

PQA 7000



USER MANUAL

V2.11



www.neo-messtechnik.com

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Thank you!

Thank you very much for your investment in our unique instrument. These are top-quality instruments which are designed to provide you years of reliable service. This guide has been prepared to help you get the most from your investment, starting from the day you take it out of the box, and extending for years into the future.

Support

When you are working with our products we want to provide you with the greatest possible benefits. If you need any support, we are here to assist you.



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Table of Contents

1	Introduction.....	6
2	Safety Information	8
2.1	General Safety	8
2.2	Safety instructions for measurement	10
2.3	Residual risks	10
2.4	Personal protective equipment.....	10
2.5	Measurement Categories	10
2.6	Battery Handling	13
2.7	Cleaning of the device.....	15
2.8	Warranty	15
2.9	Recycling	15
2.10	CE Conformity.....	16
2.11	RoHS	16
2.12	Electrical Units	17
2.13	Environmental and Others	17
3	Hardware.....	18
3.1	Voltage Inputs.....	19
3.2	Current Inputs	19
3.3	Additional Multi-Connector	21
3.4	Computer Interface	21
3.5	Antenna and Battery indicator LED	22
3.6	Fan	23
3.7	Status LED.....	23
3.8	Specifications.....	24
3.9	Accessories	25
4	Software	26
4.1	Start Measurement Software.....	26
4.2	Quick Start with a simple setup	27



4.2.1	Fundamental Frequency Setup	27
4.2.2	Basic Wiring Setup.....	28
4.3	Main Menu	34
4.3.1	Defining user and project name.....	34
4.3.2	Setting the user language	34
4.4	Data Storage.....	35
4.4.1	Store Data Panel.....	35
4.4.2	Store Events/Transients Panel	38
4.5	Measurement.....	39
4.5.1	FFT / Spectra	39
4.5.2	Oscilloscope.....	40
4.5.3	Vector Scope	40
4.5.4	Table Panel.....	41
4.5.5	Multi-Chart	42
4.5.6	EN50160 Analyzer	43
4.5.7	Transient, Event and Disturbance Recorder.....	45
4.5.8	Phase Measure Unit.....	55
4.5.9	Display of actual values.....	59
4.6	Data Analysis	60
4.6.1	Settings.....	61
4.6.2	Graphs / Time Series Data.....	62
4.6.3	FFT Data.....	67
4.6.4	Events, Alarms, Transients, Disturbances	72
4.6.5	EN50160.....	74
4.6.6	Data Export options.....	78
4.6.7	Automatic Report Generator.....	79
4.6.8	Data Analysis on PC / Copy data of instrument.....	84
4.6.9	NEO Measurement World - NEO Updater	85
5	Further Manuals and Links	87



6	Overview Training Videos	88
7	Maintenance and Care.....	90



Warning

Failure to follow the warnings and/or instructions for use may damage the device and/or its components and pose a risk to the user.

Always use the newest version of the user manual for instructions on how to use the measurement device. The latest User Manual is available at:

www.neo-messtechnik.com

1 Introduction

This manual contains important instructions for the use and operation of NEO Messtechnik instruments safely, properly and efficiently. Its purpose to help you to avoid danger, repair costs, and down time as well as to help maintain reliability and life of the instruments. For this reason, it is important to ensure that the manual is always available to authorised and trained personnel. Operating personnel should read the manual thoroughly. The manufacturer will not be held liable for any injury or damage to personnel or property through failure to observe the safety precautions contained in this handbook. The specific standards and regulations in each country must also be observed. It is important to observe the general electrical regulations of the country in which the device will be installed and operated, as well as the current national accident prevention regulations and internal company directives (work, operating and safety regulations). The system may only be installed by an authorised electrician. Use genuine accessories to ensure system safety and reliable operation. The use of other parts is not permitted and invalidates the warranty.

The PQA7000 is a Power Quality measurement instrument combining powerful energy measurement and power quality analyzer functions with the latest technology. It can be used for power measurement applications with its high sampling rates, high-resolution ADC and high accuracy. The conformity of the device according to international standards enables the user to generate reliable and accurate reports for various applications.

The LCD touch screen, that is also readable under sunlight, proves to be very comfortable for mobile measurement tasks. In combination with the internal battery pack the PQA7000 operates up to 3 hours without any external power source.



Main Features

- 24 bits / 40 kS/s sampling rate (PQA8000)





- +/- 1600 V Voltage range
- 4 Voltage Input, 4 Current Sensor Input
- GPS synchronization module inside

The instrument is designed to conform to the IEC61010 Safety Standards and has been thoroughly tested for safety prior to shipment. However, using the instrument in a way not described in this manual and instructions may negate the provided safety features. Before using the instrument be certain to carefully read the following safety notes.

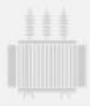
Warning sign	Type of safety instruction
	This symbol indicates cautions and hazards that may/will result in death or serious injury to the operator.
	This symbol indicates that dangerous high voltage. If a particular safety check is not performed, this may give rise to a hazardous situation. The operator may receive an electric shock, may be fatally injured or may be burnt.

Tips and recommendations

	This symbol indicates a double-insulated device.
 NOTE	These symbols indicate advisory items related to the performance or correct operation of the instrument.

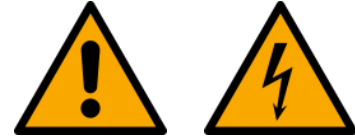


Mishandling during use could result in injury or death, as well as damage to the instrument. Be certain that you understand this instructions and precautions in the manual before use.

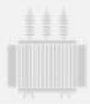


2 Safety Information

2.1 General Safety



- Carefully read this manual before using the instrument.
- Use the instrument according to these instructions only.
- Use the instruments only under environmental conditions described in the technical data.
- Personnel assigned to use the instrument must have read this reference manual and fully understood the instructions herein.
- The instruments may only be operated by trained personnel. Any maloperation can result in damage to property or persons.
- The input voltage shall not exceed the values rated in the technical data. With this product, only use the power cable delivered or defined for the host country.
- There is no guarantee if you exceed the values for your safety.
- The power supply must be within the limits given in the technical data.
- Always make a visual inspection of used equipment such as leads and clamps before use.
- Use fuses (500mA) if you connect the instrument directly to voltage where no fuse is available or high short circuit power is given.
- The product heats during operation. Make sure there is adequate ventilation. Ventilation slots must not be covered!
- When connecting to the banana plug sockets, only use cables with 4mm/0.16" safety banana connectors and plastic housing. Always insert plugs completely.
- DO NOT insert objects into sockets or ventilation slots.
- DO NOT open the instrument or remove any of its housing components. Don't carry out any modifications, extensions or adaptations at the instrument. If instrument is opened by the customer, all guarantees are invalidated.
- DO NOT use the system if equipment covers or shields are removed.
- DO NOT use the system in rooms with flammable gases, fumes or dust or in adverse environmental conditions.
- The use of the measuring system in schools and other training facilities must be observed by skilled personnel.
- Please contact a professional if you have doubts about the method of operation, safety or the connection of the system.
- Please be careful with the product. Shocks, hits and dropping it from already lower level may damage your system.
- Do not switch on the system after transporting it from a cold into a warm room and vice versa. The thereby created condensation may damage your system. Acclimatize the system unpowered to room temperature.
- Maintenance must be executed by qualified staff only.
- DO NOT operate damaged equipment: Whenever it is possible that the safety protection features built into this product have been impaired, either through physical damage, excessive moisture, or any other reason, REMOVE POWER and do not use the product until safe operation can be verified by service-trained personnel. If necessary, return the product to NEO Messtechnik sales and service office for service and repair to ensure that safety features are maintained.
- This manual is to be supplemented by existing national safety standards for accident prevention and environmental protection.
- The instructions provided in this manual and the associated software and hardware manuals are considered part of the rules governing proper usage.



- Observe local laws when using the instrument.
- The use of measuring devices under CAT II, III or IV conditions can be dangerous! Under these conditions, only appropriately trained / tested / informed about safety precautions may take measurements (for safety categories see also technical reference manual). If a measuring device, a cable or an accessory of a lower category or voltage is used, this lower category / voltage applies to the entire group (device + cable + accessories)
- During shipment of the device , handle it carefully so that it is not damaged due to vibration or shock.
- To avoid electrical shock don't remove the instrument case. The internal components of the instrument carry high voltages and may become very hot during operation.
- Don't use the instrument in environments containing ignitable gases, explosive powders etc. (Risk if explosion)
- Don't place the instrument on an unstable table or an inclined place. Dropping or knocking down the instrument can cause injury or damage to the instrument.
- Don't use the instrument at circuits exceeding its rating and specifications. Doing so may damage the instrument or cause it to become hot, resulting in electric shock or injury to persons.
- Before using the instrument inform those around you of your intention to use it.
- Before using the instrument, verify that it operates normally to ensure that no damage occurred during storage or shipping. If you find any damage, contact your authorized NEO Messtechnik sales partner or contact NEO Messtechnik directly.
- If a test lead or the instrument is damaged, there is a risk of electrical shock. Perform inspection before using the instrument. Check the coating of the test leads that they are neither ripped nor torn and that no metal parts are exposed. Using the instrument under such conditions could result in electric shock. Replace the test leads with those specified by NEO. Verify that the instrument operates normally to ensure that no damage occurred during storage or shipping. If you find any damage, contact NEO Messtechnik or an authorized sales partner.
- During shipment of the instrument, only use the packaging of the original delivery and handle it carefully so that there is no damage due to vibration or shock.
- If the product is damaged, mark it clearly so that no other person use it inadvertently.
- Touching any high voltage points inside the equipment is very dangerous. Customers are not allowed to modify, disassemble or repair the instrument. Doing so may cause fire, injury or electrical shock.
- The instrument is not drip-proof. Water droplets may result in malfunctions.
- The instrument is designed for the application in low-voltage grids (100V – 230V line-earth and 400V line-to line). Any use in other than specified voltage levels is strongly forbidden.
- Don't short the measurement test leads with metal portion or tips of the test lead. Doing so may cause fire, injury or electrical shock.
- To avoid electrical shock or short-circuit don't touch the metal parts of the connecting cable clips.
- To prevent electrical shock when measuring the voltage or connecting the GIA to the power line use only the specified test lead.
- To prevent electrical shock don't exceed the the lower of the ratings shown on the instrument and test leads.
- The system may only be installed by an authorised electrician.
- The operating safety is only guaranteed if the delivered system is used as intended. Incorrect use may result in danger to the operator, to the system and the connected equipment.
- The operation of NEO Messtechnik products in direct contact with water, aggressive substances and inflammatory gases and vapours is prohibited.





- The system may only be operated whilst it is in perfect working condition. In the event of damage, irregularities or malfunctions that cannot be resolved with the assistance of the operating instructions, the system must be shut down immediately and labelled accordingly. In such an event, the relevant management must be informed. Please contact NEO Messtechnik Service immediately to eliminate the malfunction. The system may only be started up again once the malfunction has been eliminated.
- The instrument is intended for use in a dry environment only.
- In order to ensure safe operations of this instrument, all notes and warnings in these instructions must be observed at all times.
- Never disconnect the test leads during an active measurement. This may result in electrical arcing or electrical shock.
- Wear protective gear to prevent electrical shock. Use appropriate protective insulation and adhere to applicable laws and regulations.
- With regards to the electrical supply, there are risks of electrical shock, heat generation, electrical arc, fire and short circuits. Individuals using an electrical measuring device the first time must be supervised by a technician with experience in electrical measurements.



2.2 Safety instructions for measurement



The device must not be left on the bag during the measurement, as otherwise the heat cannot be dissipated. Sufficient space should be left around the device, especially around the fans, so that the heat generated during a measurement can be dissipated.

2.3 Residual risks

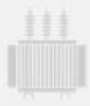
The GIA device is designed in accordance with the state of the art and current safety requirements. Nevertheless, residual risks remain that require prudent action.

2.4 Personal protective equipment

Personal protective equipment is used to protect persons from health and safety hazards. The specific regulations of the respective area or country as well as company regulations for safety in electrical engineering and the safe handling of electronic devices in accordance with EN50110 must be observed.

2.5 Measurement Categories

To ensure safe operation of measuring instruments the IEC 61010 safety standard defines several categories for various electrical environments – called measurement categories.



Using a measurement instrument in an environment designated with a higher-numbered category than that for which the instrument is rated could result in a severe accident, and must be carefully avoided.



Never use a measuring instrument that is not labelled with a measurement category according to IEC61010.

Measurement category CAT II

Measurement category II is for measurements performed on circuits directly connected to the low-voltage installation. Examples are measurements on household appliances, portable tools and similar equipment

Measurement category CAT III

Measurement category III is for measurements performed in the building installation. Examples are measurements on distribution boards, circuit-breakers, wiring, including cables, bus-bars, junction boxes, switches, socket-outlets in the fixed installation, and equipment for industries

Measurement category CAT IV

Measurement category IV is for measurements performed at the source of the low-voltage installation. Examples are electricity meters and measurements on primary overcurrent protection devices and ripple control units



For working on equipment under voltage use the guidelines given in EN50110.

Always follow the 5 golden safety rules:



1. Always switch off.

Meaning that the electrical installation must be disconnected from live parts on all poles. Block all poles of the power source for every part of the operation. Switchgear of home or factory, low voltage switch mode, the power of the machine control switch should be cut off. The power supply circuit to be supplied to the electric appliance such as lamps and motors should be cut off. If you remove the low-voltage rapid fuse, you should wear braces, a helmet, and front shields. If there is a capacitor, the residual charge must be discharged using appropriate tools.

2. Secure against reconnection.

Reliably prevent an accidental re-connection of an installation where work is in progress. This is achieved for example by just replacing the unscrewed fuses in the low-voltage system by lockable lock-out devices. Appropriate warning signs should be posted for viewing on the operating device (switch handle, instrument actuator, control device, circuit breaker, etc.). It should also be posted to closed electrical operating areas or locked switch cabinets. The contents of the warning cover should warn you that you don't manipulate the switch. In addition, provide a name for the workplace location and supervisor. The power-off device should be locked to a mechanical device. All keys must be kept in a safe place. If it is operated with the control voltage of the energy or controller, such as springs, compressed air, it must take measures to prevent the release or operation of energy.

3. Verify that the installation is dead

Use a suitable measuring / test equipment such as a voltage detector to verify on all poles that the installation is dead. Check the correct function of the voltage detector prior to using it.

4. Carry out earthing and short-circuiting.

An important point of the five safety rules is earthing and short-circuiting at the workplace. This measure ensures a voltage-free state for the duration of the work, also with regard to influencing voltages, atmospheric overvoltage or accidental restarting. Earthing and short-circuit areas should be visible at the workplace. Important: The relevant parts must be earthed before they are short-circuited!

5. Provide protection against adjacent live parts

According to the five safety rules, adjacent parts are parts located in the vicinity zone. If parts of an electrical installation in the vicinity zone of the work location cannot be disconnected, additional precautions must be taken before work starts. In this case use insulating protective



shutters or covering material as protection against accidental contact. The hazard area should be marked for clarity.

2.6 Battery Handling

Lithium-Ion rechargeable batteries require routine maintenance and care in their use and handling. Do not leave batteries unused for extended periods of time, either in the product or in storage. When a battery has been unused for 3 months, check the charge status and charge or dispose of the battery as appropriate.

Please especially consider the following points for storing the device:

- Charge the battery more than 50% of capacity before storage.
- Charge the battery more than 50% of capacity at least once every three months.
- Store the battery at temperatures between 5 °C and 20 °C (41 °F and 68 °F).
- Use the battery in ambient temperature range from 0°C to 50°C.
- The battery self-discharges during storage. Higher temperatures (above 20 °C or 68 °F) reduce the battery storage life.
- The life of the battery pack (when capacity is > 60% of initial capacity) is >500 charge-discharge cycles depending on the conditions of use.



If you will not use the instrument for longer time, always switch the Power button to OFF (bottom position). This enables the maximal power saving mode and will protect your battery of being over-discharged. Over-discharge of Li-Ion batteries has huge influence on their lifetime.



Position	Function
Right	Start (push switch)
Middle	ON after start or standby (returns to this position after push)
Left	OFF (MAX. power saving mode, useful for long term device storage)

If you start instrument after over-discharge or you didn't use it for a long time, the instrument may take several minutes to start up (even if fans are active). The integrated PC will start operation not before battery charge level will reach nominal operating conditions.

When the battery pack is used, then the instrument turns off automatically when the capacity drops. Leaving the instrument in this stage for a long time may lead to over discharge so be sure to turn off the power switch on the instrument.



Be sure to observe the following precautions. Incorrect handling may result in liquid leaks, heat generation, ignition, bursting and other hazards.



- The battery pack contains lye, which may cause blindness if it comes to contact with the eyes. Should battery liquid get into your eyes, avoid rubbing them. Flush them with water and seek immediate medical attention.
- When storing the instrument, make sure no objects that could short-circuit the connectors are placed near them.
- If the battery pack fails to finish charging within the stipulated time, disconnect the aC adapter to stop charging and contact NEO Messtechnik.
- Consult NEO Messtechnik or a sales partner in case liquid leaks, strange odor, heat, discoloration, deformation and other abnormalities conditions occur during use, charging or storage. Should these conditions occur during use or charging, turn off and disconnect the instrument immediately.
- Don't expose the instrument to water and don't use it excessively humid locations or locations exposed to rain.
- Don't expose the instrument to strong impacts and do not throw it around.

Recharging a Deeply Discharged Battery

If the unit is not used for a certain period and the Power Switch is not turned to the OFF position, the battery will continue to discharge. It is therefore recommended that the instrument be switched OFF when not in use for some time. However, there is a possibility to recharge a deeply discharged battery again with a special charging mode.

Step 1:

As shown on the right side, switch OFF the unit.

Step 2:

Connect the power cable.

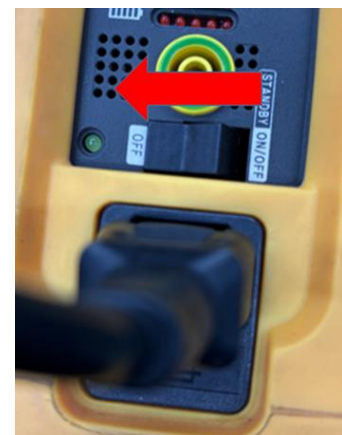
Step 3:

Charge it in this position for approximately 5 hours.

Step 4:

Switch System ON

The system may not operate immediately after complete discharge.





2.7 Cleaning of the device

Before cleaning, all cables must be disconnected and any connection to the power supply or other devices must be disconnected. Do not clean the device with alcohol or other organic solvents. Only use a soft, lint-free, dry cloth for cleaning. When cleaning, make absolutely sure that no liquid gets into the inside of the device. This could cause a short circuit and destroy the appliance or pose a danger to persons.

2.8 Warranty

The warranty for the instrument is 2 years – usual operating conditions preconditioned. This warranty does not cover wear parts, fuses, batteries and accumulators. NEO Messtechnik warrant that at the time of delivery NEO Messtechnik products are free from manufacturing or material defects which might considerably reduce their value or usability. This warranty is not applicable to faults in the software supplied. During the period of warranty, NEO Messtechnik agree to repair faulty parts or replace them with new parts or parts as new according to their choice. Each measure to remedy a claim under warranty shall exclusively be carried out by NEO Messtechnik or an authorized service partner. NEO Messtechnik reject all further claims under warranty, in particular those from consequential damage. Each component and product replaced in accordance with this warranty becomes the property of NEO Messtechnik.

This warranty does not apply to any fault or damage caused by exposing a product to conditions not in accordance with this specification, by storing, transporting, or using it improperly, or having it serviced or installed by a workshop not authorized by NEO Messtechnik.

2.9 Recycling

- This is an electronic instrument and must be recycled according to the WEEE – directive. Do not throw away.
- More information see:
http://ec.europa.eu/environment/waste/weee/index_en.htm
- Dispose of the test set in accordance with the legal environmental regulations in the country.





2.10 CE Conformity

- This instrument is compliant with the CE - requirements.
- **EMC Directive 2014/30/EU**
- **Test Procedure:**
 - EN 55011: 2009 + A1:2010(Group 1), Class A
 - EN 61326-1: 2013
 - EN 61000-3-2: 2014
 - EN 61000-3-3: 2013
- **EMI (EN55011):**
 - Conducted Emission (CE)
 - Radiated Emission (RE)
- **EMS (EN61000-4-2 ~ 11):**
 - Electrostatic discharge (ESD: EN61000-4-2)
 - Radiated RF immunity (RS: EN61000-4-3)
 - Electrical Fast Transient/BURST (EFT: EN61000-4-4)
 - Surge (Surge: EN61000-4-5)
 - Conducted RF immunity (CS: EN61000-4-6)
 - Voltage dip/interruption (DIP: EN61000-4-8/11)
- **Safety: EN 61010-1: 2010**



Note about Radiated Emissions:

The device is intended for operation in the industrial segment in accordance with EN55011 – CLASS A. When used at private houses it could cause interference with other equipment (such as the radio or television). The radiation level complies with the limit curve A (industrial area). If the living area is sufficiently far away from the planned area of operation (industrial area), equipment there will not be impaired.

2.11 RoHS

- This product is compliant with the RoHS - Directive.
- For further information see:
http://ec.europa.eu/environment/waste/rohs_eee/index_en.htm



2.12 Electrical Units

SI units are always used in this manual.

pico	p	10^{-12}	$1\text{pF} = 10^{-12}\text{F}$
nano	n	10^{-9}	$1\text{nA} = 10^{-9}\text{A}$
micro	μ	10^{-6}	$1\mu\text{A} = 10^{-6}\text{A}$
milli	m	10^{-3}	$1\text{mA} = 10^{-3}\text{A}$
kilo	k	10^3	$1\text{k}\Omega = 1000\Omega$
mega	M	10^6	$1\text{MHz} = 10^6\text{Hz}$
giga	G	10^9	$1\text{GHz} = 10^9\text{Hz}$

2.13 Environmental and Others

- Use instrument only for indoor use
- Altitude up to 2 000 m;
- Ambient temperature from 0 °C to 55 °C;
- Protection IP 20 / Protection Class II
- CAT IV 600V / Pollution Degree 2 respective / CAT III 1000V / Pollution Degree 2
- Maximum relative humidity 80 % at temperatures up to 31 °C, decreasing linearly up to 50 % relative humidity at 40 °C;
- Fluctuations of the mains supply voltage up to $\pm 10\%$ of the nominal voltage;
- Only use the auxiliary equipment provided
- Only use the cables provided
- Always use safety test leads (CAT III 1000V / CAT IV 600V) with full isolated plugs
- Don't connect the instrument to any other power supply or any other device. It is only intended to be used with PQA8000H instrument.



3 Hardware

The PQA7000 is an All-in-one Power Quality Analyzer capturing Time-domain, frequency-domain data as well as Transients and Disturbances.

Front View:



Top View:



The majority of connector pins for measurements are located on the top side and right side. The PQA7000 offers 5 banana plugs for voltage connection (L1, L2, L3, N and PE) and 5 connectors for current measurement. An additional Multi-connector allows capturing further signals via DI and bus systems.



3.1 Voltage Inputs

The device has banana connectors on its top side for measuring 4 Voltage input signals up to 1600V. All the channels are differential inputs and have a common isolation to GND.



The voltage inputs supports DC and AC measurement. Please refer to the “Neo Technical Reference Manual” for detailed information.

Depending on the hardware the channels are assigned to different Analog Input (AI) channels.

AI Channel	Name
AI0	V1
AI1	V2
AI2	V3
AI3	VN

3.2 Current Inputs

For current measurement via sensors, 5 LEMO connectors are placed on the right top side of the device.

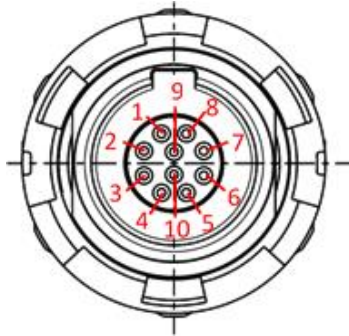


These input connectors support many different kinds of sensors including TEDS - sensors. Please refer to the “Neo Technical Reference Manual” for detailed information.



10pin LEMO connector

Current sensors like Clamps, Rogowski-coils and other current sensors can be connected using the following pin assignment.

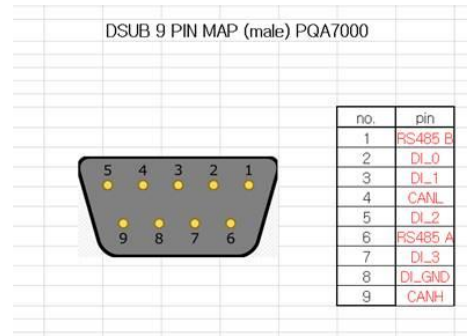
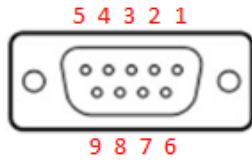


Pin	PQA7000
1	Signal +
2	Signal- / GND
3	FGND
4	Rogowski +
5	TEDS
6	GND
7	n.c.
8	n.c.
9	+15V
10	-15V



3.3 Additional Multi-Connector

DSUB-9 Female connector for additional input



- Digital Input:

The digital input is isolated and can measure up to +50 VDC with programmable Schmitt trigger levels.

- CAN interface with selectable termination

- RS485 interface

Termination 120 Ohm, 5V, 1.2k Pullup, Pulldown resistor

Pin	Signal	Description
1	RS-485_0B	RS-485 B(+)
2	DI_0	Digital In 0
3	DI_1	Digital In 1
4	CANL0	CAN low
5	DI_2	Digital In 2
6	RS-485_0A	RS-485 A(-)
7	DI_4	Digital In 4
8	DI_GND	Digital In Ground
9	CANH0	CAN high

3.4 Computer Interface

The Computer interfaces are located on the left top side

One 1GB Ethernet interface, two USB3.0, one USB2.0 interfaces.





USB 3.0	
Pin	Signal
1	VCC
2	Data-
3	Data+
4	GND
5	SSRX-
6	SSRX+
7	GND Drain
8	SSTX-
9	SSTX+

USB 2.0	
Pin	Signal
1	VCC
2	Data-
3	Data+
4	GND

1 GB LAN	
Pin	Signal
1	BI_DA+
2	BI_DA-
3	BI_DB+
4	BI_DC+
5	BI_DC-
6	BI_DB-
7	BI_DD+
8	BI_DD-

3.5 Antenna and Battery indicator LED

The SMA jack connector is prepared for external GPS antennas having a SMA plug type connector, and supports passive and active antennas.



The GPS LED indicates the GPS status, if it is locked or not.

WLAN Antenna: internal patch antenna is used.

Telecommunication modem antenna (option): can be installed inside.

The GPS antenna should be connected before the measurement software is started.

Battery indicator LED



NO. of ON LED	Remaining battery
5	80~100%
4	60~80%
3	40~60%
2	20~40%
1	0~20%



3.6 Fan

The fans for internal heat control are located on the side. The speed of the fans is controlled depending on the internal temperature. Additionally, metal mesh filters out the external dust particles.



3.7 Status LED

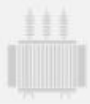
The status LED is located on the upper right side of the upper plate.

LED Status	Description
Green	Standby for measurement
Green blinking	Measuring (and storing)



3.8 Specifications

PQA7000 (48ksps)				
		HV	LV	
CH	Voltage	4	-	
	Current	-	5 (LEMO)	
Input Range	Voltage	±1600Vp MAX ±800Vp MAX	-	
	Current	Clamp	-	±2Vp MAX
		Rogowski	-	±2Vp MAX
		Direct Current	-	external sensor
DC Accuracy		±0.05%FS	±0.05%FS	
Gain	Voltage	1, 2	-	
	Current	Clamp	-	-
		Rogowski	-	1,2,5,10
		Integrator@50Hz	-	1,10
Gain Linearity		-	10ppm (MAX)	
Gain Drift Range		-	10ppm/K (MAX)	
Offset Drift		6mV/K (MAX)	9uV/K (MAX)	
Input Resistance		10Mohm	10Mohm	
ADC	Type	DeltaSigma		
	Oversampling Frequency	9MHz(Typ)		
	Data rate	48ksps(MAX)		
Filter BandWidth	-3dB BW	Analog	180kHz 4th Order Butterworth	
			23.4kHz@48ksps	
			19.5kHz@40ksps	
			11.5kHz@24ksps	
			9.6kHz@20ksps,140ksps	
			3.1kHz@12ksps,6ksps	
			2.6kHz@10ksps,5ksps	
	-0.1dB BW	Analog	61kHz 4th Order Butterworth	
			22.9kHz@48ksps (no filter)	
			19.1kHz@40ksps (no filter)	
			11kHz@24ksps (1FIR 700order)	
			9.2kHz@20ksps,140ksps (1FIR 700order)	
			3kHz@12ksps,6ksps (2FIR 700order)	
			2.5kHz@10ksps,5ksps (2FIR 700order)	
Measuring BandWidth	-3dB	23kHz		
	-0.1dB	22kHz		
Typical SNR		95dB		
Typical CMRR		90dB		
Current Sensor Power		-	±15V(1.3A)	
Sensor TEDS	Current	-	1 TEDS / CH	
Isolation Type		CH-GND	Sensor Isolation	
Isolation Voltage		6kVp	Sensor Isolation	
Digital Input	CH	4		



	Isolation Type	CH-GND 3kVp Isolation	
	Schematic	Buffer Input, 1MΩ Input Impedance	
	Positive Trigger Voltage	Adjustable 0~50V (CH1~2)	
	Negative Trigger Voltage	Adjustable 0~50V (CH1~2)	
	Trigger Resolution	12mV	
	EXT Power for DI	12V, Not Isolated	
CAN	CH	1	
	Isolation Type	CH-GND	
	Termination Resistor	None, 100Ω Selectable	
RS485	CH	1	
	Isolation Type	CH-GND	
	Termination Resistor	120Ω	
	Schematic	5V, 1.2k Pullup Pulldown Resistor	
GPS		Possible	
UPS (Interruption)		2hrs, Battery Gauge LED	
Measurement Category @<Pollution Degree 2		CATIII 1000Vrms, CATIV 600Vrms	
Surge		±4000V	±4000V
Burst		±4000V	±4000V

Environment and Mechanical

Processor		Intel®QuadCore
Storage		32GB eMMC and 1x USB 256GB
Display		7inch TFT LCD
UPS (Interruption)		2hours (Typ.), Battery Gauge LED
Power consumption		Typ. 40W
Weight		2.3kg / 5 pound
Size (width x length x height)		250 x 190 x 80 mm 9.84 x 7x5 x 3.2 inch
Temperature range	Operating	0°C ~ +60°C
	Storing	-20°C ~ +80°C

3.9 Accessories

Please check the NEO Messtechnik brochure or webpage (www.neo-messtechnik.com) to see all available accessories for the instrument.




4 Software



The measurement software is included with the device, while additional report and management software can be installed as it may be necessary. For further information, we would like to refer to the software manual.

4.1 Start Measurement Software

After turning on the instrument, the NEO Software will automatically be started. If not, the software can be started by the shortcut “ENA Measurement Software” 

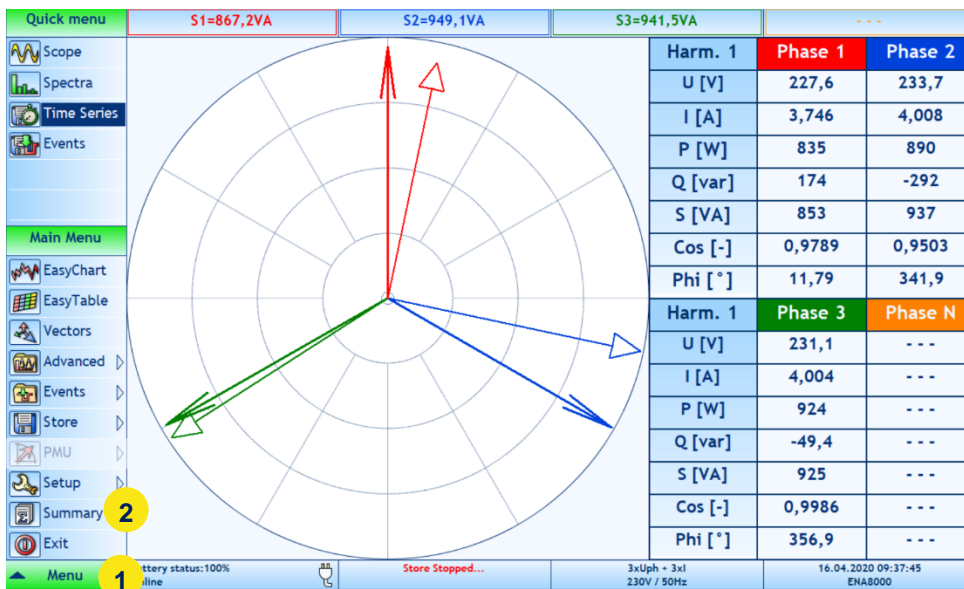
Note: The instrument always starts-up in the last used configuration (Sampling Rate, connection, range, language etc.)



4.2 Quick Start with a simple setup

4.2.1 Fundamental Frequency Setup

The Fundamental frequency is set in the **Setup Processing** panel. You can either navigate there via “Setup” - “Processing” or via the “Summary Panel”.



The **Summary** panel shows the current setup values of the device and is the easiest way to configure the instrument for your application. It summarizes all configurations for Wiring, Frequency, Limits, User Profiles and shows the storing overview for Time series data, PQ data, Digital data, Alarms, Transients, Signaling Voltage and Disturbances. To set up a fundamental frequency, click the button of ‘Fundamental Frequency’ (1).





Select a fundamental frequency (1). After selecting the fundamental frequency, click the 'Apply' button (2).



4.2.2 Basic Wiring Setup

To select a wiring type, click 'Wiring' button in **Summary panel** (1).

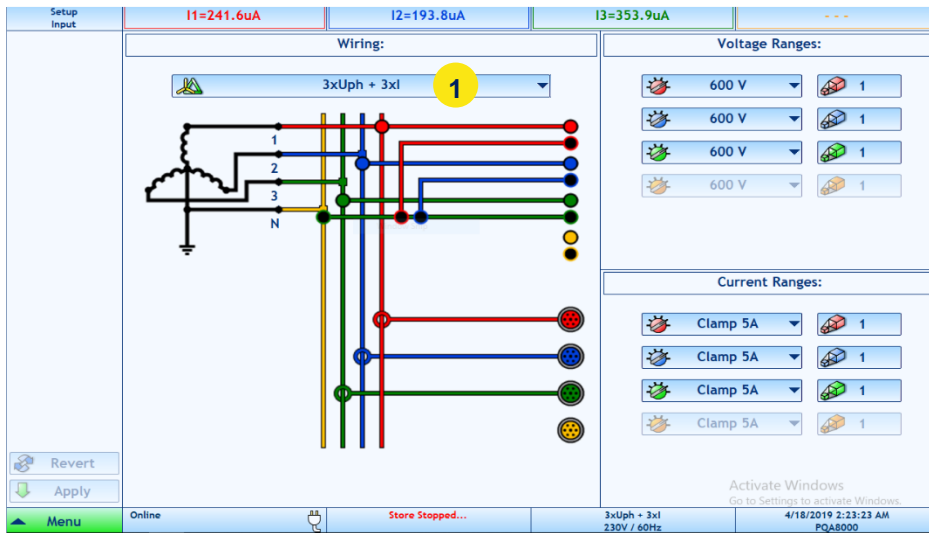
Alternative Navigation: "Setup" – "Input"



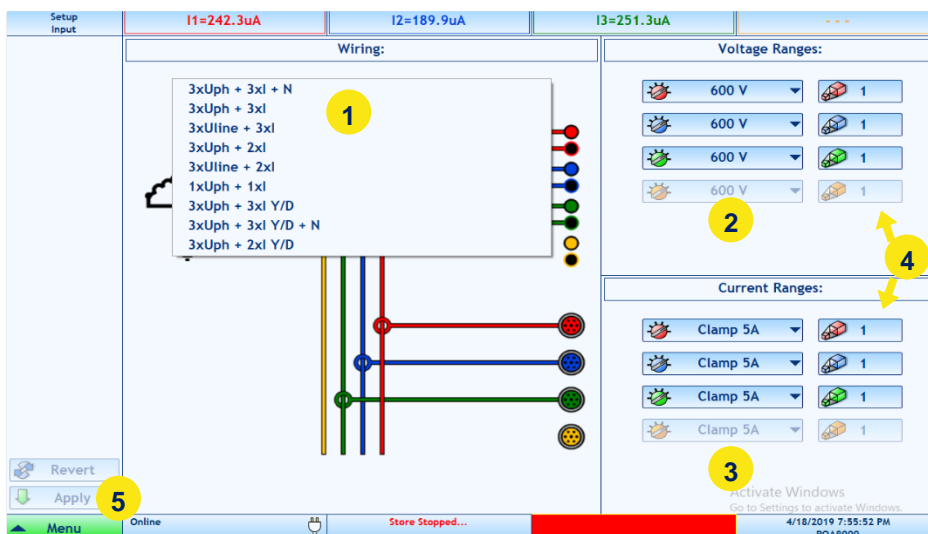


The following picture shows the 'Setup Input' panel for the wiring setup. The **Setup Input panel** allows changing the input wiring, input ranges, sensors and scale factors.

- By changing any of these parameters the measurement is restarted.
- If data is currently stored, the change of these settings is disabled.
- The System selection allows to setup these setting to actual system only or to all systems.



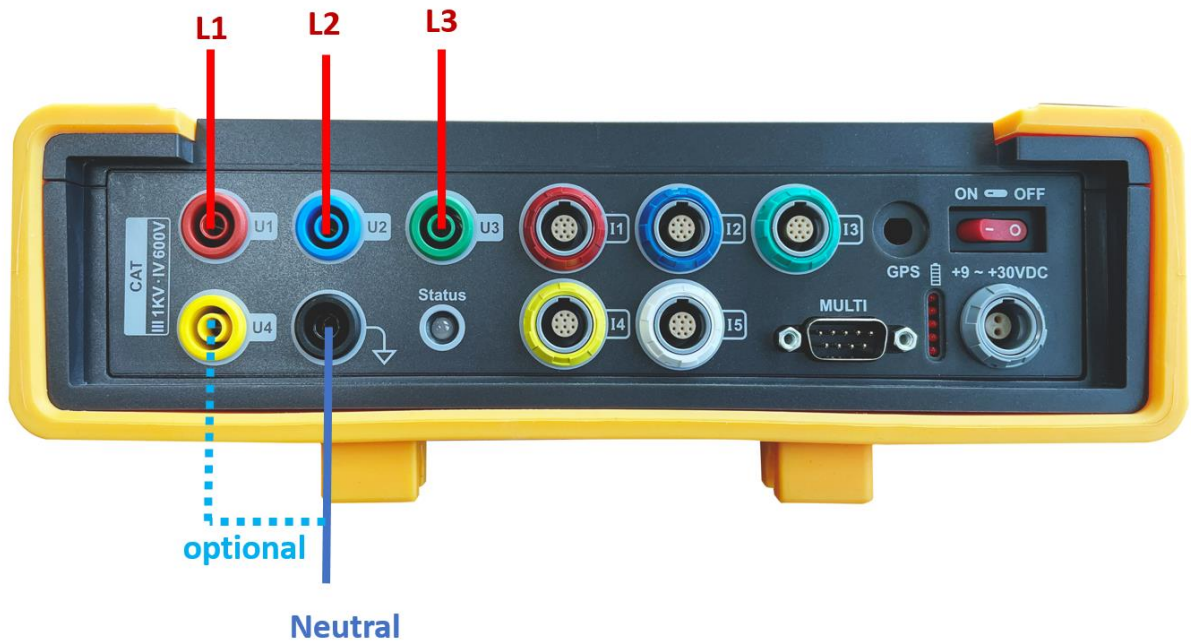
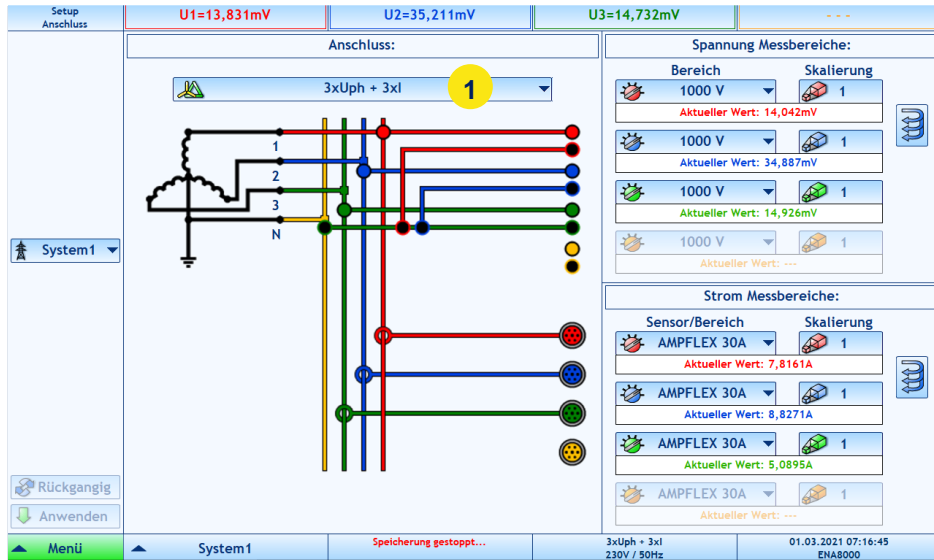
- Select a wiring type (1).
- Select a voltage input range (2).
- Select a current sensor (Clamp/Rogowski) and input range (3).
- Select a scale factor (4).
- Finally click on "Apply" button to save all changes (5)





STAR (Y) Connection

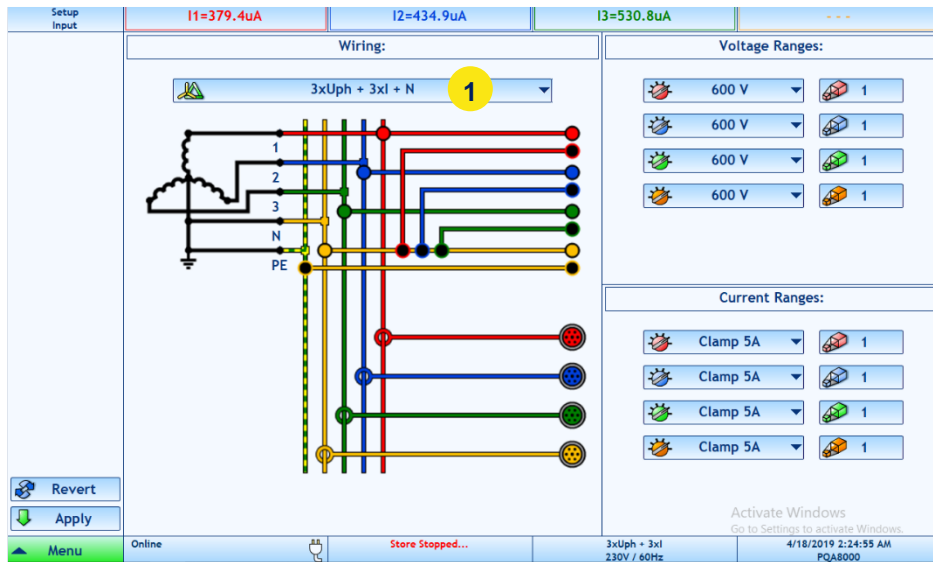
Select '3xUp + 3xI' in the wiring setup and connect the cables according to the picture below.





STAR (Y) + N-PE Connection

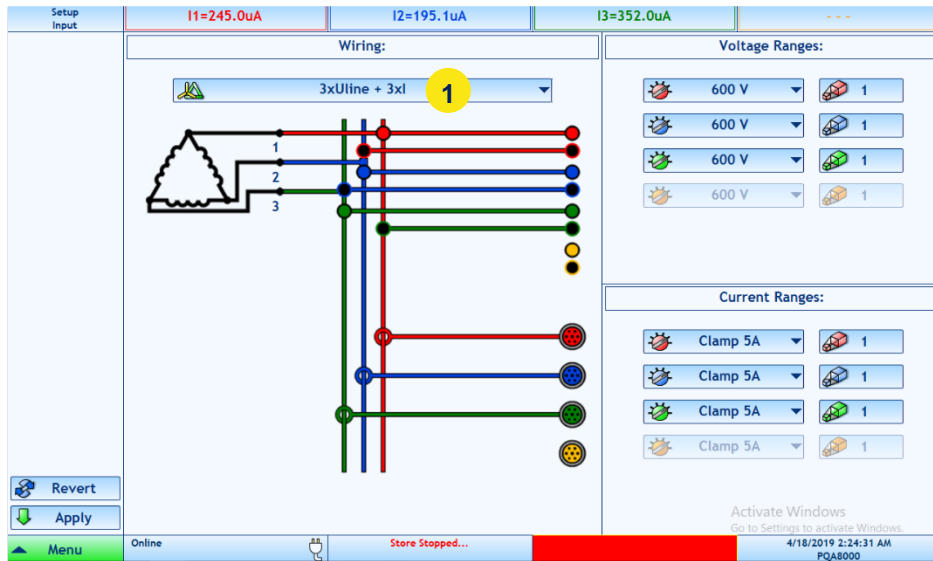
Select '3xUph + 3xl + N' in the wiring setup and connect the cables according to the picture below.





Delta Connection

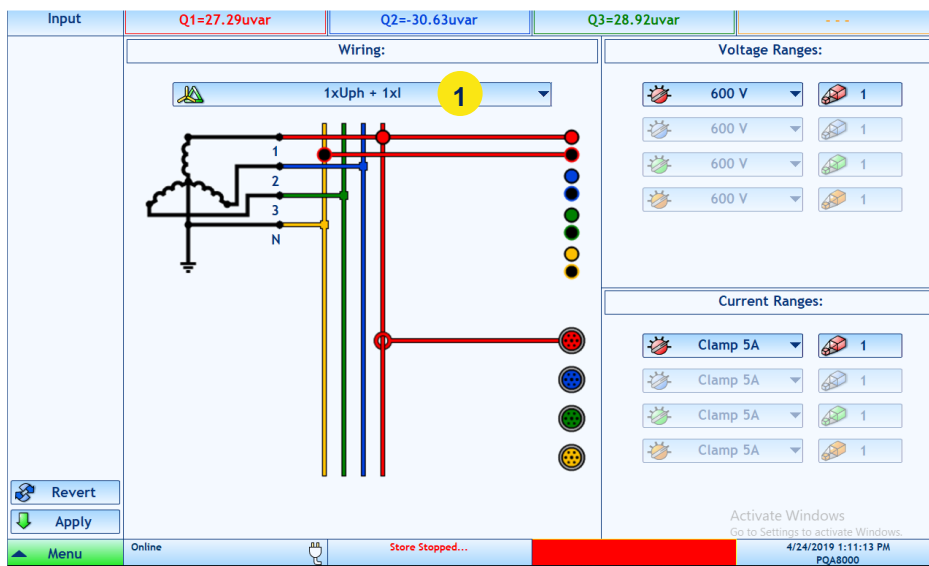
Select '3xUline + 3xl' in the wiring setup and connect the cables like below picture.





Single Phase Connection

Select '1xUp + 1xI' in the wiring setup and connect the cables like below picture.





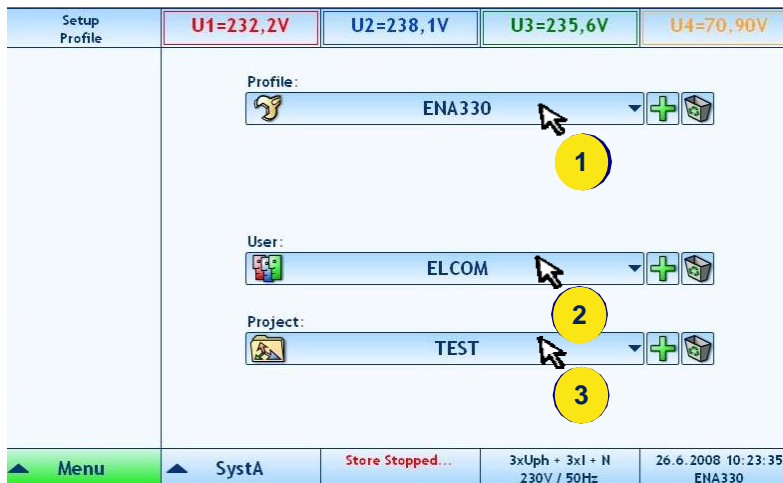
4.3 Main Menu

4.3.1 Defining user and project name

Navigation: "Setup" – "Profile"

The **Setup Profile** panel allows to change the profile of the instrument.

- PROFILE: All instrument's **settings** and **setups** are stored into a profile. The user can choose to create multiple profiles with different settings.
- USER and PROJECT: can be used for differencing the data storage. For every user/project, the measured data are stored into different folders.



1. Profile change/add/delete
2. User change/add/delete
3. Project change/add/delete

4.3.2 Setting the user language

Navigation: "Setup" – "Options"

The Setup Options panel allows changing the language.



1. Page selector
2. Available languages



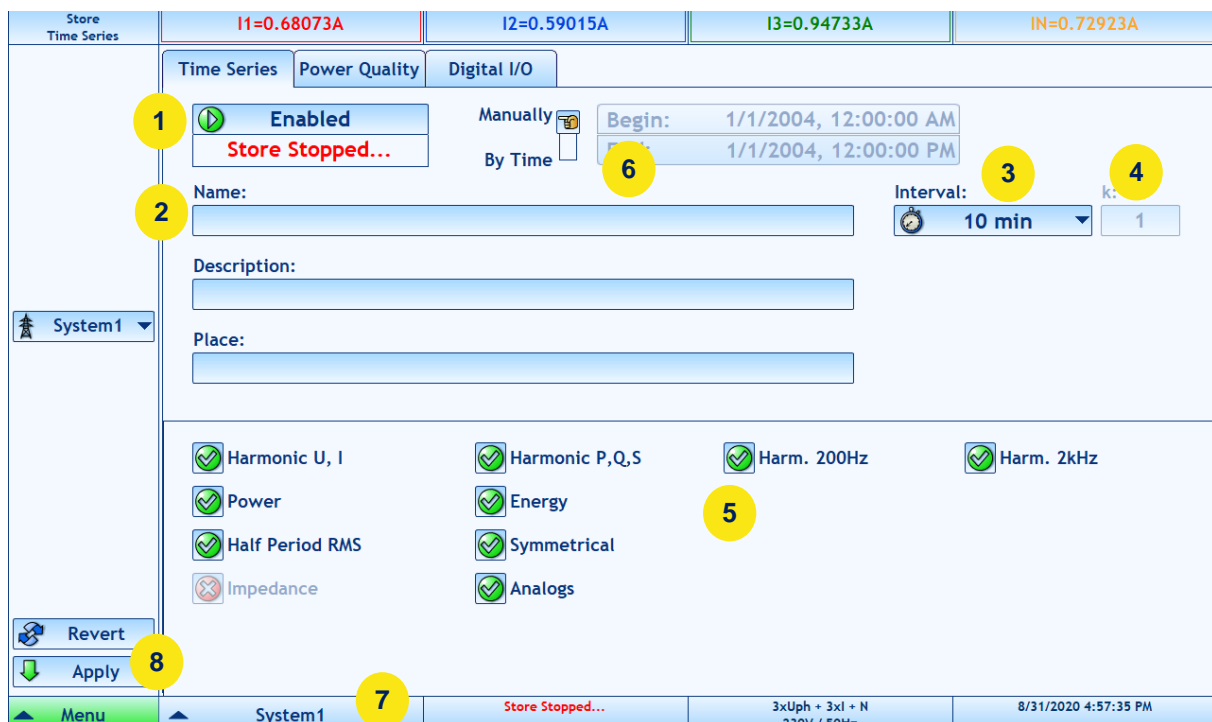
4.4 Data Storage

4.4.1 Store Data Panel

Navigation: “Store” – “Time Series”

The **Store Data panel** allows to configure the storing of calculated data. It can be set to store periodic time series data, Power Quality data and digital inputs data independently.

- Time series data: Storage rate can be set from 200ms to any averaging interval
- Power Quality: will be calculated each 10 minutes, according to international standards
- Digital Inputs: will be stored at each change of state



1. Enabled/disabled button
2. Name of measurement, Place, Description
3. Storing Interval
4. Storing interval multiplier
5. Selected values
6. Manually or automatic begin and end of storing
7. System selection (actual or all systems)
8. Apply and Revert buttons

(If storing is in progress for selected type, then only Enabled/Disabled control can be changed and applied)



How to setup storing

- Insert measurement name, description and place (2)
- Set storing interval and multiplier (3,4). Interval can be selected from 200ms up to 2 hours
- Select quantity groups that you want to store (5). Power Quality data storing and digital inputs can be configured in separated tabs.
- Select “Manually” or “By Time” condition to set up begin and end of storing (6).
- If there is the “By Time” condition activated, select the begin and end time of storing. (6). Clicking on Begin or End time area opens that calendar dialog allowing choosing begin and end time by selecting year, month, day, hour, minute and second. A left click on hour, minute or second area increases the value, while a right click decreases it.
- Enable storing (1).
- Select if changes will be applied to actual system only or to all systems (7) *supported only for multi-system instruments*
- Click Apply button to apply changes to instrument or Revert button to revert changes (8)
- To stop storing, just Disable storing (1) and Apply changes (8).



Storing Options:

- ✓ **Harmonic U,I**
Harmonics, THD, Interharmonics for voltage and current
- ✓ **Harmonic P,Q,S**
Harmonic active, reactive and apparent power
- ✓ **Power**
Active, apparent, reactive power, power factor, cos phi, etc.
- ✓ **Energy**
positive, negative, total energy
- ✓ **Symmetrical Components**
Zero, positive, negative sequence, unbalance factor
- ✓ **Analog Inputs**
Additional analogue inputs
- ✓ **Harm.200Hz:**
Storing of Supraharmonics (Higher Frequencies) in 200Hz bands up to 9kHz.
- ✓ **Harmonic 2kHz:**
Storing of Supraharmonics in 2kHz bands up to 68kHz (500kHz for PQA8000H)
- ✓ **Half-Period RMS**
This options stores for each defined storing interval (e.g. 200ms or 10min)
 - The maximal and minimal ½ period value for voltage and current
 - ½ period current value at ½ period voltage MIN or MAX
 - ½ period voltage at ½ period current MIN or MAX
 This option might allow detecting the source of voltage events (load or generation)



Summary **U1=229.39V** **U2=231.91V** **U3=230.95V** ...

Wiring: **3xUph + 3xl**
Voltage Ranges: 500 V
Current Ranges: Clamp SA, JCP

Fundamental Frequency: **50Hz**
FFT Step: Interharmonics (25Hz)
Sampling Rate for Transient: 124800Hz

EN50160 Voltage Level: **230V**
EN50160 Events: 90% / 110%
EN50160 Interruption: 5%

Profile: **SOLARWATT**
User / Project: BGIZ / SOLARWATT

Time Series: **Store Running...**
Interval: 3 s
Name:

Power Quality: **Store Stopped...**
Name:

Digital Inputs: **Store Stopped...**
Name:

Alarms: **Store Stopped...**
Name:

Transients: **Store Stopped...**
Name:

Signalling: **Store Stopped...**
Name:

Disturbances: **Store Stopped...**
Name:

Start global datastoring **Enable all**
Stop global datastoring **Disable all**

Menu AC **Store Running...** 3xUph + 3xl 230V / 50Hz 12/30/2020 7:05:32 PM

TIME SERIES

Selectable time interval (>200ms)
Data types:
POW ... P, Q, S, PF, etc.
ENE ... Energy
SYM ... Symmetrical Comp.
RMS ... % RMS values
FFT ... Harmonics, IH, THD
FFP ... Harmonic P, Q, S, phi
FFU ... Supraharmonics 9kHz
FFH ... Supraharmonics 500kHz

POWER QUALITY

Data type: *PQM*
All data are automatically stored according to standards like EN50160 etc.

DIGITAL INPUTS

Data type: *DIG*
Stored at each condition change

ALARMS

Data type: *ALA*
Definable conditions for alarm records

TRANSIENTS

Data type: *TRA*
Raw data record with full sampling rate
Defineable trigger conditions

SIGNALLING

Data type: *TEL*
Telegram record of signalling voltage

DISTURBANCES

Data type: *DIS*
% period values record
Defineable trigger conditions

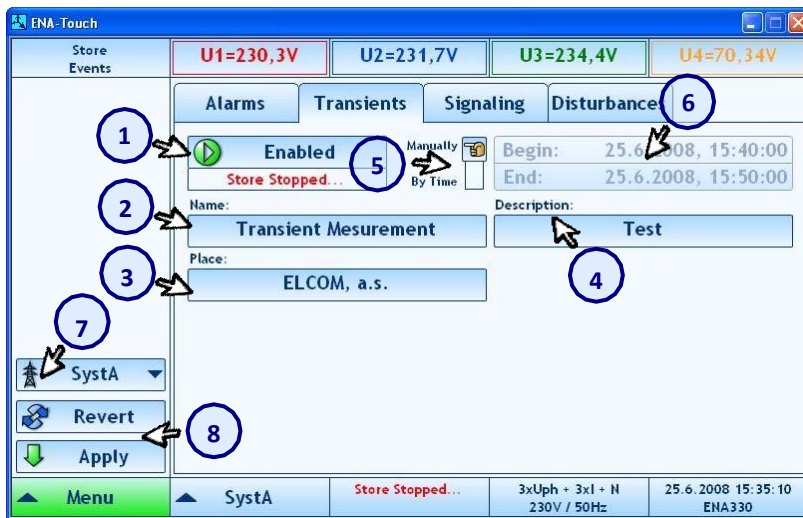


4.4.2 Store Events/Transients Panel

Navigation: "Store" – "Events"

The **Store Events panel** allows configuring storing options for capturing events.

- The configuration for storing alarms, transients, disturbances and voltage signals can be done independently.
- EN50160 events are stored automatically, if EN50160 time series storing is enabled.
- If storing is in progress for selected event type, then only Enabled/Disabled control can be changed and applied.



1. Enabled/disabled button
2. Name of measurement
3. Place
4. Description
5. Begin- /End-/Type of storing
6. Begin and End time for storing
7. System selection (actual system or all systems)
8. Apply and Revert buttons

How to setup storing:

- Insert measurement name, description and place (2, 3, 4).
- Select "Manually" or "By Time" condition for the begin and end of storing (5).
- If there is the "By Time" condition selected, then select Begin and End time of storing. (6)
- Enable storing (1).
- Select if changes will be applied to actual system only or to all systems (7).
supported only for multi-system instruments
- Click Apply button to apply changes to instrument or Revert button to revert changes (8).
- To stop storing just Disable storing (pointer 1) and Apply changes (8).



4.5 Measurement

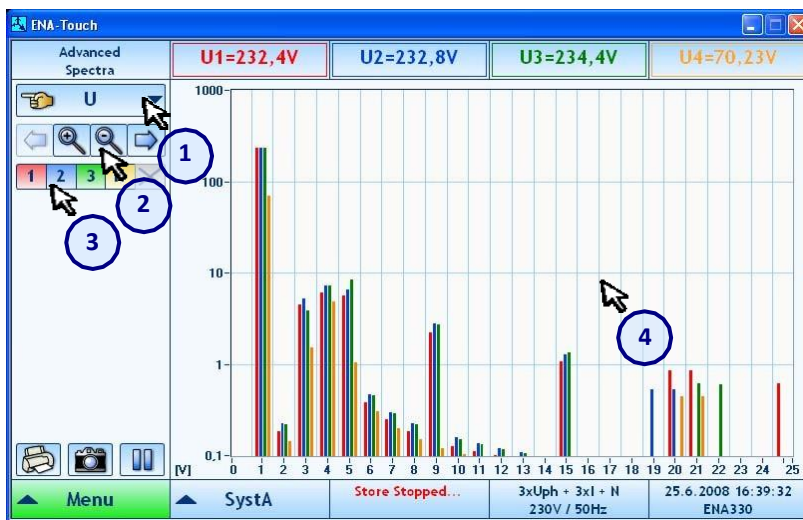
4.5.1 FFT / Spectra

Navigation: “Advanced” – “Spectra”

The **Spectra** panel displays FFT harmonic analysis either of voltage, current, active power, reactive power or apparent power.

There are four different options for visualisation:

- Harmonics
- Interharmonics
- Higher Frequencies in 200Hz bands up to 9 kHz
- Supraharmonics in 2kHz bands up to 68kHz



1. Displayed values – voltage, current, active power, reactive power or apparent power
2. Buttons for zoom or unzoom in the graph and for move through all harmonics in zoomed graph
3. Phases buttons
4. Spectra

200Hz band visualisation



5. Selection between Harmonic order or Hertz (Hz) visualisation
6. Up to 3 charts can be shown below each other
7. Zoom and Move functions
8. Switch between table and spectra visualisation
9. Switch between % values and absolute values

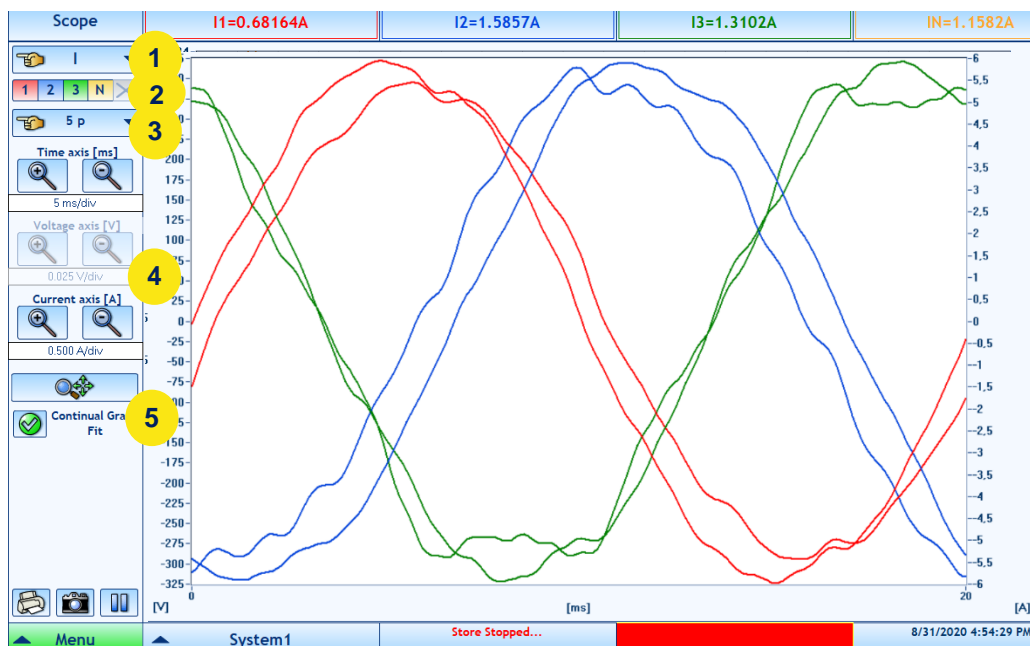


4.5.2 Oscilloscope

Navigation: “Advanced” – “Scope”

The **Scope panel** displays one period of voltage and current on all phases or instant active power $p(t)$. The Graph can be zoomed.

- 1) Selection of Parameters for Scope View (Voltage, Current, Instant Power)
- 2) Enable/Disable Phase 1-3 and Neutral
- 3) Selection of Number of Periods (1 period or 5 periods)
- 4) Zoom Functions for X and Y axis
- 5) Auto-Zoom: This options will always show from Min to Max value (if this option is enabled other zoom options will be disabled)

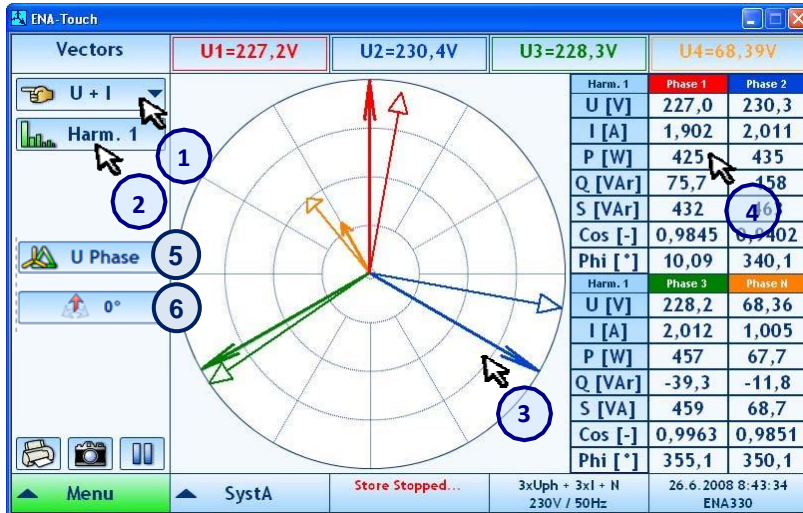


4.5.3 Vector Scope

Navigation: “Vectors”

The **Vectors panel** displays actual 3 phase vector diagram of voltage and current on the selected harmonic (frequency) and additional values of the selected harmonic.

- The vector diagram can be configured to display both voltage and current, or only one of it.
- Harmonics can be selected from the 1st up to the 50th harmonic.
- Star or delta voltage/current relation can be shown (6)
- Reference for the Phase Angle of Harmonics can be selected



1. Displayed vectors – both or voltage only or current only
2. Selected harmonic – clicking on this button will open keyboard to insert harmonic number
3. Vector diagram
4. Additional instant values of selected harmonic
5. Selection of Delta or Star values
6. Selection of Vector Scope reference point

4.5.4 Table Panel

Navigation: “Advanced” – “Table”

The **Table panel** allows showing a wide range of measured parameters (instant values) in different table sets, or customized tables with selected quantities.

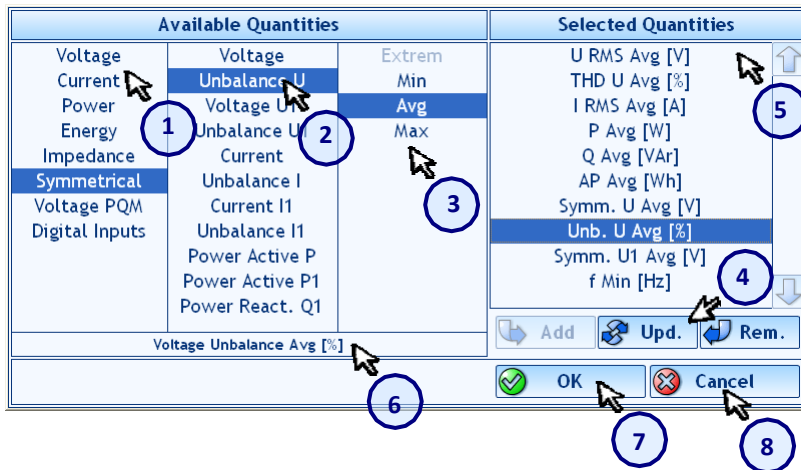
- Displayed values can be selected either from basic quantities, voltage, current, power or additional customizable tables.
- If the custom view is selected, the ‘Define’ button allows changing the selected quantities.

	Phase 1	Phase 2	Phase 3	Phase II	Total
Avg [V]	Phase 1	Phase 2	Phase 3	Phase II	Total
U RMS	225,6	231,2	227,5	68,06	228,1
Avg [%]	Phase 1	Phase 2	Phase 3	Phase II	Total
THD U	4,663	2,990	5,586	4,624	4,542
Avg [A]	Phase 1	Phase 2	Phase 3	Phase II	Total
I RMS	1,859	1,985	1,978	0,9819	1,942
Avg [W]	Phase 1	Phase 2	Phase 3	Phase II	Total
P	412,3	431,1	444,6	65,81	1,288k
Avg [VAr]	Phase 1	Phase 2	Phase 3	Phase II	Total
Q	76,33	-157,9	-69,16	-11,62	-324,9
Avg [Wh]	Phase 1	Phase 2	Phase 3	Phase II	Total
AP	965,8	959,9	1,027k	152,6	2,953k
Avg [V]	Total	Positive	Negative	Zero	Total
Symm. U	228,1	227,9	8,059	6,413	---
Avg [%]	Neg/Pos	Zero/Pos			
Unb. U	3,536	2,814	---	---	---
Avg [V]	Total	Positive	Negative	Zero	Total
Symm. U1	227,9	227,9	2,114	1,331	---
Min [Hz]					Total
f	---	---	---	---	49,99

1. Displayed view – basic, voltage, current, power, custom 1, 2 and 3
2. Quantities selection button
3. Displayed values

Changing selected quantities in custom view

Click on ‘Quantity’ button, afterwards the window ‘Select quantity’ will open:



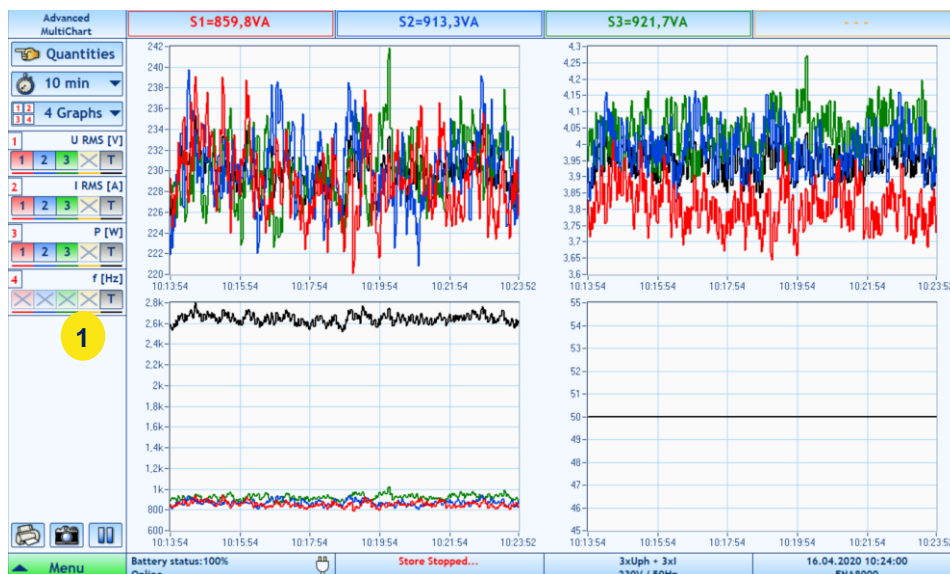
1. Select basic quantity
2. Select derived quantity
3. Select Min/Avg/Max
4. Click Add or Update button to add or change selected quantity
5. Selected quantities list
6. Name of selected quantity
7. Click OK button to apply changes
8. Click Cancel button to cancel

4.5.5 Multi-Chart

Navigation: “Advanced” – “Multichart”

Multi Chart panel allows showing up to 4 different charts. In Measurement mode the time interval can be set up to 1 hour. For further and detailed data analysis open the Report tool, which can analyze data already during measurement.

- The quantities in Multi-chart option can be defined like in the Table Panel (see 4.5.4).
- On the left side (1) you can define which phases should be shown of the individual quantities.





4.5.6 EN50160 Analyzer

Navigation: “Advanced” – “EN50160”

The **EN50160 panel** shows Power Quality evaluation according to EN50160 standard.

- It is possible to switch between the evaluation of all data and evaluation of not flagged data (data when no voltage event occurred).
- All quantities are measured and evaluated according to IEC 61000-4-30 class A.
- A complex overview and also more event details can be displayed. The event details include event distribution, rapid voltage changes distribution and rapid voltage changes statistics. EN50160 events itself are displayed in the events list panel.



For a more detailed description of the measured parameters according to the EN50160 standard, we would like to refer to the Technical Reference Manual.

Advanced EN50160		S1=912,0VA	S2=956,7VA	S3=960,1VA	...
No Flag	Complex	Events	RVC Events	RVC Statistic	
Quantity	Limit	Max*/Min	Above*/Below	% OK	Fit?
Total					
Frequency (50Hz)		[Hz]	[%]	[%]	
Limit 1	99 - 101%	50 *50	0 *0	100	>= 99.5%
Limit 2	94 - 104%	50 *50	0 *0	100	= 100%
Voltage (230V)		[V]	[%]	[%]	
Limit 1	90 - 110%	230.1 230.8 230.8 *229.2 229.9 229.3	0 0 0 *0 0 0	100 100 100	>= 95%
Limit 2	85 - 110%	230.1 230.8 230.8 *229.2 229.9 229.3	0 0 0 *0 0 0	100 100 100	= 100%
Flicker		[H]	[%]	[%]	
Flicker PLT	<= 1	0 0 0	0 0 0	100 100 100	>= 95%
Unbalance U		[%]	[%]	[%]	
Negative	<= 2%	0.9239	0	100	>= 95%
Signalling U		[% Uref]	[%]	[%]	
216.66Hz	<= 9%	3.367 3.436 3.44	0 0 0	100 100 100	>= 99%
THD U		[% Uh1]	[%]	[%]	
THD U	<= 8%	4.542 4.43 4.813	0 0 0	100 100 100	>= 95%
Harmonic U		[% Uh1]	[%]	[%]	
Uh 1: 50Hz	-	100 100 100	0 0 0	100 100 100	>= 95%
Uh 2: 100Hz	<= 2%	0.0452 0.0776 0.1292	0 0 0	100 100 100	>= 95%
Uh 3: 150Hz	<= 5%	2.18 2.527 1.82	0 0 0	100 100 100	>= 95%
Uh 4: 200Hz	<= 1%	0.2153 0.2313 0.2377	0 0 0	100 100 100	>= 95%
Uh 5: 250Hz	<= 6%	3.634 3.251 4.007	0 0 0	100 100 100	>= 95%
Uh 6: 300Hz	<= 0.5%	0.0404 0.0496 0.0529	0 0 0	100 100 100	>= 95%
Uh 7: 350Hz	<= 5%	0.0255 0.0324 0.0328	0 0 0	100 100 100	>= 95%

1. Selection of view type – complex, events distribution, RVC Events and RVC statistics
2. Select Flagged/Not Flagged data for evaluation
3. Initialization button
4. Start time of evaluation
5. Voltage quality information
 - Limit: Limit Values defined by selected standard (EN50160, IEC61000-2-2, etc.)
 - Max/*Min: Max and Min values of evaluation period
 - Above*/Below: Samples above or below the limits
 - % OK: Percentage within range
 - Fit?: Indication if standard is fulfilled or not



Advanced EN50160		S1=915,1VA			S2=967,4VA			S3=908,6VA			
No Flag		Complex	Events	RVC Events	RVC Statistic						
Init			<100ms	<500ms	<1s	<3s	<20s	<1min	<3min	>=3min	Total
Evaluation Start: 16.04.2020 10:40:00		Swells>110%	0	0	0	0	0	0	0	0	0
		Dips<90%	0	0	0	0	0	0	0	0	0
		Dips<85%	0	0	0	0	0	0	0	0	0
		Dips<70%	0	0	0	0	0	0	0	0	0
		Dips<40%	0	0	0	0	0	0	0	0	0
		Dips Total	0	0	0	0	0	0	0	0	0
		Interruptions<5%	0	0	0	0	0	0	0	0	0
		Total	0	0	0	0	0	0	0	0	0

1. Table with count of voltage events distributed by length and level

Advanced EN50160		U1=230,7V		U2=227,7V		U3=228,7V		U4=69,60V	
No Flag		Complex	Events	RVC Events		RVC Statistic			
Init		dc/t	<200ms	<500ms	<1s	<10s	>10s	Total	
Evaluation Start: 26.6.2008 8:30:00		<1.0%	01010	01010	11010	11011	71511	91512	
		<2.0%	01010	01010	01010	01010	31412	31412	
		<3.0%	01010	01010	01010	11110	01210	11310	
		<4.0%	01010	01010	01010	01010	41010	41010	
		<5.0%	01010	01010	01010	01010	11011	11011	
		<6.0%	01010	01010	01010	01010	11110	11110	
		<7.0%	01010	01010	01010	01010	11010	11010	
		<8.0%	01010	01010	01010	01010	01010	01010	
		<9.0%	01010	01010	01010	01010	01010	01010	
		>9.0%	01010	01010	01010	01010	01010	01010	
		Total	01010	01010	11010	21111	1711214	2011315	

1. Table with count of rapid voltage changes distributed by length and level

Advanced EN50160		U1=228,8V		U2=230,0V		U3=231,8V		U4=67,45V	
No Flag		Complex	Events	RVC Events		RVC Statistic			
Init		Changes per hour	dmax [% Un]	Hours Above lim./OK	Percentil % OK	Actual Hour Changes/dUmax			
Evaluation Start: 26.6.2008 8:30:00		r <= 1	dmax < 3,0	1/0	0,0	1/5,4			
		1 < r <= 10	dmax < 2,5	1/0	0,0	0/0,0			
		10 < r <= 100	dmax < 1,5	1/0	0,0	0/0,0			
		100 < r <= 1000	dmax < 1,0	1/0	0,0				
		1000 < r	-						
		dmax [% Un]	Changes per hour	Hours Above lim./OK	Percentil % OK	Actual Hour Changes			
		3,0 < dmax	r = 0	1/0	0,0	1			
				1/0	0,0	0			
				1/0	0,0	0			
		2,5 < dmax <= 3,0	r <= 1	0/1	100,0	0			
				1/0	0,0	0			
				0/1	100,0	0			
		1,5 < dmax <= 2,5	r <= 10	0/1	100,0	0			
				0/1	100,0	0			
				0/1	100,0	0			
		1,0 < dmax <= 1,5	r <= 100	0/1	100,0	0			
				0/1	100,0	0			
				0/1	100,0	0			
		dmax <= 1,0	r <= 1000	0/1	100,0	0			
				0/1	100,0	0			

1. Table with rapid voltage changes statistics



4.5.7 Transient, Event and Disturbance Recorder

4.5.7.1 Event Definition

Navigation: “Events” – “Definition”

There are different types available. The following table gives an overview about event type and recording type

Type	Recording
EN50160	Event list of all EN50160 limit violations
Alarms	Event list of defined alarms
Harmonic Voltages	Event list of harmonic voltage limit violations
Transients	Raw Data Record with full sampling rate at limit violation
Signalling Voltage	Record of binary signal of Signalling Voltage
Disturbances	½ Period record and Raw Data record at limit violation

The **Events definition panel** allows to define various trigger conditions.

- The main screen of this panel displays a list of different event types
- Event types can be activated on the left (2) and configuring on the right. (3)
- All changes in the main panel and its sub-panels must be confirmed by Apply button. (5)



1. List of available event types
2. Event enable/disable button
3. Event configuration button
4. System selection (actual system or all systems)
5. Apply and Revert buttons

EN50160 Events

Voltage events according EN50160 can only be enabled/disabled and not configured, the configuration of EN50160 events is possible in the EN50160 setup panel.

Navigation Menu → Setup → EN50160 → Events

Setup EN50160

I1=8,7512A I2=14,346A I3=28,402A IN=26,683A

Limits Events RVC Events

Power Quality Default Limits Setting: Custom

Quantity	Limit	Percentil
Frequency (50Hz)		
Limit 1	99 - 101%	>= 99.5%
Limit 2	94 - 104%	= 100%
Voltage (230V)		
Limit 1	90 - 110%	>= 95%
Limit 2	85 - 110%	= 100%
Flicker		
Flicker PLT	<= 1	>= 95%
Unbalance U		
Negative U	<= 2%	>= 95%
Signalling U		
216,66Hz	<= 9%	>= 93%
0Hz	-	>= 93%
0Hz	-	>= 93%
0Hz	-	>= 93%
0Hz	-	>= 93%
THD U		
THD U	<= 8%	>= 95%
Harmonic U		
Uh 1: 50Hz	-	>= 95%
Uh 2: 100Hz	<= 2%	>= 95%
Uh 3: 150Hz	<= 5%	>= 95%
Uh 4: 200Hz	<= 1%	>= 95%
Uh 5: 250Hz	<= 6%	>= 95%
Uh 6: 300Hz	<= 0.5%	>= 95%
Uh 7: 350Hz	<= 5%	>= 95%
Uh 8: 400Hz	<= 0.5%	>= 95%
Uh 9: 450Hz	<= 1.5%	>= 95%
Uh 10: 500Hz	<= 0.5%	>= 95%
Uh 11: 550Hz	<= 3.5%	>= 95%
Uh 12: 600Hz	<= 0.5%	>= 95%
Uh 13: 650Hz	<= 3%	>= 95%
Uh 14: 700Hz	<= 0.5%	>= 95%

Nominal Voltage Level: 230V

Nominal Voltage Level Type: Constant

EN50160 Signalling Frequency: n
216,66Hz 1

Percentil: 95%

Revert Apply

For the Voltage Limits the limits for flagging the data, Swell & Dip Limit, Interruption Limit and the hysteresis can be defined.

Limits Events RVC Events

Upper Flag Limit: 115%

Nominal Voltage Level: 230V

Lower Flag Limit: 85%

Hysteresis: 2%

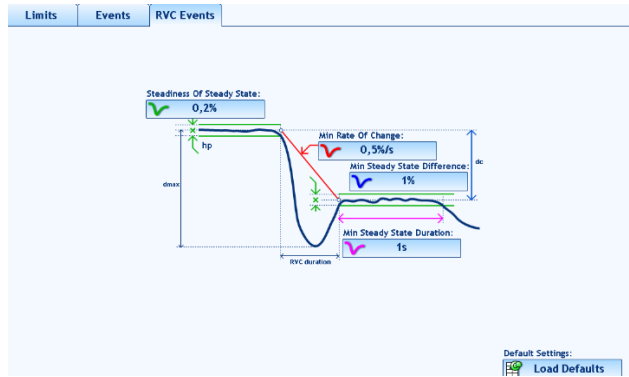
Swell Limit: 110%

Dip Limit: 90%

Interruption Limit: 5%

Default Settings: Load Defaults

For Rapid voltage changes the steady state, rate of change, min. steady state difference and duration can be define.



Alarms

Navigation: “Events” – “Definition” – “Alarms”

These events are generated if specific value crosses defined limits and can be logged (if storing of alarms is enabled). Alarms can be configured for different quantities and different evaluation times according to next picture (Alarms definition sub panel):

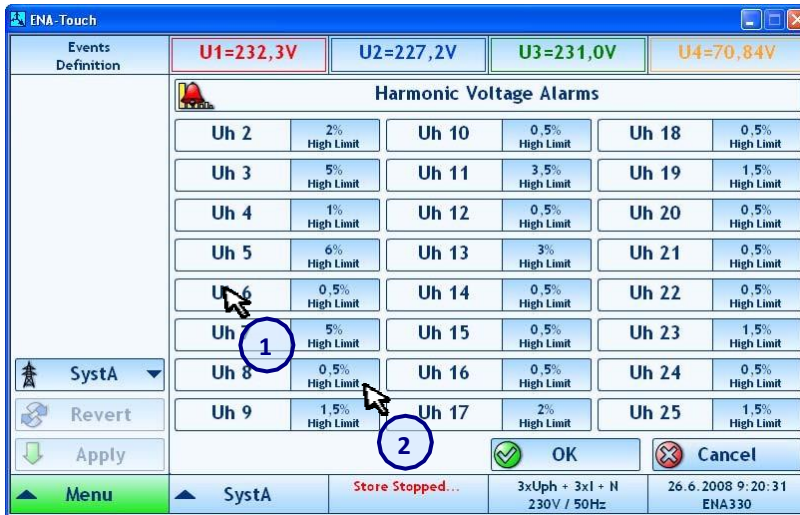
Events Definition	U1=229,4V	U2=225,3V	U3=224,4V	U4=68,00V
Alarms				
<input checked="" type="checkbox"/>	Freq. (10s)	49,5Hz Low Limit	50,5Hz High Limit	<input checked="" type="checkbox"/>
<input checked="" type="checkbox"/>	U (10min)	210V Low Limit	250V High Limit	<input checked="" type="checkbox"/>
<input checked="" type="checkbox"/>	U (1s)	215V Low Limit	245V High Limit	<input checked="" type="checkbox"/>
<input checked="" type="checkbox"/>	U (1min)	215V Low Limit	245V High Limit	<input checked="" type="checkbox"/>
<input checked="" type="checkbox"/>	U (10min)	220V Low Limit	240V High Limit	<input checked="" type="checkbox"/>
<input checked="" type="checkbox"/>	PST (10min)	1 High Limit		<input checked="" type="checkbox"/>
<input checked="" type="checkbox"/>	PLT (120min)	1 High Limit		<input checked="" type="checkbox"/>
<input checked="" type="checkbox"/>	THD U (10min)			3% High Limit
<input checked="" type="checkbox"/>	THD I (10min)			10% High Limit
<input checked="" type="checkbox"/>	Unb. U (10min)			3% High Limit
<input checked="" type="checkbox"/>	Unb. I (10min)			10% High Limit
<input checked="" type="checkbox"/>	U sig. (3s)			3% High Limit
<input checked="" type="checkbox"/>	Delta P (1min)			0W High Limit

1. List of available quantities
2. Alarm enable/disable button
3. Alarm limits

Harmonic Voltage Alarms

Navigation: “Events” – “Definition” – “Harmonic Voltage Alarms”

These events are generated when a specific voltage harmonic crosses defined limits and can be logged (if storing of alarms is enabled). Alarms can be configured for different voltage harmonics (2nd to 25th). The evaluation time for all of them is 10 minutes. See next picture (Harmonic Voltage Alarms definition sub panel):



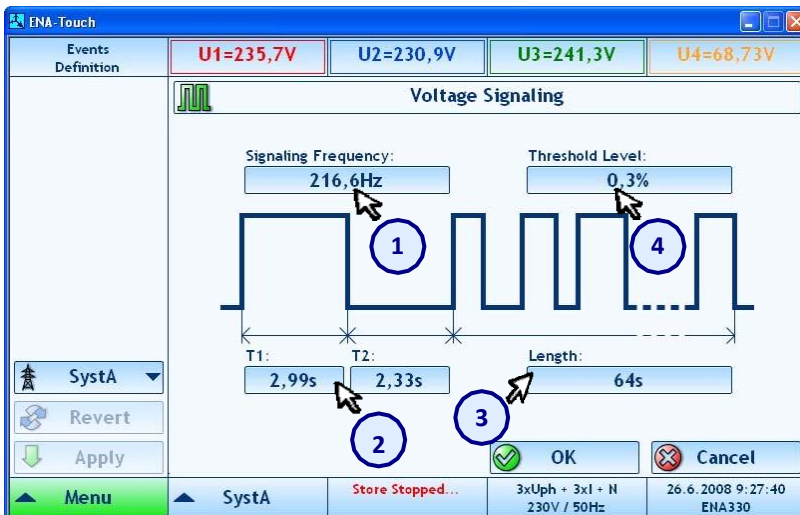
1. List of voltage harmonics
2. Voltage harmonics limits

Voltage Signaling

Navigation: "Events" – "Definition" – "Voltage Signalling"

Voltage Signaling is used for the remote control of specific devices by a signal superimposed on the fundamental frequency.

- These events can be measured, and if the storing is enabled, the binary signal (telegram) which is transported by this signaling is stored.
- The definition of this event allows the setup of specific parameters of the signaling voltage, like signal frequency, start pattern and length.



1. Signaling frequency
2. Start pattern (length of logical 1 and logical 0 on the beginning of the signal)
3. Maximum signal length
4. Threshold level

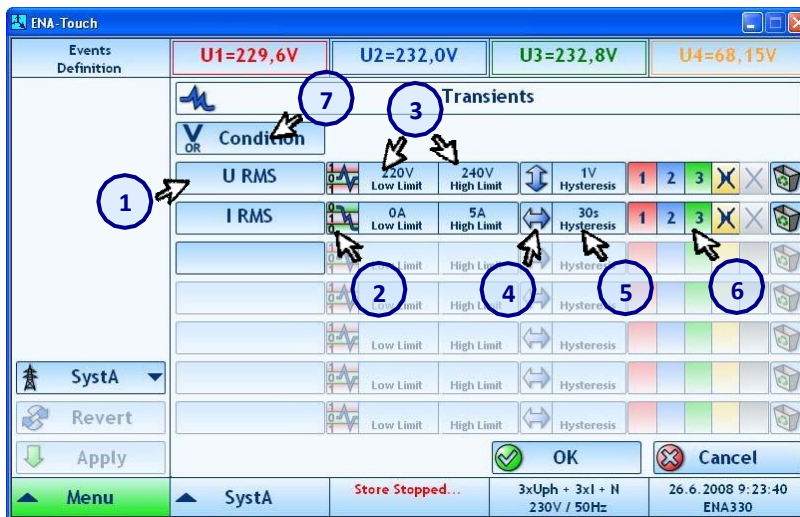


Transients

Navigation: “Events” – “Definition” – “Transients”

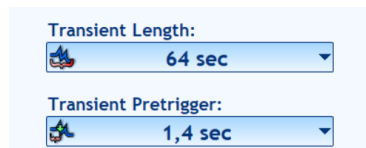
Transients are stored in full sampling rate (sampling rate defined in “Setup”-“Processing”).

- A transient event can occur if specified conditions are met. As a condition a specific quantity, their limits, hysteresis and type of hysteresis (level or time), phases and type of window (inside limits or outside limits) can be defined.
- The number of different quantities and the logical coupling between them (logical OR or AND) can be selected.
- If the value changes, the transient event is generated (edge trigger) and transients of voltage and current are stored. Via window type (2) it can be selected if trigger should start by entering the window with selected upper and lower limit or by leaving the window.



1. Evaluated quantity
2. Window type
3. Limits
4. Hysteresis type
5. Hysteresis
6. Phases
7. Coupling between quantities

- Storage Length and Pre-Trigger time of Transient can be defined in Misc. setup panel (Menu → Setup → Misc. → Transient).



Reset Energy Registers





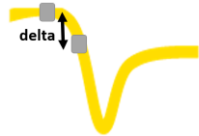

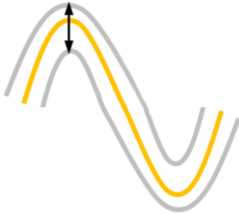

There is a possibility to reset Energy registers at start of the measurement by clicking on the Init Button under Setup → Misc. → Name/init → Init Tab.

Note: Registers will continue counting independently from storing status.





The following table shows the different trigger types and their calculation base.

Type	Time Base
RMS (U, I) Upper Limit  Lower Limit	½ Period RMS values
Harmonic (U, I, THD, etc.) 	200ms values (10/12 period-values)
P, Q, S, PF, phi 	200ms values (10/12 period-values)
Frequency	1 period value
Delta Frequency	Delta between period-values
MAX (U, I) 	Waveform (Sampled values)
Delta 	Delta between period values based on ½ period-values (sliding window)
Derivate dX/dt (dU, dI) 	Voltage, Current
Envelope 	Envelopetrigger, absolute value (voltage) as deviation within one periode
Unbalance 	Voltage, 200ms (% value) (10/12 Periods)
Periodic Interval	Triggering after a certain time. Possible values: 1, 10, 15, 30, 60 and 120 minutes.



Detailed tabular overview of the individual trigger parameters:

Condition	Description (for 50 Hz / for 60 Hz 12 periods)
du/dt (V/s) or di/dt (A/s)	Slope/steepness between samples – max value (both hi & low) of Tw = 10 periods (200 ms)
delta U or delta I	Difference between two half-period RMS values
U peak (V) or I peak (A)	Max values for U / I of Tw = 10 periods
U rms (V) or I rms (A)	RMS value for each half-period
Uhar (V) or Ihar (A)	Specified harmonic U / I of Tw = 10 periods
THD U or THD I	THD for U / I of Tw = 10 periods
delta P	Difference in active power between two consecutives Tw = 10 periods
P	Active power of Tw = 10 periods
P1	Active power 1st harmonic of Tw = 10 periods
Q	Reactive power of Tw = 10 periods
Q1	Reactive power 1st harmonic of Tw = 10 periods
S	Apparent power of Tw = 10 periods
Unbalance (α)	Unbalance negative component of Tw = 10 periods
PF	True Power factor (incl. Harmonic content) of Tw = 10 periods
Cos φ	Displacement power factor (1st harmonic) of Tw = 10 periods
Frequency	Frequency of 1 period
delta f	Frequency difference of 1 period
Hysteresis	Trigger-dead time / Trigger-dead level
Rate of Change	For the time base t, different values can be set: t = 10 periods (as well as 1, 2, 5, 10, 20, 30, 50 or 100 periods)
du/dt or di/dt derivative	Upper and lower limits refer to +/- periods of the waveform

Further information:

Each transient trigger can also trigger a disturbance trigger (and vice versa). If this setting is relevant to you, please contact our support.

dU/dt (and its derivative) are different for transient and disturbances recordings. Transients refer to the waveform as described in the table above. Disturbances are triggered based on consecutive ½ period values (RMS values).

Setting the correct lower and upper limits is particularly important for these triggers. For example, they should be +200 and -200V, as an upper or lower limit of 0V will inevitably result in **continuous trigger records**. This must be avoided! If you are unsure about a trigger setting, please contact our support.



Envelope Trigger Settings Example:

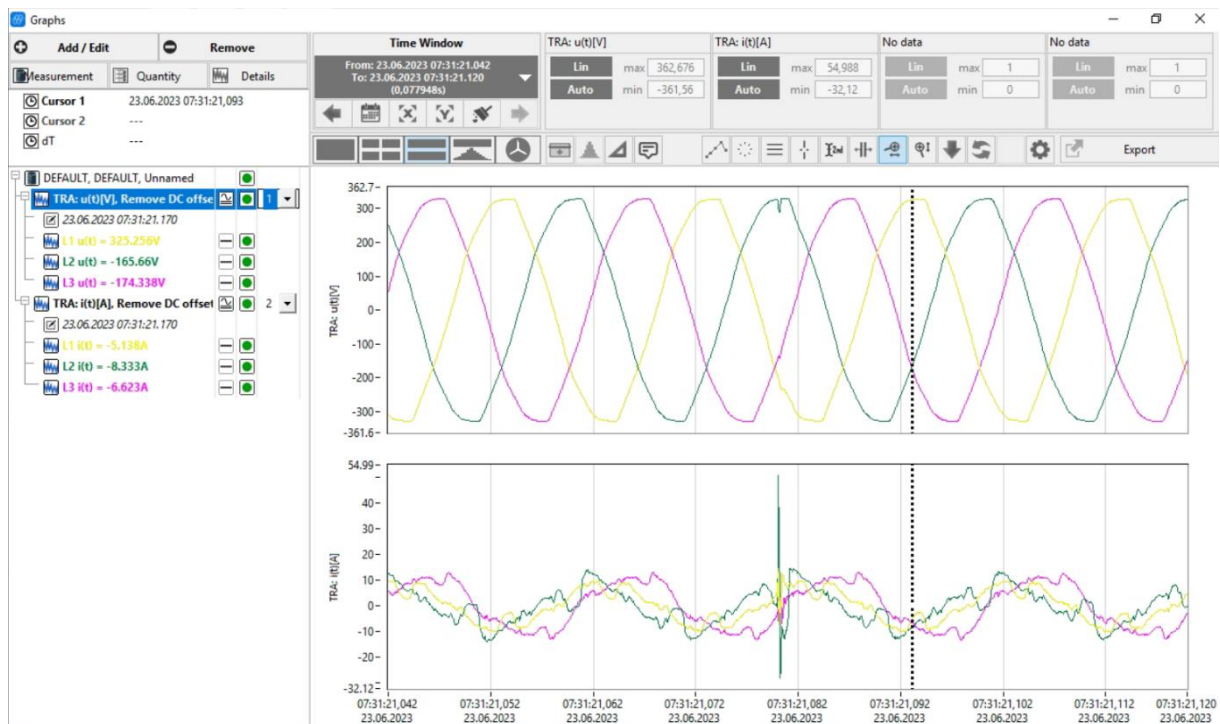
The trigger setting is done in the measurement software under „Events“ → „Definition“ → „Transients“. As shown in the example, 30V refers to a 30V envelope symmetrically around the voltage signal.

Transients

Condition	U RMS	Periodic interval	Volt. Envelope
OR	207V Low Limit, 251V High Limit, 0s Hysteresis	60min Interval, 0min, 0s Hysteresis	0 Low Limit, 30 High Limit, 0s Hysteresis

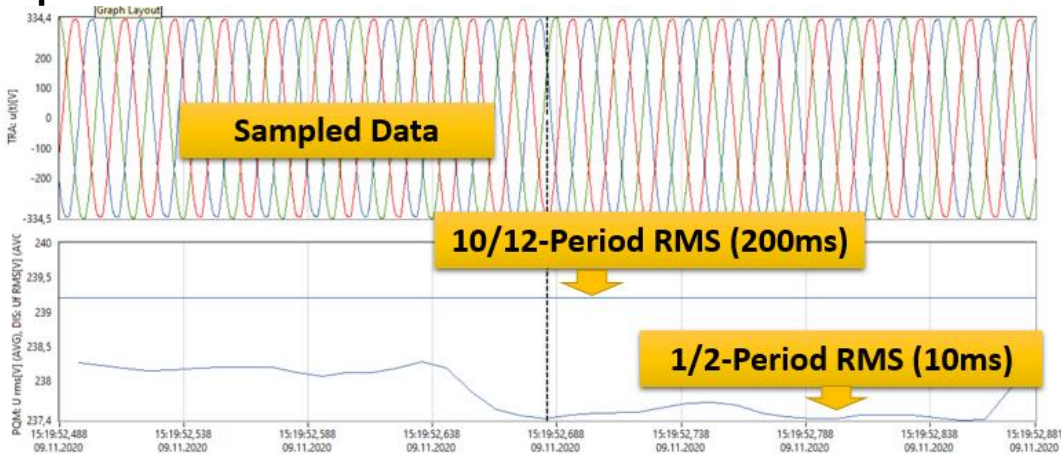
30V

In the reporting software, the recorded trigger can be displayed under „Events“.





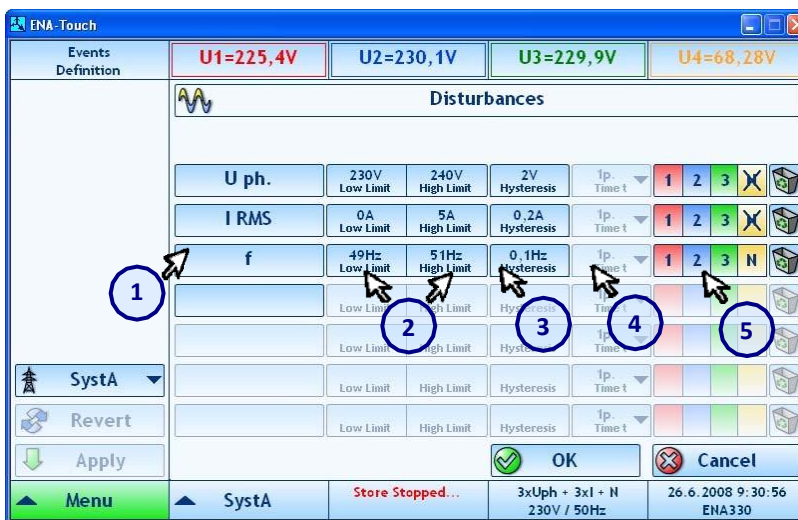
Explanation time interval



Disturbances

Navigation: "Events" – "Definition" – "Disturbances."

These events are similar to Transients. Instead of waveforms the half-period values for voltage, current, phase angle, power, power factor, etc. are stored. Each Disturbance event will also trigger an Transient event. In that way any kind of disturbance can be detected.



1. Evaluated quantity
2. Limits
3. Hysteresis
4. Time window for quantity rate of change (if selected)
5. Phases

- Storage Length and Pre-Trigger time of Disturbances can be defined in Misc. setup panel (Menu → Setup → Misc. → Disturbances).

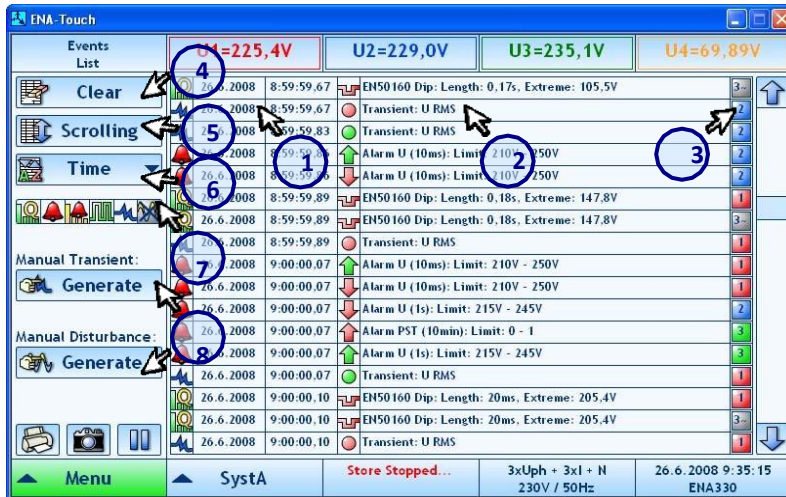




4.5.7.2 Event Table

Navigation: "Events" – "List"

This panel shows a list of already captured events. It displays up to the last 1000 events - no matter if they were stored or not. Event list is scrolled automatically or can be scrolled manually. The Event table can be sorted by event time, type or phase. The list can be cleared and disturbances or transients can be generated manually.



1. Event icon and date/time
2. Event description
3. Event phase
4. Clear event table button
5. Scrolling behavior button
6. Sort by button
7. Enable/disable selected event types
8. Manual triggers for transient and disturbance

4.5.8 Phase Measure Unit

Navigation: "Menu" – "PMU"

The instrument is a highest-precision Phase Measure Unit (PMU). The accurate voltage and current inputs, together with the high-precise internal GPS unit, allows measurements with highest quality. The PMU functionality requires a minimal sampling rate of 19,2kS/s.

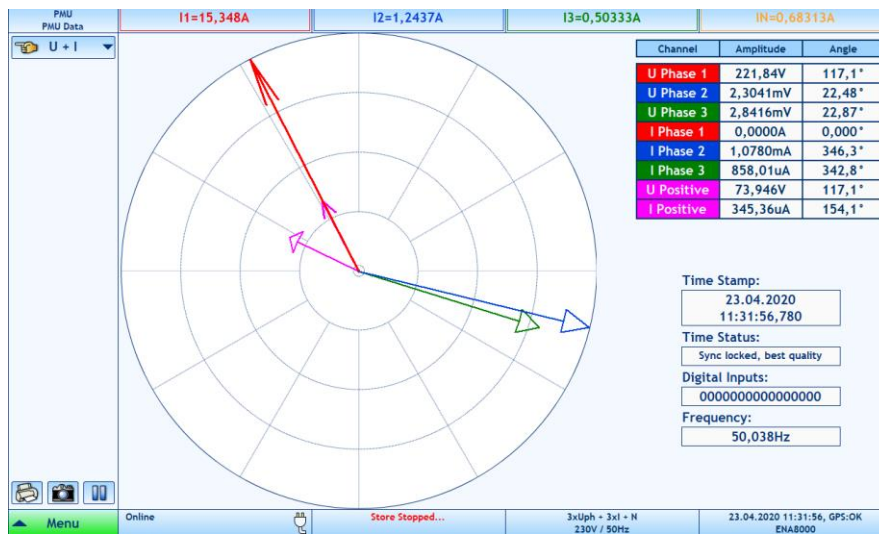
Using the PMU function doesn't store any data on the instrument. For PMU application a central software is needed, which receives the data streams of the instrument. For PMU measurements at least two PMU's needs to be installed.

For more details about principle and functionality of PMU's please refer to the Technical Reference Manual.

4.5.8.1 On-Line Phasor Daten

Navigation: "Menu" – "PMU" – "Data"

The PMU data are shown in the main panel. The Phasors are shown in the Vectorscope and the numerical table. The timestamp, status, locked or unlocked mode (with time of unlocked mode), frequency as well as digital inputs are shown on the lower right of the screen.





4.5.8.2 Configuration

Navigation: “Menu” – “PMU” – “Setup”

First the phasors need to be assigned to input channels of the instrument.

U1=222,46V		U2=9,9792mV		U3=0,12498V		UN=5,0123mV	
Phasors	Freq. Limits	Digitals					
Reported Phasor:	Phasor Name:						
<input checked="" type="checkbox"/> Voltage, Phase 1	PhasorUL1	0V Low Limit	600V High Limit				
<input checked="" type="checkbox"/> Voltage, Phase 2	PhasorUL2	0V Low Limit	600V High Limit				
<input checked="" type="checkbox"/> Voltage, Phase 3	PhasorUL3	0V Low Limit	600V High Limit				
<input checked="" type="checkbox"/> Current, Phase 1	PhasorIL1	0A Low Limit	10A High Limit				
<input checked="" type="checkbox"/> Current, Phase 2	PhasorIL2	0A Low Limit	10A High Limit				
<input checked="" type="checkbox"/> Current, Phase 3	PhasorIL3	0A Low Limit	10A High Limit				
<input checked="" type="checkbox"/> Voltage, Positive	UPOS	0V Low Limit	500V High Limit				
<input checked="" type="checkbox"/> Current, Positive	IPOS	0A Low Limit	10A High Limit				

- Reported Phasor* it can be defined which quantity is being provided – for each channel – e.g. „raw“ phasor, or positive, negative, zero component
- Phasor name* user can edit quantity name
- Limits (low and high)* exceeding the limit is included as an information in a „Status Word“ (defined by C37.118 standard)

Frequency Limits

U1=221,55V		U2=8,9952mV		U3=0,12492V		UN=4,9269mV	
Phasors	Freq. Limits	Digitals					
Upper Frequency Limit: <input type="text" value="51 Hz"/>							
Lower Frequency Limit: <input type="text" value="49 Hz"/>							
Freq. Rate of change Limit: <input type="text" value="10 Hz/s"/>							

Similar as in phasors – exceeding the limit is included as an information in a „Status Word“ – defined by C37.118 standard



4.5.8.3 Connection

Navigation: “Menu” – “PMU” – “Conn.”

At general PMU settings the connection to the central PMU software (e.g. WAMS system) can be defined.

The screenshot shows a configuration window with the following fields:

- PMU ID:** 75
- PMU TCP Port:** 4712
- PMU Station Name:** ENA8000-PMU
- PMU Header:** ENA8000
- Reporting Rate:** 50 Hz

- PMU ID** supposed to be unique identification number, one of the crucial parameters when connecting to PMU data stream
- PMU TCP port** tcp port used to connect to PMU data stream (often 4712, but for network related reasons might be changed to another)
- PMU station** supposed to be unique name of the device, this is one of the human readable parameters you can get when connected to PMU data stream, can include simple information, e.g. voltage line number and substation code
- PMU header** another human-readable parameter you can get when connected to PMU data stream
- Reporting Rate** sometimes called data rate, sometimes even sample rate, reporting rate is the most fitting
e.g. 50Hz – data points will be transferred 50times per second,



4.5.9 Display of actual values

Actual values info bar shows actual value of phase voltages or currents or active, reactive and apparent power. Switching between displayed values is done by clicking on actual values info area.

Summary		I1=0.71534A	I2=0.61877A	I3=1.2886A	IN=0.94097A
Wiring:	3xUp + 3xl + N			Time Series:	Store Stopped...
Voltage Ranges:	500 V			Interval:	10 min
Current Ranges:	AMPFLEX 300A			Name:	
Fundamental Frequency:	50Hz			Power Quality:	Store Stopped...
FFT Step:	Harmonics (50Hz)			Name:	
Sampling Rate for Transient:	9600Hz			Digital Inputs:	Store Stopped...
Name:				Name:	
EN50160 Voltage Level:	230V			Alarms:	Store Stopped...
EN50160 Events:	90% / 110%			Name:	
EN50160 Interruption:	5%			Transients:	Store Stopped...
Name:				Name:	
Profile:	DEFAULT			Signalling:	Store Stopped...
User / Project:	DEFAULT / DEFAULT			Name:	
Name:				Disturbances:	Store Stopped...
Name:				Name:	
Start global datastoring				<input type="button" value="Enable all"/>	
Stop global datastoring				<input type="button" value="Disable all"/>	
Menu	System1	Store Stopped...		8/31/2020 4:58:09 PM	

By clicking on the top bar you can switch between the different data types.

U1=232.5V	U2=237.5V	U3=244.5V	U4=218.1V
I1=64.09mA	I2=50.11mA	I3=1.982A	I4=26.58mA
P1=-335.9mW	P2=79.79mW	P3=424.3W	P4=-129.9mW
Q1=-14.78VAr	Q2=11.75VAr	Q3=232.6VAr	Q4=-5.747VAr
S1=14.88VA	S2=11.92VA	S3=481.7VA	S4=5.789VA



4.6 Data Analysis

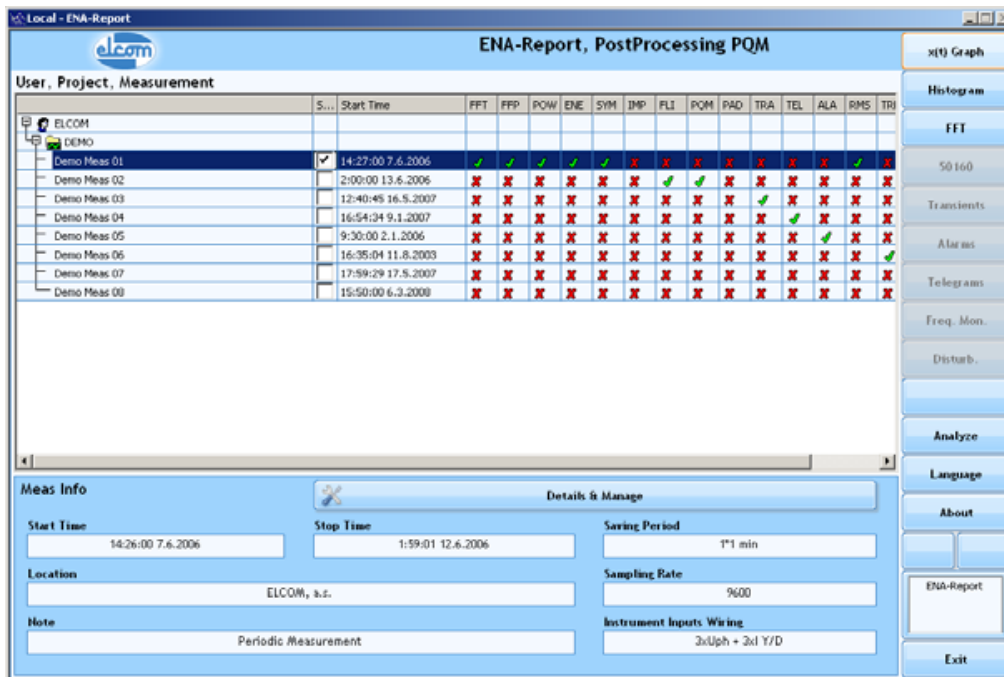
In the NEO Software Starter Screen you can select between “Report” and “Report New” tool.

- The classical “Report” tool is available on the market for more than 15 years – well known from PNA hardware products. It covers all classical functionalities. All data of PNA instruments (PNA 561, PNA571) can be opened and analyzed.
- The “Report new” tool is the latest version of a reporting tool that will cover additional functionalities compared to the Report tool. New power quality parameters like Supraharmonics will only be available in this tool, that can manage both data of old and new instruments.

Classical Report

The analysis functionalities of the classical report tool are:

Time series analysis (Graph), Histogram, FFT, EN5160 analysis, Transients, Disturbances, Alarms, Telegrams and the Frequency Monitor.

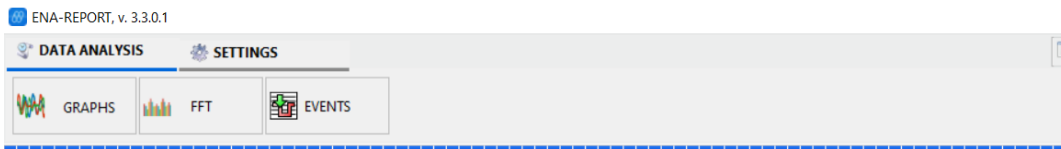


Please refer to the “REPORT Manual” for detailed instructions and information.



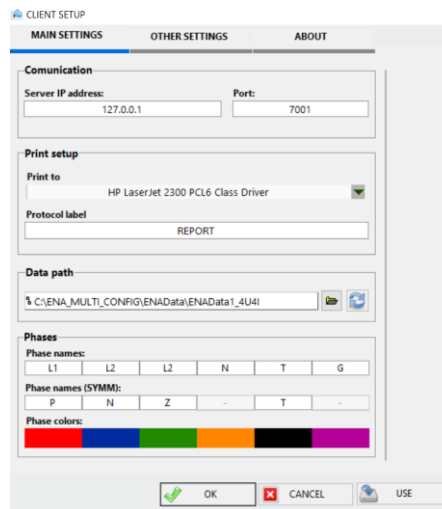
Report New

The graphical user interface of the new Report Tool was updated and optimized. In addition a couple of new features have been implemented. Simultaneous analysis of different kind of data is a new feature, as well as enhanced analysis and data visualizations functions. Another feature is the possibility to overlay data of different measurements. The user interface is now aligned to the User Interface of the PQM SCADA solution.



4.6.1 Settings

In **Settings screen**, general settings like Language, Phase name and colours, Printer, Data path, Export options,... can be defined.

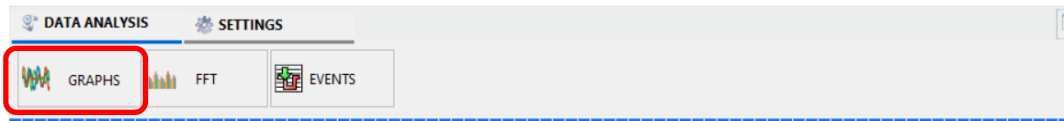


In **Data screen**, you can select between the different Data visualization options:

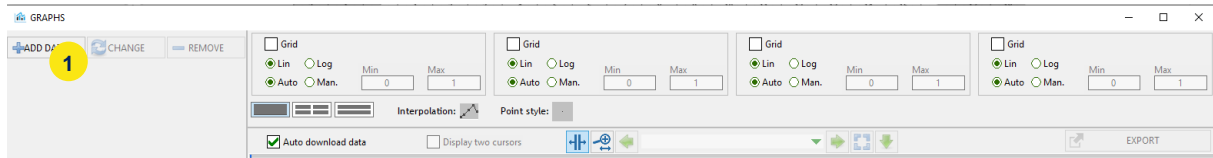
- Graphs (Time series data)
- FFT (Harmonic, FFT spectra)
- Transients
- Disturbances
- EN50160
- Etc.

4.6.2 Graphs / Time Series Data

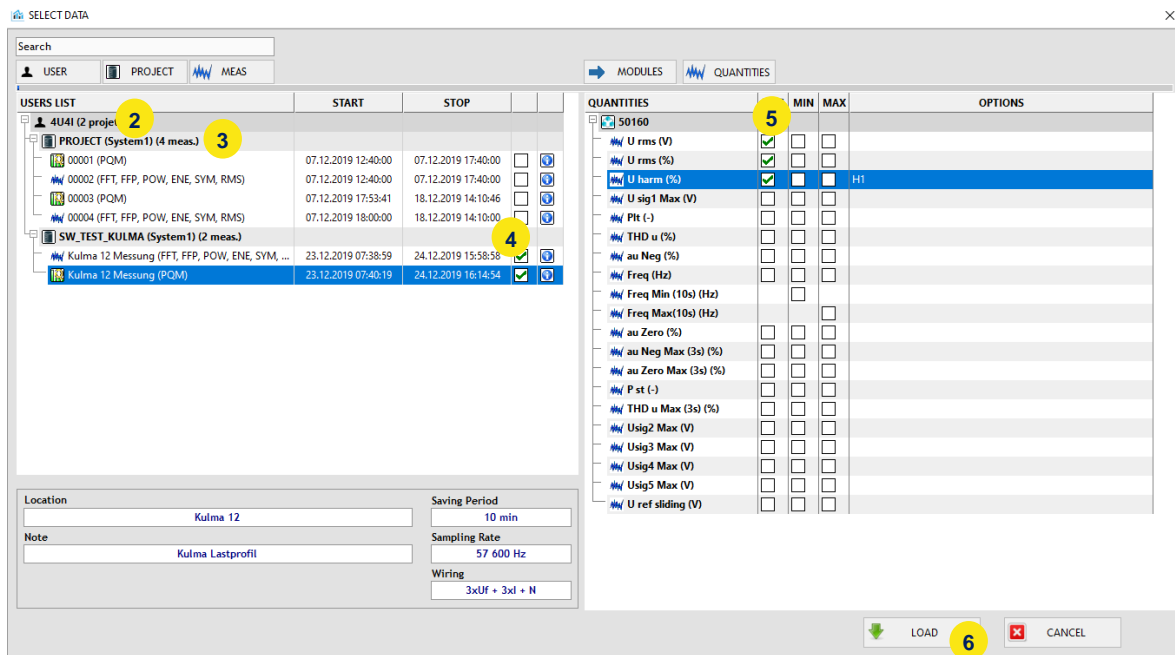
ENA-REPORT, v. 3.3.0.1



After selecting “Graphs” and pressing “Add Data” (1) button (see picture) the Channel selection menu will appear.



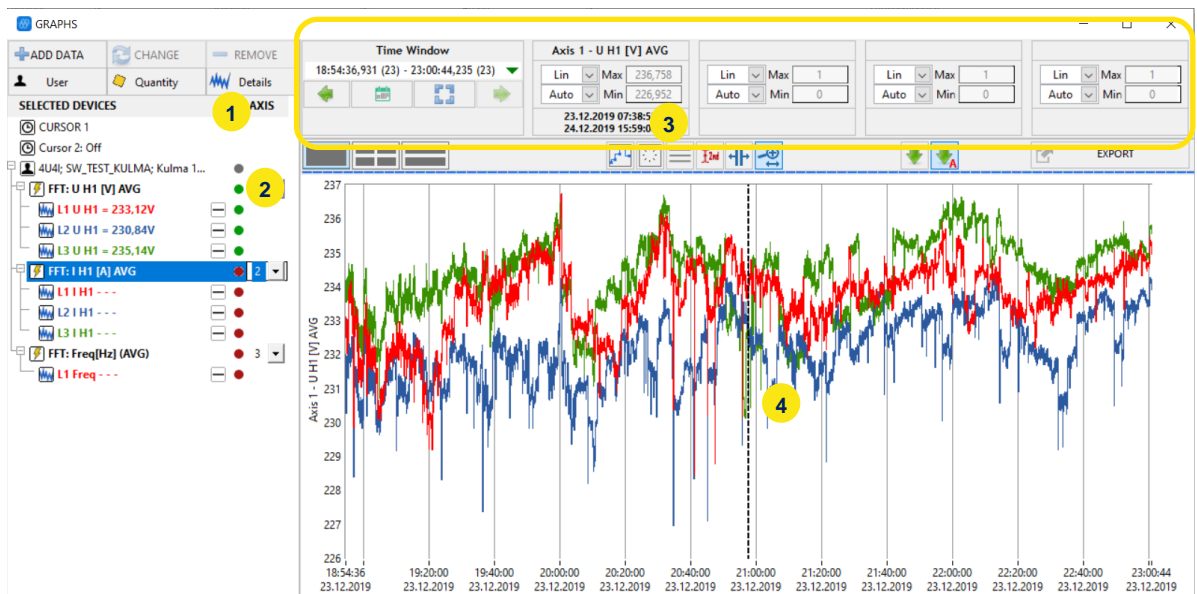
Then select the System (2) and project (3). The treeview will enhance and show the different measurements. Select the measurement (4) on the left side and check the quantities you want to show/analyze on the right (5). Finally press Load (6) and data will be shown.





Overview Data visualization panel

- Selected Quantities (1)
- By pressing on the green indication lamp you can enable/disable individual quantities or phases (2) for the Visualization
- Configuration of Visualization (3)
 - x-y axis (scaling, lin/log)
 - interpolation type
 - point style
 - number of charts
 - Cursors
 - Zoom In/out Function
 - Time-Interval
- Data Visualization (4)



If you want to add additional channels, just press “Add” again and select the quantities you want to add.

Key Feature: You can also add data of multiple data files respectively data files recorded by other instruments. In that way, you can analyse data of multiple different measurement points, which are synchronized by GPS clock, together. This allows powerful and highly synchronized data analysis.

Key Feature II: In the same Graph you can show 10-period, ½ period and Waveform data

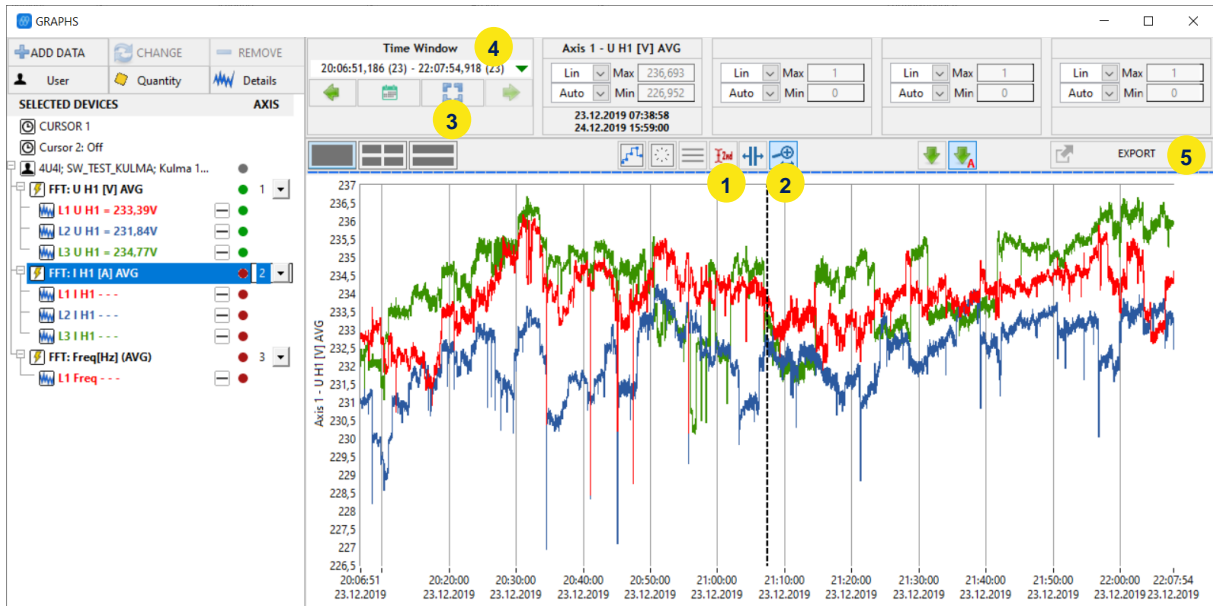


Zoom In / Out and Cursors

- A second cursor can be activate by pressing (1)
- To Zoom In activate Zoom function by pressing (2)

Now Zoom function is activated. Keep the left mouse button pressed and move over the selected area you want to zoom. The data automatically will be reloaded for the selected time frame.

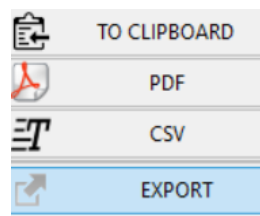
- To Zoom Out press (3)



- The last Zoom steps are stored at (4). So you easily can switch between different time frames.



- Data can be exported to Clipboard, PDF or CSV file by pressing (5)



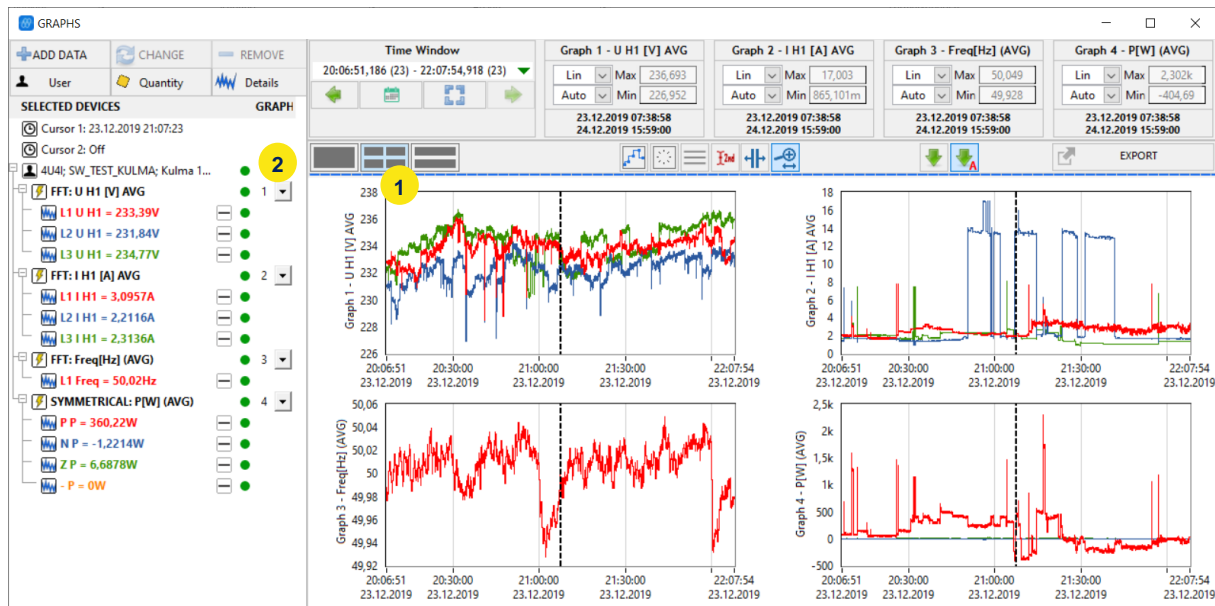


Multiple Charts

To show data in multiple charts, first select the type of multi chart visualization (1). Up to four independent charts can be defined. There are three different options available

- Single chart
- Multiple charts among each other
- Multiple charts – 2 Charts in one row (see picture)

After selecting the chart type, you can assign the quantities to the individual charts via dropdown selection (2).



THD (Total Harmonic Distortion)

NEO Instruments offers many different types of THD calculation for many different measurement applications and regions.

THD from Harmonic range (valid for IEEE519, EN50160 etc.):

- PWHD U (%)
- PWHD I (%)
- THD U (%)
- THD I (%)
- THD U max (%)
- THD I max (%)
- TDD (%)
- f (Hz)
- THDg U40 (%)
- THDg U50 (%)
- THDg I40 (%)
- THDg I50 (%)



THD from 200 Hz bands covering the range up to 9 kHz (Troubleshooting e.g. vessel, elevators, PV, EV, etc.):

THD U (%)	<input checked="" type="checkbox"/>
THD I (%)	<input type="checkbox"/>
THD U max (%)	<input type="checkbox"/>
THD I max (%)	<input type="checkbox"/>
TDD (%)	<input type="checkbox"/>

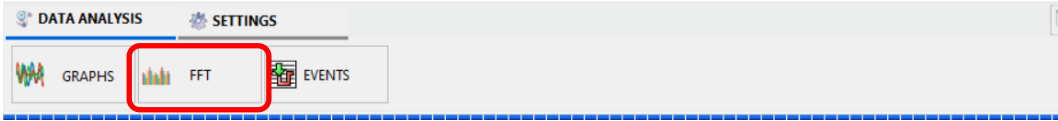
THD from 2 kHz band covering the range up to 150 kHz / 500 kHz (Troubleshooting e.g. vessel, elevators, PV, EV etc.):

THD U (%)
THD I (%)
THD U max (%)
THD I max (%)
TDD (%)
f (Hz)



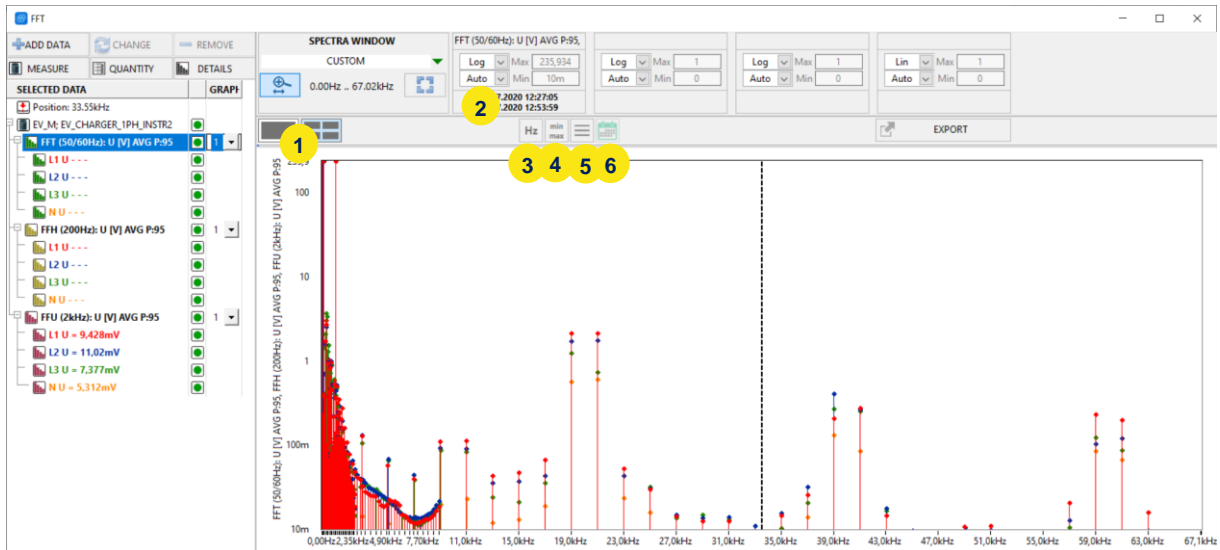
4.6.3 FFT Data

ENA-REPORT, v. 3.3.0.1



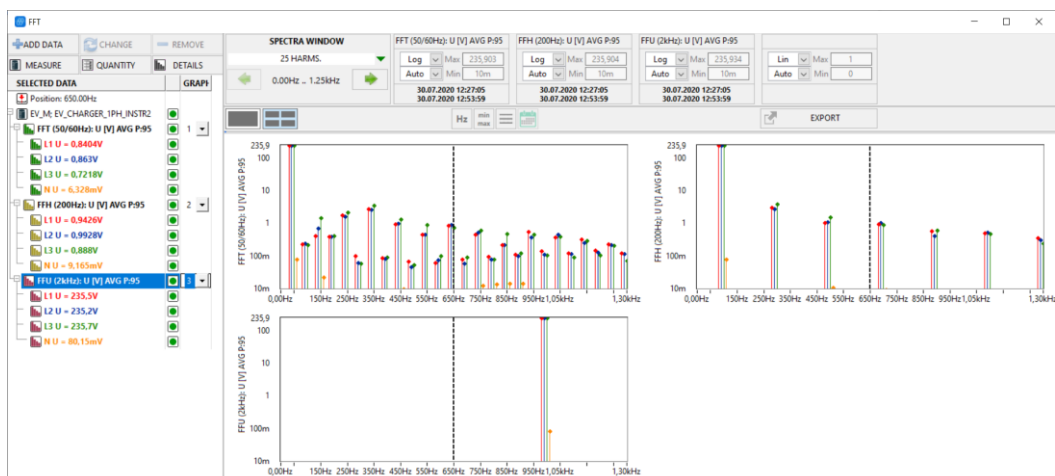
After selecting “FFT” you can add the channels in the same way as described for Graphs.

- 1) You can show the FFT data in multiple charts or all together in one
- 2) Axis scaling (linear, logarithmic, Auto, manual)
- 3) X-Axis in Harmonic orders or in Hertz (Hz)
- 4) Showing Min / Max Values
- 5) Horizontal lines
- 6) Time-Frame for additional FFT calculation



The picture above shows visualization of Harmonics (50 orders), Higher Frequencies (200Hz bands) and Supraharmonics (2kHz) of an EV charging station in one screen.

The following picture shows Harmonics, Higher Frequencies and Supraharmonics in individual tabs.

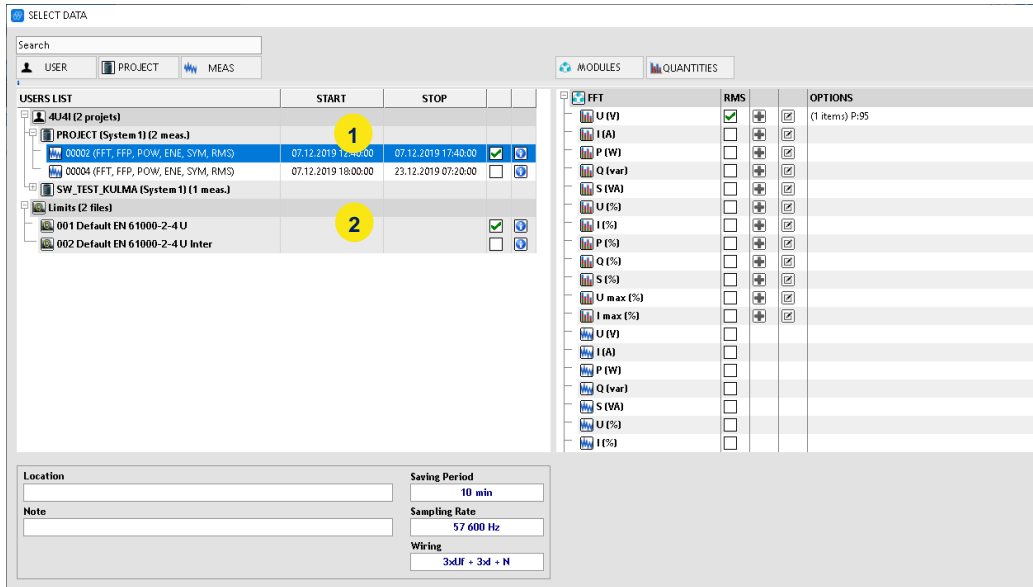




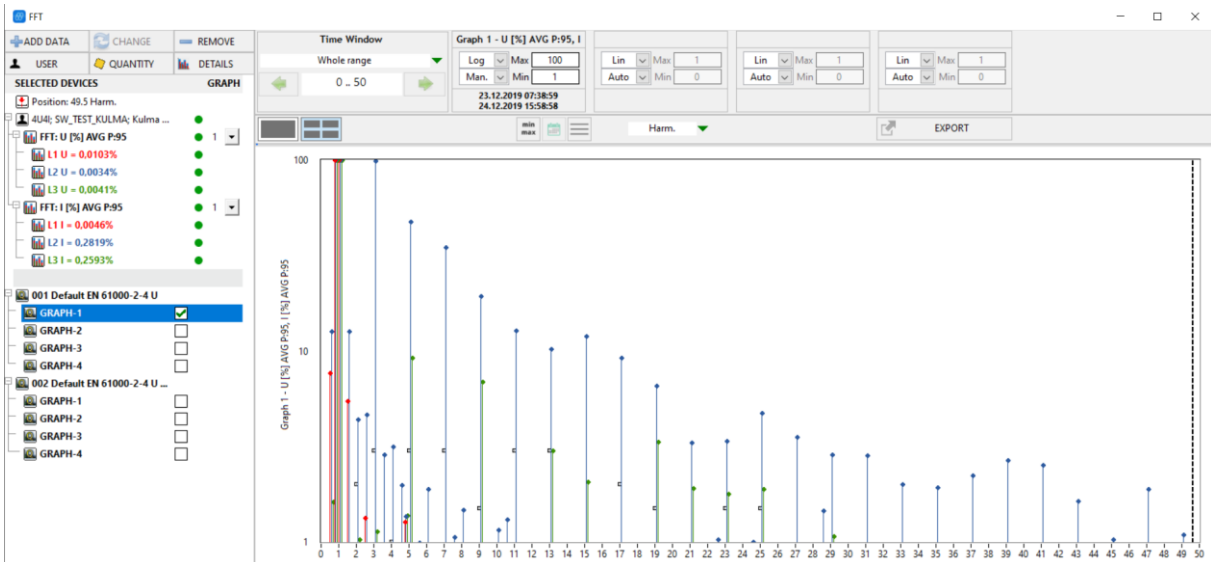
FFT Reference Curve

Application: Evaluation according to IEC61000-2-2, -3-3, IEEE519, etc.

For Harmonic FFT analysis it's possible to add a reference curve to the visualization screen. When selecting the quantities (1), you can add the desired reference curve at "Limits" (2).



The limits are shown as circles in the visualization:



For different graphs, different limits can be selected.

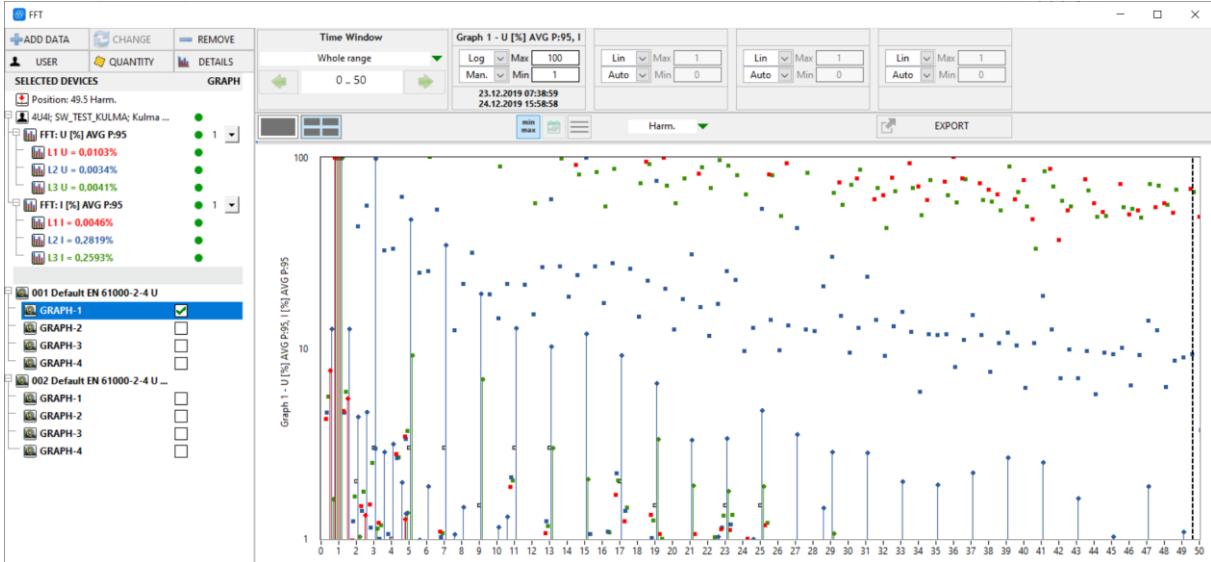
The parameters can be shown in different quantiles (95%, 99%, 100% ... definable) at the same time.

Key Feature: IEEE519 requires different quantile calculations



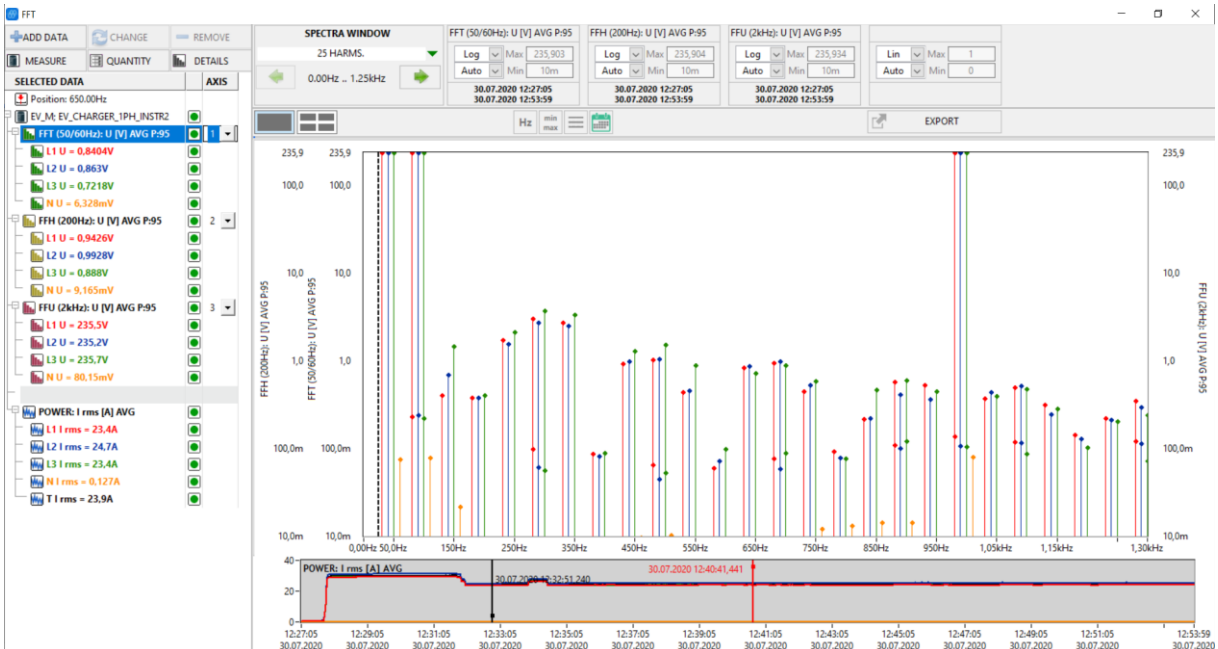
MIN / MAX values

For each harmonic the Min and Max Values can be shown in addition. They will appear as colored rectangles:



Recorder + FFT

By pressing “Add data” and selection of time-series data you can add a recorder window to the FFT data.

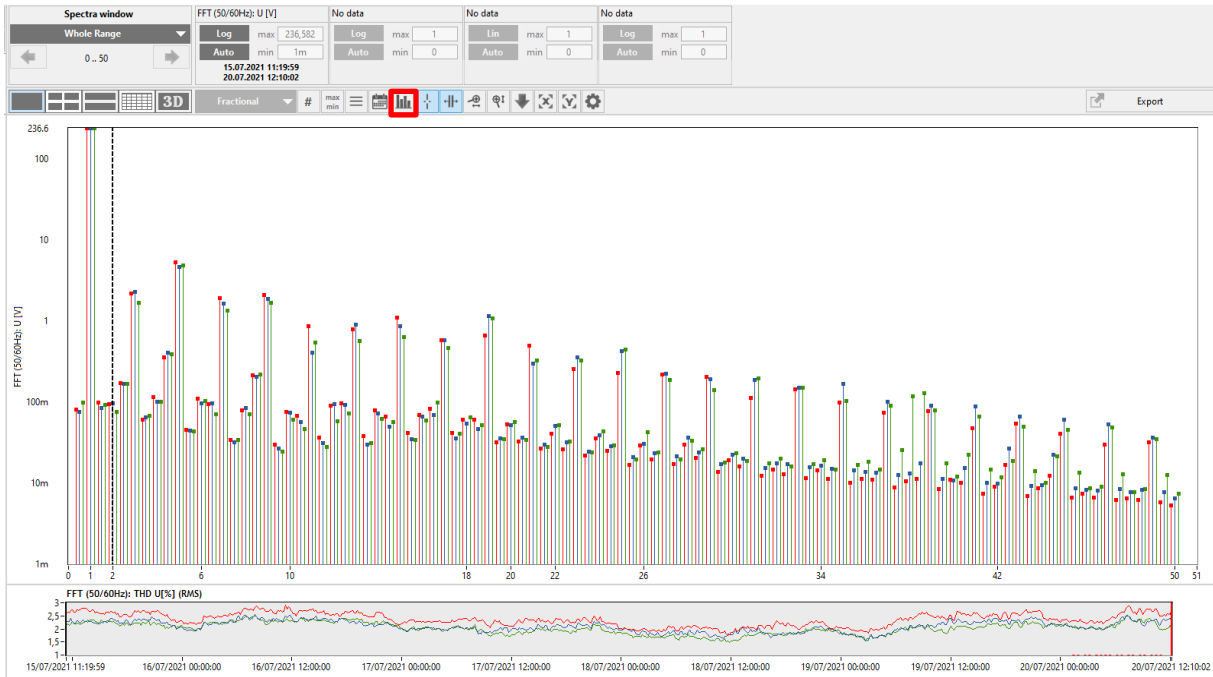


Key Feature: Show FFT at load and no-load conditions



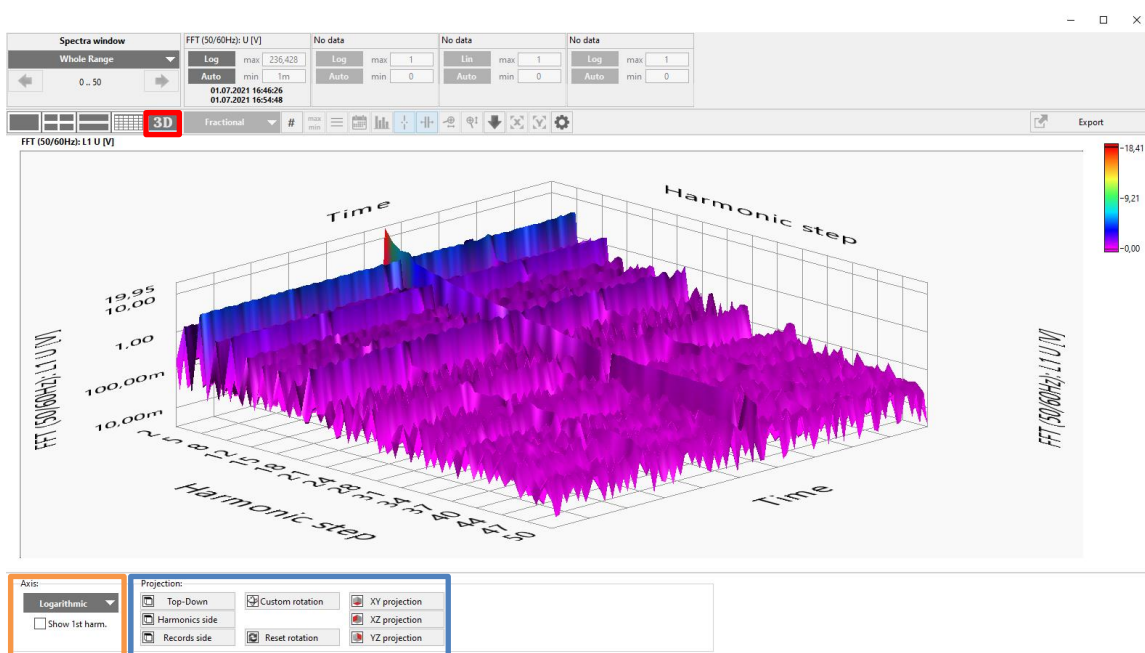
Live FFT

By choosing beside the FFT Data also a trend graph (like THD_U) the live FFT feature can be accessed. Once both are loaded the user can click on the live spectra button (marked red) and a cursor appears in the lower display. This cursor can be moved left and right to display the FFT at a certain time point.



3D (Waterfall) FFT

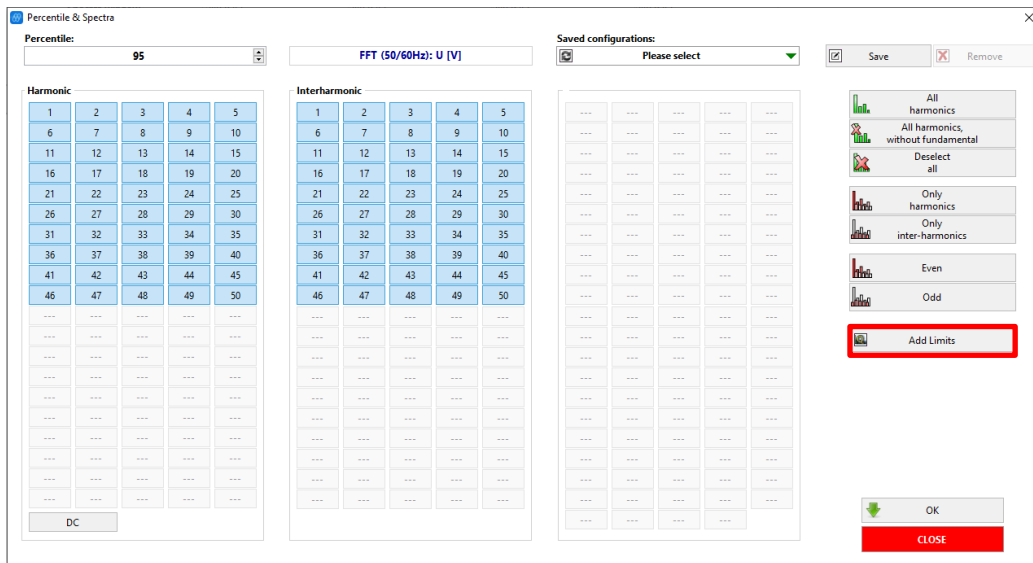
By clicking on the red marked 3D button, the waterfall FFT can be displayed. In the blue marked area the projection of the FFT can be changed and in the blue marked area the Axis scaling can be changed from logarithmic to linear and the first harmonic (fundamental) can be removed. By clicking into the FFT window the waterfall graph can be rotated.



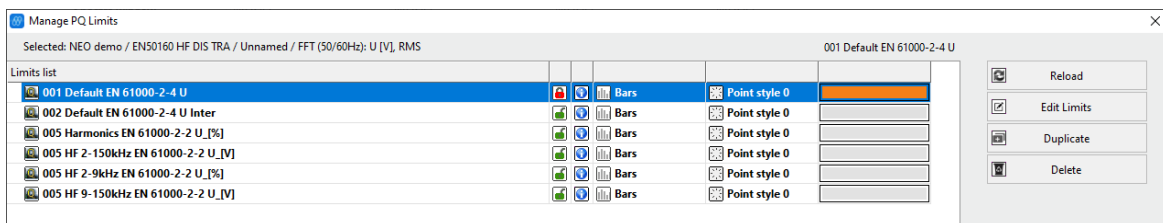


FFT Limits

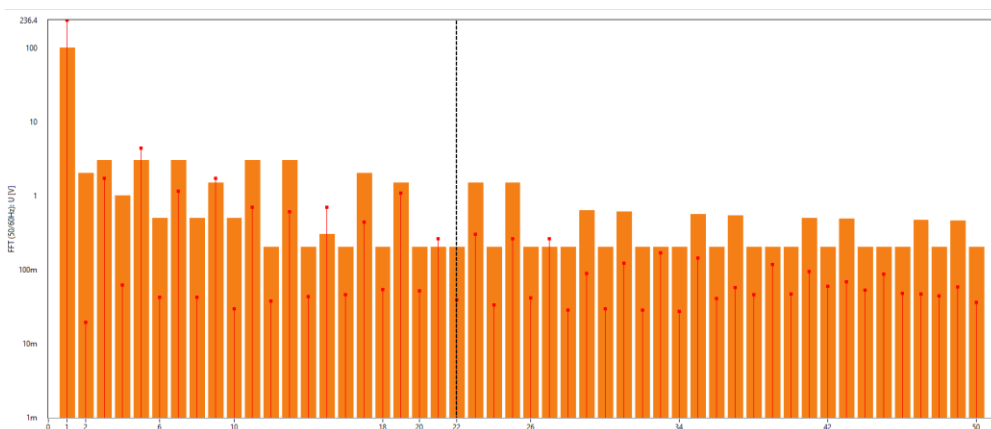
When displaying FFT data limits can be added. Click on “Add Limits” (marked in red).



This opens the Manage PQ limits window. In the first column the names of the limit files are displayed. With the lock symbol in the next column a limit can be associated with the FFT data. The blue info icon opens a window in which the limit values are displayed. By clicking on Bars in the next column the display type can be changed to Points or Envelope. Points style changes the icon displaying the limit points and in the last column the color in which the limits are displayed can be changed.



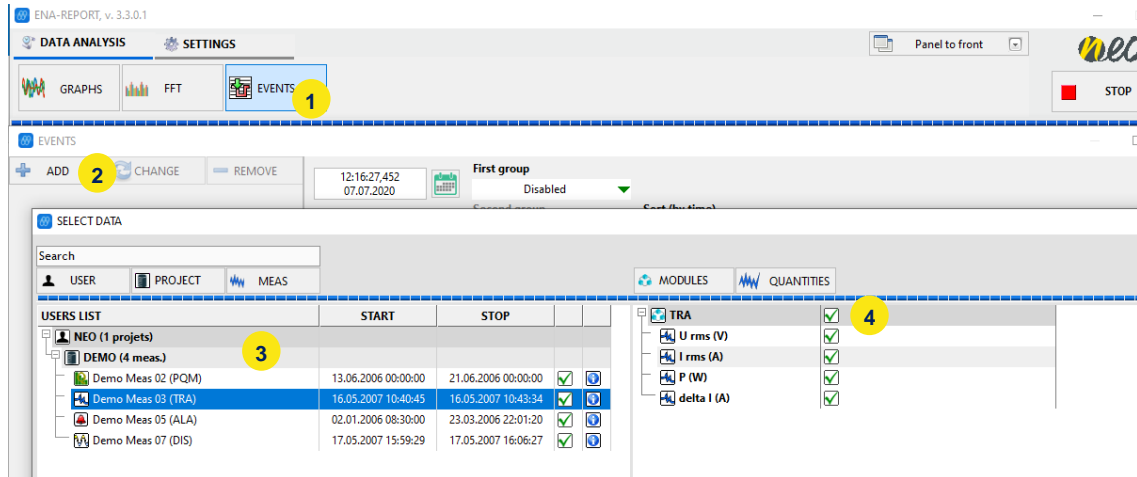
By clicking on ok, the chosen limits are confirmed and are loaded with the FFT data.





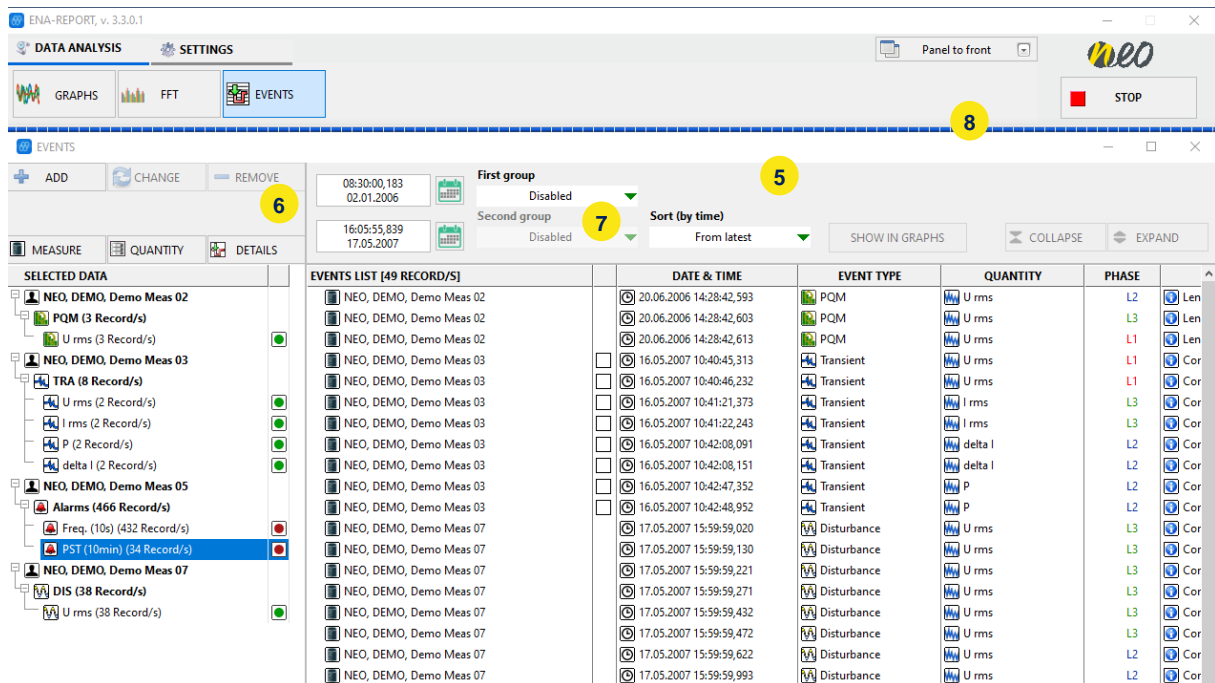
4.6.4 Events, Alarms, Transients, Disturbances

For the presentation of events, transients, alarms and deletions, the "Event Panel" is available. After clicking on Events (1), the selection of the range (2) can be selected (3). It can also be combined with all Events.

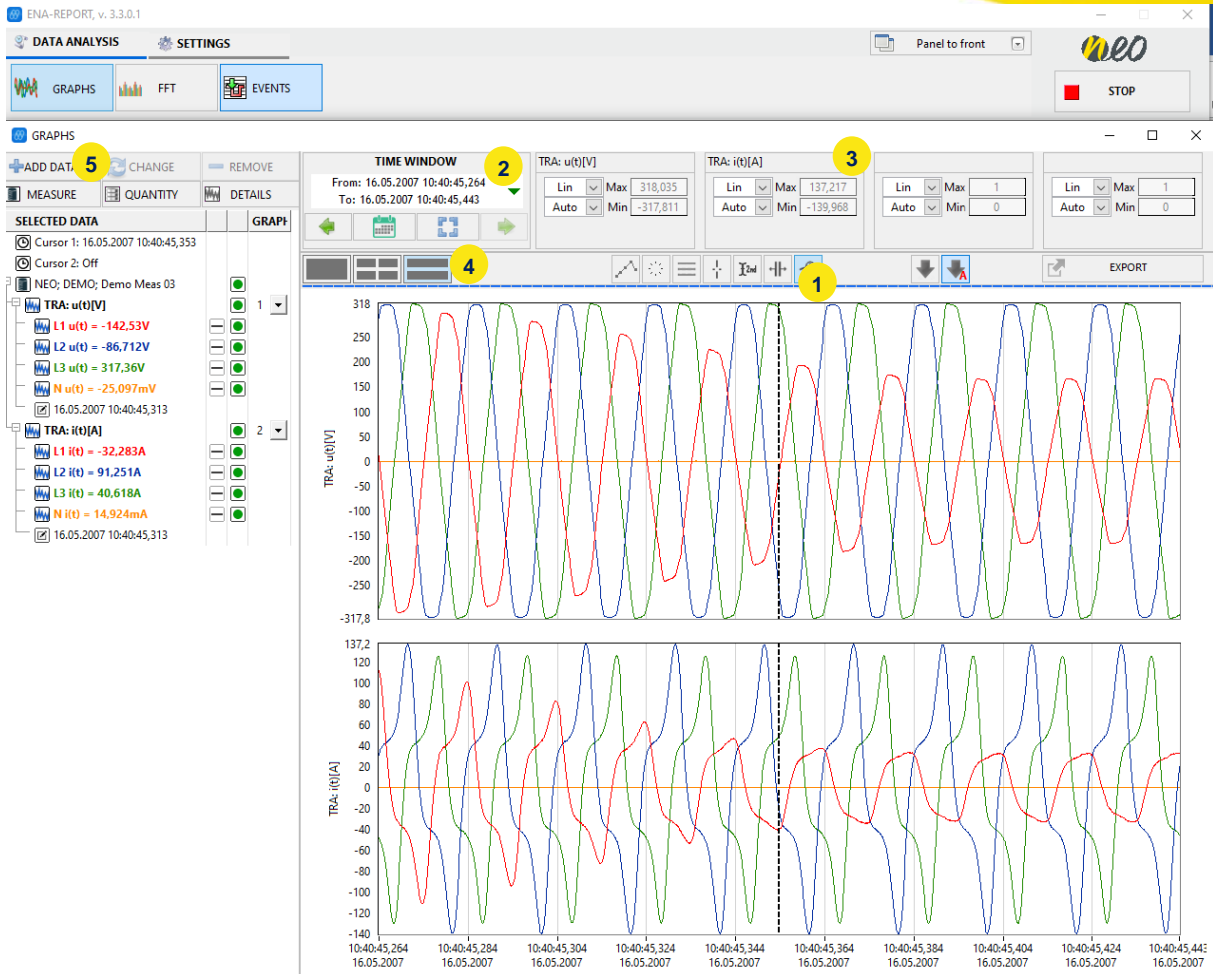


The list with all events is shown. The list can be ordered by date / time, event type, unit and phase (5). Links in the menu can also be selected / de-selected for the event type (6).

For transients, the waveform and for the disturbances of the 1/2 periodic values are shown (7). Also multiple Events can be shown. For a detailed view, click on "Details" (8).



Various parameters (transients, disturbances, 10-period values) can be shown in one recorder chart.



- Zoom (1)
- Time selection (2)
- Axis (3)
- Multi-Chart (4)

In addition, other parameters can be taken into account like derivate of voltage or current or frequency, etc. This is possible via "Add" (5) and selection of parameters at "TRA" (6 + 7)

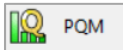
The 'SELECT DATA' dialog box is shown. The 'USERS LIST' table is highlighted with a yellow circle (6). The 'QUANTITIES' table is also highlighted with a yellow circle (7).

USERS LIST	START	STOP
NEO (1 projets)		
DEMO (3 meas.)		
Demo Meas 01 (FFT, FFP, POW, ENE, SYM, ...)	07.06.2006 12:27:00	11.06.2006 23:59:00
Demo Meas 02 (FLI, POM)	13.06.2006 00:00:00	21.06.2006 00:00:00
Demo Meas 03 (TRA)	16.05.2007 10:40:45	16.05.2007 10:43:34

QUANTITIES	RMS	MIN	MAX	OPTIONS
TRA				
du/dt (V/s)	<input checked="" type="checkbox"/>			
u(t) (V)	<input checked="" type="checkbox"/>			
U rms (V)	<input checked="" type="checkbox"/>			
THD U (%)	<input checked="" type="checkbox"/>			
dI/dt (A/s)	<input type="checkbox"/>			
i(t) (A)	<input checked="" type="checkbox"/>			
I rms (A)	<input checked="" type="checkbox"/>			
THD I (%)	<input type="checkbox"/>			



4.6.5 EN50160



This function allows the automatic evaluation according to EN50160 or other standards.

1) Select Limit and Percentile

After selecting the datafile(s) for power quality evaluation the limit values and corresponding percentil can be selected or individually defined. Predefined templates are available for EN50160, IEC61000-2-2, IEC61000-2-4, IEEE519, FoL standards. Other templates can be added by oneself or by NEO Messtechnik.

QUANTITY	LOWER LIMIT	UPPER LIMIT	PERCENTILE LIMIT
Frequency			
Frequency (10s)	99.0%	101.0%	>=99.5%
Frequency (10s)	94.0%	104.0%	=100.0%
Frequency (10s)	-	101.0%	>=99.5%
Frequency (10s)	99.0%	-	>=99.5%
Frequency (10s)	-	104.0%	=100.0%
Frequency (10s)	94.0%	-	=100.0%
Voltage			
Voltage (10min)	90.0%	110.0%	>=95.0%
Voltage (10min)	85.0%	110.0%	=100.0%
Voltage (10min)	-	110.0%	>=95.0%
Voltage (10min)	90.0%	-	>=95.0%
Voltage (10min)	-	110.0%	=100.0%

2) Select time-intervall (Note: Multiple data files can be analysed together)

3) Analysis and Report visualisations see:

The table shows all parameters and the limits according to EN50160. The limits may also be applied to other limits (see IEC61000-2-4).

QUANTITY	LIMIT	INTERVAL	MIN*/MAX%/OUT	MIN*/MAX%/OUT	MIN*/MAX%/OUT	FITS
Total						✓ Yes
Frequency (50Hz)			3--			✓ Yes
Frequency 99.5%	99%-101%	10s	50.01Hz/50.02Hz/0%			✓ Yes
Frequency 100%	94%-104%	10s	50.01Hz/50.02Hz/0%			✓ Yes
Voltage (230V)			L1	L2	L3	✓ Yes
Voltage 95%	90%-110%	10min	221.95V/224.24V/0%	224.48V/226.47V/0%	224.29V/226.63V/0%	✓ Yes
Voltage 100%	85%-110%	10min	221.95V/224.24V/0%	224.48V/226.47V/0%	224.29V/226.63V/0%	✓ Yes
Flicker			L1	L2	L3	✓ Yes
PLT 95%	<=1	10min	0/0%	0/0%	0/0%	✓ Yes
Unbalance U			3--			✓ Yes
Negative 95%	<=2%	10min	0.19%/0%			✓ Yes
Signals U			L1	L2	L3	✓ Yes
f = 216.66Hz 99%	<=9%	3s	0.16% Uref/0%	0.16% Uref/0%	0.16% Uref/0%	✓ Yes
THD U			L1	L2	L3	✓ Yes
THD U 95%	<=8%	10min	1.8% Uh1/0%	1.66% Uh1/0%	1.55% Uh1/0%	✓ Yes
Harm. U (10min)			L1	L2	L3	✓ Yes
U h1 (50Hz) 95%	-	10min	97.48% Uh1/0%	98.45% Uh1/0%	98.52% Uh1/0%	✓ Yes
U h2 (100Hz) 95%	<=2%	10min	0.05% Uh1/0%	0.03% Uh1/0%	0.04% Uh1/0%	✓ Yes
U h3 (150Hz) 95%	<=5%	10min	0.66% Uh1/0%	0.78% Uh1/0%	0.85% Uh1/0%	✓ Yes
U h4 (200Hz) 95%	<=1%	10min	0.04% Uh1/0%	0.05% Uh1/0%	0.04% Uh1/0%	✓ Yes
U h5 (250Hz) 95%	<=6%	10min	1.19% Uh1/0%	0.88% Uh1/0%	0.76% Uh1/0%	✓ Yes
U h6 (300Hz) 95%	<=0.5%	10min	0.02% Uh1/0%	0.03% Uh1/0%	0.01% Uh1/0%	✓ Yes
U h7 (350Hz) 95%	<=5%	10min	0.72% Uh1/0%	0.71% Uh1/0%	0.66% Uh1/0%	✓ Yes

- 1) Limit: Defined limit
- 2) Interval: Defined time-interval for evaluation
- 3) MIN*/MAX%/Out: MIN*...Minimal measured value
MAX...Maximal measured value
%Out...Number of samples out of limit



Extended view

It is possible to change the PQM table in the extended view mode. Therefore click on „table view“ → „extended“.

The screenshot shows the software interface with a 'Table view:' dropdown menu highlighted in a red box, currently set to 'Extended'. Below it is an unchecked checkbox for 'Include flagged records'. The interface also displays two time/date pairs: '10:19:59,000 06.10.2022' and '08:30:02,000 02.11.2022'. At the bottom, there are icons for 'PQM', 'UNIPEDE', and 'RVC', and a table titled 'PQM Evaluierung'.

PQM Evaluierung		
Spannung	Uref: 0.23 kV	
Spannung	Lim. 1	10m
Phase	100% MIN / MAX [kV]	95%
L1	0.231 / 0.237	0.231
L2	0.23 / 0.236	0.23

This will allow you a more detailed analysis of the measurement data.

Event list

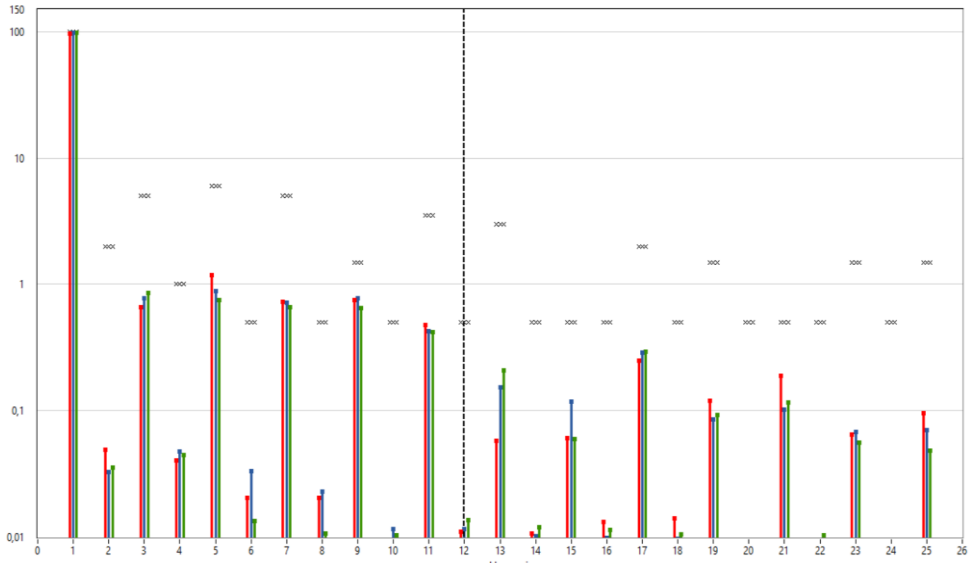
The following table shows the Event statistics and classifications.

Depending on length and extrema of voltage events, the different events will be counted.

UNIPEDE	<0 - 100ms	<100ms - 500ms	<500ms - 1.0s	<1.0s - 3.0s	<3.0s - 20.0s	<20.0s - 1min	<1min - 3min	>=3min	TOTAL
L2	0	0	0	0	0	0	0	0	0
L3	0	0	0	0	0	0	0	0	0
<5.0% - 40.0%	0	0	0	0	0	0	0	0	0
L1	0	0	0	0	0	0	0	0	0
L2	0	0	0	0	0	0	0	0	0
L3	0	0	0	0	0	0	0	0	0
<0 - 5.0%	0	0	4	0	0	4	0	8	16
L1	0	0	1	0	0	1	0	2	4
L2	0	0	1	0	0	1	0	2	4
L3	0	0	1	0	0	1	0	2	4
Interruption: <0 - 5.0%	16	4	1	0	0	4	0	8	33
L1	2	0	1	0	0	1	0	2	6
L2	4	1	0	0	0	1	0	2	8
L3	5	2	0	0	0	1	0	2	10
Total with: <0 - 5.0%	14	1	4	0	0	4	4	8	35
L1	2	0	1	0	0	1	1	2	7
L2	3	0	1	0	0	1	1	2	8
L3	4	0	1	0	0	1	1	2	9
Total without: <0 - 5.0%	14	1	0	0	0	0	4	0	19
L1	2	0	0	0	0	0	1	0	3
L2	3	0	0	0	0	0	1	0	4
L3	4	0	0	0	0	0	1	0	5

Voltage Harmonics

The following FFT chart shows 95% quantil, max and limit value of the voltage harmonics.



Event list

All events are listed with phase information date and time.

EVENTS LIST (5 RECORD/S)	DATE & TIME	EVENT TYPE	QUANTITY	PHASE	DETAILS
<input type="checkbox"/> Bidi_Ladestation, BIDI_CHARGE_DISCHARGE_X1_1, Unnamed	09.11.2020 12:54:34.036	Rapid Voltage Changes	U rms	L2	RVCH: dmax = 1.11%; dc = 1.09%
<input type="checkbox"/> Bidi_Ladestation, BIDI_CHARGE_DISCHARGE_X1_1, Unnamed	09.11.2020 12:56:23.831	Rapid Voltage Changes	U rms	L2	RVCH: dmax = 1.07%; dc = 1.01%
<input type="checkbox"/> Bidi_Ladestation, BIDI_CHARGE_DISCHARGE_X1_1, Unnamed	09.11.2020 13:01:09.329	Rapid Voltage Changes	U rms	L3	RVCH: dmax = 1.32%; dc = 1.21%
<input type="checkbox"/> Bidi_Ladestation, BIDI_CHARGE_DISCHARGE_X1_1, Unnamed	09.11.2020 13:01:09.329	Rapid Voltage Changes	U rms	L2	RVCH: dmax = 1.67%; dc = 1.24%
<input type="checkbox"/> Bidi_Ladestation, BIDI_CHARGE_DISCHARGE_X1_1, Unnamed	09.11.2020 13:01:09.339	Rapid Voltage Changes	U rms	L1	RVCH: dmax = 1.26%; dc = 1.21%

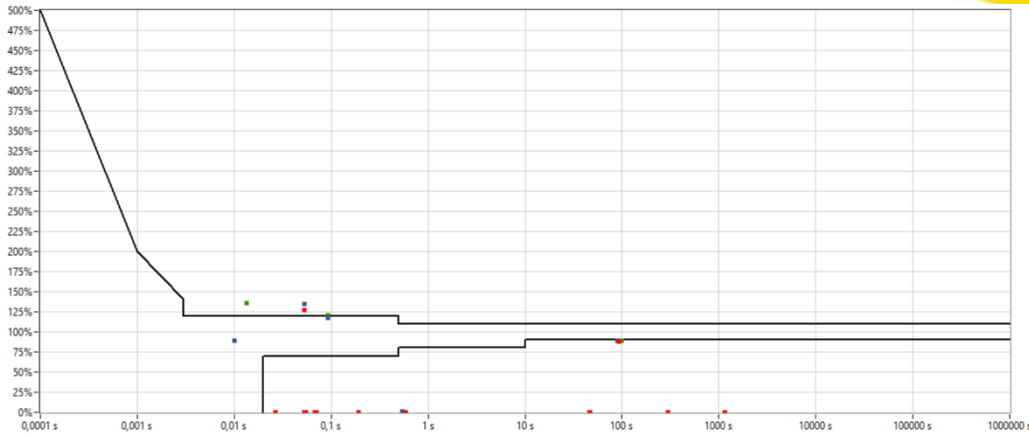
Rapid Voltage changes (RVCs)

Rapid voltage changes are by depth and changes per hour.

dmax [% Un]	CHANGES PER HOUR [r/h]	HOURS	PERCENTILE
L1		0/6	100.0
L2		0/6	100.0
L3		0/6	100.0
1.5 < dmax <= 2,5	r <= 10	Above / OK	OK
L1		0/6	100.0
L2		0/6	100.0
L3		0/6	100.0
1.0 < dmax <= 1,5	r <= 100	Above / OK	OK
L1		0/6	100.0
L2		0/6	100.0
L3		0/6	100.0
dmax <= 1,0	r <= 1000	Above / OK	OK
L1		0/6	100.0
L2		0/6	100.0
L3		0/6	100.0
Rapid Voltage Changes: Table 2			
dmax < 3,0	r <= 1		
dmax < 2,5	1 < r < 10	L1: 4/2	L1: 33.3
dmax < 1,5	10 < r < 100	L2: 4/2	L2: 33.3
dmax < 1,0	100 < r < 1000	L3: 4/2	L3: 33.3

ITIC curve

The ITIC curve is an additional visualization to show and classify events. The events will be shown in different colors as points, depending on phase. Points outside the ITIC area, can affect electronic equipment.



PQM Overview

By clicking on the red marked button the PQM overview can be opened. The PQ parameter are shown in relation to their limits. If one of them is above 110% of the limit it will be cut off. To show the full extent the area above the limit can be adjusted via the Scale Factor. The minimum is at 1.1 in which case the y-axis displays 110% of the limit.

PQM

Add / Edit **Remove**

Measure	Quantity	Details
From	13/06/2006 00:00:00	
To	20/06/2006 23:50:00	
Interval	8 Day(s) / 1152	
Validity	Yes	

NEO demo, DEMO, Demo Meas 02

Limits: Default limits (from data)

23:59:59,000 12/06/2006

00:00:02,000 21/06/2006

Scale Factor: 1,1 Default

Include flagged records

PQM UNIPED RVC Bar

PQM Evaluation: DEMO, Demo Meas 02

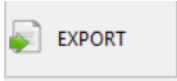
Parameter	Limit	Value
L1 Frequency	101,00%	~101%
L1 Voltage	106,00%	~106%
L2 Voltage	106,00%	~106%
L3 Voltage	106,00%	~106%
L1 Flicker PLT	1,00	~1,1
L2 Flicker PLT	1,00	~1,1
L3 Flicker PLT	1,00	~1,1
Neg. Unbalance	2,00	~1,5
Zero Unbalance	2,00	~1,5
L1 Signals f1	9,00	~9,5
L2 Signals f1	9,00	~9,5
L3 Signals f1	9,00	~9,5
L1 THD U	8,00	~8,5
L2 THD U	8,00	~8,5
L3 THD U	8,00	~8,5



4.6.6 Data Export options

There are several options to export data.

Option 1: Export in Main tab



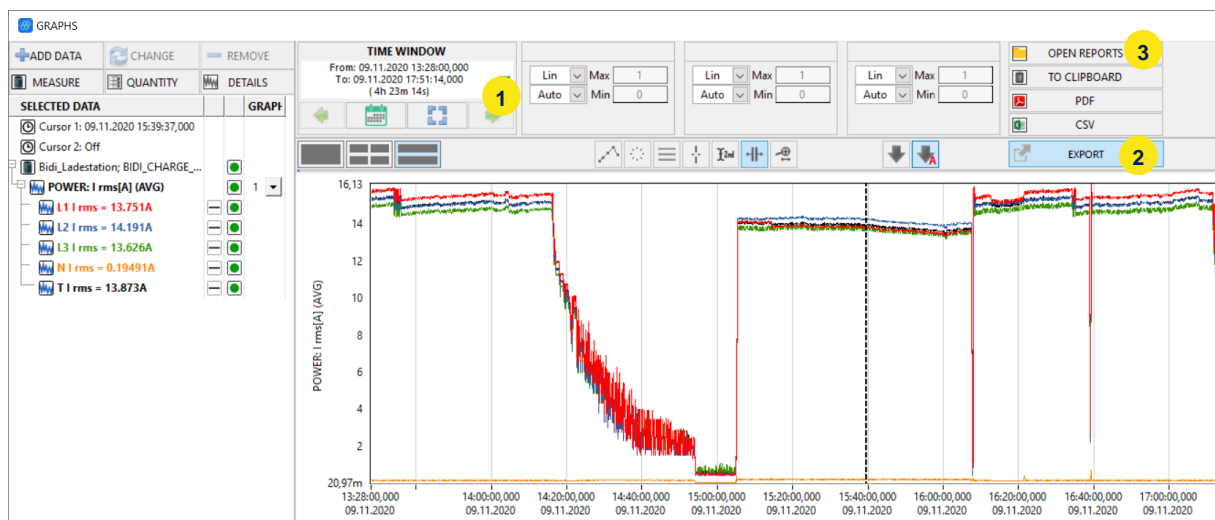
This option allows to export data of one or multiple datafiles together with full storage rate for time series data respective full sampling rate for Transients.

MESSLISTE (EVENTS)	STARTZEIT	ENDZEIT	SEL
BG02 (2 projets)			
Bidi_Ladestation (2 projets)			
BIDI_CHARGE_DISCHARGE_X1_1 (System1...)			
unbenannt (TRA)	09.11.2020 12:32:09	09.11.2020 13:12:18	<input checked="" type="checkbox"/>
unbenannt (TRA)	09.11.2020 14:15:03	09.11.2020 16:08:14	<input type="checkbox"/>
unbenannt (DIS)	09.11.2020 15:19:20	09.11.2020 16:07:58	<input type="checkbox"/>
unbenannt (TRA)	10.11.2020 10:11:51	10.11.2020 10:20:55	<input type="checkbox"/>
unbenannt (TRA)	10.11.2020 10:35:36	10.11.2020 10:35:36	<input type="checkbox"/>

- 1) Start "Export function"
- 2) Select between Periodic (Time-Series) or Events (Raw Data for Transients)
- 3) Select data file
- 4) Select transient respective parameters to export and time-range

Option 2: Export in visualization (chart, FFT, Event, ...)

Note: this option will only export averaged data for the shown time-frame. It will not export data in storage or sampling rate.



- 1) Select time-frame or use Zoom-function to define time-frame for export
- 2) Press "Export" and select one of the export options
CSV / PDF / CLIPBOARD
- 3) Click on "Open Reports" to open the directory where the exported data are stored



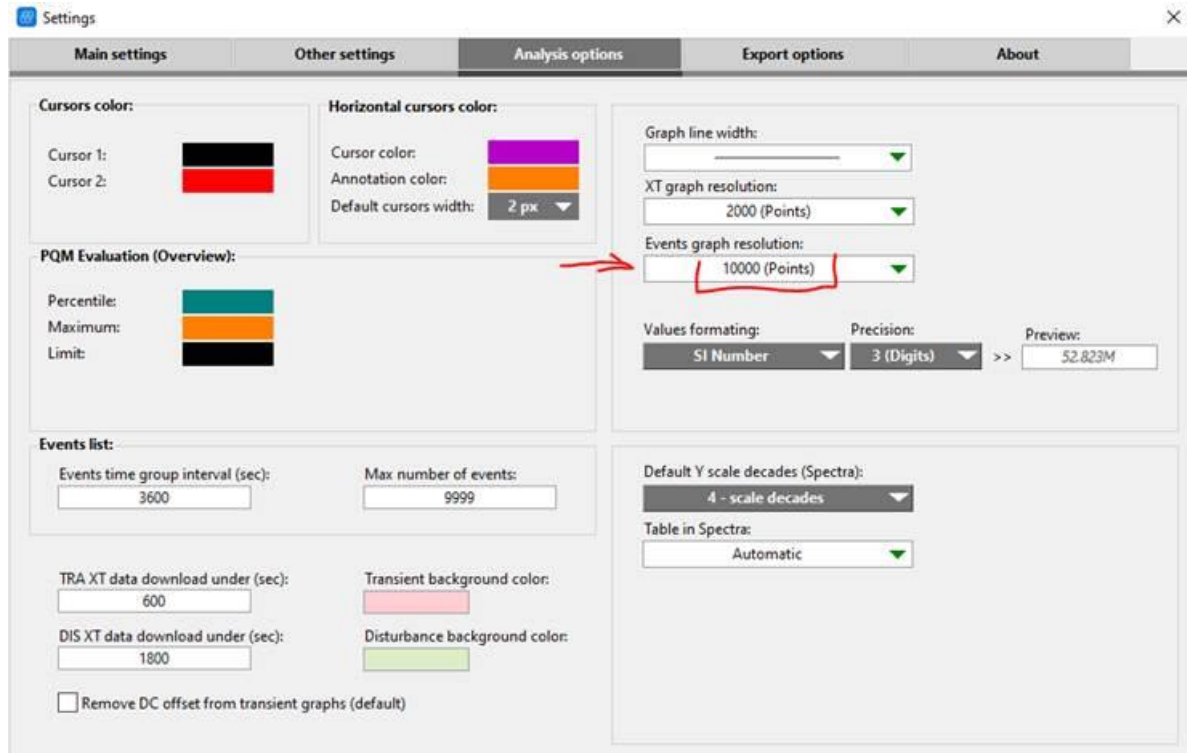
Option 3: Export only parts of recorded transients

To display and export only 4 periods (approximately) of a transient recorded at 125kS/s, you can export the transient at full resolution since there is:

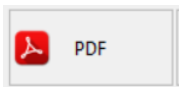
$$125000 * 4 * 0,02 = 10000 \text{ Samples}$$

$$\text{Sampling Rate} * \text{Number of Periods} * 1 \text{ period time at } 50\text{Hz} = \text{Number of Samples}$$

Note: Necessary part is to select max value at Analysis Option in ENA Report.



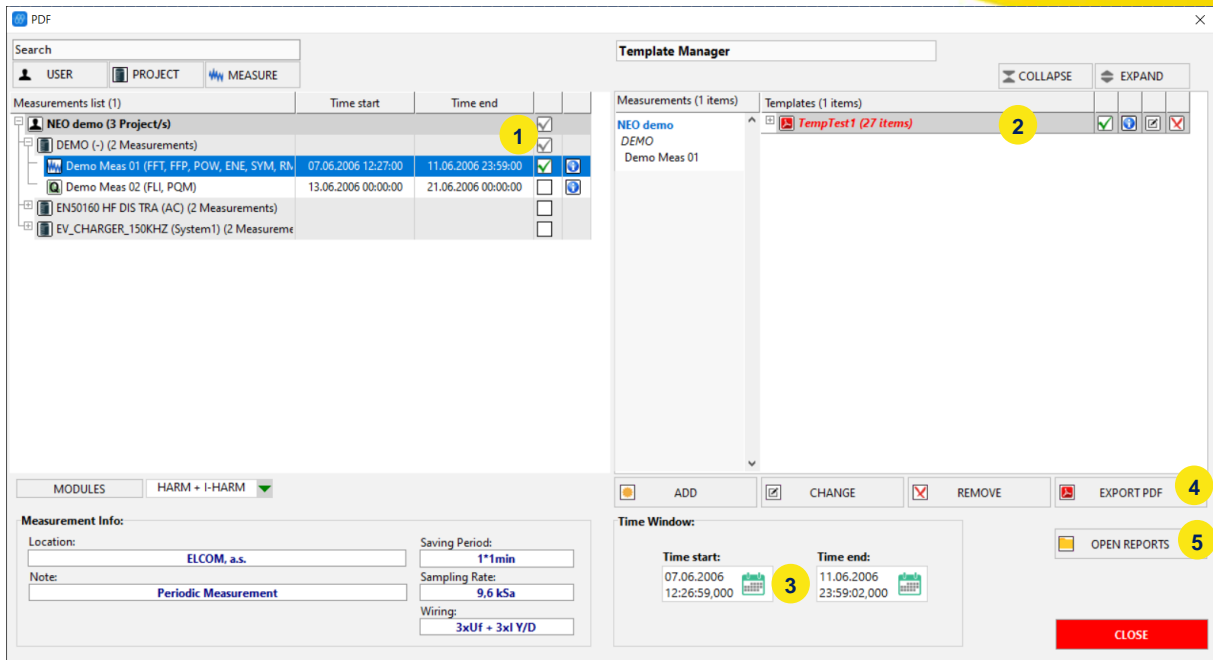
4.6.7 Automatic Report Generator



This function allows creating automatic reports with customizable templates. Any kind of stored parameter can be displayed in various visualisations like XY-Chart, FFT-Chart, Transient View etc.

4.6.7.1 How to generate a report

After opening report function via click on “PDF” the report generator screen will appear.

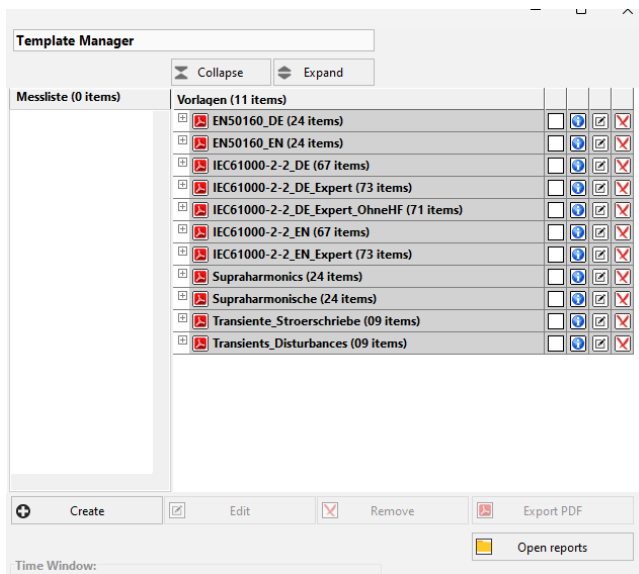


- 1) Select one or more data files
- 2) Select one templates
- 3) Define time-frame
- 4) Press “Export PDF”

Afterwards the report will be generated. A popup window will ask for having the report in **one merged file** or **individual files** for the different data files and data types.

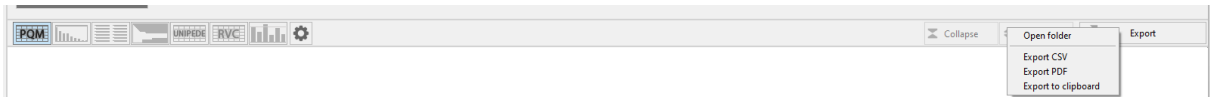
- 5) The reports are stored in the folder defined at settings and can be opened by pressing (5).

There are some predefined Templates for the Report Tool. If you haven't installed them yet, please contact our support and they will assist you installing them. (English and German)



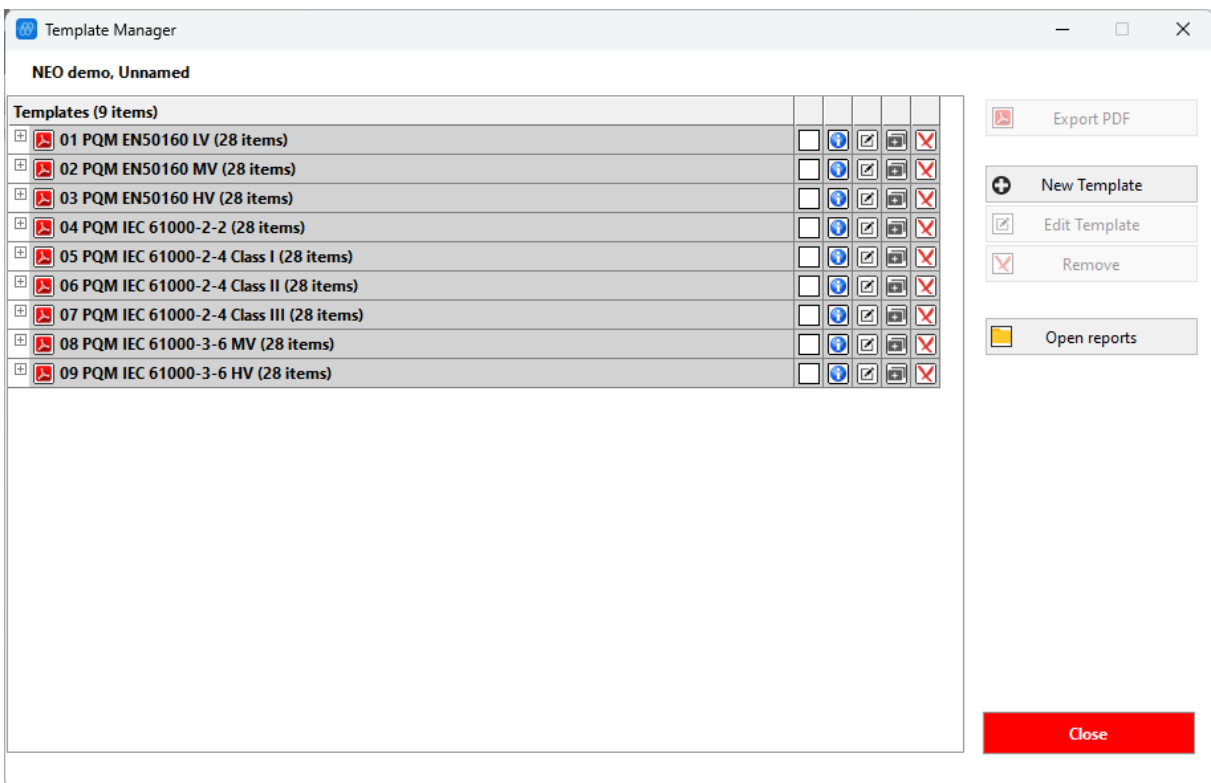
There is also the option to directly export PDF Reports from the PQM Window.

When the data is opened in the PQM Window, click on the right side on “Export” and then select “Export PDF”



You can then choose PDF templates for different standards (if installed), as before.

Note: Only PQM Data can be exported using this method.



Note: When a Template is written in red letters it is still possible to export but there are some data missing.

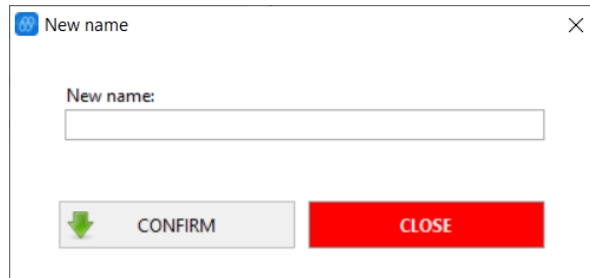


4.6.7.2 How to create a new template

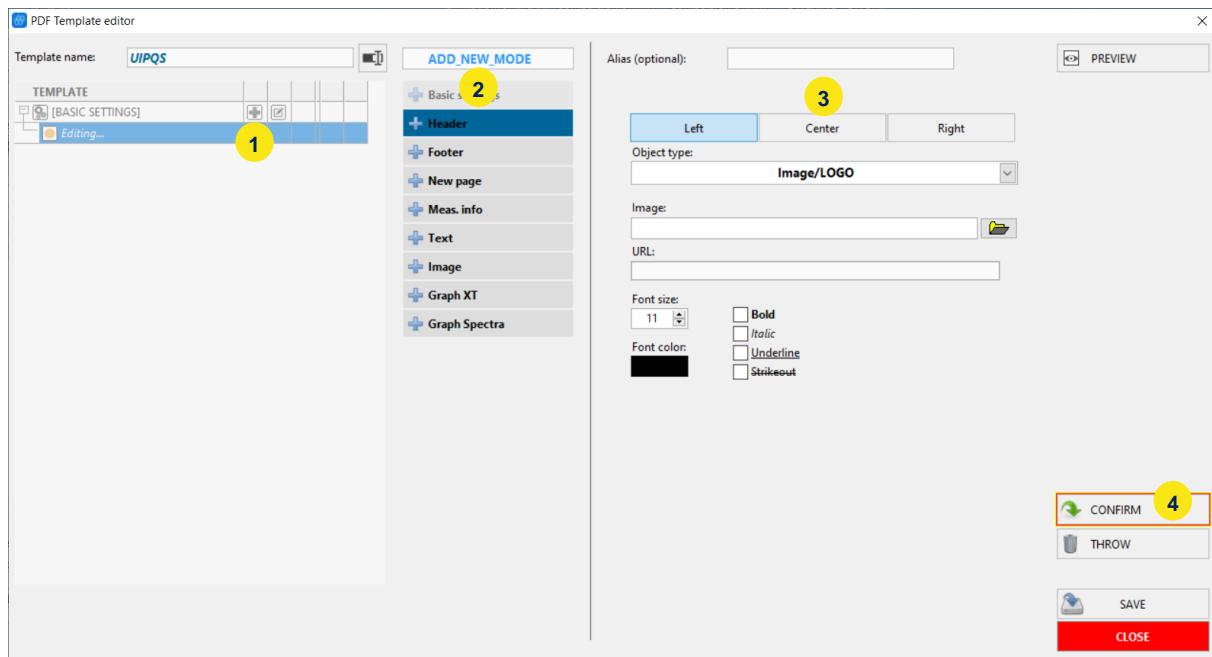
After opening the report generator panel (PDF), you can add, change or remove templates:



After adding a new template via “Add” you can define a name for the template in the popup window:

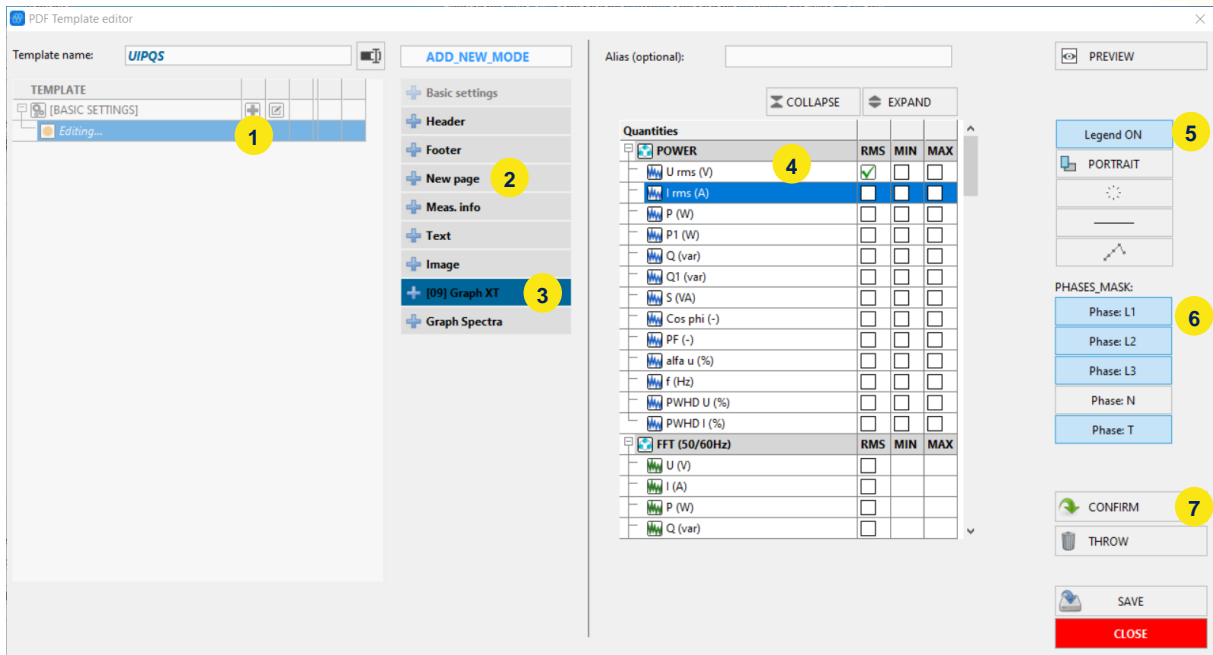


The idea of creating templates follows a modular block system.



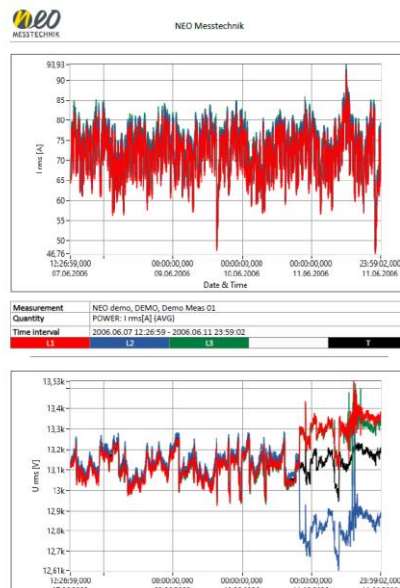
- 1) First add a new “block” by pressing “+”
- 2) Select one of the visualization, design and text options
- 3) Select the quantities or configure the visualization
- 4) Confirm the setup for the “block”
- 5) Start again with (1)

Example: Adding a XY-Chart for voltage and current on one page



- 1) Add new block
 - 2) Select block for new page and press confirm (7)
 - 3) Add new block (1) and select Graph XT
 - 4) Select Voltage Urms
 - 5) Select page style, legend off/on and line style
 - 6) Phase selection
 - 7) Confirm
 - 8) Save
- ➔ Repeat the whole procedure and select in the next step Current I rms.

After selecting a datafile and the new template you can generate your report





4.6.8 Data Analysis on PC / Copy data of instrument

All data can be analyzed on your personal computer. There are two options to copy the data:

Option 1: Copy data folder to your PC

For this option only the report tool needs to be installed on your PC.

- 1) Copy whether the data folder, where all measurements are stored, of your instrument,

ENADData

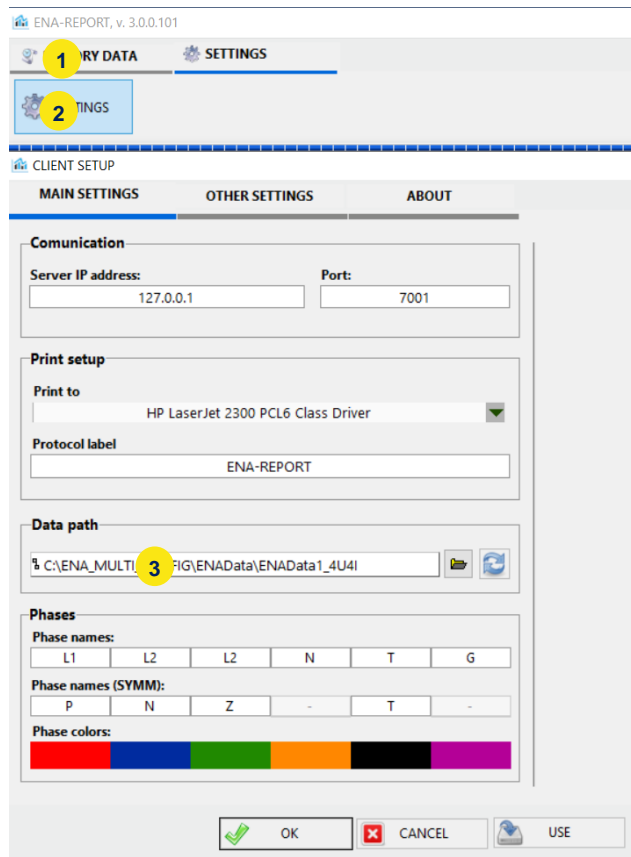
or the folder of the measurement to your PC

4U4I

Measurement 1

Measurement 2

- 2) The easiest way is to copy the folder to the exact same path of the installation folder. If you use another directory, you need to adjust the data path (3) in the settings of report tool, see screenshot:



Option 2: Remote data transfer via Measure mode

For this option the full software (Measure and Report tool) needs to be installed on your PC and the measurement instruments need to be in the same network (LAN). This option is especially helpful, if you have multiple instruments connected in the same network. You easily can transfer data to your personal computer of multiple devices and can check live values, storage space and other parameters. How to setup this option is described in the software manual.



4.6.9 NEO Measurement World - NEO Updater

NEO Measurement World 1.2.0.3

1	2	3	4	5
Software	Quick-Start Manual	Product Manual	Update	Running
ENA Measurement PQ Data Acquisition Software				Active
ENA Report Report Generation Software				Not Active
NEOSoft Data Acquisition Software				Not Active
Grid Impedance Grid Impedance Analysis				Not Active
NEODesk Support Remote Client				Active

6 Useful Links

- [Video Overview](#)
- [Technical Reference Manual](#)
- [Sensors and Accessories Manual](#)
- [Download Portal](#)
- [Desktop Report Tool Installer](#)

7 Contact

- <https://www.neo-messtechnik.com>
- support@neo-messtechnik.com
- [Contact Partner](#)
- [LinkedIn](#)
- [Youtube](#)
- Phone: +43 2642 20301

1) In the Software column, you will see a list of NEO programs. Programs that are grayed out are not available on your device. Clicking on the icons that are not grayed out will start the software.

Some software solutions cannot run simultaneously. If you try to start a new program, Measurement World will ask for permission to close any incompatible software before launching the program you selected.

2) Click the PDF icon in the Quick-Start Manual column to open the Quick-Start Manual for the software in the same row.

3) Click the PDF icon in the Product Manual column to open the Product Manual for the software in the same row.

4) When the icon in the Update column changes to a grey download arrow, a new update is available. Click the download arrow icon to start the update process.



For further information refer to the next section: [Update Process](#)

5) In the Running column you can see which NEO programs are currently active on the device.

6) Under Useful Links, you will find several resources to help you use your NEO measurement device.

7) Under Contact, you will find all the information needed to get support from our technicians.



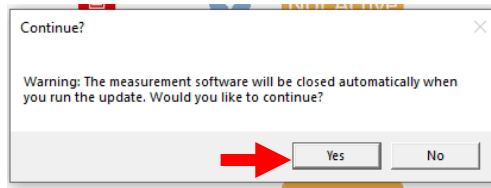
4.6.9.1 Update Process

To start the update process click on the grey download button in the update column. If the button is replaced by a green hook symbol, you are using the most recent version and now update is necessary.



The updater needs to close your measurement software to install the new version. Click on yes to close your measurement software.

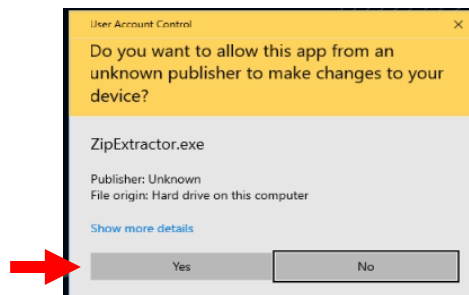
Attention: This will stop any measurement you may have started. No more data will be acquired until the Update is finished and you restart your measurement.



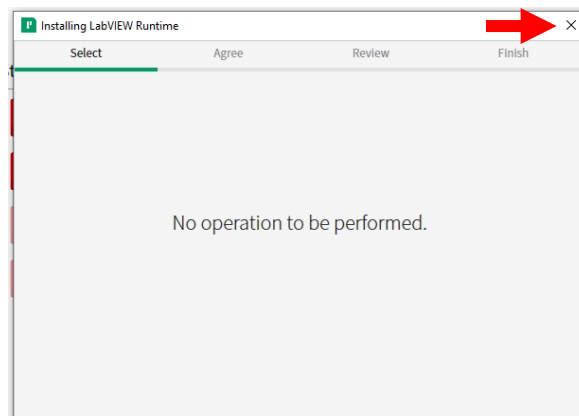
A release note window is opened, please click on the Update button to continue:

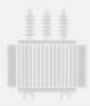


The software will download the Update automatically. Once the download is finished, let the ZipExtractor unpack the Update files onto your device. Please click on Yes.



The updater will now install any new software components and any new LV runtimes. When asked please restart your system or if no further operation is to be performed, close the LV runtime window. Congratulations your device is now on up to date.





5 Further Manuals and Links

There are a couple of additional manuals and information available for our products. All information can be found on our webpage in the download section.

www.neo-messtechnik.com

- **Technical Reference Manual**

Describes the basics of power and power quality calculations with all formulas and calculations.

- **Accessories Manual**

Shows technical data of all sensors. For all current sensors detailed technical information are found as well as accuracy specifications for different applications and use-cases.

- **Measurement Software Manual**

Detailed information for the measurement software with all functionalities described.

- **Classical Report Tool Manual**

Detailed information for the classical report tool, detailed description to all analysis and data visualization functionalities.

- **NEO Messtechnik Brochure**

Showing all products and accessories available.

- **Quick Start Manual**

This quick start manual is available online and as PDF.





6 Overview Training Videos

Measurement Software

- 1) [How to Start Storing](#)
- 2) [How to change Wiring](#)
- 3) [How to change Measurement Parameters](#)
- 4) [How to set Sampling Rate](#)
- 5) [How to set Envelope Trigger](#)
- 6) [How to change Event Lengths](#)
- 7) [How to show Scope or Vector Scope](#)
- 8) [How to show Higher Frequency Components](#)
- 9) [How to Stop Storing](#)

The screenshot shows a YouTube search results page for the query 'neo messtechnik'. The browser address bar shows the URL: https://www.youtube.com/results?search_query=neo+messtechnik. The search bar contains 'neo messtechnik'. The first video result is 'Power Quality Explained' with 131 views, posted 3 years ago by NEO Messtechnik. The video thumbnail features the 'neo' logo, a lightbulb, and a laptop displaying 'Power Quality?'. The second video result is 'PD30 Acoustic Camera for Corona and Partial Discharge NEO BST' with 13 views, posted 2 weeks ago by NEO Messtechnik. The thumbnail for this video includes the text 'What is Acoustic Imaging?' and shows three images: a microphone array, a 3D acoustic map, and a person using a handheld device. A small text block below the thumbnail explains acoustic imaging technology.



Report Software

- 1) [How to open a Datafile](#)
- 2) [How to add Limits to the FFT](#)
- 3) [How to perform Live FFT Analysis](#)
- 4) [How to show data in the recorder](#)
- 5) [How to display transients from the event list](#)
- 6) [How to zoom in and out](#)
- 7) [How to use time range setting](#)
- 8) [How to use 2nd cursor and math](#)
- 9) [How to perform 3D FFT](#)
- 10) [How to display transients in the recorder](#)
- 11) [How to display transients and half-period records](#)
- 12) [How to display disturbances and the vector scope](#)
- 13) [How to display PQ Data](#)
- 14) [How to display the Event List](#)
- 15) [How to display 2 Datafiles](#)
- 16) [How to create or edit a template](#)
- 17) [How to export raw periodic data to Excel](#)
- 18) [How to export to PQDIF](#)



19) [How to export to a PDF Template](#)

7 Maintenance and Care

Regular calibration

The Instrument must be calibrated at regular intervals as determined by the accuracy requirements of the application. For most applications a one-year cycle is appropriate. Accuracy specifications are only guaranteed if adjustments are made at regular calibration intervals. Accuracy specifications are not guaranteed unless a one-year calibration cycle is followed. Calibration cycles beyond 2 years are not recommended for any application.

Regardless of which calibration cycle you choose, it is always a good to perform a complete readjustment at each calibration cycle. This keeps the instrument within specification for the next calibration cycle and provides the best stability in the long run. Before your instrument is delivered, it is calibrated. Detailed calibration reports can be requested.

Service & Repair

The team of NEO Messtechnik performs any kinds of service and repairs to your system to assure a safe and proper operation in the future. Contact us for more information.

Repair and maintenance work has to be carried out by NEO Messtechnik or a authorised service partners using original spare parts only. by NEO Messtechnik recommends having the system tested and maintained at a Megger service centre once a year. It is not necessary to open the housing of the device t o commission and operate the system. Opening the housing causes the immediate termination of all warranty claims!

The connections and connection leads of the system must be regularly tested to ensure that they are free of defects and intact, in accordance with the applicable national and company-specific arrangements.

Storage

If the device is not used for a lengthy period, it should be stored in a dust-free and dry environment.

Display

Do not clean the display with aggressive products such as solvents or spirits. Instead, use lukewarm water and a soft, lint-free cloth for wet wiping, or a microfibre cloth for dry wiping



Training

We offer various training options (In-House, On-Site, Remote). Contact your local distributor or NEO Messtechnik directly.



Revision History

20.03.2020	Version 1	Initial Version of Manual
02.04.2020	Version 1.1	Adding Report New chapter
14.05.2020	Version 1.2	Adding PMU functionality
07.07.2020	Version 1.3.	Events, Alarms, Disturbance, EN50160
13.08.2020	Version 1.4	Picture Connection
31.08.2020	Version 1.5	Measure and Analysis updates
11.01.2021	Version 1.6.	EN50160, PQM, Events, Multisystems, Export
22.02.2021	Version 1.7	PQA8000H
30.04.2021	Version 1.8	Events description
12.08.2021	Version 1.9.	Report Generator
11.02.2022	Version 2.1.	PQA7000
19.06.2023	Version 2.2.	Complete Update Report New 3.6.2. – 3.6.8.
09.07.2023	Version 2.3.	Trigger description expanded. Table /example added
11.08.2023	Version 2.4.	THD description added
30.10.2023	Version 2.5.	Envelope trigger image changed
22.12.2023	Version 2.6.	Reset Energy Registers; Export Option
20.02.2024	Version 2.7.	Export PQM PDF
30.03.2024	Version 2.8.	Safety Guide Lines
27.05.2024	Version 2.9.	Digital In Description
12.06.2024	Version 2.10	Updated Version
26.07.2024	Version 2.11	Neo Updater

Contact

When you are working with our products we want to provide you with the greatest possible benefits. If you need any support, we are her to assist you.

support@neo-messtechnik.com

www.neo-messtechnik.com

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