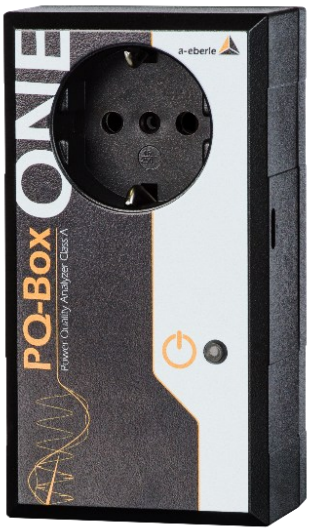
Power Quality Analyzer for power sockets

Model PQ-Box ONE

- **Load analysis and energy measurement**
- **Fault detection**
- **Evaluating power quality according to EN50160, IEC61000-2-2 /2-4 and others**
- **Oscilloscope and Half-cycle recorder**
- **Automatic phase detection**
- **Ripple Control Frequency Analysis**



1. Application

The PQ-Box ONE is a powerful, portable Power Quality Analyser for testing the quality of supply at the power socket according to EN 50160 / IEC 61000-2-2 /2-4 and others. It measures current, and the voltages between phase and neutral as well as neutral and earth.

The PQ-Box can be used as a high-precision power meter e.g. for energy audits according to ISO 50001. The aim was to develop a very compact, robust and easy to use measuring instrument with integrated power supply.

The PQ-Box ONE is intended for portable usage in the low voltage grid (300V CAT II). It is very easy to use thanks to the application-specific presetting of all trigger conditions.

To quickly identify the cause of a grid disturbance, the PQ-Box ONE is equipped with many trigger options. The PQ-Box ONE only needs to be plugged into a power socket and the recording can be started. With its large data memory, the network analyser can record all measurement data over many weeks without losing any measurement data.

A fast Wi-Fi connection and a USB-C interface are available for data transfer. In the event of a power failure, the built-in, uninterruptible and maintenance-free power supply takes over operation.

Modern power quality analysers operate in accordance with the IEC 62586 standard, which describes the complete product characteristics of a power quality analyser. In addition to the intended use, the EMC environment and the environmental conditions, this standard also defines the exact measurement methods IEC 61000-4-30 – Class A in order to create a comparable basis for the user.

Devices from different manufacturers that operate in accordance with this standard must deliver the same measurement results.

The PQ-Box ONE meets the requirements of IEC 61000-4-30 for Class A measuring devices for 100% of the parameters.

Parameter IEC 61000-4-30 Ed.4	Class
Power frequency	A
Magnitude of the Supply Voltage	A
Flicker	A
Supply voltage dips and swells	A
Voltage interruptions	A
Voltage harmonics	A
Voltage interharmonics	A
Mains signalling voltage	A
Underdevation and overdeviation	A
Measurement aggregation intervals	A
Time-clock uncertainty	A
Flagging	A
Transient influence quantities	A

Performance		
PQ-Box ONE		
Statistics according to EN 50160/IEC 61000-2-2/IEC 61000-2-4	x	
PQ-events	x	
Recording free interval (1 sec…30 min):		
Voltage: min. max. average	x	
Current: min. max. average	x	
Power: P, Q, S, PF, cos phi, sin phi, tan phi	x	
Distortion power D	x	
Energy: P, Q, P+, P-, Q+, Q-	x	
Flicker according to IEC 61000-4-15 (2010) (Pst, Plt, Ps5)	x	
Voltage harmonics mean and 200ms extreme values	up to 50th	
Voltage harmonics 200 Hz frequency bands – 2 kHz to 9 kHz	x	
Current harmonics mean and 200ms extreme values	up to 50th	
Current harmonics 200 Hz frequency bands 2 kHz to 9 kHz	x	
Phase angle of current and voltage harmonics	x	
Active, reactive, and apparent power of harmonics	x	
THD voltage, current; PWHD, PHC	x	
FFT spectrum of voltage and current	DC to 10 kHz	
Ripple control signal	x	
Frequency: min. max. average	x	
Power / Energy Interval		
10/15/30 min interval – Voltage, P, Q, S, D, cos phi, sin phi …	x	
Online mode:		
Oscilloscope recorder	x	
Half-cycle RMS recorder	x	
Voltage & current harmonics, inter harmonics	x	
FFT spectrum of voltage and current	DC to 10 kHz	
Direction of harmonics	x	
Trigger options:		
Half-cycle RMS recorder (U, I, P, Q, S, frequency)	x	
Oscilloscope recorder (U, I)	x	
Frequency trigger (level deviation, df/dt)	x	
Phase shift trigger	x	
Envelope trigger	x	
Interval trigger	x	
Automatic trigger	x	

2. Design

The robust mechanical design as well as the fact that there are no rotating parts such as fans or hard disks, make the device suitable for the toughest field use

The PQ-Box ONE is equipped with a large memory of one GByte. In this way, measured values can be stored for long periods of up to one year without any loss of data. In the event of a power failure, an internal UPS bypasses the power supply.

The measuring device is powered directly via the power plug.

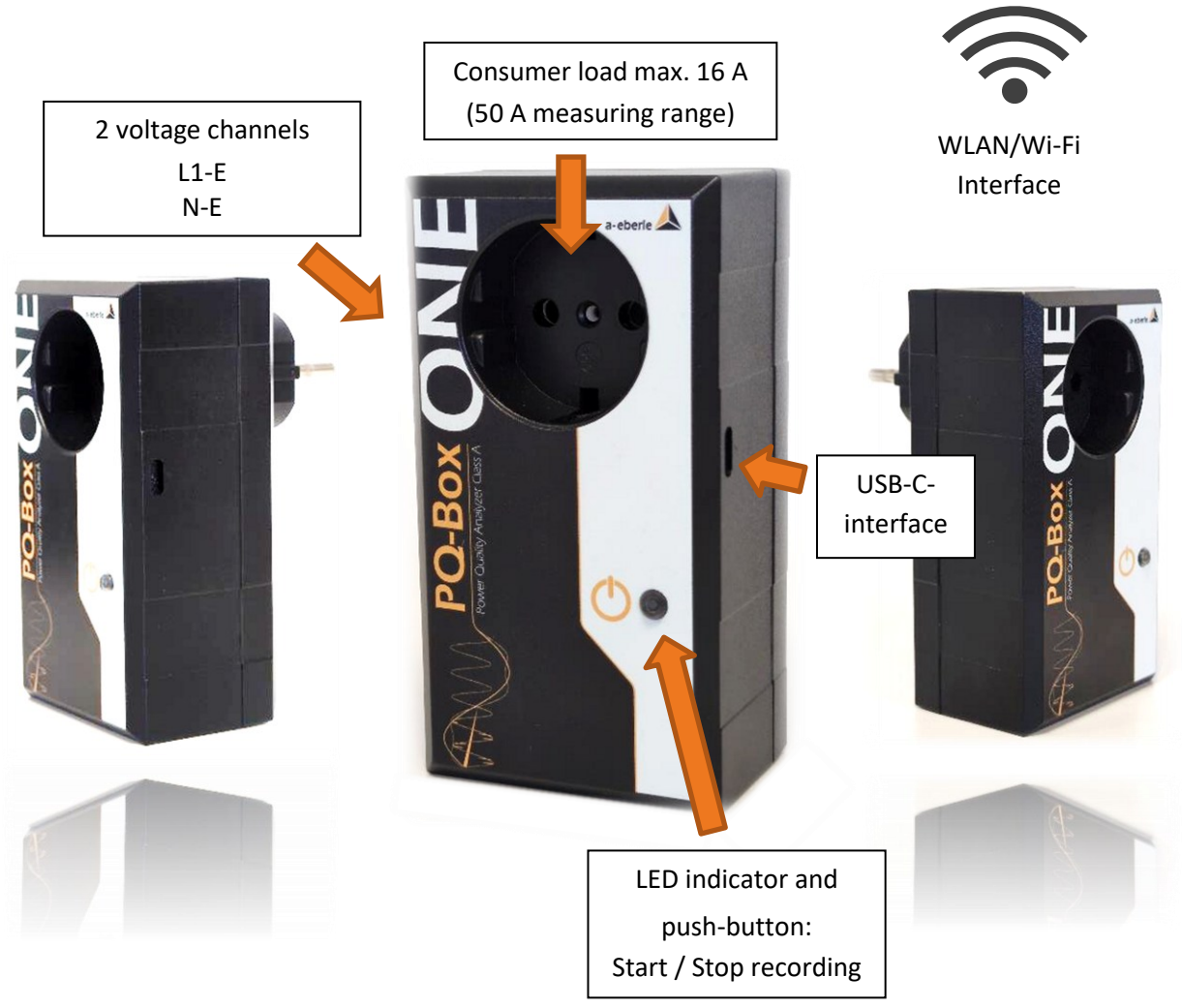
2.1 Evaluating measurement data

Recorded data is transferred to the evaluation PC via a WLAN/Wi-Fi or USB interface. The practical and comprehensive WinPQ mobil evaluation software is included in the scope of delivery and can be installed on any number of PCs.

The software offers extensive evaluation options such as load analysis or determining the cause of network disturbances. It automatically generates reports in accordance with EN 50160 / IEC 61000-2-2 and offers extensive online functions.

Updates for the evaluation software are available free of charge via the Internet (www.a-eberle.de).

2.2 Device overview



2.3 LED indicator and push button

Press the push button to start or stop recording. Various measurements can be recorded consecutively without having to read out the device beforehand. The LED indicates the various states of the PQ-Box as shown below:

LED status and description

	Off	Device is turned off.
	Steady green	Ready for operation.
	Flashing green	Recording.
	Steady orange	Memory full! Recording stopped.
	Steady red	Error.

2.4 Time synchronization

For correlating and comparing recordings from different measuring instruments, time synchronization is necessary. The PQ-Box ONE can synchronize its time stamps via the NTP protocol in a Wi-Fi network.

2.5 Bridging power supply interruptions

The PQ-Box ONE is equipped with a maintenance-free power cap for bridging short power interruptions. This buffer continues to supply the device for 30 seconds in the event of a power failure. During a power interruption, the last fault record is stored in the device's memory. In the event of longer interruptions and when the power returns, the PQ Box starts up automatically and continues the measurement. For subsequent evaluation on a PC, a measurement file is generated which shows the power interruption.

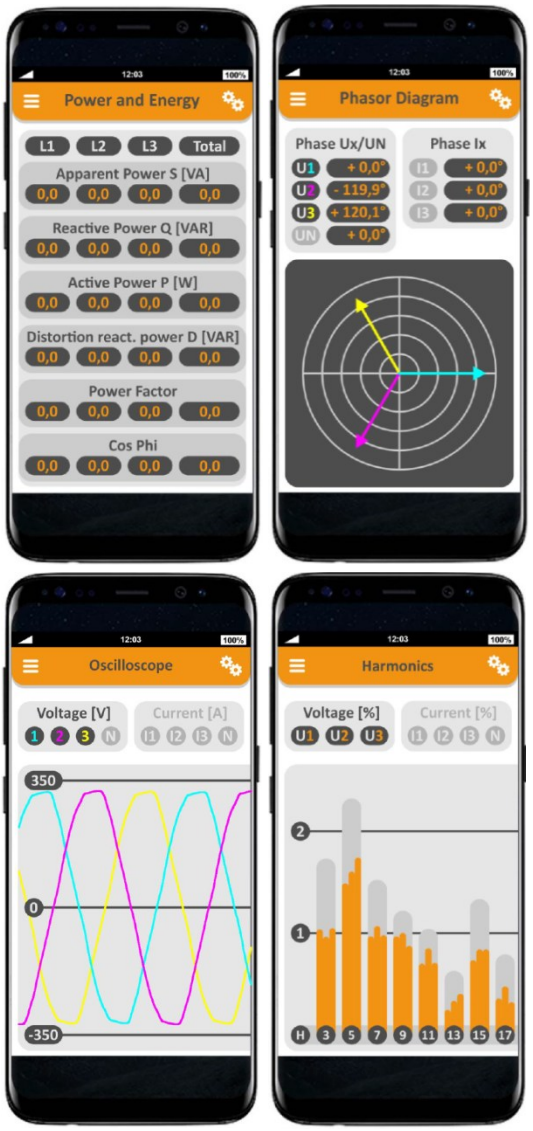
2.6 Memory

The measuring device manages the available memory (1 GB) automatically and intelligently. Many measurements can be recorded in succession without having to transfer the data to a PC.

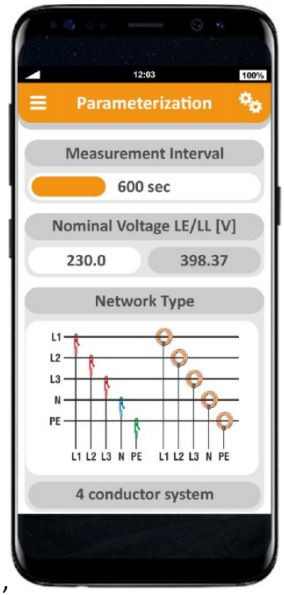
When a new recording is started, the free memory is divided up by the measuring device in a way that makes sense for long-term measurement data and interference signals. Many interference signals do not interrupt the long-term measurement.

3. PQ-Box App

Using the free PQ-Box App for Android or iOS operating systems, all measurement values can be displayed on various types of mobile phones or tablets. The PQ-Box App provides information about the correct connection of voltage leads and current clamps and displays live-data of voltage, current, THD, power, and many more variables.



The PQ-Box App allows the user to configure and parameterize the PQ-Box ONE with basic settings, like measuring interval, nominal voltage, GPS location, or power frequency.



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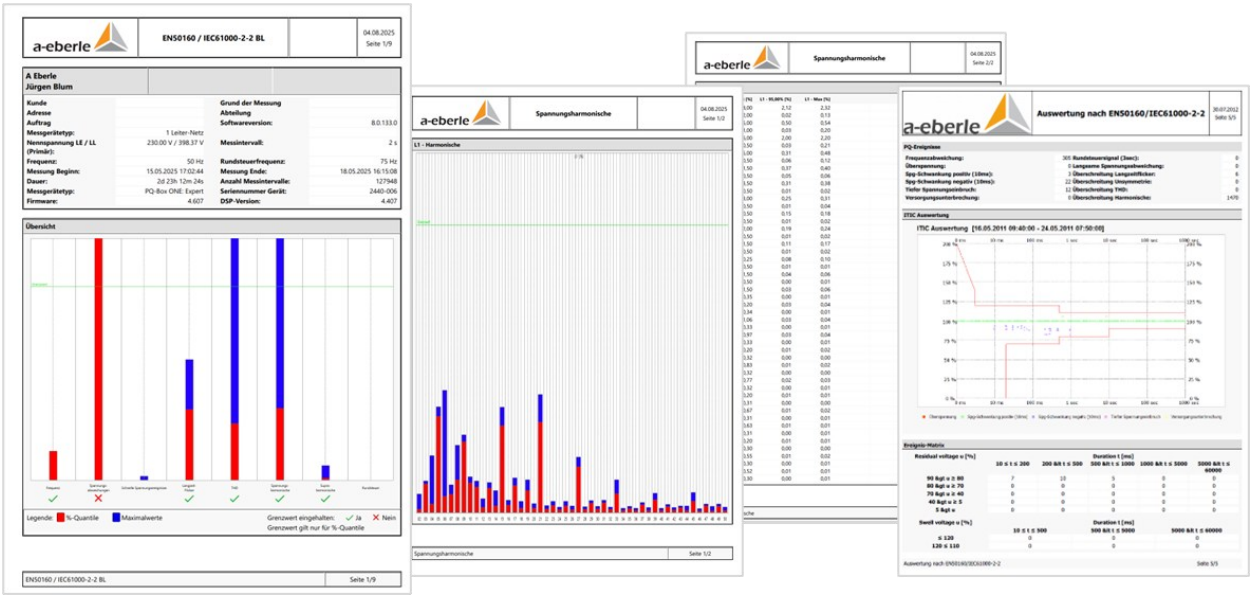
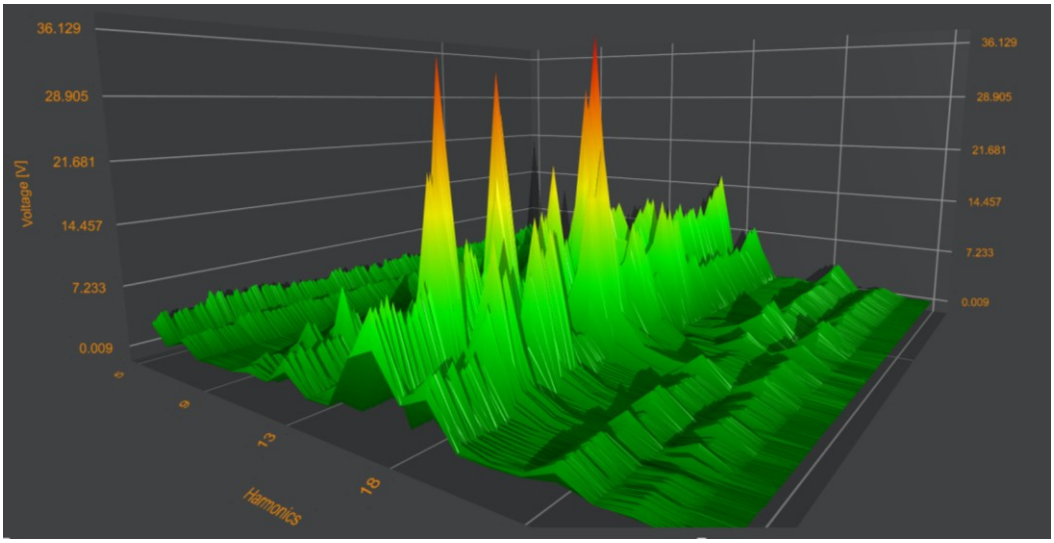
4. Evaluation and statistics

- Overview of the power quality statistic, column charts provide automatic summary of relevant parameters
- Automated reporting in accordance with EN 50160 / IEC 61000-2-2 / -2-12 (public networks), IEC 61000-2-4 (industrial networks), NRS 048, IEEE 519, etc., or your own defined limits
- Company logo in the report as well as the main text fields can be customized



Automatically generated Power Quality report



3D frequency analysis of harmonics with time and amplitude

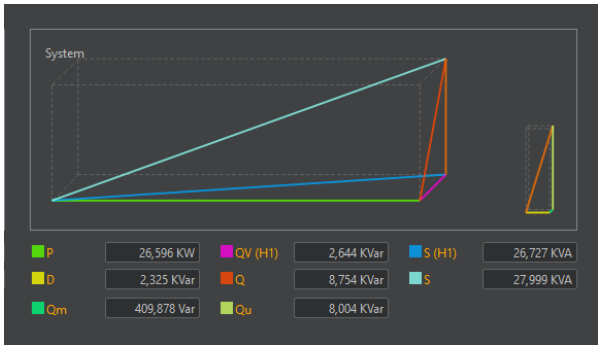
5. Live online analysis

Comprehensive online analysis software WinPQ mobil displays the current waveform of the current and voltage signals in real time and shows harmonics and interharmonics from DC to 10 kHz.

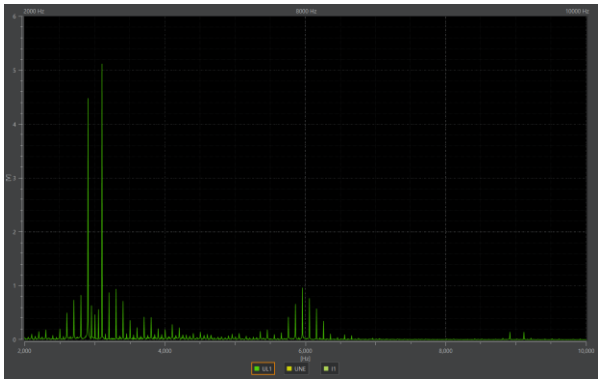
The power flow direction of the harmonics at the measuring point and the current power values (active power, reactive power, distortion reactive power, cos (phi), phase angle, power factor) are displayed.

Online oscilloscope with 20,48 kHz

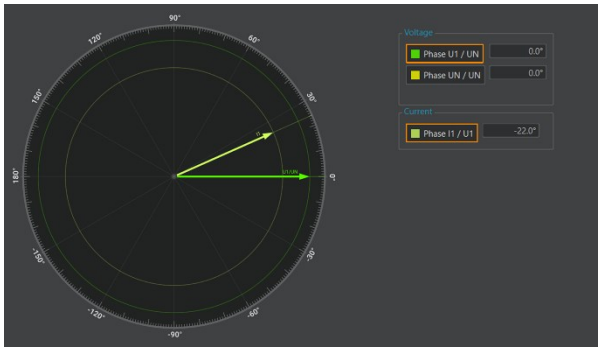
Online table with overview of measured values



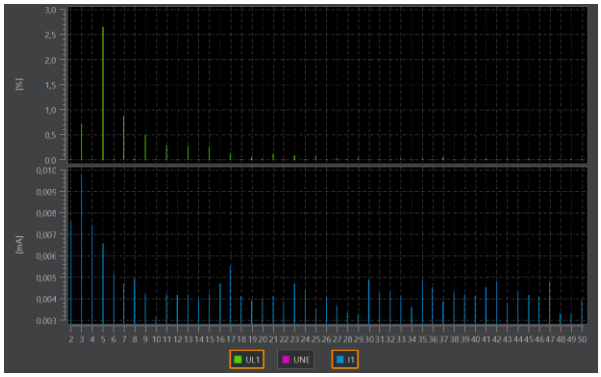
Online 3D power-cube



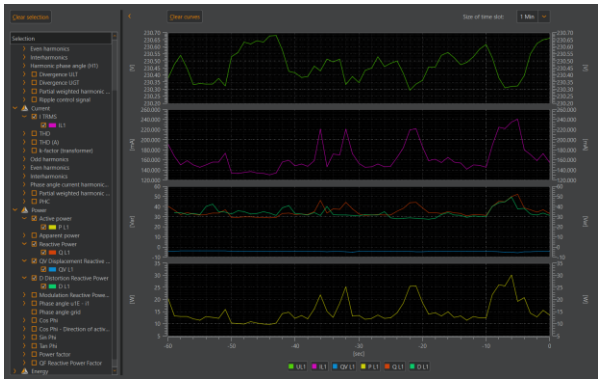
Online FFT Analysis DC to 10.000 Hz



Online phasor diagram



Online Harmonics (Voltage and current)



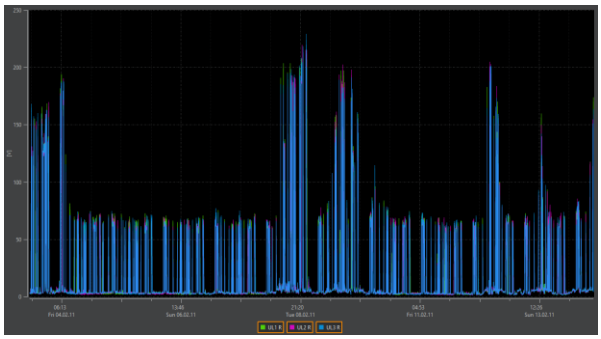
Online level-time diagram

6. Analysis of ripple control signals

Basic functions:

- Recording an adjustable frequency of 100 Hz to 3.7 kHz
- Review of ripple control signals (amplitude, pulse pattern)
- Ripple control signal levels are measured with permanent records

The ripple control recorder is suitable for recording and evaluating the ripple control pulse pattern.



Ripple control level over a few days

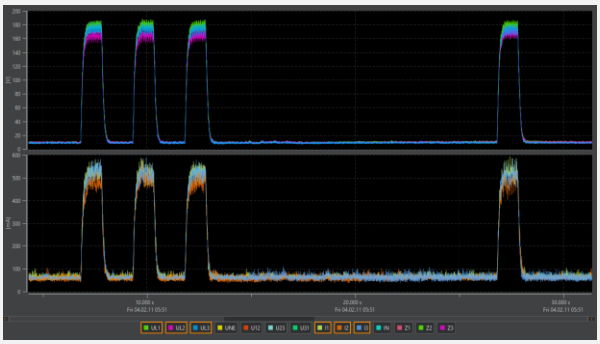
Ripple control recorder & trigger (included)

In addition to the ripple control level measurement, using this function it is possible to trigger to a ripple control frequency. Voltages and currents are recorded up to 210 seconds in length.

The complete message is displayed and disturbances in the signal form can be analysed.

The following parameters can be set:

- Triggering threshold
- Length of recording
- Ripple control frequency
- Bandwidth of the filter curve



Ripple control telegram of voltage and current

7. Trigger functions

The PQ-Box ONE offers extensive trigger functions. Trigger thresholds, recording duration, and the history of a recorder can be freely set by the operator.

Trigger conditions for voltage conductor against neutral conductor and neutral conductor against earth:

- Over/under voltage
- Voltage step
- Envelope trigger voltage
- Phase step
- Frequency above/below threshold
- Frequency step

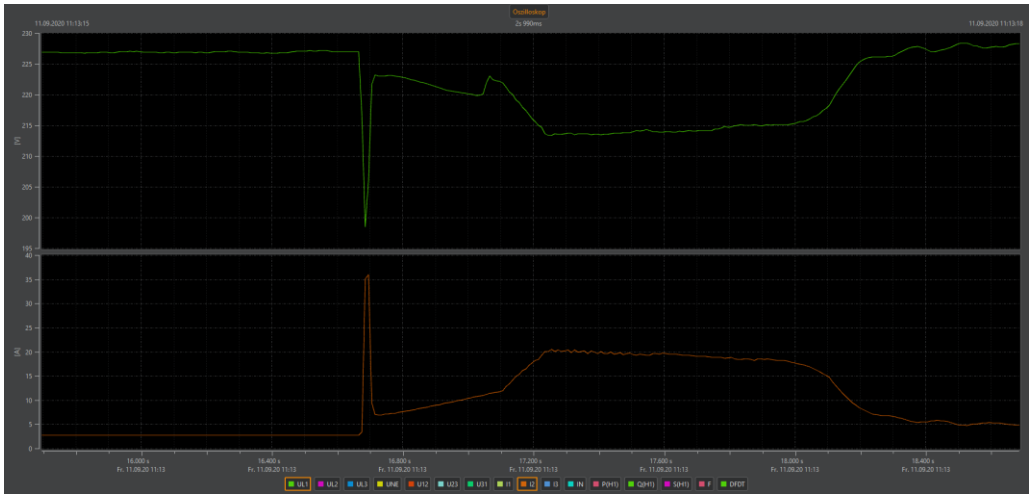
Trigger conditions for current:

- Above/below threshold
- Current step

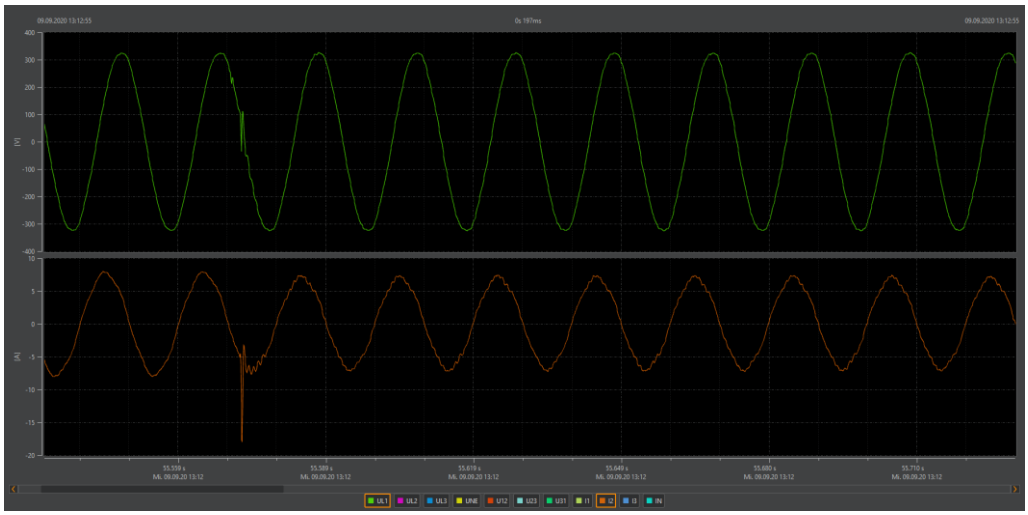
All trigger conditions run in parallel and can be activated and deactivated individually. Different trigger criteria can be set for oscilloscope recorder and half-cycle recorder.

If the automatic trigger is activated, the PQ-Box automatically intervenes in each individual trigger condition and adapts it to the current network conditions. This prevents incorrect operation of the trigger settings.

8. Fault records captured with Oscilloscope and half-cycle recorder

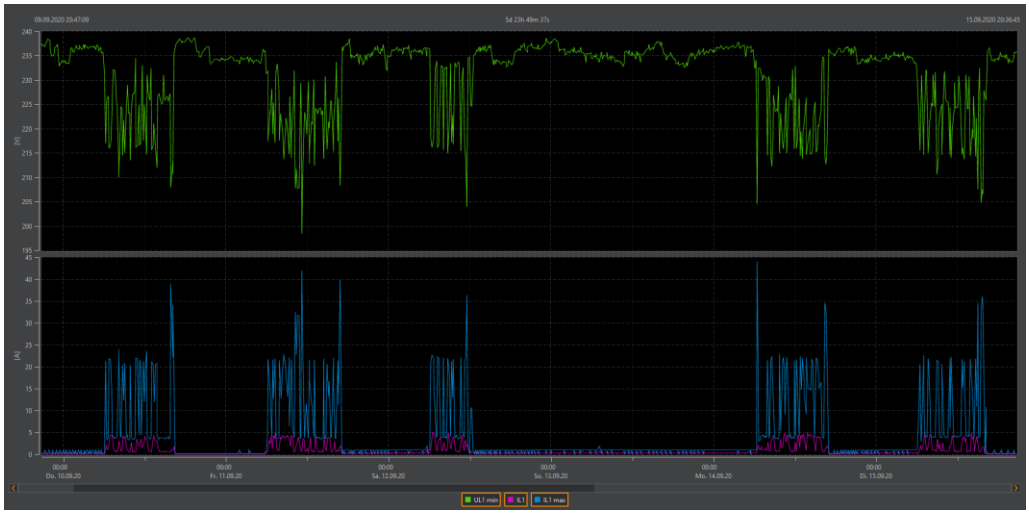


Half-cycle recorder: switching on a power supply



Oscilloscope recorder with 20.48 kHz sampling frequency

9. Continuous and permanent recording



Voltage and current recorded for more than 7 days

10. Technical data

PQ Box ONE	
2 voltage channels: Maximum input voltage Input Impedance:	L1-E, N-E 300 V AC L-N 1,2 MΩ
1 Current channel:	16 A AC continuous load 50 A peak maximum measuring range 100 A peak maximum load capacity
Sampling frequency:	20.48 kHz at 50 Hz/60 Hz
Synchronization to fundamental frequency:	45 Hz to 65 Hz
Measuring interval:	freely adjustable from 1 sec. to 30 minutes
Data memory:	1 GB
Interfaces:	WLAN/Wi-Fi, USB-C
Time synchronization:	NTP via WLAN/Wi-Fi
Dimensions:	125 x 67 x 50 mm
Weight:	0,25 kg
Degree of Protection:	IP 30
IEC 61000-4-30 Ed. 4:	Class A
Inaccuracy:	< 0,1%
Insulation class voltage channels:	CAT II / 300V
Insulation test:	Impulse voltage = 6 kV 5 sec = 2,5 kV RMS
A/D converter:	16 Bit
Climate / temperature proof:	Operation: -10° ….50°C Storage: -20°….70°C
Power supply voltage:	88 V…300 V AC 300V CAT II

Electromagnetic compatibility (EMC)	
CE-Conformity ● Interference immunity – EN 61326 – EN 61000-6-2 ● Emitted interference – EN 61326 – EN 61000-6-4 – EN 61000-6-3	
ESD – IEC 61000-4-2 – IEC 60 255-22-2	4 kV / 8 kV
Electromagnetic fields – IEC 61000-4-3 – IEC 60 255-22-3	10 V/m
Burst – IEC 61000-4-4 – IEC 60 255-22-4	2 kV
Surge – IEC 61000-4-5	1 kV
HF conducted disturb. – IEC 61000-4-6	10 V, 150 kHz ... 80 MHz
Voltage dips – IEC 61000-4-11	100 % 1min
● Housing at distance of 10 m	30...230 MHz, 40dB/30dB 230...1000 MHz, 47dB/37dB
● AC power supply	0,15...0,5 MHz, 79 dB 0,5...5 MHz, 73 dB 5...30 MHz, 73 dB

11. Order details

CHARACTERISTICS	CODE
Portable Power Quality Analyzer and energy meter for power sockets according to IEC 61000-3-40 Class A and EN 50160 ● 1 GByte flash memory ● WLAN/Wi-Fi and USB-C Interface ● IP30 protection ● Uninterruptible power supply (Power Cap) ● USB-C Cable	**PQ-Box ONE**

ACCESSORIES	IDENT-Nr.
● Power socket adapter Typ E (France, Poland..)	101.7360.01
●	

PQ-Box ONE
Information

WinPQ mobil
Software

Video-Tutorials
PQ-Box & WinPQ mobil

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