color selection with the color tool
Here you can just choose a color for the channel by selecting with the mouse or other pointing

device in use.

Setup...to set up the channel just select the line and the properties will be shown on the right side:



caption...name of channel

sensor...select the sensor or the sensor is indicated when a TEDS is used
type...hardware input type (for example ARTEMES AM-A-V, Direct,...)
Mode...hardware Setting (for example HV, LV, Lemo, Direct,...)
Filter...the used filter (if used), depending on the hardware this field can be empty
Range...the maximum range value (ranges depend on the Hardware)
Prim...If a transducer is connected to the instrument you can set here the primary value (for example 10 kV).
Sec...If a transducer is connected to the instrument you can set here the secondary value (for example 100 V).
Offset....If a transducer with offset is connected to the instrument you can set here the offset value.
ADC Range...the internal ADC range for fine tuning

Counter...if you want to use a analogue channel as a counter then activate this box. Then the channel counts analogue pulses on the input and gives this value as result (application example: energy meter monitoring)
In this case additional setup boxes come up:

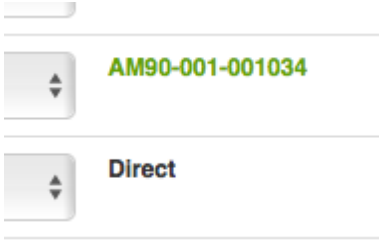
Falling Edge..when the counter shall grow on falling edge (active) or rising edge (inactive) of the signal
Threshold Value...the value of the signal where the counter increases the value
Factor... the meter constant (for example 1000 pulses per kWh)

3.1.1.1.1 TEDS

TEDS = Transducer Electronic Data Sheet

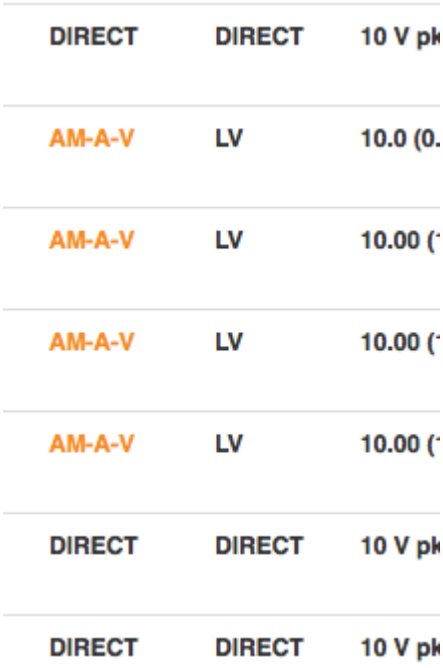
Most of the ARTEMES sensors have a TEDS inside. They are automatically recognised after pressing "**SCAN Inputs**".

The sensors are then shown in green with their serial number and the mode turns to the right value.

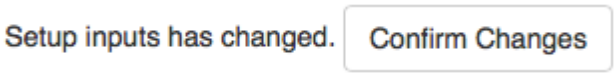


3.1.1.1.2 Hardware has changed

If the hardware changed after the last time the setup had been used or if the setup comes from an other instrument then different hardware channels are indicated in orange.



This is also indicated on the top menu bar and the "**Confirm Changes**" button must be pressed.



After pressing this button the changes are accepted and the channels turn into black.

3.1.1.2 CAN Channels

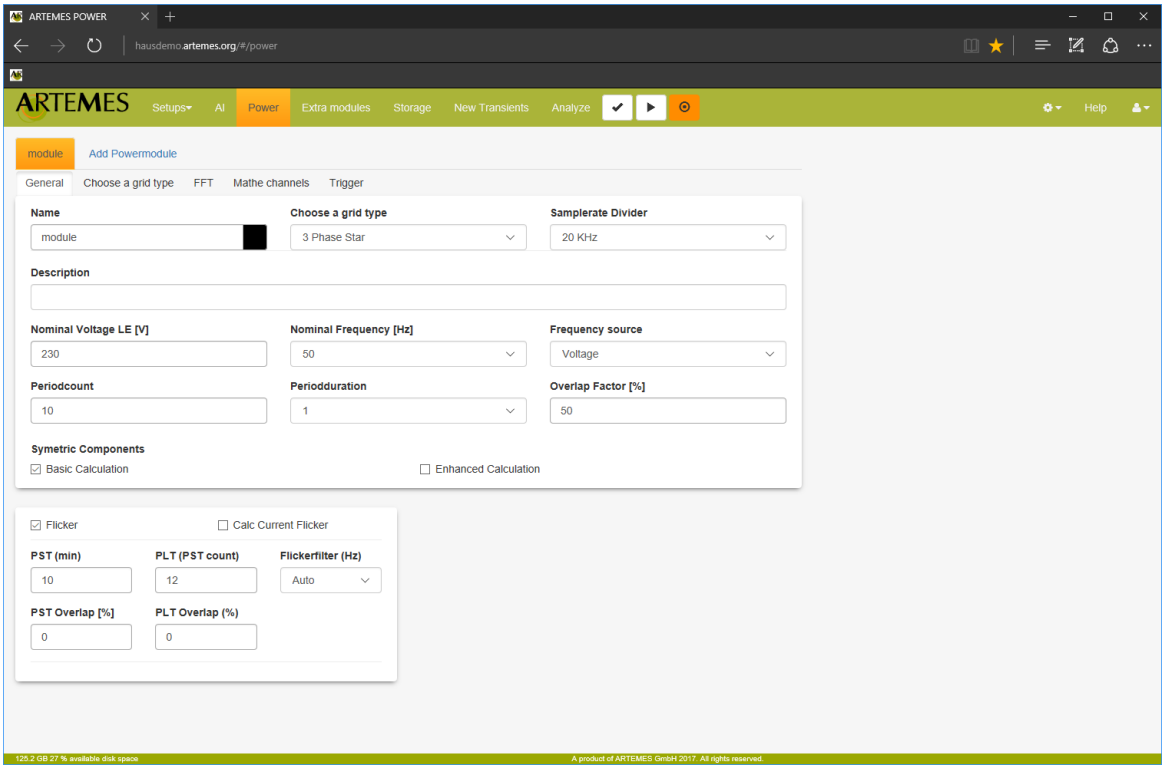
to be added

3.1.2 Power Module Setup

The power module setup starts with the following screen, where you can easily add or remove the power modules.

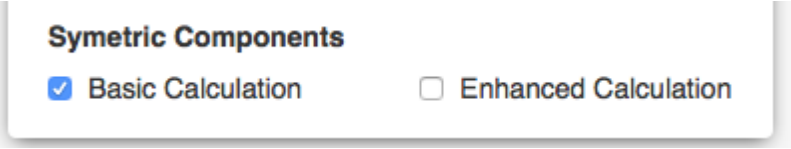
One power module is like a virtual power meter that can do power measurement, power quality, phasor measurement (option), frequency analysis and fault recording at the same time.

You can define several modules with different wiring schematics and even different frequencies. Input channels can be used more times, so that you can define for example more power modules with the same voltages and different currents for multi-channel power analysis.



Name.... name of the module as it is seen later on the online screens or in data analysis.
Choose a grid Type...to choose the Grid Type directly
Sample rate Divider...If calculation for the power module must not be done for the full recording rate, this value can be set. Example: Raw data recording is 1 MHz, but the power or harmonics are just needed up to 10 kHz, then set the divider to 100. It saves calculation power and memory space.
Description...individual text
Nominal voltage...the nominal voltage of the system. It is used for the fault recorder, where you can define relative limits to nominal voltage. Also some reports use this value like harmonics analysis.
Normally it is **LE** what means line to earth voltage (phase voltage). For delta applications or when you calculate line values from phase values (calculate ULL) then **LL** is indicated and the nominal line voltage must be defined.
Nominal Frequency.... the nominal Frequency of the system. THis value sis also used for relative limit calculations and for setting the flicker filter.
Frequency Source...normally the voltage is the source for frequency calculation. In some cases (PWM) the source might be set to current.
Period count...the number of periods used for harmonics calculation (default, as defined by IEC 61000-4-7, it is 10)
Period duration...the duration for the calculation of period values (normally 1).
Overlap Factor...the overlapping of the period values in %.
Example 1: If you want to have half period values then set period duration to 1/2 and overlapping to 0%
Example 2: If you want to have period values which are recalculated each half period then set period duration to 1 and overlapping to 50%
Example 3: If you want to have pure period values then set period duration to 1 and overlapping to 0%

Symmetric components:

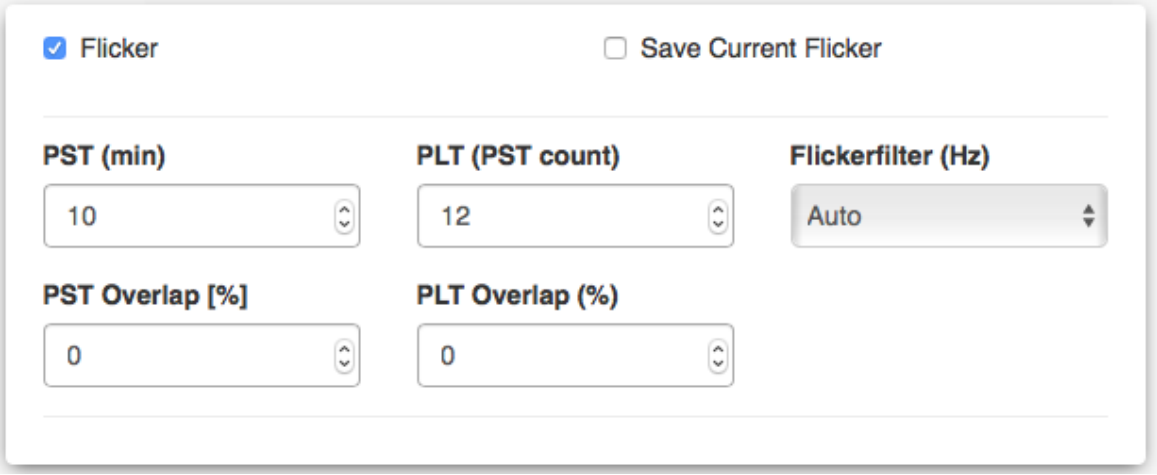


Basic calculation...enables the calculation according to IEC 61000-4-30 based on 10 period values (or what ever is set up in period count).

Enhanced calculation...enables the calculation according to IEC 61400-21 based on period values.

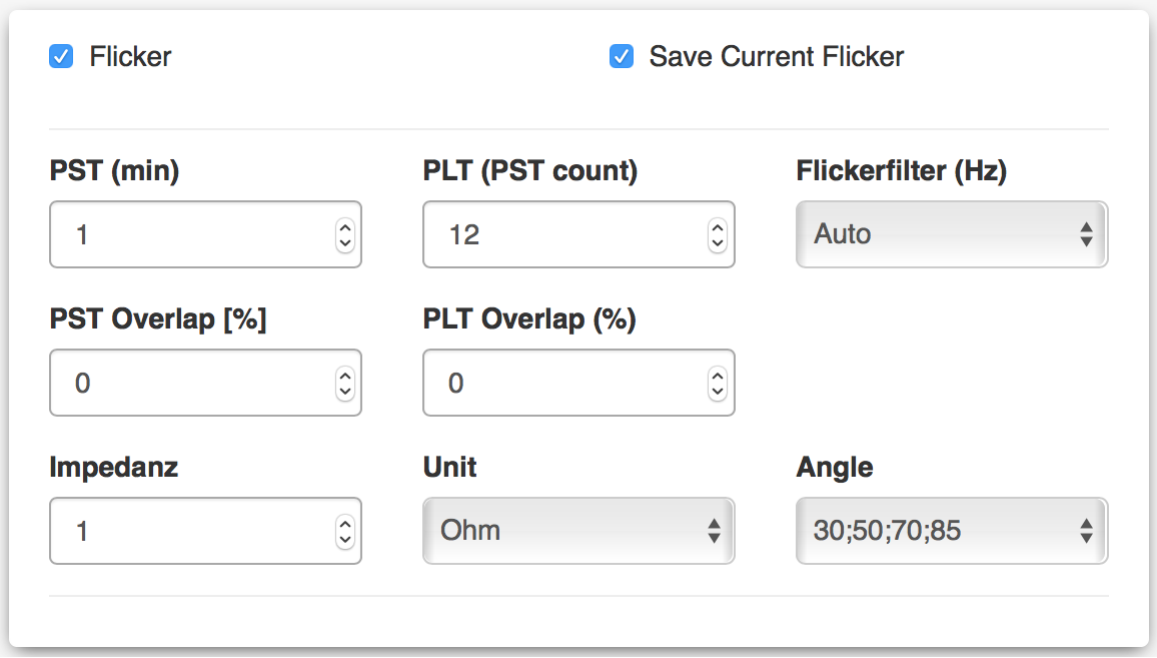
Flicker:

The flicker calculation according to IEC 61000-4-15 can be done by using this toolbox.
In addition the current flicker (or flicker emission) can be calculated according to IEC 61400-21.



Flicker...enables the voltage flicker calculation
PST (min)...the PST time - normally 10 minutes, but can be changed
PLT (PST count)...PLT count - normally 12 PST values
Flickerfilter...values
PST Overlap...If you want to have a sliding flicker PST value, then define the overlapping factor here. For example 50% means: to calculations of PST happens all 5 minutes for a 10 minute window.
PLT Overlap...If you want to have a sliding flicker PLT value, then define the overlapping factor here. For example 50% means: to calculations of PLT happens all 6 PST values for a 12 value window.

Save current Flicker...enables the current Flicker calculation (see IEC 61400-21)



Impedance...the grid impedance where the flicker emission shall be calculated. If the unit is VA then fill in the short circuit power.
Unit...Ohm for impedance or VA for short circuit power
Angle...the grid angle to be calculated - 30,50,70 or 85 degree. Can also be 4 values at the same time.

Other TABS:

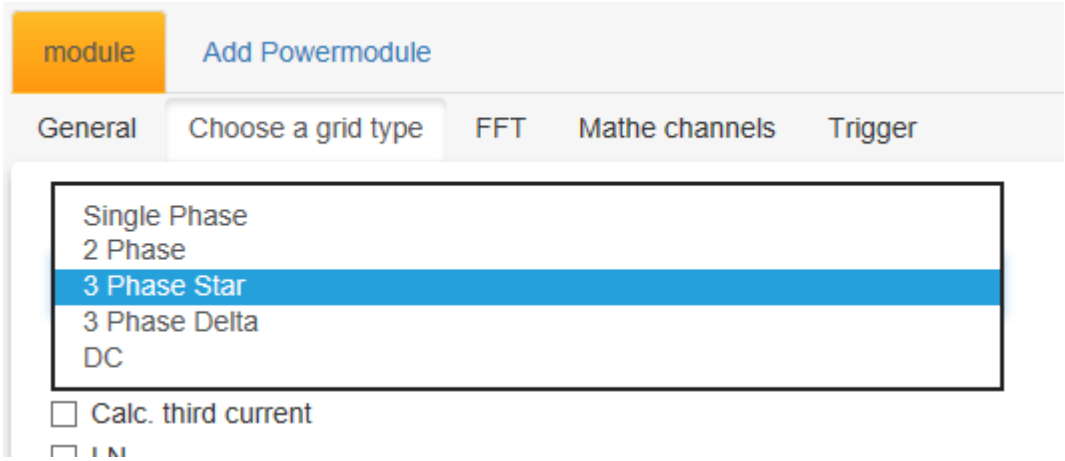
Choose a grid type
FFT
Flicker
Mathe Channels
Trigger / Fault recorder
PMU / Phasor Measurement

3.1.2.1 Grid Type

The grid type is the wiring schematic and can be, depending on the individual application, different.

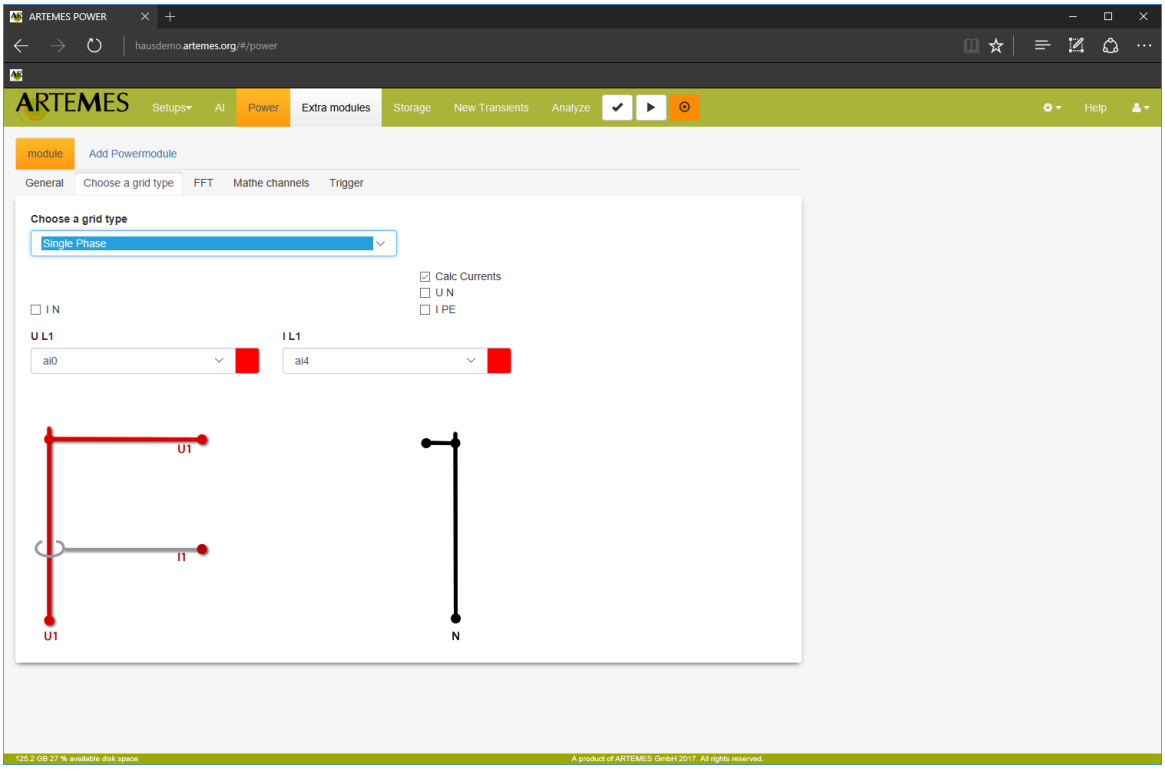
The main types are:
Single Phase
2 Phase
3 Phase Star
3 Phase Delta
DC

To modify your schematics to 5-wire (Neutral Line and PE) or Aron (V-Connection) you can individually set additional Values



3.1.2.1.1 Single Phase

The single-phase connection is used for example for equipment testing or single phase loads in distribution panels.



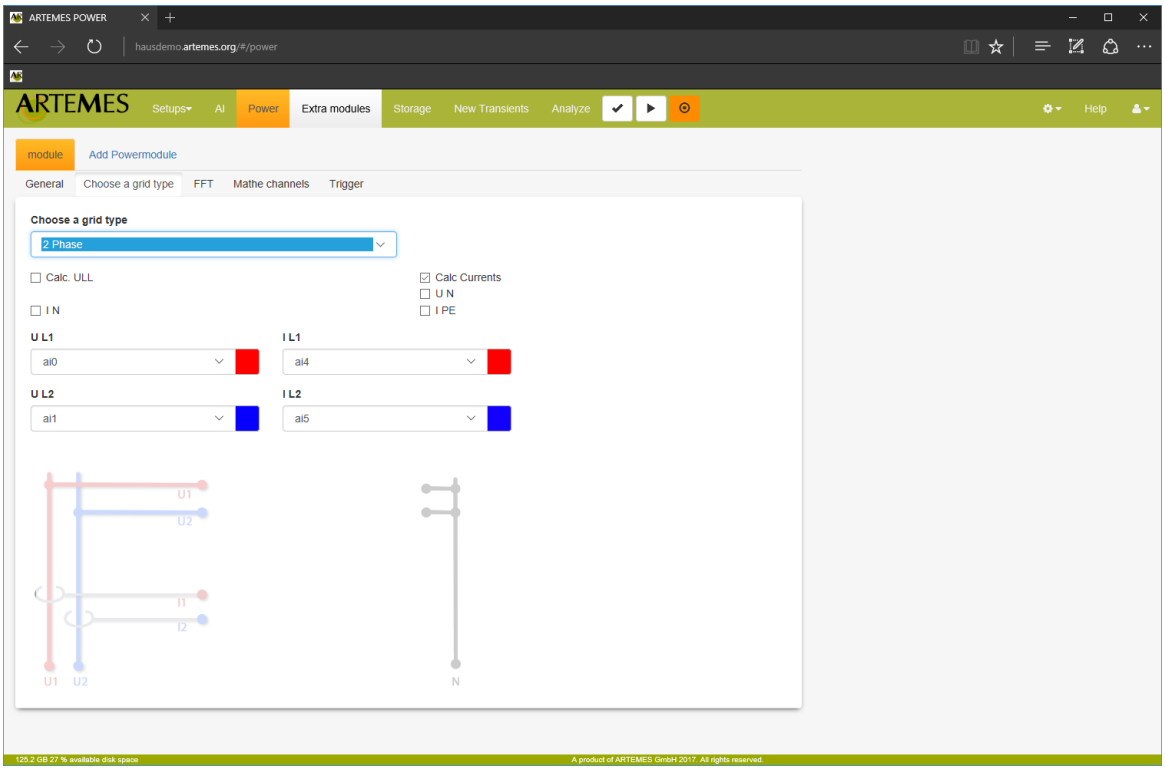
U L1.. the voltage channel
I L1..the current channel

In addition you can also define:
U N
I N
I PE

Or you can measure only the voltage by removing the current channel (disable **Save Current**).

3.1.2.1.2 2 Phase

2-phase systems are used to transfer single-phase energy on HV Lines. Typically railways are using this possibility.



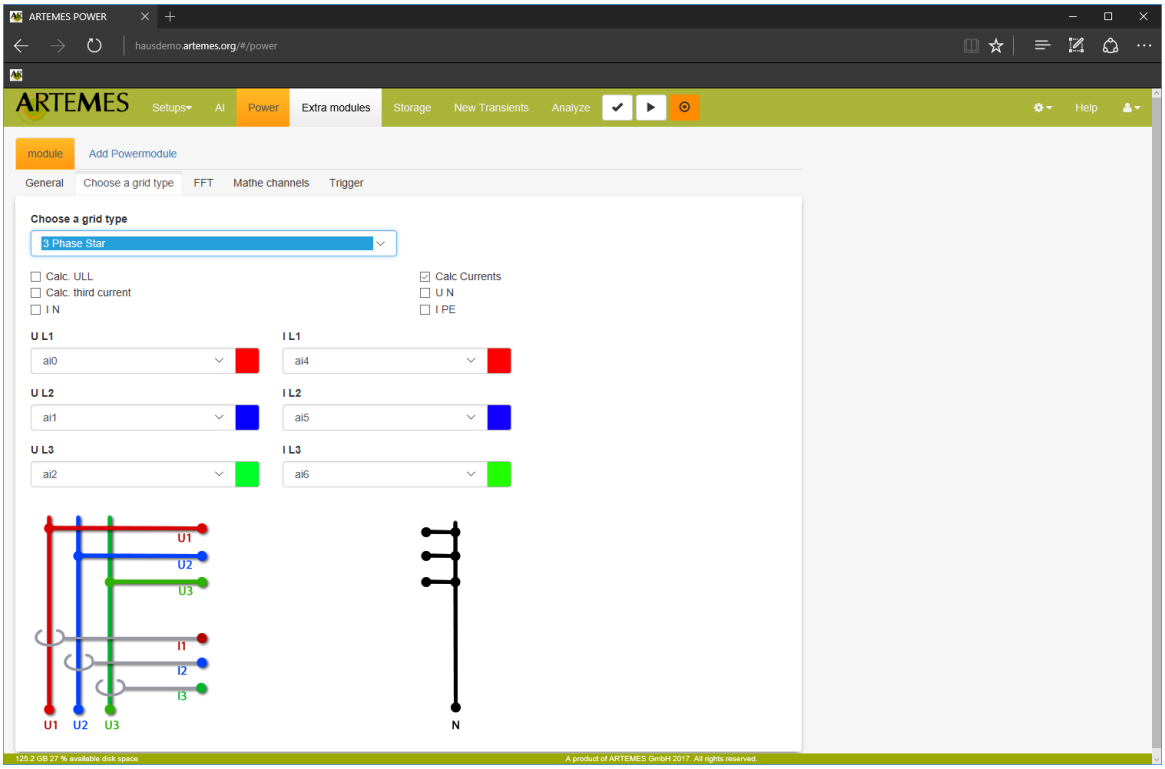
U L1, 2.. the voltage channels
I L1, 2..the current channels

In addition you can also define:
U N
I N
I PE

Or you can measure only the voltage by removing the current channel (disable **Save Current**).

3.1.2.1.3 3 Phase Star

3-phase star systems are the most common connection - also known as 4-wire connection.
In combination with the neutral and earth (PE) it is called 5-wire connection.



U L1, 2, 3.. the voltage channels (phase values connected from line to neutral
I L1, 2, 3..the current channels

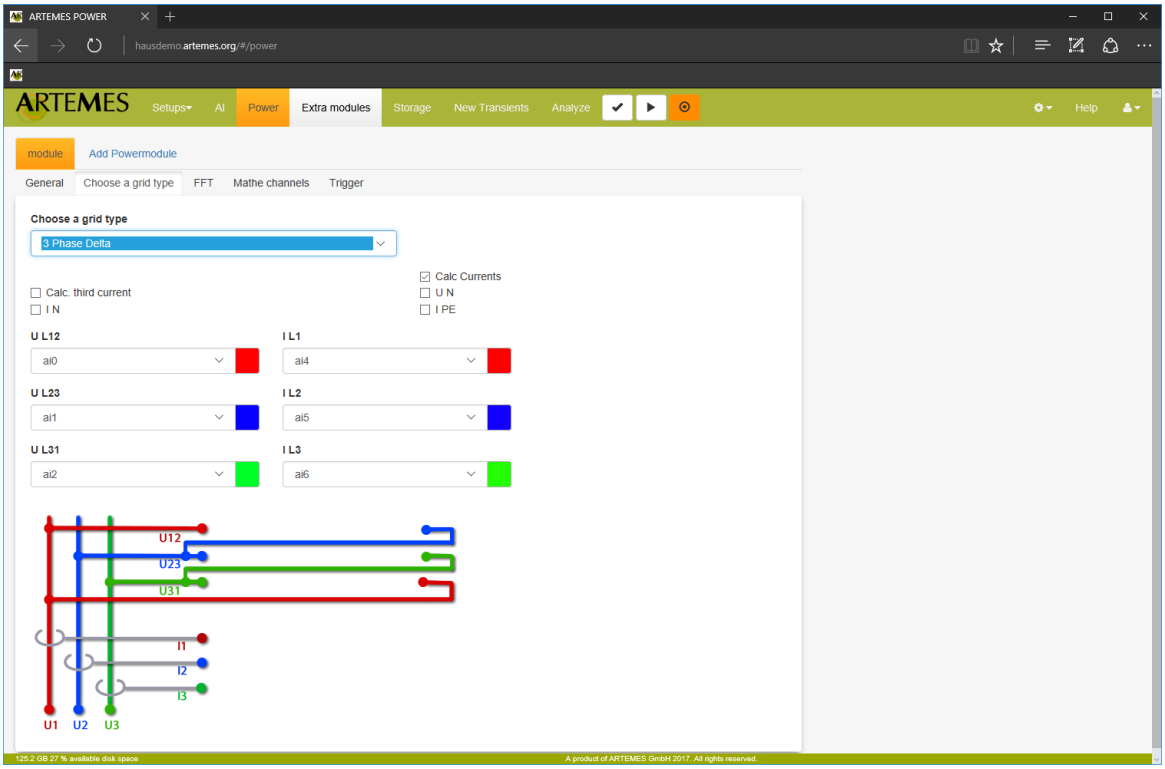
In addition you can also define:
U N
I N
I PE

Or you can measure only the voltage by removing the current channel (disable **Save Current**).

To measure combined voltage connections in medium and high voltage systems use the Calc U LL option.

3.1.2.1.4 3 Phase Delta

This connection schematic is used, where no neutral is available. Typically this is when an electric motor is connected directly to the power supply.



U L1, 2, 3.. the voltage channels (line values connected from line to line) UL1 means U12, UL2 = U23, U3 = U31
I L1, 2, 3..the current channels

In addition you can also define:
U N (if it makes sense)
I N (if it makes sense)
I PE (if it makes sense)

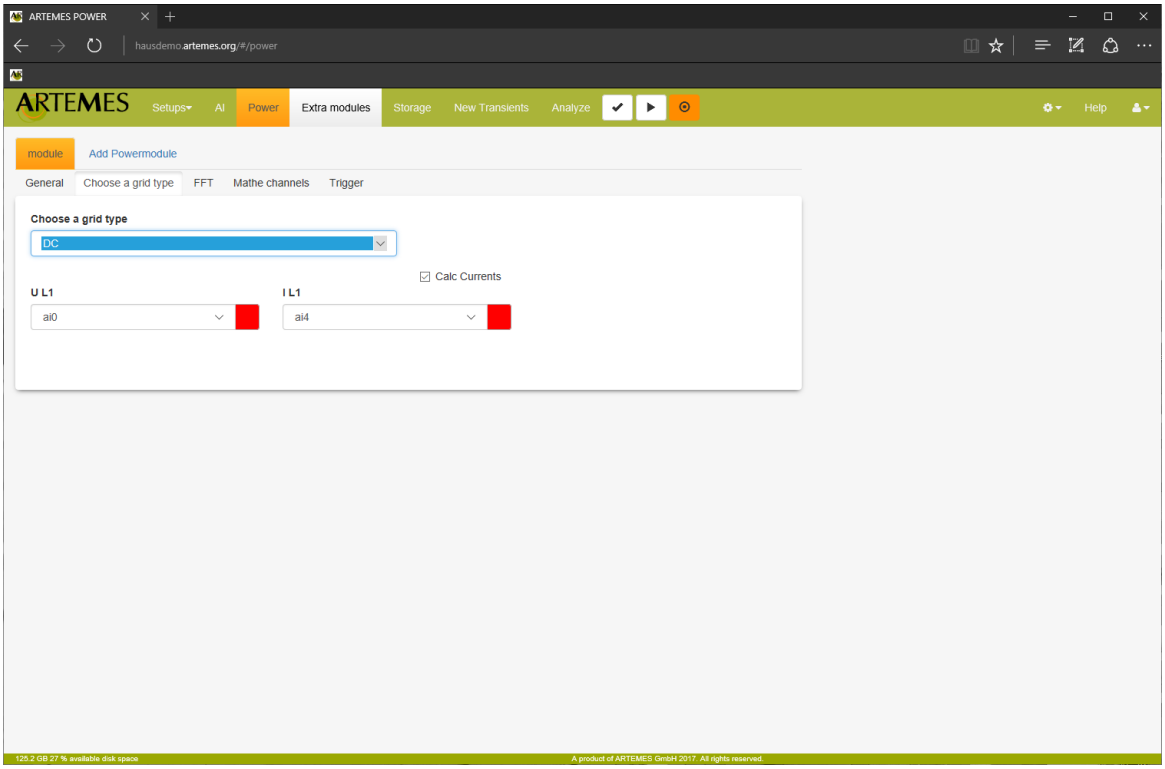
Or you can measure only the voltage by removing the current channel (disable **Save Current**).

Note: the **nominal voltage** is set to line values as well !

To save a current sensor you can use the option Calc. third current (ARON, V-connection).

3.1.2.1.5 DC

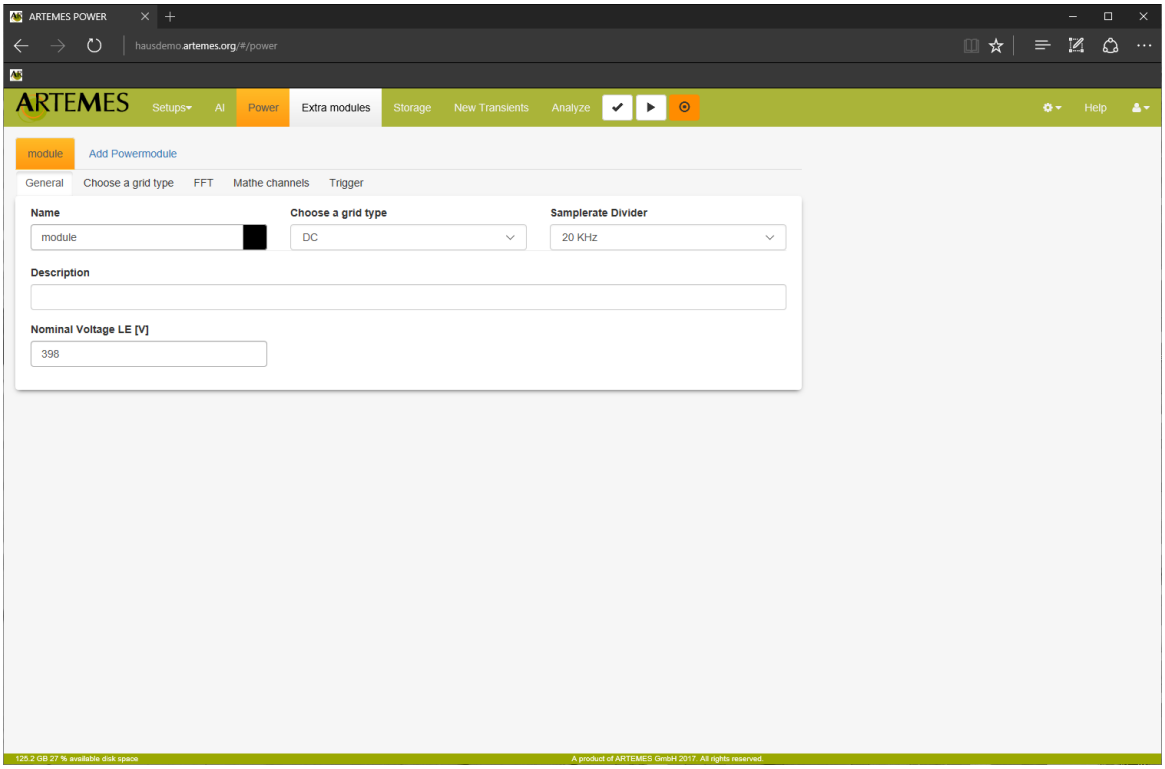
For real DC applications an own DC module is available.
The main difference in calculation is that there is no frequency available and the calculation is done only time based.



U L1.. the voltage channel
I L1..the current channel

Or you can measure only the voltage by removing the current channel (disable **Save Current**).

On the parameters' side (General TAB) there is also a change and you can define only limited parameters now:
Nominal voltage...the nominal voltage of the system. It is used for the fault recorder, where you can define relative limits to nominal voltage. Also some reports use this value like harmonics analysis.
Sample rate divider...If the calculation for the power module does not have to be done for the full recording rate, this value can be set. Example: Raw data recording is 1 MHz, but the power is just needed up to 10 kHz, then set the divider to 100. It saves calculation power and memory space.



3.1.2.1.6 Additional Values

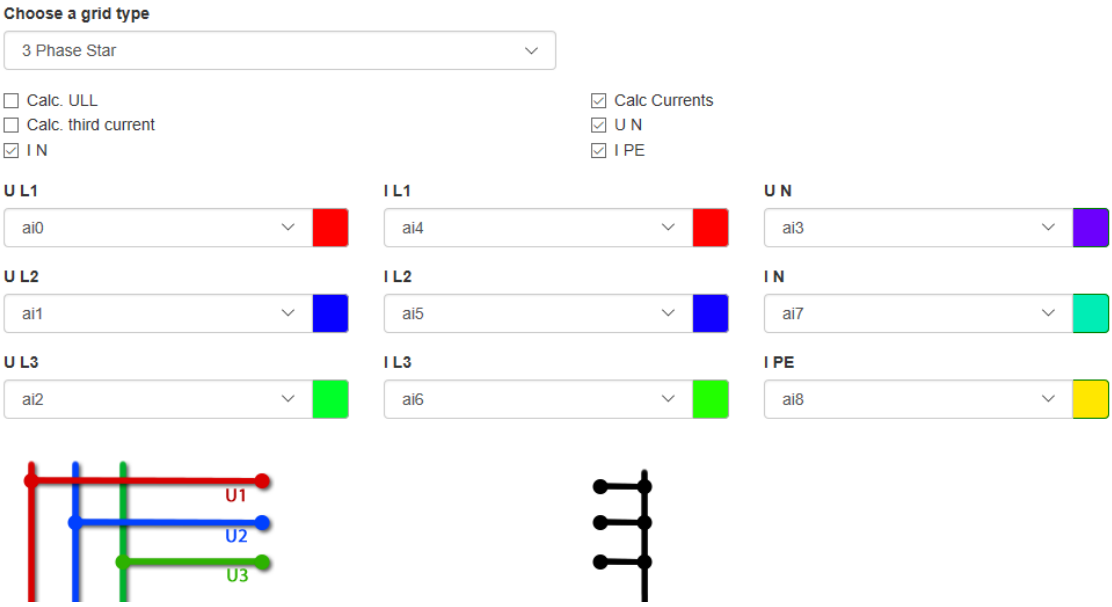
The following additional values can be set - depending on the wiring schematic and number of real input channels:

U N
I N
I PE

Calc ULL

Calc third current

Save Currents



3.1.2.1.6.1 U N

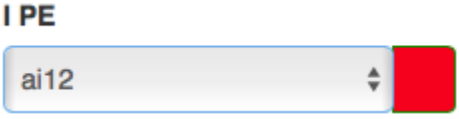
Use this if you also want to measure the voltage between neutral N and protected earth PE.

3.1.2.1.6.2 I N

Use this if you also want to measure the current on the neutral line.

3.1.2.1.6.3 I PE

Use this if you also want to measure the current on the protected earth.

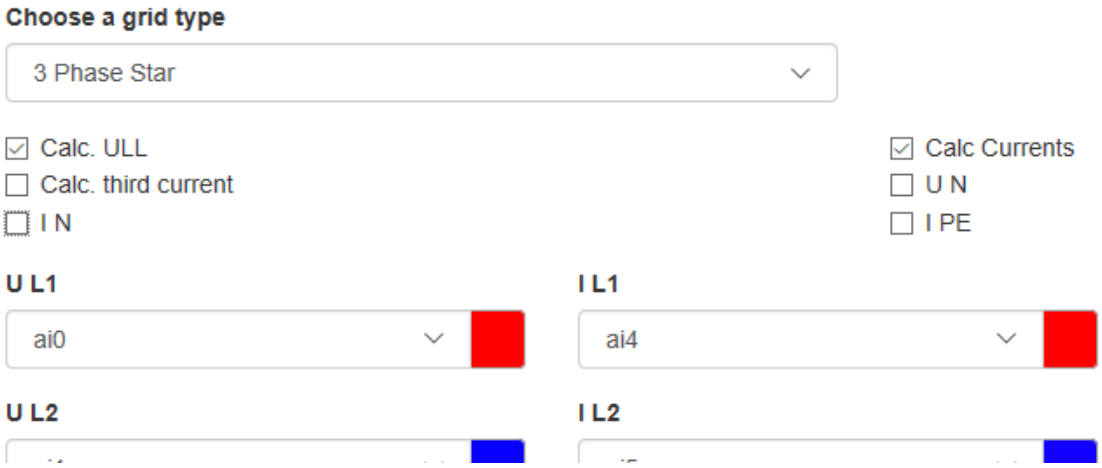


3.1.2.1.6.4 Calc ULL

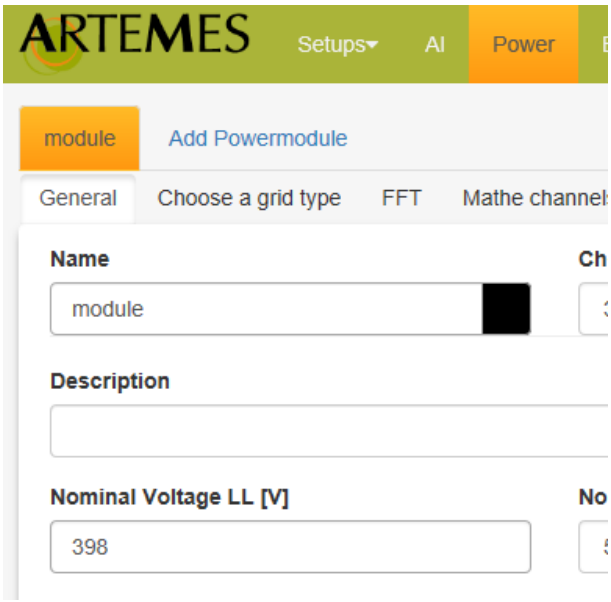
In some cases beside the phase values also the line values shall be evaluated.

Example: measurement in a medium or high voltage grid
The VTs (voltage transducers) are connected between line and earth.

If you want to see the U LE (Phase values) for the earth fault detection and the U LL (Line values) for the power quality (Uc) use this option.
Harmonics and Flicker can then be calculated for U LE and U LL.



Attention: By using this option the nominal Voltage switches from U LE to U LL! (left side, third line in the following picture)



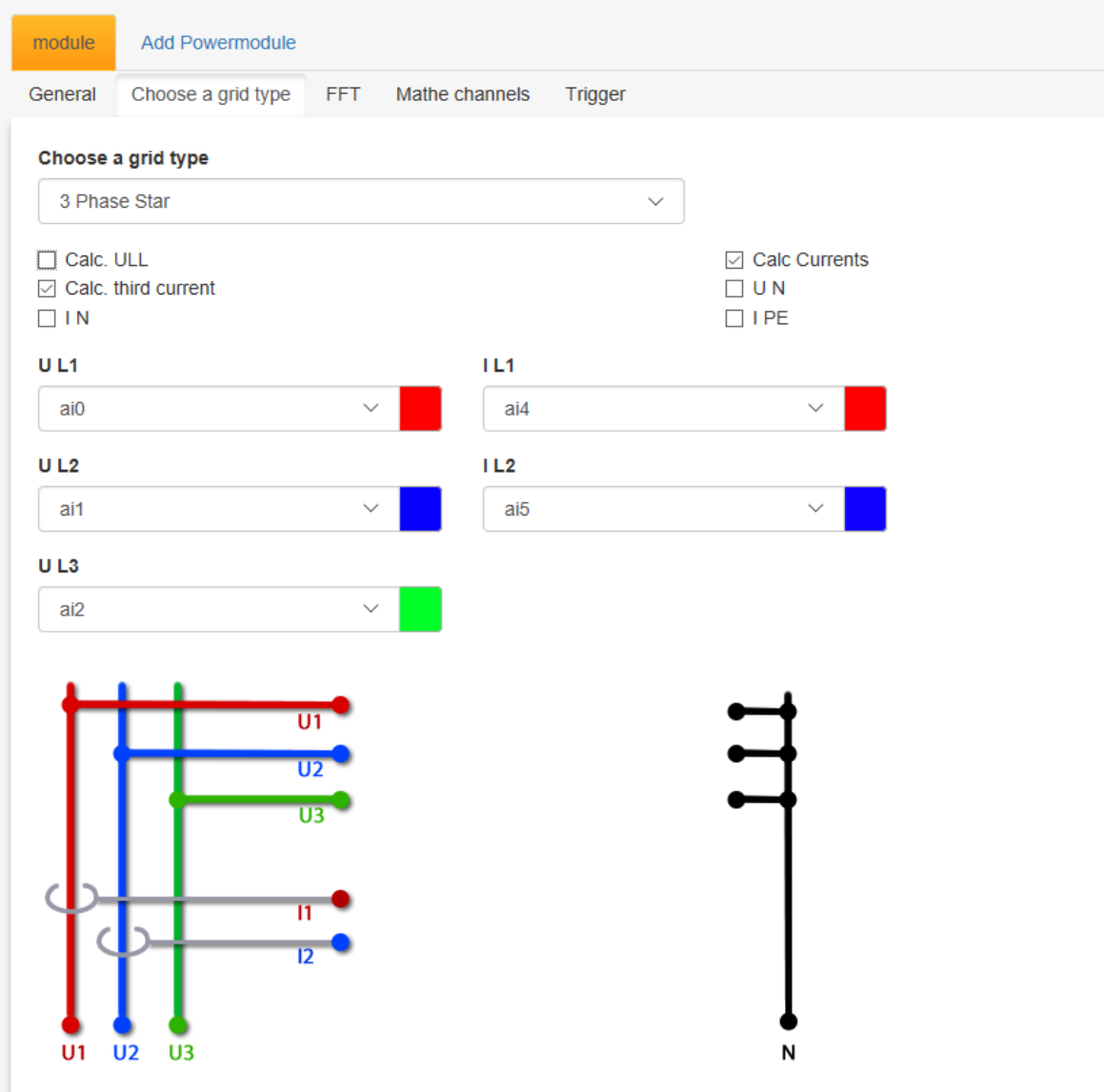
Note: This option is not available for delta and single-phase measurements.

3.1.2.1.6.5 Calc. Third current

If you wan to save the third current connection you can choose this option (Also used as **ARON** or **V-connection**).
The third current is then calculated by i3=-i1-i2.

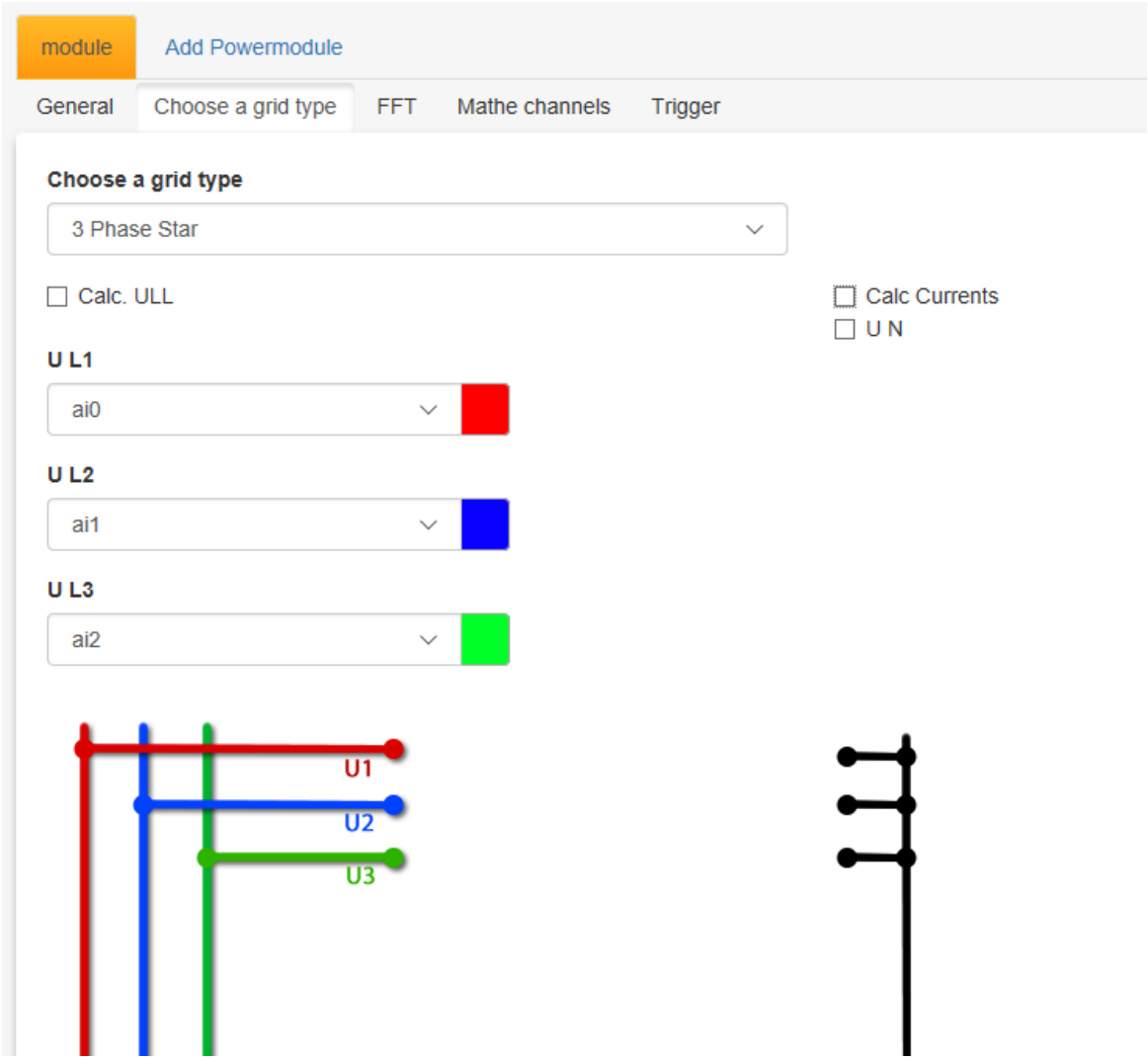
Attention: It works only when there is no neutral line connected!

Attention: Don't use for PWM applications - there the capacitive current is too high and influences the result.



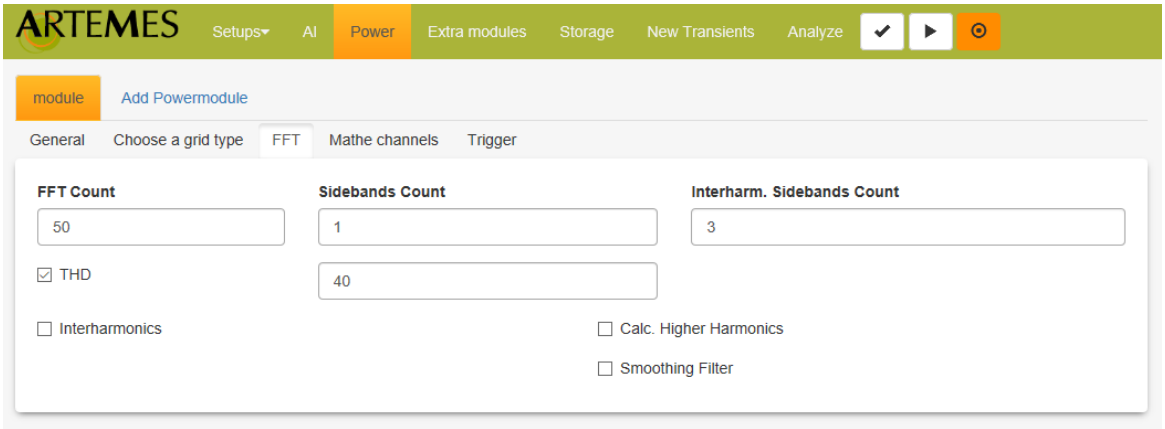
3.1.2.1.6.6 Save Currents

When you remove the currents only voltages are stored.
This will be used when you want to evaluate only voltages as for pure power quality measurements (for example EN 501060 defines only voltage limits).



3.1.2.2 FFT / Harmonics

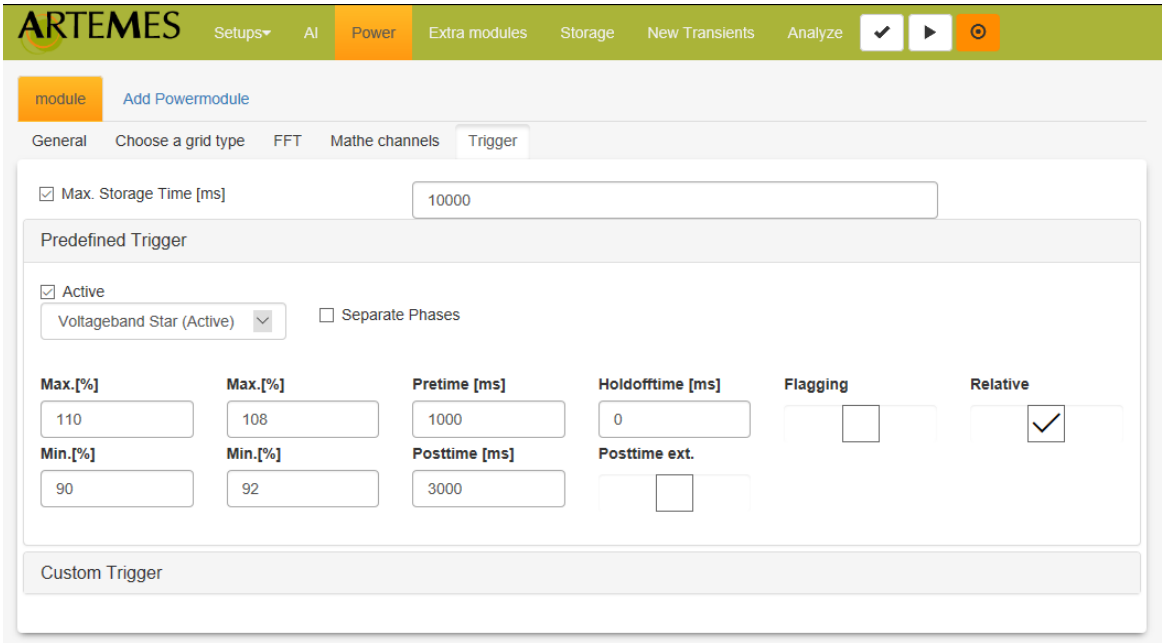
To calculate the FFT values according to IEC 61000-4-7 enable this part of the ARTEMES power tool box.



FFT Count...the number of harmonics to be calculated (default 50)
Sidebands Count...the number of pins to be added to the exact pin. For example when you have 10 periods calculation and 50 Hz fundamental frequency you get 50/10 = 5 Hz values. 1 sideband means the 50 Hz component is the RMS value of 45, 50 and 55 Hz (default = 1).
Interharm Sidebands Count...The number of pins used for interharmonics calculation. If this value is 3, then there are used for example 60, 65, 70, **75 Hz** (interhamonics nominal value), 80, 85 and 90 Hz
THD...if THD shall be calculated. The value sets the highest harmonic to be used - default is 40 as defined in IEC 61000-4-7.
Interharmonics...enables the calculation of interharmonics.
Calc higher Harmonics...enables the 200Hz blocks from 2kHz to 9 kHz (according to IEC 61000-4-30). The highest values will be limited by the real bandwidth and sample rate of the instrument.
Clac Highest Harmonics...enables the 2kHz blocks up to 150 kHz (according to IEC 61000-4-30). The highest Values will be limited by the real bandwidth and sample rate of the instrument.
Smoothing Filter...enables the smoothing filter as described in IEC 61000-4-7

3.1.2.3 Trigger / Fault recorder

The ARTEMES power toolbox also includes a very complete fault recorder library.
Beside the storing of raw data (power fault recorder = PFR) during seconds also period values can be stored over minutes. And this is done by a disturbance fault recorder (DFR).



The different predefined trigger modes are:

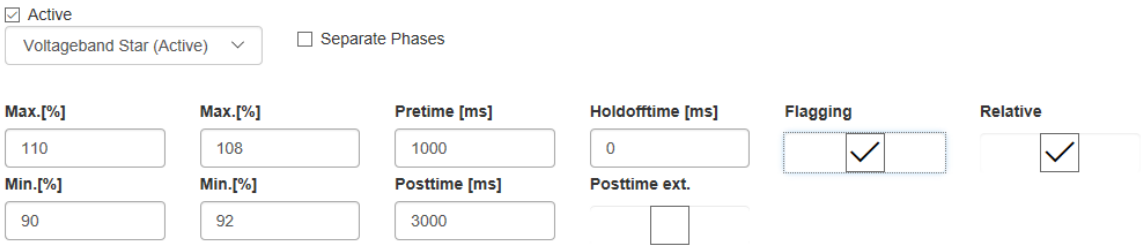
Voltage band Star
Voltage band delta
Voltage Slope Star
Voltage Slope Delta
Rapid voltage changes

Custom Trigger can be defines more complex

Max storage Time...the maximum length of a triggered record in ms

3.1.2.3.1 Voltage Band Star

Typically used for triggers according to standards like EN50160, where you want to see if the band is left or not. Star triggers are used in low voltage grids mainly.

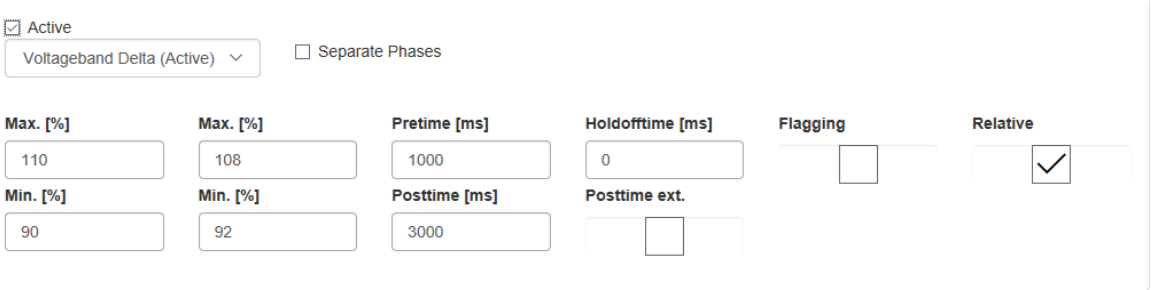


Voltage Star...enable to activate the trigger
Relative...if enabled the following limit values are to fill in in % of the nominal voltage. If this is deactivated then fill in Volts.

Max 110%...the start value for the upper limit
Max 108%...the end value for the upper limit
Min 90%...the start value for the lower limit
Min 92%...the stop value for the lower limit
Pretime (ms)...stored time before the trigger starts
Posttime (ms)...stored time after the trigger ends
Holdofftime (ms)...time to suppress retriggering after a trigger (for example earth faults should be suppressed a little while)
Posttime ext....if the post time shall be extended when the trigger comes up again. In this case the post time starts counting again after the end of the new trigger.
Flagging...if the data shall be flagged according to IEC 61000-4-30. If this parameter is set, then all calculated data during this time are marked (flagged) and can be removed for later evaluations for example EN50160.

3.1.2.3.2 Voltage band delta

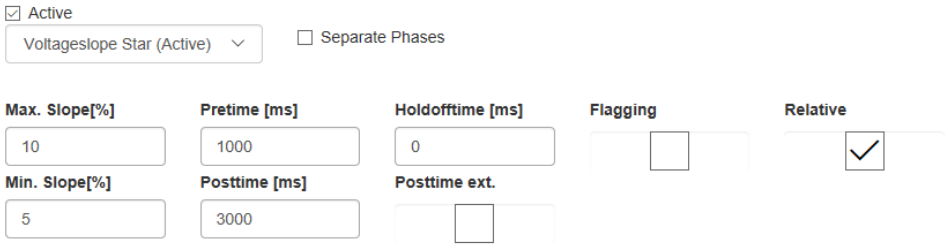
Typically used for Triggers according to standards like EN50160, where you want to see if the band is left or not. Delta Triggers are used in Medium and High voltage grids mainly.



Voltage Delta...enable to activate the trigger
Relative...If enabled the following limit values have be filled in - in % of the nominal voltage. If this is deactivated then fill in Volts.
Max 110%...the start value for the upper limit
Max 108%...the end value for the upper limit
Min 90%...the start value for the lower limit
Min 92%...the stop value for the lower limit
Pretime (ms)...Stored time before the trigger starts
Posttime (ms)...Stored time after the trigger ends
Holdofftime (ms)...time to suppress retriggering after a trigger (for example earth faults should be suppressed a little while)
Posttime ext....if the post time shall be extended when the trigger comes up again. In this case the post time starts counting again after the end of the new trigger.
Flagging...if the data shall be flagged according to IEC 61000-4-30. If this parameter is set, then all calculated data during this time are marked (flagged) and can be removed for later evaluations for example EN50160.

3.1.2.3.3 Voltage Slope Star

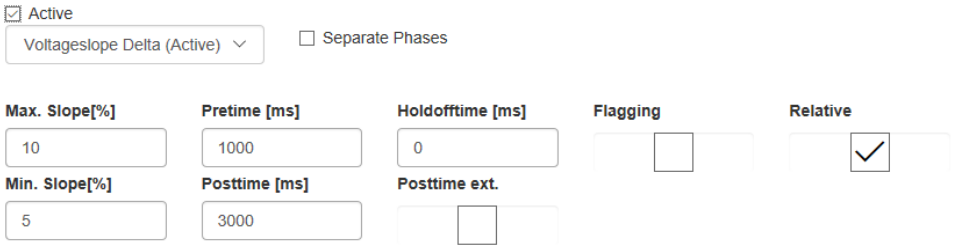
Typically used for triggers where you want to see if there is a jump from one period value to the next.



Voltage Slope Star...enable to activate the trigger
Relative...If enabled the following limit values have to be filled in - in % of the nominal voltage. If this is deactivated then fill in Volts.
Max Slope...the limit value for positive changes between two period values
Min Slope...the limit value for negative changes between two period values
Pretime (ms)...stored time before the trigger
Posttime (ms)...stored time after the trigger
Holdofftime (ms)...time to suppress retriggering after a trigger (for example earth faults should be suppressed a little while)
Posttime ext....if the post time shall be extended when the trigger comes up again. In this case the post time starts counting again after the end of the new trigger.
Flagging...if the data shall be flagged according to IEC 61000-4-30. If this parameter is set, then all calculated data during this time are marked (flagged) and can be removed for later evaluations for example EN50160.

3.1.2.3.4 Voltage Slope Delta

Typically used for triggers, where you want to see if there is a jump from one period value to the next.

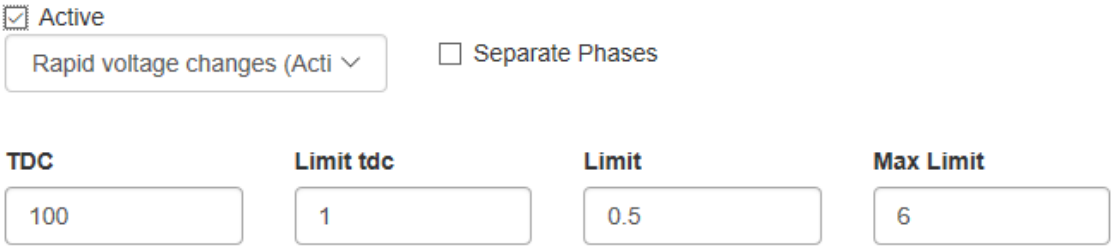


Voltage Slope Delta...enable to activate the trigger
Relative...If enabled the following limit values have to be filled in - in % of the nominal voltage. If this is deactivated then fill in Volts.
Max Slope...the limit value for positive changes between two period values
Min Slope...the limit value for negative changes between two period values
Pretime (ms)...Stored time before the trigger
Posttime (ms)...Stored time after the trigger

Holdofftime (ms)...time to suppress retriggering after a trigger (for example earth faults should be suppressed a little while)
Posttime ext....if the post time shall be extended when the trigger comes up again. In this case the post time starts counting again after the end of the new trigger.
Flagging...if the data shall be flagged according to IEC 61000-4-30. If this parameter is set, then all calculated data during this time are marked (flagged) and can be removed for later evaluations for example EN50160.

3.1.2.3.5 Rapid Voltage Changes

Geben Sie hier den Text ein.

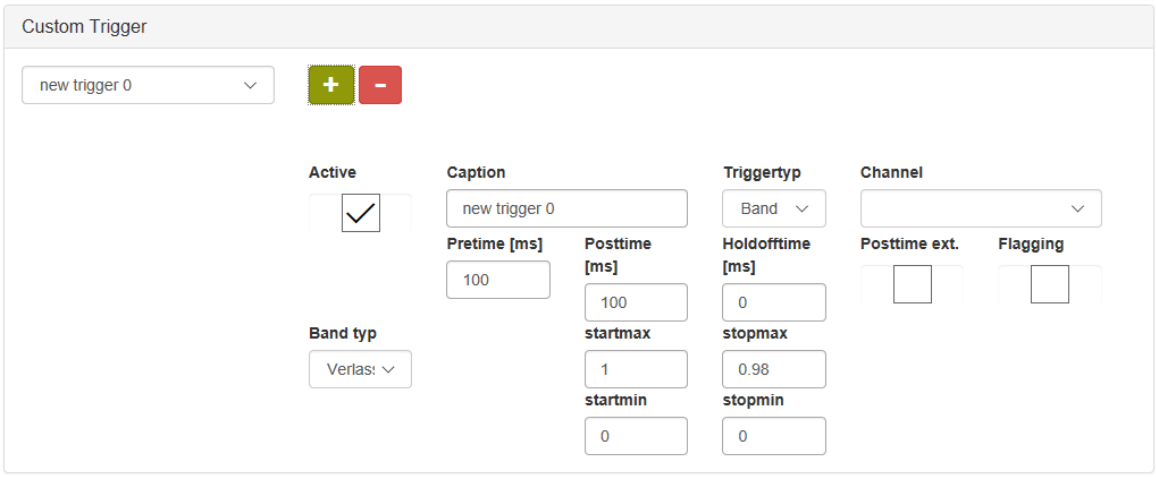


3.1.2.3.6 Custom Trigger

Custom Trigger can be defined very individual


...to add a Trigger


...to remove a Trigger



Active...to activate the Trigger

Caption...name of the Trigger

Triggertype: there a 4 different types of Trigger

Band
Harmonic
Frequency band
Slope

Common settings for all:

channel...the used channel of the Trigger

Pretime (ms)...stored time before the trigger starts
Posttime (ms)...stored time after the trigger ends
Holdofftime (ms)...time to suppress retriggering after a trigger (for example earth faults should be suppressed a little while)
Posttime ext....if the post time shall be extended when the trigger comes up again. In this case the post time starts counting again after the end of the new trigger.
Flagging...if the data shall be flagged according to IEC 61000-4-30. If this parameter is set, then all calculated data during this time are marked (flagged) and can be removed for later evaluations for example EN50160.

3.1.2.3.6.1 Band

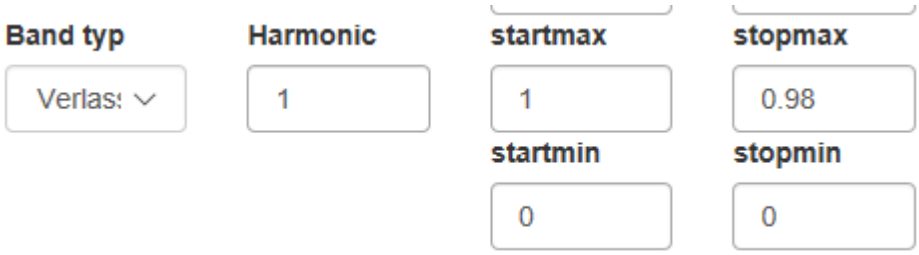
band type...enter or leave the band

startmax...the start value for the upper limit
stopmax...the end value for the upper limit
startmin...the start value for the lower limit
stopmin...the stop value for the lower limit

3.1.2.3.6.2 Harmonic

Harmonic band Trigger

This Trigger is similar to the band Trigger, but can use a Harmonic



band type...enter or leave the harmonic band
harmonic...the order of Harmonic

startmax...the start value for the upper limit
stopmax...the end value for the upper limit
startmin...the start value for the lower limit
stopmin...the stop value for the lower limit

3.1.2.3.6.3 Frequency band

Frequency band Trigger

This Trigger is similar to the band Trigger, but can use the rms value of a Frequency range

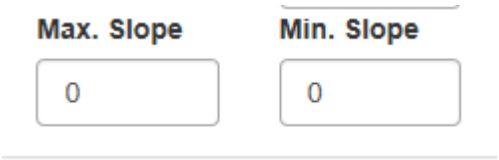
In this example the range from 49 to 51 Hz will be used and start a triggered record when the value is larger then 1

band type...enter or leave the harmonic band

Max F (Hz)...the lower Frequency value
Min F (Hz)...the lower Frequency value

startmax...the start value for the upper limit
stopmax...the end value for the upper limit
startmin...the start value for the lower limit
stopmin...the stop value for the lower limit

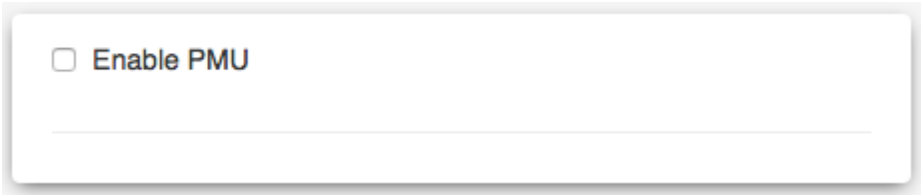
3.1.2.3.6.4 Slope



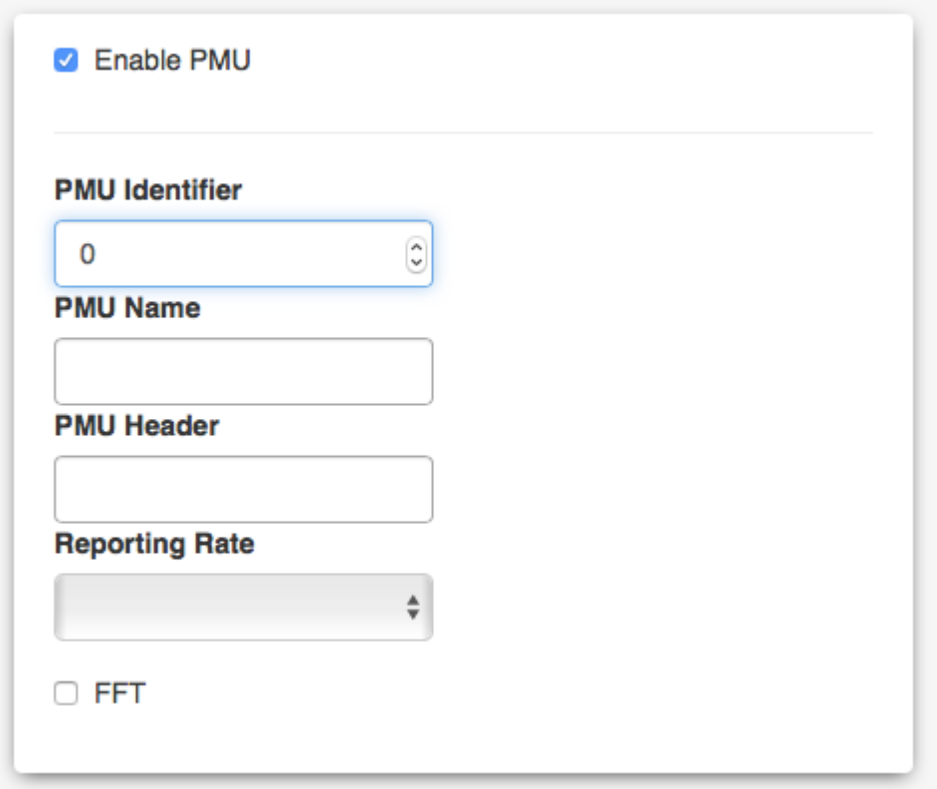
Max slope...the upper value for the slope trigger
Min slope...the lower value for the slope trigger

3.1.2.4 PMU / Phasor Measurement

The PMU (phasor measurement unit) is an extra Option.
If it is activated and installed you can easily enable it in the power setup page.

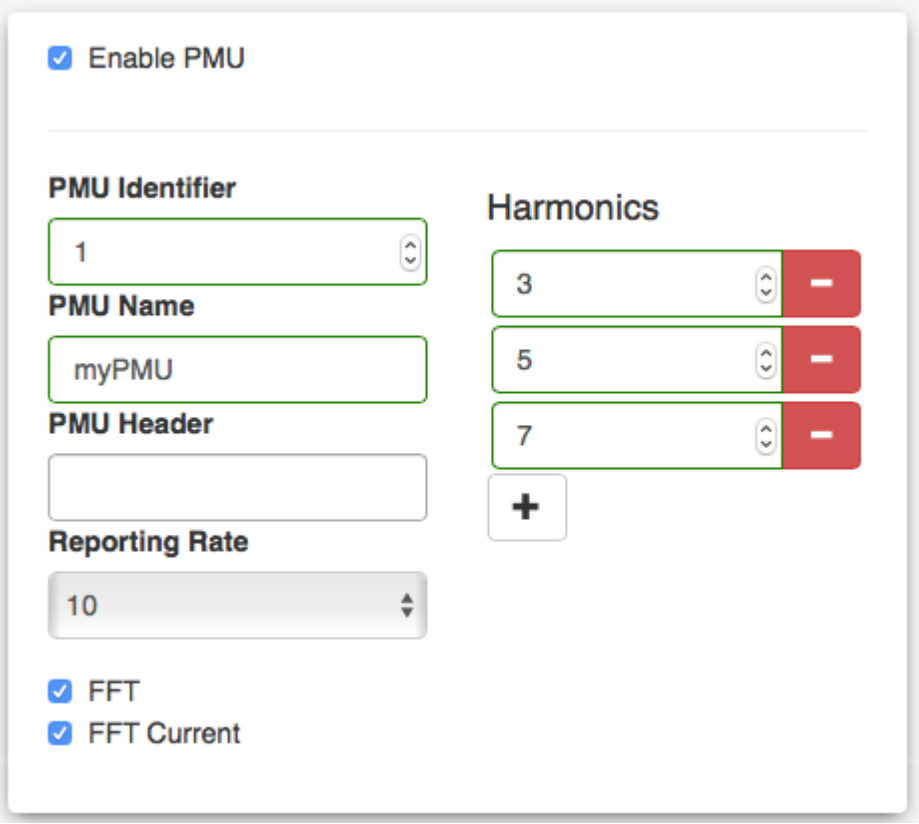


PMU Identifier...identifier as defined for the IEEE PMU protocol.
PMU Name...individual name
PMU Header...additional note
Reporting Rate...select 10 or 25 Hz



Additionally to voltage and current phasors the ARTEMES PMU can also send power quality parameters.
For this you must enable **FFT.**

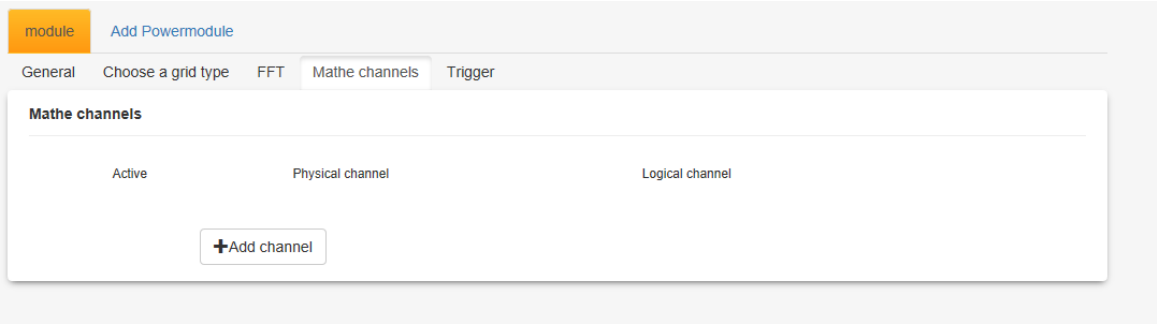
On the right side you can then add the **harmonics** you want to get on the PMU server.
By default the voltage FFT is sent, If yu want to get current values as well enable this **FFT current** option.
Also the flicker is available as output 5 of the flicker meter.



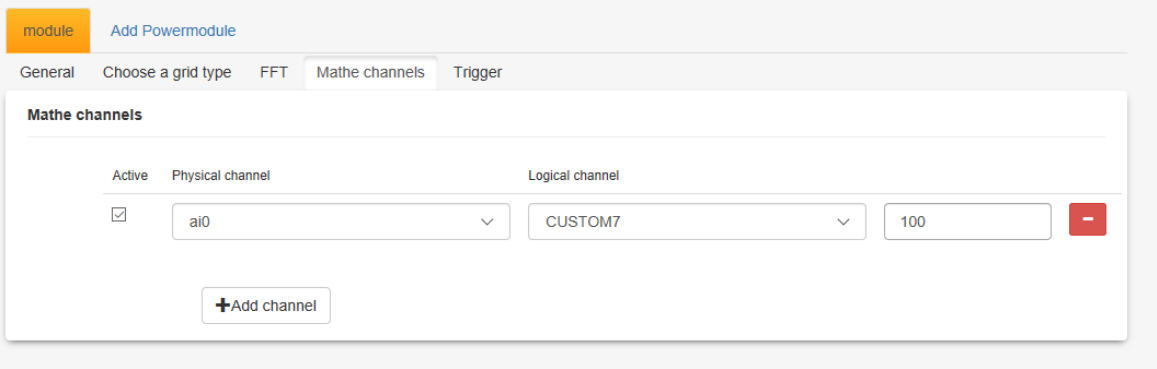
3.1.2.5 Mathe channels

Mathe channels can be assigned to a power module and are used to add other measured parameters or mathematic channels.
Example: a wind speed for wind turbine tests.

Later these channels can be used in data processing and found in the same data set.



+Add channel...adds a channel to the power module
Physical channel...the AI channel, or CAN channel or other physical source defined tin the channel setup.
Save interval...the storing interval of this channel

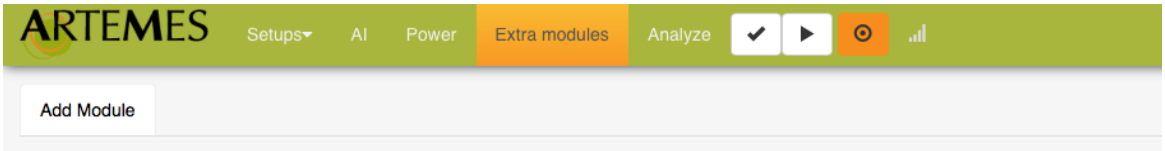


You can add as many channels as you need.

If you want to group channels without a power module simply use the "extra module" function.

3.1.3 Extra Module Setup

To Add an Extra Module click Extra Module and the Add Module

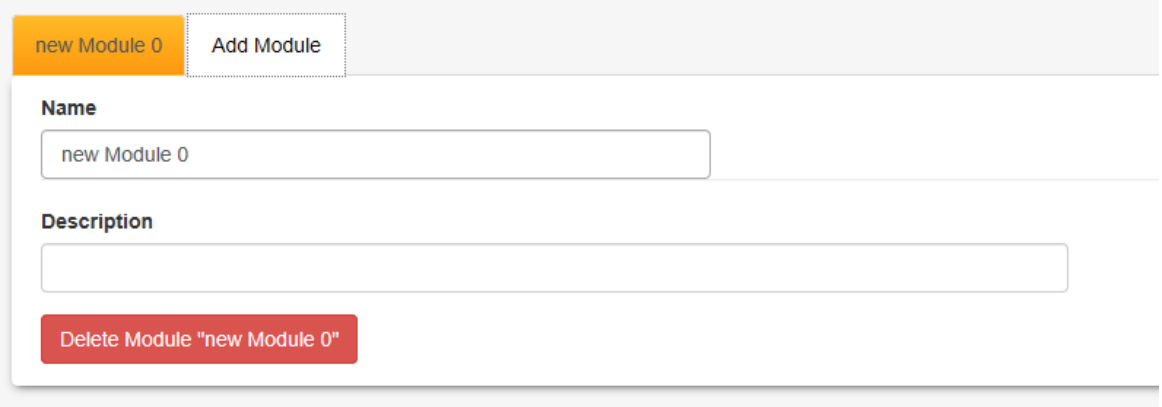


What is an extra module?
An extra module is a module to make groups of channels. These channels can then be found under the module name in data analysis.

For Example: You have two test benches with two same channels like temperature and humidity.
Then you define one extra module as test bench1 and assign two channels: temperature an humidity.
Then you define one extra module as test bench2 and assign two channels: temperature an humidity.

In post processing you prepare the one chart for temperature and humidity and can then choose between bench 1 and bench 2.

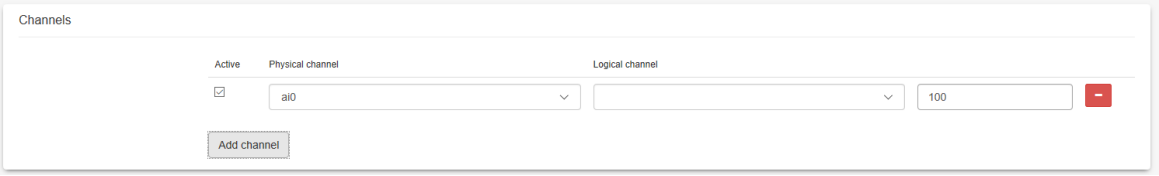
These modules can also be on different instruments when you store the data on the server.
Also the channels could be on different instruments - the extra module name must just be the same one (for post processing in Matlab(r)/Octave).



Name...name of the module as it will be found in Data Analysis
Description...individual text
Channels:
Add channel ... to add a channel. The channels must be defined previously in the AI channel setup

Add Module...to add extra modules
Delete Module...to remove the module

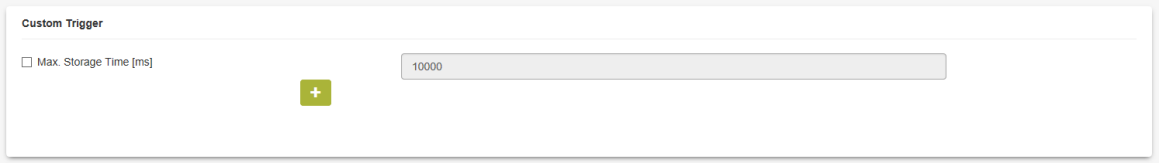
The next screen shot shows two added channels form different sources (CAN and Analogue Channel) and with different storing intervals.



Custom Trigger:

with the help of this function yo can add Triggers to extra modules

the settings are the same as for power Triggers



3.1.4 Storing the Data

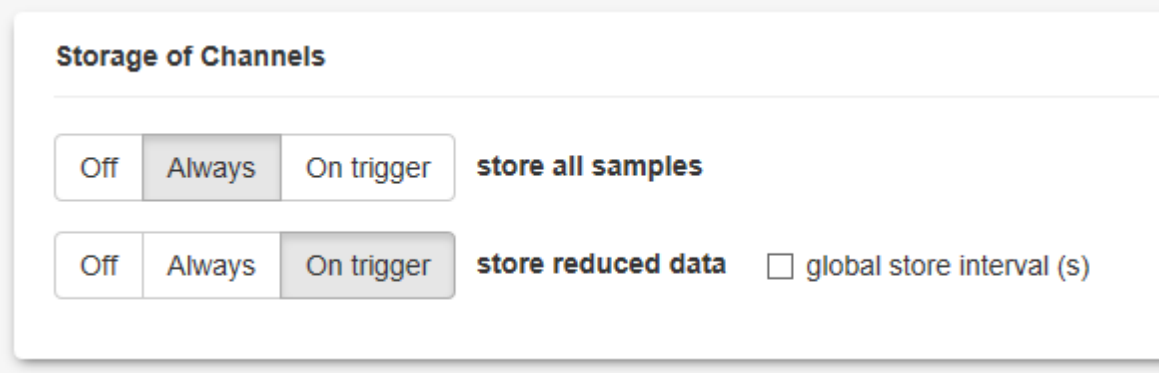
To Store the Data you need to push the Icon  on the menu bar.

But before you need to define what shall be stored and how.

In general the system uses two different groups of data: "samples" and "reduced" data

"Samples" means full samples as chosen in the AI setup - for example 20kHz
"Reduced" means average data for example 10 minutes

Each data set can be stored "always" or "on Trigger"
"Always" means full streeaming mode where all data are stored leakless as slonas you do not press stop 
"On Trigger" measn data are stored when a Trigger condition happens.



In addition the storing intervall can be set individual or global by selecting the box **"global storing intervall"** and setting a value in (s)

The channels can be defined by selecting the checkboxes for Samples or Reduced.
If the Storing interval is not global each parameter has an own row for the individual **"save intervall"** (s).

	Samples	Reduced	Type	Module	Name	Unit	Save Inte	A
☐	✓		Synchron	input channel	ai0	-		
☐	✓		Synchron	input channel	ai1	-		
☐	✓		Synchron	input channel	ai2	-		
☐	✓		Synchron	input channel	ai4	-		
☐	✓		Synchron	input channel	ai5	-		
☐	✓		Synchron	input channel	ai6	-		
☐			Synchron	input channel	ai12	-		
☐	✓	✓	Asynchron	module	Frequency	Hz	1	
☐		✓	Asynchron	module	U_RMS_L1	V	1	
☐			Synchron	module	U_L1	V		
☑	✓	✓	Asynchron	module	U_RMS_L2	V	1	
☐			Synchron	module	U_L2	V		
☐		✓	Asynchron	module	U_RMS_L3	V	1	
☐			Synchron	module	U_L3	V		

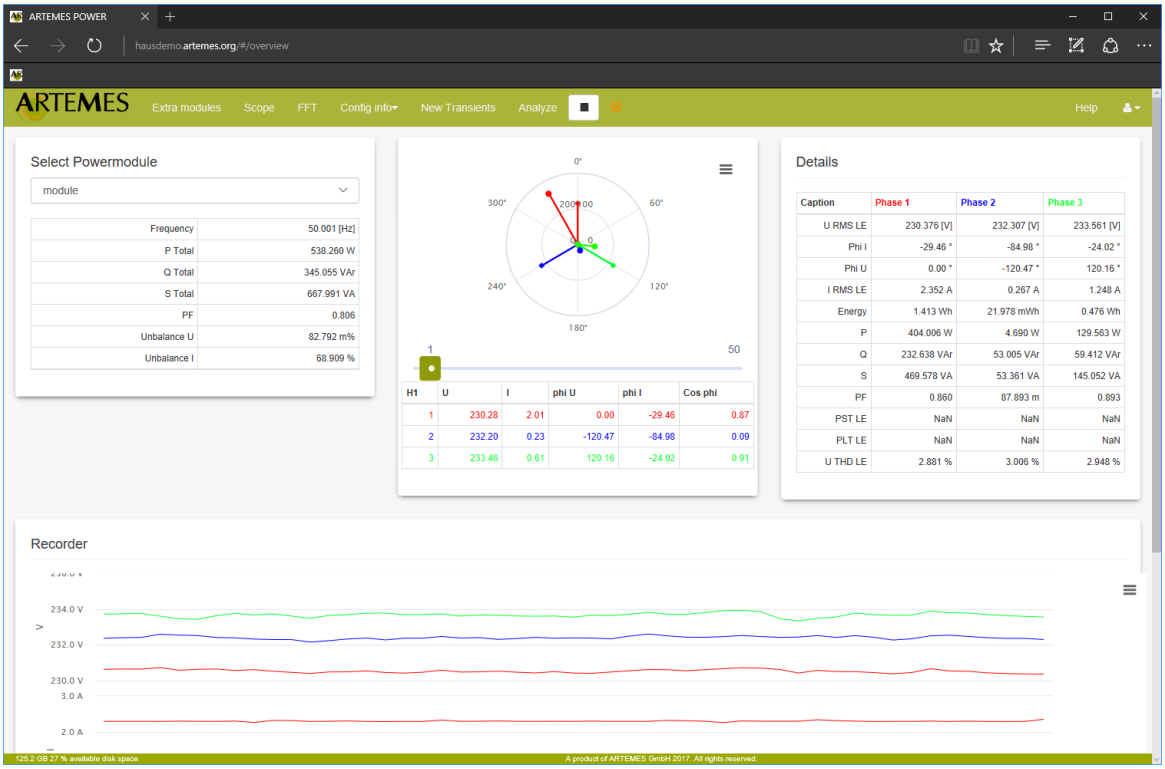
3.2 Online measurements

Pressing  turns the instrument into the viewing mode.

Pressing  start the recording mode of the instrument.

Pressing  stops the instrument and returns into the set up mode.

The following screen shows the default measuring screen. To return to this screen press the ARTEMES logo on top left.



The different measurement screens can be accessed with the main menu and are:

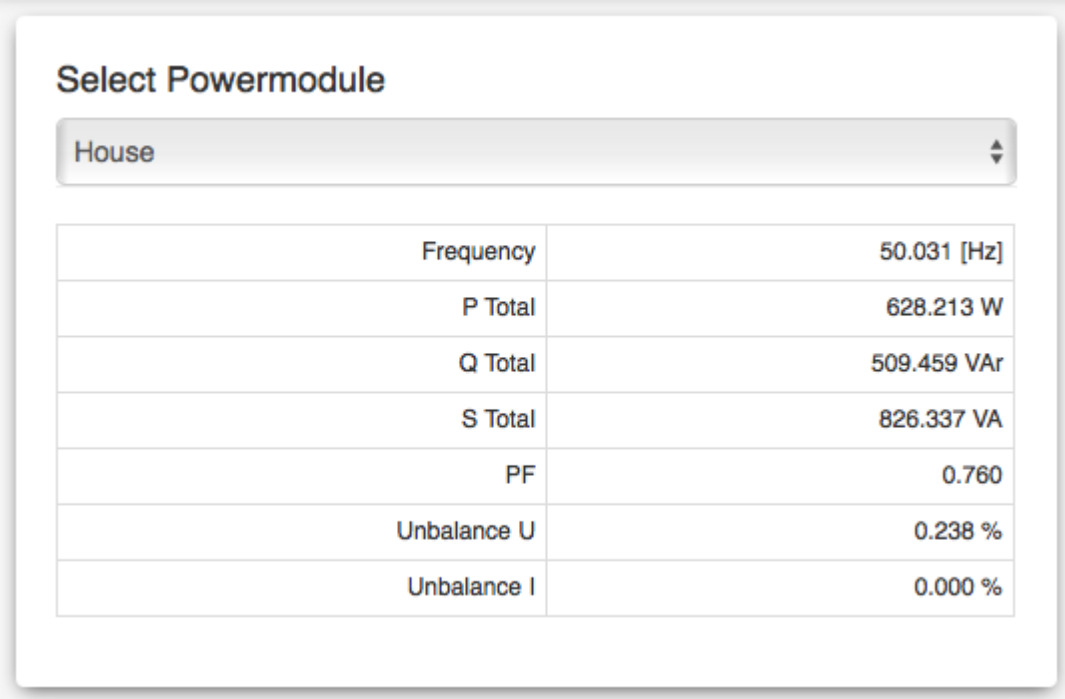
Overview - Online (ARTEMES logo)
Scope - Online
FFT - Online
PMU - Online
Config Info
Analyze

3.2.1 Overview - Online

The measurement overview consists of several instruments:
It can be different depending on the connection schema.

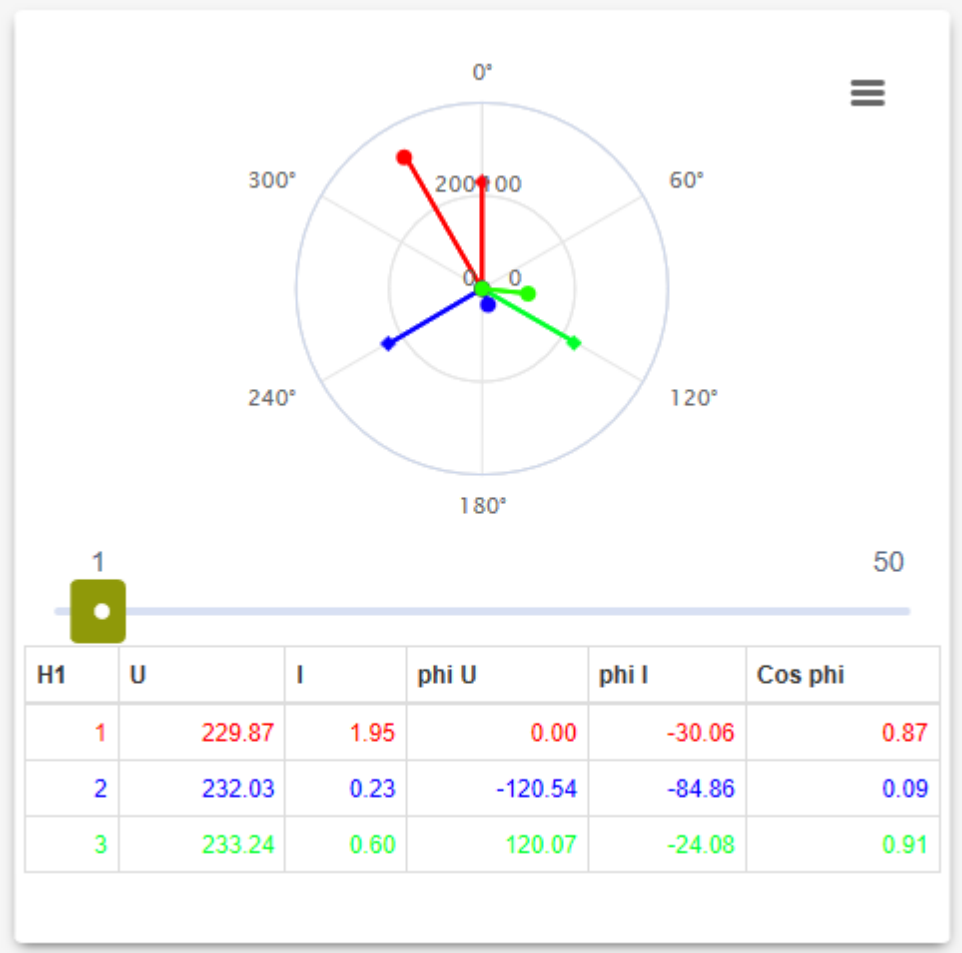
The selector:

It lets you choose which power module shall be shown and also indicates the basic power values:



The vector scope:

It shows the vectors of voltage and current.
With the slider bar you can choose the harmonic order ...



H1	U	I	phi U	phi I	Cos phi
1	229.87	1.95	0.00	-30.06	0.87
2	232.03	0.23	-120.54	-84.86	0.09
3	233.24	0.60	120.07	-24.08	0.91

...to export the screen in different formats, as vector graph or as image.

Details:

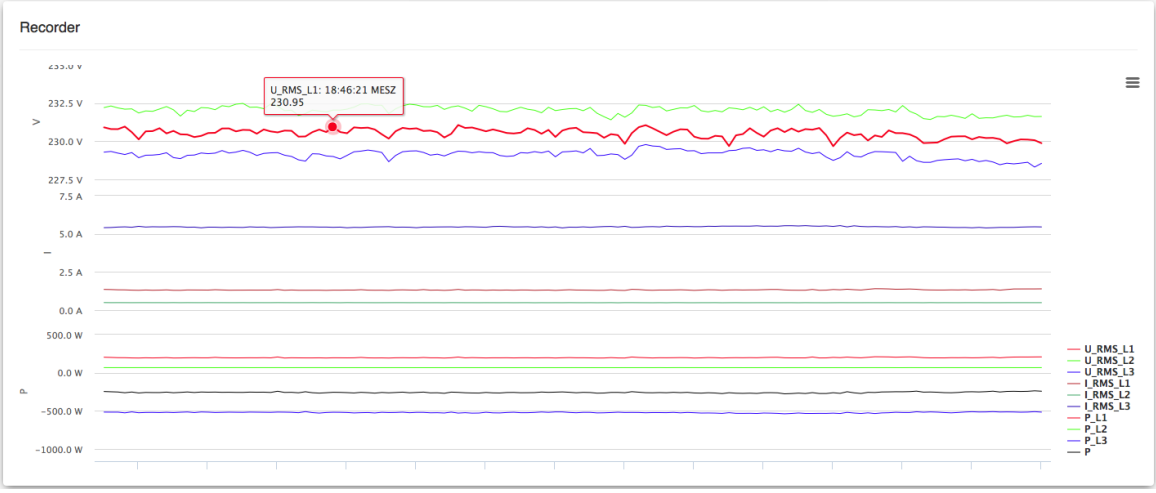
shows phase values

Details

Caption	Phase 1	Phase 2	Phase 3
U RMS LE	230.124 [V]	228.858 [V]	228.403 [V]
Phi I	44.13 °	39.99 °	25.02 °
Phi U	0.00 °	119.82 °	-119.97 °
I RMS LE	2.572 A	0.531 A	0.925 A
P	374.638 W	90.068 W	175.966 W
Q	367.054 VAr	76.069 VAr	79.106 VAr
S	530.504 VA	118.394 VA	195.254 VA
PF	0.706	0.761	0.901
PST LE	0.299	0.234	0.467
PLT LE	0.668	0.576	0.698
U THD LE	2.535 %	2.173 %	2.545 %

Recorder:

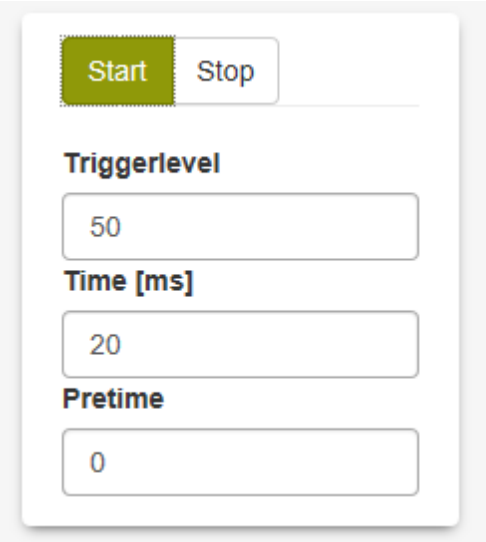
Online recorder view for voltage, current and power. By clicking on the legend values you can deactivate the view of them.
Using the mouse pointer on the diagram shows you the values.



3.2.2 Scope - Online

The scope function is an online function which gives the real curve of the actual voltages and currents. Depending on the speed of the connection the update rate may vary, but the view is always as complete and as actual as possible. The number of points depends on the resolution of the screen.

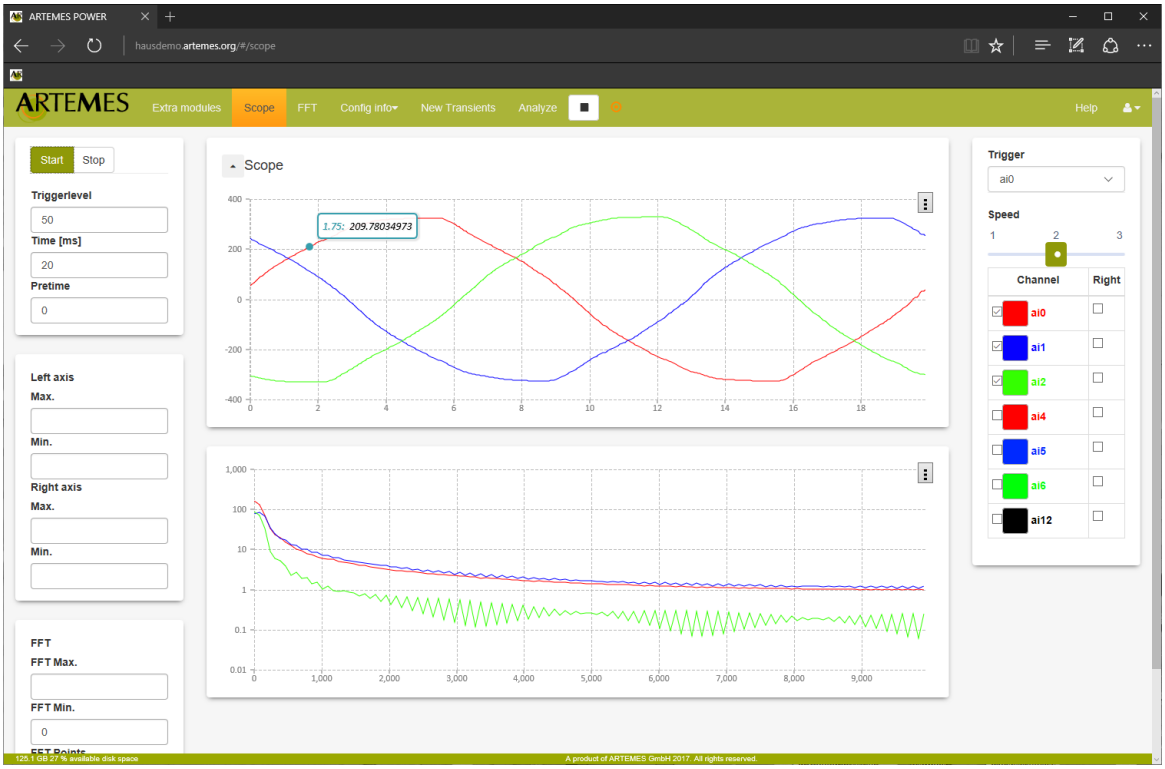
To set up the scope just activate the channels you want to see and press **start.**



Right...to use the right axis - for example voltages use the left axis and currents could use the right one for a better scaling.
Triggerlevel...the level of triggering the first value - here 10V for UL1
Time (ms)... the time window to show on the screen...typically 20ms for one period
Max..upper value of the scale of the axis (left or right). If empty the AUTO is used.
Min...lower value of the scale of the axis (left or right). If empty the AUTO is used.

Reload...to reload the scope for changing parameters
Stop...to stop the scope

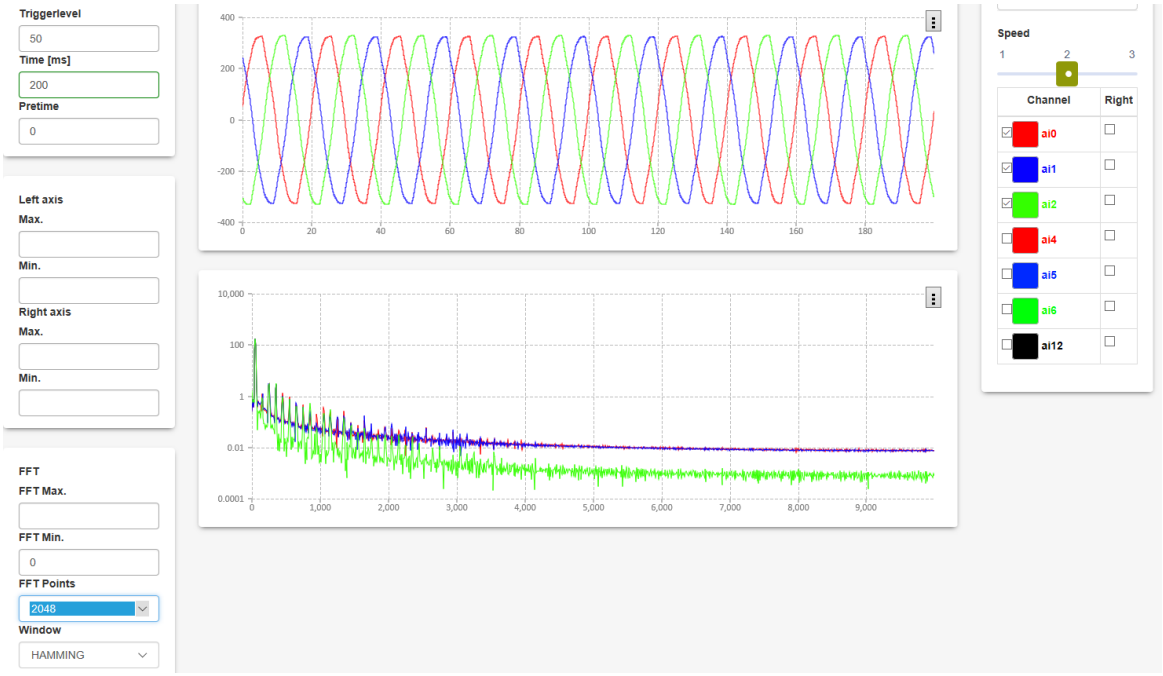

...to export the screen in different formats, as vector graph or as image.



a very unique function is also the live FFT view on the bottom of the Scope

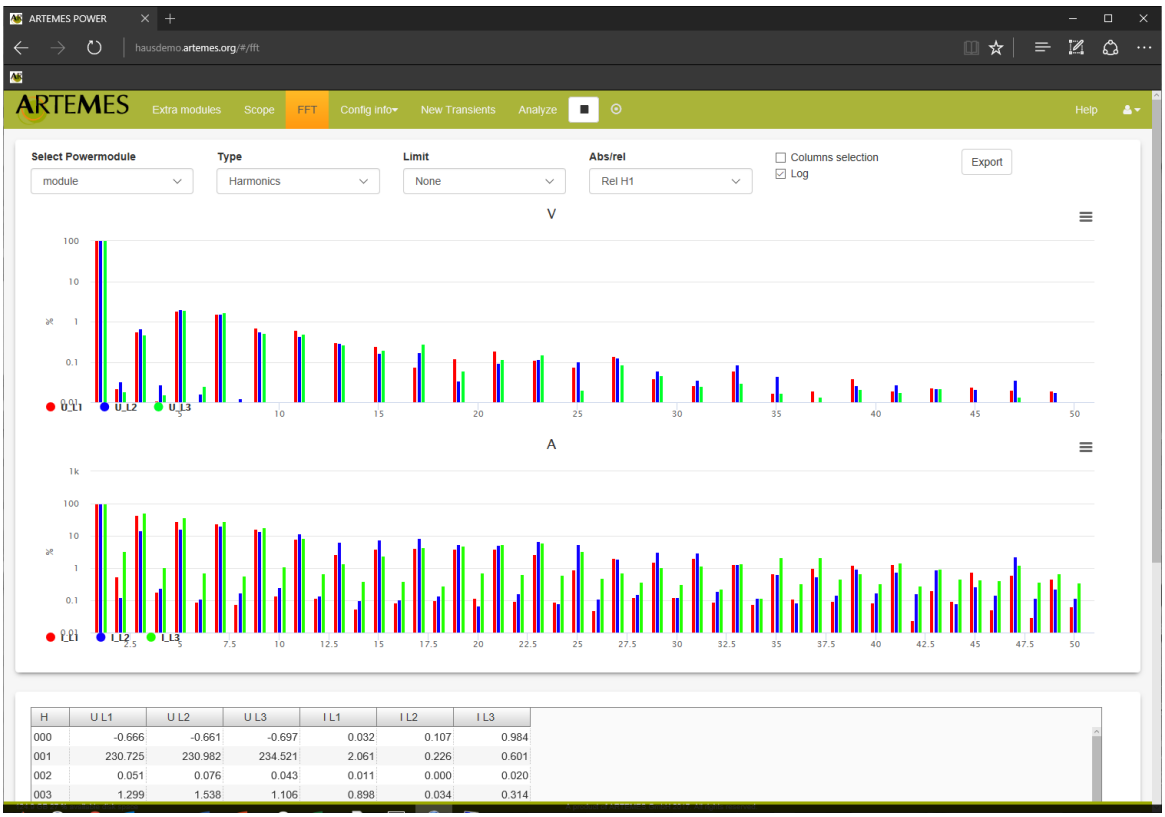
by selecting a larger Time window (here:200ms) and a large number of FFT Points (here 2048) you can already get a very precise FFT od the input signal

In addition the FFT Filters can be choosen from the following list:
Hanning
Haming
Rectangular
Lanczos
Triangular
Gauss
Cosine
Blackmann
Bartlett
Bartletthann



3.2.3 FFT - Online

To show the harmonics (FFT) choose this page.
Depending on the wiring schematic you will see phase voltages (UL), line voltage (ULL) and currents.



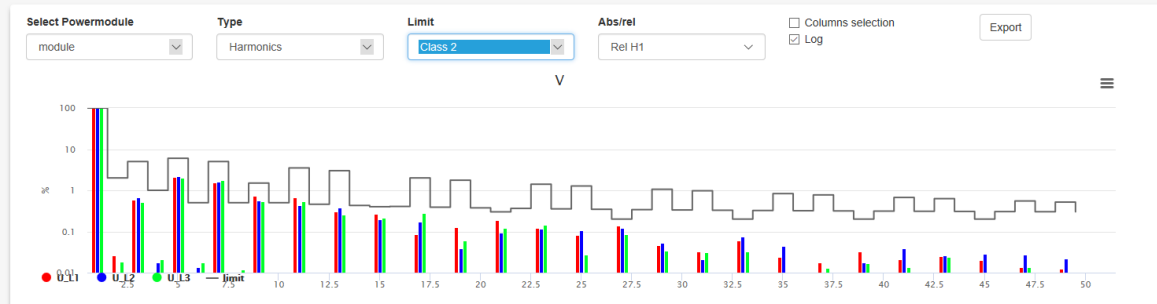
...to export the screen in different formats, as vector graph or as image.

Type..choose from Harmonics, Interharmonics, Higher Harmonics 2-9 kHz or Highest Harmonics 8 to 150 kHz (available only when sampling rate is high enough and function is enabled in FFT setup)
Abs/Rel..To choose if the Values are shown absolute (V, A) or relative to the fundamental (%)

Online FFT with Limits...to show online the limits of e.g. IEC 61000-2-4 or EN 50160
Columns selection...to select which column of data shall be shown

3.2.3.1 Online FFT with Limits

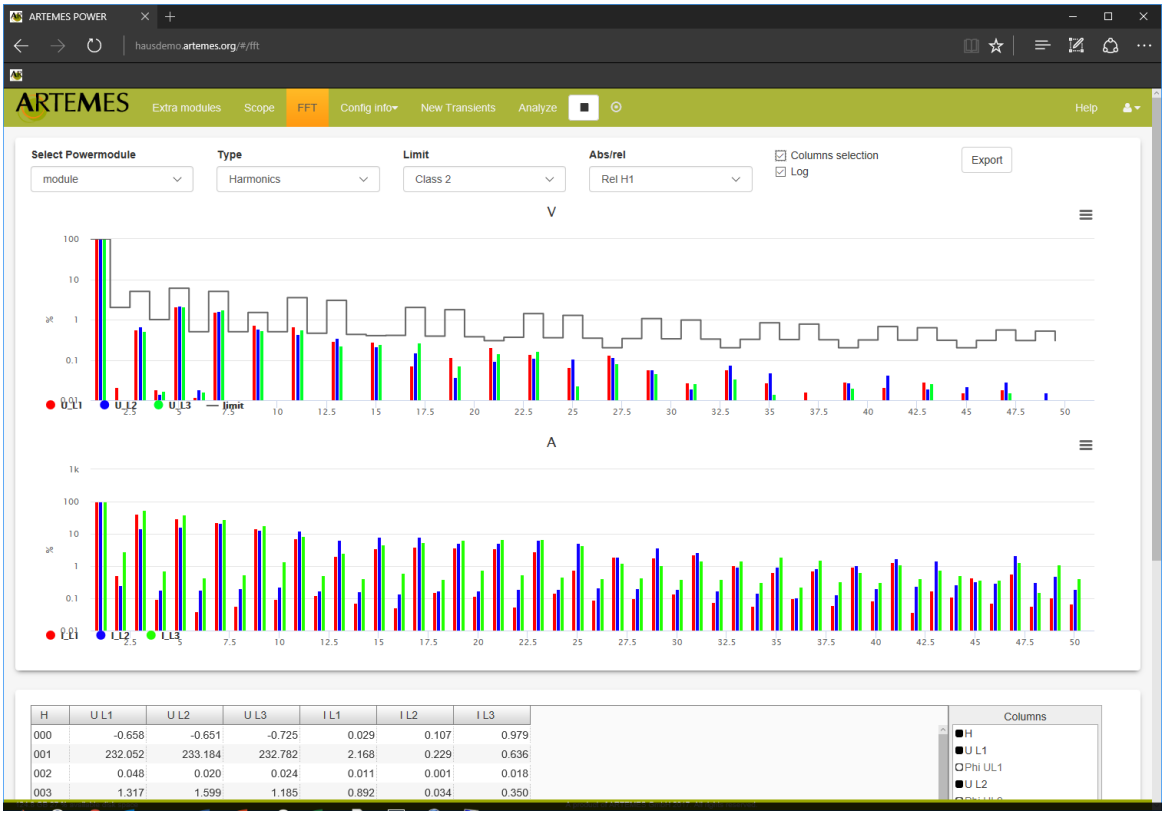
To show the online FFT limits select them from the list given in the pull down menu "limits".



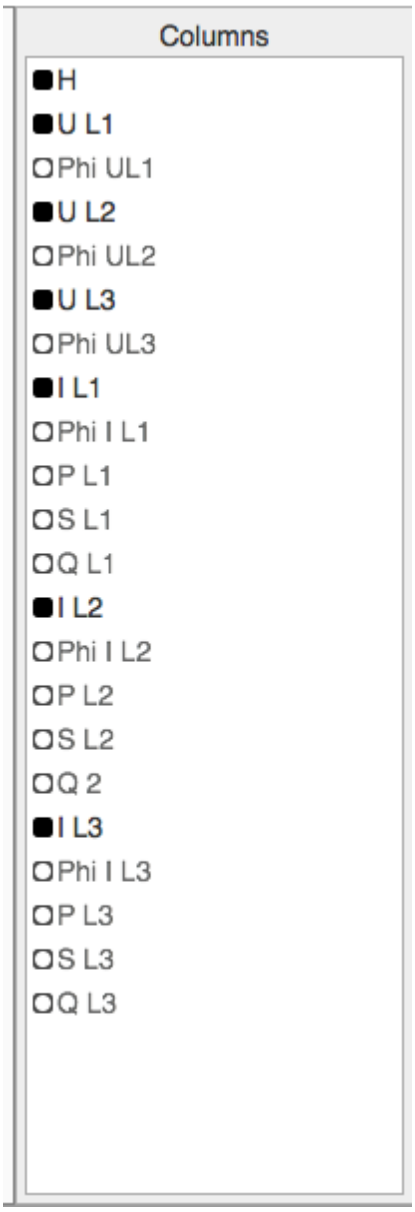
3.2.3.2 Columns Selection

On bottom of the page there is a graphical interpretation and on the bottom is a numeric view of the data.

Selecting "column selection" on top of the graphical view enables the columns list on the right side of the numeric view. There you can choose different values to be shown online just by enabling the appropriate parameter.



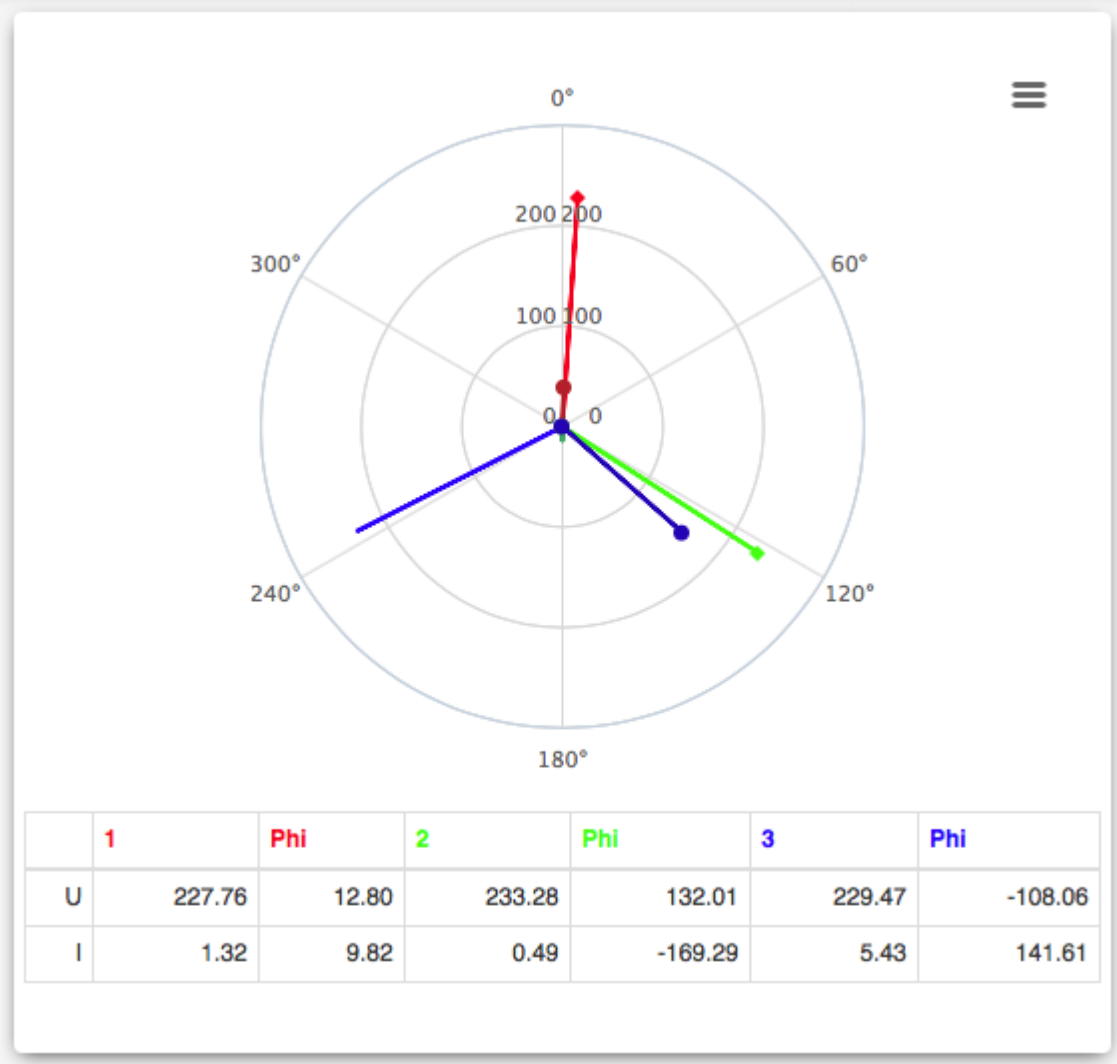
The possible values are shown in the list:



3.2.4 PMU - Online

The phasor measurement option PMU shows the phasors of voltage and current in a vector scope. The rotation indicates whether the frequency is faster or lower than the nominal frequency.

This view is part of the PMU option and needs to be licensed separately. It also requires the PMU hardware option from ARTEMES.



	1	Phi	2	Phi	3	Phi
U	227.76	12.80	233.28	132.01	229.47	-108.06
I	1.32	9.82	0.49	-169.29	5.43	141.61

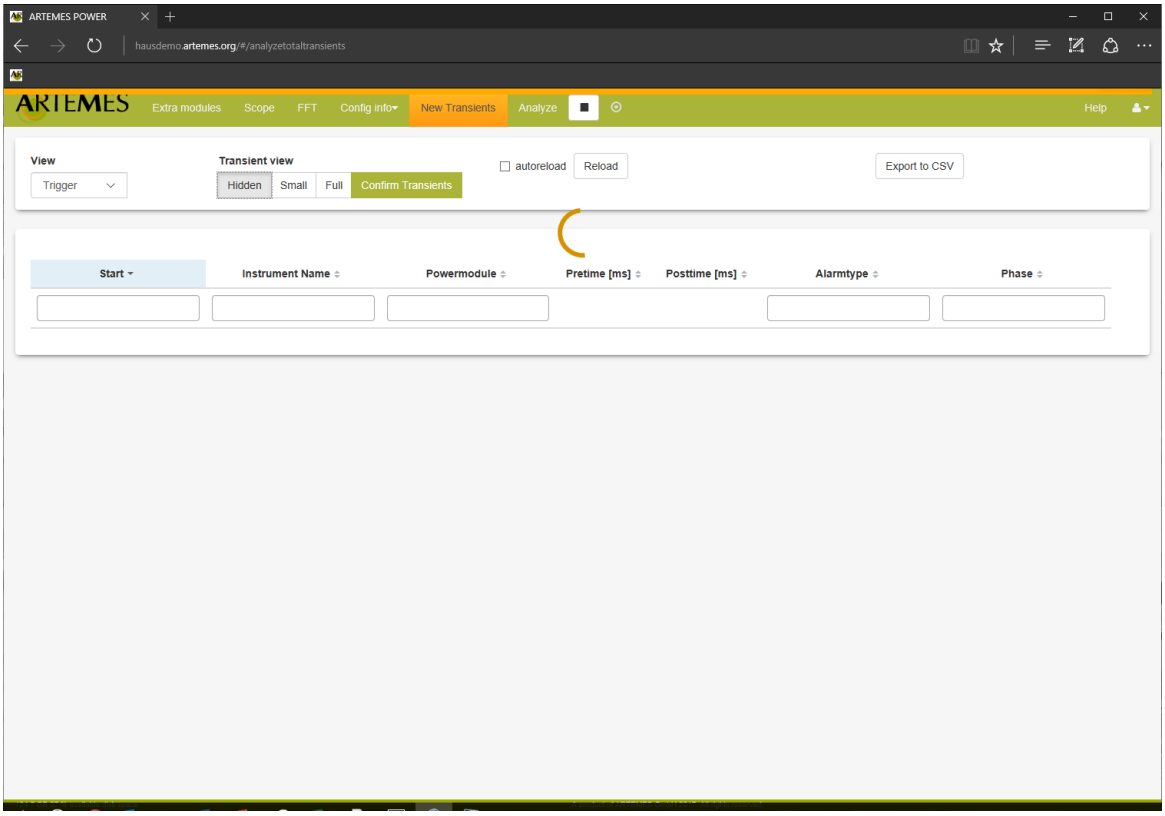
 This sign indicates the strength of the GPS signal.

 ...to export the screen in different formats, as vector graph or as image.

3.2.5 New Transients

This page shows new Transients automaically in the measurement mode.

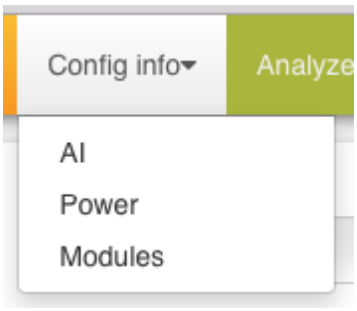
For the settings please see section Transients in data analysis



3.2.6 Config Info

This view shows the setup information as defined in the set up.
The values are the same as in the set up and are only for indication, not to be changed during the running measurement.

For detailed information on the values see the setup section of this manual



3.3 Recording Data

To start recording the data press the record button 
This button shall then turn into red and blink in one-second intervals.

The instruments are the same as described in the "Online measurments" section.

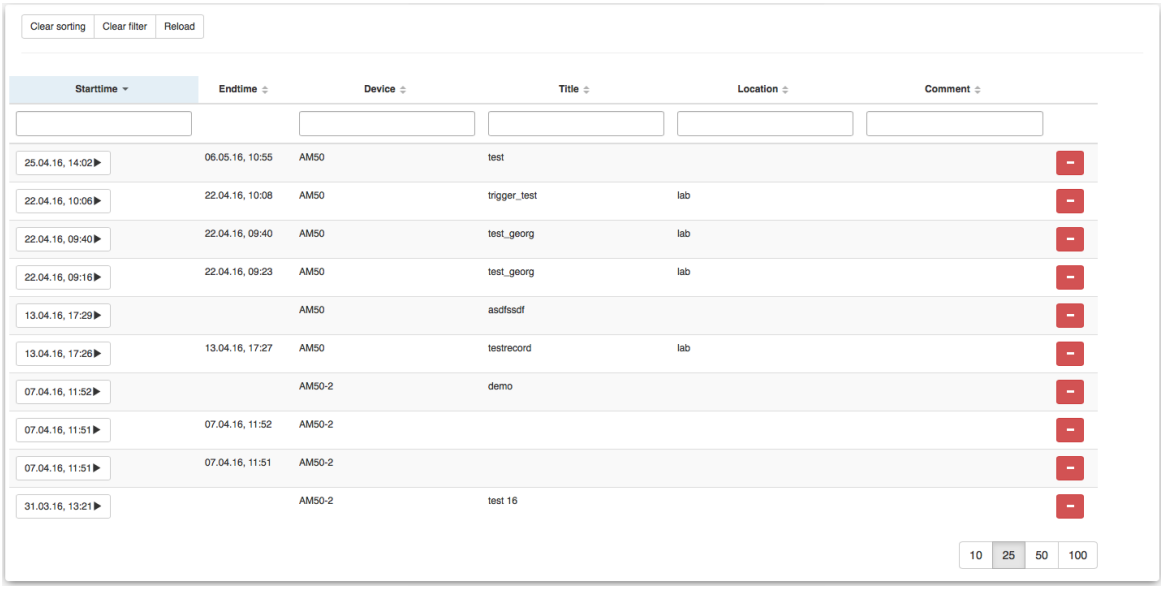
To stop the recording and return to setup mode press 

The recorded data are shown in the list Analyze.

4 Data analysis

The menu item analyze 

on the instrument or server brings up a list with all recorded measurements.

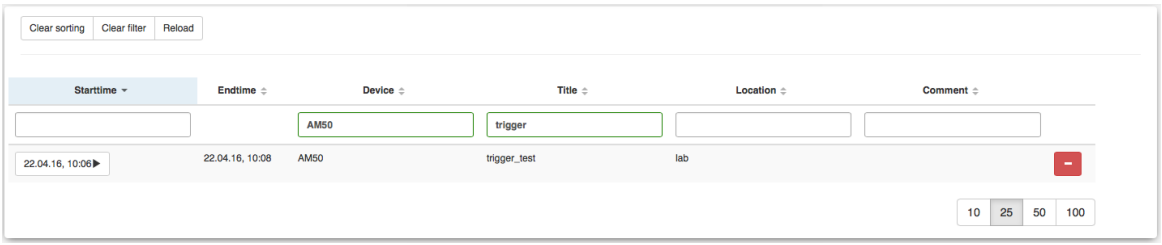


Starttime...Clicking on the date opens the selected measurement for further analysis.
- ... deletes the measurement

By using the **up and down** arrows beside the titles you can **sort** the measurements.

By using the fields **above the rows** you can **filter** the data.

Example: the following list was filtered by device "AM50" and title "Trigger".



Clear sorting... resets the sorting criteria
Clear filter...deletes the filter
Reload..refreshes the list

After opening a measurement the menu changes and you have the following entries:

Analyze
Info
Charts
FFT
Transients
Events
Alarms
Reports

4.1 Analyze

With this button you return to the list of measurements.

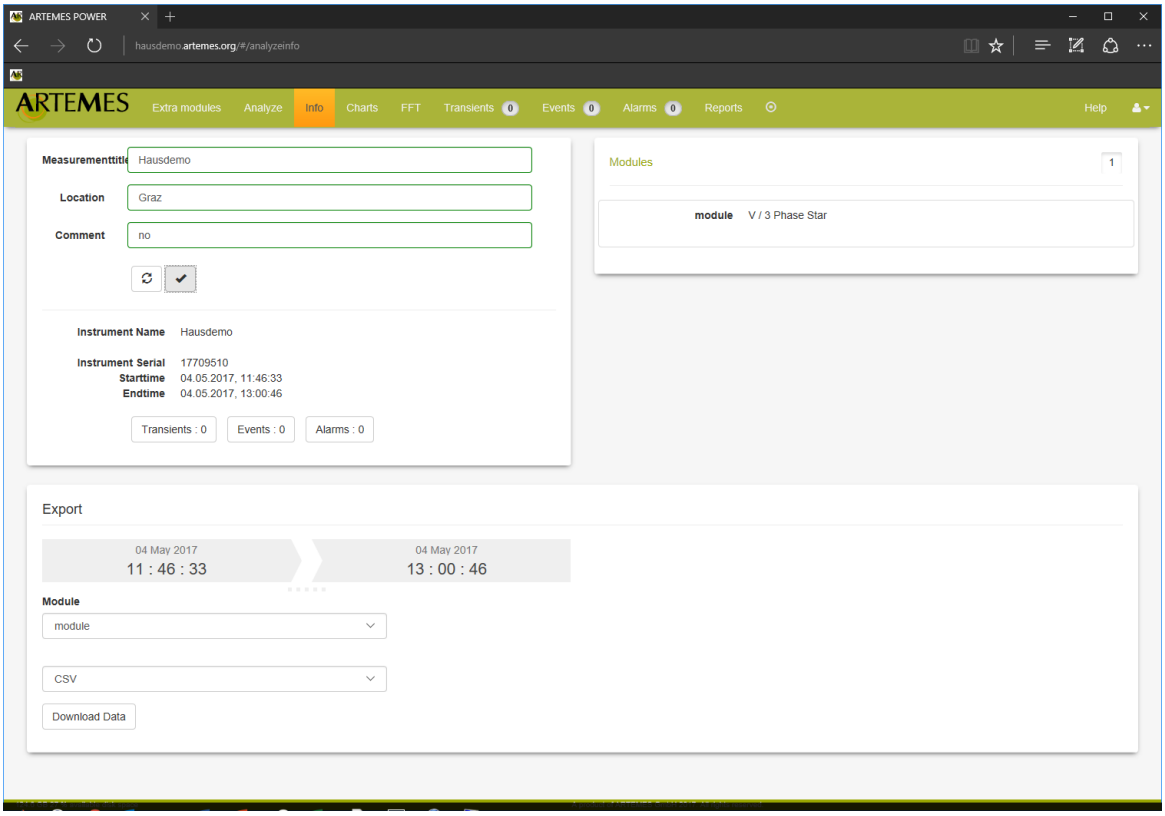
4.2 Info

This page gives a quick overview on the recorded data, the power modules and the number of events, transients and alarms.

The Infos like measurementtitle, Location and comment can be changed or set.

With  the values are stored.

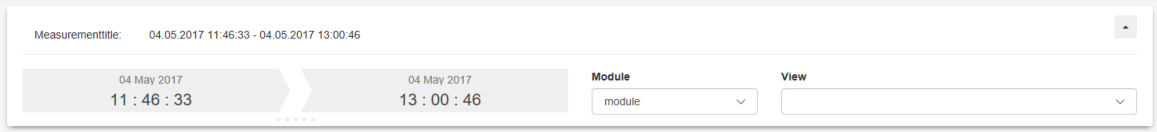
With **"Export"** you can download the compete data set to your local drive - either in "CSV" or "RAW Data" format.



4.3 Charts

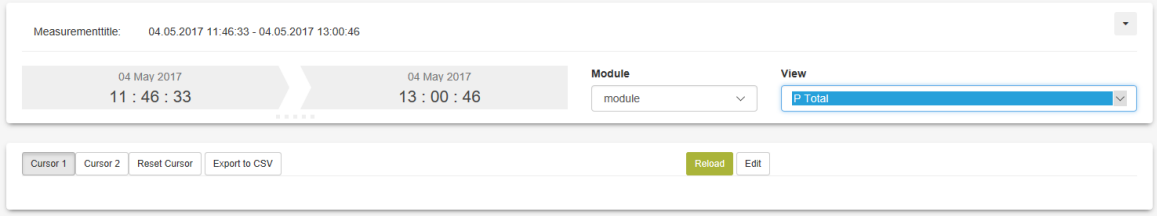
Charts are the most used post-processing part.
Any data channel can be chosen and shown as timegraph.
Also data from different modules can be compared or simple math can be made with more channels.

To load a predefined graph just choose **start** and **endtime**, the **module** and the **view**, which gives a list of already defined graph sets.



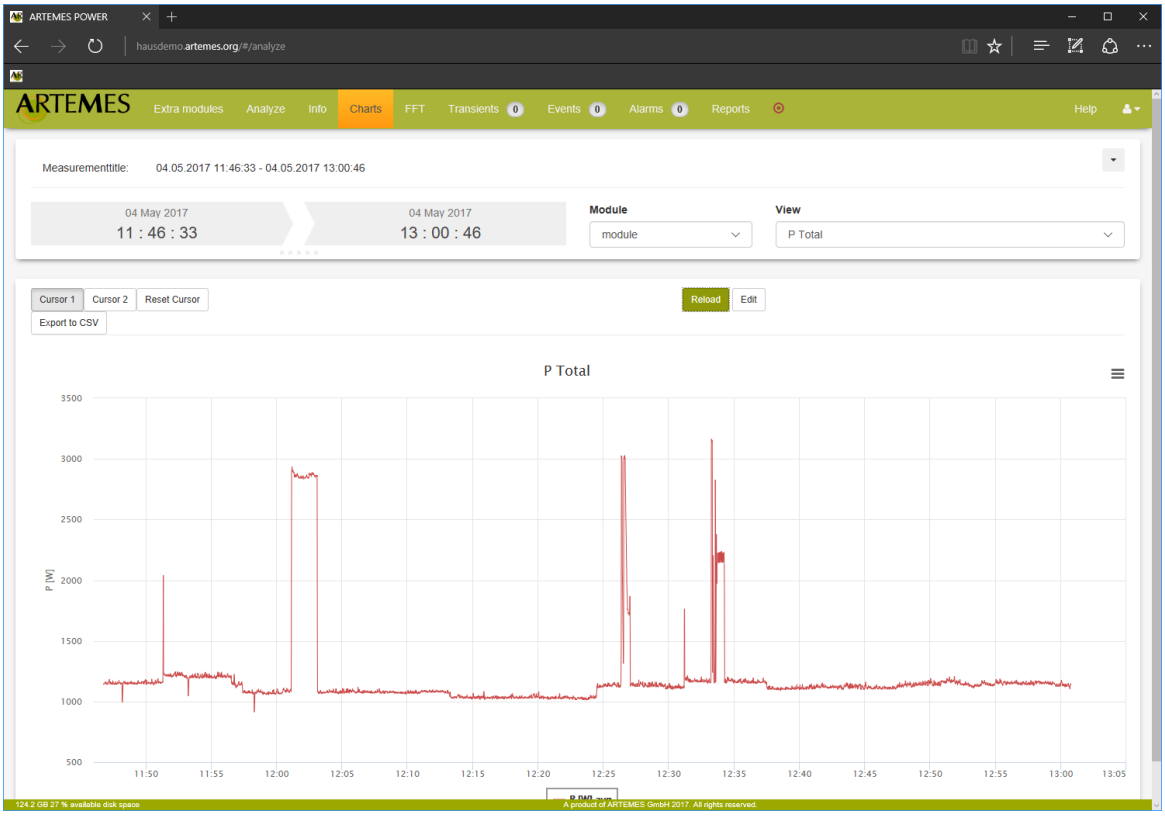
In this example the selected **view** is "P total".

Then press **reload** and the graph will be shown on the screen.



Now you can **set cursors**, export the data with the **export** button (direct CSV export) or the button for different export formats.

Channel names...click into the legend to show/hide any channel



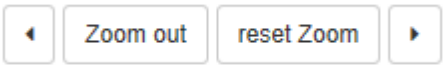
Further functions are:

[Zoom](#)
[Changing a Graph](#)
[More Graphs on one page](#)
[Math Functions](#)
[Math Functions with different power modules](#)

4.3.1 The Zoom Function

To Zoom just use the mouse and click in the grapf window, hold the mouse button and open a recangular window, then release the button.

The Zoom Menu appears to shift, reset or unzoom



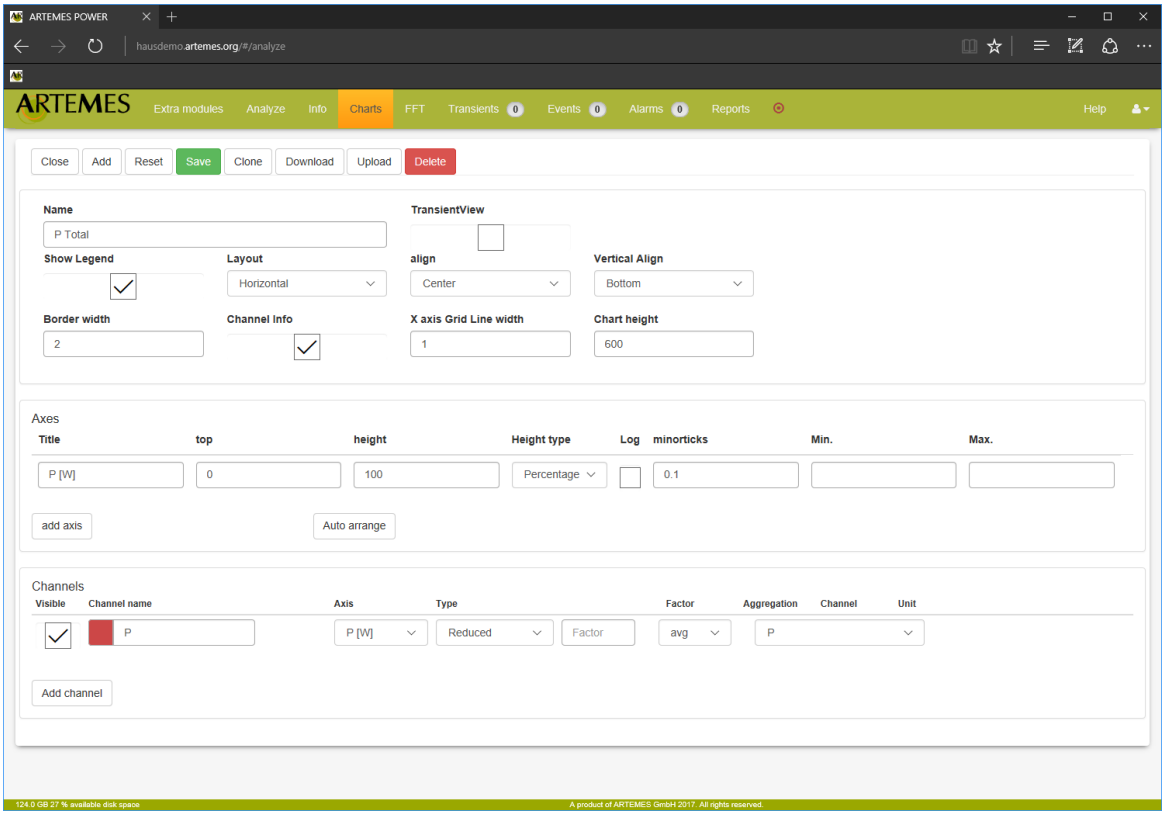
The next window shows a zoomed graph.

4.3.2 Changing a Graph

Once the graph is loaded you get an **edit** button on the right side of the view selector.

Click on it and you get the following page:

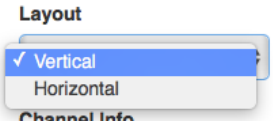
close...to close this page and return to the graph
add...to add a new view
reset...to reload the previously stored version
save...to save the setting
clone...to duplicate a graph
download...to download the settings
delete...to delete the graph



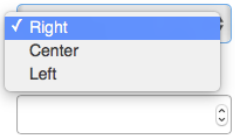
The general settings of the graph are:

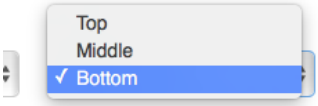
Name...the name of the view
Transient View...to use this view also for transients
Show Legend...to show the legend of data

Layout...the direction of the legend



align...the horizontal align of the legend





Vertical align...the vertical align of the legend
Border width...the width of the border
X axis Grid line width...width of the grid
chart height...heigth of the total graph

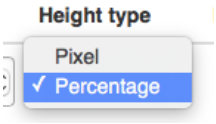
Axis settings:

Each graph can have more axis.

Each axis has its own heigth and start position

using the **auto arrange** calculates the height and position automatically.

Title...name of axis
top...position of then top of the axis (top is 0)
height...heigth of the axis

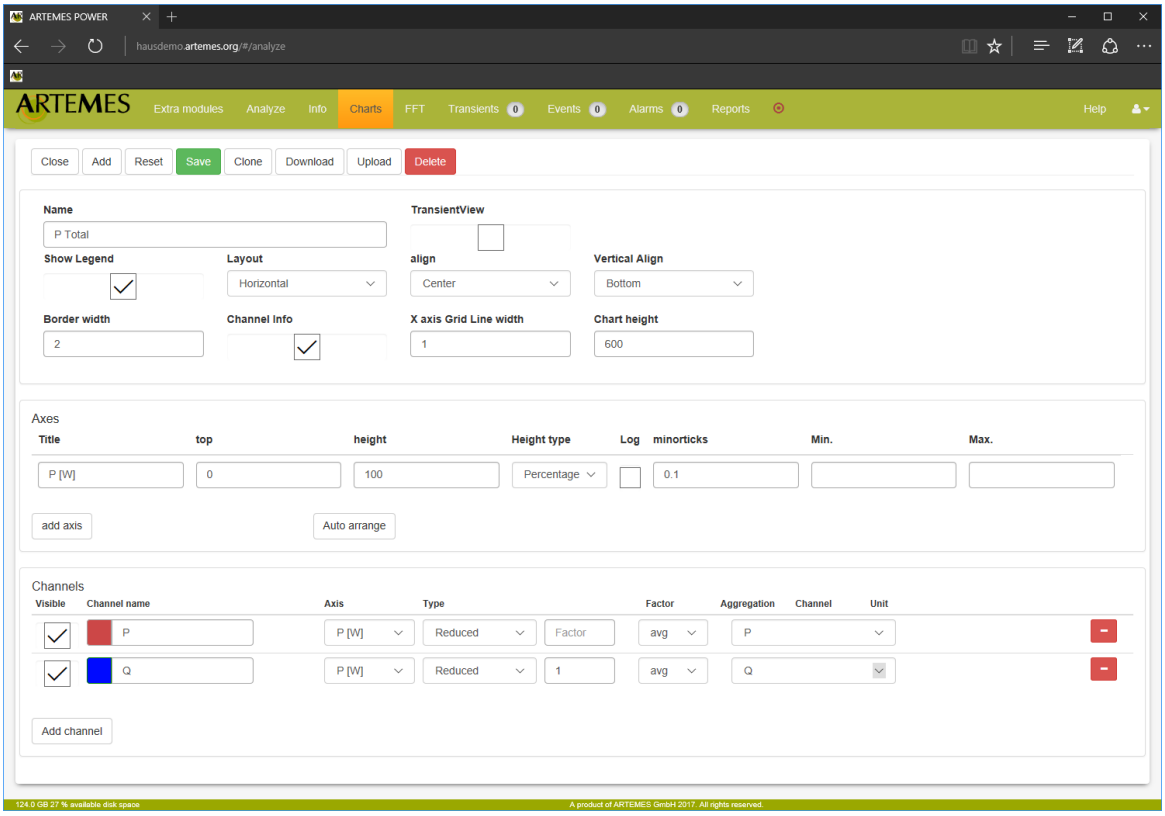


height type...percent or pixel
log...logarithmic scaling or not
min...lower value or AUTO
max...upper value or AUTO
add axis...to add an axis
-...to delete an axis

Channel settings:

several channels can be displayed on the graph.
each channel is assign to an axis.

visible...to show or hide a channel
channel name...name of the channel to be shown
axis...in which axis the channel shall be shown
type...Data channel or math channel or raw channel (see transients view or to show full sample data)
factor...a multiplication factor to the value
aggregatioon...min/max/or average value of the data
channel...the channel from the channel list file
Unit...the Unit of the channel
add channel...to add a channel
-...to delete a channel

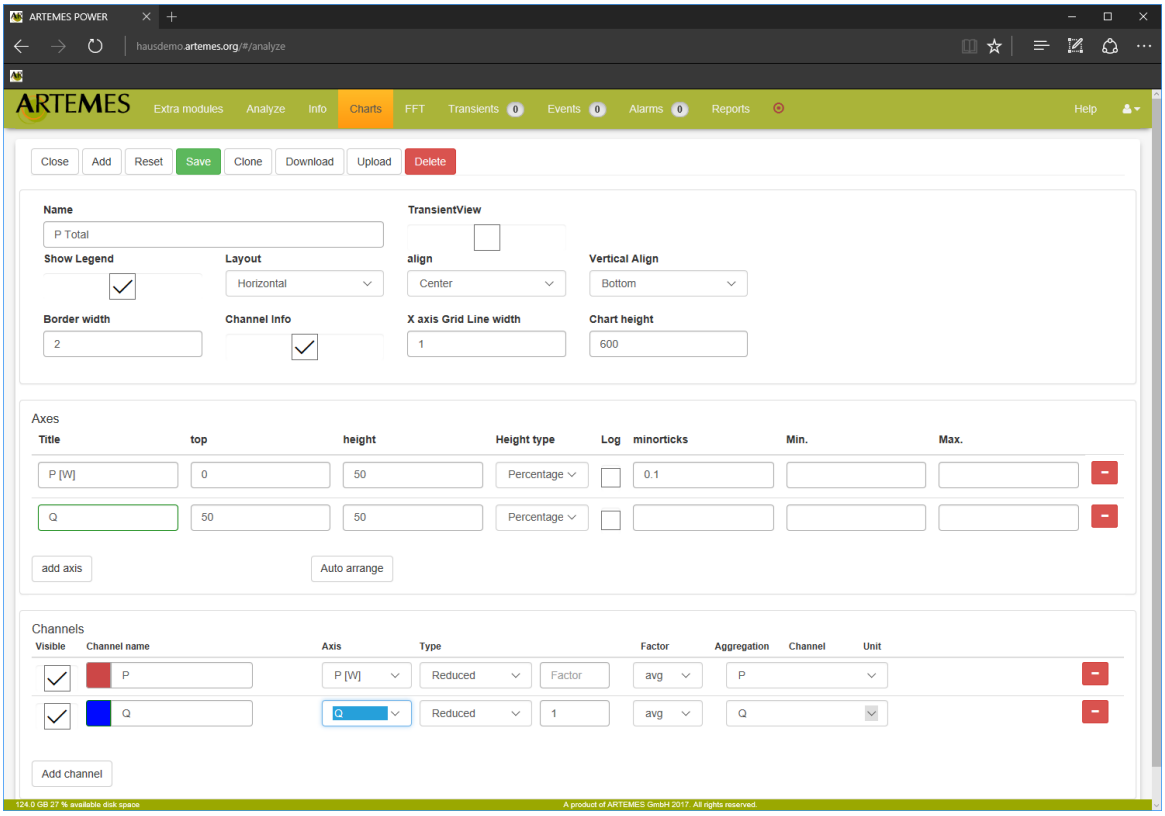


In our example a second channel Q is added to the Power channel P
The color is selected as blue.

After saving, closing and reloading the set up the graph is shown as below:

4.3.3 More Graphs on one page

To show more graphs simply **add** a chart axis - here it is called "Q".
Press **Auto arrange** for setting the top and height values.
Then assign the second channel Q to the axis "Q".

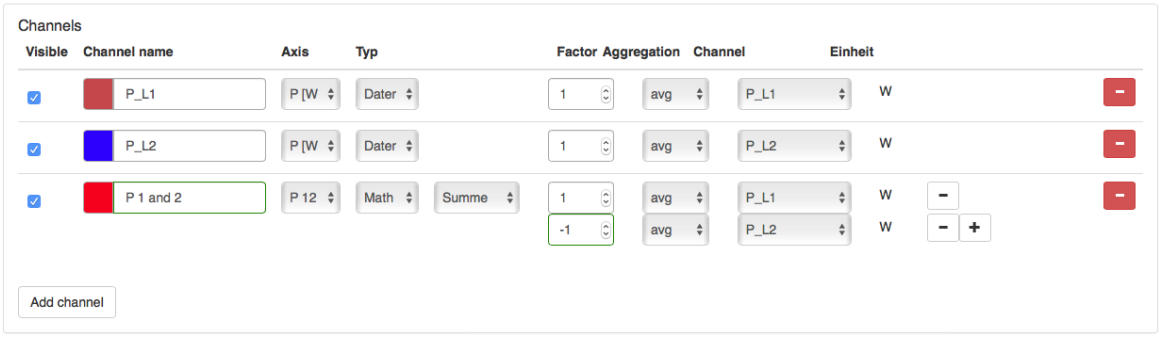


Save, **close** and **reload** the graph.
The result will look like the following screen:

4.3.4 Math Functions

In this example we have 2 power channels and we want to add a channel which shows the difference of these 2 channels.

- P_L1 and P_L2 must be created first.
- Then create an other channel. The type is math.
- Then choose the math function "sum".
- Assign the first channel P_L1 with factor "1".
- Click "+" and assign a new channel P_L2 with factor "-1". The name is "P 1 and 2".

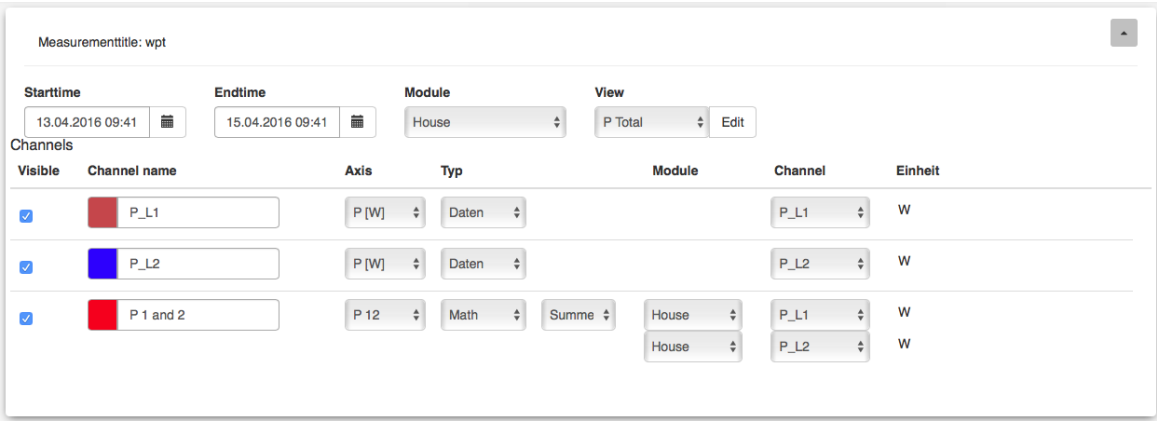


Save, **close** and **reload** the graph. The result will look like the following screen:

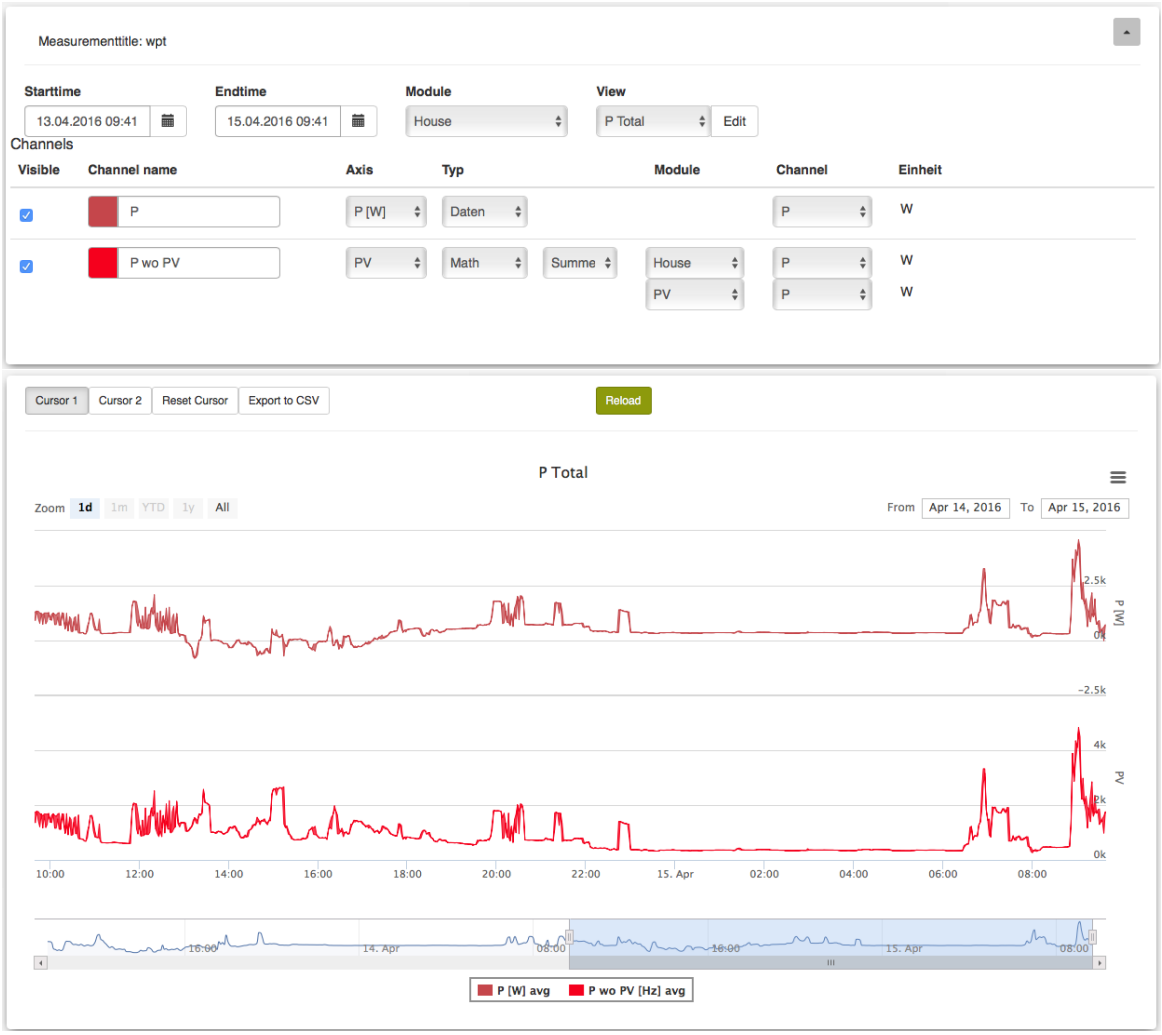
4.3.5 Math Functions with Different Power Modules

If you have defined math channels you can even use different power modules.

Just choose the modules after loading the graph.



In this example the module "House" of the P_L2 was changed to "P" from the module PV.
The result shows the power from the module "house" minus the "PV" system.



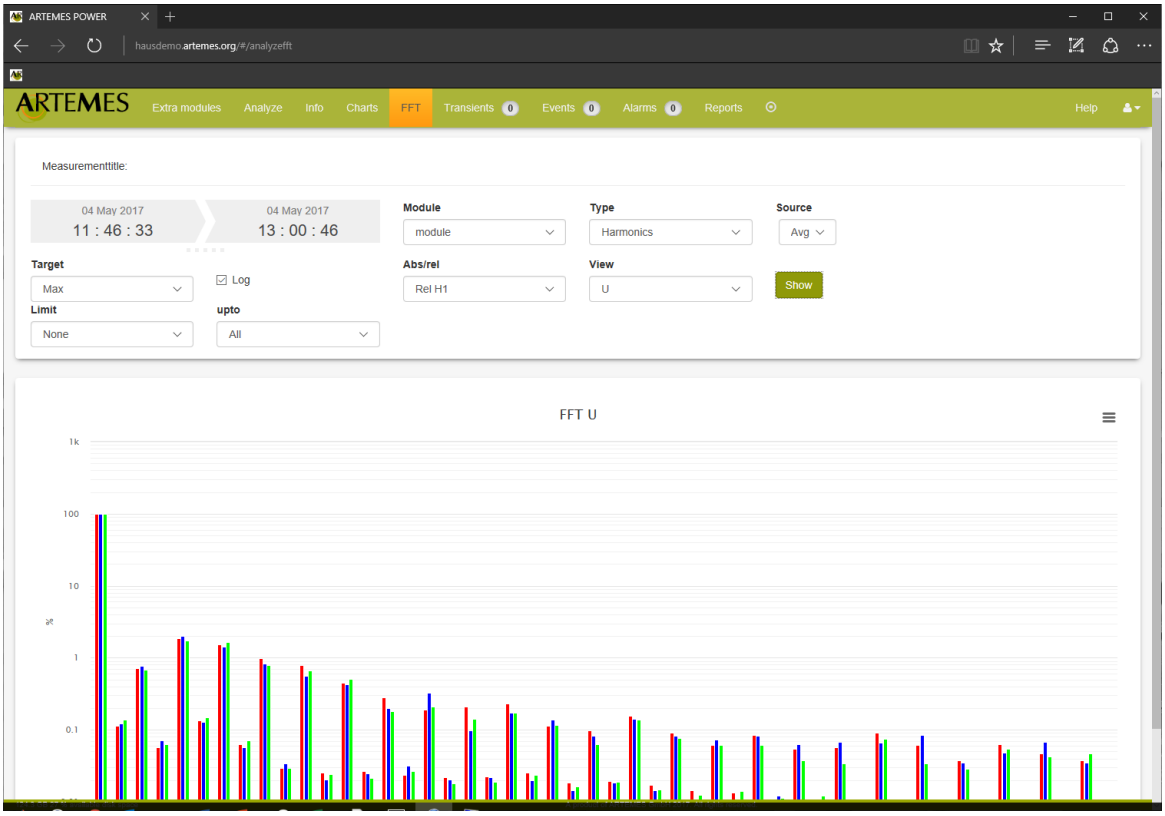
4.4 FFT

The evalution of the harmonics (FFT) can be done in three ways.

1) Bar graph...as described on this page
2) Time graph...time lines described in charts
3) Report... as described in the predefined reports

Bar graph:

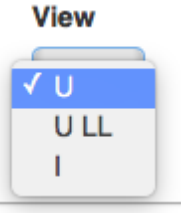
Choose the power module and time interval to evaluate - then press show.
The graph will be shown immediately (depending on the size of data it takes some time)



Module...the power module to show
Starttime...begin of the data window to evaluate
Endtime...end of the data window to show
Show...refresh the display and take the changes of the parameters

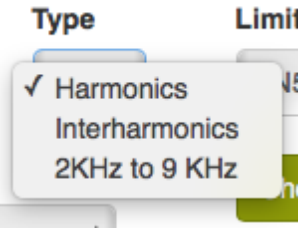
source...normally avg. The data which shall be chosen for the evaluation. In a storing interval there are stored avg / min and max values.
target...which data of the evaluation period shall be shown: average, minimum or maximum

log...if the diagram shall be shown logarithmic or linear



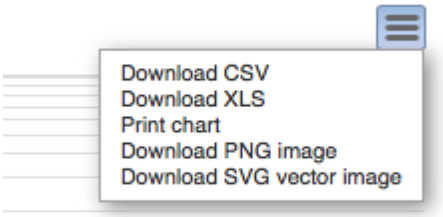
view... which data shall be shown: phase voltages U, line voltages ULL or currents

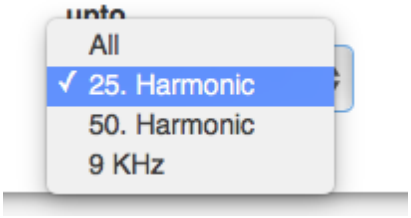
Abs/rel...if data shall be shown in absolute values (V, A) or relative (%) to the fundamental



Type... whether the harmonics shall be shown (IEC 61000-4-7, the higher frequencies 2-9 kHz in 200 Hz groups or 8-150 kHz in 2 kHz groups)
The amount of datan is depending on the real sampling rate and bandwidth of the instrument which has recorded the data. Also the options must have been set up on the FFT Setup section)
Limit...the limit to be shown (IEC 61000-2-4, EN 50160)
UpTo...the upper value of FFT to be shown

To **download** data choose the symbol on top right of the chart

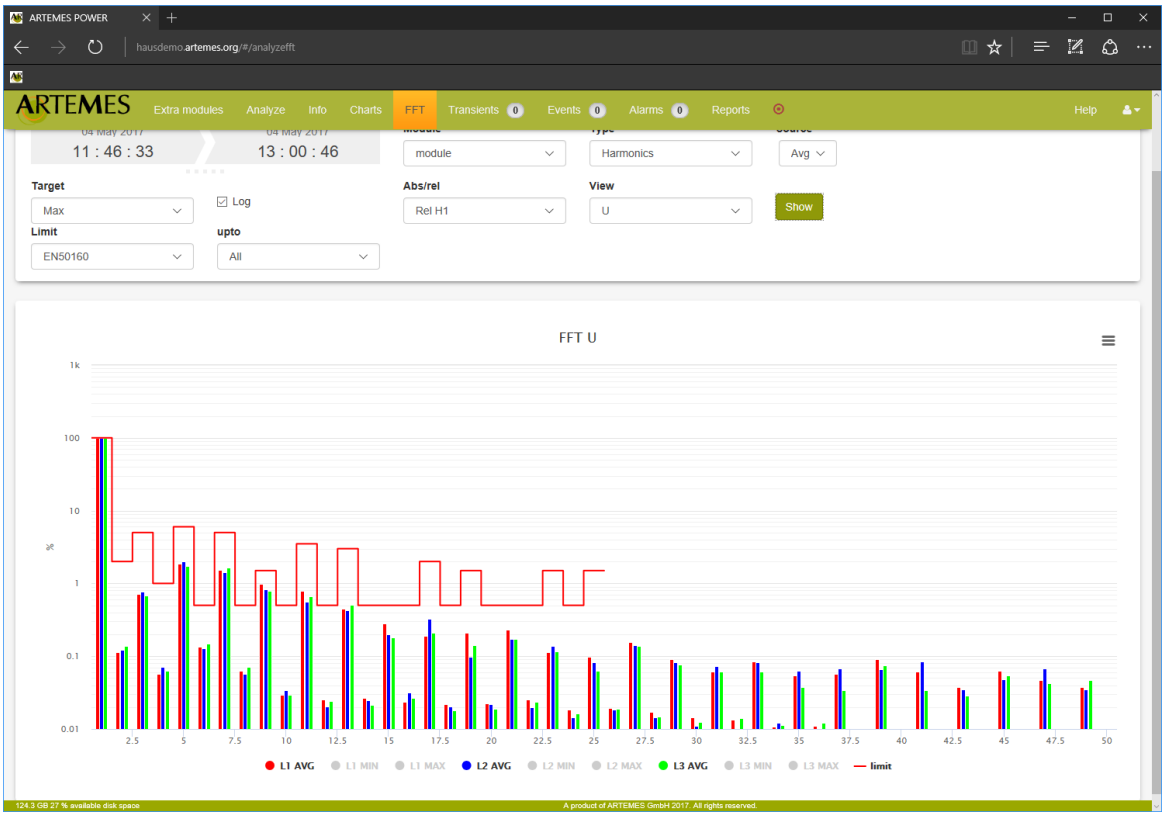




Geben Sie hier den Text ein.

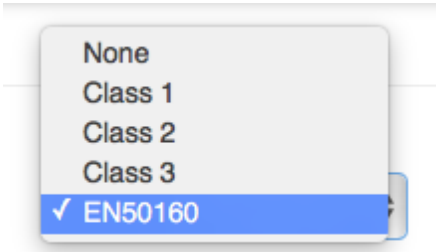
4.4.1 FFT with Limits

To show also limits on the FFT page select **limit**



In addition the red step chart is shown which indicates the limits of the selected standard.

The values can be:
Class 1,2 or 3 from IEC 61000-2-4
EN 50160

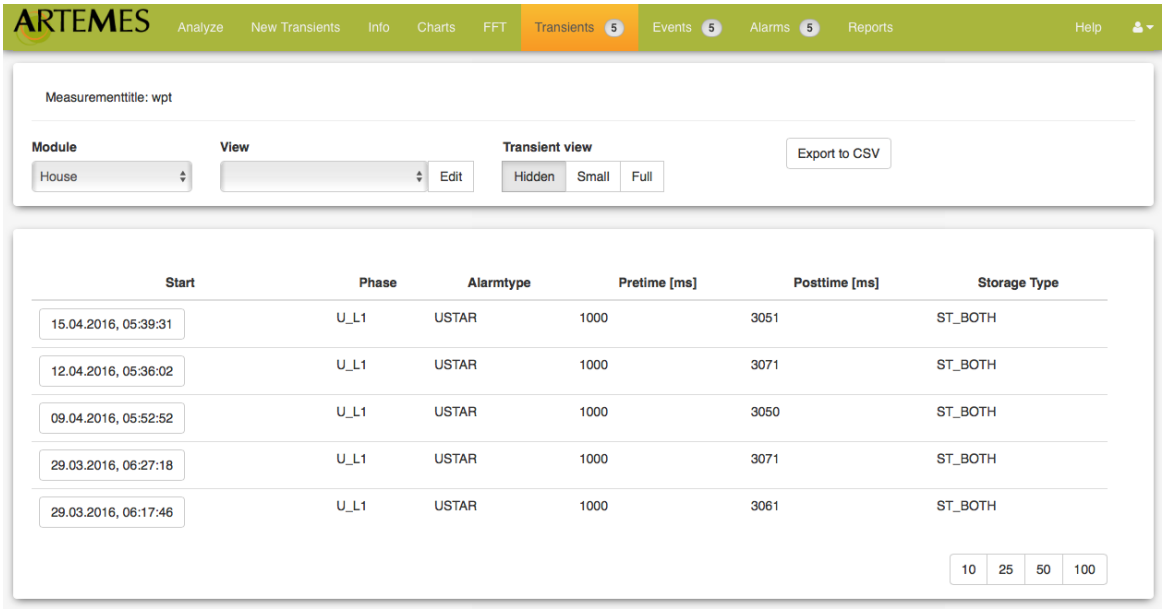


Further limit analysis can be made with the FFT report described in the reports section.

4.5 Transients

This page shows a list of transients that have been recorded.
The captured data are according to the settings in the transients setup.

The number in the menu indicates the amount of recorded transients.

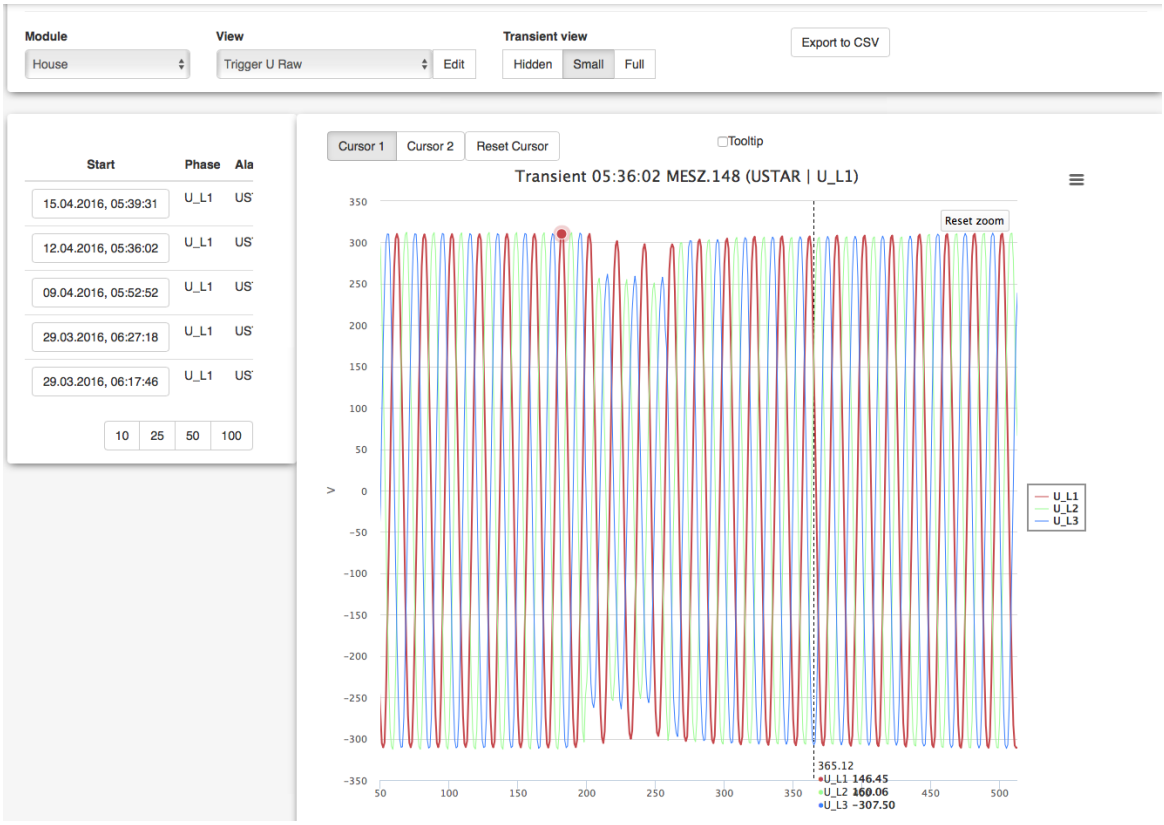


Click on the date/time of a transient to get the data view.

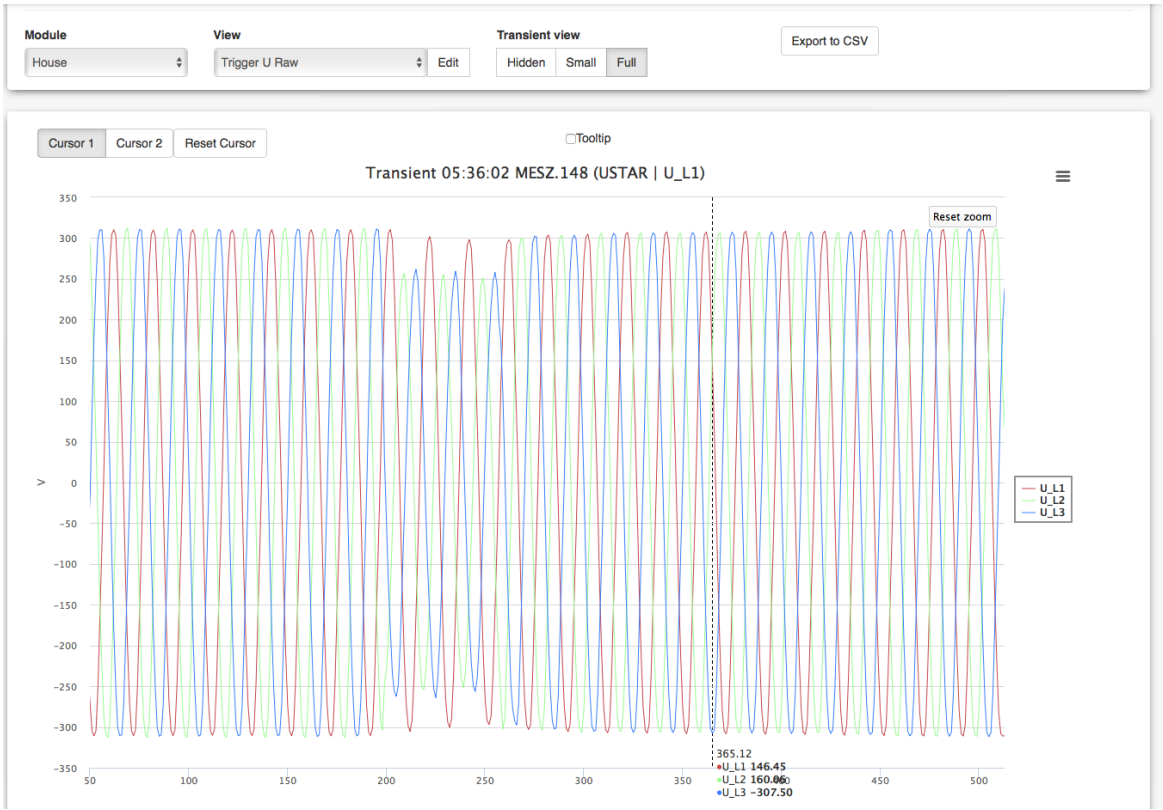
4.5.1 Transients View

The transient view window has three different ways of viewing the data:
Hidden...only the list of transients is shown
Small...shows the list and the data
Full...shows only the data

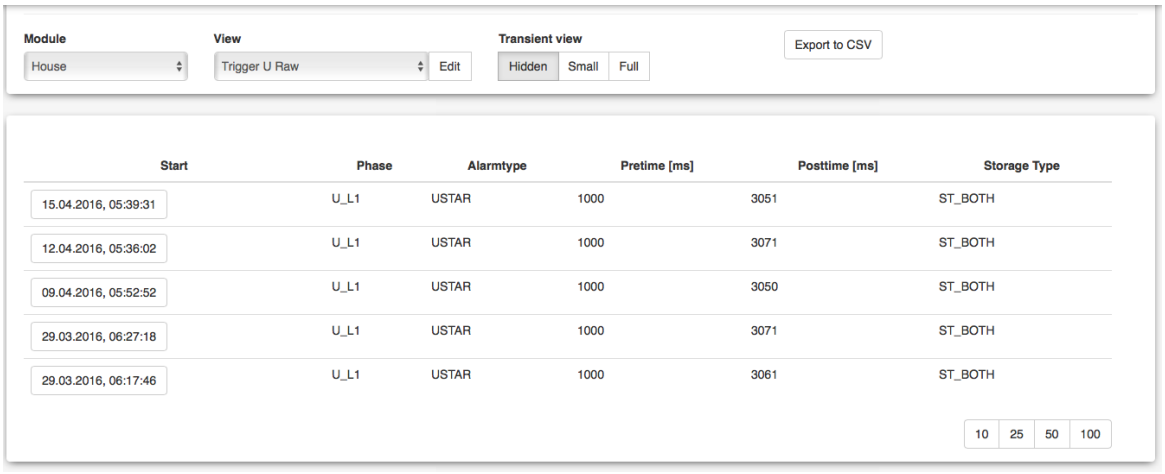
Small view:



Full view:



Hidden view:



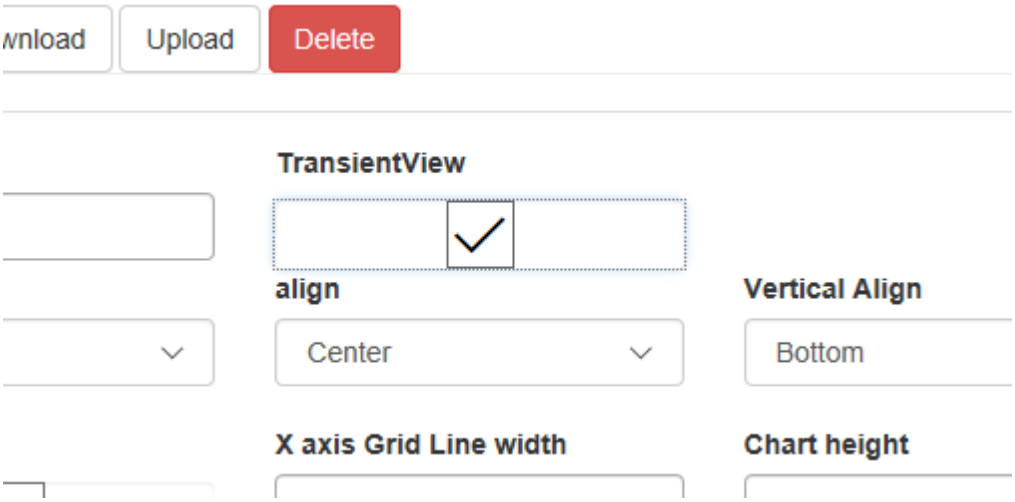
Module...the module of which the transients shall be shown
View...the predefined view setup, can be created or modified by user.
Export to csv...direct csv export

...export to other file formats
Zoom...with mouse click/hold and zoom in the time window
Click **reset zoom** to go back to full time.
Tooltip...to show values on the mouse cursor
Channel names...Click into the legend to show/hide any channel.
Cursor 1 (2)...to set 2 different cursors. Values and difference will be shown on the screen.

4.5.2 Changing the Transient View

To change a transient view is similar to the graph view.
For detailed information please see the chapter charts/changing the graph.

!! Take care that the **"Transient view"** is set !!



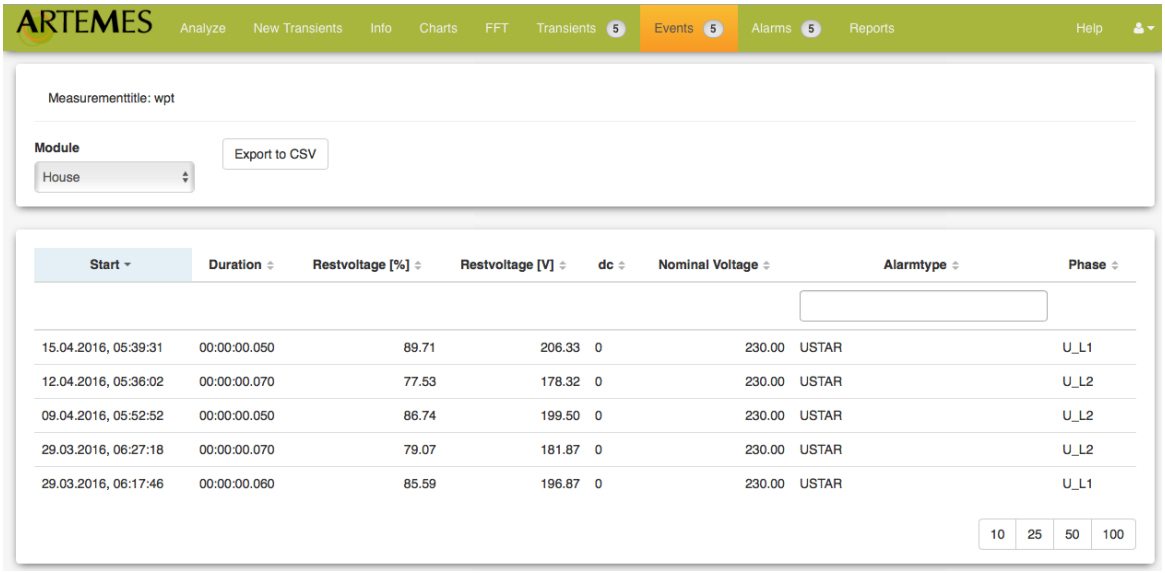
The channels type must be set to **"raw"**l

4.6 Events

This page shows a list of events that were recorded.
The definition of events corresponds to EN 50160 and evaluated on basis of the voltage band triggers.

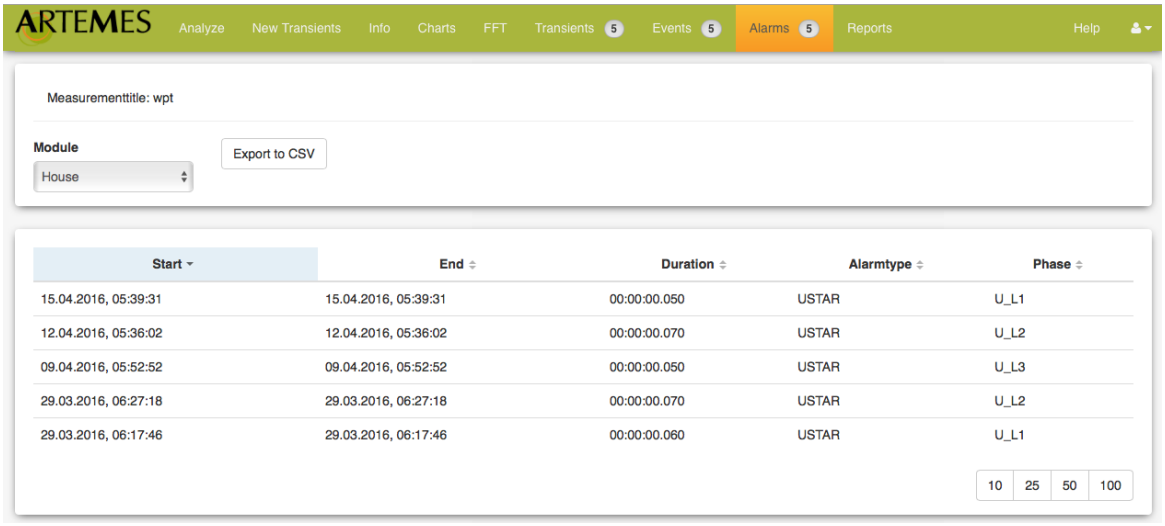
The number in the menu indicates the amount of recorded events.

A more compete evaluation of the data can be carried out with the Events Report in the report section.



4.7 Alarms

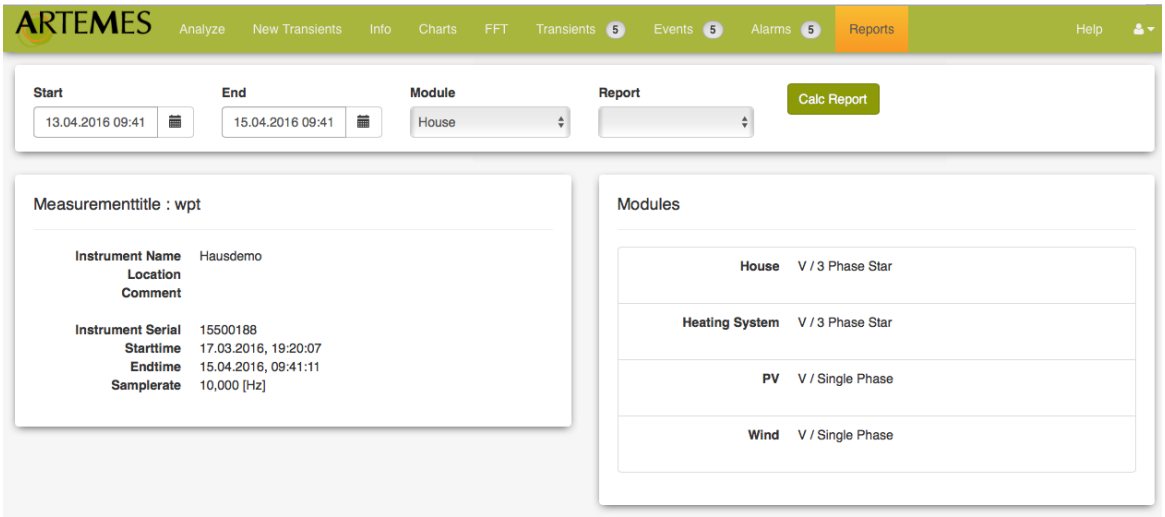
This page shows a list of alarms that happened during the recording. The number in the menu indicates the amount of recorded alarms.



4.8 Reports

In this section predifined reports can be loaded very easy. Reports are scripts that run on the server and are well-layouted pdf-files.

Chooses the **duration** of the reporting interval (**Start**, **End**), the **module** and which **report** you want to show - the click **"calc report"**.



After starting the report there will pop up additional windows, which already depends on the kind of report itself.
The pdf-report will be opened as a new TAB in the browser.

If an error occurs during calculation a text window in the browser will inform you about that. For

analysis of the error please send us the text and provide the data (Mail: support(at)artemes.org). Also if you want to include own reports or modify the existing ones please contact us.

More detailed examples can be found in the step by step chapter:

EN50160: Power Quality

IEC 61000-2-4: Hamonics and Limits

Events: Dis Dip, ITIC/CBEMA and more

IEC 61400-12-1: Power performance Test

IEC 61400-21: Power Quality Test on renewable energy sources

Energyreport: for ISO 50001 reports

5 The Server Solution

ARTEMES provides the data analysis functions also as a dedicated server.

All data can be synchronised during the running measurement to the server from several instruments at the same time.
The evaluation of data can then be done crosswise between different data sources. the strong reporting engine is used.

6 Report Engine

The report engine is a very strong and flexible engine which consists of two parts:
1) The report calculation - This part is based on Matlab(r) / Octave.
2) The layout engine - This engine is based on Latex.

The reports can be loaded directly from command line, the editor or from the web software in post processing mode.

There are a large number of already predefined reports available.

We provide a set of functions with which you get direct access to the data.

6.1 Predifined Reports

Diagrams:	
U_I_Diagram	Voltage and Current

U_I_f_Diagram	Voltage, current and frequency
P_Q_S_PF_Diagram	All kinds of Power, total values
U_min_max_Diagram	min and max of voltage

Reports according to certain Standards:

En 50160	Power Quality Report according to EN 50160
IEC 61000-2-4	Power Quality Report for customer girds according to IEC 61000-2-4
IEC 61400-12-1	Power Performance Test for Wind turbines according to IEC 61400-12-1
IEC 61400-21	Power Quality Type Test for Wind turbines and other renewables according to IEC 61400-21
DisDip	Event List, Cbema curve and dis dip statsitic
Transient List	List of recorded faults
Energy Report	Energy Report for ISO 50001

this lists may vary from the real installed diagrams

7 Matlab(TM) routines to load Data

ARTEMES provides a set of functions to get direct access to the data in Matlab(r) or Octave.

First we should explain the data structure:

There are some different kinds of data in the ARTEMES data system:

- recorded data - this are data which have been periodically stored, but not in full sample mode. for example 1 min average values of power, 10 second values of frequency or 10 minute rms values of voltages. The data are stored in the directory M_xxxx/P_xxx/D_xxx/async/*.001. To load those data see "Loading recorded data"
- triggered data (Transients): this data are data stored with full samples (for example 10Samples/sec, 2MSamples/sec). They have been triggered automatically on a predefined event and have a pre and post storing time. The data are stored in the directory M_xxxx/P_xxx/Transients/*.ams. To load those data see "Loading triggered data"
- streamed data: this data have been recorded with full samples continuously. The data are stored in the directory M_xxxx/sync/*.ams. To load those data see "Loading streamed data"

Further functions to use in Matlab(TM) are:

- To get the channel index number:
- Change time intervals: To normalize to a new time axis
- Event List: to load the event list

7.1 Loading recorded data (reduced storing)

Recorded data are data which have been periodically stored, but not in full sample mode. for example 1 min average values of power, 10 second values of frequency or 10 minute rms values of voltages. The data are stored in the directory M_xxxx/P_xxx/D_xxx/async/*.001.

getAsyncSingleValueFromFilter...returns a vector where the first column is time, the second is the value

function [retval] = getAsyncSingleValueFromFilter(abasedir, atitle, alocation, acomment, apowermodulename, achannelcode, astarttime, aendtime, avaluetype)

abasedir...the directory where the function starts searching (Datapath)
atitle...filter for the title of the measurement (if empty, then all values are taken, where the other filter values are used)
alocation...filter for the alocation of the measurement (if empty, then all values are taken, where the other filter values are used)
acomment...filter for the comment of the measurement (if empty, then all values are taken, where the other filter values are used)
apowermodulename...filter for the powermodule of the measurement (if empty, then all values are taken, where the other filter values are used)
achannelcode...the number of the channel from the converNameToLogCode function
astarttime...starttime of the data to be loaded. if 0 then the first valid data is taken
aendtime...stoptime of the data to be loaded. if 0 then the last valid data is taken
avaluetype...1=max, 2=min, 3=average, 4=S (deviation) or for counters 4=difference to last value

getArrayValueFromFilter...returns an array value like harmonics, where the first coliumn istime, the others the harmonics

function [retval] = getArrayValueFromFilter (abasedir, atitle, alocation, acomment, apowermodulename, achannelcode, astarttime, aendtime, avaluetype)

7.2 Loading triggered data (full sample storing)

Triggered data (or "Transients") are data stored with full samples (for example 10Samples/sec, 2MSamples/sec). They have been triggered automatically on a predefined event and have a pre and post storing time.

To load the data you use the sdame function as for streamed data, but the data path is different and the name of transient is depending on which transient you want to load.

7.3 Loading streamed data (full continuous sample storing)

Streamed data have been recorded with full samples continuously.

To load the data use "getTransient"

function [output_args , firsttime_out, x_axis_out] = getTransient(afile, achannelindex, astartoffset, amaxsize)

Parameters:

afile ... the direct path and name of the file: e.g "yourroot/M_xxxxx.../sync/?????????.ams" this data have been recorded with full samples continuously. It has the extension ".ams"

achannelindex ... the index of the channel to load from the file (starts with 1). Example: If you want to load voltage 2 and the file has three voltages in rising order, then use "2"
astartoffset ... number of samples to cut before the loadad data.
amaxsize ... maximum number of samples to load

Returns
Output_args ... The function returns the raw data in an arry consisting of timestamp and data.
Firsttime_out ... time stamp of first value
X_axis_out: time axis in absolute time

Example:

```
m = 'M_xxx';
basedir = ['/Users/dg/Documents/Messung xxx/AM5/' m];
p1 = [basedir '/sync/0000.ams'];

% Load Setup infowith channel infos k = channel index for getTransient
%
```

```
inf = [basedir '/' m '.amc'];
info = loadjson(inf);

k=0;
for i=1:size(info.inputs(1).analog(1).channels,2)
  if (info.inputs(1).analog(1).channels{i}.save)
    i
    k = k+1
    channel = info.inputs(1).analog(1).channels{i}.caption
  end
end


%% Shows titel of measurement
tit = [basedir '/' m '.amm'];
titel = loadjson(tit)


[y1, dt1, x1] = getTransient(p1,12,20000*23,20000*4);
plot(x1(:,1),y1(:,1));
```

7.4 Get the Channel Index

convertNameToLogCode...returns the channel code from the name of the parameter. The channel code and the parameter are defined in the channel list file.

name=convertNameToLogCode(achannelfile,channelname)

achannelfile...the channel list file, full path and name
channelname...name of the parameter (for exmaple "P, U_rms_1")
name...the value of the channel

7.5 To normalice to a new time axis

normToTime...returns a vector with normalized time intervals

values=normToTime(values,starttime,endtime, averagetime, avaluetype);

averagetime...the new time interval

7.6 Loading the Event List

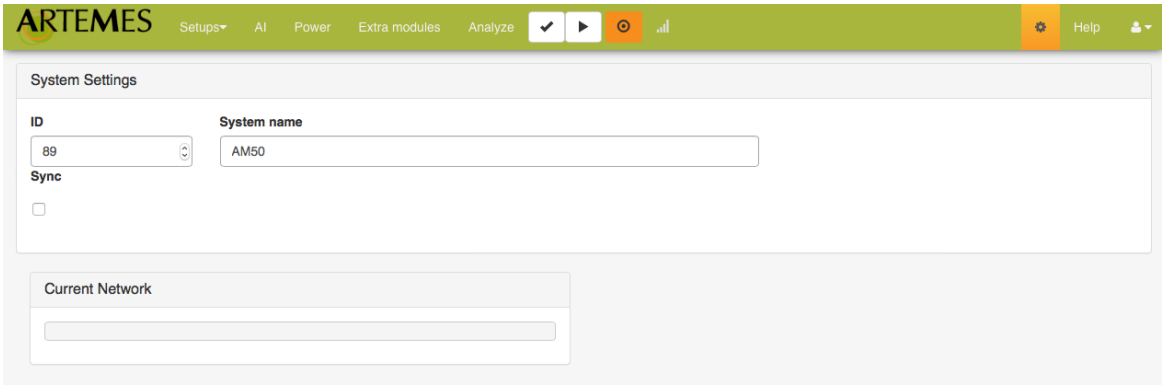
getEventsFromTitle...loads the list of events from a power module

function [retval] = getEventsFromTitle (abasedir, atitle, astarttime, aendtime)

8 Installation and System Setup

8.1 System Setup of measurement instrument

Pressing the setup button on top right of the browser you come into the system setup mode.



ID...identifier of the instrument
System Name...name of the instrument how it appears on the server
Sync...activate/deactivate the synchronisation of the data to the server
Currrent Network...used network

8.2 Installing the Measurement instrument

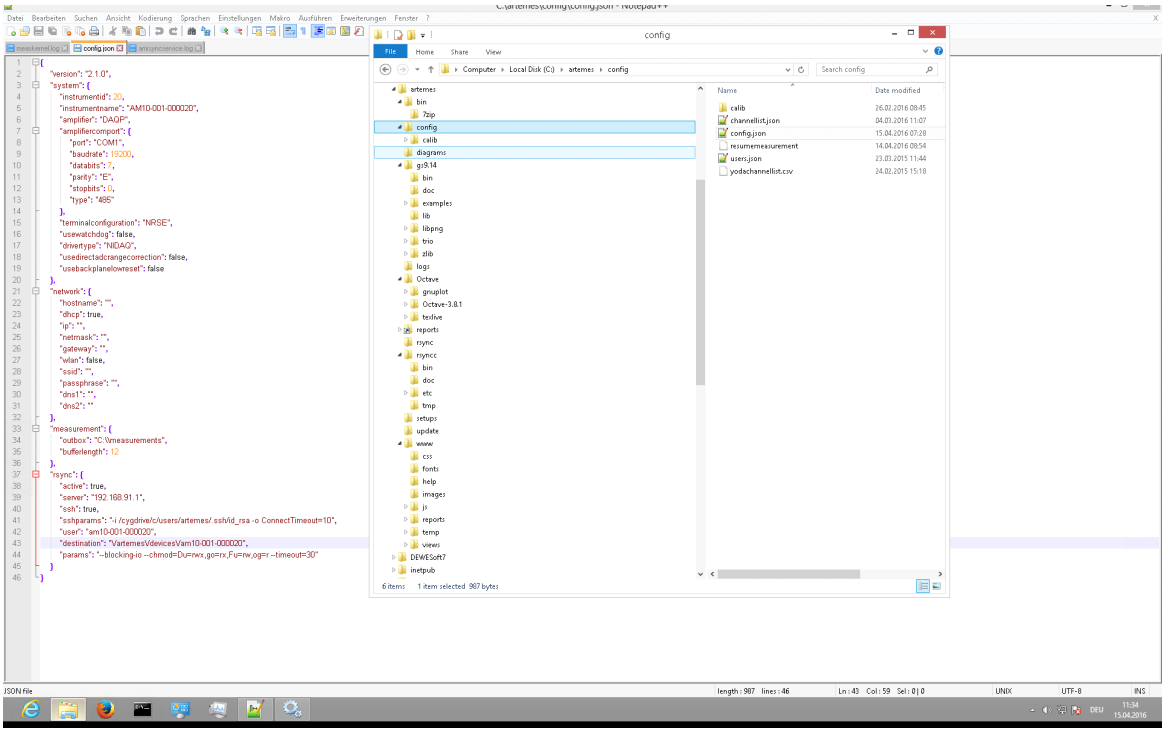
Geben Sie hier den Text ein.

8.3 Installing the Web Server

Installation of the AM power server

1. Download the file artemes.zip from https://www4.artemes.org/d/64438af2bd/
2. Unzip the file to c:\artemes

The following file structure will be created:



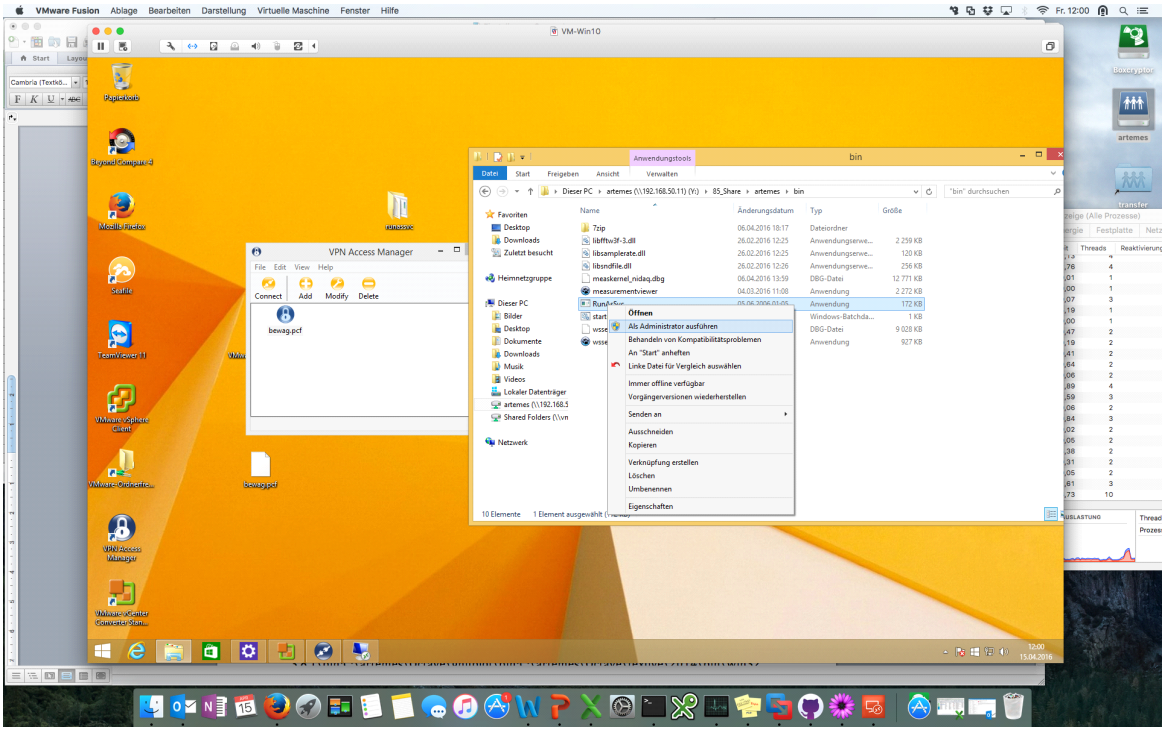
3. Modify the users.jscon in c:\artemes\config (Details from users.json in ...)

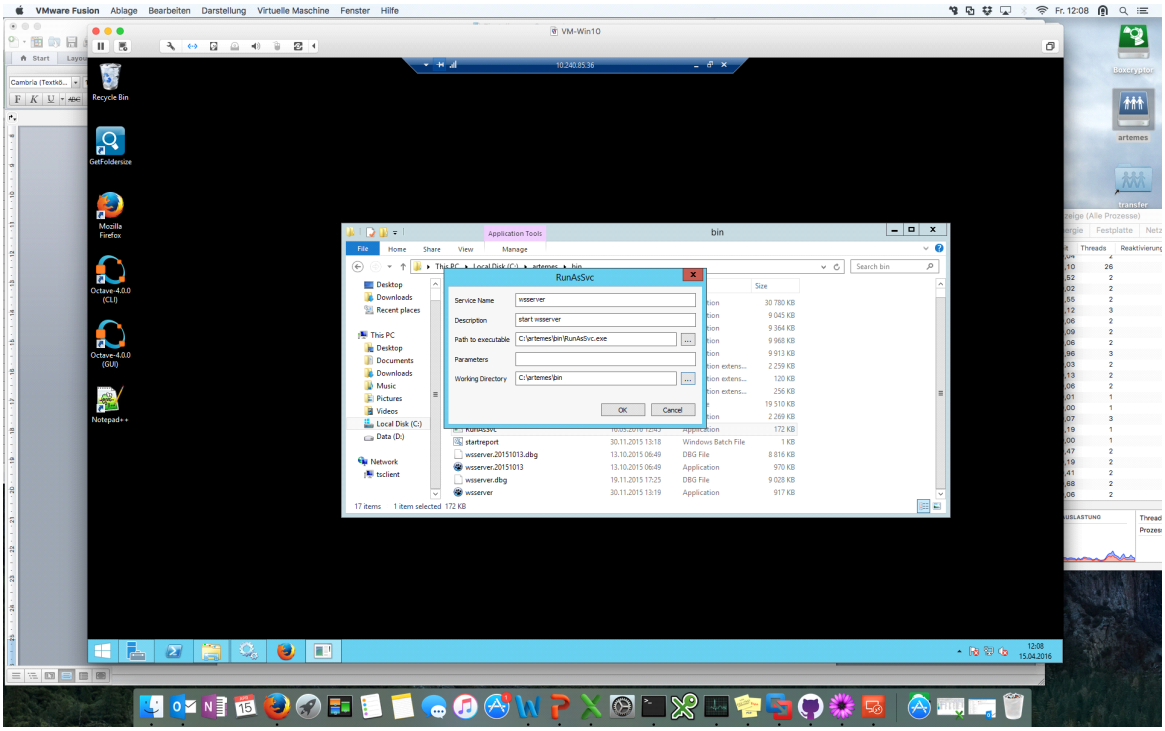
In the section groups/devices for all users who shall see the instrument, the number 90 must be entered at the end.

```
...
{
        "version": "1.0.0",
        "groups": [{
                "id": "2CC15FBC-8426-43AA-8400-BC965899F420",
                "name": "Admin",
                "right": 15,
                "devices": [...,90]
        },
        {
                "id": "12345678-1234-5678-9012-ABCDEF012350",
                "name": "viewer",
                "right": 1,
                "devices": [...,90]
        }
],
...
```

4. Register the system service

In C:\artemes\bin there is the file runassvc.exe
Click with the right mouse button, open as administrator.
The enter the following:





Click OK.

The service is created and the it should be set to "automatic".

5. Setting the paths for the reporting.

After that you go to system control - advanced system configuration - environment variable - system variable and add the paths to the folder path.txt. This ensures the routing to the required programmes in order to calculate the data.

C:\Program Files\OpenVPN\bin;C:\Program Files\NTP\bin;C:\artemes\Octave\Octave-3.8.1 \bin;C:\artemes\Octave\gnuplot\bin;C:\artemes\Octave\texlive\2014\bin\win32;C:\artemes\gs9.14\bin

6. Setting the path for the measured data
This is done in the file serverconfig.jsonim verzeichnis c:\artemes\config

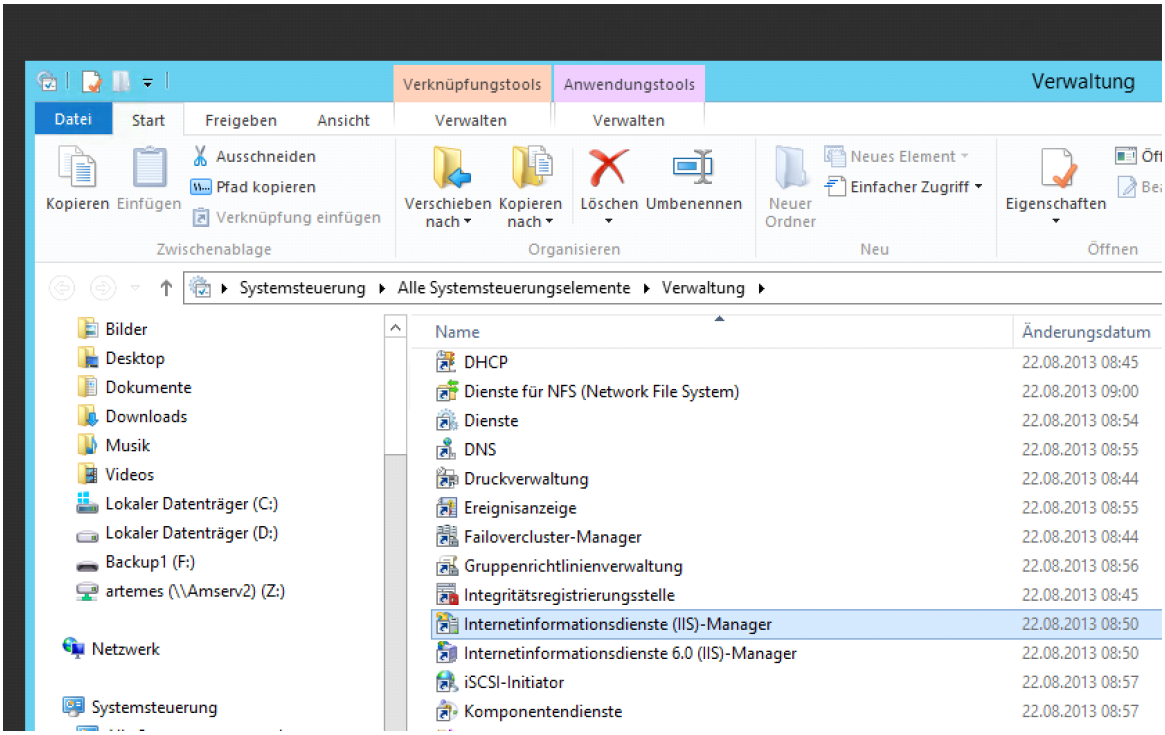
```
{
	"version": "1.0.0",
	"measurementpath": "C:\\artemes\\devices\\"
}
```

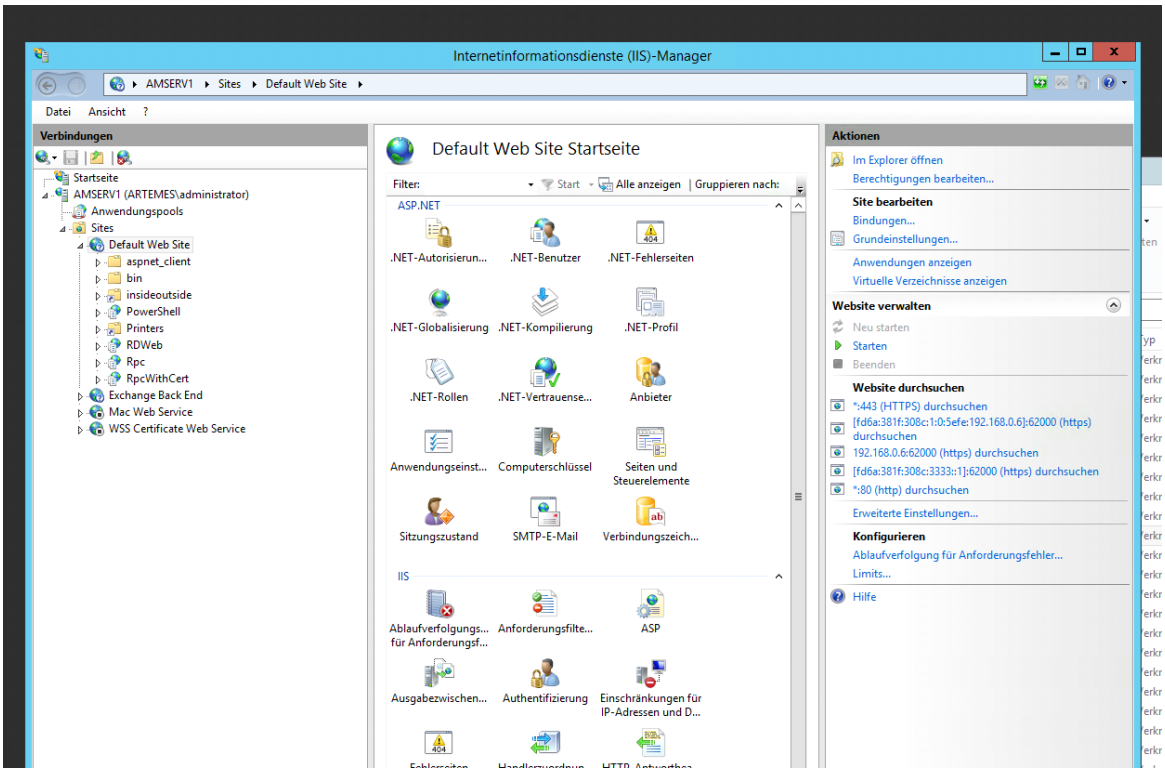
The path is listed here so that the GUI knows where the measured data are stored. (In this case I chose C:\\artemes\\devices\\.)

Attention: Please consider the double-backslash!

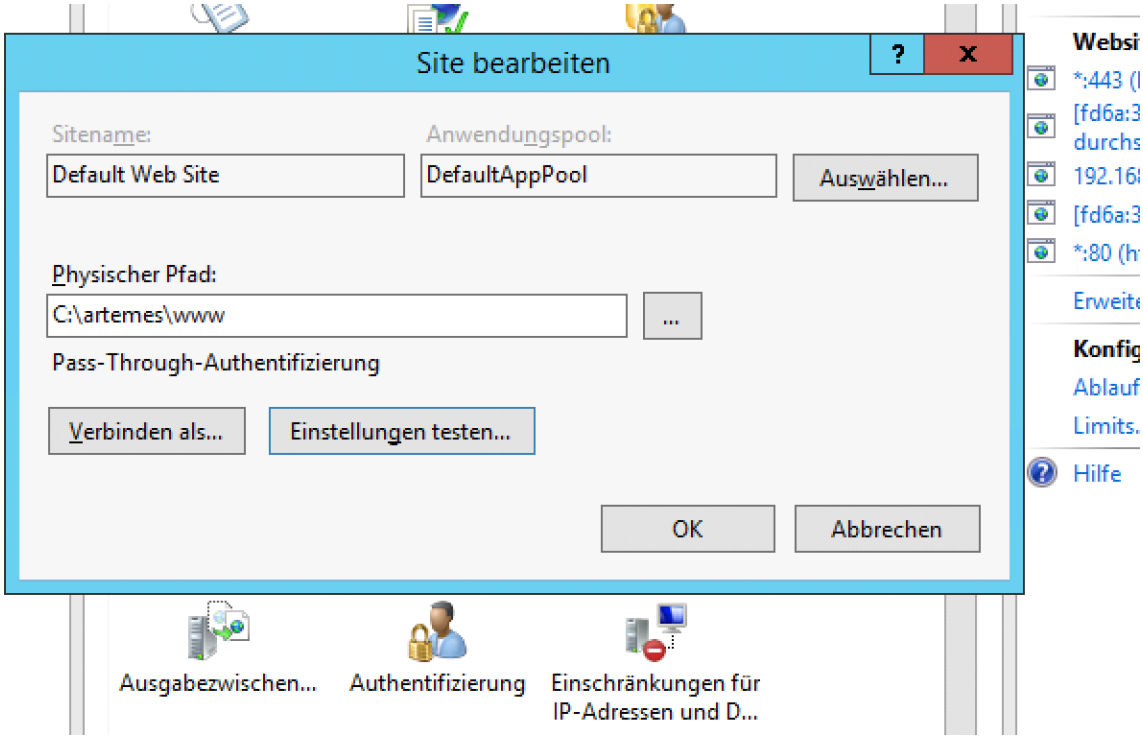
7. For the operation of the web server the IIS or Apache is needed.

It is assumed that the ISS is used as this one is enclosed in Windows and as it can easily be installed directly via Windows afterwards.
Under administration - internet information services the root directory of IIS has to be put to c:\artemes\www. (Systemsteuerung - alle Systemsteuerungselemente - Verwaltung - Internetinformationsdienste)





When going to Sites-default sites there is a link bottom down on the right (general settings - Grundeinstellungen). Please, list the path here.



8.) Start service 4.

9.) Test the installation with the browser.

Remark:
The following TCP ports are necessary:
Port 80 Http
Port 2001 exchange of data streaming between browser and AM server.

8.4 Channel List File

This file describes all variables used inside the software and can be adopted to your needs.
Name of the file: channellist.json
Location: config directory of the instrument or server.

It is based on a json structure.

Each variable has an unique identifier.

Example for Frequency, Id=1 and unit=Hz:

```
"id": 1,
"name": "Frequency",
"unit": "Hz",
```

"color": 0,
"array": false,
"group": 1

Array channels are for example used for harmonics where more columns are stored under one name.
Example: voltage Harmonics for voltage U_L1

"id": 23,
"name": "U_L1_H",
"unit": "V",
"color": 0,
"array": true,
"group": 1

9 Step by Step Tuturial

The step-by-step guide is always described in a few steps to get the report or result you want.

Power Measurement with different connections

EN50160: Power Quality

9.1 Power Measurement

Depending on what shall be measured there are different ways to connect the instrument.

In general the star connection shall be used for multi phase systems.

If there is no neutral, then the delta connection OR the star connection can be used. In the second case just make an artifical star point by connection the negative inputs from the voltage channels together. This is used typically by measuring on electrical engines.

In medium voltage grids star is used as well as delta. The VTs are normally connected in star. Measuring in parallel lets you see the earth faults (phase voltage). Meauring the Line voltages shows the voltage on the customer side itself (delta to star conversion). To see both just measure star and use the "calculate ULL" option in the power module connection setup.

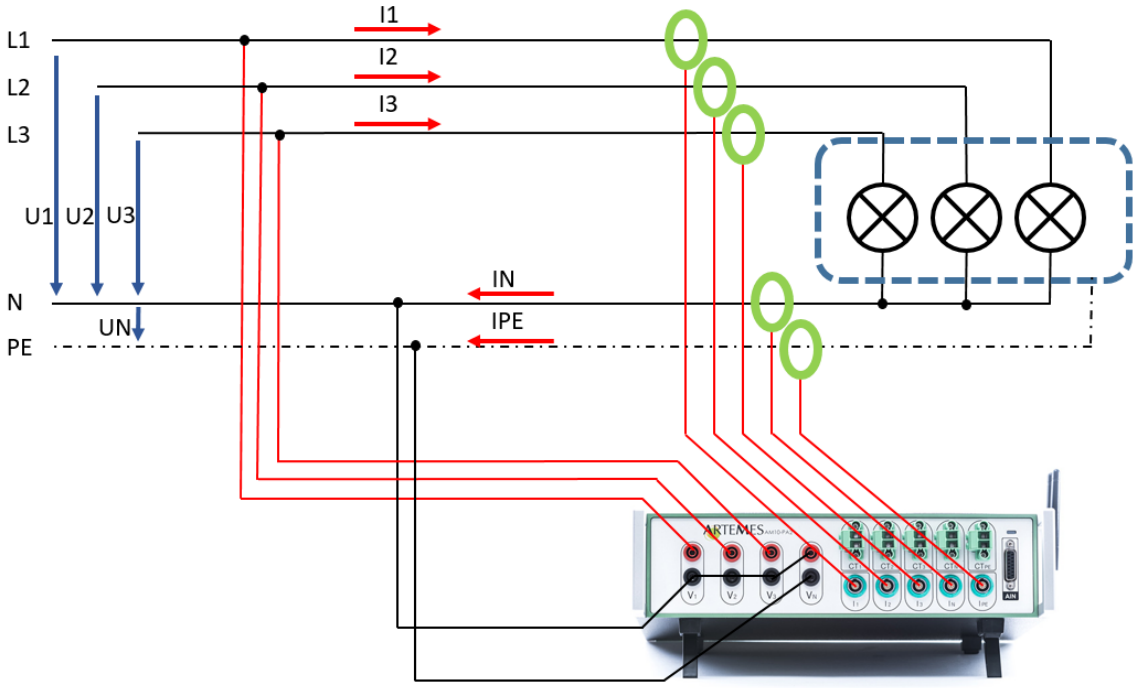
9.1.1 Low Voltage Grid

Measurements in low voltage grids are typically used to measure power and power quality in a distribution grid.

The connection there is normally star and in addition also the neutral voltage (U N, neutral to earth), the neutral current (I N) and the earth current (I PE) are for interest.

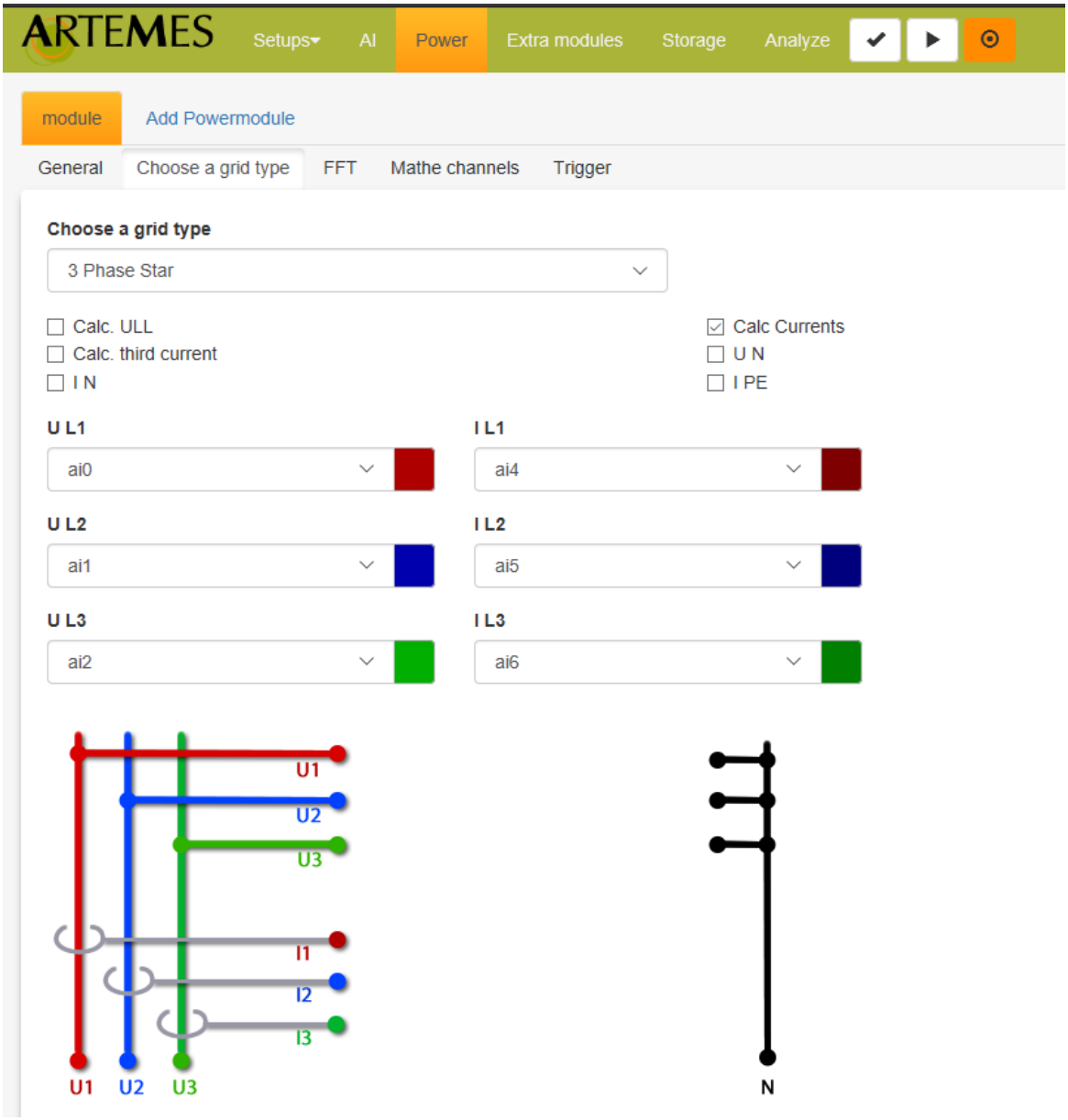
1): connect the channels to your instrument

Example: AM-10-PA2

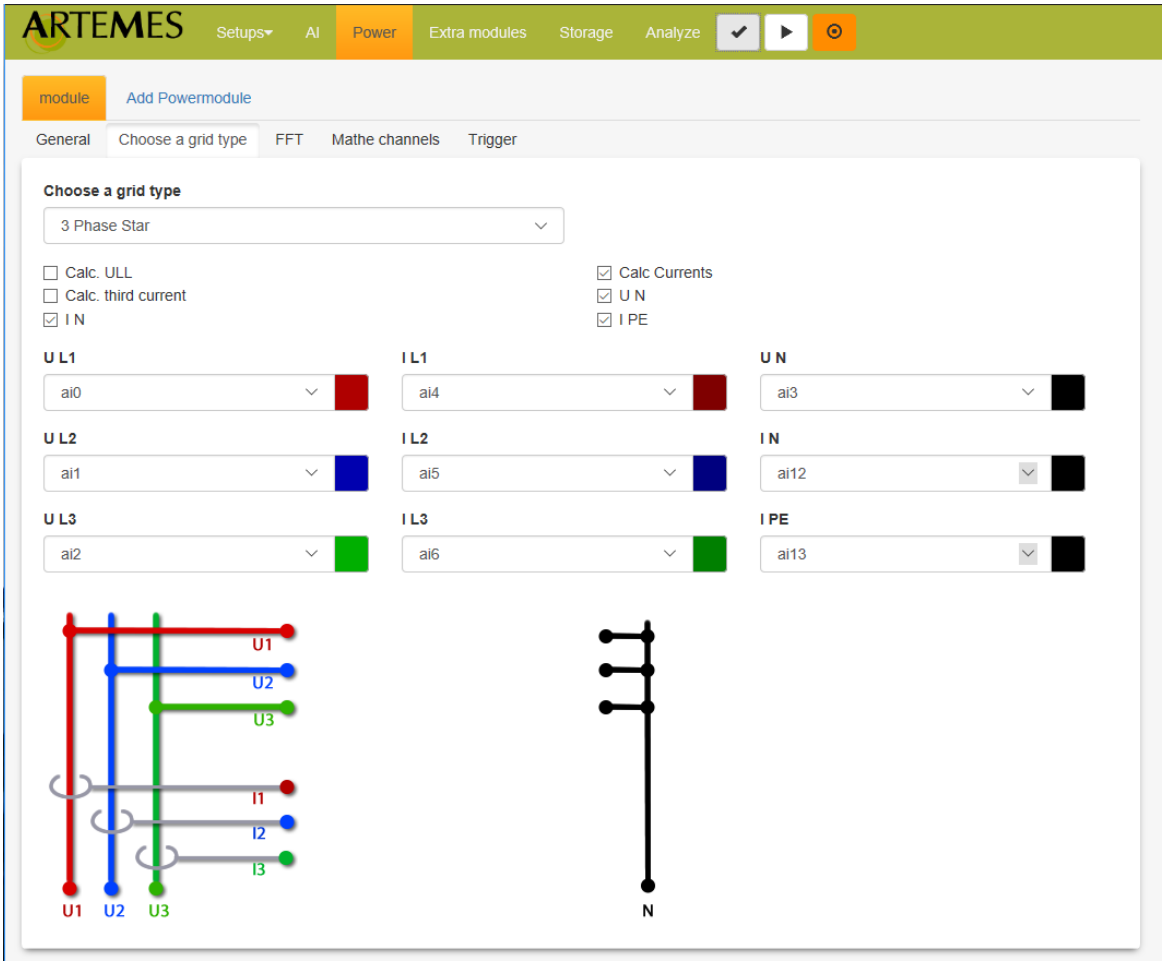


2) Connect to your instrument using a web browser, go to set up mode and set all input channels and transducers

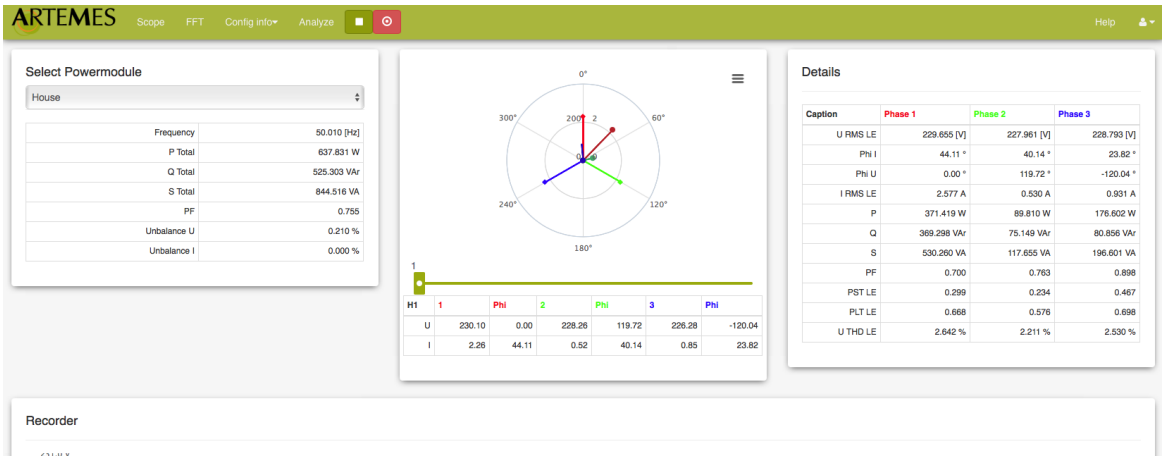
3) Set the grid type to star and assign the input channels



4) If neutral and earth are connected as well then check the boxes and assign also this channels



5) Start the measurement and see the power values for the star connection.



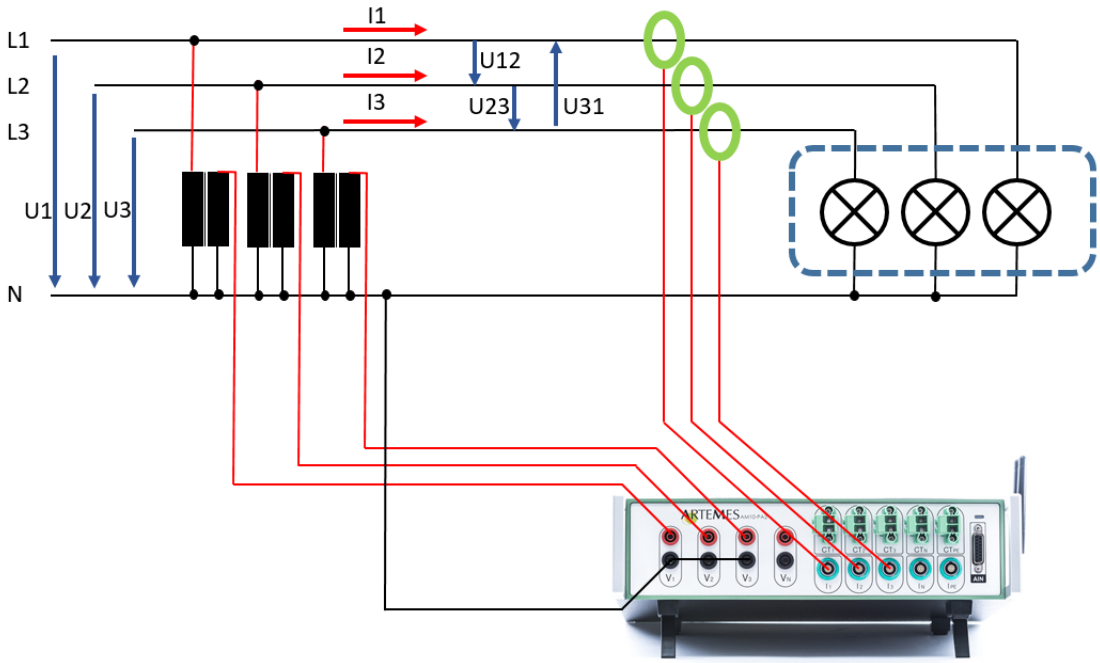
9.1.2 Medium and High Voltage Grid

Measurements in medium and high voltage grids are typically used to measure power and power quality in medium voltage distribution or high voltage transmission grids.

The connection there is normally star on VTs. Interesting are Phase voltages and Line voltages. By using the checkbox "Calc. ULL" both can be measured at the same time.

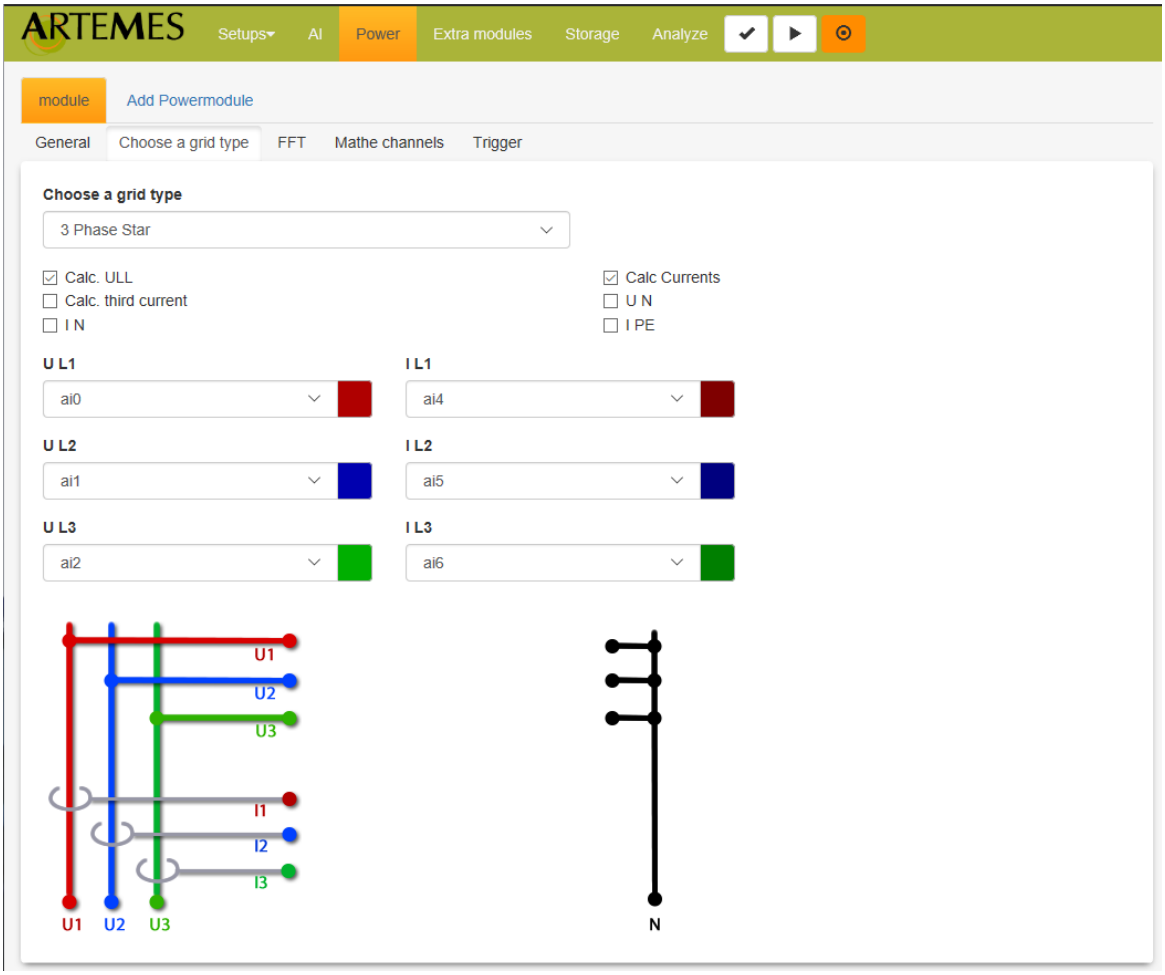
1): connect the channels to your instrument on the secondary side of VTs and CTs
Example: AM-10-PA2

The secondary side of CTs can be measured directly with the 5A inputs (Screw terminals) or by using the AM-CL5 Clamp.

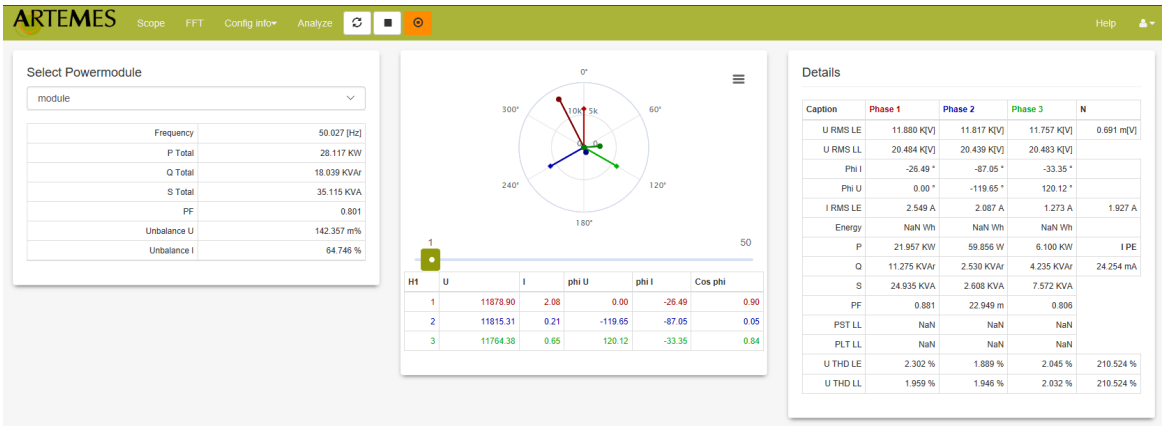


2) Connect to your instrument using a web browser, go to set up mode and set all input channels and transducers. Take care of the transducer ratios (prim/sec).

3) Set the grid type to star and assign the input channels. Check the box "Calc U LL" on the left top side.



4) Start the measurement and see the power values for the combined star/delta connection. The voltage values on the right side are now for star (U RMS LE) and delta (U RMS LL)



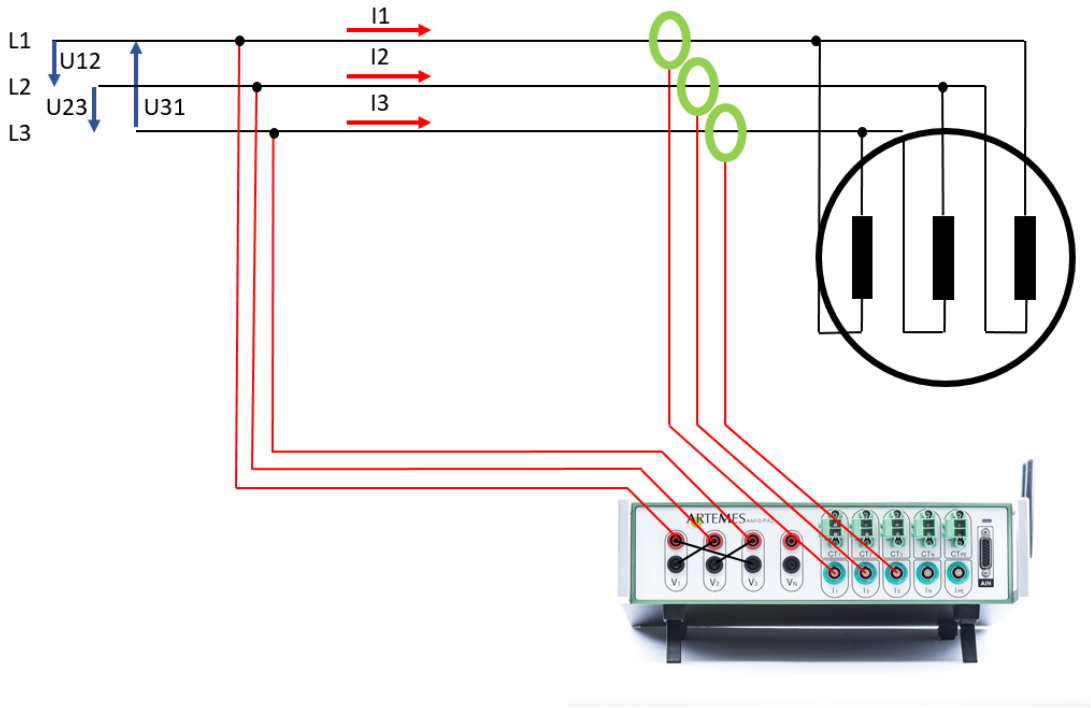
5) HINT: If you want to use the connection also for fault recording set the nominal value to the nominal U LL value - then the limits will be used relative to U LL!.

9.1.3 Low Voltage Delta (Motor)

To measure the power of an electrical engine (motor) star or delta-connection can be used.

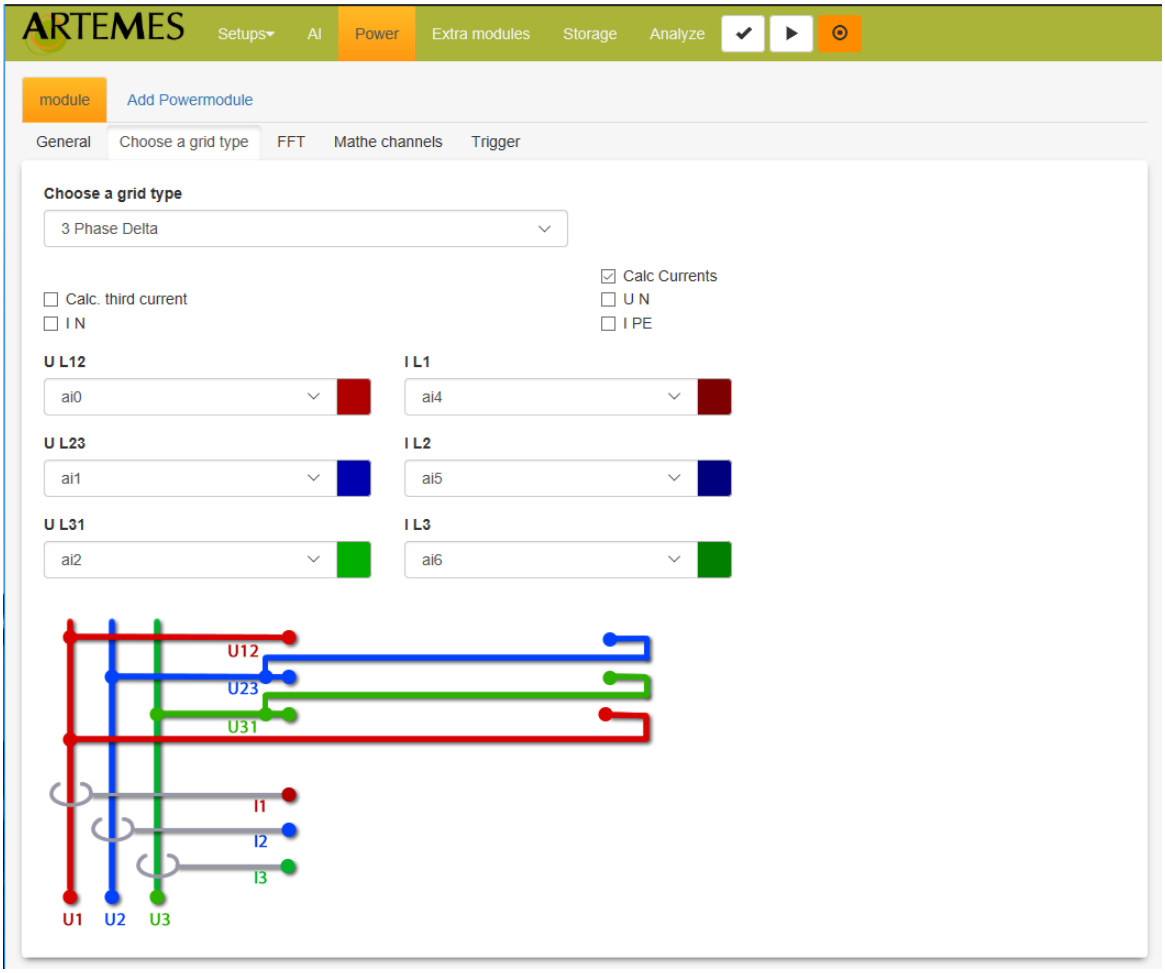
In this example the engine is connected in delta

1): connect the channels to your instrument
Example: AM-10-PA2



2) Connect to your instrument using a web browser, go to set up mode and set all input channels and transducers

3) set the grid type to delta and assign the input channels



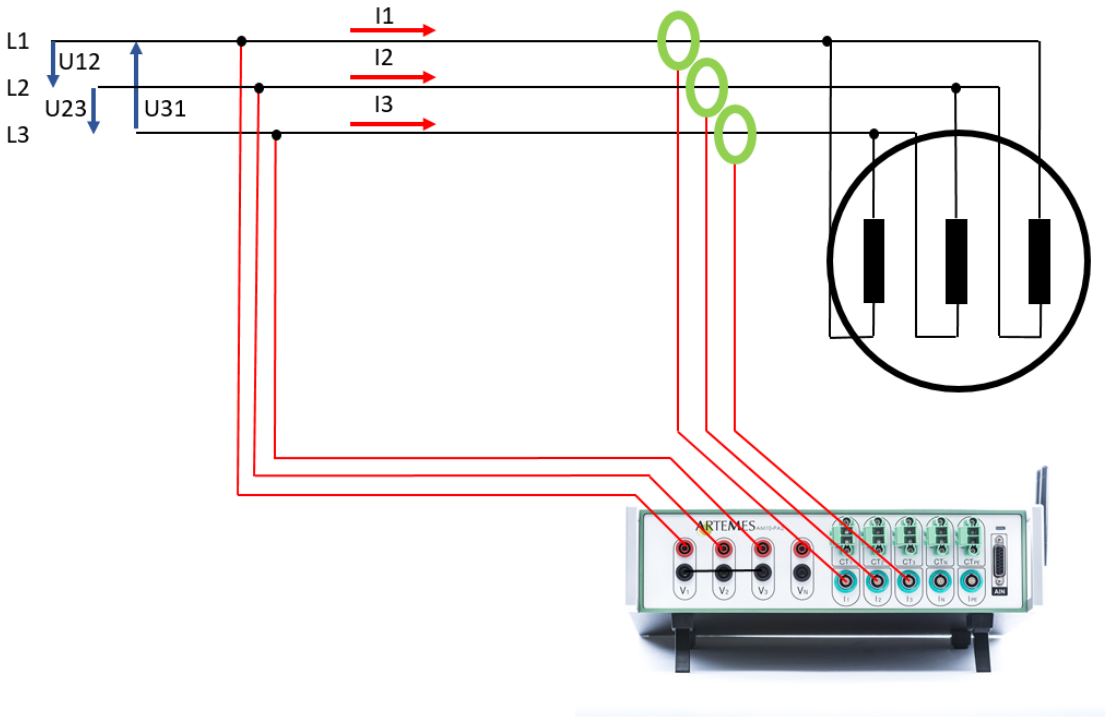
4) Start the measurement and see the power values for the delta connection.

9.1.4 Low Voltage Star with artificial Star point (Motor)

To measure the power of an electrical engine (motor) star or delta-connection can be used.

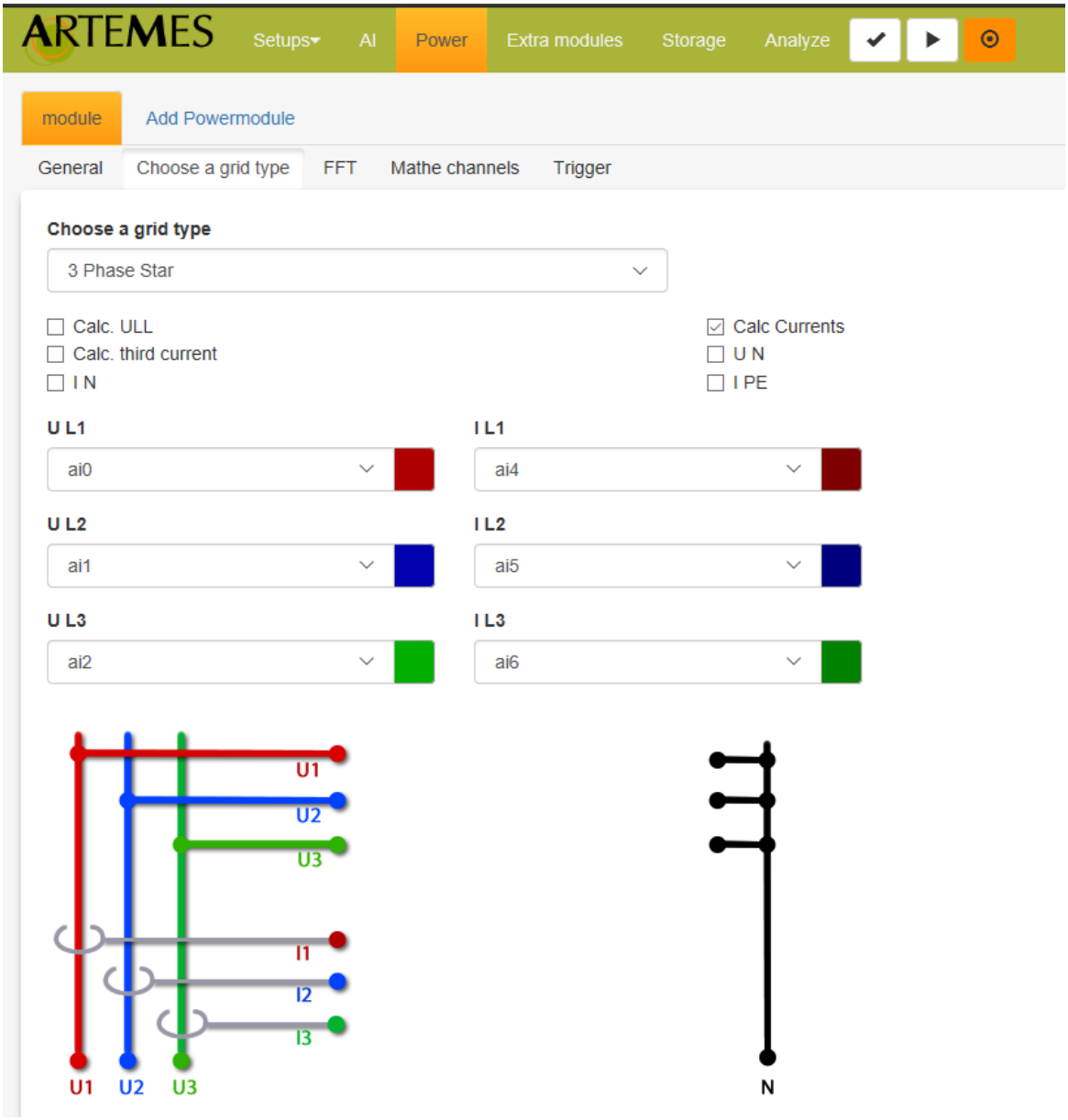
In this example the engine is connected in star with an artificial star point.

1): connect the channels to your instrument
Example: AM-10-PA2



2) Connect to your instrument using a web browser, go to set up mode and set all input channels and transducers

3) set the grid type to star and assign the input channels



4) Start the measurement and see the power values for the star connection.

9.2 Report: EN50160

To create an EN50160 measurement and get the report you have to do mainly 2 steps:

1) Measurement
2) Report

To perform this example you should have already some knowledge of setting up an instrument and how to evaluate data.

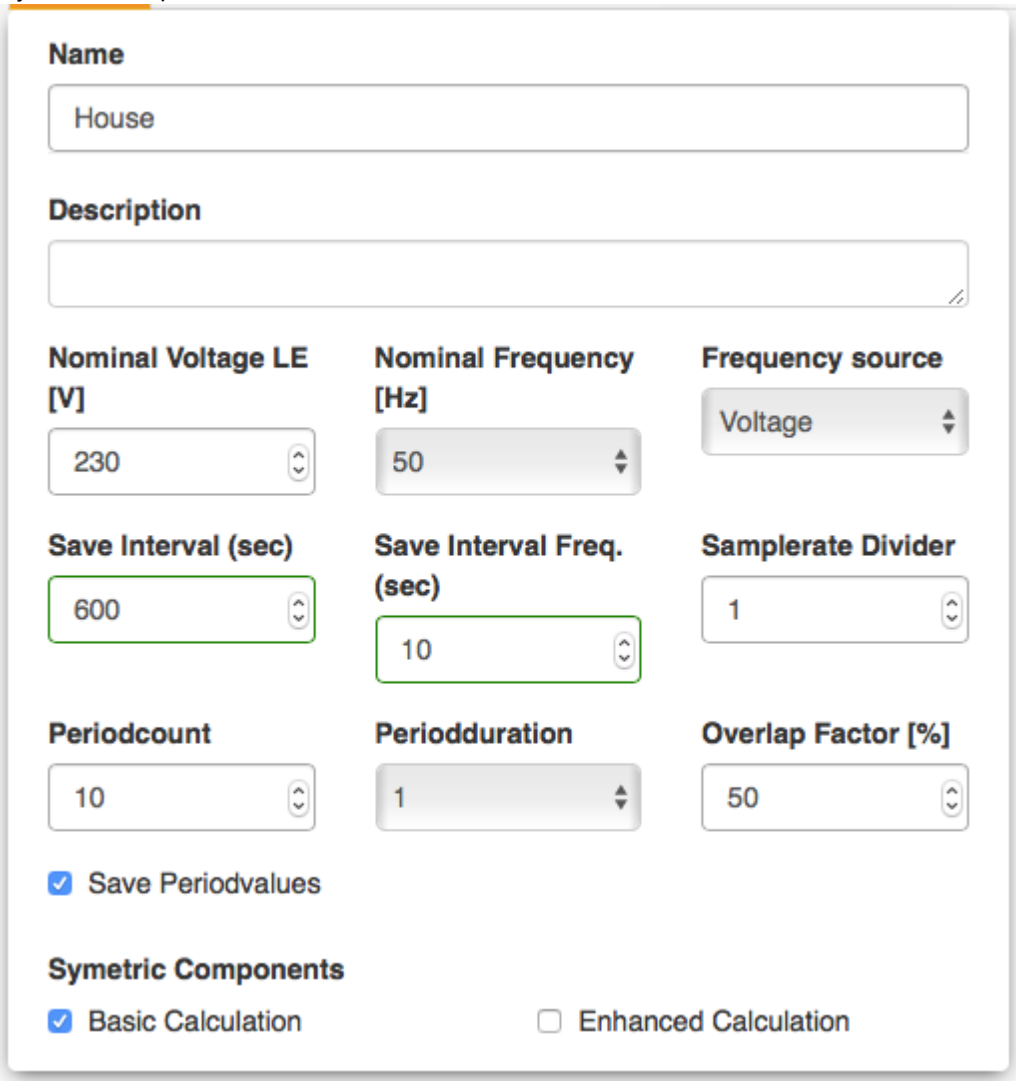
The report can be created already during the running measurement. It is not necessary to stop the recording during data processing.

1) Measurement set up

After configuring the AI channels create a new power module.

The following settings must be done for EN50160 (3 phase star or delta)

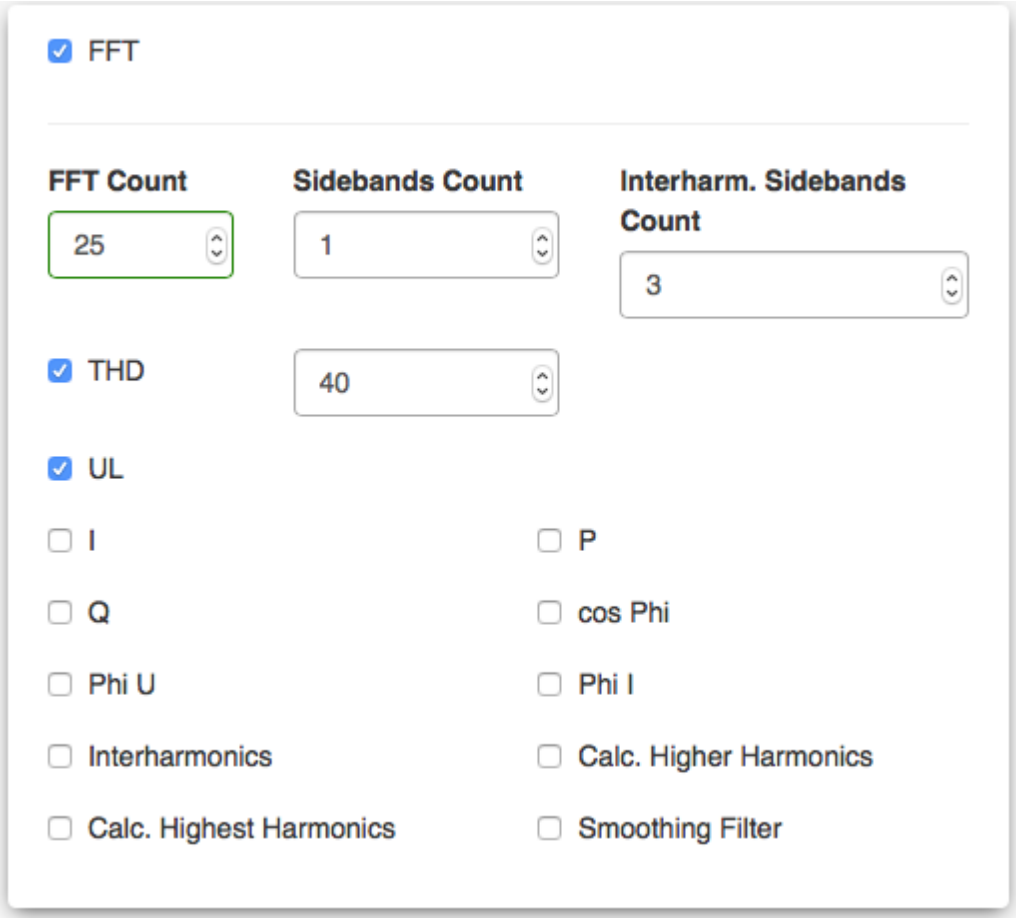
Nominal Voltage UL (or ULL for delta)
Nominal frequency
Save interval to 600 sec
Save Interval Frequency to 10 sec
Save period values
Symetric components: Basic calculation



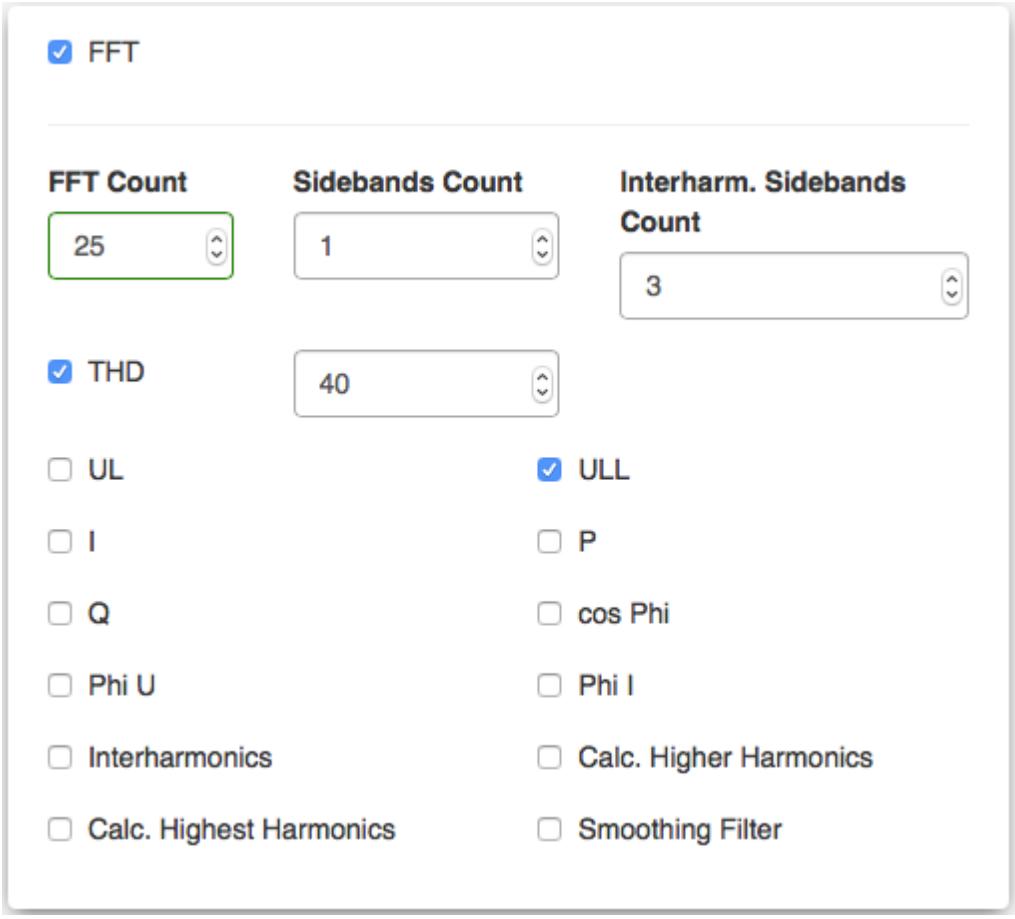
FFT settings:
THD with 40 lines

FFT count to minimum 25
sidebands count to 1
UL active for star
ULL active for delta

Example star:

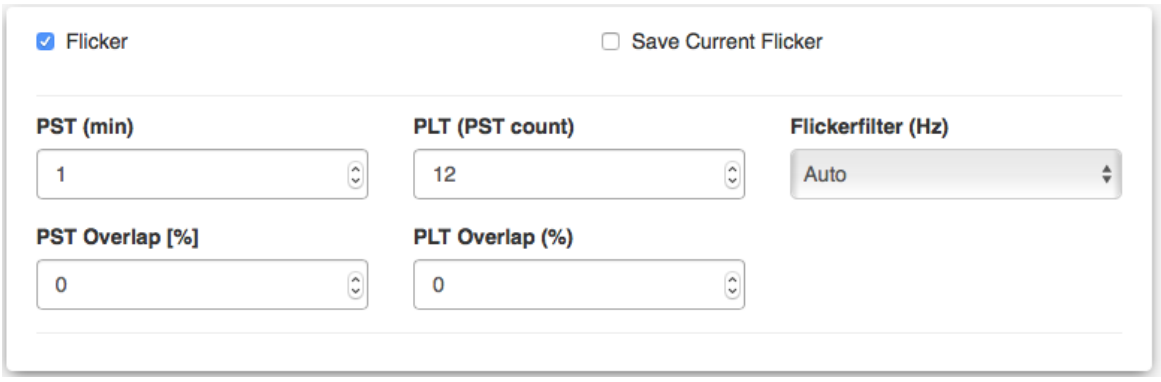


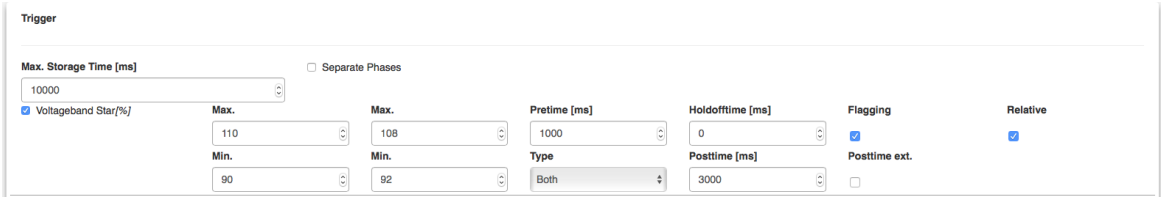
example Delta:



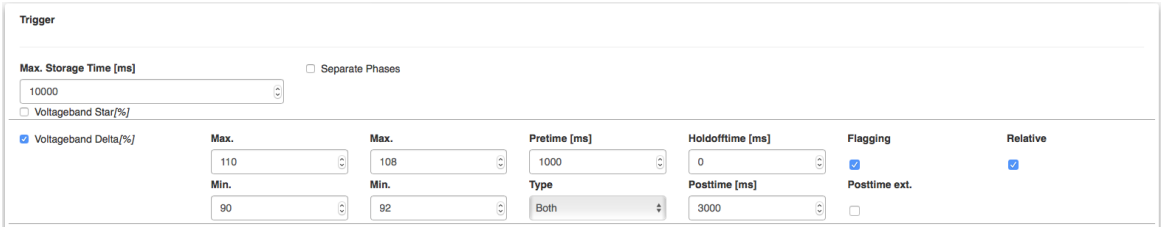
Flicker settings:

PST (min) to 10 minutes
PLT to 12 counts
Flickerfilter to Auto
both Overlap values to 0%





Transoient recorder settings:
activate band trigger for star or delta
start: 90% to 110%
stop: 92% to 108%
activate flagging
activate relative to have percentage limits of nominal voltage

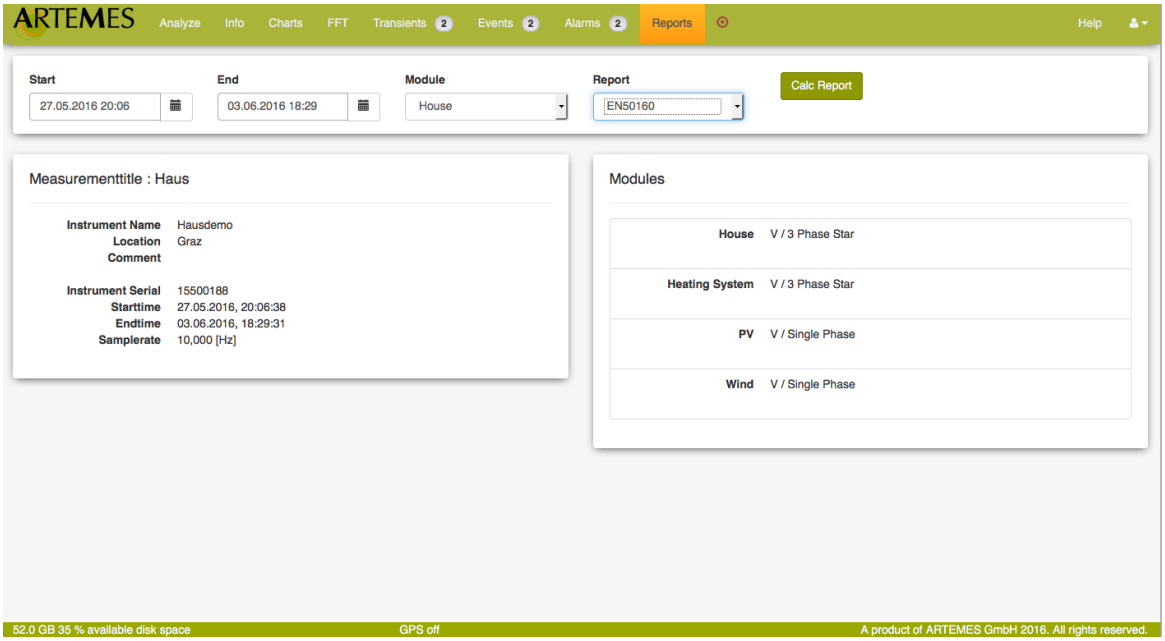


Then start the measurement and record the data for a minimum of one week

2) Report

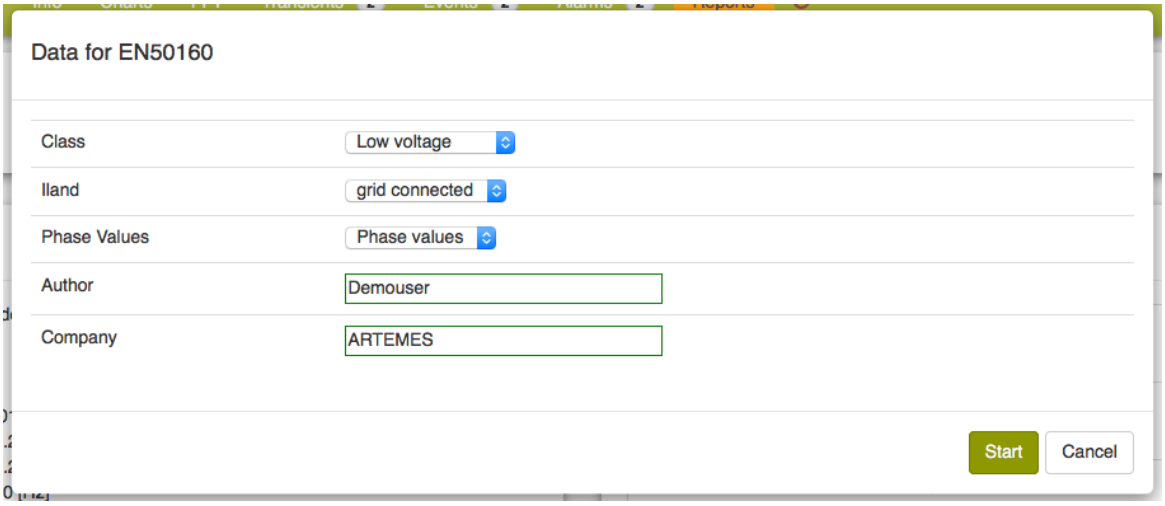
Star the Analyze section and open the reports page in the menu bar.

The choose the time, the power module and the EN50160 as shown below:



Next step is to fill in the report specific data:

Class...the voltage level of the measurement (influences the limits in the evaluation according to the standard)
Iland...gird connected or ilanfd grid (influences the limits in the evaluation according to the standard)
Phase or line values...to switch between UL and ULL
Author...your name
Company...Cour Company

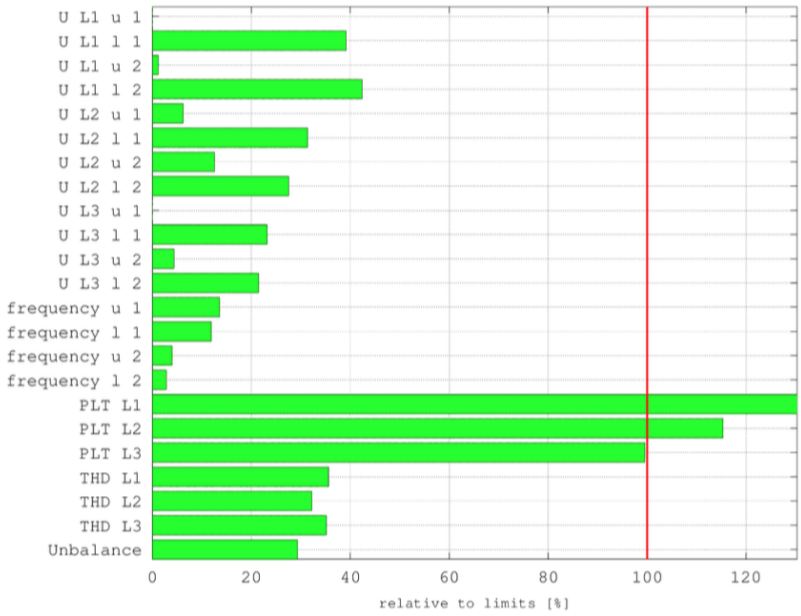


After clicking on Start the Report will get calculated and is shown on the screen as PDF file. Depending on the network connection this can take some minutes.

Example pages from the EN50160 report:

l...lower limit
1...first limit
2...second limit

2.2 PQ data and Limits - Bar



2.3 Table of PQ data

Name	Unit	Quantil	Value	Limit	Valid
U L1	V	5.0	220.99	>= 207.00	YES
U L1	V	95.0	228.05	<= 253.00	YES
U L1	V	0.0	215.39	>= 195.50	YES
U L1	V	100.0	230.27	<= 253.00	YES
U L2	V	5.0	222.78	>= 207.00	YES
U L2	V	95.0	231.43	<= 253.00	YES
U L2	V	0.0	220.50	>= 195.50	YES

Index