Power quality analyser and fault recorder

Model: PQI-LV

- **Din-Rail housing**
- **Panel mounting enclosure**

1. Application

The *PQI-LV* power quality analyser and fault recorder for low-voltage grids is the central component of a system that can be used to solve all measurement tasks in electrical low-voltage grids. The *PQI-LV* can be used both as a power quality interface in accordance with power quality standards and as a measuring device for all physically defined measured values in three-phase grids.

The component is particularly suitable for monitoring and recording special supply qualities or quality agreements between the energy supplier and customer and making them available for evaluation. In addition, the measuring device offers the option of recording up to 16 feeders via I-Sense technology, processing them and transferring them to the higher-level WebPQ software solution!

In addition to the option of standard evaluations in accordance with EN50160, the *PQI-LV* also has a high-speed disturbance recorder with a recording rate of 40.96 kHz / 10.24 kHz and a 10 ms RMS value recorder via an additional licence S1. This enables a detailed analysis of grid faults.

Modern power quality measuring devices work 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 ambient 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.

According to IEC 62586, the *PQI-LV is* a class **PQI-A-FI-G** device.

The measuring device and its development are subject to strict security requirements due to the area of application in critical infrastructure.

With regard to this, active patch management, encrypted communication standards and user rights management (URM as RBAC) via RADIUS are available in the device! This also includes signed firmware updates, security audit logging and active protection against brute force attacks. All this contributes to secure operation in your KRITIS environment!

The *PQI-LV* fulfils the requirements of IEC 61000-4-30:2015 Ed 3 +A1:2021 for Class A measuring devices for 100% of the parameters.

Parameter IEC61000-4-30	Class
Frequency	A
Magnitude of the Supply Voltage	A
Flicker	A
Voltage dips or swells	A
Voltage interruptions	A
Voltage unbalance	A
Voltage harmonics	A
Voltage interharmonics	A
Mains signalling voltage on the supply voltage	A
Underdeviation and overdeviation	A
Clock uncertainty testing	A
Flagging	A
Variations due to external influence quantities	A

2. Design

The *PQI-LV* was developed for measurements in public grids and measurements in industrial environments with up to 690V (phase / phase) measurement voltage.

- Device for the top-hat rail
- No moving parts (fan, hard drive)
- CAT IV
- Parameterisation via WebServer
- **Optional: "Modbus Master" (P3)**
  Recording of external Modbus signals / Feeders with I-Sense
- **Optional: "Fault recorder " (S1)**
- Voltage and current oscillograph Sampling frequency: 40.96kHz / 10.24kHz with powerful trigger release
- **Optional: "IEC61000-4-7 - 2 kHz to 20 kHz" (B1)**
- Frequency measurement of voltage and current in accordance with IEC 61000-4-7 from 2 kHz to 20 kHz.
- **Optional: "Data format PQDIF" (F1)**
- Open data exchange format in accordance with IEEE1159-3 via MMS / IEC61850 (feature P2) or REST API / HTTPS

2.1 Characteristics of the Power-Quality Interface *PQI-LV*

2.1.1 Technical Data

- WebServer for basic configuration on the device
- 1 GB internal memory
- Input channel bandwidth 20 kHz
- 4 voltage inputs
  Measuring range end value: 480V L-N,
  Accuracy < 0.1%
- 4 current sensor inputs for Rogowski coils or mini current clamps
- Simultaneous processing of sampled and calculated voltages and currents
- IEC 61000-4-30, Class A measurement data processing
- Recording of power quality incidents in accordance with DIN EN 50160; IEC61000-2-2; -2-12; -2-4.
- Energy buffer for grid interruptions of up to 2 seconds
- Spectral analysis 2 kHz...20 kHz, (90 frequency bands, BW = 200Hz) of voltages and currents according to (IEC 61000-4-7) (feature B1)
- Voltage and current harmonics n=2..50
- EDGE function with 32 freely parameterisable monitoring states for monitoring and triggering all measured variables – output via protocol for control tasks on site!
- Free evaluation software WinPQ lite
- **Option**: Analysis of the data on a database using the WebPQ software package. Permanent communication and evaluation of the data with many devices in parallel

Communication Protocols
– MODBUS RTU (Master & Slave) – MODBUS TCP
– IEC60870-5-104 (option P1) – IEC61850 (option P2) – Modbus Master / Modbus Gateway for I-Sense - current feeder measurement (option P3)

Time synchronisation Protocols
– IEEE1344 / IRIG-B000..007
– DCF 77
– NTP

Interfaces:	
Ethernet	RJ45 (10/100 Mbit)
RS485	UART (Modbus)

Dimensions	
L x W x H	130 x 90 x 58 mm

Weight:	
Weight	298g

Voltage inputs	
Channels	U_1 , U_2 , U_3 , $U_{N/E/4}$
Electrical safety DIN EN 61010	300V CAT IV 600V CAT III
Input reference	PE
Impedance -> PE	10 MΩ || 25pF
Nominal input voltage U_{nom}	230 VAC
Measuring range end value	0...480 V_{AC} L-E
Overload capacity, permanent	600V_{AC}
Maximum crest factor @ U_{nom}	3
Bandwidth	DC...20 kHz
Rated mains frequency f_n	50 Hz / 60 Hz
Frequency range of the fundamental	f_n ± 15 % 42.5..50..57.5 Hz 51.0..60..69.0 Hz

Accuracy	
Fundamental frequency, r.m.s. $U_1 \leq 150\%\ U_{nom}$ 0°C ≤ T_A ≤ +45°C: -25°C ≤ T_A ≤ +55°C:	 ±0.1% v. U_{nom} ±0.2% of U_{nom}
Fundamental frequency, phase $U_1 \geq 10\%\ U_{nom}$:	±0.02°
Harmonics n = 2...50, r.m.s. $U_h \geq 1\%\ U_{nom}$: $U_h < 1\%\ U_{nom}$:	 ±5.0% v. U_h ±0.05% of U_{nom}
Harmonics n = 2...50, phase $U_h \geq 1\%\ U_{nom}$:	 ±0.5°
Interharmonics n = 1...49, r.m.s. $U_{ih} \geq 1\%\ U_{nom}$: $U_{ih} < 1\%\ U_{nom}$:	 ±5.0% v. U_h ±0.05% of U_{nom}
Mains frequency	±1 mHz @ 10 %...200 % U_n
Flickermeter DIN EN 61000-4-15:2011	Class F1
Dip residual voltage	±0.2 % U_n @ 10 %..100 % U_n
Dip duration	±20 ms @ 10 %..100 % U_n
Swell residual voltage	±0.2 % U_n @ 100 %..150 % U_n

Voltage inputs	
Swell duration	±20 ms @ 100 %..150 % U_n
Interruption duration	±20 ms @ 1 %..100 % U_n
Voltage unbalance	±0.15 % @ 1 %..5 % measured value
Ripple control voltage (< 3kHz)	±5% of the measured value @ Us = 3%..15% U_n ±0.15 % U_n @ Us = 1 %..3 % U_n

Current sensor inputs (switchable)	
Full Scale Range (FSR)	0.35V_{AC} @ 50Hz
Input impedance	2MΩ
Input type	symmetrical
External sensors (switchable)	Rogowski coil, mini current clamp potential-free
Differential overload capacity, permanent	10V_{AC}
Common mode area	±15V
Measuring bandwidth	25Hz...20kHz
Fundamental frequency, r.m.s. $I_1 \geq 10\%$ FSR: $I_1 < 10\%$ FSR:	 ±0.2% of I_1 ±0.02% of FSR
Fundamental frequency, phase $I_1 \geq 10\%$ FSR:	 ±0.2°
Harmonics n = 2...50, r.m.s. $I_h \geq 1\%$ FSR: $I_h < 1\%$ FSR:	 ±5.0% of I_h ±0.05% of FSR
Harmonics n = 2...50, phase $I_h \geq 1\%$ FSR:	 ±1.0°
Interharmonics n = 1...49, r.m.s. $I_{ih} \geq 1\%$ FSR: $I_{ih} < 1\%$ FSR:	 ±5.0% of I_{ih} ±0.05% of FSR

Storage of the measured data	
Internal memory	1024 MB = 130 weeks

Auxiliary voltage		
Feature	**H1**	**H2**
AC Nominal range [V]	100...240	-
AC Operating range [V]	90...264	-
DC Nominal range [V]	150...340	24...110
DC Operating range [V]	120...430	12...150
Power consumption	≤ 5 W < 7 VA	≤ 7 W
Frequency Nominal range	50...60Hz	DC
Frequency Operating range	40...70Hz	DC
External fuse characteristic	6A B	6A B
Energy storage	2 sec	2 sec

Electrical safety	
– IEC 61010-1 – IEC 61010-2-030	
Protection class	1
Pollution degree	2
Overvoltage category Mains supply option: H1 H2	 300V / CAT III 150V / CAT II
Measurement category	300V / CAT IV 600V / CAT III
Altitude	≤ 2000m
IP protection class	IP20

Environmental parameters	Storage and transport	Operation
Ambient temperature: Limit range of operation	IEC 60721-3-1 / 1K5 -40 ... +70°C IEC 60721-3-2 / 2K4 -40 ... +70°C	IEC 60721-3-3 / 3K6 -25 ... +55°C
Ambient temperature: Nominal operating range	---	IEC DIN EN 61010 -25 ... +45°C H1 -25 ... +50°C H2
Relative humidity: 24 hour average No condensation or ice	5...95 %	5...95 %
Solar radiation	---	700W/m2
Vibrations, earth tremors	IEC 60721-3-1 / 1M1 IEC 60721-3-2 / 2M1	IEC 60721-3-3 / 3M1

According to **IEC61557-12**, the PQI-LV corresponds to a PMD type III of class PMD -SD according to table 2 (indirect current measurement, direct voltage measurement) for low voltage or PMD SS (indirect current measurement, indirect voltage measurement) in climate category K55.

Thus a marking according to IEC61557-12 is possible for the measuring device as follows:

PMD SD / K55 / 0.2

PMD SS / K55 / 0.2

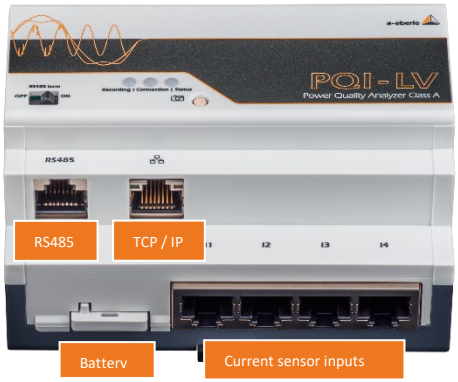
Herewith the PQI-LV fulfils the following accuracies:

Measured variable	C46	With current clamp Class 0.5	With current clamp Class 1
Energy	0.2	< 1	< 2
Active power	0.2	< 1	< 2
Reactive energy	< 2	< 2	2
Reactive power	< 1	1	< 2
Apparent energy	0.2	< 1	< 2
Apparent power	0.2	< 1	< 2
Frequency	< 0.02		
Phase current	0.1	< 1	< 2
Measured IN	< 0.2	< 1	< 2
Calculated IN	0.1	< 1	< 2
Voltage	0.1		
Power factor	< 0.5	< 1	< 2
Flicker	5		
Dips and swells	< 0.5		
Voltage interruption	0.5		
Voltage unbalance	0.2		
Voltage harmonics	1		
Distortion factor of the voltage	1		
Current unbalance	0.2	< 1	< 2
Current - Harmonics	1	< 2	2
THDI	1	1	1

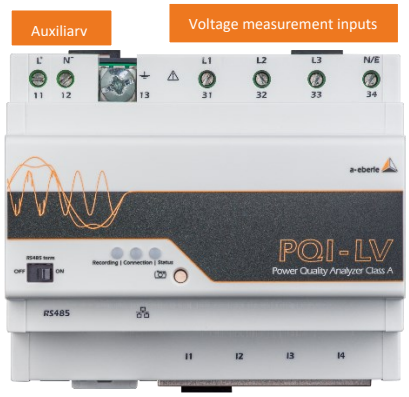
2.1.2 Mechanical design

The *PQI-LV* can be used both as din rail device or wall mounting and as a panel-mounted device using an adapter. The voltage connections and the auxiliary voltage are accessible from above via screw terminals. All other connections such as current sensors and RS485 are designed as RJ45 sockets to simplify EMC-compliant connection from below. An RJ 45 connection (LAN) is also available for the TCP/IP interface.

Front view

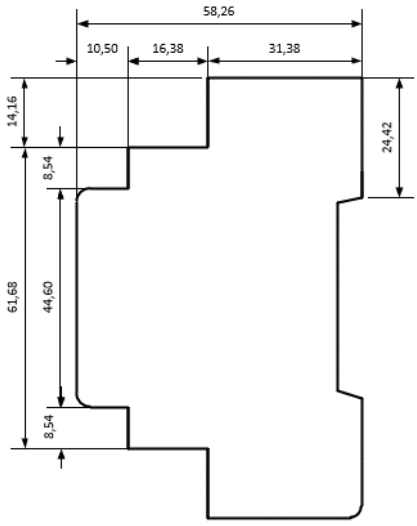


Bottom view PQI-LV

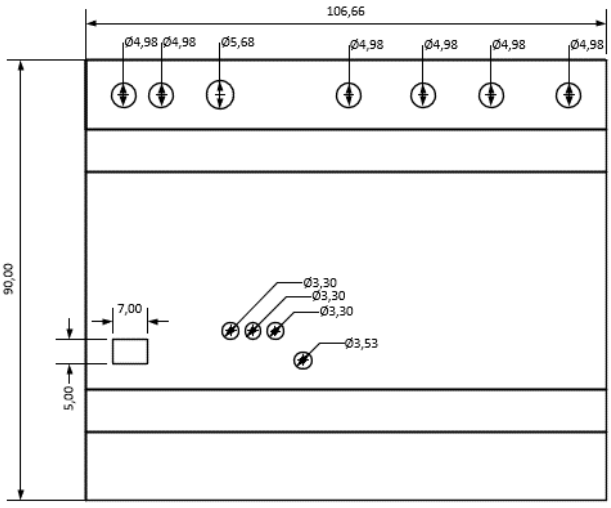


Top view PQI-LV

2.1.3 Dimensions



Sideview



Frontview

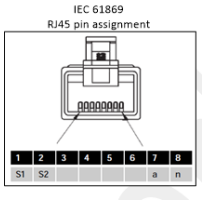
2.1.4 Terminal strip number PQI-LV

Connection strip no.	Designation		Function	Terminal no.
X1	Auxiliary voltage	U_H	L (+)	11
			L (-)	12
X1	Reference potential (earth)	GND	E	13
X3	Phase voltage L1	U_1	L1	31
	Phase voltage L2	U_2	L2	32
	Phase voltage L3	U_3	L3	33
	Neutral point voltage	U_4	N	34
X6	Phase current L1 (mV Input)	I1	I1	RJ45
	Phase current L2 (mV Input)	I2	I2	RJ45
	Phase current L3 (mV Input)	I3	I3	RJ45
	Neutral conductor / total current	I4	I4	RJ45

2.1.4.1 Sensor Current Inputs – RJ45

Current inputs are designed as follows in accordance with IEC61689. Suitable accessories can be found in chapter 3.2.

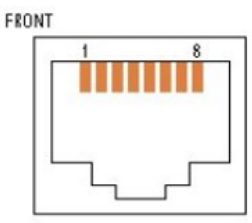
Pin assignment RJ45 - Current	
Pin 1	S1
Pin 2	S2

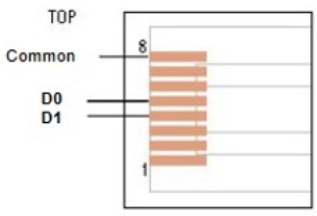


2.1.4.2 RS485 – Modbus – RJ45

The RS485 Modbus interface is designed according to the 2W Modbus standard for RJ45 interfaces as follows:

Pin assignment RJ45 - Modbus	
Pin 4	RS485 Pos (A)
Pin 5	RS485 Neg (B)
Pin 8	Common





2.2 Device Operation

2.2.1 On-site display and controls

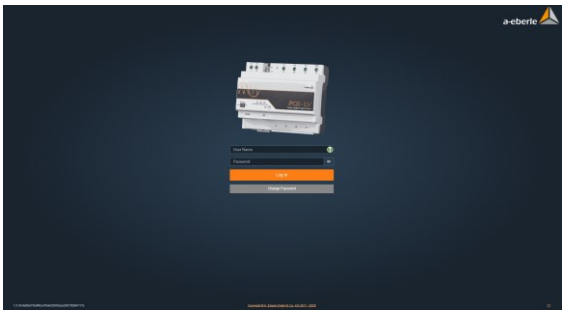
The device has a **button on the** front and **three LED** indicator which represent the status of the device

- **Status LED**
- **Connection LED**
- **Recording LED**
- **Control button / trigger button**

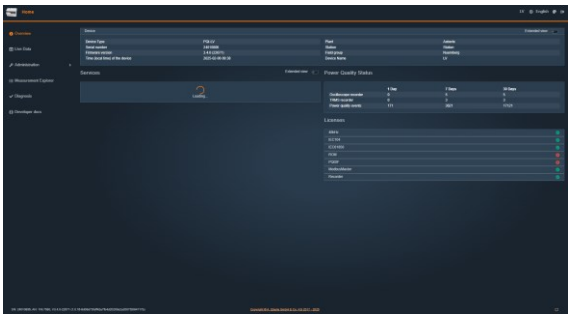
2.3 WebServer & Software

The PQI-LV device has a WebServer for parameterisation and online data visualisation via which the most necessary settings can be made locally and live data for connection testing can be visualised. Compatibility with the WinPQ lite software for offline configuration and offline analysis is also guaranteed. The device also integrates seamlessly into the WebPQ software.

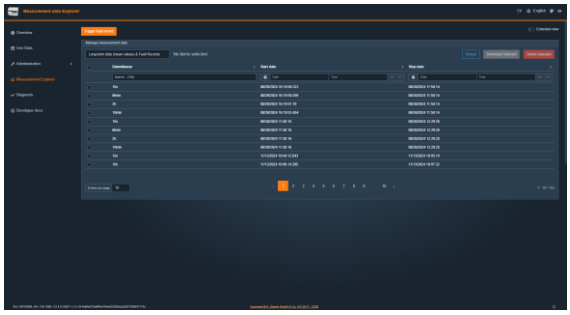
Examples of the Webpages:



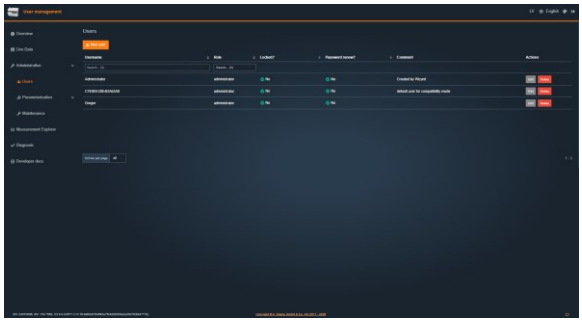
Login Screen



Overview page



Measurement data Explorer



User Management

2.4 Measurement / Functions

The *PQI-LV* is compatible with the following standards:

EN50160:2022/ IEC61000-2-2 / IEC61000-2-4 (Class 1; 2; 3) / NRS048 / IEEE519 / IEC61000-4-30 Class A Ed 3/ IEC 61000-4-7 / IEC61000-4-15 / IEEE1159-3

Permanent recording:

Five fixed and two variable measuring time intervals are available for permanent recording:

10/12 T (200ms), 1 sec, n*sec, 150/180 T (3sec), n*min, 10 min, 2 hrs.

Time Interval Voltage	10/ 12T	150/ 180T	10 min	2 h	1 s	10s	N* s	N* min
PQDIF			✓(*)	✓(*)		✓		
Power frequency	✓	✓	✓	✓	✓	✓	✓	✓
Extremes, standard deviation of power frequency (10s)			✓			✓		
r.m.s. values (IEC61000-4-30)	✓	✓	✓	✓	✓		✓	✓
Extremes, standard deviation of T/2-values			✓					
Underdeviation [%] , Overdeviation [%] (IEC61000-4-30)	✓	✓	✓	✓				
Harmonic subgroups n= 0..50 (IEC61000-4-7)	✓	✓	✓	✓				
Maximum values of 10/12 T harmonic subgroups n = 2..50			✓					
Interharmonic subgroups n=0..49 (IEC61000-4-7)	✓	✓	✓	✓				
Total Harmonic Distortion (THDS) (IEC61000-4-7)	✓	✓	✓	✓	✓		✓	✓
Partial Weighted Harmonic Distortion (PWHD)	✓	✓	✓	✓	✓		✓	✓
Unbalance, negative/positive sequence , sequence sign	✓	✓	✓	✓	✓		✓	✓
Unbalance, zero/positive sequence	✓	✓	✓	✓	✓		✓	✓
Positive-, negative-, zero sequence phasors	✓	✓	✓	✓	✓		✓	✓
Phasors (fundamental)	✓	✓	✓	✓	✓		✓	✓
Flicker (IEC61000-4-15)			✓	✓				
Instant flicker (IEC61000-4-15)	✓		✓					
Mains signalling voltages [%] (IEC61000-4-30)	✓	✓						
Phase angle (zero crossings) of phase voltage harmonics n=2..50 to fundamental of reference voltage	✓	✓	✓	✓				
Frequency bands 1..90 , 2kHz..20kHz, r.m.s. (IEC61000-4-7)			✓	✓	✓		✓	✓

(*) The following restrictions apply to PQDIF:

- 10 min and 2 h: No phase angles of voltage and current harmonics
- 2 h: No Supraharmonics >9kHz

Time Interval Current	10/ 12T	150 /180T	10 min	2 h	1 s	N* s	N* min
PQDIF			✓(*)	✓(*)			
r.m.s. values	✓	✓	✓	✓	✓	✓	✓
Extremes of T/2-values			✓				
Harmonic subgroups n= 0..50 (IEC61000-4-7)	✓	✓	✓	✓			
Maximum values of 10/12 T harmonic subgroups n = 2..50			✓				
Interharmonic subgroups n=0..49 (IEC61000-4-7)	✓	✓	✓	✓			
Total Harmonic Distortion (THDS) (IEC61000-4-7)	✓	✓	✓	✓	✓	✓	✓
Total Harmonic Currents	✓	✓	✓	✓	✓	✓	✓
Partial Weighted Harmonic Distortion (PWHD)	✓	✓	✓	✓	✓	✓	✓
Partial Odd Harmonic Currents (PHC)	✓	✓	✓	✓	✓	✓	✓
K-Factors	✓	✓	✓	✓	✓	✓	✓
Unbalance, negative/positive sequence , sequence sign	✓	✓	✓	✓	✓	✓	✓
Unbalance, zero/positive sequence	✓	✓	✓	✓	✓	✓	✓
Positive-, negative-, zero sequence phasors	✓	✓	✓	✓	✓	✓	✓
Phasors (fundamental)	✓	✓	✓	✓	✓	✓	✓
Phase angle (zero crossings) of current harmonics n=2..50 to fundamental of reference voltage	✓	✓	✓	✓			
Frequency bands 1..90 , 2kHz..20kHz, r.m.s. (IEC61000-4-7)			✓	✓	✓	✓	✓

Time Interval Energy	10 min	2 h	1 s	N* s	N* min
PQDIF	✓	✓			
Active energy, phase	✓	✓	✓	✓	✓
Active energy, total	✓	✓	✓	✓	✓
Exported active energy, phase	✓	✓	✓	✓	✓
Exported active energy, total	✓	✓	✓	✓	✓
Imported active energy, phase	✓	✓	✓	✓	✓
Imported active energy, total	✓	✓	✓	✓	✓
Reactive energy (inductive), phase	✓	✓	✓	✓	✓
Reactive energy (inductive), total	✓	✓	✓	✓	✓
Exported reactive energy (inductive), phase	✓	✓	✓	✓	✓
Exported reactive energy (inductive), total	✓	✓	✓	✓	✓
Imported reactive energy (inductive), phase	✓	✓	✓	✓	✓
Imported reactive energy (inductive), total	✓	✓	✓	✓	✓
Total apparent energies, phase& total	✓	✓	✓	✓	✓
Export apparent energies, phase & total	✓	✓	✓	✓	✓
Import apparent energies, phase & total	✓	✓	✓	✓	✓
Distortion reactive energies, phase & total	✓	✓	✓	✓	✓

Time Interval Power	10 min	2 h	1 s	N* s	N* min
PQDIF	✓	✓			
Active power, phase	✓	✓	✓	✓	✓
Active power, total	✓	✓	✓	✓	✓
Active power extremes	✓				
Reactive power, phase	✓	✓	✓	✓	✓
Reactive power, total	✓	✓	✓	✓	✓
Reactive power extremes	✓				
Apparent power, phase	✓	✓	✓	✓	✓
Apparent power, total	✓	✓	✓	✓	✓
Fundamental active power, phase	✓	✓	✓	✓	✓
Fundamental active power, total	✓	✓	✓	✓	✓
Fundamental reactive power, phase	✓	✓	✓	✓	✓
Fundamental reactive power (displacement), total	✓	✓	✓	✓	✓
Fundamental apparent power, phase	✓	✓	✓	✓	✓
Phase angle of fundamental apparent power, phase	✓	✓	✓	✓	✓
Fundamental apparent power, total	✓	✓	✓	✓	✓
Phase angle of fundamental apparent power, total	✓	✓	✓	✓	✓
Reactive distortion power, phase	✓	✓	✓	✓	✓
Reactive distortion power, total	✓	✓	✓	✓	✓
Active power factors, phase, total	✓	✓	✓	✓	✓
Reactive power factors, phase, total	✓	✓	✓	✓	✓
COSφ + sign, phase, total	✓	✓	✓	✓	✓
SINφ + sign, phase, total	✓	✓	✓	✓	✓
COSφ + sign of reactive distortion power, phase, total	✓	✓	✓	✓	✓
Capacitive-, inductive scaling factor of COSφ (-1..0..+1) :	✓	✓	✓	✓	✓
tanφ (L+), Phase, total on imported inductive reactive energy	✓		✓	✓	✓
tanφ (C-),Phase, total on exported capacitive reactive energy	✓		✓	✓	✓
tanφ (L-),Phase, total on exported inductive reactive energy	✓		✓	✓	✓
tanφ (C+),Phase, total on imported capacitve reactive energy	✓		✓	✓	✓
Triggered interval mean active power, phase					
Triggered interval mean active power, total					
Triggered interval mean reactive power, phase					
Triggered interval mean reactive power, total					

2.5 Disturbance Fault Recorder (Option: S1)

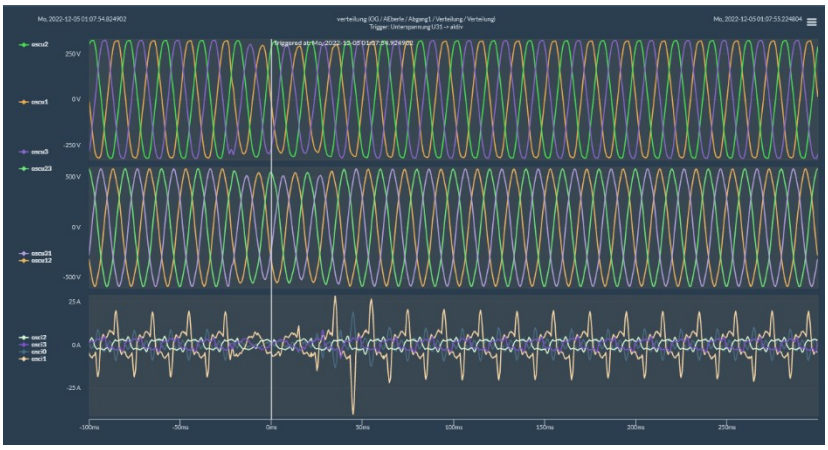
The PQI-LV device can be upgraded with the fault recorder option with feature S1!

2.5.1 Oscillograph

Sampling rate: 40.96kHz / 10.24kHz / 1.024kHz

Max. Recording length: 4sec (40.96kHz) / 16sec (10.24kHz) / 160sec (1.024kHz)

Measured variable	
3-wire system	**4-wire system**
Phase-earth conductor voltages	Phase-neutral voltages
Residual voltage	Neutral conductor e-arth voltages
Phase-phase voltages	
Phase currents	
Total current	Neutral conductor current

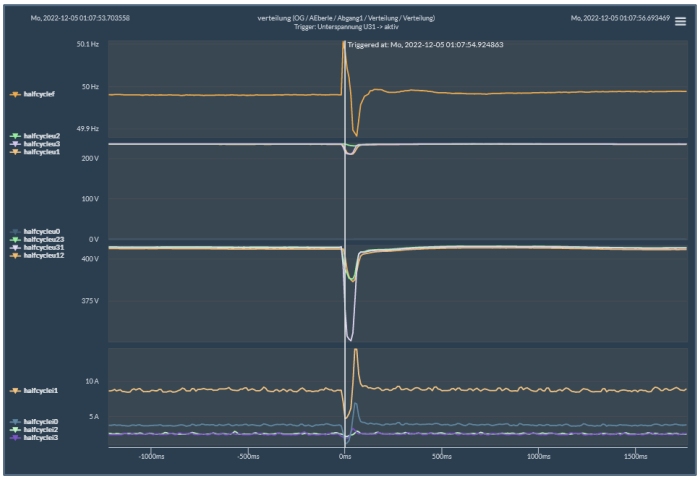


2.5.2 Half-wave recorder

Recording rate: ~10ms (50Hz) or ~8.333ms (60Hz)

Max. Recording length: 6min (50Hz) or 5min (60Hz)

Measured variable
Mains frequency
Effective voltages (RMS)
RMS currents (RMS)
Active power, phase
Reactive power, phase
Active power, total
Total fundamental reactive power
Phase angle of the fundamental apparent power, total
Phase angle Voltages (fundamental)
Phase angle currents (fundamental)
Positive, negative, zero sequence voltage pointer
Positive, negative, zero sequence current pointer



2.5.3 Trigger Options

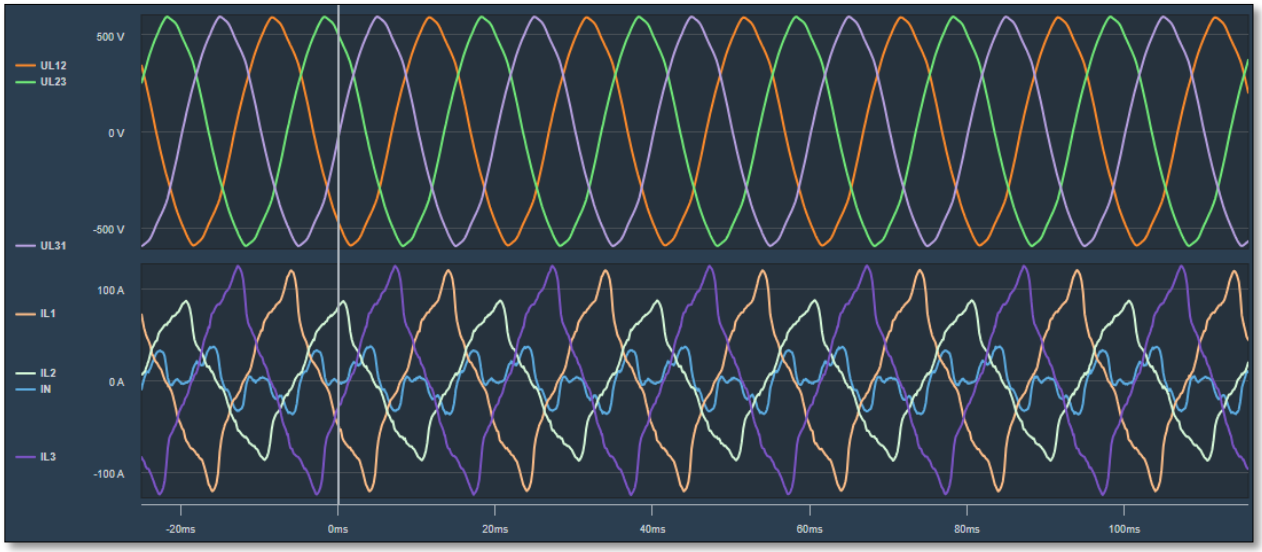
Trigger release	below	upper	Step
(RMS) Phase voltages (T/2)	✓	✓	✓
(RMS) Phase-phase voltages (T/2)	✓	✓	✓
(RMS) Residual/neutral earth conductor voltage (T/2)		✓	✓
Positive sequence voltage (T/2)	✓	✓	
Negative sequence voltage (T/2)		✓	
Zero sequence voltage (T/2)		✓	
Phase voltage Phase (T/2)			✓
Phase voltage waveforms (envelope triggers)	+/- Threshold value		
Phase-phase voltage waveforms (envelope triggers)			
Residual/neutral earth conductor voltage waveform (envelope trigger)			
Effective value (RMS) Phase currents (T/2)	✓	✓	✓
Effective value (RMS) (total/neutral conductor current (T/2)		✓	✓
Mains frequency (T/2)	✓	✓	✓
Binary inputs (debounced)	Rising, falling edge		
Command	external		
32 Monitoring states	✓	✓	

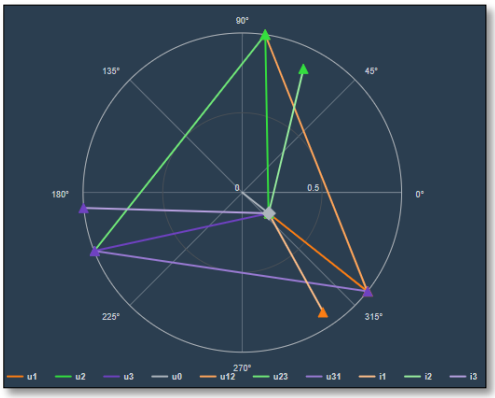
2.6 PQ events

Number of releases	below	upper
Voltage dip (T/2)	✓	
Voltage swell (T/2)		✓
Voltage interruption (T/2)	✓	
Rapid voltage change (T/2)	Filter for moving average Mean +/- threshold value	
Voltage change (10min)	✓	✓
Voltage unbalance (10min)		✓
Mains ripple control voltage (150/180T)		✓
Voltage harmonics (10min)		✓
Total harmonic distortion (THD) (10min)		✓
Short-term voltage fluctuations PST (10min)		✓
Long-term voltage fluctuations PLT (10min)		✓
Mains frequency (10s)	✓	✓

2.7 Online mode for direct readout:

Measurement / Functions
Oscillograph (feature S1)
Phasor diagram
Voltage and current harmonics n=2..50
Voltage and current interharmonics n=0..49
Voltage and current harmonics 2-9kHz (option B1)
Frequency spectra up to 20kHz of voltages and currents (feature S1)
Online streaming of all data classes and all measured values





Live data

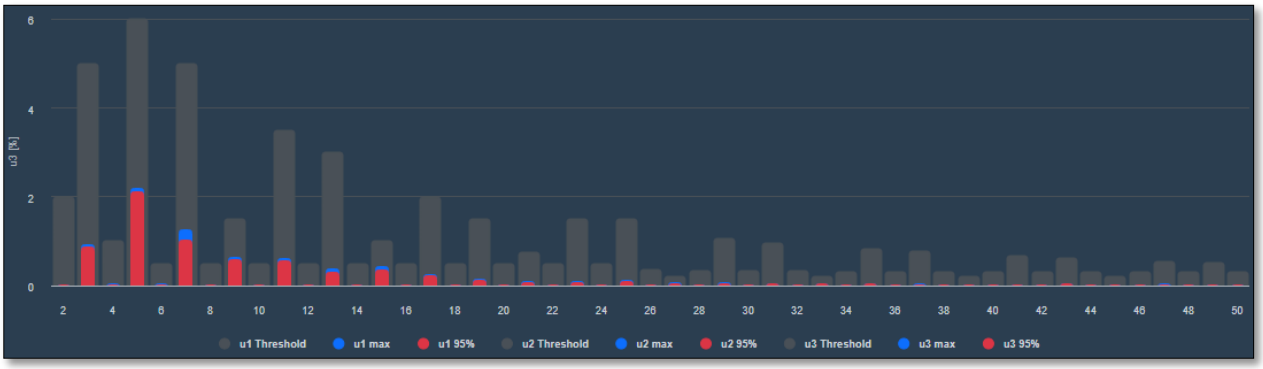
	L1	L2	L3	N
U	233.053 V	233.119 V	233.9 V	0.083 V
I	74.149 A	63.186 A	75.747 A	23.064 A
P	16.767 kW	14.305 kW	17.322 kW	48.394 kW
THD U	2.786 %	2.457 %	2.492 %	0 %
THD I	19.051 %	14.262 %	14.453 %	94.497 %

Frequency

50.002 Hz

Power

	L1	L2	L3	Total
S	17.714 kVA	14.746 kVA	17.684 kVA	50.13 kVA
Q	4.232 kVAR	3.468 kVAR	3.755 kVAR	11.41 kVAR
P	17.201 kW	14.333 kW	17.281 kW	48.814 kW
D	3.317 kVAR	2.202 kVAR	2.613 kVAR	8.132 kVAR
PF	0.971	0.972	0.977	0.974
cos(phi)	0.989 cap.	0.983 cap.	0.988 cap.	0.987 cap.



3. Order specifications *PQI-LV*

The following applies to the determination of the order details:

- Only one unit can be ordered for codes with the same capital letter.

Features	Identifier
Power Quality Interface and fault recorder ● 4 voltage inputs (230V / 400V / 690V, CAT IV 300V, 10MOhm) ● 4 sensor current inputs for mini current clamps or Rogowski coils (switch-able) ● In accordance with DIN EN-50160 and IEC 61000-4-30 (class A) ● DIN rail mounting for low-voltage networks ● Certified according to IEC 61000-4-30 (Class A, Ed. 3) ● Reports in accordance with EN 50160, IEEE 519, IEC 61000-2-2/2-4 ● Sampling rate: 10.24 kHz / 40.96 kHz (optional) ● Intelligent memory for 130 weeks of recording ● Webserver, 1x Ethernet RJ45, 1x RS485 (RJ45) interface ● Protocols: Modbus RTU & TCP/IP ● WinPQ lite software for PQI-LV	*PQI-LV*
Supply voltage ● AC 90 V..110 V..264 V or DC 120 V..220 V..430V ● DC 12V...60 V...150V	 H1 H2
Option IEC61000-4-7 (40.96kHz sampling rate) ● 10.24kHz sampling rate; without 2kHz to 20 kHz measurement ● Frequency measurement of voltage and current from 2 kHz to 20 kHz Oscillograph with 40.96 kHz sampling rate	 B0 B1
Option Communication protocol ● Modbus RTU & TCP ● IEC 60870-5-104 (RJ45) ● IEC61850 (RJ45) ● Modbus master for I-Sense current feeder measurement and recording	 P0 P1 P2 P3
Option Disturbance Fault Recorder ● Without Disturbance fault recorder (DFR) ● With Disturbance fault recorder (DFR) Voltage and current waveform a sampling frequency: 40.96kHz / 10.24kHz and TRMS recorder with powerful trigger opportunities	 S0 S1
Option Data format ● Without PQDIF export function according to IEEE1159-3 ● With PQDIF export function in accordance with IEEE1159-3 Data transfer via feature P2 - IEC61850 / MMS or REST API	 F0 F1
Operating instructions ● German ● English	 G1 G2

3.1 Software for PQI-LV

Software WebPQ	Code
WebPQ database software incl. PostgreSQL database for fully automated processing and evaluation of power quality data in your IT environment! The basic versions always include 3 units – expandable via add-on. **Range of functions** – Automated readout of measurement data from the PQI-LV / PQI-DA smart and PQI-DE devices via SSH and CCCI interface – Web server for visualisation of measurement data and fault records in level - time diagrams / histograms / bar charts / pointer diagrams / ITIC / and more – Responsive live data display of one or more devices in parallel – Automated alarm management in the event of faults – Automated reports in accordance with EN50160 and IEC61000-2-2 / IEC61000-2-4 / IEC61000-2-12 switchable to up to 65 standard templates – Parameterisation and management of the measuring devices via the web server – IT security via a comprehensive user rights management system with audit logging, password policies, etc. – Visualisation of measurement data from PQI-D and PQI-DA devices – Integration of WinPQ in WebPQ to support PQI-D's – CSV and Comtrade export functionality	
WebPQ Licences ● WebPQ Basic incl. 3 units for a maximum of 30 units with basic functionality ● WebPQ Professional incl. 3 units for up to a maximum of 100 units with professional functionality ● WebPQ Enterprise incl. 3 units for systems > 100 units with enterprise functionality	 L.900.9266.10 L.900.9266.20 L.900.9266.30
● WebPQ FirstOrder 10 Units ● WebPQ FirstOrder 30 Units ● WebPQ FirstOrder 50 Units ● WebPQ FirstOrder 100 Units ● WebPQ FirstOrder 500 Units ● WebPQ FirstOrder 1000 Units	L.900.9266.1010 L.900.9266.1025 L.900.9266.2050 L.900.9266.2100 L.900.9266.3500 L.900.9266.3599
● WebPQ Add on "Fleetmanagement" – ● WebPQ Add on "Nequal-Export"	L.900.9265.32 L.900.9265.34
Extension of the number of units ● WebPQ Addon 10 Units ● WebPQ Addon 50 Units ● WebPQ Addon 100 Units	 L.900.9266.60 L.900.9266.61 L.900.9266.62
Maintenance Agreements ● WebPQ Annual maintenance agreement ● WebPQ One-time maintenance agreement	 L.900.9066.10.01 L.900.9066.10.02

3.2 *PQI-LV* Accessoires

The accessories for the *PQI-LV* can be accessed directly via the link below or by scanning the QR code.

Link:

www.a-eberle.de/pqsys-accessories

QR-Code:

Note: When selecting the accessories, the corresponding hardware properties must be observed.

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Presented by:

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Version: 24.02.2025 14:16