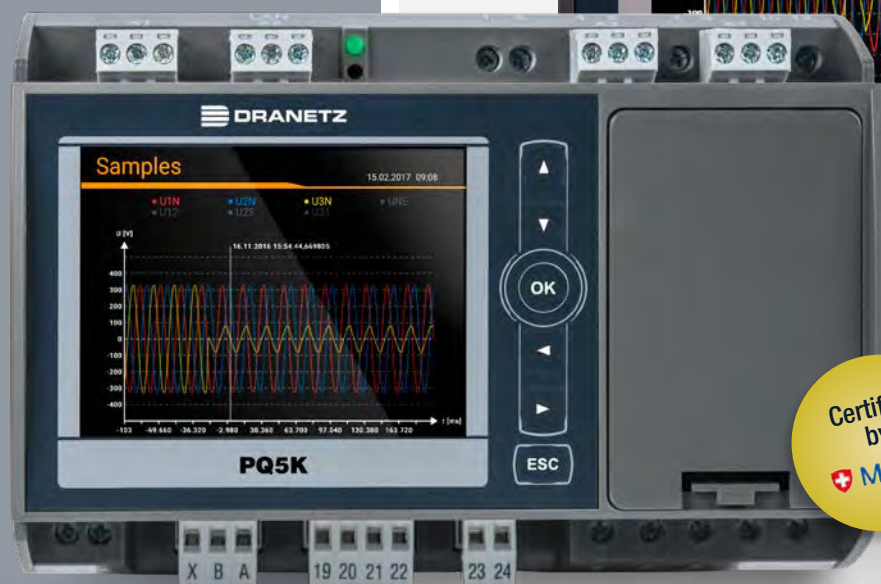
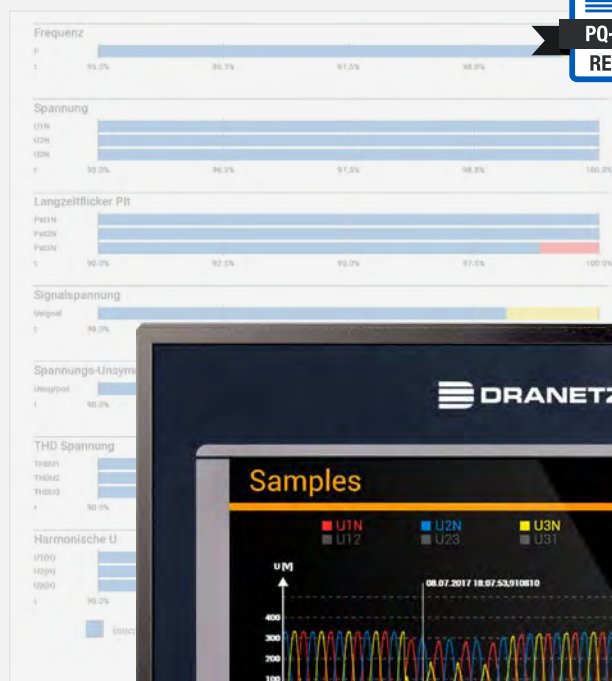


POWER QUALITY MONITORING

COMBINED POWER QUALITY
AND ENERGY CONSUMPTION
MEASUREMENT

CONFORMITY REPORT VIA BROWSER
WITHOUT EXTRA SOFTWARE



PQ3K - PQ5K



Comprehensive instrument
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 biggest advantage of continuous power quality monitoring is that users put themselves in a position to proactively build up their knowledge thus increasing system availability.

DRANETZ PQ3K / PQ5K 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.

DRANETZ PQ3K / PQ5K 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. Conformity reports on various standards can be generated directly via the website of the device.

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

Certified power quality monitoring according to IEC 61000-4-30 Ed. 3, class A

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 values and meters

Freely definable alarm conditions with summary alarm and recording

SCALABLE

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



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. voltage dips). This facilitates the analysis of causes and effects.

POWER QUALITY EVALUATION	DESCRIPTION	BENEFIT
Statistical evaluation	All relevant parameters of the supply voltage are monitored, statistically averaged and compared to specified values. This way, one can either prove compliance or call attention to possible problems. In addition to the voltages, also magnitude, harmonic content and unbalance of currents are recorded. But, a statistical evaluation is carried out only if corresponding limit values exist, for example for harmonics in IEEE 519.	Verification of the compliance with standards (e.g. EN 50160) or contracts between energy suppliers and energy consumers. Users may adapt the specified values as they desire. By observing changes in the results, one can detect any deterioration of power quality early on and identify the causes. Introduced improvements can be verified immediately.
Recording of malfunctions	All voltages are monitored for disturbances, such as dip, interruption or swell. These incidents are registered as event. A statistical evaluation is not required because there is no limitation for such events. An event recording comprises the waveshape of all voltages and currents upon occurrence of the event as well as the course of the corresponding RMS half cycle values for the entire duration of the event (max. 3 min.).	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.

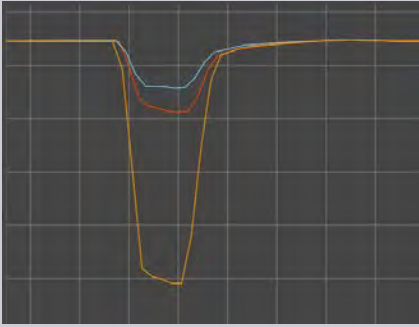
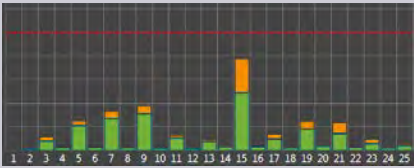
POWER QUALITY DATA EXCHANGE

DRANETZ PQ3K / PQ5K stores the acquired power quality data in the standardized Power Quality Data Interchange Format (PQDIF) according to IEEE 1159.3.

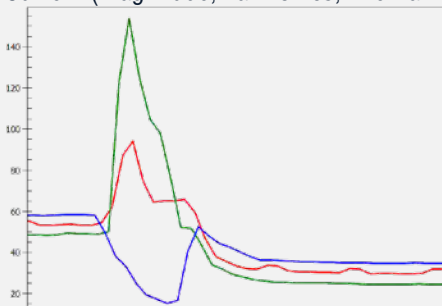
The storage principle provides daily PQDIF files containing either statistical data, histograms or event recordings. The creation is done shortly after midnight for the past day.

All these files may also be generated manually via the service menu of the device at any time for the ongoing day.



MONITORED VOLTAGE PHENOMENON	CAUSES	POSSIBLE CONSEQUENTIAL PROBLEMS
Mains frequency	• Loss of power generators • Large load changes	• Instability of the mains power supply
Magnitude of supply voltage 	• Changes in grid load	• Disruption of equipment • System shut-down • Loss of data
Flicker and rapid voltage changes (RVC)	• Frequent load changes • Start of engines	• Flickering lighting • Impairment of the performance of exposed people
Supply voltage dips and swells 	• Large load changes • Short circuit, contact to earth • Thunderstorm • Power supply overload • Feed-in of renewable energies such as wind or photovoltaic energy	• Disruption of equipment such as control or drive systems • Operational interruption • Data loss in control systems and computers
Voltage interruptions	• Short circuit • Blown fuses • Component failures • Planned supply interruption	• Production stoppage • Process interruptions • Data loss in control systems and computers
Supply voltage unbalance	• Uneven load on phases due to one or two-phase consumers	• Current in the neutral conductor • Overload / overheating of equipment • Increase of harmonics
Voltage harmonics 	• Non-linear loads such as frequency converters, rectifiers, switching power supplies, arc furnaces, computers, fluorescent tubes etc.	• 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	• Frequency converters and similar control devices	• Flicker • Malfunction of ripple control

Current (magnitude, harmonics, interharmonics, events)



In parallel with the voltages the corresponding current values are recorded in the same manner.

Current course during voltage dip in the mains



MEASURED VALUES

MEASURED VALUE GROUP	APPLICATION
INSTANTANEOUS VALUES V, 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 IEC 61000-4-7) Total harmonics content THD V/I and TDD I Individual harmonics V/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 (derived from symmetrical components) Deviation from V/I mean value	Equipment overload protection Failure/earth fault 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)	• Device type PQI-A FI2 (IEC 62586-1) • Independent and accredited laboratory: Federal Institute of Metrology METAS. Tested at both 230V / 50Hz and 120V / 60Hz. • Thanks to the certification according to IEC 62586-2 (standard for verifying compliance with IEC 61000-4-30) the device can serve as a reliable and comparable source of information for regulatory agencies, for negotiations with energy suppliers or for internal quality control. • Generation of compliance reports by means of the device website. • Improving the quality and reliability of the mains supply. • Identifying causes of disruptions.



DATA RECORDING

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

• PERIODIC DATA

This feature allows to record the time course of measured variables. Averaged measurements or meter contents serve as base and are saved in regular intervals. Typical applications are the acquisition of load profiles (intervals of 10s to 1h) or the determination of the energy consumption from the difference of meter readings. For both categories pre-defined courses are available, based on the system power values, and as well courses for freely selectable basic quantities. For further processing periodic data can be exported in Excel format for a definable time range.

• EVENTS

Here the occurrence of events or alarms is recorded in form of a list with time information. A distinction is made between self-defined events (such as ON/OFF of limit states or monitoring functions) which the user can classify as alarm or event and the so-called operator list in which system events such as changes of the device configuration, reset operations, powering the device and many more are held.

• PQ EVENTS

The occurrence of monitored PQ events is available in list form with the most important information about the events. Each entry can be directly selected to switch to the graphical event presentation. There the courses of the RMS half-cycle values and the waveshape during the disturbance are available, divided into presentations of all voltages, all currents and mixed displays.

Event lists, PQ event recordings, mean value courses (load profiles) and meter readings may be displayed directly at the device or via the device webpage.



PQ events

#	time	Trigger channel	Event type	Event value	Event value	Duration [s]
1	08.07.2017 18:12:05.728	U1, U2	Rapid voltage change	U1/min	87.1% V	0.48 V
2	08.07.2017 18:11:35.849	U2	Rapid voltage change	U2/min	7.18 V	0.02 V
3	08.07.2017 18:07:58.913	U2	Voltage dip	U2/min	174.25 V	0.02 V
4	08.07.2017 18:07:53.910	U1, U2	Voltage dip	U1/min	109.29 V	0.02 V
5	30.06.2017 14:20:31.613	U1	Rapid voltage change	U1/min	17.17 V	0.02 V
6	28.06.2017 19:05:29.778	U1	Rapid voltage change	U1/min	18.56 V	0.02 V
7	27.06.2017 14:20:08.760	U1	Shaggle	U1/min	16.46 V	0.02 V
8	25.06.2017 19:05:53.020	U1	Rapid voltage change	U1/min	16.46 V	0.02 V
9	22.06.2017 07:40:56.165	U1	Shaggle	U1/min	16.46 V	0.02 V
10	21.06.2017 14:56:08.515	U2, U3	Rapid voltage change	U2/min	13.07 V	0.02 V
11	14.06.2017 10:11:23.678	U1, U2	Rapid voltage change	U1/min	14.55 V	0.02 V



MONITORING AND ALARMING

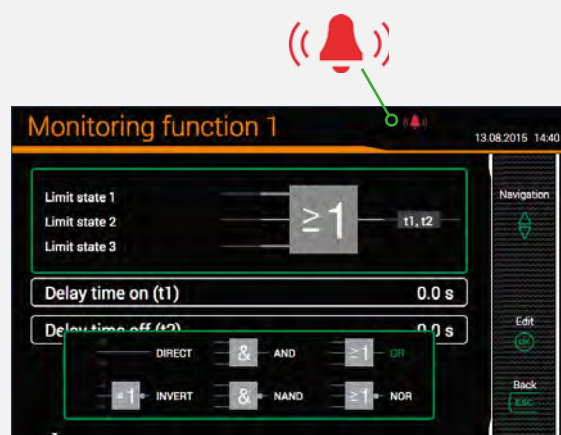
The instrument supports the on-site analysis of acquired measured data in order to initiate directly immediate or delayed actions. This facilitates the protection of equipment and also monitoring of service intervals.

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 summary alarm.

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





OPERATION AND ANALYSIS



OPERATION

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

Apart from the details of the PQ statistics, all data are available via both the local GUI and the WEB interface of the device.

PQ EASY-REPORT



- PDF creation via WEB interface of the device
- Selectable report duration
- Selectable report scope (overview, statistic details, event overview)
- Direct compliance assessment of standards EN 50160, IEC 61000-2-2 / 2-4 / 2-12, GB/T, IEEE 519 or customer specific limits
- Customer specific logo in the report



CERTIFIED POWER QUALITY MONITORING

- Independent certification by Federal Institute of Metrology
- Device type PQI-A F12 acc. IEC 62586-1
- Proven at 230V / 50 Hz and 120V / 60Hz
- Flicker meter class F1
- Flagging concept: Multiphase approach in accordance with IEC 61000-4-30

Thanks to the certification according to IEC 62586-2 (standard for verifying compliance with IEC 61000-4-30) the device can serve as a reliable and comparable source of information for regulatory agencies, for negotiations with energy suppliers or for internal quality control.





TECHNICAL DATA

INPUTS

NOMINAL CURRENT

	1 ... 5 A (max. 7.5 A)
Maximum	7.5 A
Overload capacity	10 A permanent 100 A, 5x1 s, interval 300 s

NOMINAL VOLTAGE

Maximum	57.7 ... 400 V _{LN} , 100 ... 693 V _{LL} PQ3K: 480 V _{LN} , 832 V _{LL} (sinusoidal) PQ5K: 520 V _{LN} , 900 V _{LL} (sinusoidal)
Overload capacity	PQ3K: 480 V _{LN} , 832 V _{LL} permanent PQ5K: 520 V _{LN} , 900 V _{LL} permanent 800 V _{LN} , 1386 V _{LL} , 10x1 s, interval 10 s
Nominal frequency	42 ... <u>50</u> ... 58 Hz, 50.5 ... <u>60</u> ... 69.5 Hz
Sampling rate	18 kHz

POWER SUPPLY VARIANTS

Nominal voltage	100...230 V AC/DC (PQ5K) 110...230 V AC, 130...230 V DC (PQ3K) 110...200 V AC, 110...200 V DC (PQ3K) 24...48 V DC (PQ3K / PQ5K)
Consumption	≤ 27 VA, ≤ 12 W (PQ5K); ≤ 30 VA, ≤ 13 W (PQ3K)

UNINTERRUPTIBLE POWER SUPPLY (UPS)

Type (3.7 V)	VARTA Easy Pack EZPackL, UL listed MH16707
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TYPES OF CONNECTION

- Single phase or split phase (2-phase system)
- 3 or 4-wire balanced load
- 3-wire balanced load [2U, 1I]
- 3-wire unbalanced load, Aron connection
- 3 or 4-wire unbalanced load
- 4-wire unbalanced load, Open-Y

I/O-INTERFACE

ANALOG OUTPUTS

	(optional)
Linearisation	Linear, kinked
Range	± 20 mA (24 mA max.), bipolar
Accuracy	± 0.2 % von 20 mA
Burden	≤ 500 Ω (max. 10 V/20 mA)

RELAYS

	(optional)
Contacts	Changeover contact
Load capacity	250 V AC, 2 A, 500 VA; 30 V DC, 2 A, 60 W

DIGITAL INPUTS PASSIVE

Nominal voltage	12/24 V DC (30 V max.)
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DIGITAL INPUTS ACTIVE (optional)

Open circuit voltage	≤ 15 V
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DIGITAL OUTPUTS

	2, Standard
Nominal voltage	12/24 V DC (30 V max.)

FAULT CURRENT MONITORING For grounded systems (optional)

Number of meas. channels	2 (2 measurement ranges each)
Measurement range 1 (1A)	Earth current measurement
• Measuring transformer	1/1 up to 1/1000 A
• Alarm limit	30 mA up to 1000 A
Measurement range 2 (2mA)	RCM with connection monitoring
• Measuring transformer	Residual current transformer 500/1 up to 1000/1 A
• Alarm limit	30 mA up to 1 A

TEMPERATURE INPUTS (optional)

Number of channels	2
Measurement sensor	Pt100 / PTC; 2-wire

BASIC UNCERTAINTY ACCORDING IEC/EN 60688

Voltage, current	±0.1 %
Power	±0.2 %
Power factor	±0.1°
Frequency	±0.01 Hz
Imbalance U, I	±0.5 %
Harmonic	±0.5 %
THD U, I	±0.5 %
Active energy	Class 0.5S (IEC/EN 62 053-22)
Reactive energy	Class 0.5S (IEC/EN 62 053-24)

INTERFACES

ETHERNET

Standard	Standard
Physics	Ethernet 100Base TX; RJ45 socket
Mode	10/100 Mbit/s, full/half duplex, autonegotiation
Protocols	Modbus/TCP, http, NTP (time synchronisation)

IEC61850

optional	optional
Physics	Ethernet 100BaseTX, RJ45 sockets, 2 ports
Mode	10/100 Mbit/s, full/half duplex, auto-negotiation
Protocol	IEC61850, NTP

PROFINET IO

optional	optional
Conformance class	CC-B
Physics	Ethernet 100BaseTX, RJ45-Buchsen, 2 ports
Mode	10/100 Mbit/s, full/half duplex, auto-negotiation
Protocol	PROFINET, LLDP, SNMP

MODBUS/RTU

Standard (PQ5K), optional (PQ3K)	Standard (PQ5K), optional (PQ3K)
Physics	RS-485, max. 1200 m (4000 ft)
Baud rate	9.6 to 115.2 kBaud

TIME REFERENCE

Internal clock	Internal clock
Clock accuracy	± 2 minutes/month (15 to 30°C)
Synchronisation	via NTP server or GPS

ENVIRONMENTAL CONDITIONS, GENERAL INFORMATION

Operating temperature	without UPS: -10 up to <u>15 up to 30</u> up to + 55 °C with UPS: 0 up to <u>15 up to 30</u> up to + 35 °C
Storage temperature	-25 to +70 °C
Temperature influence	0.5 x basic uncertainty per 10 K
Long-term drift	0.5 x basic uncertainty per year
Others	Application group II (IEC/EN 60 688)
Relative air humidity	<95 % without condensation
Operating altitude	≤2000 m above NN
Only to be used in buildings!	

MECHANICAL PROPERTIES

Housing material	Polycarbonate (Makrolon)
Flammability class	V-0 according UL94, self-extinguishing, not dripping, free of halogen
Weight	800 g (PQ3K), 600g (PQ5K)

SAFETY

Current inputs are galvanically isolated from each other.	
Protection class	II (protective insulation, voltage inputs via protective impedance)
Pollution degree	2
Protection	IP54 (front), IP30 (housing), IP20 (terminals)
Measurement category	U: 600 V CAT III, I: 300 V CAT III

ORDER CODE PQ3K-

1. BASIC DEVICE FOR PANEL-MOUNTING	
With TFT display	1
2. INPUT I FREQUENCY RANGE	
Current transformer inputs, 42 ... 50/60 ... 69,5 Hz	1
3. POWER SUPPLY	
Nominal voltage 110 ... 230 V AC, 130 ... 230 V DC	1
Nominal voltage 24 ... 48 V DC	2
Nominal voltage 110 ... 200 V AC, 110 ... 200 V DC	3
4. BUS CONNECTION	
Ethernet (Modbus/TCP protocol+web server)	1
Ethernet (Modbus/TCP+web server)+RS485 (Modbus/RTU)	2
5. EXTENSION 1	
Without	0
2 relays	1
2 analog outputs, bipolar (± 20 mA)	2
4 analog outputs, bipolar (± 20 mA)	3
4 digital inputs passive	4
4 digital inputs active	5
Fault current detection, 2 channels	6
GPS connection module	7
Temperature monitoring, 2 channels	C
6. EXTENSION 2	
Without	0
2 relays	1
2 analog outputs, bipolar (± 20 mA)	2
4 analog outputs, bipolar (± 20 mA)	3
4 digital inputs passive	4
4 digital inputs active	5
Fault current detection, 2 channels	6
GPS connection module	7
Profinet interface	A
IEC61850 interface	B
Temperature monitoring, 2 channels	C
7. EXTENSION 3	
Without	0
2 analog outputs bipolar (± 20 mA)	2
4 analog outputs bipolar (± 20 mA)	3
4 digital inputs passive	4
4 digital inputs active	5
Fault current detection, 2 channels	6
Uninterruptible power supply	8
Temperature monitoring, 2 channels	C
8. TEST CERTIFICATE	
Without	0
Test certificate in German	D
Test certificate in English	E

ORDER CODE PQ5K-

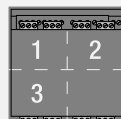
1. BASIC DEVICE FOR TOP-HAT RAIL MOUNTING	
Without display	0
With TFT display	1
2. INPUT I FREQUENCY RANGE	
Current transformer inputs, 42 ... 50/60 ... 69,5 Hz	1
3. POWER SUPPLY	
Nominal voltage 100 ... 230 V AC/DC	1
Nominal voltage 24 ... 48 V DC	2
4. BUS CONNECTION	
Ethernet (Modbus/TCP+web server) + RS485 (Modbus/RTU)	1
5. UNINTERRUPTIBLE POWER SUPPLY	
Without	0
With uninterruptible power supply	1
6. EXTENSION 1	
Without	0
2 relays	1
2 analog outputs, bipolar (± 20 mA)	2
4 analog outputs, bipolar (± 20 mA)	3
4 digital inputs passive	4
4 digital inputs active	5
Fault current detection, 2 channels	6
GPS connection module	7
Profinet interface	A
IEC61850 interface	B
Temperature monitoring, 2 channels	C
7. EXTENSION 2	
Without	0
2 relays	1
2 analog outputs, bipolar (± 20 mA)	2
4 analog outputs, bipolar (± 20 mA)	3
4 digital inputs passive	4
4 digital inputs active	5
Fault current detection, 2 channels	6
GPS connection module	7
Temperature monitoring, 2 channels	C
8. TEST CERTIFICATE	
Without	0
Test certificate in German	D
Test certificate in English	E

ACCESSORIES

ARTICLE NO

Documentation on USB stick	156 027
Interface converter USB $\leftrightarrow$ RS485	163 189
GPS receiver 16x-LVS, configured	181 131
Transformers for fault current detection see accessory current transformers	

DIMENSIONAL DRAWING PQ3K



EXTENSIONS PQ3K

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

DIMENSIONAL DRAWING PQ5K

