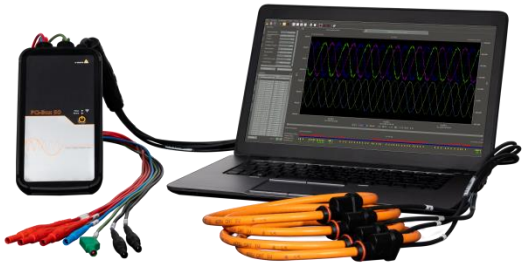
Network Analyzer for Low-, Medium- and High-Voltage Networks

Model PQ-Box 50



- **Load Analysis; Energy Measurement**
- **Evaluation of Voltage Quality according to EN50160 and IEC61000-2-2 /2-4**
- **Fault Recorder Functions**
- **Ripple Control Signal Analysis**
- **Ripple Control Frequency Measurement**

1. Application

The PQ-Box 50 is a powerful, portable Power Quality Analyser for testing the quality of supply according to EN50160 / IEC61000-2-2 /2-4 as well as a high-precision power meter e.g. for energy audits according to ISO50001. The aim was to develop a very compact, robust and easy to use measuring instrument with integrated power supply. The power supply of the power analyser is connected directly via measuring lines.

The PQ-Box 50 has been developed for mobile operation (protection class IP65) and is suitable for measurements in public networks (600V CAT IV) as well as for measurements in industrial environments up to 690V operating voltage.

The very small dimensions allow installation in small enclosures and control cabinets, even directly next to voltage conducting components. The device is very easy to handle due to the application-specific presetting of all trigger conditions.

The device is equipped with a large number of trigger options in order to quickly locate the cause of mains disturbances.

A fast WLAN and a USB interface are available for data transmission. In the event of a power failure, the built-in, integrated UPS takes over.

Modern power quality analyzers operate according to the IEC 62586 standard, which describes the complete product characteristic of a power quality analyzer. This standard defines not only the intended use, the EMC environment, the environmental conditions, but also 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 work according to this standard must provide the same measurement results. According to IEC 62586, the PQ-Box 50 smart is a device of the **PQI-A-MO-H**

Power **Q**uality **I**nterface – Class **A** – **M**obile Measurement Device for **O**utdoor operation in **H**arsh EMC environments

The PQ-Box 50 meets therefore the full requirements of IEC 61000-4-30 Ed.3 (2015) for Class A measuring instruments for 100% of the parameters.

Parameter IEC61000-4-30 Ed. 3	Class
Power frequency	A
Magnitude of the Supply Voltage	A
Flicker	A
Supply voltage dips and swells	A
Voltage interruptions	A
Supplv voltage unbalance	A
Voltage harmonics	A
Voltage interharmonics	A
Mains signaling voltage	A
Underdevation and overdeviation	A
Measurement aggregation intervals	A
Time-clock uncertainty	A
Flagging	A
Transient influence quantities	A

2. Measurement functions

The PQ-50 Box is available in different versions:

- **PQ-Box 50 basic (B0)**

The device is suitable for performance analyses for energy audits according to ISO 50001, as a data logger for troubleshooting and for online measurements.

- **PQ-Box 50 light (B1)**

This version is equipped with manual trigger option for oscilloscope and ½ cycle RMS records. Standard evaluations according to EN50160, IEC61000-2-2/2-4 for public and industrial power systems are automatically generated.

- **PQ-Box 50 expert (B2)**

This version is additionally equipped with comprehensive trigger functions for oscilloscope and ½ cycle RMS records.

- **Option "Ripple Control Signals" (R1)**

Using this function, triggering to ripple control signaling in the network is possible. These signals can be evaluated by means of software as fast RMS values for voltages and currents.

Each variant can be upgraded afterwards via a license (option).

Depending on the license, the PQ-Box 50 can record over 3,000 different measured values in a continuous recording: voltage, current, frequency, power, energy consumption, unbalance, flicker, harmonics and interharmonics. Without limiting the number of parameters, the measurement interval for permanent recording can be set to a minimum of one second.

Performance			
PQ-Box 50	**basic (B0)**	**light (B1)**	**expert (B2)**
Statistic EN50160/IEC 61000-2-2/IEC 61000-2-4		x	x
PQ-events		x	x
Recording free interval (1sec…30min):			
Voltage: min. max. average	x	x	x
Current: min. max. average	x	x	x
Power: P, Q, S, PF, cos phi, sin phi, tan phi	x	x	x
Distortion power D	x	x	x
Energy: P, Q, P+, P-, Q+, Q-	x	x	x
Flicker according IEC61000-4-15 (2010) (Pst, Plt,Ps5)		x	x
Unbalanced voltage, current	x	x	x
Voltage harmonics		up to 50th	up to 50th
Voltage harmonics extreme values 200ms			x
Current harmonics		up to 50th	up to 50th
Current harmonics extreme values 200ms			x
Phase angle of current and voltage harmonics			x
Real, apparent and reactive power of harmonics			x
THD voltage, current; PWHD, PHC	x	x	x
Inter harmonics – voltage, current			DC to 10 kHz
Ripple control signal		x	x
Frequency: min. max. average	x	x	x
Power / Energy Interval			
10/15/30 min interval – Voltage, P, Q, S, D, cos phi, sin phi …	x	x	x
Online mode:			
Oscilloscope recorder	x	x	x
½ cycle RMS recorder		x	x
Voltage & current harmonics, inter harmonics		x	x
FFT spectrum (U, I)			DC to 10kHz
Direction of harmonics			x
Trigger options:			
½ cycle RMS recorder (U, I, P, Q, S, frequency)			x
Oscilloscope recorder (U, I)			x
Phase shift trigger, wave shape trigger			x
Interval-trigger			x
Automatic trigger			x

3. Design

The robust mechanical design and the IP65 protection class, 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 50 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 leaks. In the event of a power failure, an internal UPS bypasses the power supply of the power analyzer for two hours.

No separate socket is required for the power supply - The power supply of the measuring instrument can be tapped directly via the measuring leads.

3.1 Evaluating measured data

Recorded data is transferred to the analyzing-PC via a high-speed WLAN/WiFi or USB interface. The practice-oriented analysis software is included in delivery and can be installed on any number of PCs.

The software provides a wide range of analysis options such as load analyses or the detection of the cause of a grid disturbance. Reports according to EN50160/IEC61000-2-2 (2-4) are automatically generated and comprehensive online-functions are available.

Updates of the analysis software can be downloaded via internet free of charge (www.a-ebere.de).

3.2 Device front panel

3.3 LED PQ-Box 50

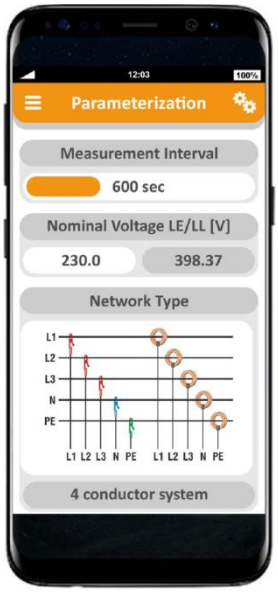
Using the Start/Stop-button the measurement is started or stopped. Any number of measurements can be recorded consecutively, without reading out the device in between.

The WLAN symbol shows the status of the WLAN interface.

3.4 PQ-Box App

Using the PQ-Box App for Android or IOS operation systems, all measurement values can be displayed on any type of mobile phone. The PQ-Box App provides information about the correct connection of measuring cables and current clamps and indicates online-data of voltage, current, THD and power.

With the setup function of PQ-Box App, all settings of the PQ Box 50 can be done without a PC.

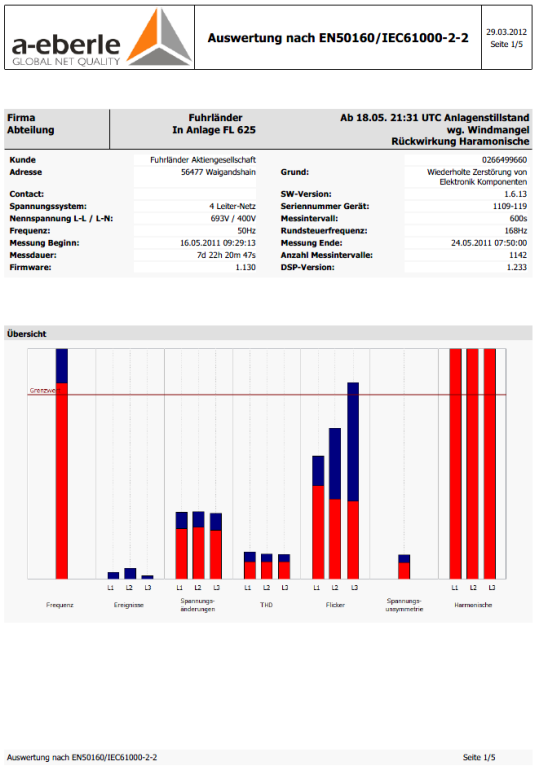


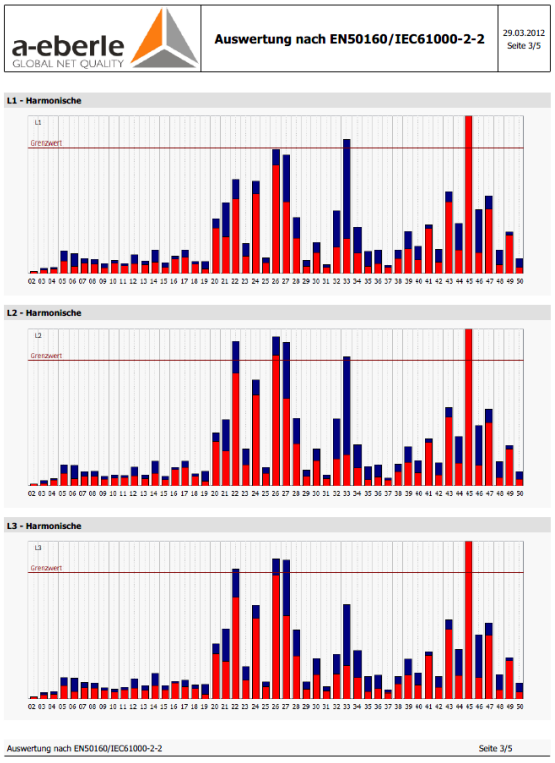
3.5 Time synchronization

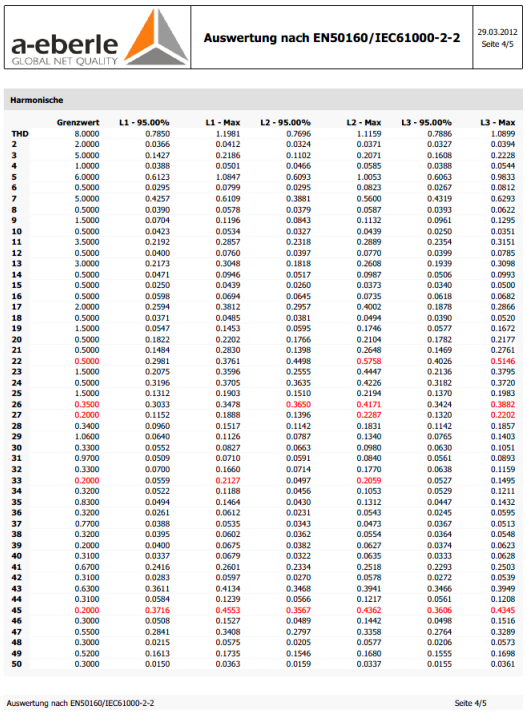
In order to synchronize measurement data of different devices, time synchronization is essential. For this purpose, the PQ Box 50 can be synchronized to NTP network with the WLAN interface.

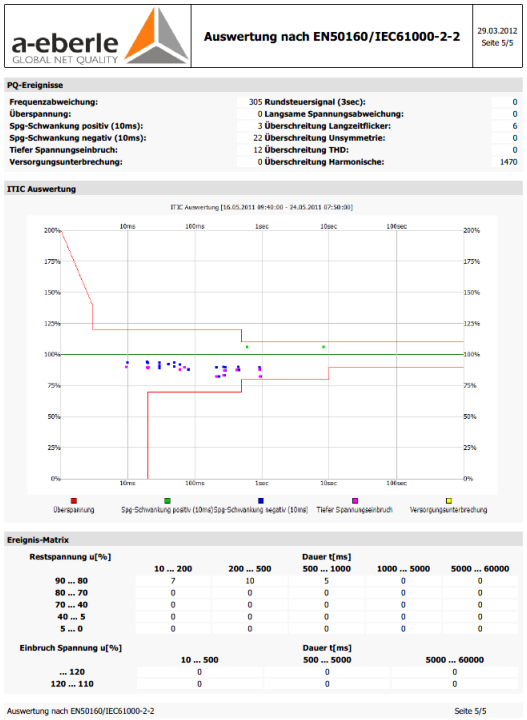
3.6 EN50160/IEC61000-2-2 Evaluation (Option B1/B2)

- Overview of the power quality statistics. Bar charts provide automatic summary of relevant measures.
- Automated reporting in accordance with EN50160 / IEC61000-4-15 / IEC61000-4-7 / IEC61000-2-2 / -2-12 (public networks), IEC61000-2-4 (industrial networks), NRS048, IEEE519, or your customized limits.
- Company logo in the report and as well as main text fields can be customized.







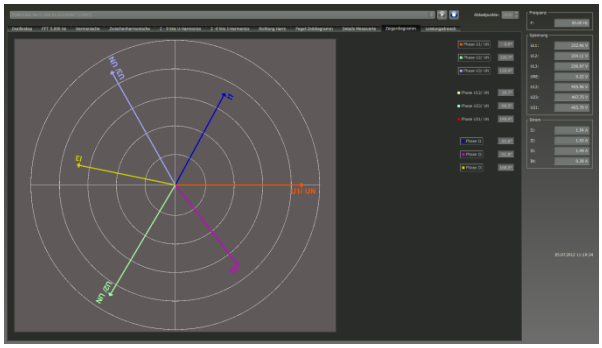


Automatically generated standard report

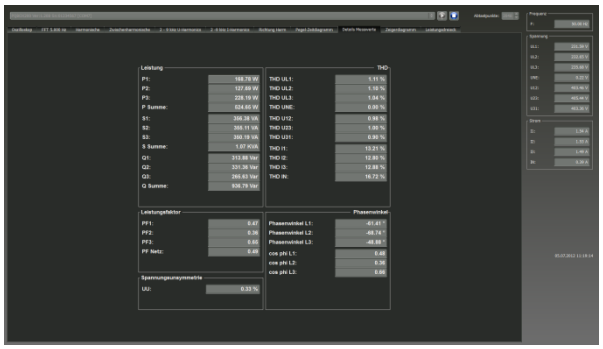
3.7 Online analysis-software

A comprehensive online analysis-software depicts the actual waveform of the current- and voltage signals as well as harmonics and interharmonics from DC to 10.000 Hz.

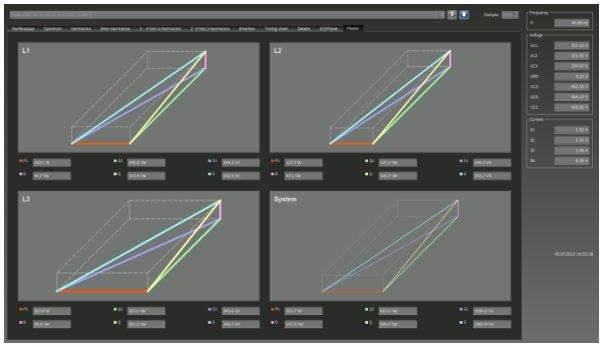
The power flow direction of the harmonics at the measuring point as well as the actual power values (active power, reactive power, distorted reactive power, cos-phi, phase angle, power factor) are displayed.



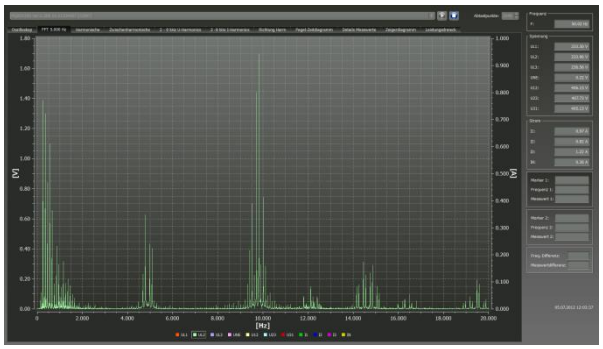
Online phasor diagram



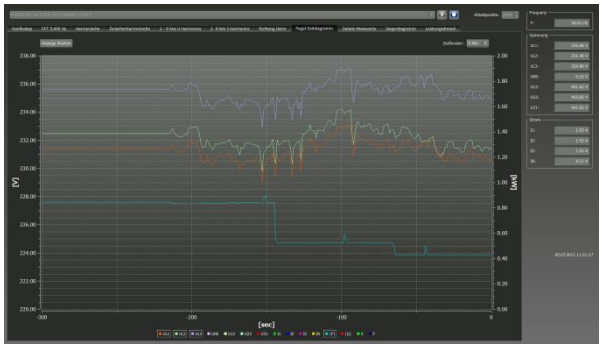
Online measured-values table



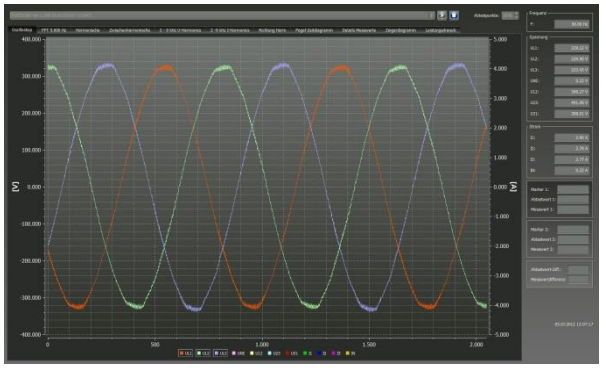
Online power-cube



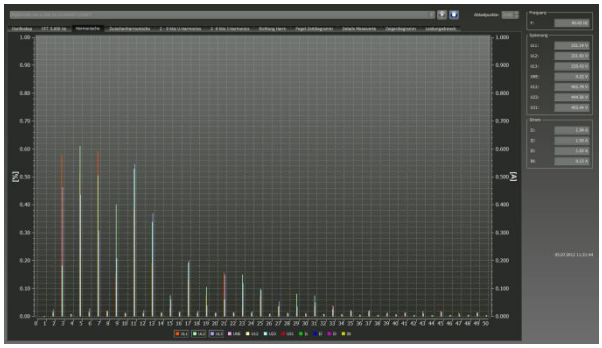
FFT-Analysis DC up to 10.000 Hz



Online time level diagram



Online oscilloscope-recorder with 20,48 kHz



Spectrum voltage and current harmonics

3.8 Analysis of ripple control signals

In addition to the harmonics, PQ-Box 50 is able to record any frequency between 100Hz and 3700Hz. This feature can be used to evaluate the signal amplitude of ripple control signals.

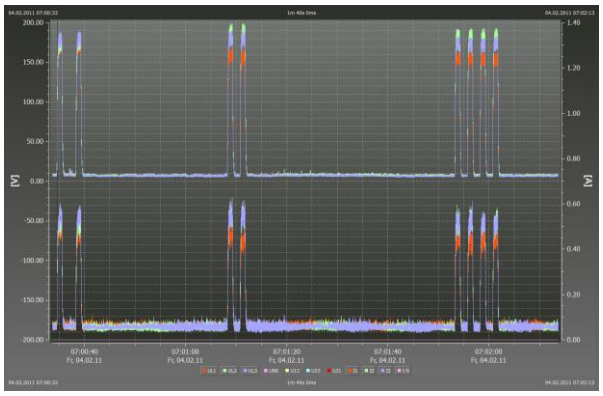
Ripple control level over a few days

Option: analysis of ripple control signals (R1)

In addition to the ripple control level measurement, using this function it is possible to trigger to a ripple control frequency. The complete message up to 210 seconds for voltages and currents is displayed and disturbances in the signal form can be analyzed. It is possible to record more than 500 telegrams per measurement.

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 (option)

3.9 Trigger functions

The version “PQ-Box 50 expert” offers comprehensive trigger functions. Triggering thresholds, length of recording and pre-event history of the record can be freely adjusted by the user. If the automatic trigger is activated, an autonomous intervention to each trigger condition and its adjustment to the actual network condition is made by the device. Therefore, an operating error of the trigger setting is impossible.

Trigger conditions for voltage (phase to phase; phase to neutral; neutral to earth)

- Lower/upper threshold
- Voltage step
- Wave shape trigger
- Phase angle step
- Lower/upper threshold frequency
- Frequency step

Trigger conditions for current (L1, L2, L3, neutral)

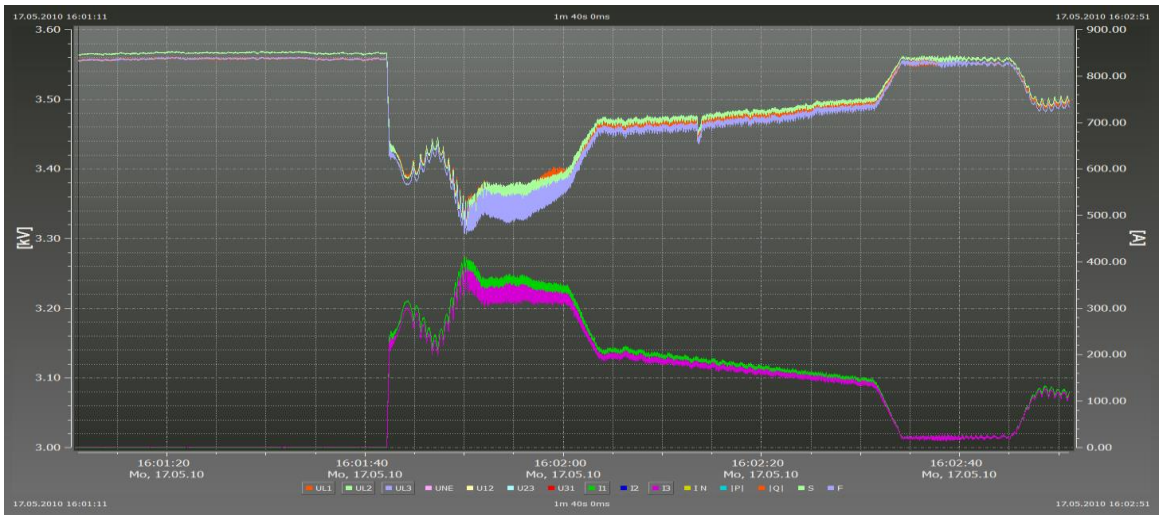
- Lower/upper threshold
- Current step

3.10 Memory

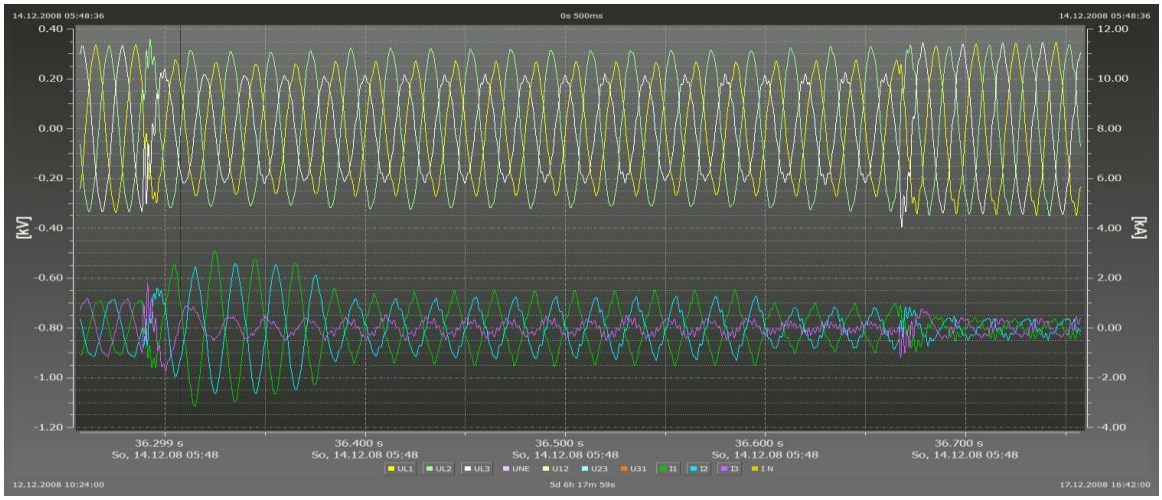
The available memory (1GByte) is organized automatically and smart by the device. Numbers of measurements can be recorded consecutively without having rerecorded the data to a PC.

At the beginning of a new measurement, the free memory is split reasonably for long-time measurement values and recordings.

3.11 Fault records as oscilloscope image and ½ cycle RMS record

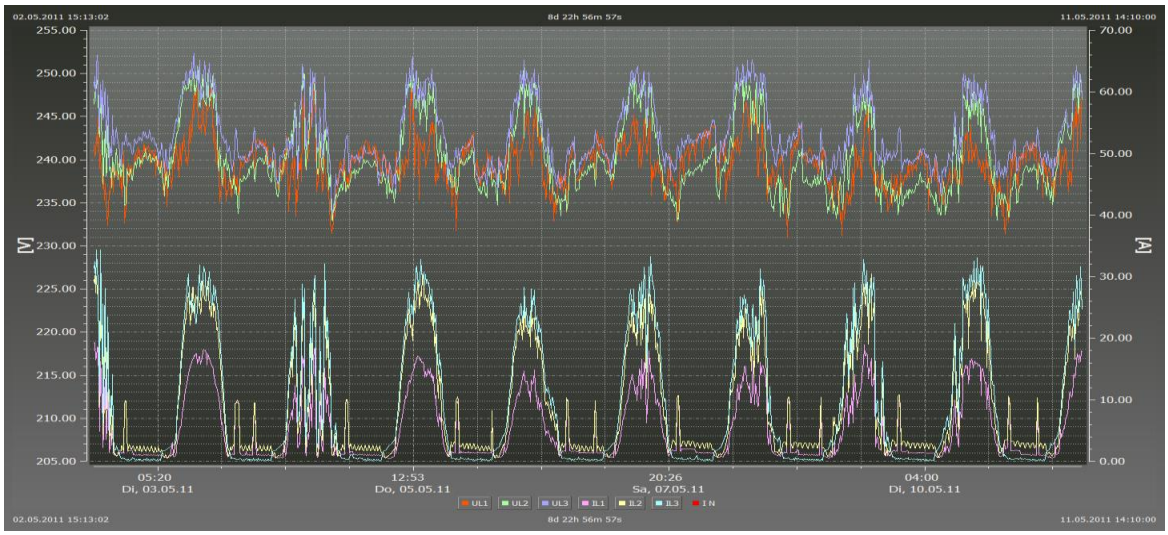


½ cycle RMS – record (machine start-up)



Oscilloscope record with 20.48 kHz sampling rate

Continuous recording



Voltage, current 3-phase

4. Technical data

PQ Box 50 (4U/4I)	
4 voltage inputs (AC/DC): Maximum input voltage:	L1, L2, L3, N, E; 565 V AC/800 V DC L-N 980 V AC/1380 V DC L-L 1.2 MΩ impedance
4 current inputs (AC/DC):	1000 mV input for mini clamp and 330 mV for Rogowski coils 15 kΩ impedance
Sampling rate:	20.48 kHz at 50 Hz/60 Hz
Automatic synchronization to fundamental oscillation:	45 Hz to 65 Hz
Measurement intervals:	Freely adjustable from 1 s to 30 min + 10/15/30 min
Data memory:	1 GB
Interfaces:	WLAN/WiFi; USB
Time synchronization:	NTP with WLAN
Dimensions:	220 x 110 x 40 mm
Mass:	1 kg
Degree of protection:	IP65
IEC 61000-4-30 Ed.3:	Class A
Accuracy:	< 0,1 %
Insulation class:	CAT IV / 600 V
Insulation test	Impulse voltage = 12,8 kV 5 sec = 7,4 kV rms
A/D converter:	16 Bit
Climate/temperature proof:	Function: -20° ….60°C Storage: -30°….80°C

PQ Box 50 (4U/4I)	
Power supply:	88 V …500 V AC or 100 V…300 V DC 300 V CAT IV

EMC	
CE- conformity ● Interference immunity – EN 61326 – EN 61000-6-2 ● Emittedinterference – EN 61326 – EN 61000-6-4	
ESD – IEC 61000-4-2 – IEC 60 255-22-2	8 kV / 16 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	4 kV/2 kV
Surge – IEC 61000-4-5	2 kV/1 kV
HF conducted disturbances – IEC 61000-4-6	10 V, 150 kHz … 80 MHz
Voltage dips – IEC 61000-4-11	100 % 1 min
● Housing at a distance of 10 m ● AC supply connection at a distance of 10 m	30...230 MHz, 40 dB 230...1000 MHz, 47 dB 0.15...0.5 MHz, 79 dB 0.5...5 MHz, 73 dB 5...30 MHz, 73 dB

5. Order details

When ordering please note:

- Only one of the identifiers with the same capital letter may be selected.
- If the capital letters of the identifier are followed by the number 9, additional information in plain text is required.
- If the capital letters of the identifier follow only zeros, this identifier is not required in the order specification.

CHARACTERISTICS	CODE
Fault recorder and network analyzer according toDIN EN 50160 and IEC 61000-3-40 class A ● 1 GB flash memory ● WLAN/WiFi; USB interface ● IP65 ● Uninterruptible power supply ● USB cable ● 4 Voltage connecting cable with internal power fuse 50kA ● 2 power supply cables with internal power fuse ● 5 Dolphin clips ● 2 pcs. voltage connectors for power supply and voltage leads ● Hard case for current clamps and measurement cables incl. analysis software	**PQ-Box 50**
Version	
● PQ-Box 50 (4U/4I) basic	B0
● PQ-Box 50 (4U/4I) light	B1
● PQ-Box 50 (4U/4I) expert	B2
● Option ripple control	R1
Operating manual and display	
● German	G1
● English	G2
● French	G3
● Spanish	G4
● Italian	G5
● Polish	G9

ACCESSOIRES	IDENT-NO.
● Power socket adapter for 1 ~; 4 mm safety plugs	582.0511
● Calibration set for PQ-Box 50/100/150/200/300 calibration software and adapter box	111.7039
● Set of magnetic voltage taps	111.7008
● Voltage insulated cable; contact support1~, connectable for 35-240mm² cable	111.7037
● Cable set 4 phase, 1.5 mm², 2m length, 4x 16 A fuse, 4x 4mm safety plugs	111.7038
● Lemp isolation case	111.7012

6. Accessories for current measurement

A. Eberle standard accessories are automatically recognized by the meter and can be found inside the accessories catalogue:

- Datasheets: https://www.a-eberle.de/en/downloads/power-quality/accessories-catalog/data-sheets
- Catalogue: https://www.a-eberle.de/en/downloads/power-quality/accessories-catalog/catalog

PQ-Box 50 with accessories and case

PQ-Box 50 with case

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Version 11.04.2019 08:39:00