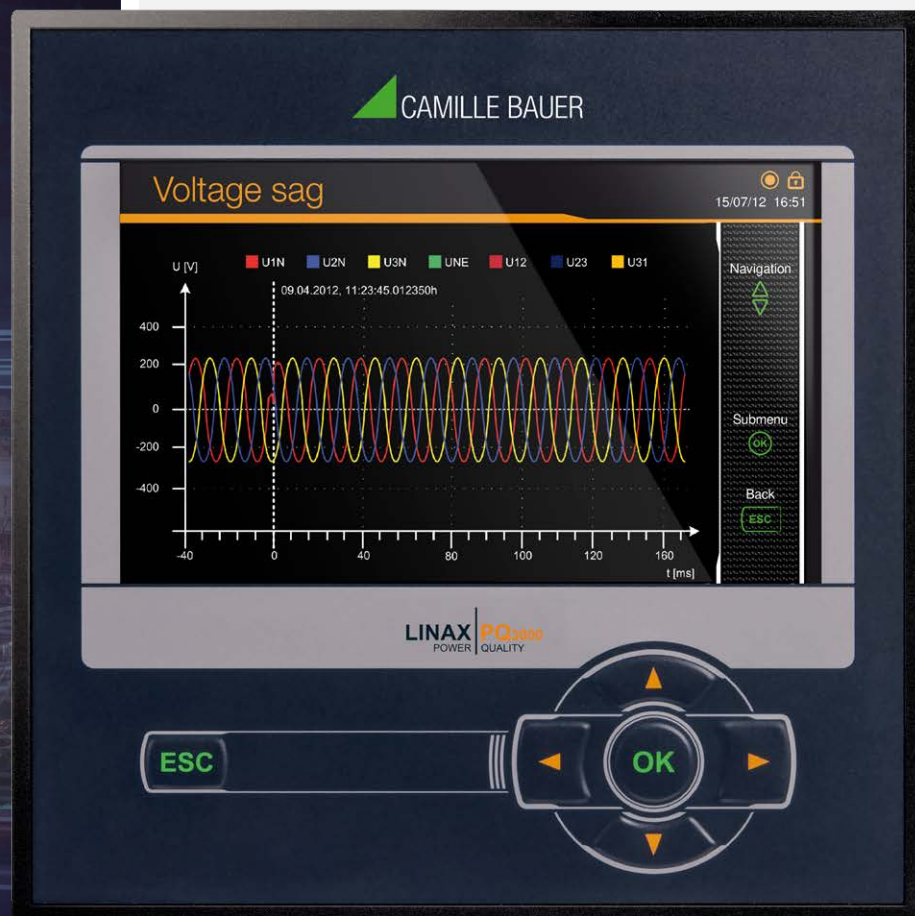


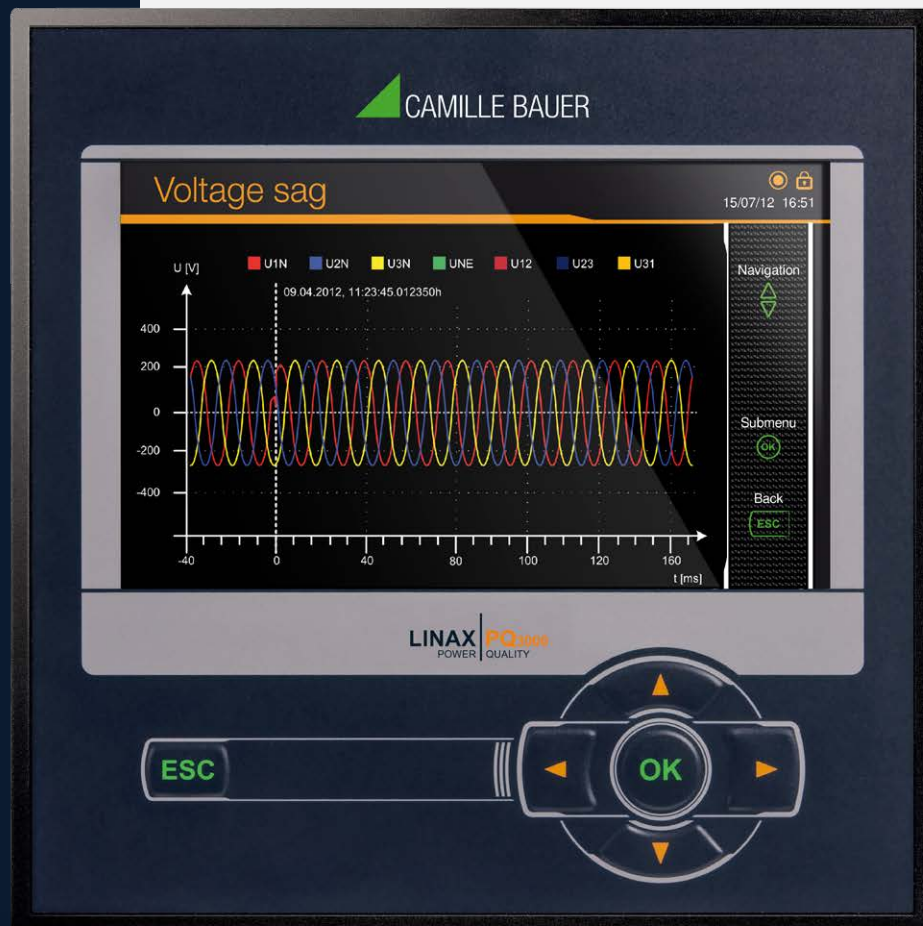
AVOIDING POWER QUALITY PROBLEMS

COMBINED POWER QUALITY
AND ENERGY CONSUMPTION
MONITORING





Panel-mounted devices for
Power quality monitoring in
electric mains



Traditionally, power quality monitoring is only conducted as a reaction to trouble such as device failure, plant malfunctions, process interruptions or communication breakdowns. However, all these problems cost money and nobody wants to experience the same thing again just to be able to create a corresponding record for analysis.

Therefore, the greatest advantage of continuous power quality monitoring is that users put themselves in a position to proactively build up their knowledge thus increasing system availability.

LINAX PQ3000 helps to detect trouble before it can do any damage and to provide data for the identification of the root cause in case an event actually occurs.

PQ3000 is a Class A device according to the IEC 61000-4-30 Ed.3 power quality standard. It can thus provide reliable and comparable information for regulatory agencies, negotiations with energy suppliers or internal quality control. It also supports a conformity report according to the EN 50160 voltage quality standard.

CLEAR

High resolution, colour TFT display for the pin-sharp indication of measured data

Consistently visible status information (alarms, password protection, data recording, time/date and much more)

Clear Design

INTUITIVE

Language-specific plain text menu navigation

Topical arrangement of measured value information for quick data access

Service area for maintenance and commissioning

MULTIFUNCTIONAL

Monitoring of power quality according to IEC 61000-4-30 Ed. 3

Acquisition of energy consumption: Meters and load profiles

Plant condition monitoring

FLEXIBLE

Applicable in all network configurations without hardware variance

Freely selectable measured variables for mean value and meter

Freely definable alarm conditions with collective alarm and recording

SCALABLE

Combinable device design (functionality, interfaces, I/Os, auxiliary energy)

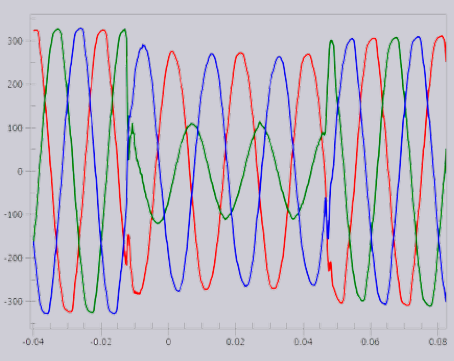
May be integrated directly in the SMARTCOLLECT software



AVOIDING POWER QUALITY PROBLEMS - THROUGH CONTINUOUS MONITORING

Disruptions of the energy supply may result in production or equipment outages. Often people do not react until great financial damage has been caused. Yet, many of these incidents could be avoided if the signs were recognised in the continuous monitoring of the situation. Any form of power quality monitoring provides both a statistical evaluation

allowing the comparison with standards (e.g. EN 50160) or supply contracts as well as records of events in the grid (e.g. power voltage dips). This facilitates the analysis of causes and effects.

POWER QUALITY EVALUATION	DESCRIPTION	BENEFIT
<p>Statistical evaluation</p>  <p>Legend: ■ Data within limits ■ Missing data ■ Limit violation</p>	<p>All relevant parameters of the supply voltage are monitored, statistically averaged and compared to specified values. This way, one can either prove conformity or call attention to possible problems.</p> <p>Also currents are monitored for magnitude, harmonics content and unbalance. However, since there are no limit values, these results are not included in the statistical evaluation.</p>	<p>Verification of the compliance with standards (e.g. EN 50160) or contracts between energy suppliers and energy consumers.</p> <p>Users may adapt the specified values as they desire.</p> <p>By observing changes in the results, one can detect any deterioration of power quality early on, identify the causes and introduce improvements.</p>
<p>Recording of malfunctions</p> 	<p>Voltage and current events are registered as such but not evaluated statistically.</p> <p>The recording of events comprises the curve shape of all voltages and currents upon occurrence of the event as well as course of the RMS values for the entire duration of the event.</p>	<p>The evaluation of malfunction recording lets you identify the cause of the malfunction and - at best - establish a correlation with the events witnessed (such as outage of control systems or equipment). Suitable remedies may then be derived.</p>

LINAX PQ3000 stores the acquired power quality data in a standardised Power Quality Data Interchange Format (PQDIF) according to IEEE 1159.3. Many evaluation programs for the analysis of power quality data support this data format, e.g. SMARTCOLLECT PM20 of Camille Bauer Metrawatt or PQView of Electrotek Concepts.

The storage principle provides one PQDIF file containing statistical data per day. Voltage or current events are stored in an individual file per event so that event data are available immediately.



MONITORED VOLTAGE PHENOMENON	CAUSES	POSSIBLE CONSEQUENTIAL PROBLEMS
Mains frequency	<ul style="list-style-type: none"> • Loss of power generators • Great load changes 	<ul style="list-style-type: none"> • Instability of the mains power supply
Magnitude of supply voltage	<ul style="list-style-type: none"> • Changes in grid load 	<ul style="list-style-type: none"> • Disruption of equipment • System shut-down • Loss of data
Flicker and rapid voltage changes (RVC)	<ul style="list-style-type: none"> • Frequent load changes • Start of engine 	<ul style="list-style-type: none"> • Flickering lighting • Impairment of the performance of exposed people
Supply voltage dips and swells 	<ul style="list-style-type: none"> • Great load changes • Short circuit, contact to earth • Thunderstorm • Power supply overload • Feed-in of renewable energies such as wind or photovoltaic energy 	<ul style="list-style-type: none"> • Disruption of equipment such as control or drive systems • Operational interruption • Data loss in control systems and computers
Voltage interruptions	<ul style="list-style-type: none"> • Short circuit • Blown fuses • Component failure • Planned supply interruption 	<ul style="list-style-type: none"> • Production stoppage • Process interruptions • Data loss in control systems and computers
Supply voltage unbalance	<ul style="list-style-type: none"> • Uneven load on phases due to one or two-phase consumers 	<ul style="list-style-type: none"> • Current in the neutral conductor • Overload / overheating of equipment • Increase of harmonics
Voltage harmonics 	<ul style="list-style-type: none"> • Non-linear loads such as frequency converters, rectifiers, switching power supplies, arc furnaces, computers, fluorescent tubes etc. 	<ul style="list-style-type: none"> • Reduction of machine efficiency • Increased energy losses • Overload / overheating of equipment • Current in the neutral conductor
Voltage interharmonics, mains signalling voltage on the supply voltage 	<ul style="list-style-type: none"> • Frequency converters and similar control devices 	<ul style="list-style-type: none"> • Flicker • Malfunction of ripple control

Current (magnitude, harmonics, interharmonics, events)



Analogously to voltages, the pertaining current values are recorded in the same manner.

Current course in voltage dips in the mains

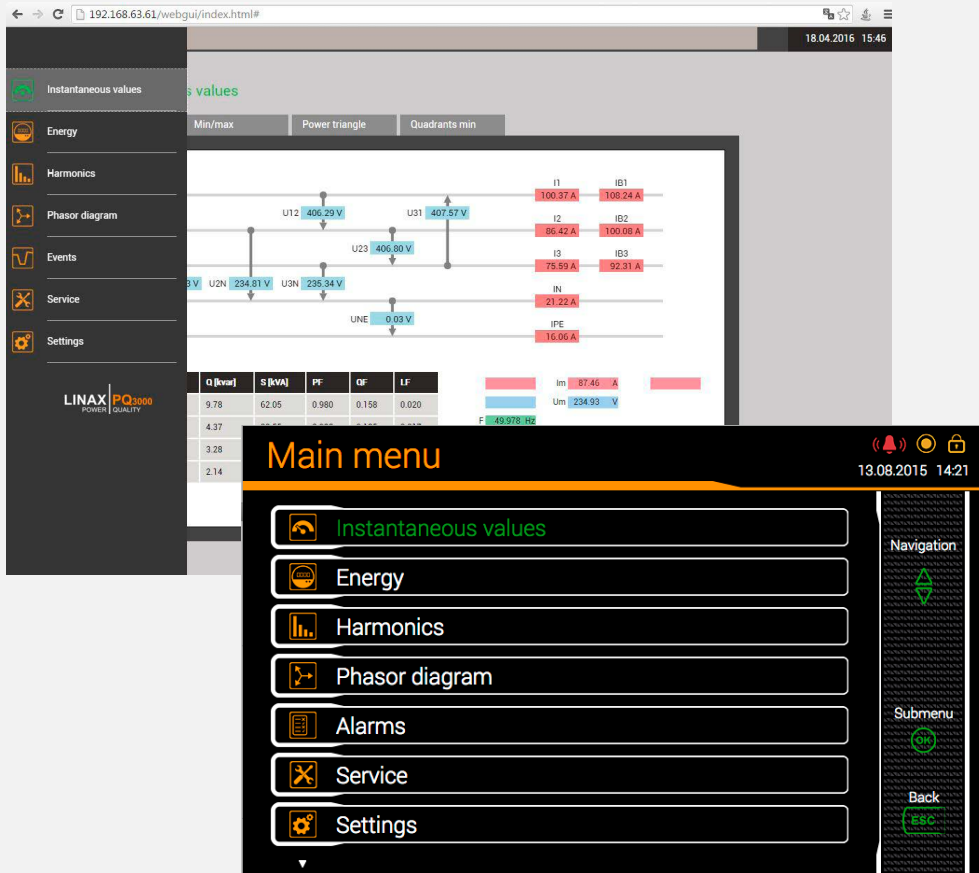


MEASURED VALUES

MEASURED VALUE GROUP	APPLICATION
INSTANTANEOUS VALUES U, I, IMS, P, Q, S, PF, LF, QF ... Angle between voltage phasors Min/max of instantaneous values with time stamp	Transparent monitoring of present system state Fault detection, connection check, sense of rotation check Determination of grid variable variance with time reference
EXTENDED REACTIVE POWER ANALYSIS Total reactive power, fundamental frequency, harmonics $\cos\phi$, $\tan\phi$ of fundamental frequency with min values in all quadrants	Reactive power compensation Verification of specified power factor
HARMONICS ANALYSIS (ACCORDING TO EN 61 000-4-7) Total harmonics content THD U/I and TDD I Individual harmonics U/I up to 50th	Evaluation of the thermic load of equipment Analysis of system perturbation and consumer structure
IMBALANCE ANALYSIS Symmetrical components (positive, negative, zero sequence system) Imbalance (from symmetrical components) Deviation from U/I mean value	Equipment overload protection Fault/earth contact detection
ENERGY BALANCE ANALYSIS Meters for the demand/supply of active/reactive power, high/low tariff, meters with selectable fundamental variable Power mean values active/reactive power, demand and supply, freely definable mean values (e.g. phase power, voltage, current and much more) Mean value trends	Preparation of (internal) energy billing Determination of energy consumption versus time (load profile) for energy management or energy efficiency verification Energy consumption trend analysis for load management
OPERATING HOURS 3 operating hour counters with programmable running condition Operating hours of the device	Monitoring of service and maintenance intervals of equipments
POWER QUALITY Parameters according to IEC 61000-4-30, Class A Chap. 5.1 Power frequency Chap. 5.2 Magnitude of supply voltage Chap. 5.3 Flicker Chap. 5.4 Supply voltage dips / swells Chap. 5.5 Voltage interruptions Chap. 5.7 Supply voltage unbalance Chap. 5.8 Voltage harmonics Chap. 5.9 Voltage interharmonics Chap. 5.10 Mains signalling voltage on the supply voltage Chap. 5.11 Rapid voltage changes (RVC) Chap. 5.12 Underdeviation and overdeviation Chap. 5.13 Current (magnitude, harmonics, interharmonics)	LINAX PQ3000 is a Class A device according to the IEC 61000-4-30 Ed.3 power quality standard. Thus it may serve as a reliable and comparable source of information for regulatory agencies, for negotiations with energy suppliers or for internal quality control. The device is certified according to IEC 62586 (PQI-A F12). It also supports a conformity report according to the EN 50160 voltage quality standard by means of the SMARTCOLLECT PM20 Software.

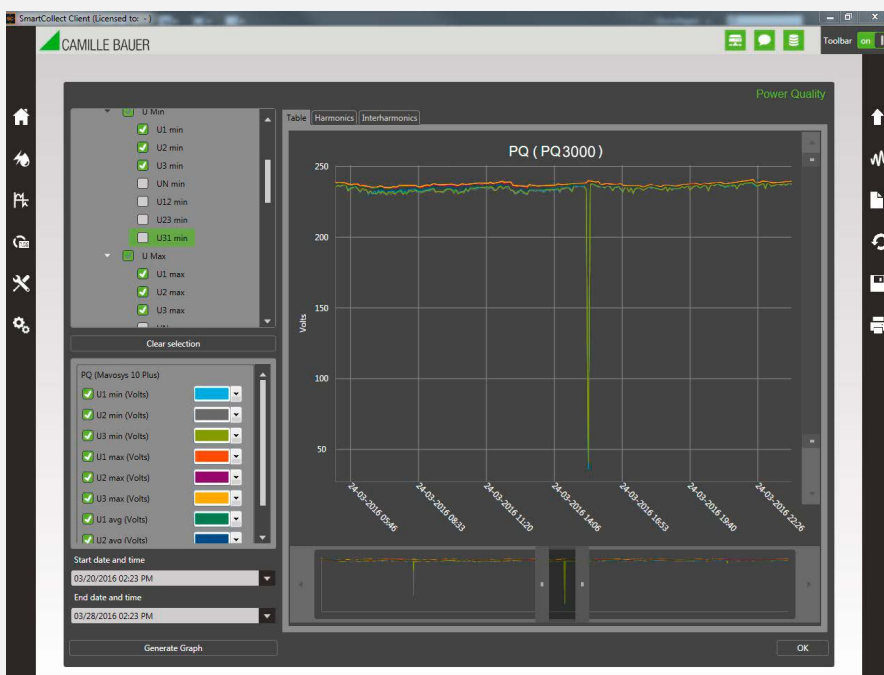


OPERATION AND EVALUATION



OPERATION

The local operation at the device itself and the access via web interface are structured identically. One can access the available measured data or parametrise the instrument via the language-specific, topically structured menu navigation. Also the status bar at the top right, uniformly shows the statuses of alarm monitoring, of the password protection system as well as time / date.



EVALUATION

By means of the SMARTCOLLECT PM20 software, the PQDIF files of the device can be displayed, stored in the database and analysed. A conformity report can be prepared, as well.

Most data displays are also available via the local GUI or the web interface of PQ3000.



MONITORING AND ALARMS

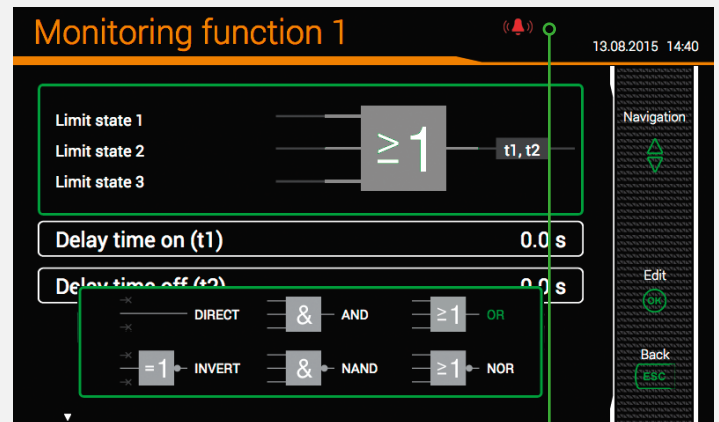
The instrument supports the on-site analysis of acquired measured data in order to initiate directly immediate or delayed measures without involving a separate control. This facilitates the protection of equipment and also monitoring of service intervals.

The following items are available:

- 12 limit values
- 8 monitoring functions with 3 inputs each
- 1 collective alarm as a combination of all monitoring functions
- 3 operating hourcounters with definable running conditions

The available digital outputs may be used directly for the transmission of limit values and monitoring functions as well as the resettable collective alarm.

A text may be allocated to each monitoring function which is used both for the alarm list and the event entries in the data logger.



DATA RECORDING

Apart from the automatic recording of power quality statistics, the high-performance data logger also provides the following recording options:

• PERIODIC DATA

Selectable measured values are saved in regular intervals, e.g. to acquire load profiles (intervals of 10s to 1h) or periodic meters readings (e.g. daily, weekly, monthly).

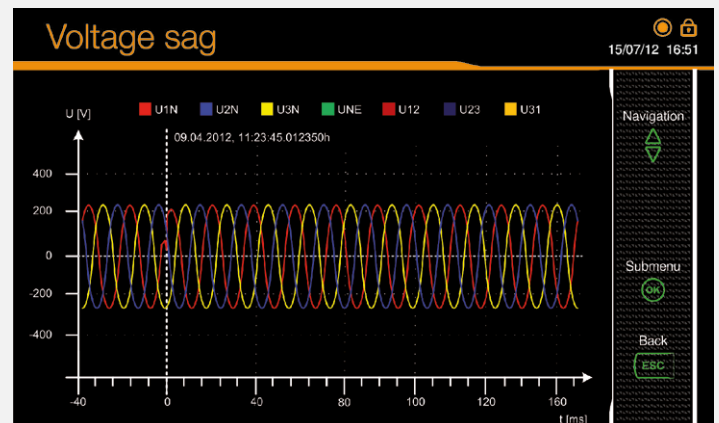
• EVENTS

A kind of logbook that records events with time information: The onset and end of power quality events, monitoring functions, configuration changes, power failures and many more.

• DISTURBANCE RECORDER

Recording of current and voltage progression in case of disturbances on basis of 1/2 cycle RMS values. In addition, the curve shape during the disturbance is recorded.

Event lists, records of the disturbance recorder, mean value courses (load profiles) and counter readings may be displayed directly at the device itself. Further analysis are possible via the web page of the device or via the SMARTCOLLECT PM20 software.



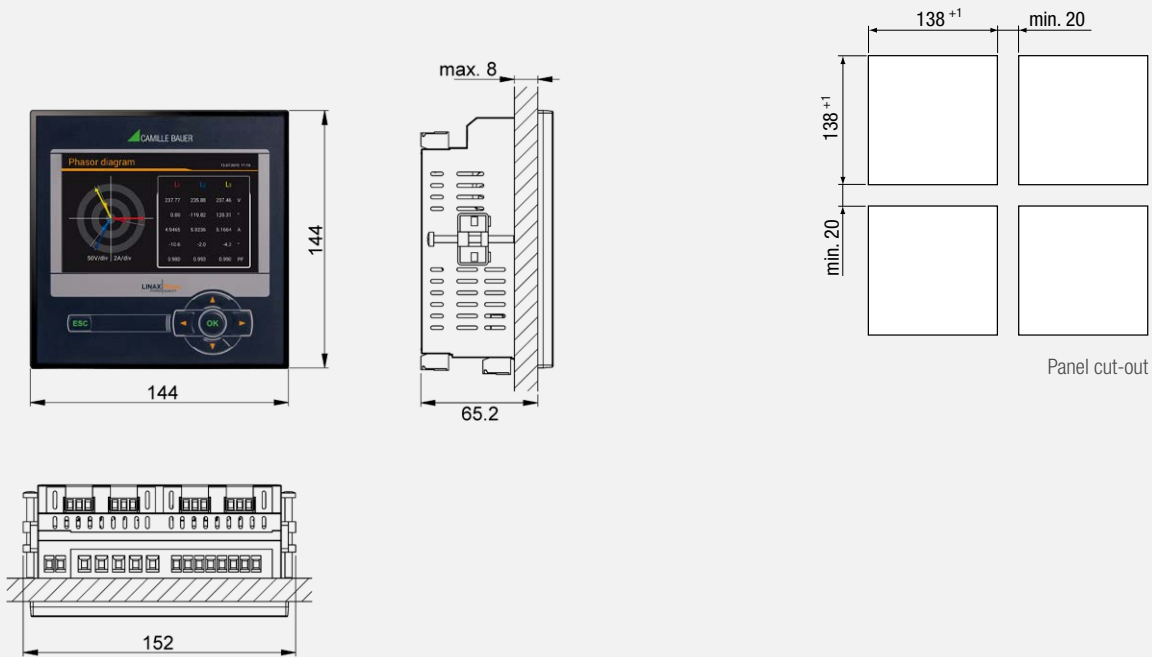


TECHNICAL DATA

INPUTS		BASIC UNCERTAINTY ACCORDING IEC/EN 60688	
NOMINAL CURRENT	1 ... 5 A (max. 7.5 A)	Voltage, current	±0.1°
Maximum	7.5 A	Power	±0.2 %
Overload capacity	10 A permanent 100 A, 5x1 s, interval 300 s	Power factor	±0.1°
		Frequency	±0.01 Hz
		Imbalance U, I	±0.5 %
NOMINAL VOLTAGE	57.7 ... 400 V _{LN} , 100 ... 693 V _{LL}	Harmonic	±0.5 %
Maximum	480 V _{LN} , 832 V _{LL} (sinusoidal)	THD U, I	±0.5 %
Overload capacity	480 V _{LN} , 832 V _{LL} permanent 800 V _{LN} , 1386 V _{LL} , 10x1 s, interval 10 s	Active energy	Class 0.5S (EN 62 053-22)
Nominal frequency	42 ... 50 ... 58 Hz, 50.5 ... 60 ... 69.5 Hz	Reactive energy	Class 0.5S (EN 62 053-24)
Sampling rate	18 kHz	INTERFACES	
		ETHERNET	Standard
POWER SUPPLY VARIANTS		Connection	RJ45 socket
Nominal voltage	110 ... 230 V AC, 130 ... 230 V DC 110 ... 200 V AC, 110 ... 200 V DC 24 ... 48 V DC	Physics	Ethernet 100Base TX
Consumption	≤ 20 VA	Mode	10/100 MBit/s, full/half duplex, autonegotiation
UPS (optional)	3 min.	Protocols	Modbus/TCP, http, NTP (time synchronisation)
		MODBUS/RTU	Standard
		Physics	RS-485, max. 1200 m (4000 ft)
		Baud rate	2.4 to 155.2 kBaud
		Number of participants	≤ 32
TYPES OF CONNECTION		TIME REFERENCE	Internal clock
Single phase or split phase (2-phase system)		Clock accuracy	± 2 minutes/month (15 to 30°C)
3 or 4-wire balanced load		Synchronisation	via NTP server
3-wire balanced load [2U, 1I]		Power reserve	> 10 years
3-wire unbalanced load, Aron connection			
3 or 4-wire unbalanced load			
4-wire unbalanced load, Open-Y			
		ENVIRONMENTAL CONDITIONS, GENERAL INFORMATION	
I/O-INTERFACE		Operating temperature	-10 to 15 to 30 to +55 °C 0 to +45 °C (with USV)
ANALOG OUTPUTS (optional)		Storage temperature	-25 to +70 °C
Linearisation	Linear, kinked	Temperature influence	0.5 x basic uncertainty per 10 K
Range	± 20 mA (24 mA max.), bipolar	Long-term drift	0.5 x basic uncertainty per year
Accuracy	± 0.2 % von 20 mA	Others	Application group II (EN 60 688)
Burden	≤ 500 Ω (max. 10 V/20 mA)	Relative air humidity	<95 % without condensation
Burden influence	≤ 0.2 %	Operating altitude	≤ 2000 m above NN
Residual ripple	≤ 0.4 %	Only to be used in buildings!	
		MECHANICAL PROPERTIES	
RELAYS (optional)		Installation position	Control panel installation
Contacts	Changeover contact, bistable	Housing material	Polycarbonate (Makrolon)
Load capacity	250 V AC, 2 A, 500 VA 30 V DC, 2 A, 60 W	Flammability class	V-0 according UL94, self-extinguishing, not dripping, free of halogen
		Weight	800 g
DIGITAL INPUT		SAFETY	
Nominal voltage	12/24 V DC (30 V max.)	Current inputs are galvanically isolated from each other.	
Logical ZERO	-3 to +5 V	Protection class	II (protective insulation, voltage inputs via protective impedance)
Logical ONE	11 to 30 V	Pollution degree	2
		Protection	IP54 (front), IP30 (housing), IP20 (terminals)
DIGITAL OUTPUT		Measurement category	CATIII
Nominal voltage	12/24 V DC (30 V max.)		
Nominal current	50 mA (60 mA max.)		
Load capacity	400 Ω ... 1 MΩ		

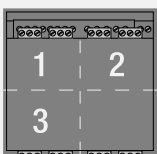


DIMENSIONAL DRAWING PQ3000



ORDER CODE

ORDER CODE PQ3000-			
1. BASIC DEVICE PQ3000		6. I/O-EXTENSION 2	
With TFT display, for control panel installation	1	Without	0
2. INPUT I FREQUENCY RANGE		2 relays	1
Current transformer inputs, 42 ... 50/60 ... 69.5 Hz	1	2 analog outputs, bipolar (± 20 mA)	2
3. POWER SUPPLY		4 analog outputs, bipolar (± 20 mA)	3
Nominal voltage 100 ... 230 V AC/DC, 130 ... 230 V DC	1	7. I/O-EXTENSION 3	
Nominal voltage 24 ... 48 V DC	2	Without	0
Nominal voltage 110 ... 200 V AC, 110 ... 200 V DC	3	2 relays	1
4. BUS CONNECTION		2 analog outputs, bipolar (± 20 mA)	2
Ethernet (Modbus/TCP+webserver)	1	4 analog outputs, bipolar (± 20 mA)	3
Ethernet (Modbus/TCP+webserver) + RS485 (Modbus/RTU)	2	8. TEST PROTOCOL	
5. I/O-EXTENSION 1		Without	0
Without	0	Test protocol in German	D
2 relays	1	Test protocol in English	E
2 analog outputs, bipolar (± 20 mA)	2		
4 analog outputs, bipolar (± 20 mA)	3	ACCESSORIES	ARTICLE-NO.
		Documentation-CD	156 027
		Interface converter USB <> RS485	163 189



I/O EXTENSIONS PQ3000

Maximum one I/O extension with analog outputs may be provided per device.



SMARTCOLLECT



SMARTCOLLECT is a data management software which can acquire measured data in an easy manner and store the same in an open SQL database. This software offers basic functionalities for data analysis and for easy energy monitoring as well as the easy preparation and disposal of reports.

Providing a mature graphic user interface, the SMARTCOLLECT software is clearly structured and easily operated.

SMARTCOLLECT is modularly designed and permits supplementing modules or functions at any time.

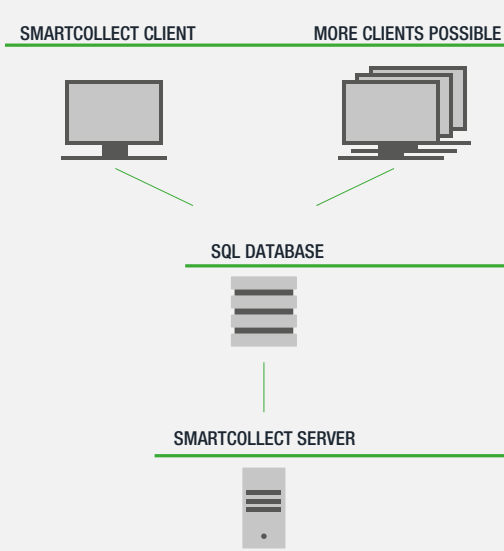
CUSTOMER BENEFITS

- Easy data communication via Modbus RTU / TCP, ECL and SmartControl-Direct
- Connection also via OPC
- Devices of Camille Bauer and Gossen Metrawatt are already predefined and selectable in the software
- Open for the devices of all manufacturers
- Data is stored in an open SQL database
- Modular cost / performance model – basic version may be extended at any time

MODULAR DESIGN

COMPONENTS

The SMARTCOLLECT data management software consists of the following components:



SMARTCOLLECT CLIENT

- Graphic visualisation of queried data
- Export via Excel file
- User interface to define the data sources to be read out as well as error and warning messages via email.

SMARTCOLLECT DATABASE

- SQL database
- Contains the collected data
- Open and unencrypted



SMARTCOLLECT SERVER

- Collects and configures data from active sources and channels and writes the same directly into the central database.

SMARTCOLLECT software components may be installed on an individual system or on several servers or computers.



GMC INSTRUMENTS

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