Operating Manual

Network Analyzer / Transient Recorder
PQ-Box 200 & PQ-Box 300

Available user manuals:

- Operating manual PQ-Box 200 & 300 Hardware (this print version)
- Operating manual WinPQ mobil Software (available as PDF download from our homepage via www.a-eberle.de or via WinPQ mobil software --> Help)

GB

Note:

Please note that this operating manual cannot describe the latest version of the device in all cases. For example, if you download a more recent firmware version from the internet, the following description may no longer be accurate in every point.

In this case, either contact us directly or refer to the most recent version of the operating manual, available on our website (www.a-eberle.de).

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Table of Contents

1. User Guidance

1.1 Target group

The User Manual is intended for skilled technicians as well trained and certified operators.

The contents of this User Manual must be accessible to people tasked with the installation and operation of the system.

1.2 Warnings

Structure of the warnings

Warnings are structured as follows:

⚠ SIGNAL WORD	**Nature and source of the danger.** Consequences of non-compliance. ● Actions to avoid the danger.

Types of warnings

Warnings are distinguished by the type of danger they are warning against:

⚠ DANGER!	Warns of imminent danger that can result in death or serious injuries if not avoided.

⚠ WARNING!	Warns of a potentially dangerous situation that can result in death or serious injuries when not avoided.

⚠ CAUTION!	Warns of a potentially dangerous situation that can result in fairly serious or minor injuries when not avoided.

NOTICE:	Warns of a potentially dangerous situation that if not avoided could result in material or environmental damage.

1.3 Tips

Tips on the appropriate device use and recommendations.

1.4 Other Symbols

Instructions

Structure of instructions:

✋ Guidance for an action.

→ Indication of an outcome, if necessary.

Lists

Structure of unnumbered lists:

- List level 1
  - List level 2

Structure of numbered lists:

1) List level 1
2) List level 1
   1. List level 2
   2. List level 2

1.5 Applicable documentation

For the safe and correct use of the product, observe the additional documentation that is delivered with the system as well as the relevant standards and laws.

1.6 Keeping

Keep the user manual, including the supplied documentation, readily accessible near the system.

1.7 Updated documentation

The most recent versions of the documents can be obtained at https://www.a-eberle.de/de/downloads.

2. Safety Instructions

2.1 Safety instructions

- Follow the operating instructions.
- Keep the operating instructions with the device.
- Ensure that the device is operated only in a perfect condition.
- Never open the device.
- When opening the battery compartment, disconnect the power supply.
- Ensure that only qualified personnel operate the device.
- Connect the device only as specified.
- Ensure that the device is operated only in the original condition.
- Connect the device only with recommended accessories.
- Ensure that the device is not operated outside the design limits. (See the technical data)
- Ensure that the original accessories are not operated outside the design limits.
- For measurements in short circuit resistant systems, ensure that voltage taps with integrated fuses are used.
- Do not use the device in environments where explosive gases, dust or fumes occur.
- Clean the device only with commercially available cleaning agents.

⚠ DANGER!	**Danger to life due to electric shock!** If the device is used in a way not specified by the equipment producer, the device protection will be impaired. - Observe safety instructions

2.2 Meaning of the symbols used on the device

Nature and source of the danger! Read the safety instructions inside the manual!

Voltage ground

USB-interface

TCP-IP interface

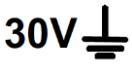
CE marking guarantees compliance with the European directives and regulations regarding EMC.

The unit is fully protected by double or reinforced insulation.

IP65 **6X** = Protection against dust
Protection against water **X5** = Protection against water jets from any angle

AC voltage

DC voltage



Maximum allowed RMS voltage against earth potential

CAT IV Category IV

2.3 Declaration of Conformity

Hereby, A. Eberle GmbH & Co. KG declares that the radio equipment type PQ-Box 300 is in compliance with Directive 2014/53/EU. The full text of the EU declaration of conformity is available at the following internet address:
https://www.a-eberle.de/en/company-profile/certificates

3. Scope of Delivery/Order Codes PQ-Box 200 & 300

3.1 Scope of Delivery

- PQ-Box 200/300
- User Manual
- Case
- 3 red dolphin clips, 1 blue dolphin clip, 1 green dolphin clip
- 3 high-load fuses integrated in voltage leads
- USB cable, Ethernet cable
- Adaptor cable for AUX input
- AC socket adapter with country-specific adapters
- Wide range power supply with 2 x 4 mm safety plugs and integrated high-load fuses
- 2 pcs. 4mm safety connectors (to staple power supply and voltage leads to one dolphin clip)

3.2 Order Codes

Option only for PQ-Box 200:

- Transient measuring board (hardware circuit board)

- 4 MHz sampling rate; +/- 5,000V measurement range; 14-bit resolution

The transient measuring board must be installed by the manufacturer.

Option for PQ-Box 200 and 300:

WLAN / Wi-Fi Interface S1 (license code)

- Wireless communication between measurement device and PC via WLAN / Wi-Fi

The WLAN / Wi-Fi Interface can be enabled with a license code subsequently.

Ripple control signal analysis (License Code)

- Used for triggering and recording ripple control signals for voltages and currents.

With a license code, the PQ-Box 200 can be upgraded with ripple control recorder.

ACCESSOIRES PQ-Box 200 & 300	IDENT-NO.
● Voltage tap on insulated cable; contact support 1 ~, connected for 35-240mm ² ● Cable set 4 phase, 1.5 mm ², 2m long, 4x 16A fuse, 4x 4mm safety plugs	111.7037 111.7038
● Calibration set for PQ-Box 100/150/200/300; calibration software and adapter box	111.7039
● Kensington lock - Lock for PQ-Box 200/300, 1.8 m length	111.7032
● Temperature sensor, air temperature -20…80°C	111.7041
● Combination sensor for lighting 0-1400W/m2 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
● CAT-Booster (600 V CAT IV) voltage adapter for PQ-Box 100 / 200	111.7026
● SD memory card, 4GByte industry-standard	900.9099.04
● SD memory card 8 GByte industry-standard	900.9099.08
● Replacement battery pack	570.0011

Measured Values / Functions	PQ-Box 200
Automatic standard analysis and event collection in accordance with: EN50160 (2011) / IEC61000-2-2 / IEC61000-2-12 /IEC61000-2-4 (class 1; 2; 3) / NRS048 / IEEE519 / own generating plants in the low-voltage network; MS Network	
Record free interval 1sec to 30 min (>2,600 measurement parameter permanent parallel):	X
Voltage: Average. Min. Max. Value	X
Power, Average, Max. Value	X
Power: P, Q, S, PF, cos phi, sin phi	X
Distortion power D; Fundamental oscillation power	X
Energy: P, Q, P+, P-, Q+, Q-	X
Flicker (Pst, Plt, Ps5)	X
Unbalanced current and voltage; reactive system,	X
Voltage harmonics according to IEC61000-4-30 Class A	up to 50
Voltage harmonics 200 Hz frequency bands	2 kHz to 9 kHz
Current harmonics	up to 50
Current harmonics 200 Hz frequency bands	2 kHz to 9 kHz
Phase angle of current harmonics	up to 50
THD U and I; PWHD U and I; PHC	X
FFT calculation of voltages and currents	DC to 20 kHz
Ripple control signal 100 Hz to 3 kHz	X
Frequency, 10 sec, average. Min. Max. Value	X
10/15/30 min Interval power value P, Q, S, D, cos phi, sin phi	X
Online Mode:	
Oscilloscope image	40.96kHz
3D power triangle for active, reactive, apparent power and distortion power	X
Voltage, current harmonics	DC to 20 kHz
Inter-harmonic groups (U, I)	DC to 20 kHz
Direction of harmonics and current harmonics phase angle	X
Trigger functions (Rec A / Rec B)	
Manual trigger - trigger button	X
RMS trigger on below, above threshold (U, I)	X
RMS trigger jump (U, I)	X
Phase shift trigger	X
Envelope trigger	X
Automatic trigger	X
Trigger on binary input (0 – 250 V AC/DC; 10 V threshold)	X
Ripple control signal analysis recorder for voltage and current – **Option R1**	100Hz to 3kHz
Transient Recorder programmable 200 kHz; 500 kHz; 1 MHz; 2 MHz – **Option T1**	2MHz

Measurement / Functions	PQ-Box 300
Automatic event detection and evaluation standards for: EN50160 (2015) / IEC61000-2-2 / IEC61000-2-12 / IEC61000-2-4 (Class 1; 2; 3) / NRS048 / IEEE519 / VDE N-4105 / IEC61000-4-30 Ed. 3 Class A / IEC61000-4-7 / IEC61000-4-15 / IEC62586-2 Ed. 2 / IEC62586-1	
Recording with user defined interval of 1sec to 30min (>3.900 parameters permanently measured):	X
Voltage: min. max. average	X
Current: min. max. average	X
Power: P, Q, S, PF, cos phi, sin phi	X
Distortion-, basic-, unbalance- and modulation reactive power	X
Energy: P, Q, P+, P-, Q+, Q-	X
Flicker (Pst, Plt, Pinst)	X
Unbalanced voltage, current; positive-, negative- and zero-sequence	X
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	X
FFT calculation of voltages and current	DC up to 20kHz
Ripple control signal	100 Hz to 3 kHz
Frequency, 10sec, min. max. average	X
10/15/30 Min interval power values P, Q, S, D, cos phi, sin phi	X
Online mode:	
Oscilloscope recorder	X
3D power triangle for active, reactive, apparent power and distortion power	X
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	X
Trigger functions (Rec A / Rec B)	
Manual trigger – trigger button	X
RMS level trigger (voltage, current)	X
RMS jump trigger (voltage, current)	X
Phase shift trigger	X
Envelope trigger	X
Automatic trigger	X
Trigger on binary input (0 – 250V AC/DC; 10 V threshold)	X
Ripple control signal analysis recorder for voltage and current – **Option R1**	100Hz to 3kHz

3.3 Technical Data PQ-Box 200 & 300

4 voltage inputs (TRMS): Maximum input voltage: Input Impedance:	L1, L2, L3, N, PE 565V AC/800V DC L-N 980V AC/1380V DC L-L 10 MΩ impedance
Voltage range AC adapter Power supply PQ-Box 200	100-400 V AC/DC; 47Hz – 63Hz / 15 V DC, 0,58A output
Voltage range of the current measurement channel - Mini current clamps / Adapter connection set - Rogowski coils - AUX input	 700 mV RMS; 1000 mV DC 330 mV AC 1000 mV RMS; 1400 mV DC
micro SD card memory	4 GB standard / up to 32 GB optional
Interfaces - USB 2.0 - TCP/IP - RS232 -WLAN / Wi-Fi *(option only for PQ-Box 300)*	 Communication Communication DCF77 connection or GPS synchronization unit Radio communication frequency band 2.4 GHz max. radiated output power 18 dBm EIRP max. conducted output power 15 dBm
Display	Illuminated
Dimensions	242 x 181 x 50 mm
Protection class	IP65 rated enclosure
Measurement methods	IEC 61000-4-30; class A
Temperature range	Operation: -20 °C …. 60 °C Storage: -30 °C …. 80 °C
USV	Li ion battery (bridging 6 Std.)
Insulation category	CAT IV / 300V L-E (CAT III/ 600 V L-E)
Converter	24 Bit A/D
Input impedance of the voltage measurement channel	1 MΩ
Accuracy current measurement channel - 0.85 mV ≤ Ue < 5 mV - 5 mV ≤ Ue < 50 mV - 50 mV ≤ Uc ≤ 700 mV	 0.01 % of end value < 0,5 % of the measured value < 0.1% of the measured value

Measurement quantity	Error limits according IEC 61000-4-30, Class A
Fundamental oscillation: r.m.s.	±0.1% of U_{din} over 10% ~ 150% of U_{din}
Fundamental oscillation: Phase	± 0.15° over 50% ~ 150% of U_{din} over f_{nom} ±15%
2nd ... 50th harmonic	±5% of display over U_m = 1% ~ 16% of U_{din} ±0.05% of U_{din} over U_m < 1% of U_{din}
2nd .... 49th inter-harmonic	±5% of display over U_m = 1% ~ 16% of U_{din} ±0.05% of U_{din} over U_m < 1% of U_{din}
Frequency	± 5mHz over f_{nom} ±15% (f_{nom} = 50 Hz / 60 Hz)
Flicker, Pst, Plt	±5% of display over 0.02% ~ 20% of ΔU / U
Dip residual voltage	±0.2% of U_{din} over 10% ~ 100% of U_{din}
Dip duration	±20 ms over 10% ~ 100% of U_{din}
Swell residual voltage	±0.2% of U_{din} over 100% ~ 150% of U_{din}
Swell duration	±20 ms over 100% ~ 150% of U_{din}
Interruption duration	±20 ms over 1% ~ 100% of U_{din}
Voltage asymmetry	±0.15% over 1% ~ 5% of display
Ripple control voltage	±5% of display over U_m = 3% ~ 15% of U_{din} ±0.15% of U_{din} over U_m = 1% ~ 3% of U_{din}

Environmental conditions

Temperature range

Function	-20 ... +60°C
Transport and storage	-30 ... +80°C

Humidity

No condensation	< 95 % rel.

Dry, cold

IEC 60068-2-1	-15°C / 16 h

Dry, hot

IEC 60068-2-2	+55°C / 16 h

Constant humid heat

IEC 60068-2-3	+ 40 °C / 93 % / 2 days

Cyclical humid heat

IEC 60068-2-30	12+12h, 6 cycles, +55°C/93%

Toppling

IEC 60068-2-31	100 mm drop, unwrapped

Vibration

IEC 60255-21-1	Class 1

Impact

IEC 60255-21-2	Class 1

Operating conditions and magnitude of additional error

Temperature in range 0°C to 45°C	35ppm / 1K
Humidity	< 95%
Instrument supply voltage and related series interferences	< 1ppm
Common-mode interference voltage between earth connection of the instrument and input circuits	Current: 50Hz / 1,5µA/V; 1kHz / 50µA/V Voltage: 50Hz / 85dB; 1kHz / 60dB Isolated inputs

EMC

CE- conformity

- Interference immunity
  - EN 61326
  - EN 61000-6-2
- Emitted interference
  - 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 % 1min
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

4. External power supply

4.1 Requirement external power supply

Maximum power consumption incl. Backlight PQ-Box 200 – PQ-Box 300	Output power supply: Voltage: 15V DC Current: 0,58A

⚠ **CAUTION!**	**Protection strength** In order not to reduce the device protection class and surge strength of the network analyzer, the following requirements must be met by the external power supply. If these details are reduced, so the entire PQ-Box is reduced to this lower requirement.

IP protection	IP 65
Temperature	Function: -20° ….60°C Storage: -30°….70°C
Overvoltage category	EN61010-1 600V / CAT IV
surge	12kV 1,2/50 µsec
AC voltage	7,4kV 5 sec

Polarity of the external voltage supply with 15V DC

4.2 External power supply

Scope of Delivery PQ-Box

- AC socket adapter with country-specific adapters (582.0509)
- Wide range power supply with safety plugs and integrated high-load fuses (111.7069)
- 2 pcs. 4mm safety connectors (582.2037)

The PQ-Box is equipped with an extremely robust power supply unit. The power supply is designed for high noise immunity of 600V CAT IV and meets the IP65 protection class.

The PQ-Box can be supplied with energy directly at the measurement place and does not require a socket. The following voltage ranges for the power supply are possible: 100V to 440V AC or 100V to 300V DC.

In fuse carrier only 6.3mm x 32mm, 3 A, F, fuses are allowed, with a shut-off value of 50kA. Only fuses with the identical data must be used.

Suggestion: SIBA, Part.no. 7009463; 3AF

With two short adapter cables, the user has the option to tap into the wide range power supply and the voltage leads the network analyzer to one dolphin clip.

Socket adapter with 4 mm safety banana plugs for voltage measurement or connection of the wide range power supply at a socket.

⚠ CAUTION!

Damage to power supply due to under- or overvoltage

- Only power the device between 88V and 500V AC.
- Only supply power between 100 and 300 V DC.
- Do not supply the device directly from strongly disturbed voltages. (eg. at the frequency inverter output / Caution high clock frequencies can destroy the internal power supply)

5. Accessories for current measurement

- Standard accessories are automatically recognized by the meter.
- The conversion factor is automatically adjusted for the connected accessory.

5.1 Rogowski current clamps

- **Rogowski current clamp 4~: Ident-No. 111.7001**
- **Rogowski current clamp 4~: Ident-No. 111.7006**

Model 111.7001/6

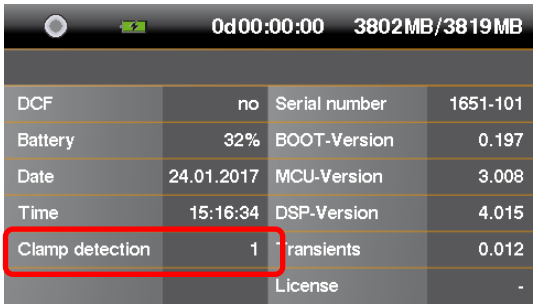
Model	**111.7001 Pro Flex 3000 4~**	**111.7006 Pro Flex 6000 4~**
Current range	3,000 A AC RMS	6,000 A AC RMS
Measurement range	0-3300 A AC RMS	0-6,600 A AC RMS
Output voltage	85 mV / 1000 A	42.5 mV / 1000 A
Frequency range	10 Hz to 20 kHz	10 Hz to 20 kHz
Isolation voltage type	600 V AC / DC CAT IV	600 V AC / DC CAT IV
Accuracy (20 °; 50 Hz)	<50 A/0.1 % of the full scale value 50-3000 A/1.5 % of the measured value	<100 A/0.1 % of the full scale value 100-6000 A/1.5 % of the measured value
Angle error (45-65 Hz)	<50 A/2.5 ° 50-3000 A/1 °	<100 A/2.5 ° 100-6000 A/1 °
Position accuracy	<50 A/0.2 % of the full scale value 50-3000 A/1.5% of the measured value	<100 A/0.1 % of the full scale value 100-6000 A/1.5% of the measured value
Long Rogowski coils	610 mm	910mm
Diameter clamp head	9,9mm	9,9mm

- **Mini- Rogowski current clamp 4~: Ident-No. 111.7085**

Current range: 500A RMS; Accuracy: 1%
Rogowski clamp length = 220mm;
Diameter = 70mm; Rogowski clamp head = 6mm
Frequency range: 10Hz to 50kHz

Automatic current clamp factor detection.

In this example the PQ-Box set the clamp factor to 1



5.2 Current clamps

The MU-metal clamp is especially applicable for small current measurements on secondary transformers in medium- and high-voltage networks. High accuracy and small angle errors are combined.

- **Mu-Metal Mini-Current clamps 3~: Ident-No. 111.7003**

Current range: 10mA to 20A

Frequency range: 40Hz to 20kHz

- **Mu-Metal Mini-Current clamps 4~: Ident-No. 111.7015**

Current range: 10mA to 20A/200A AC RMS (two ranges)

Frequency range: 40Hz to 20kHz

Model 111.7015

Measurement range	**20 A measurement range**	**200A measurement range**
Current range	20 A AC RMS	200 A AC RMS
Measurement range	100 mA to 20 A RMS	1 A to 200 A RMS
Output voltage	10 mV/A	1 mV/A
Frequency range	40 Hz to 20 kHz	40 Hz to 20 kHz
Isolation voltage type	600 V AC	600 V AC
Accuracy	100 mA- 10 A/1.5 % of the measured value 10-20 A/1 % of the measured value >20 A/1% of the measured value	10-40 A/<2 % of the measured value 40-100 A/<1.5 % of the measured value 100-200 A/<1 % of the measured value
Angle error	100 mA- 10 A/2 ° 10-20 A/2° >20 A/2°	10-40 A/<2 ° 40-100 A/<1.5 ° 100-200 A/<1 °

200 A Measurement range (111.7015)

Adjustment of the power converter factor to x10. For the clamp with two ranges the automatic factor detection of the PQ-Box does not work for the second.

- **Mu-Metal Mini-Current clamp 0…5A 1~: Ident-No. 111.7043**

Current range: 5mA to 5A AC RMS

Frequency range: 40Hz to 20kHz

Free current adapter set necessary

- **AC/DC Current clamp 1~: Ident-No. 111.7094**

AC/DC Hall sensor clamp. Set with power supply and 2 pcs. 4mm connectors

Current range 60A/600A (two ranges)

Model 111.7094

Measurement range	**AC/DC 60 A**	**AC/DC 600 A**
Current range	60 A DC / 40A AC RMS	600 A DC / 400A AC RMS
Measurement range	200 mA to 60 A RMS	600 A RMS
Output voltage	10 mV/A	1 mV/A
Frequency range	DC to 10 kHz	DC to 10 kHz
Isolation voltage type		
Accuracy	0.5-40 A/<1.5 % +5 mV 40-60 A/1.5 %	0.5-100 A/<1.5 % +1 mV 100-400 A/<2 % 400-600 A(DC only)/<2.5 %
Angle error	10-20 A/<3 ° 20-40 A/<2.2 °	10-300 A/<2.2 ° 300-400 A/<1.5 °

600 A Measurement range (AC/DC)

Adjustment of the power converter factor to x10

5.3 Accessories for current measurement

- **Free Adapter set for connecting 4 clamps: Ident-No.: 111.7004**

Adapter set for connecting 4 clamps or shunt with 4mm connectors and 2m in length

Power conversion factor

Current conversion correction factor; the default is 1 A/10 mV

Example:

If you use a current clamp with a 500 A to 500 mV range, it is necessary to change the CT ratio in the setup of the device to “10x”.

⚠ CAUTION!	**Damage to the device from external current clamps**
	✋ Do not use clamps with A or mA output
	✋ Avoid input voltages at the current inputs greater than 30 V

▶ **Current clamp cable extension: Ident-No.: 111.7025**

Cable extension 5m for current clamps or Rogowski coils.

▶ **Current-shunt 2A: Ident-No.: 111.7055**

Measurement of AC- and DC-currents. Current range = 2A / 200mV output signal

6. Intended use

The product is exclusively for the measurement and evaluation of voltages and currents. The current inputs are mV-inputs.

✋ Observe safety instructions
✋ Ensure that the device is not operated above the rated data

7. Description

The Network Analyzers PQ-Box 200 & 300 are suitable for analysis in low, medium and high-voltage networks. They meet all the requirements of the measurement equipment standard IEC61000-4-30 Ed. 3 class A.

Functions:

→ Voltage quality measurements according to EN50160, IEC61000-2-2 and IEC61000-2-4 for low and medium voltage networks

→ Fault recorder functions

→ Load analysis; energy measurements

→ Ripple control signal analysis

→ Transient analysis

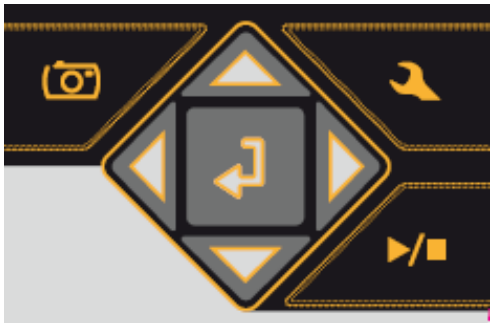
8. Hardware PQ-Box 200 & 300

PQ-Box 200 & 300 overview

Top panel view

1) Securely connected voltage inputs
   L1 (red + label L1)
   L2 (red + label L2)
   L3 (red + label L3)
   N (blue + label N)
   Measurement ground (green + label E)
2) Binary input (0 – 250V AC/DC; threshold >20V high; <12V low)
3) AUX input (1 V AC / 1.4 V DC)
4) Current clamp connection (7-pin plug)

Front panel - keypad



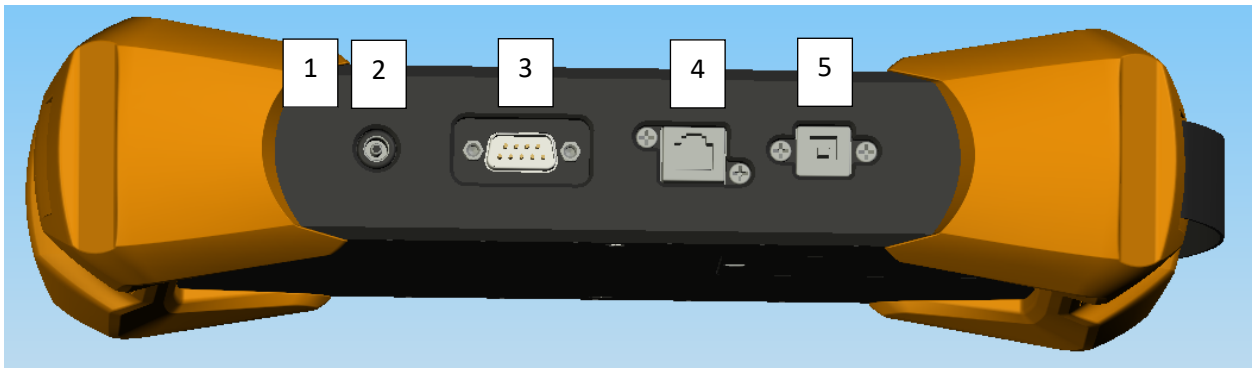

Measurement Start / Stop


Manual trigger

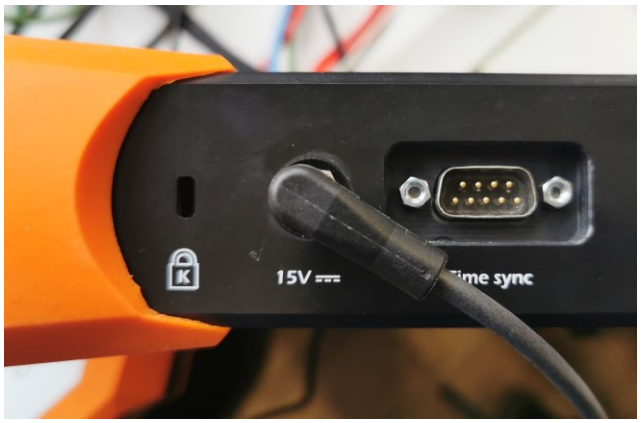

Setup


Panel with 5 keys for scrolling and changing setup parameters

Bottom view

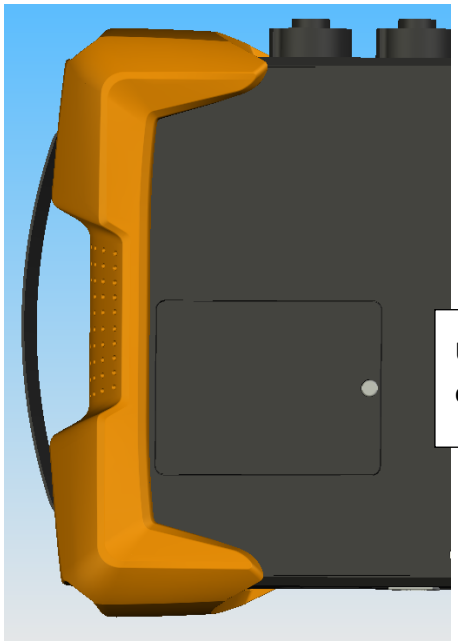


1) Kensington lock
2) 15 V DC power supply



3) RS232 interface – for connecting a DCF77 or GPS radio clock
4) TCP/IP interface
5) USB 2.0 interface

Rear view



Under the cover you find a battery pack and a card slot for a micro SD card (1 Gb to 32 Gb)

9. Battery management and micro SD card

9.1 Micro SD card

To replace the microSD card, please note the following:

- The PQ-Box support microSD cards up to a maximum size of 32 GB.
- We recommend the use of an industrial grade micro-SD card.

- Insert the micro SD card into the appropriate slot in the correct direction. The correct direction is defined by a notch on the microSD card.

9.2 Accumulator

The PQ-Box is equipped with a lithium-ion battery and intelligent charging electronic.
The aim is to achieve a long battery life time. At 80% capacity, the PQ-Box can run approximately 6 hours without mains supply.
The Li-ion battery is first charged to 100% when the threshold (75%) is reached. This has a very positive effect on the total life time of the batteries.
Aging: At high temperature and when the battery is full, the cell oxidation developed particularly rapidly. This condition may occur, f. e. in notebooks when the battery is fully charged and at the same time, the device is in operation. The optimal charge level is between 50% and 80% during storage.

- Charging stops when exceeding a battery temperature of 50 ° C
- Start charging only when the battery temperature is less than 45 ° C
- Warning Battery capacity below 7%
- PQ-Box shutdown when battery capacity <5%

▶ **Display state of charge battery:**

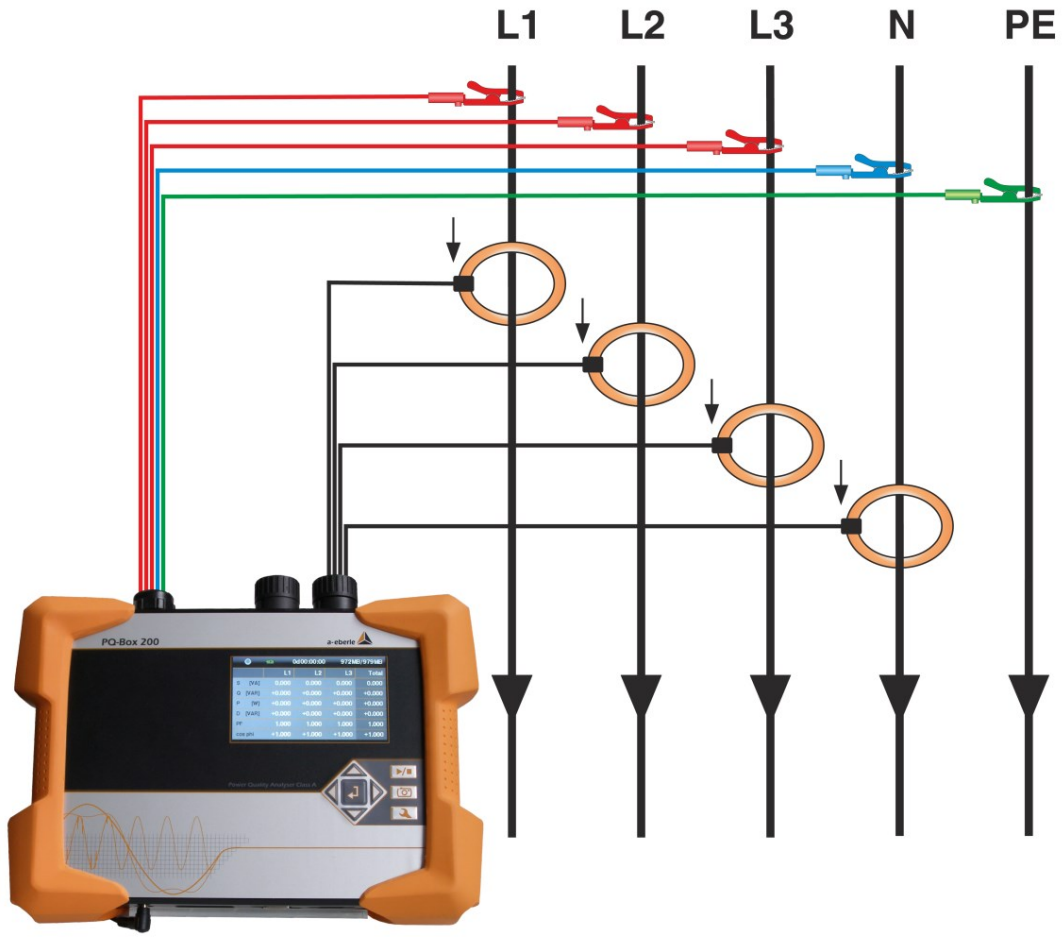
state of charge >= 100% --> four green bars
state of charge >= 75% --> three green bars
state of charge >= 40% --> two green bars
state of charge >= 20% --> one red bar
state of charge < 20% --> empty

We recommend storing the battery of the PQ-Box at 15 ° C with a charge of 60% - this is a compromise between accelerated aging and self-discharge. The battery of the PQ-Box should be recharged to approximately 55-75% every six months, due to the natural self-discharge, in order to ensure a long-term service life.

10. Network connection PQ-Box 200 & 300

10.1 Direct connection to a 3-phase low voltage network

Connection in a 3-phase 4-wire AC network



Voltage connection

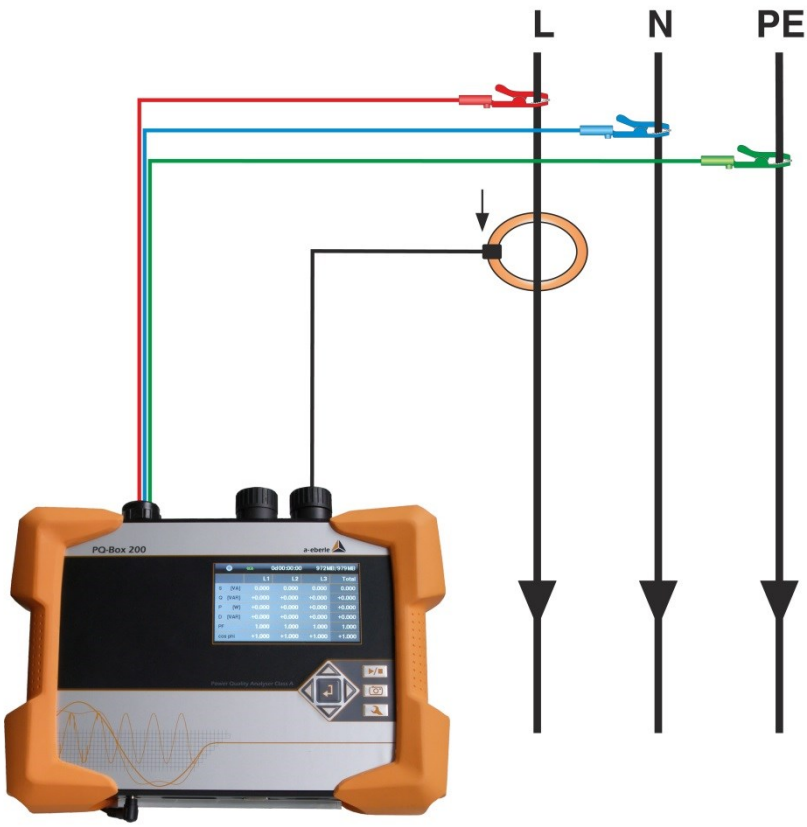
- Ensure that voltage measurement cable PE is connected for every measurement.
- If no PE connection is available, connect E and N together.
- Ensure that switching (4-wire) is selected. (Setting via display or software)

PE conductor current measurement

The PQ-Box offers the possibility to use the AUX input to measure the PE conductor current or differential current in parallel with the L1, L2, L3 and N conductor currents.

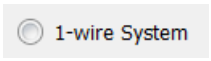
10.2 Connection to a single-phase low voltage network

Connection for single-phase measurements



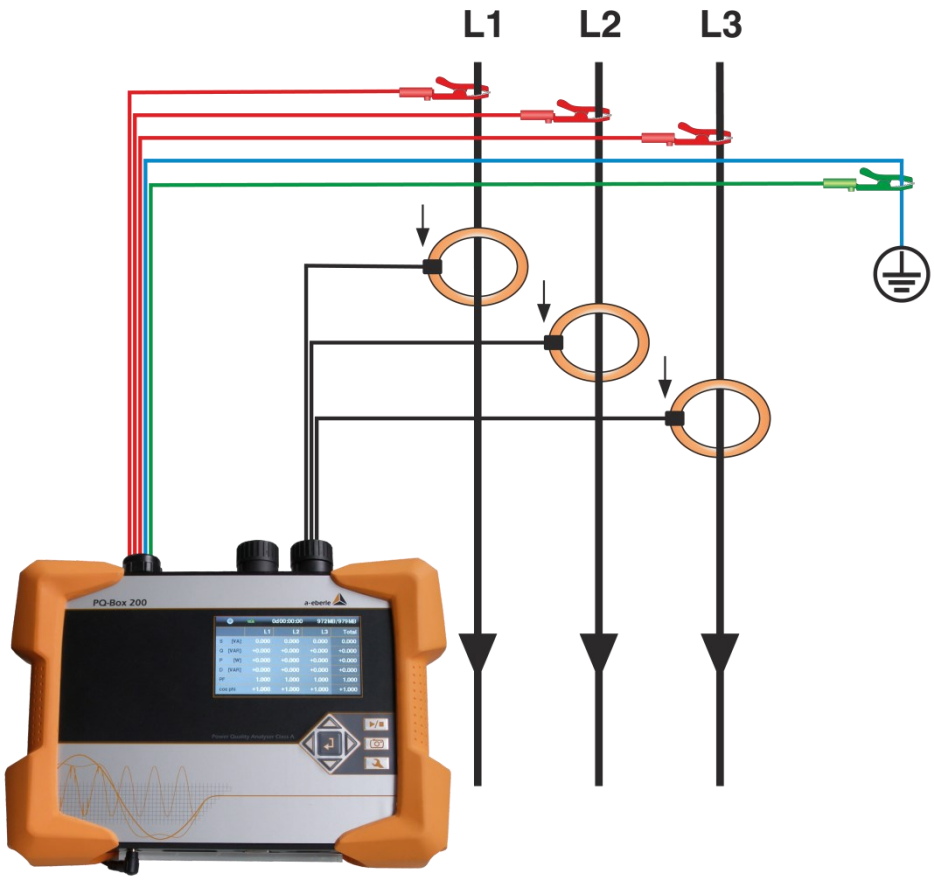
Voltage connection

- Ensure that voltage measurement cable E is connected for every measurement.
- If no PE connection is available, connect E and N together.
- Ensure that switching “1-wire system” is selected. (Setting via display or software)



- Not necessary to connect phases L2 and L3 for voltage and currents in single phase measurement.

10.3 Connection to an isolated network



Connections

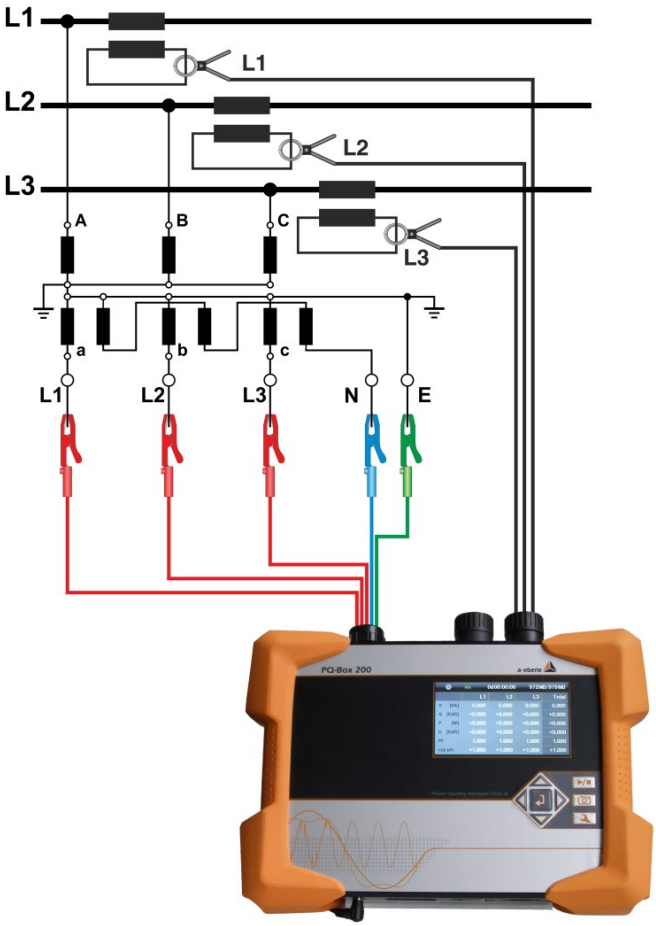
- Connect terminals E and N together and connect it to a ground potential.
- Ensure that switching (3-wire) is selected. (Setting via display or software)

The input impedance of a measuring input is 10 mega ohms.

If the high-resistance ground connection is not desired, it is also possible to interconnect the terminals E and N and to hang open. (No connection to any ground)

In 3-wire connection the 4th voltage channel and the 4th current channel will be calculated from the device. (Voltage Neutral to Ground and current of the star point)

10.4 Connection to secondary transformer



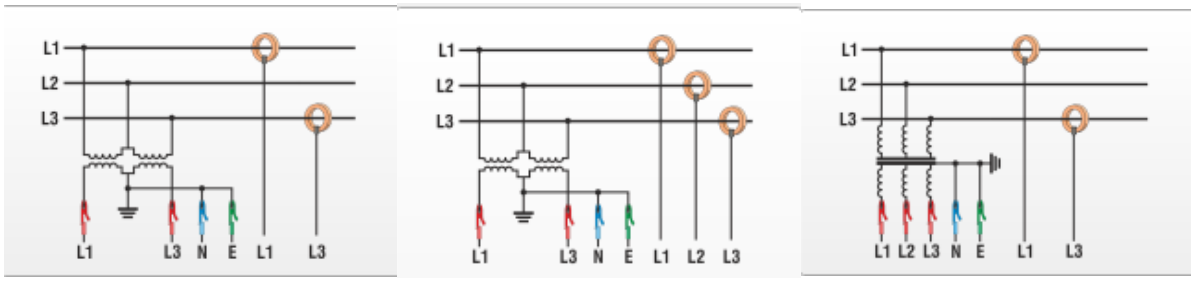
Connections

- Ensure that voltage measurement cable E is connected for every measurement.
- If no PE connection is available, connect E and N together.
- Ensure that switching (3-wire) is selected. (Setting via display or software)
- Set the voltage transformer ratio
- Enter the nominal conductor-conductor voltage
- Set the current transformer ratio

In 3-wire connection the 4th voltage channel and the 4th current channel will be calculated from the device. (Voltage Neutral to Ground and current of the star point)

10.5 Special circuit types

Configurations such as a V connection or Aron connection can be set-up.



- V connection (set-up through the evaluation software or device setup)
- Aron connection (set-up through the evaluation software or device setup)

Isolated networks

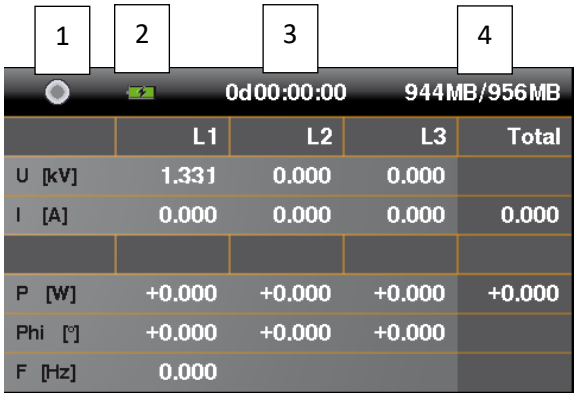
Connections

- Connect voltage measurement conductors E and N to ground
- If this is not desired in the plant due to isolation monitoring, the E and N connections can be connected together and remain free without connection.
- Ensure that switching (3-wire) is selected.
- Set the voltage transformer ratio
- Enter the nominal conductor-conductor voltage
- Set the current transformer ratio

11. Display

Pressing the right and left arrows on the directional pad  changes the page of the Display.

Display page 1

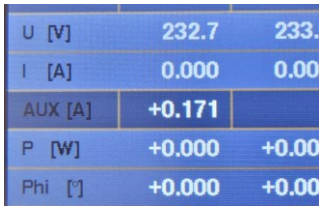


1) Recording "On" is indicated by a flashing red light 
2) Display state of charge battery
   state of charge >= 100% --> four green bars
   state of charge >= 75% --> three green bars
   state of charge >= 40% --> two green bars
   state of charge >= 20% --> one red bar
   state of charge < 20% --> empty
3) Current recording duration
4) Free space for recording / SD card size

AUX input display

If a sensor was parameterized at the AUX input, the output of the sensor with converted units is shown on the 1st display page.

Example: temperature sensor



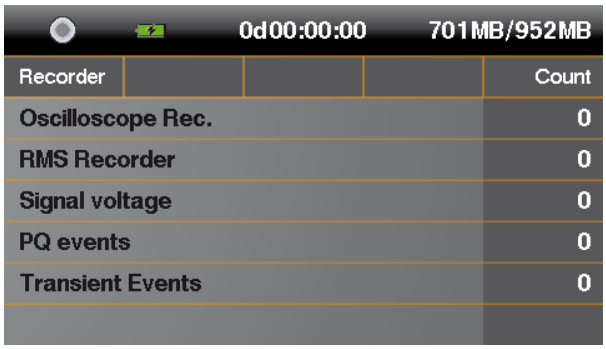
Example: differential current clamp

Display page 2

		L1	L2	L3
Imax	[A]	1.763	1.515	1.597
I	[A]	0.000	0.000	0.000
Umax	[V]	233.5	232.3	233.0
U	[V]	232.4	231.8	232.5
Umin	[V]	231.4	230.6	231.3

→ Display of the ½ period extreme values Imax, Umin, Umax over the entire recording period

Display page 3



Recorder	Count
Oscilloscope Rec.	0
RMS Recorder	0
Signal voltage	0
PQ events	0
Transient Events	0

→ Display the number of PQ events and fault recorder during the current measurement

Display page 4

		L1	L2	L3	Total
S	[VA]	0.000	0.000	0.000	0.000
Q	[VAR]	+0.000	+0.000	+0.000	+0.000
P	[W]	+0.000	+0.000	+0.000	+0.000
D	[VAR]	+0.000	+0.000	+0.000	+0.000
PF		1.000	1.000	1.000	1.000
cos phi		+1.000	+1.000	+1.000	+1.000

→ Display of the apparent, active and reactive power with sign prefix (individual phases and total performance)

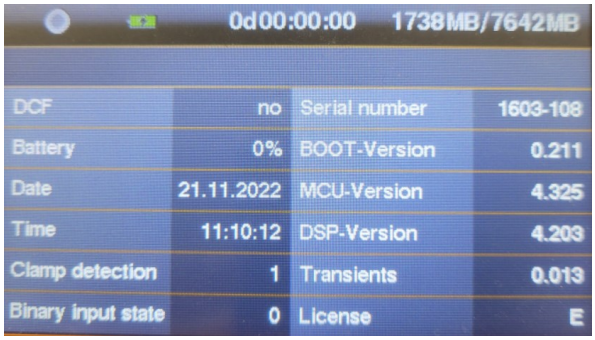
Display page 5

→ Display of the current and voltage THD (individual phases, neutral conductor)

→ Display of the conductor-conductor voltages

→ On the last two lines, the active and reactive power are displayed from the start of the measurement.

Display page 6



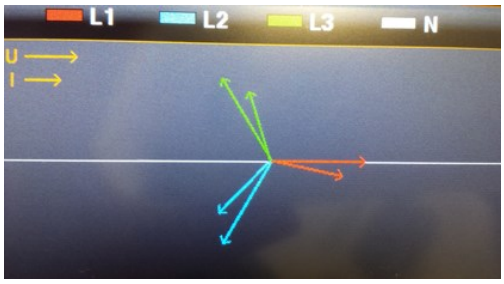
→ Date, time, version, current firmware version, time synchronization and the status of the binary input of the PQ-Box

→ After changing display pages once more, display page 1 appears again.

Graphic display PQ-Box

With the keypad by pressing, "up" or "down" you get into the graphic screens.

Graphic display 1: Phasor diagram voltage and current



.

Scroll to the right or to the left with the keypad  to reach the oscilloscope pictures.

Graphic display 2: oscilloscope voltage and current
Graphic display 3: oscilloscope voltage
Graphic display 4: oscilloscope current

With the “Enter” key it is possible to get back to the value view.

11.1 Starting a measurement

Press the  key to stop or start measuring.

- Recording "On" is indicated by a flashing red light 

For a positive display of the active power

Ensure that the arrows on the current clamps point towards the consumer.

11.2 Manual Trigger

Press the  key to set manual trigger.

→ Store the current voltages and currents with:

- Oscilloscope recorder
- 10ms RMS recorder
- Transient recorder

1) The number of the Oscilloscope record increases by 1.

2) The number of the RMS record increases by 1.

3) Transient events increased by 1.

The recording length and sampling frequency from transient measurement depends on the recorder configuration selected in the software.

Example 3/4:

4 fault records were triggered in internal memory, while 3 fault records been stored on the SD card.

Example:

To evaluate the network perturbation of a consumer in the network:

Before starting the consumer, activate manual trigger.

After starting the consumer, activate manual trigger.

It is possible to compare all the images in the software. The images provide information about the cause of the network perturbations

11.3 Time synchronisation using the RS232 interface

→ The RS232 interface is equipped as standard for a DCF77 or GPS receiver connection.

- Automatic synchronization of the measurement equipment after connecting receivers. If synchronization is lost, the PQ-Box 200 runs with an internal quartz clock.

- A detected external clock is shown on the equipment display on display page 5.

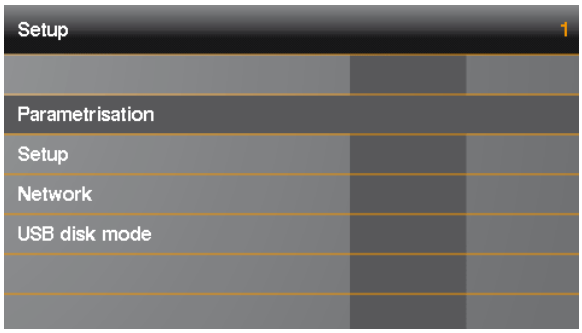
Please start the measurement only after the initial synchronization is completed (this may take a few minutes depending on the GPS signal strength).

11.4 PQ-Box Setup

Press the  key to open Setup.

Press this key again to exit the Setup Menu.

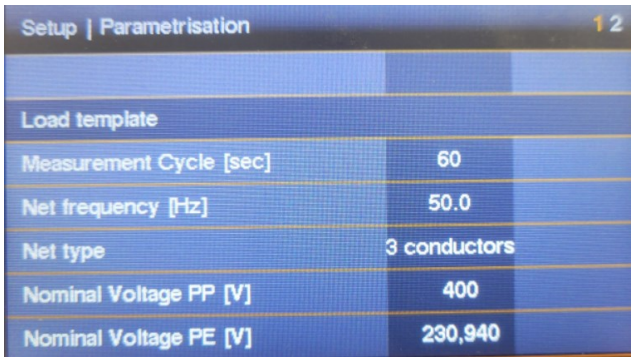
→ Display page changes to the Main Menu.



1) Change the network data parameters (measurement interval, nominal voltage, conversion factors)
2) Basic equipment settings (display language, date, time)
3) TCP-IP interface settings
4) Change USB interface of PQ-Box to mass storage (very fast USB data transfer to PC)

   For the transfer of very large measurement files from the PQ-Box to the PC via a USB connection, we recommend the "USB mass storage" setting. With this function, the PQ-Box registers itself as a storage medium on the PC and large measurement data can be transmitted much more quickly.

Parameterisation page 1



1) Load template
   Various setup files can be stored in the PQ-Box via the WinPQ mobile software, which can be selected at this point.
2) Freely adjustable measurement interval: 1 sec to 30 min (default interval setting = 600 sec)
   Settings < 1 min should only be used for short measurements.
3) Network frequency
   16,7Hz, 50Hz or 60Hz net is available
4) Switch between 1~; 3~ and 4~ conductor networks.
   In a single phase network, only phase L1, neutral and earth will be measured.
   In a 3-conductor system, all evaluations of the standard reports are calculated from the phase-phase voltages.
   In a 4-conductor system, all evaluations of the standard reports are calculated from the phase-ground voltages.
   Additional network types are: V-connection, split phase and delta high leg
5) Nominal voltage refers to the contractually agreed phase-to-phase voltage.
   All recorders refer to this value as a percentage.
   For the low voltage: 400 V applies.

scroll with the left/right control keys

Parameterisation page 2

1) Voltage converter corresponds to the ratio between the primary and secondary voltage.
2) Current converter corresponds to the ratio between the primary and secondary current.
   Example: CT 600A/5A = factor 120
3) Switch Aron connection for 2-current converter measurement on and off (only available in 3-wire network)

Changing parameters

Setup | Parametrisation	1 2
Measurement Cycle	0600
Nominal Voltage	400
Voltage Converter L	1
Voltage Converter N	1
Current Converter L	1
Current Converter N	1

Press  .

→ the color of the selected parameter changes to orange

Select position

→ the value can now be changed with the up and down arrows

Press  to accept the changed value

→ the new value appears in the Menu

Settings page 1

Setup | Setup	1 2
Language	English
Date	25.09.2017
Time	17:48
Continuous mode	off
Memory limitation (680MB)	active
Interface Lock	off

1) Change the display language
2) Change the date
3) Change the time
4) Continuous mode (active = PQ-Box run permanent)
5) Memory limitation to 680 MB – active or no limitation of memory (Memory management)
6) Password protection for interfaces and display of PQ-Box (see chapter password protection)

11.5 Keypad Lock

Press and hold the Setup key for > 5 sec while a measurement is in progress.

→ Keypad lock active.

Then press and hold > 5 sec.

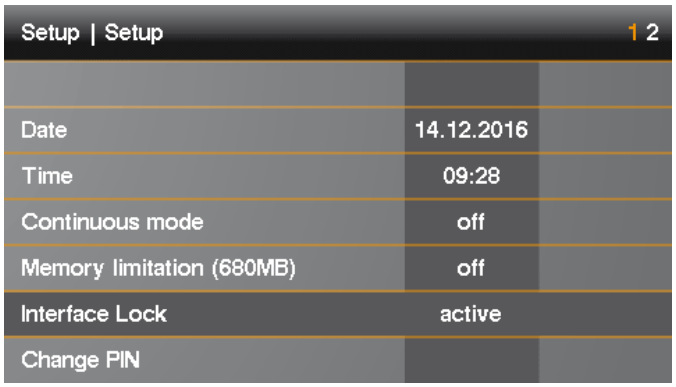
→ Keypad lock inactive.

It is possible to see the measurement readings when the keypad is locked.

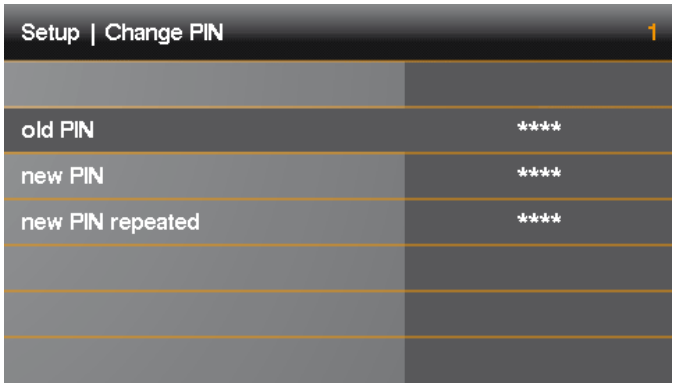
The Setup menu and screen pages are locked.

11.6 Password Protection and Interface Lock

In order to protect the PQ-box from unauthorized access and manipulation during measurement task the device provides an interface lock mode with password (PIN) protection. The interface lock can be activated in the setup menu and is protected with a corresponding four-digit numerical password, a PIN consisting of any combination from 0000 to 9999.



The PIN (default factory setting is 0000) is set in the menu item Change PIN.



If the interface lock is active, the password protection locks the device automatically one minute after starting a measurement. With the keypad lock function (see description above) the device can be locked with password protection manually. In locked mode the USB and Ethernet interface are deactivated and a display lock is active.

In active interface lock mode the device can only be unlocked with the correct PIN. After more than ten incorrect PIN entries, user access is locked permanently. The device can be reset by A. Eberle Support using a master password.

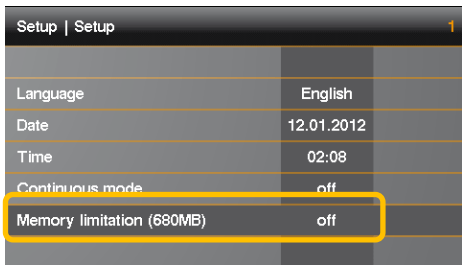
11.7 Memory management

So that the recorder data does not fill the whole memory when a too sensitive or incorrect trigger level is set and thus the long-term recording is stopped, at the start of the measurement the PQ-Box reserves a maximum size of the free space for all fault records. If this memory size is reached, this can be seen in the display by an asterisk * after the number of fault records.

e.g. Display: Oscilloscope recorder = 1312*

If the memory of the SC card is filled 100%, the message "**Memory full**“, appears in the display.

Two possibilities to run the memory management:



- **Memory limitation (680MB) = off**

  On single data file can get up to the maximum size of 3,41GB. If the data size is reached then the PQ-Box automatically starts a new measurement file. This will be repeated until the maximum size of the microSD memory card is reached (f. e. 32 GByte). The size of all recorders is limited to 2GB in one 3,41GB file.

  Warning: This type needed for evaluating the 64bit WinPQ mobile software.

- **Memory limitation (680MB) = active**

  The PQ-Box memory size for one measurement file is limited to 680 MByte, to avoid problems with Windows 32bit systems. If the data size is reached then the PQ-Box automatically starts a new measurement file. This will be repeated until the maximum size of the microSD memory card is reached (f. e. 32 GByte).

  The size of all recorders is limited to 300 MB in one 680 MB file.

The data converter provides the opportunity to connect several measurements to one measurement file, if needed. (see chapter “Data Converter”)

• Auto: The device limits the maximum file size of all recorders as described above.

• Off: The limit is deactivated. All recorders can fill the entire device memory.

11.8 Delete device memory

It is possible to clear the device memory of the PQ-Box using the front panel keys while the PQ-Box is booting up.

✋ Connect the power supply

✋ If “A. Eberle logo” appears hold enter key  for some seconds

→ Message appears: "Please press start button to clear the device memory"

✋ Press record button 

→ Device memory is formatted
→ PQ-Box is starting

11.9 Storage requirements for measurement data

Storage requirements for long-term measurement data:
Example PQ-Box 200:

- 1 sec measurement interval generates approx. 33MB of data per hour
- 10 min measurement interval generates approx. 15MB of data per week

Example PQ-Box 300 (with HF data mean and max. values)

- 1 sec measurement interval generates approx. 44MB of data per hour
- 10 min measurement interval generates approx. 20MB of data per week

Events and fault records have to be added to this amount of data. The amount of data is dependent on the occurrence of these events and the trigger settings of the measuring device.

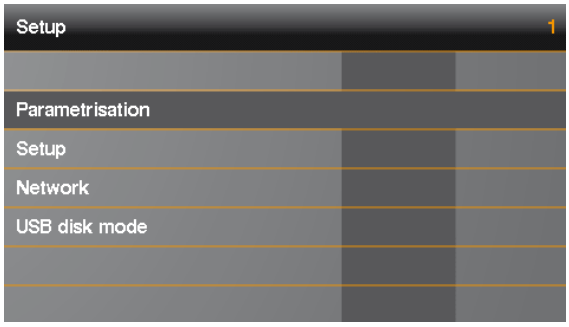
11.10 Continuous mode without power supply

If the function „continuous mode“ is active, the PQ-Box does not stop running if the power supply is off momentarily. The PQ-Box can work up to 4 hours with battery supply. You can start and stop records or measure in online mode.
At 7% capacity, about 10 minutes before turning off, a warning message appears on the display.

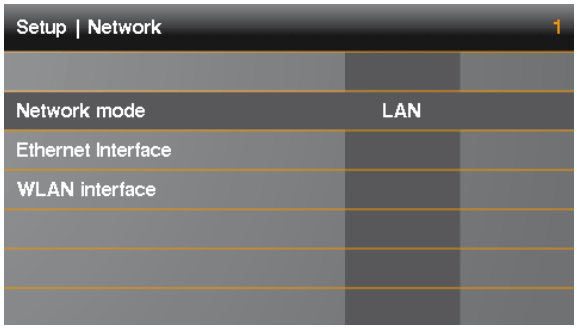
Deactivate battery mode via the setup menu "Off".

11.11 Interface and TCP/IP settings

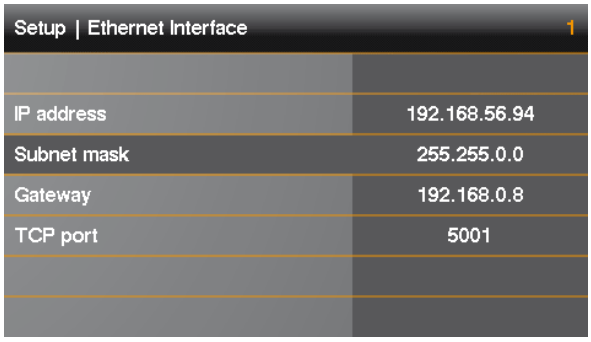
In “Setup/Network” you can change the configuration for TCP/IP interface and WLAN interface.



In “Network mode” it is possible to switch between WLAN and LAN communication. Both ways of communication can´t run at the same time.



Ethernet settings
This example shows the basic settings for the PQ-Box Ethernet interface.
All parameters can be changed with the control keys on the box.

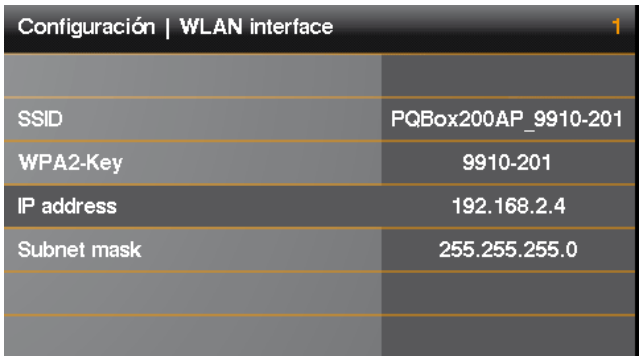


To accept the changed parameters, the device must be restarted.

11.12 WLAN Settings (Option for PQ-Box 200/300)

The display screen shows the basic setting of the WLAN configuration with the following parameters. The IP address and subnet mask of the WLAN module can be set using the control pad.

Parameter	Meaning
SSID	Name of PQ-Box in network
WPA2-Key	password
IP-Address	IP Address of PQ-Box
Subnet-mask	Restriction of the DHCP address range



Please use the address range 2 to 99 in the 4th block of IP address.

WLAN Connection with WinPQ mobil software or PQ-Box App:

- **When the WLAN module is activated, the PQ-Box is displayed with its SSID in the wireless network connections.**
- **To establish a connection, the WPA2 key must be entered. SSID and password for a WPA2 connection can be found on the nameplate of the network analyzer. (Example: for „SSID: PQBox200AP_1804-204“ the password would be „1804-204“)**

The connection establishment may take a few seconds, as many PCs first try to establish an Internet connection via the PQ-Box.

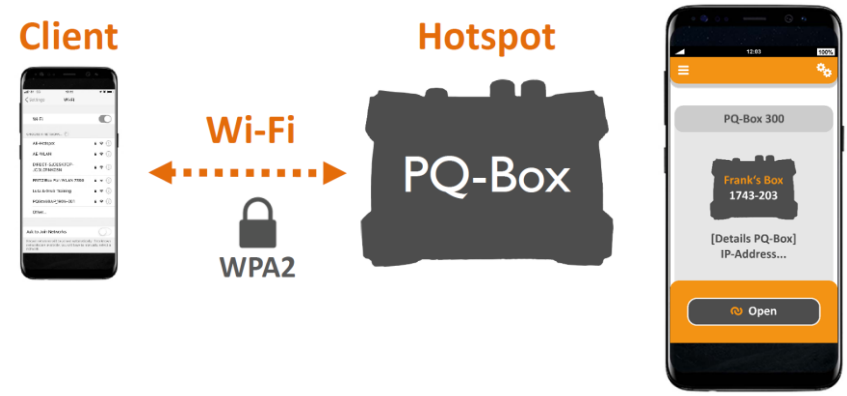
12. PQ-Box App

Via an app for Android and IOS operating systems, all PQ-Boxes with integrated WLAN/Wifi interface can be operated wirelessly. The app is available for free download in the Apple App Store as well as in the Google Play Store.

A variety of online screens are available. All measuring devices can also be easily parameterized, e.g. via a smartphone. A detailed parameterization of the PQ-Box (trigger limits, ripple control signal analysis, ...) is only possible via the WinPQ mobil software.

1.1 Connection to PQ-Box

The PQ-Box acts as a WLAN router. SSID and password for a WPA2 connection can be found on the nameplate of the network analyzer. (Example: for „SSID: PQBox200AP_1804-204“ the password would be „1804-204“)



13. Maintenance/Cleaning

13.1 Maintenance

This unit is maintenance-free for customers.

Exceptions are the battery pack and micro-SD card, which can be accessed via a maintenance cover on the rear panel. The fuses are in the voltage leads.

Spare parts no.

● SD memory card, 8 GByte industry-standard	900.9099-8
● Replacement battery pack	570.0010
● Fuse for voltage leads; 500mA (FF) 30kA AC/DC; 1000V 6,3mmx32mm	582.1058

⚠ **DANGER!**	**Danger of electric shock!**
	✋ Do not open the unit.
	✋ Maintenance of the equipment can only be carried out by A-Eberle.

For service, contact A-Eberle.

Service address:

A. Eberle GmbH & Co. KG

Frankenstraße 160

D-90461 Nuremberg

13.2 Cleaning

Cleaning of labeling fields

Use a soft, light moistened and lint-free cloth for cleaning the surface of the device. Do not use any kind of window or household cleaner, spray, solvents, spirit cleaners, ammonia solution or scouring agents for cleaning.

14. Calibration

We recommend a calibration interval of three years for the network analyzer PQ-Box 300 & 200 to maintain the accuracy of GEFOR-made-IEC61000-4-30 Class A instruments.

15. Disposal

To dispose of the device and its accessories, send all components to A-Eberle.

16. Product Warranty

- A-Eberle guarantees that this product will remain free of defects in material and workmanship for a period of three years from the date of purchase.
- For accessories like current clamps and the battery the period is one year.
- This warranty does not cover damage caused by accident, misuse or abnormal operating conditions.

To obtain service during the warranty period, please contact A-Eberle GmbH & Co KG in Nuremberg.

The detailed conditions for the warranty can be found in our terms and conditions:

https://www.a-eberle.de/agbs

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No. 584.0851

Vers. PQ-Box 200 & 300 – 15.02.2024 10:07:00