

# PQM200

## User Manual V2.2



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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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# 1 Safety Information

## 1.1 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)



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.



## 1.2 Warranty

The warranty for the instrument is 4 years – usual operating conditions preconditioned.

## 1.3 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](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.



## 1.4 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**



## 1.5 RoHS

- This product is compliant with the RoHS - Directive.
- For further information see:  
[http://ec.europa.eu/environment/waste/rohs\\_eee/index\\_en.htm](http://ec.europa.eu/environment/waste/rohs_eee/index_en.htm)



## 2 Hardware

The PQM200 is an All-in-one Power Quality Analyzer capturing Time-domain, frequency-domain data as well as Transients and Disturbances.

Front View:



Rear Side:



The majority of connector pins for measurements are located on the back side. The PQM200 base unit offers 4 slots for input modules. The picture below shows the back side of the PQM200 unit including one input slot (PQM200-V4C4D-144k24-SS) having 4x differential voltage inputs, 4x current inputs, digital in and digital out.

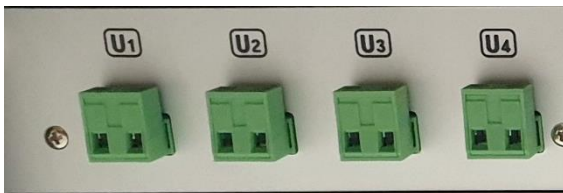




## 2.1 Input Card PQM200-V4C4D-144k24-SS

### 2.1.1 Voltage Inputs

The voltage signals are connected via screw terminals. All the channels are differential inputs and isolated channel by channel and channel by ground. For each voltage input a 2-pin screw terminal is available. This allows any kind of measurement (inverter measurements, mixed AC/DC measurements or mixed frequency measurements 50Hz/16.7Hz) and ensures highest signal quality



Pin	Signal
Left	U+ (L)
Right	U- (N)

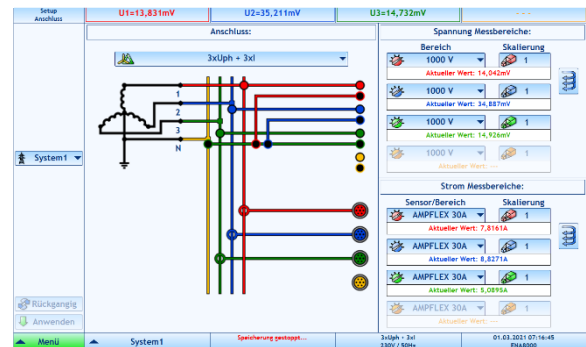
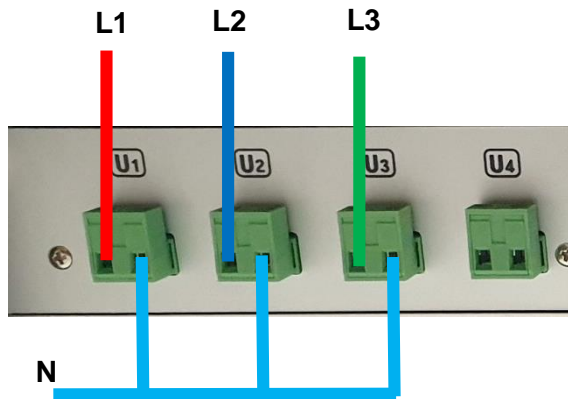


The voltage inputs supports DC and AC measurement. Please refer to the “*Neo Technical Reference Manual*” for detailed information.



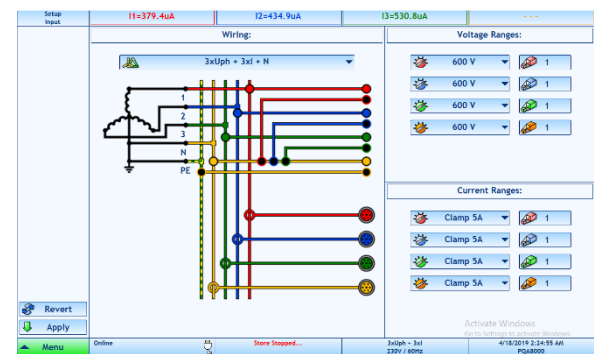
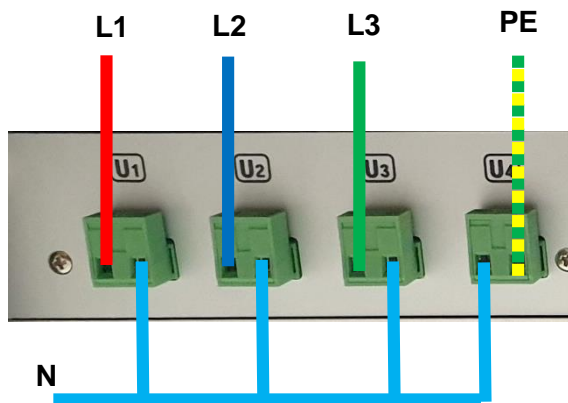
Exemplary connection for **STAR (Y)** connection:

(Hardware Wiring on the left + Software setup on the right)



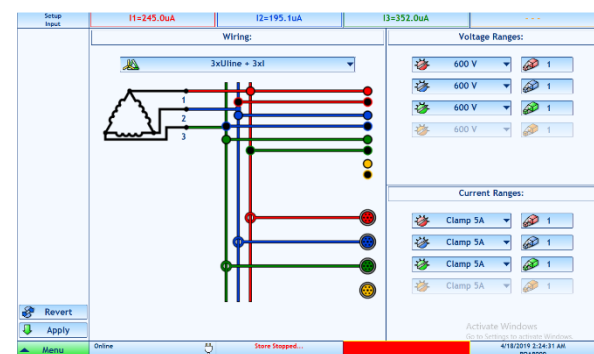
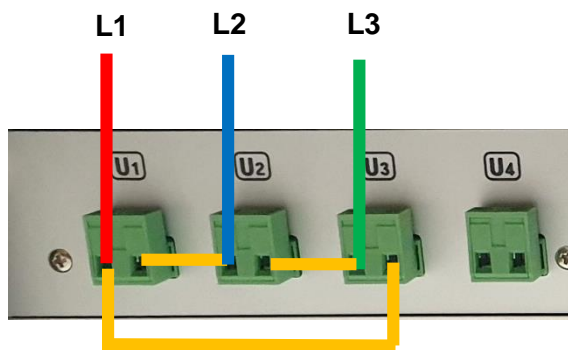
Exemplary connection for **STAR + N-PE** connection:

(Hardware Wiring on the left + Software setup on the right)



Exemplary connection for **DELTA** connection:

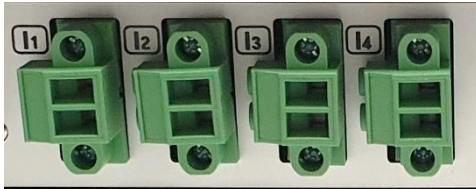
(Hardware Wiring on the left + Software setup on the right)





### 2.1.2 Current Inputs

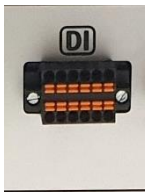
The PQM200-V4C4D-144k24-SS input module offers 4 current inputs for direct current measurement up to 5A rms. The inputs are located on the back side of the PQM200 instrument.



For detailed information how to connect to the current path, please refer to the “Neo Technical Reference Manual” for detailed information.

### 2.1.3 Digital Input

The isolated digital inputs (8 bit) are located on the back side of the PQM200. The pinning is shown in the following picture:



+5V	DI0	DI1	DI2	DI3	DIGND
2	4	6	8	10	12
1	3	5	7	9	11
GND	DI4	DI5	DI6	DI7	FGND
DI8 : 2.54mm Terminal Block					

	CH	8
<b>Digital Input</b>	Isolation Type	CH-GND 3kVp Isolation
	Schematic	Buffer Input, 1MΩ Input Impedance
	Positive Trigger Voltage	Adjustable 0~50V (CH1~8)
	Negative Trigger Voltage	Adjustable 0~50V (CH1~8)
	Trigger Resolution	12mV
	EXT Power for DI	-



## 2.1.4 Digital Output

The isolated digital outputs (2 bit) are located on the back side of the PQM200. The pinning is shown in the following picture:



DO0	DO1	DO2	
2	4	6	8
1	3	5	7
DO0_COM	DO1_COM	DO2_COM	FGND

Digital Output	CH	2
	Isolation Type	CH-GND 3kV Isolation
	Schematic	Open Collector Output
	Load Voltage	80V MAX (Reverse 7V MAX)
	Load Current	0.02A MAX
	Load Power	150mW MAX



## 2.1.5 Specification PQM200-V4C4D-144k24-SS

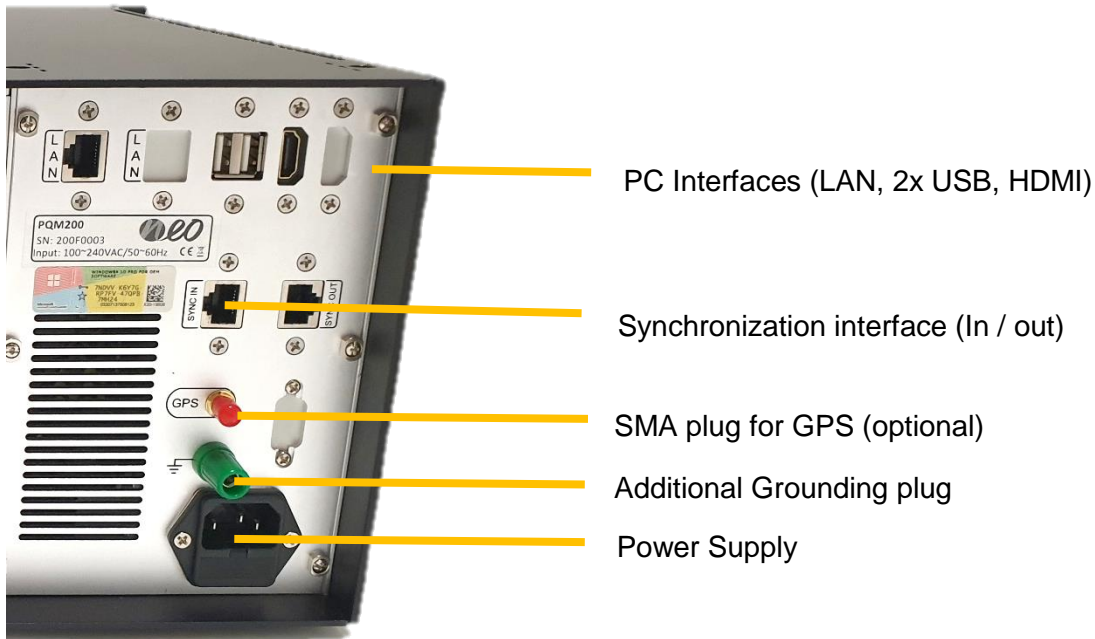
ANALOG			Voltage	Current
Channel			4	4
Input Range			±1,600Vp MAX	±5A rms
Safety Category			CATIII 1000Vrms, CATIV 600Vrms	
DC Accuracy			±0.05%FS	±0.1%FS
Offset Drift			6mV/K (MAX)	
Input Resistance			10Mohm	
ADC	Type		Delta-Sigma	
	Oversampling Frequency		9MHz(Typ.)	
	Data rate		144ksps(MAX)	
Filter Bandwidth	-3dB BW	Analog		630kHz 4th Order Butterworth
		Digital (FIR)	No FIR filter	68kHz@140ksps
			One FIR 700 order	9.6kHz@20ksps,140ksps
			Two FIR 700 order	3.1kHz@12ksps,6ksps
			Two FIR 700 order	2.6kHz@10ksps,5ksps
	-0.1dB BW	Analog		320kHz 4th Order Butterworth
		Digital (FIR)	No FIR filter	66kHz@140ksps
			One FIR 700 order	9.2kHz@20ksps,140ksps
			Two FIR 700 order	3kHz@12ksps,6ksps
			Two FIR 700 order	2.5kHz@10ksps,5ksps
Measuring BandWidth	-3dB	68kHz		
	-0.1dB	66kHz		
Typical SNR	95dB			
Typical CMRR	90dB			
Isolation Type			CH-CH	
Isolation Voltage			6kVp	Sensor Isolation
Measurement Category @ <Pollution Degree 2				
Surge			±4000V	
Burst			±4000V	



## 2.2 PQM200 base unit

Integrated PC		Intel® Core™ i7 processor, 8GB RAM, Antenna for WiFi and GPS, 64-bit Microsoft® Windows® 10 operating system,
PQM200 base unit		19" rack-mountable chassis, 4U, 300mm depth, 4 free slots for user exchangeable modules,
Storage		SSD 1 TB
Synchronisation		2x Sync Ports for synchronization of multiple devices
Power supply		90~250VAC / 47~63Hz
Power consumption		Typ. 40W
Temperature range	Operating	0°C ~ +60°C
	Storing	-20°C ~ +80°C

The following picture shows the PQM200 base unit from the back side





## 2.2.1 Computer Interface

The Computer interfaces are located on the front and back side.

One 1GB Ethernet interface, two USB3.0, two USB2.0 interfaces and one HDMI port for an external monitor.



HDMI Port	
Pin	Signal
1	TMDS data2+
2	TMDS data2 shield
3	TMDS data 2-
4	TMDS data 1+
5	TMDS data1 shield
6	TMDS data 1-
7	TMDS data 0+
8	TMDS data0 shield
9	TMDS data 0-
10	TMDS clock +
11	TMDS clock shield
12	TMDS clock -
13	CEC
14	NC
15	DDC clock
16	DDC data
17	GND
18	+ 5V
19	Plug detected

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

2x 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-



### 2.2.2 Antenna

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.

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

### 2.2.3 Status LED

The status LED is located on the upper left side of the PQM200 front side.

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





### 3 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.

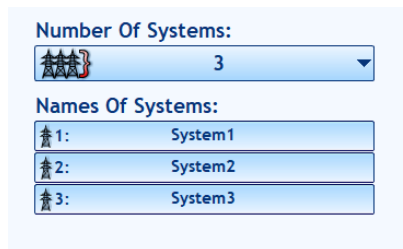
#### 3.1 Start Measurement Software

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”

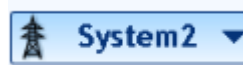
The number of systems can be configured at: „Setup“ – „Misc.“ – „Multisystem“.

If one system is selected, then automatically the 4U4I configuration will be active.

If two systems are selected then depending on the instrument version the 3U3I+1U1I config (PQA8000) or the 3U3I+3U3I config (PQA8000M, PQA8000P) will be applied..



In the software you can switch between the systems with this button:



The button is either located on the bottom of the screen (Measurement mode) or on the left side (Configuration).

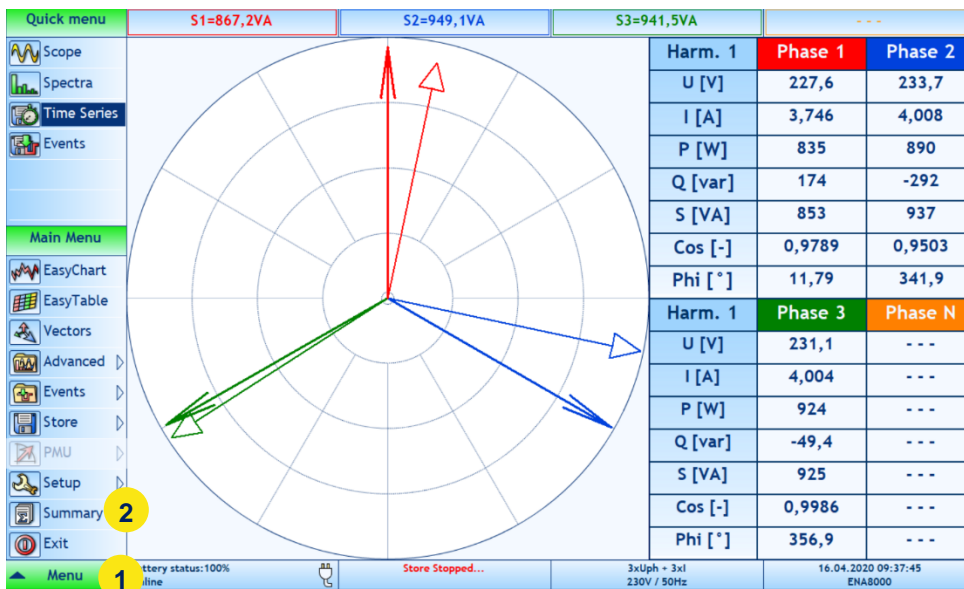
Note: The instrument always starts-up in the last used configuration (Sampling Rate, connection, range, language etc.)



## 3.2 Quick Start with a simple setup

### 3.2.1 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).



### 3.2.2 Basic Wiring Setup

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

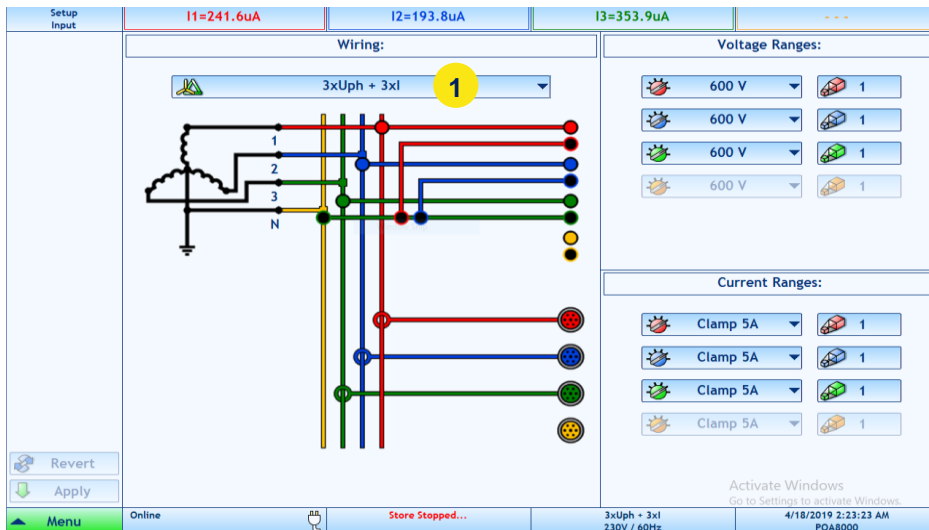
*Alternative Navigation: "Setup" – "Input"*



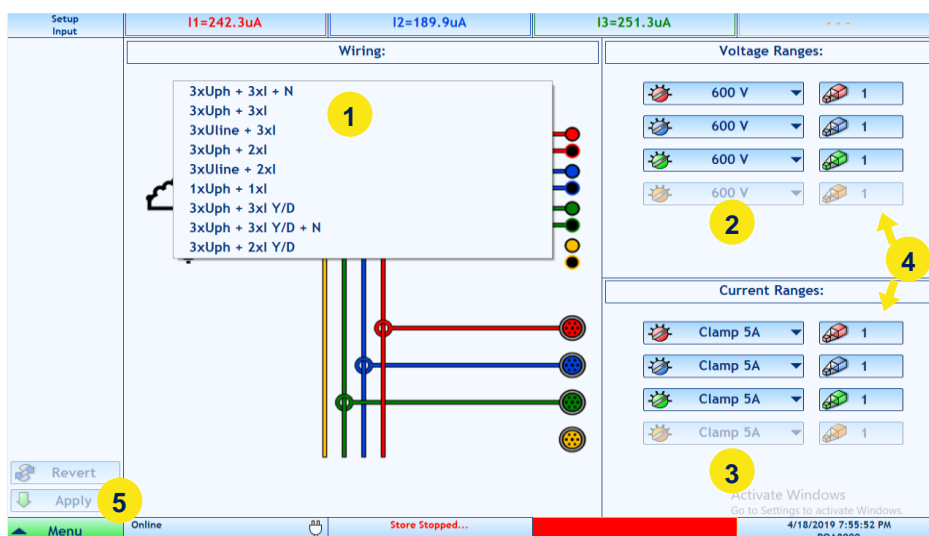


The following picture shows the 'Setup Input' panel for the wiring setup. The **Setup Input panel** allows changing the input wiring, input ranges, sensors and scale factors.

- 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)





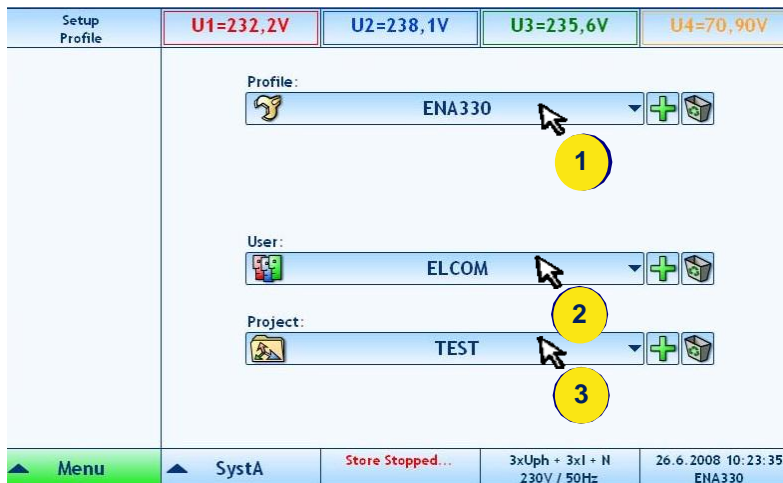
### 3.3 Main Menu

#### 3.3.1 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

#### 3.3.2 Setting the user language

Navigation: "Setup" – "Options"

The Setup Options panel allows changing the language.



1. Page selector
2. Available languages



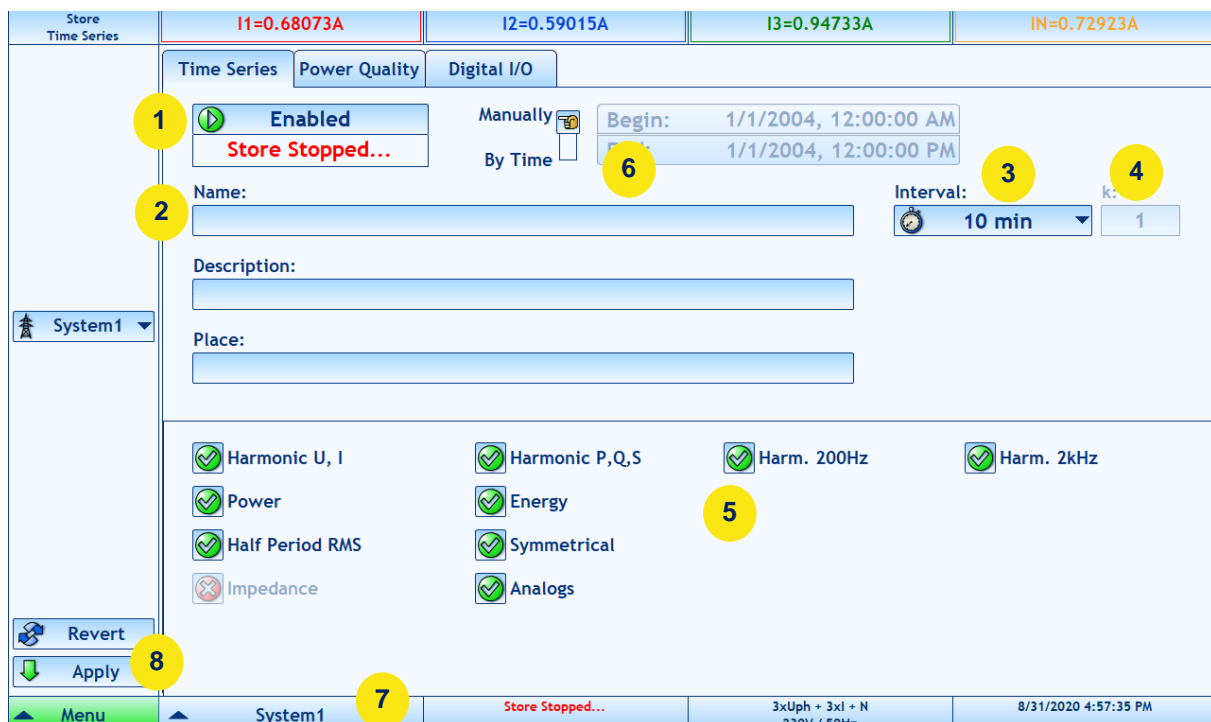
### 3.4 Data Storage

#### 3.4.1 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: **3xUp + 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... 3xUp + 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



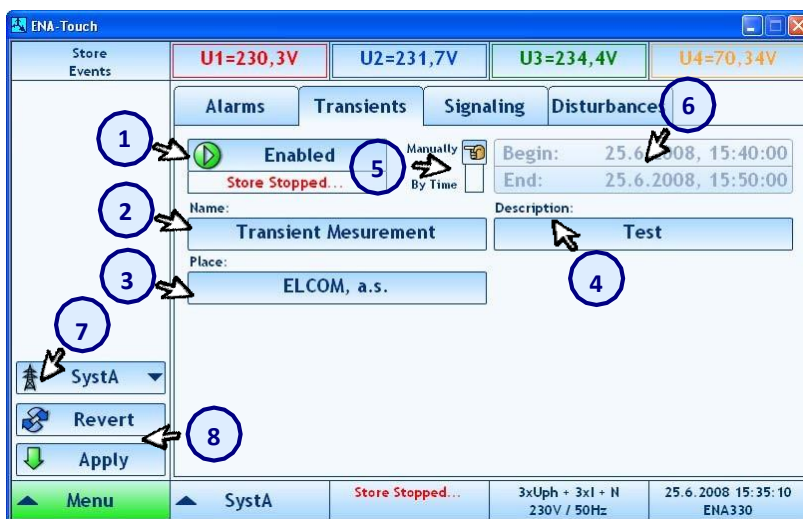


### 3.4.2 Store Events/Transients Panel

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).



### 3.5 Measurement

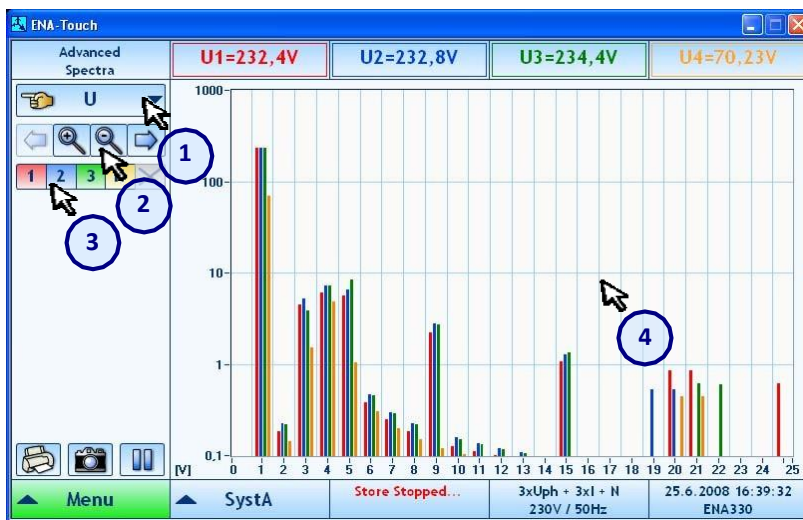
#### 3.5.1 FFT / Spectra

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

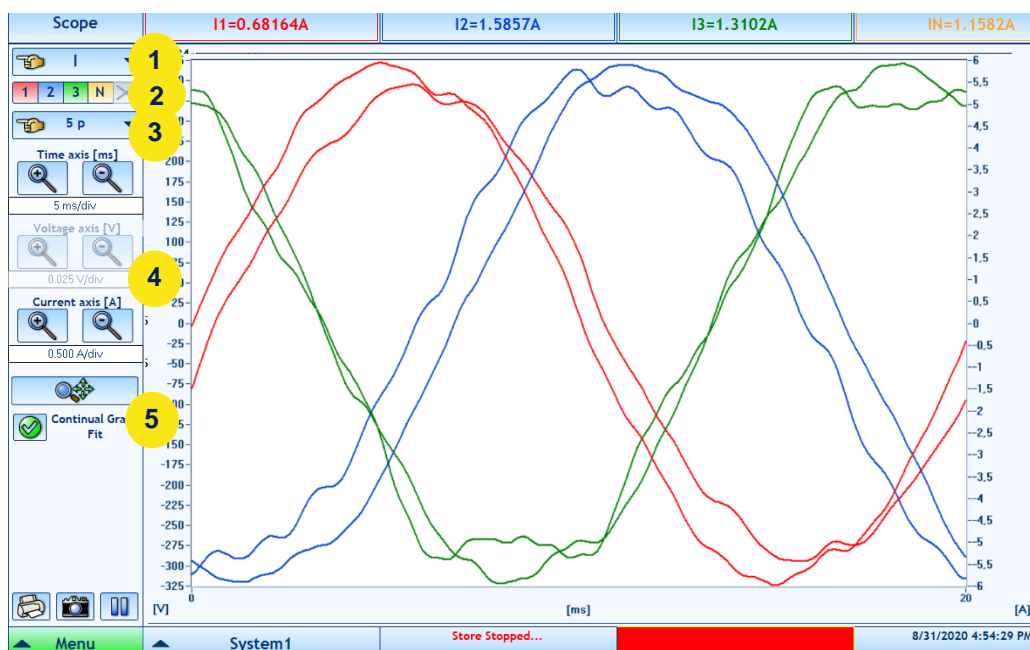


### 3.5.2 Oscilloscope

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)

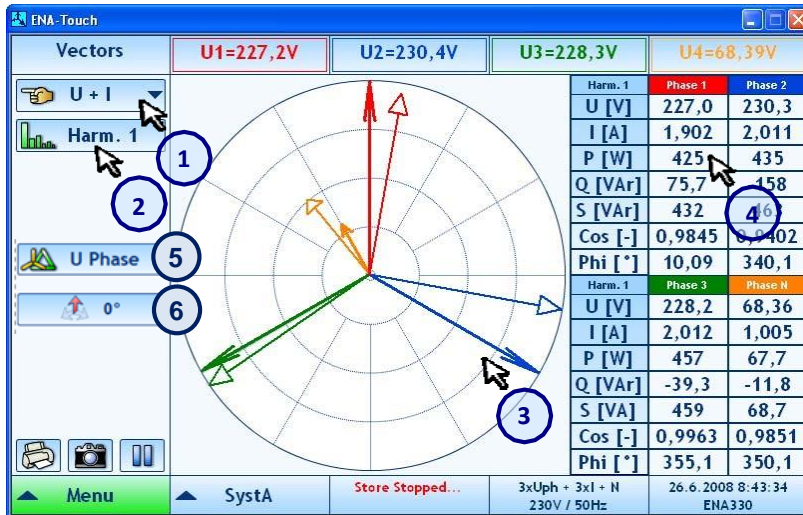


### 3.5.3 Vector Scope

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



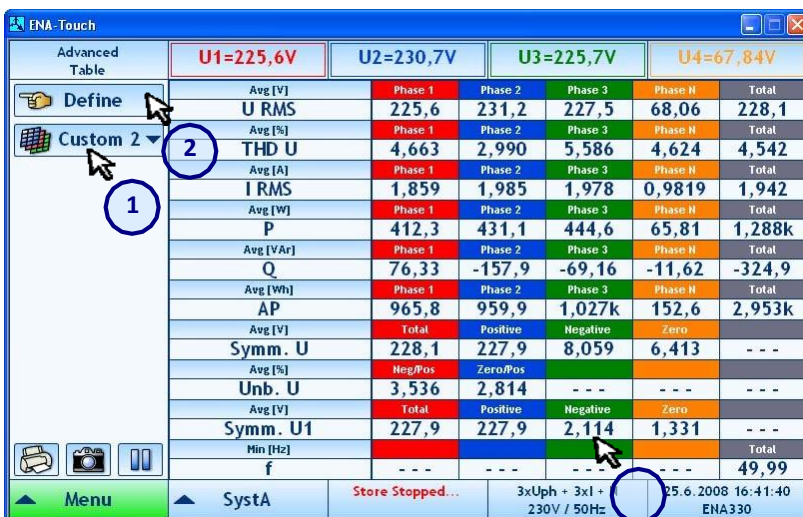
1. Displayed vectors – both or voltage only or current only
2. Selected harmonic – clicking on this button will open keyboard to insert harmonic number
3. Vector diagram
4. Additional instant values of selected harmonic
5. Selection of Delta or Star values
6. Selection of Vector Scope reference point

### 3.5.4 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.

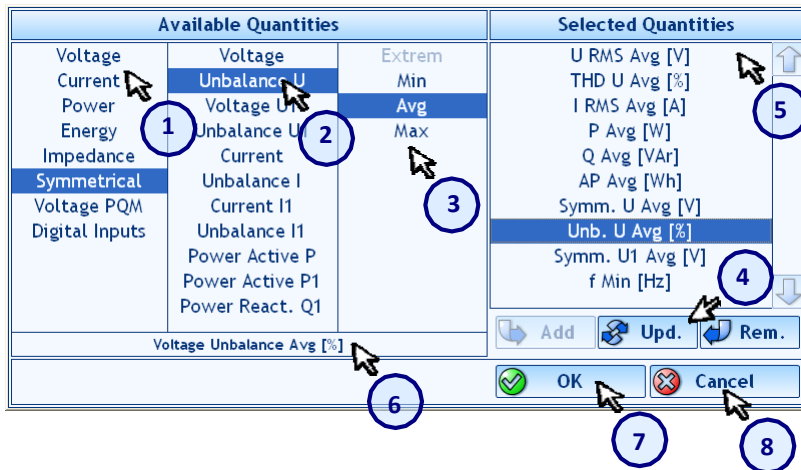
- Displayed values can be selected either from basic quantities, voltage, current, power or additional customizable tables.
- If the custom view is selected, the ‘Define’ button allows changing the selected quantities.



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:



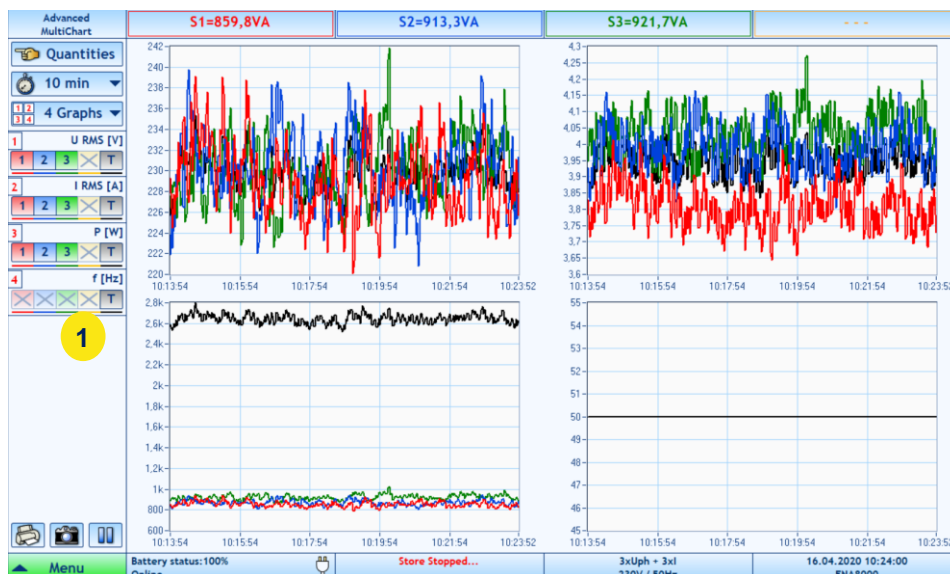
1. Select basic quantity
2. Select derived quantity
3. Select Min/Avg/Max
4. Click Add or Update button to add or change selected quantity
5. Selected quantities list
6. Name of selected quantity
7. Click OK button to apply changes
8. Click Cancel button to cancel

### 3.5.5 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 0).
- On the left side (1) you can define which phases should be shown of the individual quantities.



### 3.5.6 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		
Init	Quantity	Limit	Max*/Min	Above*/Below	% OK	
Evaluation Start: 16.04.2020 09:40:00	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		[f]	[%]	[%]	
	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 Flagg		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	0
		Dips<90%	0	0	0	0	0	0	0	0	0	0
		Dips<85%	0	0	0	0	0	0	0	0	0	0
		Dips<70%	0	0	0	0	0	0	0	0	0	0
		Dips<40%	0	0	0	0	0	0	0	0	0	0
		Dips Total	0	0	0	0	0	0	0	0	0	0
		Interruptions<5%	0	0	0	0	0	0	0	0	0	0
		Total	0	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 Flagg		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 Flagg		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



### 3.5.7 Transient, Event and Disturbance Recorder

#### 3.5.7.1 Event Definition

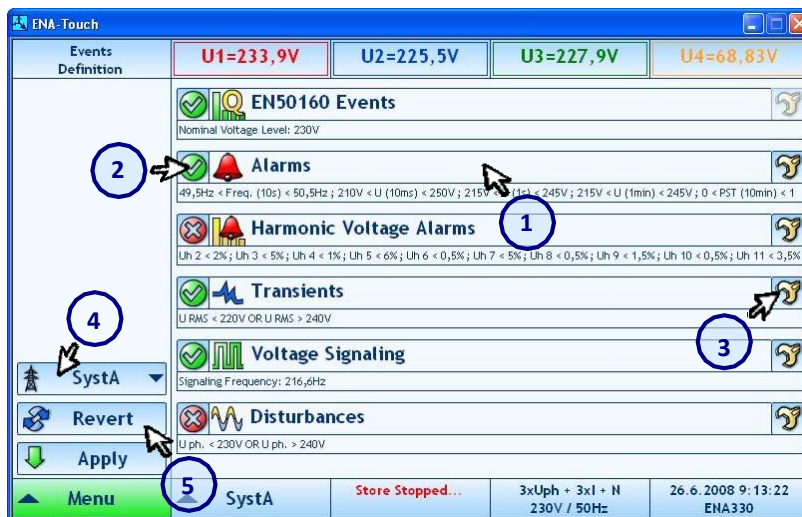
Navigation: “Events” – “Definition”

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

Type	Recording
<b>EN50160</b>	Event list of all EN50160 limit violations
<b>Alarms</b>	Event list of defined alarms
<b>Harmonic Voltages</b>	Event list of harmonic voltage limit violations
<b>Transients</b>	<b>Raw Data Record with full sampling rate</b> at limit violation
<b>Signalling Voltage</b>	Record of binary signal of Signalling Voltage
<b>Disturbances</b>	<b>½ Period record and Raw Data record</b> 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
<b>Frequency (50Hz)</b>		
Limit 1	99 - 101%	>= 99,5%
Limit 2	94 - 104%	= 100%
<b>Voltage (230V)</b>		
Limit 1	90 - 110%	>= 95%
Limit 2	85 - 110%	= 100%
<b>Flicker</b>		
Flicker PLT	<= 1	>= 95%
<b>Unbalance U</b>		
Negative U	<= 2%	>= 95%
<b>Signalling U</b>		
216,66Hz	<= 9%	>= 99%
0Hz	-	>= 99%
0Hz	-	>= 99%
0Hz	-	>= 99%
0Hz	-	>= 99%
<b>THD U</b>		
THD U	<= 8%	>= 95%
<b>Harmonic U</b>		
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%

Revert    Apply

Nominal Voltage Level: 230V

Nominal Voltage Level Type: Constant

EN50160 Signalling Frequency: n  
216,66Hz    1

Percentil: 95%

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.

Limits    Events    RVC Events

Steadiness Of Steady State: 0,2%

Min Rate Of Change: 0,5%/s

Min Steady State Difference: 1%

Min Steady State Duration: 1s

Default Settings: Load Defaults

## 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):

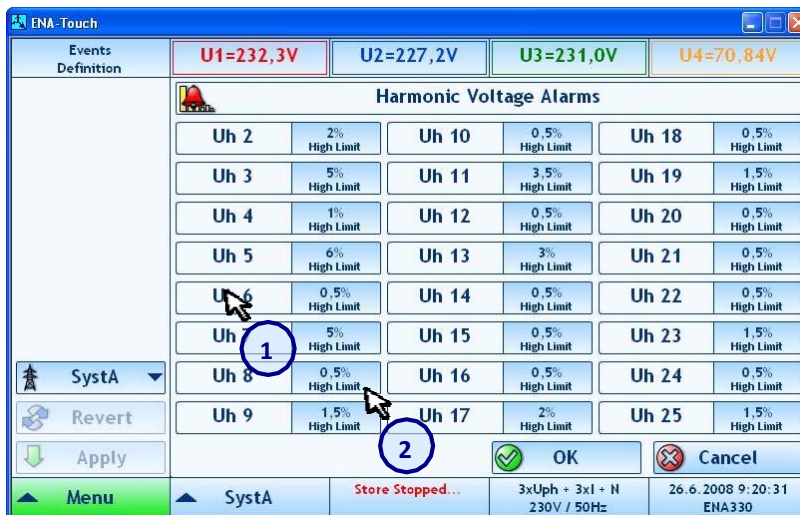


1. List of available quantities
2. Alarm enable/disable button
3. Alarm limits

### 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 (2<sup>nd</sup> to 25<sup>th</sup>). 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”

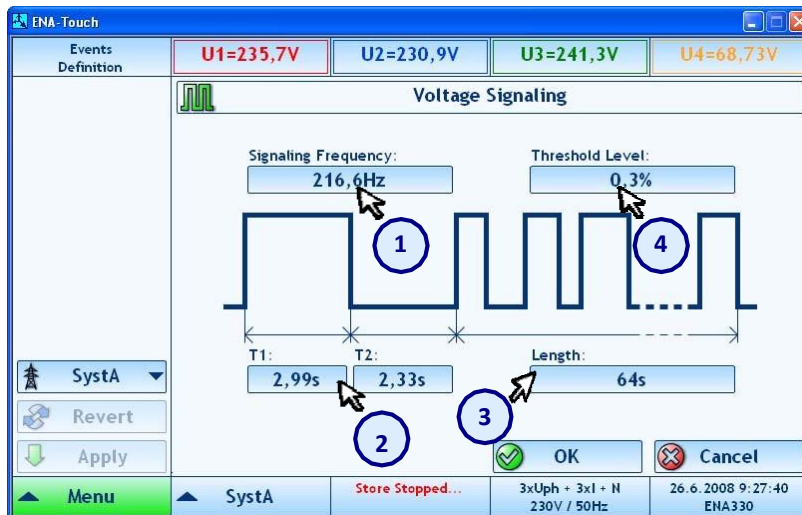
Voltage Signaling is used for the remote control of specific devices by a signal superimposed on the fundamental frequency.

- 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.



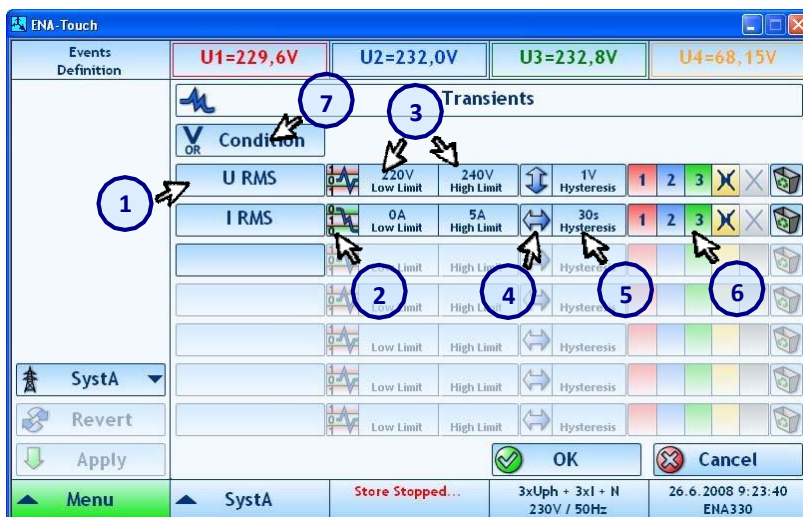
1. Signaling frequency
2. Start pattern (length of logical 1 and logical 0 on the beginning of the signal)
3. Maximum signal length
4. Threshold level

## Transients

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

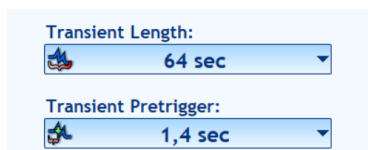
Transients are stored in full sampling rate (sampling rate defined in “Setup”-“Processing”).

- 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.







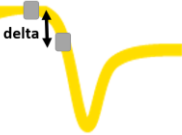
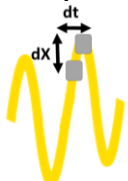
1. Evaluated quantity
2. Window type
3. Limits
4. Hysteresis type
5. Hysteresis
6. Phases
7. Coupling between quantities

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

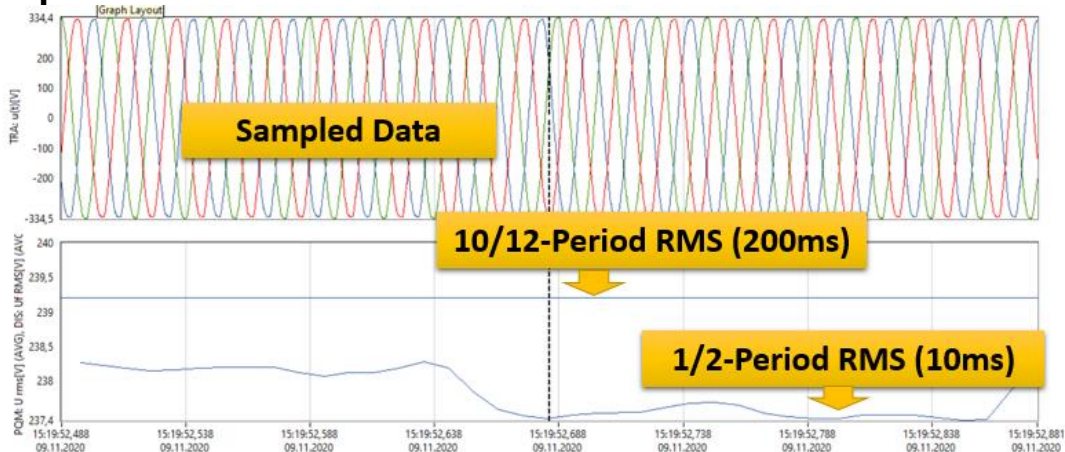




The following table shows the different trigger types and their calculation base.

Type	Time Base
<b>RMS (U, I)</b> Upper Limit  Lower Limit	½ Period RMS values
<b>Harmonic (U, I, THD, etc.)</b> 	200ms values (10/12 period-values)
<b>P, Q, S, PF, phi</b> 	200ms values (10/12 period-values)
<b>Frequency</b> <b>Delta Frequency</b>	1 period value Delta between period-values
<b>MAX (U, I)</b> 	Waveform (Sampled values)
<b>Delta</b> 	Delta between period values based on ½ period-values (sliding window)
<b>dX/dt (dU, dI)</b> 	Waveform (Sampled values)
<b>Derivate</b>	Voltage, Current

### Explanation time interval

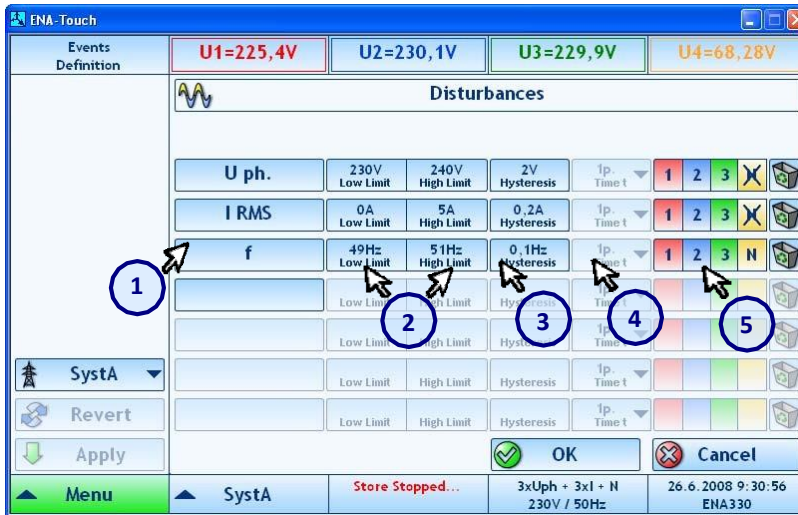




## Disturbances

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

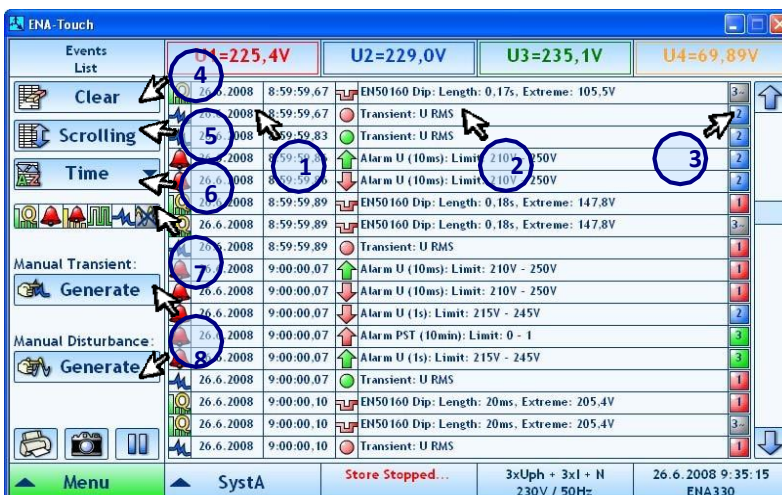
- Storage Length and Pre-Trigger time of Disturbances can be defined in Misc. setup panel (Menu → Setup → Misc. → Disturbances).



### 3.5.7.2 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



### 3.5.8 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.

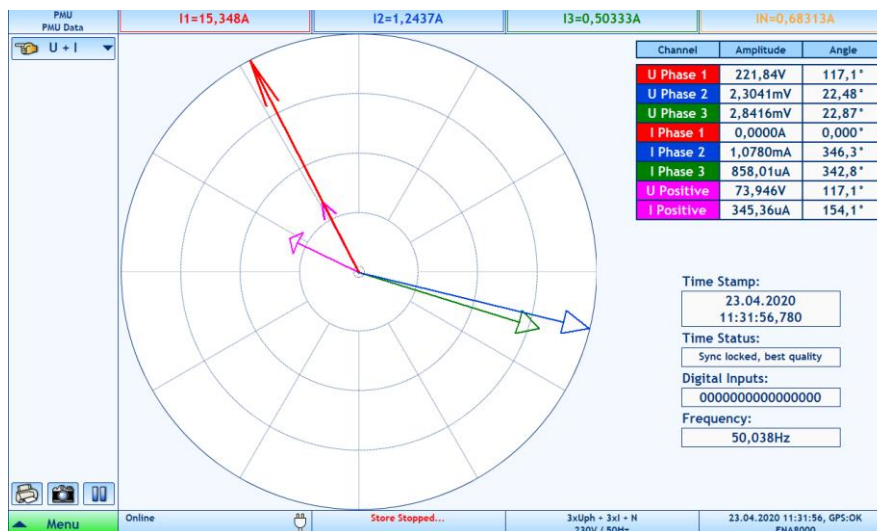
Using the PMU function doesn't store any data on the instrument. For PMU application a central software is needed, which receives the data streams of the instrument. For PMU measurements at least two PMU's needs to be installed.

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

#### 3.5.8.1 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.





### 3.5.8.2 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:		0V	600V		
<input checked="" type="checkbox"/>	Voltage, Phase 1	PhasorUL1	0V	600V			
<input checked="" type="checkbox"/>	Voltage, Phase 2	PhasorUL2	0V	600V			
<input checked="" type="checkbox"/>	Voltage, Phase 3	PhasorUL3	0V	600V			
<input checked="" type="checkbox"/>	Current, Phase 1	PhasorIL1	0A	10A			
<input checked="" type="checkbox"/>	Current, Phase 2	PhasorIL2	0A	10A			
<input checked="" type="checkbox"/>	Current, Phase 3	PhasorIL3	0A	10A			
<input checked="" type="checkbox"/>	Voltage, Positive	UPOS	0V	500V			
<input checked="" type="checkbox"/>	Current, Positive	IPOS	0A	10A			

- 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:		51 Hz					
Lower Frequency Limit:		49 Hz					
Freq. Rate of change Limit:		10 Hz/s					

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





### 3.5.8.3 Connection

Navigation: “Menu” – “PMU” – “Conn.”

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

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,



### 3.5.9 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
<b>Wiring:</b> 3xUp + 3xl + N Voltage Ranges: 500 V Current Ranges: AMPFLEX 300A		<b>Time Series:</b> Store Stopped... Interval: 10 min		<b>Power Quality:</b> Store Stopped...	
<b>Fundamental Frequency:</b> 50Hz FFT Step: Harmonics (50Hz) Sampling Rate for Transient: 9600Hz		<b>Digital Inputs:</b> Store Stopped...		<b>Alarms:</b> Store Stopped...	
<b>EN50160 Voltage Level:</b> 230V EN50160 Events: 90% / 110% EN50160 Interruption: 5%		<b>Transients:</b> Store Stopped...		<b>Signalling:</b> Store Stopped...	
<b>Profile:</b> DEFAULT User / Project: DEFAULT / DEFAULT		<b>Disturbances:</b> Store Stopped...		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



### 3.6 Data Analysis

For the data analysis two options are possible:

- 1) Data Analysis in PQM-SCADA Software (see PQM-SCADA Manual)
- 2) Data Analysis using standalone Report New Software (see Report New Manual)

## 4 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](http://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.

- **NEO Messtechnik Brochure**

Showing all products and accessories available.

- **Quick Start Manual**

This quick start manual is available online and as PDF.





## 5 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. Maintenance work should be done by NEO Messtechnik only.

### Training

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

### Measurement Service

We are happy to execute measurement services for our clients. From supporting measurement setups, data analysis to complete measurements with measurement reports we offer the full scope of services.



## 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	PQA
30.04.2021	Version 1.8	Events description
12.12.2021	Version 2.0.	PQM200
08.02.2022	Version 2.1.	PQM200 digital inputs and outputs specs
14.03.2022	Version 2.2.	Warranty Updated

## 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.

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