

measurement competence centre www.artemes.org

ARTEMES Software

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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:

192.168.50.118	C 1 1 -
User Vasword Password	
English \$	
Force user session takeover	
Login	
	A product of ARTEMES GmbH 2016. All rights reserved.

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



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"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

distribut 1	Andrea 1	Review 1	True 1	Location :	Exercise 1
BOOK HIDE	1010-0.1010	NEC	-		
2013.008	2010-0.1016	180	1997.001	-	
2013/0404	2010/16/16 10:10	1800	wei, perg	-	
2010/0104	1010-0,0024	100	we perp	-	
024.0.7284		1000	andread		
024.0.728	1000-0,1221	100	Server 1	-	
d'den name		Marca -	auto.		
4744.0.0.00	0100.0010.000	MED.			
4744.00.0.00P	00000-000	MER.			
And a state of		MEC.	547 W		
(Or					

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.



7

3.1 Setup a measurement

In the setup mode the first screen looks the following	ng:
--	-----

	19	92.168.50.118	C	0 1 - +
ARTEMES Setups- AI Power	Extra modules Analyze	✓ ► <mark>○</mark>		🗢 Help 🔺 🗸
Current Setup		System Information		
test Description	•	Instrument ID Device Ins. time: Status Software Version	89 AM50 25.05.2016, 20:48:20 Stopped 3.0.0.TEST	
Creation Date 10.05.2016, 09:07:11 Last modified 10.05.2016, 14:25:25 Samplerate 10,000 [Hz] ADC ORION-1616-101 Analogchannels used 9 of 16				
module 230 V Single Phase				
4.9 GB 18 % available disk space	GPS locked I GPS State :	G3	A product of ARTE	MES GmbH 2016. All rights reserved.

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



8	ARTEMES Software							
	MES	Setups ▼	AI	Power	Extra mod			
	t Setup	Create new	v Setup Setup					
		Rename S	etup					
	ion	Reset Cha	nges					
		Save Setu						
	Creation Last mod Sample	Delete Set	up 00 [Hz]	7:11 5:25				

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:

Al...to set up the analogue input channels <u>Power</u>...to set up power modules <u>Extra Module</u>...to define additional modules (groups of measurement channels) <u>Analyze</u>...to start data processing - either during setup up or even during the running measurement task





...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)

Martemes power × +						– 🗆 X
\leftarrow \rightarrow \circlearrowright hausdemo.artemes.org/#/inputs						□ ★ = 🛛 ۵ …
W						
ARTEMES Setups- AI Powe			Analyze 🖌 🕨	•		
Analogehannals						
Analogunamets						
Samplerate: 20 KHz V	Sca	n Inputs				
Name	Range (Prim / Sek)	Sensor	Amplifier	Filter	Caption	~
⊙ ai0	564.7 V / 10.0 V(at ADC 10)	Direct	DIRECT - DIRECT	3 KHz	ai0	
o ai1	565.6 V / 10.0 V(at ADC 10)	Direct	DIRECT - DIRECT	3 KHz	Sensor Direct	
ai2	566.3 V / 10.0 V(at ADC 10)	Direct	DIRECT - DIRECT	3 KHz	Direct	
ai3	10.0 V / 10.0 V(at ADC 10)	Direct	DIRECT - DIRECT	3 KHz	DIRECT	DIRECT
	49.7 V / 10.0 V(at ADC 10)	Direct	DIRECT - DIRECT	3 KHz	Filter	Range
⊘ ai5	49.7 V / 10.0 V(at ADC 10)	Direct	DIRECT - DIRECT	3 KHz	3 KHz 🗸	400 ~
o ai6	988.4 V / 10.0 V(at ADC 10)	Direct	DIRECT - DIRECT	3 KHz	Prim	Sec
ai7	10.0 V / 10.0 V(at ADC 10)	Direct	DIRECT - DIRECT	3 KHz	200	3.542
	10.0 V / 10.0 V(at ADC 10)	Direct	DIRECT - DIRECT	3 KHz	Offset	ADC Range
ai9	10.0 V / 10.0 V(at ADC 10)	Direct	DIRECT - DIRECT	3 KHz		10 🗸
ai10	10.0 V / 10.0 V(at ADC 10)	Direct	DIRECT - DIRECT	3 KHz		
ai11	10.0 V / 10.0 V(at ADC 10)	Direct	DIRECT - DIRECT	3 KHz	Amplifier Type 10 Amplifier SN	000
► ai12	1000.0 A / 1000.0 A(at ADC 10)	AM90-001-001030	AM-A-V - LV	10 KHz v	Amplifier calib date 19 ADC Type Po	000-01-01 CI-6013
128.2 (29.22 % available disk seese			A product of APTENEC Car	hu 2017. All rights recorded		

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 <u>hardware has changed</u> or the setup comes from a different instrument then wrong channels are indicated in orange.



MARTEMES POWER × +								
\leftarrow \rightarrow O \mid hausdemo.artemes.org						□ ★ = 12	۵	
<u>w</u>								
ARTEMES Setups- AI	Power Extra modules Storage	New Transients	Analyze 🖌 🕨	• •		0+	Help	4+
Analogchannels								
Samplerate: 20 KHz V	Sca	n Inputs						
Name	Range (Prim / Sek)	Sensor	Amplifier	Filter	Caption			^
	564.7 V / 10.0 V(at ADC 10)	Direct	DIRECT - DIRECT	3 KHz	ai0			J.
O ai1	565.6 V / 10.0 V(at ADC 10)	Direct	DIRECT - DIRECT	3 KHz	Sensor Direct			
o ai2	566.3 V / 10.0 V(at ADC 10)	Direct	DIRECT - DIRECT	3 KHz	Direct	Mode	~	
ai3	10.0 V / 10.0 V(at ADC 10)	Direct	DIRECT - DIRECT	3 KHz	DIRECT	DIRECT		
O ai4	49.7 V / 10.0 V(at ADC 10)	Direct	DIRECT - DIRECT	3 KHz	Filter	Range		ш
O ai5	49.7 V / 10.0 V(at ADC 10)	Direct	DIRECT - DIRECT	3 KHz	3 KHz 🗸	400	~	
o ai6	988.4 V / 10.0 V(at ADC 10)	Direct	DIRECT - DIRECT	3 KHz	Prim	Sec		
ai7	10.0 V / 10.0 V(at ADC 10)	Direct	DIRECT - DIRECT	3 KHz	200	3.542		
ai8	10.0 V / 10.0 V(at ADC 10)	Direct	DIRECT - DIRECT	3 KHz	Offset	ADC Range	V	
ai9	10.0 V / 10.0 V(at ADC 10)	Direct	DIRECT - DIRECT	3 KHz				ш
ai10	10.0 V / 10.0 V(at ADC 10)	Direct	DIRECT - DIRECT	3 KHz				
ai11	10.0 V / 10.0 V(at ADC 10)	Direct	DIRECT - DIRECT	3 KHz	Amplifier Type 1000 Amplifier SN	0		
ai12	1000.0 A / 1000.0 A(at ADC 10)	AM90-001-001030	AM-A-V - LV	10 KHz	Amplifier calib date 1900 ADC Type PCI-	0-01-01 -6013		~
432 3 CB 27 M and bla disk areas			A product of ADTEMES (2)	mbH 2017. All ciable cos	second			- 1

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 <u>TEDS</u> 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

0

►

0

.Color selection with the color tool

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



Measurement instrument

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device in use.

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

Caption			
ai0			
Sensor Direct			
Direct			~
Туре		Mode	
DIRECT		DIRECT	
Filter		Range	
3 KHz V		400	~
Prim		Sec	
200		3.542	
Offset		ADC Range	
0		10	~
Counter			
Amplifier Type	1000		
Amplifier SN Amplifier calib date	1900- PCI-6	-01-01	
	- C) - C		



caption...name of channel

sensor...select the sensor or the sensor is indicated when a <u>TEDS</u> is used **type**...hardware input type (for example ARTEMES AM-A-V, Direct,...)

Mode...hardware Setting (for example HV, LV, Lemo, Direct,...)

Mode...nardware 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:

Counter	Falling edge	Threshold Value		Factor	
		0	0	1	٢

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 Hardw are 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.

DIRECT	DIRECT	10 V pk
AM-A-V	LV	10.0 (0.
AM-A-V	LV	10.00 (
AM-A-V	LV	10.00 (
AM-A-V	LV	10.00 (
DIRECT	DIRECT	10 V pk
DIRECT	DIRECT	10 V pk

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

Setup inputs has changed. Confirm Changes

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.



ARTEMES POWER × +			– c
· -> 🕐 hausdemo.artemes.org/4			
	Power Extra modules Storage New Transient		Ör Holo
Module Add Powermodule			
General Choose a grid type FFT M	athe channels Trigger		
Name	Choose a grid type	Samplerate Divider	
module	3 Phase Star V	20 KHz ~	
Description			
Nominal Voltage LE [V]	Nominal Frequency [Hz]	Frequency source	
230	50 ~	Voltage ~	
Periodcount	Periodduration	Overlap Factor [%]	
10	1 ~	50	
Sumatria Componente			
Basic Calculation	Enhanced Calculat	ion	
☑ Flicker □ C	alc Current Flicker		
PST (min) PLT (PST count)	Flickerfilter (Hz)		
10 12	Auto ~		
PST Overlap [%] PLT Overlap (%)			
0 0			

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 <u>Grid Type</u> 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%

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Measurement instrument

Symmetric components:

Sympetric Components	
 Basic Calculation 	Enhanced Calculation

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	□ Save	Save Current Flicker			
PST (min)	PLT (PST count)	Flickerfilter (Hz)			
10	٤ 12	C Auto			
PST Overlap [%]	PLT Overlap (%)				
0	© 0	٢			

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)



Flicker	Save	Current Flicker
PST (min)	PLT (PST count)	Flickerfilter (Hz)
1	ث 12	Auto
PST Overlap [%]	PLT Overlap (%)	
0	0	
Impedanz	Unit	Angle
1 (Ohm	30;50;70;85

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:

<u>Choose a grid type</u> <u>FFT</u> Flicker <u>Mathe Channels</u> <u>Trigger / Fault recorder</u> 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 <u>additional Values</u>

			Measu	rement instrument	17
module	Add Powermodule				
General	Choose a grid type	FFT	Mathe channels	Trigger	
Single 2 Phas	Phase se				
3 Phas 3 Phas DC	se Star se Delta				
	third current				

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.

ARTEMES POWER × +	– 🗆 X
\leftarrow $ ightarrow$ hausdemo.artemes.org/#/power	
ARTEMES Setups- AI Power Extra modules Storage New Transients Analyze V No	&∓ Help ≜∓
module Add Powermodule	
General Choose a grid type FFT Mathe channels Trigger	
Choose a grid type	
Single Phase V	
al0 v al4 v	
U1 N	
128 2 GB 27 % svalkble dak space A product of APTEMES GmbH 2017. All rights reserved.	

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

In addition you can also define: UN IN IPE



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.

ARTEINES POWER X +	– 🗆 X
\leftarrow \rightarrow D hausdemo artemes.org/#/power	
8	
ARTEMES Setups- Al Power Extra modules Storage New Transients Analyze O	🔅 👻 Help 🚨 🗸
module Add Powermodule	
General Choose a grid type FFT Mathe channels Trigger	
Choose a grid type	
2 Phase V	
Calc. ULL Clarc Currents	
UN IN IPE	
ai0 v ai4 v	
UL2 IL2	
al1 × al5 ×	
12.	
Ŭ1 Ŭ2 N	

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

In addition you can also define:

UN IN IPE

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.



				Measurement	instrument	19
M ARTEMES POWER × +						– 🗆 X
← → Č) hausdemo.artemes.org/#/pow					□ ☆ =	Z &
ARTEMES Setups- AI Pow	er Extra modules Storage	New Transients Analyze	· · · O		0. .	Help 🚨 🗸
module Add Powermodule						
	hannolo Triagor					
General Choose a grid type PPT Matheo	indimens i ngger					
Choose a grid type						
3 Phase Star	~					
Calc. ULL	⊡ C:	alc Currents				
Calc. third current		N PF				
UI1						
	ai4	~				
U L2	1 L2					
an v	CIE	Ť				
U L3	I L3					
ai2 V	ai6	~				
	- - -					



In addition you can also define:

<u>U N</u> <u>I N</u> 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 <u>Calc U LL</u> 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.

🐱 ARTEMES POWER X +		- 🗆 X
\leftarrow \rightarrow \circlearrowright hausdemo.artemes.org/#/power		
ARTEMES Setups AI Powe	r Extra modules Storage New Transients Analyze 🖌 🕑	Фт нер ≜т
module Add Powermodule		
General Choose a grid type FFT Mathe ch	nannels Trigger	
Choose a grid type		
3 Phase Delta	▼	
Calc. third current	Calc Currents	
U L12	IL1	
ai0 ~	al4 v	
U L23	1L2	
ai1 V	al5 v	
U L31	1L3	
ai2 V	ai6 V	

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>U N</u> (if it makes sense) <u>I N</u> (if it makes sense) <u>I PE</u> (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.



	Measurement instrument	21
		- 🗆 X
\leftarrow \rightarrow \bigcirc hausdemo artemes.org/#/power		Z &
0		
ARTEMES Setups- AI Power Extra modules Storage New Transients Analyze V 🕨 🎯		
module Add Powermodule		
General Choose a grid type FFT Mathe channels Trigger		
Choose a grid type		
☑ Calc Currents		
122 2 GB 27 % available disk space A product of ARTEMES GmbH 2017 /	All rights reserved.	

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.



_			
MARTEMES POWER × +			– 🗆 X
\leftarrow \rightarrow \circlearrowright hausdemo.artemes.org/#/power			
ARTEMES Setups- AI Power	Extra modules Storage New Transients	Analyze 🖌 🕨 📀	¢≁ Help ≜≁
Module Add Powermodule			
General Choose a grid type FFT Mathe cha	annels Trigger		
Name	Choose a grid type	Samplerate Divider	
module	DC ~	20 KHz 🗸	
Description			
Nominal Voltage LE IVI			
398			
125.2 GP 27.56 available disk cases		A product of ARTEMES GrahH 2017. All rights reserved	

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:

UN IN IPE

Calc ULL

Calc third current

Save Currents



Measurement instrument 23 Choose a grid type \sim 3 Phase Star Calc. ULL Calc Currents Calc. third current 🗹 U N 🖂 I PE U L1 IL1 UN ai0 \sim ai4 \sim ai3 \sim U L2 I L2 I N ai1 \sim ai5 \sim ai7 U L3 I L3 I PE ai2 ai6 ai8 \sim \sim

3.1.2.1.6.1 UN

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

UN	
ai3	÷

3.1.2.1.6.2 IN

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



3.1.2.1.6.3 IPE

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

I PE	
ai12	÷

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.

Choose a grid type

3 Phase Star			~	
Calc. ULL Calc. third current IN				 ✓ Calc Currents ◯ U N ◯ I PE
U L1		IL1		
ai0	~	ai4		~
U L2		I L2		
· · ·		· ·-		

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

ARTE	MES	Setup	s ▼ Al	Power	E
module	Add Powe	rmodule			
General	Choose a g	rid type	FFT	Mathe cha	nnel
Name module	5				Ch (;
Descript	ion				
Nominal	Voltage LL [V]			No
398					

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!



Measurement instrument 25

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).



26	ARTEM	ES Software				
	module	Add Powermodule				
	General	Choose a grid type	FFT	Mathe channels	Trigger	
	Choose	a grid type				
	3 Phas	se Star			~	
	Calc.	ULL				Calc Currents
	U L1					
	ai0		~			
	U L2			_		
	ai1		~			
	U L3			-		
	aiz		~			
			J1 J2 J3			



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.

	Al Power Extra modules	Storage New Transients Analyze 🖌 🕨 📀
Module Add Powermodule		
General Choose a grid type F	FFT Mathe channels Trigger	
FFT Count	Sidebands Count	Interharm. Sidebands Count
50	1	3
I THD	40	
□ Interharmonics		Calc. Higher Harmonics
		Smoothing Filter

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).



W IENIE	S Setups - Al	Power Extra modules	Storage New Transients	Analyze 🖌	
module Add F	Powermodule				
General Choos	e a grid type FFT Ma	the channels Trigger			
Max. Storage	Time [ms]	10000			
Predefined Trig	ger	<u></u>			
L d A otimo					
Voltageband Si	tar (Active) S	eparate Phases Pretime [ms]	Holdofftime [ms]	Flagging	Relative
Voltageband Si Max.[%] 110	tar (Active) S Max.[%] 108	Pretime [ms]	Holdofftime [ms]	Flagging	Relative
Voltageband Si Max.[%] 110 Min.[%]	Max.[%] 108 Min.[%]	Pretime [ms] 1000 Posttime [ms]	Holdofftime [ms]	Flagging	Relative
Voltageband Si Max.[%] 110 Min.[%] 90	tar (Active) Max.[%] Max.[%] 108 Min.[%] 92	Pretime [ms] 1000 Posttime [ms] 3000	Holdofftime [ms]	Flagging	Relative

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.

Active Voltageband St	tar (Active) V	eparate Phases			
Max.[%]	Max.[%]	Pretime [ms]	Holdofftime [ms]	Flagging	Relative
110	108	1000	0		\checkmark
Min.[%]	Min.[%]	Posttime [ms]	Posttime ext.	I	
90	92	3000			

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.

Voltageband De	elta (Active) 🗸 🗆 S	eparate Phases			
Max. [%]	Max. [%]	Pretime [ms]	Holdofftime [ms]	Flagging	Relative
110	108	1000	0		\checkmark
Min. [%]	Min. [%]	Posttime [ms]	Posttime ext.		
90	92	3000			

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.

Voltageslope Star	(Active) 🗸 🗌 Sep	arate Phases		
Max. Slope[%]	Pretime [ms]	Holdofftime [ms]	Flagging	Relative
10	1000	0		\checkmark
Min. Slope[%]	Posttime [ms]	Posttime ext.		
5	3000			

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

Col Activo

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

Voltageslope Delta	a (Active) 🗸 🗌 Sep	arate Phases		
Max. Slope[%]	Pretime [ms]	Holdofftime [ms]	Flagging	Relative
10	1000	0		\checkmark
Min. Slope[%]	Posttime [ms]	Posttime ext.		
5	3000			

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

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Measurement instrument

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.

Active	s (Acti 🗸 🗆 🗆 S	Separate Phases	
TDC	Limit tdc	Limit	Max Limit
100	1	0.5	6

3.1.2.3.6 Custom Trigger

Custom Trigger can be defined very individual





ARTEMES S	oftware						
Custom Trigger							
new trigger 0	~	+ -					
	,	Active	Caption		Triggertyp	Channel	
		\checkmark	new trigger 0		Band 🗸		
		\checkmark	new trigger 0 Pretime [ms]	Posttime [ms]	Band ∨ Holdofftime [ms]	Posttime ext.	Flagging
		\checkmark	new trigger 0 Pretime [ms] 100	Posttime [ms]	Band V Holdofftime [ms]	Posttime ext.	Flagging
		Band typ	new trigger 0 Pretime [ms] 100	Posttime [ms] 100 startmax	Band Holdofftime [ms] 0 stopmax	Posttime ext.	Flagging
	E	Band typ	new trigger 0 Pretime [ms] 100	Posttime [ms] 100 startmax	Band V Holdofftime [ms] 0 stopmax 0.98	Posttime ext.	Flagging

0

0

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

d typ	startmax	stopmax
Verlas: V	1	0.98
	startmin	stopmin
	0	0





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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	Min. Slope
0	0

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.

Enable PMU

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

Enable PMU			
PMU Identifier			
0	٢		
PMU Name			
PMU Header			
Reporting Rate			
	\$		

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.



PMU Identifier	Harmonic	S
1		
PMU Name	3	U -
myPMU	5	0 -
PMU Header	7	0 -
	+	
Reporting Rate		
10	*	

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.

module	Add Powermodule				
General	Choose a grid type	FFT Mathe channels	Trigger		
Mathe ch	nannels				
	Active	Physical channel		Logical channel	
	+Add channel				

+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


						Measurement instrument	37
						L	
module	Add Pov	wermodule					
General	Choose a	a grid type FFT	Mathe channels	Trigger			
Mathe ch	annels						
	Active	Physical channel			Logical channel		
	\checkmark	ai0		\sim	CUSTOM7	✓100	-
		+Add cha	nnel				

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

ARTEMES		Extra modules	~	►	0	
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).



38	ARTEMES Software
	new Module 0 Add Module
	Name
	new Module 0
	Description

Name...name of the module as it will be found in <u>Data Analysis</u> **Description**...individual text Channels:

Add channel ... to add a channel. The channels must be defined previously in the Al channel setup

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

Delete Module "new Module 0"

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

Channels						
	Active	Physical channel	Logical channel			
		ai0 ~		~	100 -	
	Add chanr	nel				

Custom Trigger:

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

the settings are the same as for power Triggers

Custom Trigger			
Max. Storage Time [ms]	-	10000	
	+		

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



"On Trigger" measn data are stored when a Trigger condition happens.

Off	Always	On trigger	store all samples	
			,	
Off	Always	On trigger	store reduced data	global store interval (s)

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	Туре	Module	Name	Unit	Save Inte	A
\checkmark		Synchron	input channel	ai0	-		
\checkmark		Synchron	input channel	ai1	-		
\checkmark		Synchron	input channel	ai2	-		
\checkmark		Synchron	input channel	ai4	-		
\checkmark		Synchron	input channel	ai5	-		
\checkmark		Synchron	input channel	ai6	-		
		Synchron	input channel	ai12	-		
\checkmark	1	Asynchron	module	Frequency	Hz	1	
	√	Asynchron	module	U_RMS_L1	V	1	
		Synchron	module	U_L1	V		
\checkmark	\checkmark	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 <u>set up</u> mode.

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

												- 0
ightarrow $ig angle$ hausdemo.artemes.or	g /#/overview										□ ☆ =	- 12 0
TEMES Extra modules	Scope FFT Config in	nto v l	New Tra	ansients	Analy	ze 🔳 🤅	•					Help
						_			-			
ect Powermodule						0°		-	Details			
nodule	~							-				
				300	· /~	2009.00	60,		Caption	Phase 1	Phase 2	Phase 3
Frequency	50.001 [Hz]								U RMS LE	230.376 [V]	232.307 [V]	233.561 [
P Total	538.260 W					\nearrow			Phil	-29.46 °	-84.98 °	-24.02
Q Total	345.055 VAr			240	. 🗸 🗖	\checkmark	1201		Phi U	0.00 *	-120.47 *	120.16
S Total	667.991 VA			240			120		I RMS LE	2.352 A	0.267 A	1.248
PF	0.806					180*			Energy	1.413 Wh	21.978 mWh	0.476 W
Unbalance U	82.792 m%		4			100		50	P	404.006 W	4.690 W	129.563 \
Unbalance I	68.909 %	1.4							Q	232.638 VAr	53.005 VAr	59.412 V/
		HI				nhi II	phi l	Cos phi	S	469.578 VA	53.361 VA	145.052 V
			1	230.28	. 2.01	0.00	-20.46	0.87	PF	0.860	87.893 m	0.89
			2	232.20	0.23	-120.47	-84.98	0.09	PSILE	NaN	NaN	Na
			3	233.46	0.61	120.16	-24.02	0.91	PLILE	NaN	NaN	Na
									UTHDLE	2.881 %	3.000 %	2.948
ecorder												
234.0 V												
												-
232.0 V												
232.0 V												
232.0 V 230.0 V 3.0 A												-
232.0 V 230.0 V 3.0 A												-

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

<u>Overview - Online</u> (ARTEMES logo) <u>Scope - Online</u> <u>FFT - Online</u> <u>PMU - Online</u> <u>Config Info</u> <u>Analyze</u>

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:

TE		EC
	VI	EЭ

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Measurement instrument

House	÷
Frequency	50.031 [Hz]
P Tota	628.213 W
Q Tota	509.459 VAr
S Tota	826.337 VA
PF	0.760
Unbalance U	0.238 %
Unbalance	0.000 %

The vector scope:

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







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

Details:

shows phase values



Measurement instrument

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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
Р	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.





ARTEMES Software

3.2.2 Scope - Online

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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.

Start Stop
Triggerlevel
50
Time [ms]
20
Pretime
0

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/ReI**..To choose if the Values are shown absolute (V, A) or relative to the fundamental (%)

<u>Online FFT with Limits</u>...to show online the limits of e.g. IEC 61000-2-4 or EN 50160 <u>Columns selection</u>...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.



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The possible values are shown in the list:



3.2.4 **PMU - Online**

θH UL1

UL2

UL3

IL1

OP L1 OS L1 OQ L1 I L2

OP L2 OSL2 DQ2 I L3

OP L3 OS L3 OQ L3

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.





al

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



EMES POWER × + → ① hausdemo artemes.org / / analyzetotalitransients IEMES Extra modules Scope FFT Contig infor New Transients Analyze w Transient view inger ∨ Hidden Small Full Confirm Transients w Transient view Transient view T	— (= 12 в Нер
New Transients Analyze Image: Transient view I	Неір
w Transient view autoreload Reload Export to CSV rigger v Hidden Small Full Confirm Transients	
Start * Instrument Name > Powermodule > Pretime [ms] > Postume [ms] > Alarmitype > Phase	•

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

Config info ▼	Analyze
AI	
Power	
Modules	

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 <u>setup</u> 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.

Clear sorting Clear filter Reload					
Starttime 👻	Endtime ¢	Device \Leftrightarrow	Title 💠	Location \Rightarrow	Comment ¢
25.04.16, 14:02▶	06.05.16, 10:55	AM50	test		
22.04.16, 10:06	22.04.16, 10:08	AM50	trigger_test	lab	
22.04.16, 09:40	22.04.16, 09:40	AM50	test_georg	lab	
22.04.16, 09:16	22.04.16, 09:23	AM50	test_georg	lab	
13.04.16, 17:29		AM50	asdfssdf		
13.04.16, 17:26	13.04.16, 17:27	AM50	testrecord	lab	
07.04.16, 11:52		AM50-2	demo		
07.04.16, 11:51	07.04.16, 11:52	AM50-2			
07.04.16, 11:51	07.04.16, 11:51	AM50-2			
31.03.16, 13:21		AM50-2	test 16		
					10 25 50 100

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 Clear filter Reloa	d					
Starttime 👻	Endtime ‡	Device \Leftrightarrow	Title 🗘	Location \Rightarrow	Comment	÷
		AM50	trigger			
22.04.16, 10:06	22.04.16, 10:08	AM50	trigger_test	lab		-
					1	0 25 50 100

53

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 FET 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.



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\rightarrow \heartsuit	hausdemo.artemes.org						□ ☆	<u> </u>	y
RTEMES		Analyze Info Cha		0 Events (Alarms 0				
Measurementtitle	Hausdemo				Modules			1	-
Leastion	Croz								
Location	GIAZ					module V/3 Phase Star			
Comment	no								
	3 🖌								_
	DC								
Instrument	Name Hausdemo								
Instrument	Serial 17709510								
St	ndtime 04.05.2017, 04.05.2017,	, 11:46:33 , 13:00:46							
	Transients : 0	Events : 0 Alarms : 0							
Export									
	04 May 2017		04 May 2017						
1	1 : 46 : 33		13 : 00 : 46						
Module									
module			~						
CSV			~						
Download Data									
									_

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 <u>compared</u> or simple <u>math</u> 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.

Measurementtitle: 04.05.2017 11:46:33 - 04.05.2017	13:00:46				
04 May 2017	04 May 2017	Module		View	
11 : 46 : 33	13 : 00 : 46	module	~		~

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

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

Measurementtitle: 04.05.2017 11:46:33 - 04.05.20	17 13:00:46		
04 May 2017 11 : 46 : 33	04 May 2017 13:00:46	Module View P Total	×
Cursor 1 Cursor 2 Reset Cursor Export to CSV		Reload Edit	

Data analysis 55

_

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

ARTEMES POWER □ ☆ ക <u>\</u> ARTEMES Extra modules Analyze Charts -Measurementtitle: 04.05.2017 11:46:33 - 04.05.2017 13:00:46 04 May 2017 04 May 2017 Module View 11:46:33 13:00:46 modul P Tota Cursor 1 Cursor 2 Reset Cursor Reload Edit Export to CSV P Total ≡ ∑ 2 11-50 12:00 12:05 12.10 12:30 12:35 12:40 12:45 12.50 12:55 13:00

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

•	Zoom out	reset Zoom	
---	----------	------------	--

The next window shows a zoomed graph.



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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



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ightarrow $ig $ hausdemo.ar	temes.org/#/analyze				□ ☆ =	1 6
RTEMES Extra m	odules Analyze Info Char	FFT Transients 0 Ever	its 🕕 Alarms 🕕 Reports	⊚		Help
Close Add Reset S	Clone Download Up	Delete				
Name		TransientView				
P Total						
Show Legend	Layout	align	Vertical Align			
\checkmark	Horizontal ~	Center ~	Bottom ~			
Border width	Channel Info	X axis Grid Line width	Chart height			
2		1	600			
xes Title	top heig	ht Height type	Log minorticks	Min.	Max.	
P [W]	0 10	0 Percenta	je v 0.1			
add axis	Auto arran	je				
hannels /isible Channel name	Axis	Туре	Factor Agg	regation Channel Unit		
P	P [W]	✓ Reduced ✓	Factor avg ~	P ~		
Add channel						

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



Axis settings:

Each graph can have more axis.



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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



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	nencsorg/~/analyze					•≕• ب
DTENAEC						
SIE/VIES Extra m	odules Analyze Info Charts	FFT Transients 🧿 E	vents 0 Alarms 0 Repor	ts 💿		
Close Add Reset S	Save Clone Download Uplo	ad Delete				
Name		TransientView				
P Total						
Show Legend	Layout	align	Vertical Align			
\checkmark	Horizontal V	Center	Bottom			
Border width	Channel Info	X axis Grid Line width	Chart height			
2	\checkmark	1	600			
xes Title	top heigh	nt Height ty	/pe Log minorticks	Min.	Max.	
P [W]	0 100) Percer	ntage > 0.1			
add axis	Auto arrang	e				
hannels fisible Channel name	Axis	Туре	Factor Aggr	egation Channel Unit		
P	P [W]	V Reduced V	Factor avg V	P v		-
Q	P [W]	Reduced V	1 avg ~	Q 🗸		-
Add 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".



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ightarrow O $ $ hausdemo.a	rtemes.org/#/analyze					₩ ☆ =	4 63
RTEMES Extra m	odules Analyze Info	Charts FFT Transie	nts 🕕 Events 🕕	Alarms 🧿 Rep	orts 💿		Help
Close Add Reset S	Clone Download	Upload Delete					
Name		TransientView					
P Total	Lavout	alian	Ver	ical Align			
	Horizontal	 Center 		ottom v	~		
	Channel Info	V avis Crid Lin	a width	rt hoight			
2							
xes Title	top	height	Height type L	og minorticks	Min.	Max.	
P [W]	0	50	Percentage ~	0.1			-
Q	50	50	Percentage ~				-
add axis	Auto	o arrange					
Channels							
Visible Channel name	Axis	s Type		Factor Agg	regation Channel Ur	iit	
		. [w] V Reduced		avg V	P V		
		Destroyed		31/0 1/	0		-
✓ Q		Reduced	L	avg 🔹	Q V	1	
Q		Reduced		avg 🔹	u P		

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".

Channel	S				
Visible	Channel name	Axis	Тур	Factor Aggregation Channel	Einheit
	P_L1	P [W \$	Dater 🜩	1 🗊 avg 🕈 P_L1	¢ ₩ -
	P_L2	P [W 🛊	Dater 🛊	1 0 avg 🕈 P_L2	↓ W
	P 1 and 2	P 12 🛊	Math \$ Summe \$	1 © avg ₽_L1 -1 © avg ₽_L2	 ↓ W - + → W - +
Add cha	annel				

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



Cursor 1 Cursor 2 Reset Cursor Export to CSV Reload		
P Total		=
Zoom 1d 1m YTD 1y All	From Apr 14, 2016 To Ap	r 15, 2016
	M	
~ MMhhal ~ Mhal	M	2k
10:00 12:00 14:00 16:00 18:00 20:00 22:00 15. Apr 02:00	04:00 06:00 08:00	-1k
16.00 16.00 16.00 16.00 16.00 16.00	15. Apr	28:00.

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.

Meas	urementtitle: wpt								•
Starttim	e 2016 09:41	Endtime 15.04.2016 09:41	m	Module House	\$	View P Total	\$ Edit		
Channels Visible	Channel name		Axis	Тур		Мос	ule	Channel	Einheit
 Image: A start of the start of	P_L1		P [W]	\$ Daten \$				P_L1 \$	w
	P_L2		P [W]	\$ Daten \$				P_L2 \$	W
	P 1 and 2		P 12	♣ Math ♣	Summe	e 🕈 Hou Hou	3e ‡ 3e ‡	P_L1	w w

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.



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Measur	ementtitle: w	vpt												
starttime			Endtime		Modu	lle		View						
13.04.20 annels	016 09:41	i	15.04.2016 09:41		Hou	ISE	÷	P Total	¢	Edit				
sible	Channel n	ame		Axis		Тур			Module		Channel		Einheit	
1	P			P [W]	\$	Daten	\$				Ρ	\$	W	
	Pw	o PV		PV	÷	Math	\$ Summ	е 🛊	House	\$	Р	\$	w	
	_								PV	\$	Р	\$	w	
Cursor 1	Cursor 2	Reset C	ursor Export to CSV					Reload						
							P Total					-		=
Zoom 1	ld 1m Y		All									FI	rom Apr 14, 2016 To Apr	15, 2016
														A
Belada:	. Λ <i>μ</i>	hila				Diu	n n	D					.Am	2.58
, and and a second	<u>/\</u>]\		my	n	Am	IN	"						/ ¹ hu	or s
		v												-2.5k
														4k
		La -	L M											₹ ₽k
MMMM	A M	Why	hald	hm	M	~ _/\		Π					M	My
10:00	12:00)	14:00 16:00		18:00	20:00	22:	I 00	15. Apr	02	00 04:0	00	06:00 08:00	0k
	~	A-15	and the	14 02	N.		MARIE-	nm	A	16.00			Apr	
0~			.00	14. 74	21		00.00		0 - 0			1.1		

4.4 FFT

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

- 1) Bar graph...as described on this page
- 2) <u>Time graph</u>...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)



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E		
ARTEMES Extra modules Analyze into Charts FFT Transients () Events () Alarms () Reports ()		
Measurementtille		
04 May 2017 04 May 2017 Module Type Source		
11:46:33 13:00:46 module Harmonics Avg >		
Target Abs/rel View		
Limit upto		
None v All v		
FFT U		=
1k		
100		
10 .		
×		

Module...the power module to showStarttime...begin of the data window to evaluateEndtime...end of the data window to showShow...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





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 <u>FFT Setup</u> section) <u>Limit</u>...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

Download CSV	
Download XLS	
Print chart	
Download PNG imag	e
Download SVG vecto	r image

All	
✓ 25. Harmonic	
50. Harmonic 9 KHz	

Geben Sie hier den Text ein.



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4.4.1 FFT with Limits

To show also limits on the FFT page select $\ensuremath{\mathsf{limit}}$

M ARTEMES POWER	× +								- 🗆 ×
$\leftarrow \rightarrow $ 0 $ $	nausdemo. artemes.org /#/analyzefft						0,	☆ =	Z & ···
*									
ARTEMES		nfo Charts FFT	Transients 🧿 E	vents 🕕 🧳	larms 🧿 Reports	•			
оч мау 201 11:46:3	33 13 : 00 :	: 46 mode	ile 🗸	Harmo	nics 🗸	Avg ~			
Target		Abs/rel		View					
Max	✓ Log	Rel H	I1 ~	U	~	Show			
Limit	upto								
EN50160	∽ All	~							
100 10 24				7 [-					
0.1	5 7.5 10 • LI AVG	12.5 15 12 • LI MIN © LI MA	.5 20 22.5 C 12 AVG 0 12	25 MIN © L2 MA	27.5 30 32 x 13 AVG 13	.5 35 37.5 Min @ L3 MAX — 1	40 42.5	45 47.	5 50

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

None	
Class 1	
Class 2	
Class 3	
✓ EN50160	-

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



4.5 Transients

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

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

ARTEMES Analyze New Trar	nsients Info	Charts FFT	Transients 5 Events 5	Alarms 5 Reports	Help 🛔
Measurementtitle: wpt					
Module View House \$		Tran	sient view Iden Small Full	Export to CSV	
Start	Phase	Alarmtype	Pretime [ms]	Posttime [ms]	Storage Type
15.04.2016, 05:39:31	U_L1	USTAR	1000	3051	ST_BOTH
12.04.2016, 05:36:02	U_L1	USTAR	1000	3071	ST_BOTH
09.04.2016, 05:52:52	U_L1	USTAR	1000	3050	ST_BOTH
29.03.2016, 06:27:18	U_L1	USTAR	1000	3071	ST_BOTH
29.03.2016, 06:17:46	U_L1	USTAR	1000	3061	ST_BOTH
					10 25 50 100

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 Vic House C T	ew Trigger U Raw	Transient vi	ew Small Full	Export to CSV	
Start	Phase	Alarmtype	Pretime [ms]	Posttime [ms]	Storage Type
15.04.2016, 05:39:31	U_L1	USTAR	1000	3051	ST_BOTH
12.04.2016, 05:36:02	U_L1	USTAR	1000	3071	ST_BOTH
09.04.2016, 05:52:52	U_L1	USTAR	1000	3050	ST_BOTH
29.03.2016, 06:27:18	U_L1	USTAR	1000	3071	ST_BOTH
29.03.2016, 06:17:46	U_L1	USTAR	1000	3061	ST_BOTH
					10 25 50 100

Module...the module of which the transients shall be shown **View**...the predefined view setup, can be <u>created or modified</u> 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 <u>charts/changing the graph</u>.

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



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Data ana				
		Delete	Upload	vnload
	ew	TransientV		
Vertical Align	\checkmark	align		
 ✓ Bottom 		Center	~	
Chart height	Line width	X axis Grid		
Vertical Align Bottom Chart height	Line width	align Center X axis Grid	~	

The channels type must be set to "raw"I

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.

ARTEMES	Analyze New Tra	ansients Info Charts	FFT Transient	s 5	Events 5 Alarms	s 5 Reports		Help	4-
Measurementtitle: wpt Module House	¢ Export to C	sv							-
Start -	Duration \$	Restvoltage [%] ¢	Restvoltage [V] 🗢	dc ≑	Nominal Voltage 🗧	Ala	ırmtype 🗢	Phase ¢	
15.04.2016, 05:39:31	00:00:00.050	89.71	206.33	0	230.00	USTAR		U_L1	
12.04.2016, 05:36:02	00:00:00.070	77.53	178.32	0	230.00	USTAR		U_L2	
09.04.2016, 05:52:52	00:00:00.050	86.74	199.50	0	230.00	USTAR		U_L2	
29.03.2016, 06:27:18	00:00:00.070	79.07	181.87	0	230.00	USTAR		U_L2	
29.03.2016, 06:17:46	00:00:00.060	85.59	196.87	0	230.00	USTAR		U_L1	
							10 25	50 100	0



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.

RTEMES Analyze Ne	w Transients Info Charts FFT T	ransients 6 Events 5 Alar	ms 5 Reports	Help 📤
Measurementtitle: wpt				
Module Expor	t to CSV			
Start -	End ¢	Duration ≑	Alarmtype ≑	Phase 🔶
15.04.2016, 05:39:31	15.04.2016, 05:39:31	00:00:00.050	USTAR	U_L1
12.04.2016, 05:36:02	12.04.2016, 05:36:02	00:00:00.070	USTAR	U_L2
09.04.2016, 05:52:52	09.04.2016, 05:52:52	00:00:00.050	USTAR	U_L3
29.03.2016, 06:27:18	29.03.2016, 06:27:18	00:00:00.070	USTAR	U_L2
29.03.2016, 06:17:46	29.03.2016, 06:17:46	00:00:00.060	USTAR	U_L1
				10 25 50 100

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"**.

ARTEMES A	nalyze New Transients	Info Charts	FFT Transients	5 E	ivents 5	Alarms	5 Reports	Help	
Start 13.04.2016 09:41	End 15.04.2016 09:41 i	Module House	\$	Report		\$	Calc Report		
Measurementtitle : wpt				Modul	es				
Instrument Name Location Comment	Hausdemo					House	V / 3 Phase Star		
Instrument Serial Starttime	Instrument Serial 15500188 Starttime 17.03.2016, 19:20:07				Heating S	System	V / 3 Phase Star		
Endtime Samplerate	15.04.2016, 09:41:11 10,000 [Hz]					PV	V / Single Phase		
						Wind	V / Single Phase		

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
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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 <u>post</u> <u>processing mode</u>.

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**





U_I_f_	Voltage, current
Diagra	and frequency
m P O S	All kinds of Dowor
PF D	total values
iagram	
U_min	min and max of
max	voltage
Diagra	
m	
	·
Reports	according to
certain \$	Standards:
<u>En</u>	Power Quality
<u>50160</u>	Report according
	to EN 50160
IEC	Power Quality
61000- 2 4	Report for
2-4	
	61000-2-4
IEC	Power
61400-	Performance Test
12-1	for Wind turbines
	according to IEC
	61400-12-1
IEC	Power Quality
61400-	lype lest for
21	other renewables
	61400-21
DisDip	Event List, Cbema
	curve and dis dip
	statsitic
Transie	List of recorded
nt List	faults
Energy	Energy Report for
Report	150 50001
4 min 11 - 1	
inis lists	s may vary from the
roal inct	alled diagrams

Matlab(TM) routines to load Data

RTEMES

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 <u>converNameToLogCode</u> 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



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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 <u>streamed data</u>, 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 %



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Matlab(TM) routines to load Data

```
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 <u>channel list file</u>.

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



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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:



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Installation and System Setup

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Datei Bearbeiten Suchen Ansicht Kodierung Sprachen Einstellungen Makro Ausführen Erweiten	ingen Fenster ?			Х
	11 D 18 - 1	config	- 🗆 X	
	- 12 B + 1	coning		
🔤 measkernel log 🖾 🔚 config joon 🖾 📑 amrijinoservice log 🖾	File Home Share View		~ 😗 _	
1 🖓				
2 "version": "2.1.0",	(e) → T → Computer → Local Disk (C) → artemes → cor	ing v o	search config ,p	
3 🖨 "system": (a 📜 estance	A	B (1971)	
4 "instrumentid": 20.	= in arcernes	name	Date modified	
5 Dirstnimentname ¹ : TAM10-001-0009200	4 🎉 bin	🔒 calib	26.02.2016.08:45	
6 familifier: "DAOP"	🍌 7zip	C shappellist is an	04.02.2016.11.07	
7 B "amplifiant and "	🖌 🌽 config		45 04 001 0 07 00	
2 ampinercomport .	P 🔒 calib	Config.json	15.04.2016 07:28	
b por a cowr y	a disapara	🗋 resumemeasurement	14.04.2016 08:54	
Baudrate : 19200,		🥁 users.json	23.03.2015 11:44	
to dataons : / ,	# g39.14	vodachannellist.csv	24.02.2015 15:18	
11 "parity": "E",	🕌 bin			
12 "stopbits": 0,	🔒 doc			
13 "type": "485"	k examples			
14 -] ,	i in			
15 "terminalconfiguration": "NRSE",	h Barra			
16 "usewatchdog": false,	v 👞 noping			
17 "drivertype": "NIDAQ",	P 📕 trio			
18 "usedirectadcrangecorrection": failse,	🖻 🏄 zlib			
19 "usebackplanelowreset": false	🕌 logs			
20 - 3	4 🎴 Octave			
21 E Datanta (C)	h an solat			
22 Thesteren T	- s grapher			
22 Incontaine , ,	Distance 3.8.1			
20 Unity index	b 🎉 textive			
29 Ip : ,	P is reports			
25 Inetmask": ",	rsync			
26 "gateway": ",	A 🕌 rivince			
27 "wian": faise,	hin.			
28 "ssid": "',	is bit			
29 "passphrase": "",	doc doc			
30 "dns1": ",	🖻 🎂 etc			
31 "dns2": "	🎉 tmp			
32 -).	setups			
33 😑 "measurement": {	undate			
34 Douthor's DS Wmeasurements'				
35 "hufferlandth" 12	- <u>.</u> www			
	📕 C33			
27 🖨 Travent f	🎉 fonts			
20 Tasting true	🎥 help			
30 active : true,	images			
39 server: 192.100.91.1 ,				
40 sen': true,	· · · · · · · · · · · · · · · · · · ·			
41 "sshparams": "+ /cygdme/c/users/artemes/.ssh/id_rsa +o ConnectTimeout=10",	P 🚛 reports			
42 "user": "am10-001-000020",	🖻 🌽 temp			
43 "destination": "VartemesVdevicesVam10-001-000020",	D 🕌 views			
44 "params": "blocking-iochmod=Du=nwx,go=rx,Fu=rw,og=rtimeout=30"	DEWESoft7			
45 - }	b 🎴 inetnab			
46 }		~ <	>	
	6 items 1 item selected 987 bytes			
ISON File		Janoth - 987 Error 44	10:43 Col:59 Sel:010	UNIX LITE-8 MIC
		renguri 307 lines 148	CITING COLLOG SETUID	0104 01010 115
				🔺 🕕 👾 🍓 DEU 🛛 11:34
				15.04.2016

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.



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Installation and System Setup

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)



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



		Installation	and System Setup		83
	Site beark		? X		Websi
Sitena <u>m</u> e: Default Web Site	Anwendu <u>n</u>	gspool: Pool	Aus <u>w</u> ählen	•	*:443 ([fd6a:3 durchs 192.16
<u>P</u> hysischer Pfad: C:\artemes\www				•	[fd6a:3 *:80 (h Erweit
Pass-Through-Authentifizierung Verbinden als Einstellu	ngen testen			0	Konfig Ablauf Limits
		ОК	Abbrechen	٢	Hilfe
Ausgabezwischen Au	thentifizierung	Einschränkungen für IP-Adressen und D			

- 8.) Start service 4.
- 9.) Test the installation with the browser.

Remark:The following TCP ports are necessary:Port 80HttpPort 2001exchange 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 <u>delta connection</u> OR the <u>star connection</u> 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 <u>medium voltage grids</u> 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



Step by Step Tuturial





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



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ARTE	MES Setups-	AI Power	Extra modules	Storage	Analyze	/ ►	•
module	Add Powermodule						
General	Choose a grid type	FFT Mathe cha	innels Trigger				
Choose a	a grid type						
3 Phas	se Star		\ \	~			
Calc. I	ULL third current				alc Currents N		
					РЕ		
U L1			I L1				
alu		~	a14		~		
U L2		_	I L2		_		
aıı		~	alb		~		
U L3			I L3		_		
ai2		\sim	ai6		\sim		
		•					

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.





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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) <u>star</u> 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



					Ste	p by St	tep Tuturia	I 91
RTEMES Setups	AI Power	Extra modules	Storage .	Analyze	*	0		
module Add Powermodule								
General Choose a grid type	FFT Mathe cha	annels Trigger						
Choose a grid type								
3 Phase Delta		`	\sim					
Calc. third current			 ✓ Calc □ U N □ I PE 	Currents				
U L12		IL1						
ai0	\sim	ai4		\sim				
U L23		I L2						
ai1	\sim	ai5		~				
U L31		I L3						
ai2	\sim	ai6		\sim				
U12 U23 U31 U1 U1 U2 U3 U1 U2 U3								

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 <u>delta-connection</u> 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



ARTEMES Setups Al Power Extra modules Storage Analyze module Add Powermodule General Choose a grid type FFT Mathe channels Trigger Choose a grid type 3 Phase Star ✓ Calc Current □ Calc. ULL □ Calc. third current □ U N □ I N □ I PE	5	0
Module General Choose a grid type FFT Mathe channels Trigger Choose a grid type 3 Phase Star 3 Phase Star Calc. ULL Calc. third current I N UL1 ill ai0 Add Powermodule FFT Mathe channels Trigger Choose a grid type Second a grid type Output Image: Choose a grid type Second a grid type Image: Choose a grid type	s	
General Choose a grid type FFT Mathe channels Trigger Choose a grid type 3 Phase Star > Calc. ULL Calc Current Calc. third current U N I N I PE UL1 IL1 ai0 >	5	
Choose a grid type 3 Phase Star ✓ Calc. ULL ✓ Calc Current Calc. third current U N I N I PE UL1 IL1 ai0 ✓	S	
3 Phase Star ~ Calc. ULL \bigcirc Calc Current Calc. third current \bigcirc U N I N \bigcirc I L1 ai0 ~	S	
□ Calc. ULL □ Calc Current □ Calc. third current □ U N □ I N □ I PE UL1 IL1 ai0 ∨	S	
UL1 IL1 ai0 ~ ai4 ~		
ai0 ~ ai4 ~		
U L2 I L2		
ai1 ~ ai5 ~		
U L3 I L3		
ai2 × ai6 ×		

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 <u>setting up</u> an instrument and how to <u>evaluate data</u>.



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 <u>AI channels</u> 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

Name		
House		
Description		
Nominal Voltage LE	Nominal Frequency	Frequency source
230	50 \$	Voltage \$
Save Interval (sec)	Save Interval Freq. (sec)	Samplerate Divider
Periodcount	Periodduration	Overlap Factor [%]
10 🕄	1 🔷	50 🗘
Save Periodvalues		
Symetric Components Basic Calculation	Enhance	ced Calculation

FFT settings: THD with 40 lines

Step	by	Step	Tuturial	95
------	----	------	----------	----

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

Example star:

FFT						
FFT Count	Sidebands Count	Interharm. Sidebands Count				
25 🗊	1	3				
THD	40 3					
🗹 UL						
	C) P				
Q	C	cos Phi				
🗆 Phi U	C	D Phi I				
Interharmonic	s	Calc. Higher Harmonics				
Calc. Highest	Harmonics	Smoothing Filter				

example Delta:



96	ARTEMES Softwar	e		
	S FFT			
	FFT Count	Sidebands Count	\$	Interharm. Sidebands Count
		40	0	
			🖸 U	LL
			□ P	
	Q			os Phi
	🗆 Phi U		🗆 PI	hi I
	Interharmonics	i		alc. Higher Harmonics
	Calc. Highest H	Harmonics	🗆 SI	moothing Filter

Flicker settings:

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

Flicker	Save Current Flicker				
PST (min)		PLT (PST count)		Flickerfilter (Hz)	
1	٢	12	٢	Auto	\$
PST Overlap [%]		PLT Overlap (%)			
0	0	0	6		



				Ste	p by Step T	uturial	97
Trigger							
Max. Storage Time [ms]		Separate Phases					
Voltageband Star/%1	Max.	Max.	Pretime [ms]	Holdofftime [ms]	Flagging	Relative	
	110	0 108	0 1000	0			
	Min.	Min.	Туре	Posttime [ms]	Posttime ext.		
	90	92	Both	\$ 3000	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

Trigger						
Max. Storage Time [ms] 10000 Voltageband Star/%]	٢	Separate Phases				
Voltageband Delta[%]	Max.	Max.	Pretime [ms]	Holdofftime [ms]	Flagging	Relative
	110	0 108	0 1000	0	0	
	Min.	Min.	Туре	Posttime [ms]	Posttime ext.	
	90	3	Both	\$ 3000	0	

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

2) Report

Star the <u>Analyze</u> section and open the <u>reports</u> page in the menu bar.

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

ARTEMES		FFT Transients 2	Events 2 A	larms 🙎	Reports O		4*
Start 27.05.2016 20:06	End 03.06.2016 18:29	Module House	·	Report EN50	160	Calc Report	
Measurementtitle : H	laus			Mod	ules		
Instrument Name Location Comment	Hausdemo Graz				House	V / 3 Phase Star	
Instrument Serial Starttime	15500188 27.05.2016, 20:06:38				Heating System	V / 3 Phase Star	
Endtime Samplerate	03.06.2016, 18:29:31 10,000 [Hz]				PV	V / Single Phase	
					Wind	V / Single Phase	

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

	Data for EN50160			
L	Class	Low voltage		
t.	lland	grid connected ᅌ		
L	Phase Values	Phase values ᅌ		
Ŀ	Author	Demouser		
dı	Company	ARTEMES		
L				
)' .1 .1				Start Cancel

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:

ARTEMES





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- 3 -

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3 Phase star 18

- 4 -

4 wire 18

- 5 -

5 wire 18

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- C -

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- D -

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- E -

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- F -

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- P -

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- T -

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- V -

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