

# Power Quality Analyzer / High frequency Recorder

## Model PQ-Box 300

- ▶ **Fault detection**
- ▶ **Evaluation of voltage quality according to EN50160 und IEC61000-2-2/-2-4**
- ▶ **Permanent FFT Analysis from DC to 170kHz**
- ▶ **Load analysis; Energy measurements**
- ▶ **Ripple control signal analysis**
- ▶ **High-quality Software for PQ-Box family 100/150/200/300**



## 1. Application

The PQ-Box 300 is a high-performance, portable grid-analyzer, power meter and transient recorder. User-friendliness was one of the main objectives of the device development.

Frequencies up to 170 kHz are permanently and gap-less recorded by the device. PQ-Box 300 has been designed for mobile operation (degree of protection IP65); it is applicable for measurements in public grids (CAT IV) as well as for measurements in industrial environment up to 1000V.

The PQ-Box 300 meets 100% the demands of the IEC 61000-4-30 Ed. 3 and IEC62586-2 Ed.2 standards for class-A devices:

Parameter	Class
Accuracy of voltage measurement	A
Determination of time intervals	A
Marking of measured values at events	A
Harmonics, Interharmonics	A
Flicker	A
Frequency	A
Voltage asymmetry	A
Event recording	A
Time synchronization	A

Its compact dimension enables the device to be installed in small-sized spaces and switchgear cabinets. The non-conductive housing of the box allows the direct usage in the immediate vicinity of current

carrying conductors. Due to the application-specific setting of trigger conditions, the device is very easy to handle.

In order to quickly identify the cause of a grid disturbance, the PQ-Box 300 is equipped with a large number of trigger options.

For a quick data transfer, an USB 2.0 interface, a TCP/IP interface and as an option a WLAN interface are available. The integrated Micro-SD memory card (8GB) may also be replaced by the user.

In the case of a supply interruption the integrated UPS allows to continue operation for up to 3,5 hours.

## 2. Measurement functions

The PQ-Box 300 is optionally available with ripple control signal analysis and WLAN interface.

- ▶ **PQ-Box 300**
  - Frequency Analysis up to 170 kHz
  - Data Logger
  - Fault Detection
  - Online Data
  - Programmable Trigger for oscilloscope- recorder
  - Programmable Trigger for 10ms RMS recorder
  - Standard Reports according to EN50160, IEC61000-2-2/-2-4
- ▶ **Optional "Ripple control recorder" (R1)**
  - Ripple-control telegrams of voltage and current.
- ▶ **Optional WLAN Interface (S1)**
  - Wireless communication between User-PC and PQ-Box 300.

We take care of it.

Measurement / Functions	
<b>PQ-Box 300</b>	
Automatic event detection and evaluation standards for: EN50160 (2015) / IEC61000-2-2 / IEC61000-2-12 / IEC61000-2-4 (Class 1; 2; 3) / NRS048 / IEE519 / VDE N-4105 / IEC61000-4-30 Ed. 3 Class A / IEC61000-4-7 / IEC61000-4-15 / IEC62586-2 Ed. 2 / IEC62586-1	
<b>Recording with user defined interval of 1sec to 30min (&gt;3.900 parameters permanently measured):</b>	
Voltage: min. max. average	
Current: min. max. average	
Power: P, Q, S, PF, cos phi, sin phi	
Distortion-, basic-, unbalance- and modulation reactive power	
Energy: P, Q, P+, P-, Q+, Q-	
Flicker (Pst, Plt, Pinst)	
Unbalanced voltage, current; positive-, negative- and zero-sequence	
Voltage harmonics according to EN 61000-4-30 Class A	Up to 50th
Voltage harmonics to 9kHz (200Hz frequency bands)	2kHz to 9kHz
Supra harmonics to 170kHz (2kHz frequency bands) (Mean values and 200ms min.- und max. values)	8kHz to 170kHz
Current harmonics	Up to 50th
Current harmonics to 9 kHz (200Hz frequency bands)	2kHz to 9kHz
Phase-angle of voltage and current harmonics	Up to 50th
THD voltage, current; PWHD, PHC	
FFT calculation of voltages and current	DC up to 20kHz
Ripple control signal	100 Hz to 3 kHz
Frequency, 10sec, min. max. average	
10/15/30 Min interval power values P, Q, S, D, cos phi, sin phi	
<b>Online mode:</b>	
Oscilloscope recorder	
3D power triangle for active, reactive, apparent power and distortion power	
Voltage, current harmonics (5Hz frequency bands)	DC to 20kHz
Supra harmonics of voltage to 170kHz (200Hz frequency bands)	8kHz to 170kHz
Direction of harmonics & phase angle of harmonics	
<b>Trigger functions (Rec A / Rec B)</b>	
Manual trigger – trigger button	
RMS level trigger (voltage, current)	
RMS jump trigger (voltage, current)	
Phase shift trigger	
Envelope trigger	
Automatic trigger	
Trigger on binary input (0 – 250V AC/DC; 10 V threshold)	

### 3. Design

Suitable for robust measurement conditions:

- Extremely robust mechanical construction
- Protection class IP65
- 8 GB Micro-SD data storage as standard, extendable by the user up to 32 GB (permitting several years recording)
- Internal UPS bridges the power for up to 3,5 hours.

#### 3.1 Evaluating measured data

The following measuring intervals can be recorded simultaneously by PQ-Box 300:

- 200ms values
- 3sec values
- N x sec values (1 sec to 30 min selectable)
- 10/15/30min power interval

Recorded data is transferred to the analyzing-PC via a high-speed USB interface, TCP/IP interface or via optional WLAN interface.

Powerful, easy to use analysis software is included in the delivery and can be installed on any number of PCs.

#### 3.2 Power Supply

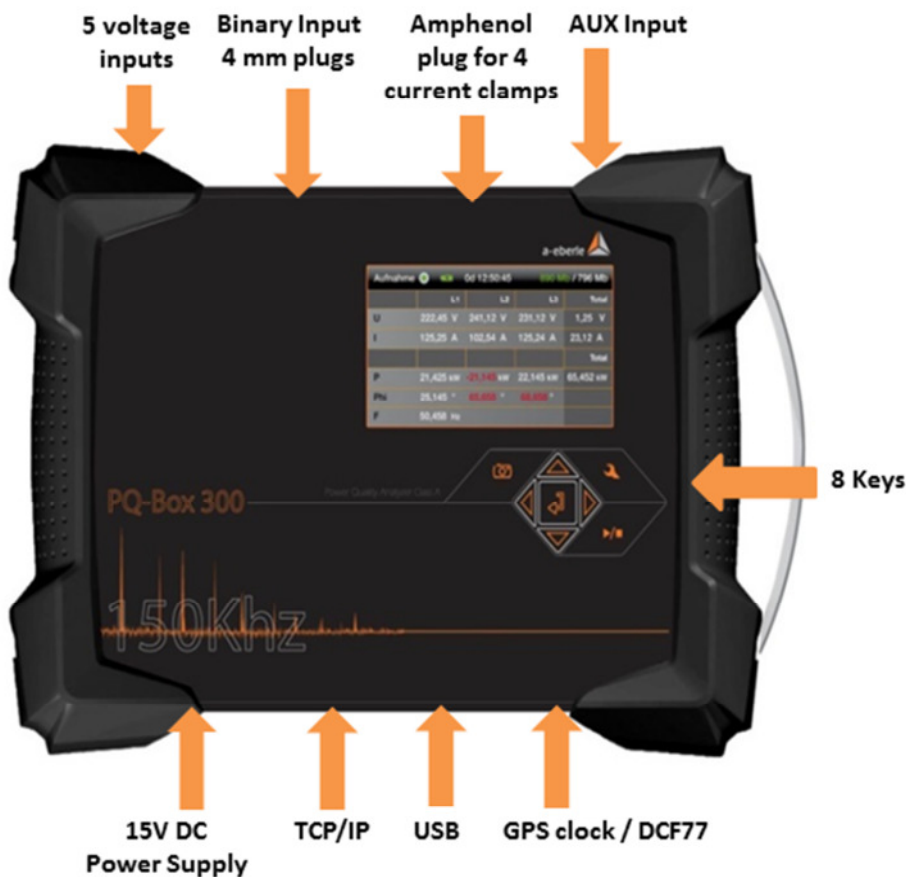
PQ-Box 300 is equipped by an extremely robust power supply unit. The power supply is designed for high noise immunity according to 600 V CAT IV standards and fulfils protection class IP65.

The device may be supplied with electrical energy directly via measurement cables, so there is no need for a power socket.

The following supply voltages are permitted:

- 100V to 440V AC
- 100V to 400V DC.

#### 3.3 Device Connections





We take care of it.

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### 3.4 Colored display

The display of the device provides information about the correct connection of measuring cables and current clamps and indicates online-data of voltage, current, THD and power. Red readings warn of possible incorrect connection of the device. The numbers of occurred events as well as the recorded time period are shown on the display. In order to prevent tampering with the meter by unauthorized persons, a password protection can lock the display functions and interfaces.

Aufnahme  0d 12:50:45 890 Mb / 796 Mb				
	L1	L2	L3	Total
U	222,45 V	241,12 V	231,12 V	1,25 V
I	125,25 A	102,54 A	125,24 A	23,12 A
				Total
P	21,425 kW	-21,145 kW	22,145 kW	65,452 kW
Phi	25,145 °	65,658 °	68,658 °	
F	50,458 Hz			

Aufnahme  0d 12:50:45 890 Mb / 796 Mb				
Rekorder				Anzahl
Oszilloskoprekorder				54
RMS Rekorder				125
Rundsteuersignale				14
PQ Ereignisse				458
Transiente Ereignisse				25

### 3.5 Push buttons

Using the Start/Stop-button measurements are started or stopped. Any number of measurements can be recorded consecutively, without the need to read out prior recorded data.

The button “manual trigger” enables a “snapshot” of the measured system to be taken with oscilloscope event recorder and 10ms RMS recorder.

By “scrolling”, a number of measurement data is indicated on the display. So the correct connection of the device can be tested.

The button “setup” allows the user to modify, for example, configurations for current- or voltage transformer, the measuring interval or the nominal voltage, directly at the PQ-Box 300, without need for connected PC.

### 3.6 Time synchronization

If an application requires high accuracy clocks (Class A), the time of PQ-Box 300 can be synchronized via their GPS/DCF77 interface.

### 3.7 Binary input

One digital input for an external trigger signal is available via two 4mm sockets. This starts oscilloscope recorders 10ms RMS recorders or transient recorders. AC/DC signals up to 230 V may be applied with the recorder being set to trigger by a rising or falling edge. The switching threshold is set at 10 V.

### 3.8 Analog input

An analog input 1 V (AC/DC) is designed for connection of external sensors such as a 5th clamp for the PE current, a DC current probe or a temperature sensor. The measured signal is freely scalable with the evaluation software and the measurement units can be set arbitrarily.

### 3.9 Data memory


The meter is equipped with a micro-SD card of 8 GB and can use micro-SD memory cards up to 32 GB. While 8 GB of memory is sufficient for several months of recording per EN 50160 procedures, the additional memory capability provides for longer term measurements, or for special high speed recording application. The additional SD card can be changed easily by the operator, providing another method for data to be taken from site.

Multiple recording sessions can be recorded consecutively without having to transfer the data to a PC at the end of each recording. At the beginning of a new measurement the free memory is automatically split to reserve space for long-time measurement values and space for event records. The PQ-Box 300 manages the available memory automatically and intelligently.

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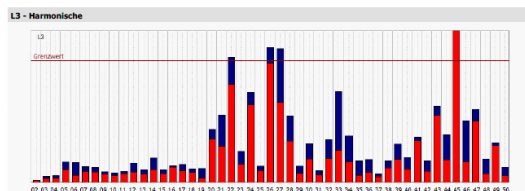
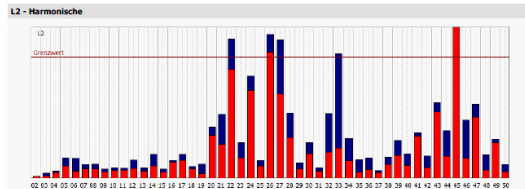
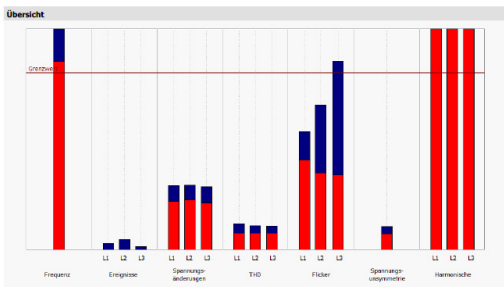
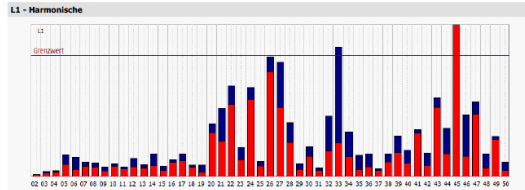
## 4. Evaluation and statistics

- Automated reporting in accordance with EN50160 / IEC61000-2-2 / -2-12 (public networks), IEC61000-2-4 (industrial networks), NRS048
- Overview of the power quality statistics
- Bar chart provides automatic summary of relevant harmonics
- Limits and valuations up to 170 kHz


**Auswertung nach EN50160/IEC61000-2-2**
29.03.2012  
Seite 1/5


**Auswertung nach EN50160/IEC61000-2-2**
29.03.2012  
Seite 3/5

Firma Abteilung	Führhändler In Anlage FL 625	Ab 18.05. 21:31 UTC Anlagenstillstand wg. Windmangel Rückwirkung Harmonische
Kunde	Führhändler Aktiengesellschaft	0266499660
Adresse	56477 Walgandshain	Wiederholte Zerstörung von Elektronik Komponenten
Contact:		1.6.13
Spannungssystem:	4 Leiter-Netz	SW-Version:
Nennspannung L-L / L-N:	693V / 400V	Seriennummer Gerät:
Frequenz:	50Hz	Messintervalle:
Messung Beginn:	16.05.2011 09:29:13	Rundsteuerfrequenz:
Messdauer:	7d 22h 20m 47s	Messung Ende:
Firmware:	1.130	Anzahl Messintervalle:
		DSP-Version:
		1.233



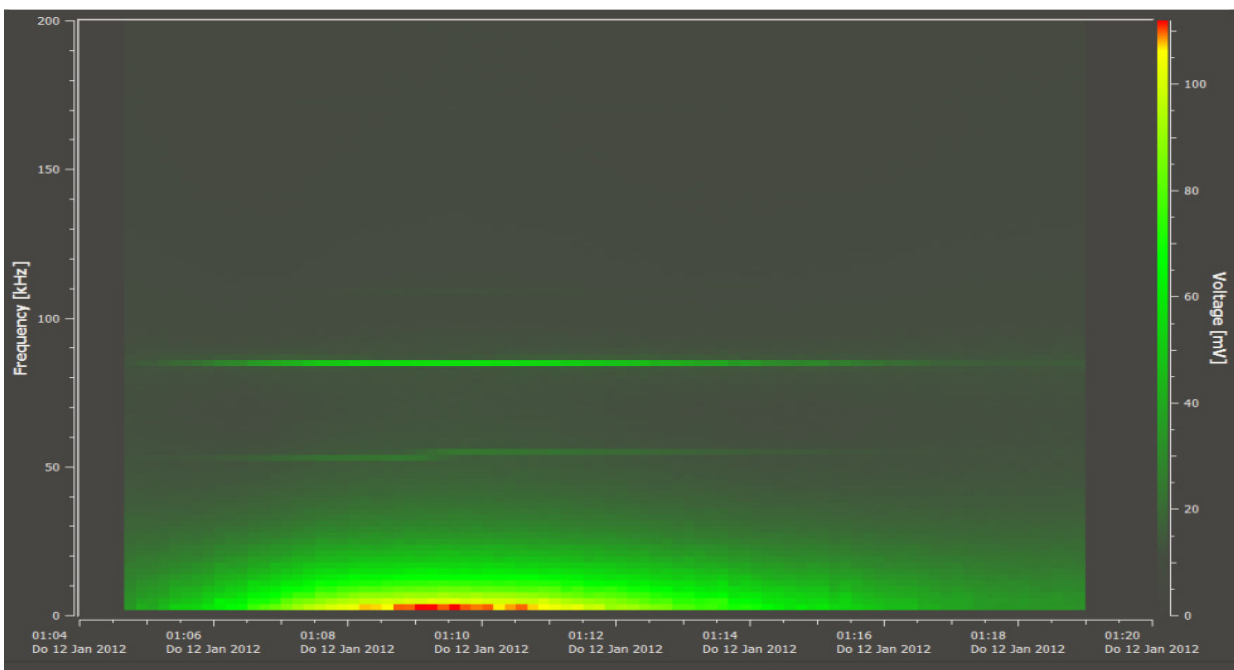
Auswertung nach EN50160/IEC61000-2-2

Seite 1/5

Auswertung nach EN50160/IEC61000-2-2

Seite 3/5

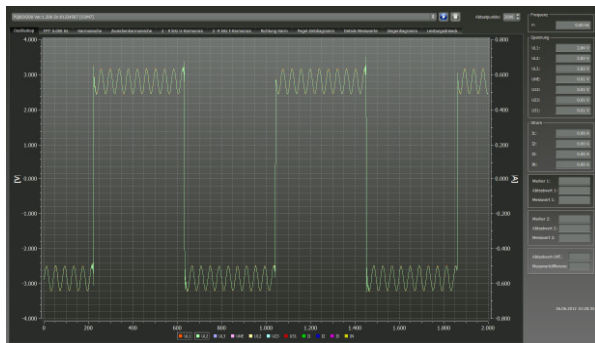
### Automatic standard report



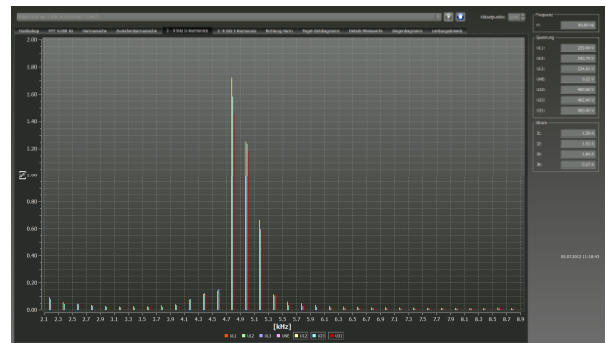
### 3-D frequency analysis up to 170 kHz versus time and amplitude

We take care of it.

## 4.1 Online analysis software



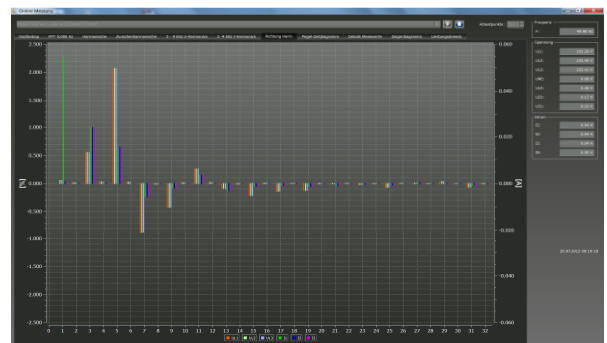
Online oscilloscope with 409,6 kHz



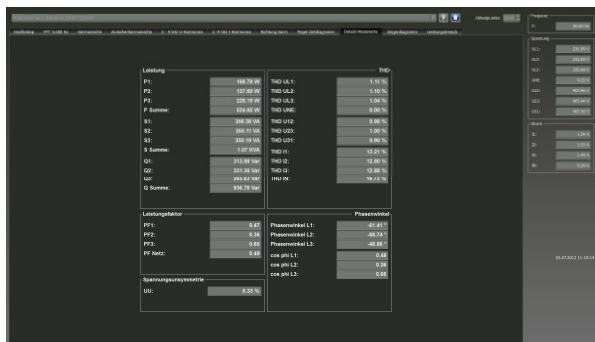
Online harmonics (up to 170 kHz)



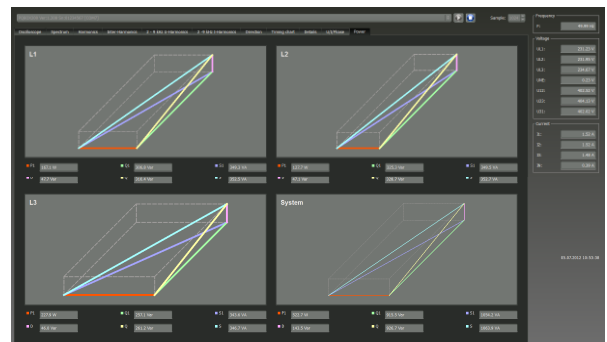
Online time level diagram



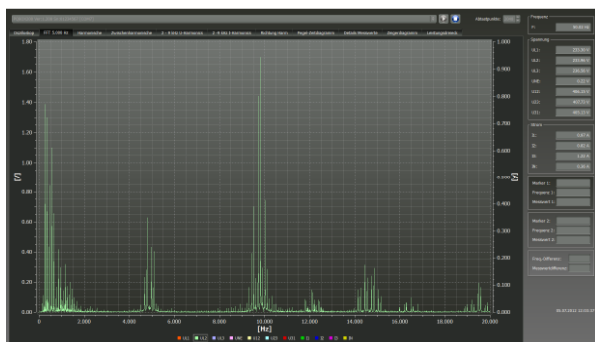
Direction and phase angle of harmonics



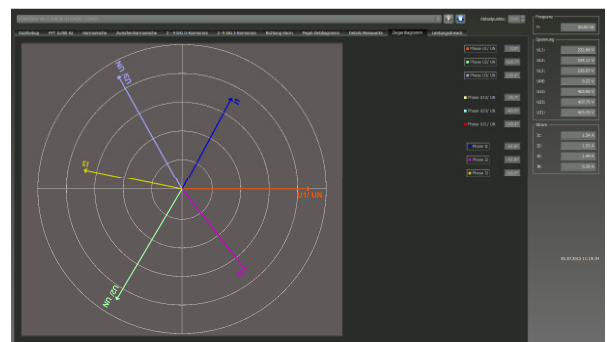
Online measured-values table



Online power-cube



FFT Analysis DC up to 170 kHz



Online phasor-diagram



## 4.2 Analysis of ripple control signals

- Recording an adjustable frequency of 100Hz to 3kHz.
- Review of ripple control signals (amplitude, pulse pattern)
- ripple control signal levels are measured with permanent records.
- The pulse recorder is suitable for evaluation of the ripple control pulse pattern.



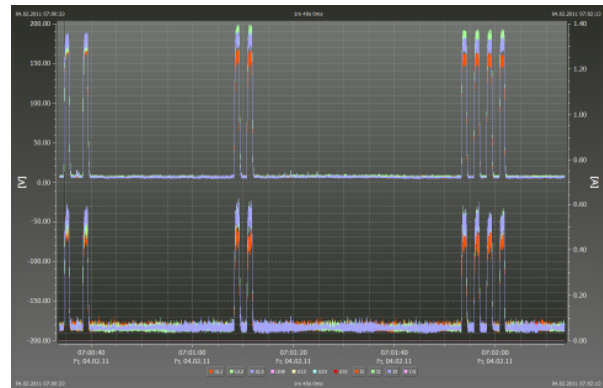
*Ripple control level over a few days*

### Ripple control signal - trigger (Option)

In addition to the ripple control level measurement, using this function it is possible to trigger to a ripple control frequency. The complete message is displayed and disturbances in the signal form can be analyzed.

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*

## 4.3 Trigger functions

PQ-Box 300 provides a large number of trigger functions for voltage, current and frequency (underrange, overrange, RMS jump, envelope trigger and phase shift).

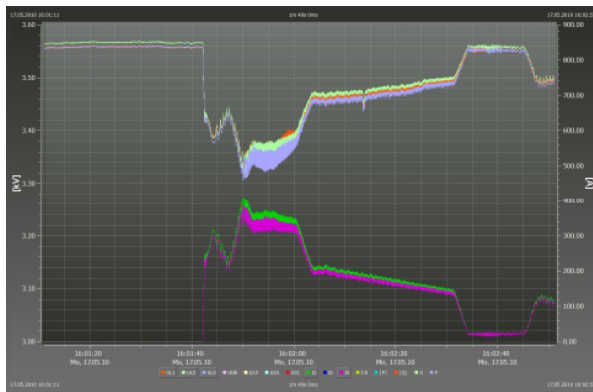
- Programmable trigger thresholds
- Programmable recording duration, pre/post time and hysteresis
- Automatic trigger selectable (in case of incorrect parameterization, Trigger values are automatically adjusted by automatic trigger; thereby memory overflow is excluded).
- External trigger by a signal via binary input

Trigger on limit violation of a frequency up to 170 kHz.

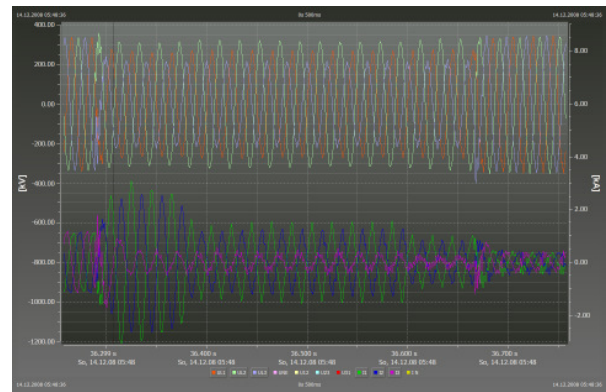
We take care of it.

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## 4.4 Fault records captured with oscilloscope and 10ms RMS recorders



10 ms RMS record (example machine start-up)

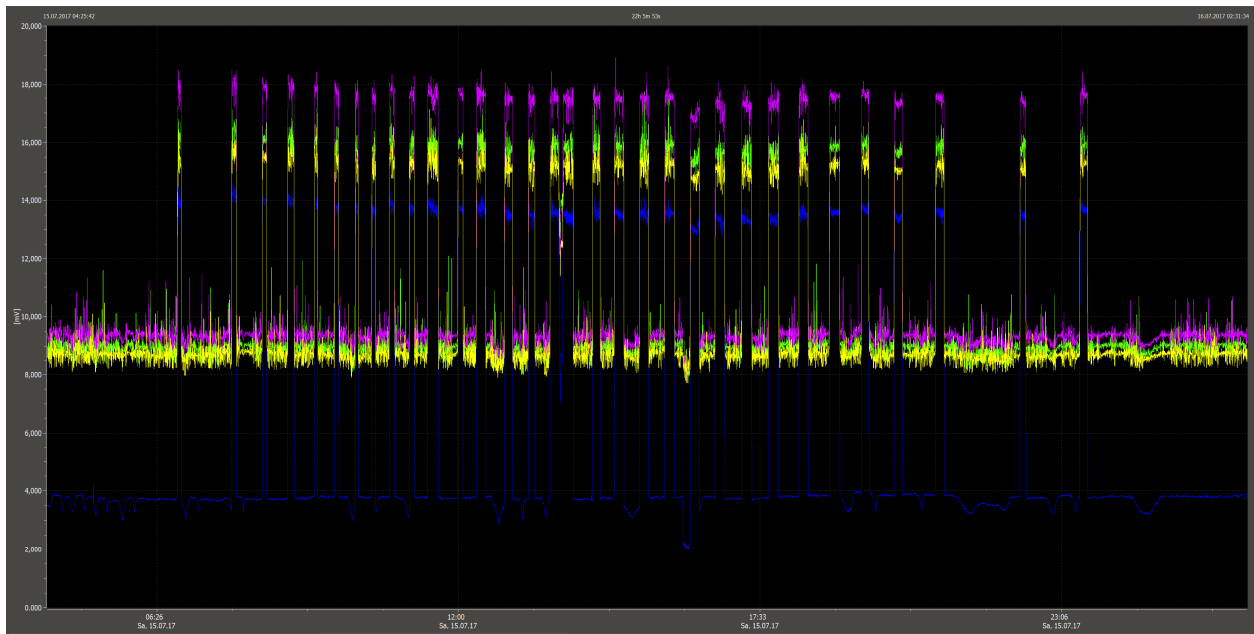


Oscilloscope record

## 5. Continuous recording

More than 4.500 measurement values are recorded continuously at each measurement, which can be evaluated by the software. The following measurement intervals can be recorded **simultaneously**:

- 200ms values
- 3sec values
- 10sec frequency
- N x sec values (1 sec to 30 min freely selectable)
- 10/15/30 min power values
- 2 Std. Long term flicker values.



72kHz signal 3-phase voltage

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## 6. Measurement procedure 2kHz to 170kHz

The voltage measuring inputs are scanned via 24-bit-Delta-Sigma converters with a sampling frequency of 20 MHz. An extremely high signal-to-noise ratio up to high frequencies is ensured by 32 x oversampling.

- ▶ **Gapless FFT calculation**
- ▶ **Programmable recording interval for all frequencies (1 sec to 30 min)**
- ▶ **Frequency resolution is 200Hz or 2kHz**

- ▶ **Frequency range 2 kHz to 9 kHz**

The calculation from 2 kHz to 9 kHz is implemented according to IEC61000-4-7 standard for current and voltage with 200 Hz frequency bands.

For example: 8,9kHz is the frequency band from 8,8kHz to 9kHz.

- ▶ **Frequency range 8 kHz to 170 kHz**

Between 8 kHz and 170 kHz a complete FFT calculation is performed as a 200 ms interval. The measurement interval for data recording is fully programmable in the range of 1 sec to 30 min with 200 ms minimum and maximum values.

- The aggregation of the frequency bands is selectable (200 Hz or 2 kHz aggregation)
- Average values and 200 ms min and max values are available for each interval
- From 8 kHz to 170 kHz the basic setting is 2 kHz frequency bands
- Frequency bands can be calculated as phase-to-ground or phase-to-neutral values
- Frequency groups can be aggregated as even or odd groups
  - Version 1: 139 kHz to 141 kHz = 140 kHz (2 kHz aggregation)
  - Version 2: 140 kHz to 142 kHz = 141 kHz (2 kHz aggregation)
- Limit values of IEC61000-2-2 (2017) standard are deposited in the software WinPQ mobil and are freely programmable by the user.

## 6.1 Technical data

PQ-Box 300	
4 voltage inputs:	L1, L2, L3, N, PE
Maximum input voltage:	565V AC/800V DC L-N 980V AC/1380V DC L-L 10 MΩ impedance
4 current inputs(AC/DC):	1000 mV input for mini clamp and 330mV for Rogowski current probes 10 kΩ impedance
AUX Input:	1V AC / 1,4V DC 10 MΩ Impedance
A/D Converter:	20 MHz Delta-Sigma Transducer 32x Oversampling 24 Bit
Synchronisation to fundamental oscillation:	45 Hz to 65 Hz
Recorder interval:	fully programmable von 1 s to 30 min
Data storage Micro-SD card:	8 GB Standard (Optional up to 32 GB)
Interfaces:	USB 2.0 TCP/IP WLAN IEEE 802.11
Time synchronisation:	DCF77 or GPS clock
Dimensions:	242 x 181 x 50 mm
Weight:	2,5 kg
Degree of protection:	IP 65
IEC 61000-4-30:	Class A
Accuracy (voltage, current):	< 0,1%
Insulation class:	CAT III / 600V CAT IV / 300V
Insulation test:	Impulse voltage 6 kV 5 sec 5,4 kV RMS 1 min 3,6kV RMS

PQ-Box 300	
Climate resistance/ Temperature:	Operation: -20° ... 60°C Storage: -30°... 80°C
TFT-colour display:	100 x 60 mm
Power supply: Via external adapter:	100 V...400 V AC/ DC 15V DC Output 47Hz to 63Hz

EMC	
CE-conformity	
<ul style="list-style-type: none"> <li>● Immunity                             <ul style="list-style-type: none"> <li>— EN 61326</li> <li>— EN 61000-6-2</li> </ul> </li> <li>● Emitted interference                             <ul style="list-style-type: none"> <li>— EN 61326</li> <li>— EN 61000-6-4</li> </ul> </li> </ul>	
ESD	
<ul style="list-style-type: none"> <li>— IEC 61000-4-2</li> <li>— IEC 60 255-22-2</li> </ul>	8 kV / 16 kV
Electromagnetic fields	
<ul style="list-style-type: none"> <li>— IEC 61000-4-3</li> <li>— IEC 60 255-22-3</li> </ul>	10 V/m
Burst	
<ul style="list-style-type: none"> <li>— IEC 61000-4-4</li> <li>— IEC 60 255-22-4</li> </ul>	4 kV / 2 kV
Surge	
<ul style="list-style-type: none"> <li>— IEC 61000-4-5</li> </ul>	2 kV / 1 kV
HF conducted disturbances	
<ul style="list-style-type: none"> <li>— IEC 61000-4-6</li> </ul>	10 V, 150 kHz ... 80 MHz
Voltage dips	
<ul style="list-style-type: none"> <li>— IEC 61000-4-11</li> </ul>	100 1min
Emmitted interference:	
<ul style="list-style-type: none"> <li>● Housing at a distance of 10 m</li> <li>● AC supply connection at a distance of 10 m</li> </ul>	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

## 7. Order Details

CHARACTERISTICS	CODE
<b>Fault recorder and grid analyzer according to DIN EN 50160 and IEC 61000-4-30 class A</b> Mobile power-quality-network analyzer and power-meter for low-, medium- and high voltage networks according to DIN EN-50160/IEC 61000-4-30 class A <ul style="list-style-type: none"> <li>● 8 GB Micro SD memory card</li> <li>● Slot for Micro-SD memory card (4 up to 32 GB cards)</li> <li>● USB 2.0 and TCP/IP Interface</li> <li>● Connection for radio clock (GPS &amp; DCF77)</li> <li>● Colour display</li> <li>● IP65 rated enclosure</li> <li>● Uninterruptable power supply for up to 3,5 h</li> <li>● USB- und TCP/IP cable set</li> <li>● Connection cable with 4 mm banana plus for voltage (phase connections fused)</li> <li>● Connection set for AUX Input (4mm banana plug)</li> <li>● 5 pcs. Dolphin clips</li> <li>● Hard case for PQ-Box 300 and accessories</li> <li>● Power supply AC/DC for supply via measurement cables</li> <li>● Evaluation software WinPQ mobil</li> </ul>	<b>PQ-Box 300</b>
<b>Option</b> <ul style="list-style-type: none"> <li>● Ripple control analysis (upgradable via licence code)</li> <li>● WLAN Interface (upgradable via licence code)</li> </ul>	R1 S1
<b>Operating manual and display language</b> <ul style="list-style-type: none"> <li>● German</li> <li>● English</li> <li>● French</li> <li>● Spanish</li> <li>● Italian</li> <li>● Dutch</li> <li>● Czech</li> <li>● Russian</li> <li>● Polish</li> </ul>	G1 G2 G3 G4 G5 G6 G7 G8 G9
ACCESSORIES	CODE
● Voltage tap on insulated cable; contact support 1 ~, connected for 35-240mm <sup>2</sup>	111.7037
● Cable set 4 phase, 1.5 mm <sup>2</sup> , 2m long, 4x 16A fuse, 4x 4mm safety plugs	111.7038
● Network adapter connector socket for 1 ~; 4mm safety plugs	582.0511
● Calibration set for PQ-Box 150/200/300 ; calibration software and adapter box	111.7039
● Kensington lock - Lock for PQ-Box 300, 1.8 m length	111.7032
● Temperature sensor, air temperature -20...80°C	111.7041
● Combination sensor for lighting 0-1400W/m <sup>2</sup> and temperature -30...70°C	111.7040
● Kit of magnetic voltage taps	111.7008
● DCF 77 radio controlled clock	111.9024.01
● GPS radio clock (230 V – RS 232)	111.9024.47
● SD memory card, 8 GB industry-standard	900.9099.8
● Replacement battery pack	570.0011



*PQ-Box 300, Case, Current Clamps*

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<http://www.a-eberle.de>

Software - Version:

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