

– Reference conditions for factory tests: 19 to 25°C, 10% to 70% RH

MAINS VOLTAGE MEASURING CHANNELS

Mains voltage channels 3× Line-to-Neutral, 3× Line-to-Line, 3× Line-to-Earth, 1× Neutral-to-Earth

Power configuration / Range of nominal input voltage Single-phase - 69 Vac to 480 Vac (L-N)
 Split-single-phase – 50 Vac to 480 Vac (L-N) and 100 Vac to 960 Vac (L-L)
 3 phase wye/star - 50 Vac to 480 Nominal input (L-N) and 100 Vac to 830 Vac (L-L)
 3 phase delta - 100 Vac to 600 Vac
Power configuration and nominal voltages can be user-selected or auto-selected.

Voltage measurement range 0 Vac to 750 Vac (L-N) and 0 VAC to 1300 Vac (L-L)

Magnitude accuracy (±% rdg ±% FS)

Typical	Specification
±0.01%	±0.05%

10Vac to 750Vac L-N, 50/60 Hz.

Voltage fundamental angle accuracy (relative to L1-E channel)

Typical	Specification
±0.002°	±0.01°

Sub-sample analog angle calibration
 Calibrated ±0.01 sample resolution 50/60 Hz.
 All specifications relative to L1-E angle, at nominal voltage, 50/60 Hz. Typical and factory specifications are limited by system resolution.

Range of nominal frequencies

16.67 Hz, Nominal 50 Hz, 60 Hz, or 400 Hz auto-selected

Simultaneous sampling rates

	Sampling Rate	Notes
50/60 Hz	512 Samples per cycle	<ul style="list-style-type: none"> Phase-locked to frequency on reference channel (L1-N or L1-L2) Simultaneous sampling on all voltage, current, analog and digital input channels Fully certified to IEC 61000-4-30 Class A Ed. 3 and Class 0.2 revenue meter accuracy
High-Frequency Impulse	4.0 MHz	<ul style="list-style-type: none"> ±6 kV measurement range 4 MHz on L1-E channel only or 1 MHz on 4 channels (L1-E, L2-E, L3-E, N-E), user-selected Measured through 1.5 kHz 2-pole high-pass filter Fully compatible with ANSI/IEEE C62.41, C3 and B3 combination wave, ring wave and IEC 61000-4-5 waveforms
2 kHz-150 kHz Emissions	1.0 MHz	<ul style="list-style-type: none"> ±60 V measurement range, 12-bit min/avg/max recording 4 channels, 2 kHz bins Filters per IEC 61000-4-30 Ed. 3

Frequency measurement range

13.3 Hz to 23.3 Hz, 40 Hz to 70 Hz and 320 Hz to 560 Hz

Input impedance

4.8 MΩ || 7.33 pF to Earth per phase

Physical connection

L1, L2, L3, N, E pluggable screw terminal block (max torque 5 inch-pounds (0,6 Nm))

Wire connection

Minimum wire size 20 AWG (0,52 mm²), maximum 14 AWG (2,1 mm²)
 600 V UL-recognized insulation required.

CURRENT INPUT CHANNELS

Measurement channels	8 inputs: I1, I2, I3, I4, I5, I6, I7, I8 (typically used as L1, L2, L3, N, E, I6, I7, I8)		
full scale)	1A, 5A, 20A... 300A, 400A...6000A ranges available through CTs 3000A available through Flexible current sensors Nominal for the CT outputs: 0.333 V _{rms} (Low range) or 3.33 V _{rms} (High range) - user selected.		
Crest factor	3.5 (±1.17 V _{pk}) (Low range) or 3.0 (±10 V _{pk}) (High range)		
Magnitude accuracy - including POWERSIDE Ultra-Precise calibrated shielded split-core current sensors (±% rdg ±% FS)	Typical	Specification	At 50/60 Hz, 2.5% FS to 120% FS Additional uncertainty is the uncertainty due to the Factory CT Calibration System, plus uncertainty due to the resolution of the entries in the CT-specific Calibration Table and the algorithms for applying the CT-specific Calibration Table.
	±0.05%	±0.1%	
Angle accuracy - including POWERSIDE Ultra-Precise calibrated shielded split-core current sensors	Typical	Specification	Sub-sample analog angle calibration Calibrated to ±0.01 sample resolution at 50/60 Hz. All channels calibrated relative to L1-E angle, 50/60 Hz.
	±0.07°	±0.1°	
Magnitude accuracy excluding external CT's (±% rdg ±% FS)	Typical	Specification	At 50/60 Hz, 2.5% FS to 120% FS
	±0.01%	±0.05%	
Angle accuracy - excluding external CT's	Typical	Specification	
	±0.002°	±0.01°	
Sampling rate	Same rate as mains voltage measuring channels: 512 Samples per cycle		
Input impedance/burden	33.3 kΩ <1 VA for CTs		
CT ratio range	1:1 to 50000:1		
Physical connection	Interfaces with External CT (current transformer) with voltage-type secondary or Flexible current sensors 5 or 8 pairs of pluggable screw terminals (Max torque 2 inch-pounds (0,25 Nm)) Connections to feeder wires are done by clamping on split-core CTs around the feeder.		
Wire connection	Connection of the CT voltage output to the PQube 3 input terminal: Min wire size 28 AWG (0,8 mm ²), Max. 16 AWG (1,31 mm ²). 600V UL- recognized insulation required.		

ANALOG INPUT CHANNELS

Measurement channels	User-selected Standard Mode or DC Energy Mode Standard mode: AN1-E, AN2-E, AN3-E, AN4-E (common mode), AN1 to AN2, AN3 to AN4 (differential mode) DC Energy mode: AN1×AN2, AN3×AN4 (bi-directional DC power), AN1×AN2×hours, AN3×AN4×hours (DC Energy)
Nominal input	High range: ±60 Vdc to Earth. Low range: ±10 Vdc to Earth.
Measurement range	High range: ±100 Vdc, Low range ±10 Vdc.
Accuracy	±0.05% rdg ±0.05% FS typical (1% to 100% FS), ANx-E
Internal pull-up voltage	2.5 Vdc
Analog ratio range	1:1 to 10000:1
Input impedance	1 MΩ to Earth
Physical connection	Pluggable screw terminals (Max torque 2 inch-pounds (0,25 Nm)) AN1, AN2, AN3, AN4 and Earth

DIGITAL INPUT CHANNEL

Rating	Typical 3.3 Vdc, 5 Vdc, 24 Vdc. Maximum input 60 Vdc (differential input)
Wetting	2.2 Vdc typical. Can be used with NC or NO dry contacts.
Digital threshold	1.5 V ±0.2V with 0.1 V hysteresis typical.
Sampling rate	Same rate as mains voltage measuring channels
Input impedance	>1MΩ
Physical connection	Pluggable screw terminals (Max torque 2 inch-pounds (0,25 Nm)) DIG1+ and DIG1-

SIGNAL OUTPUT RELAY

Connection	RLY1 pluggable screw terminals standard
Rating	30 Vac/30 Vdc, 300 mA max
Function	When PQube 3 is off, normally open. When PQube 3 is on, normally closed. Contacts open for duration of event or 3 seconds (whichever is longer).
Operate time	20 milliseconds

POWER MEASUREMENTS

Definitions	
Watts (power)	Sum of true instantaneous per-phase bi-directional power, taken over the measurement interval.
Volt-Amps (apparent power)	Sum of per-phase product of RMS voltage and RMS current, taken over the measurement interval.
Power factor	True power factor-ratio of Watts to Volt-Amps
VARs (volt-amps reactive)	Fundamental VARs on L1, L2, L3 and total

Inputs	
Voltages	L-N, or L-N _m for delta configurations. N _m defined as measurement neutral, the instantaneous mean of the three L-E voltages.
Currents	L1, L2, L3
Measurement interval	Phase-locked, 10-cycles (50 Hz nominal) or 12-cycles (60 Hz nominal).
Accuracy including POWERSIDE Ultra-Precise current sensor:	
Watts (power)	±0.1% rdg typical at unity power factor, nominal voltage, 10% to 100% FS current. ±0.2% rdg typical at 0.5 power factor, nominal voltage, 10% to 100% FS current.
Watt-hours (energy)	Accuracy certified to ANSI C12.20 Class 0.2 and IEC 62053-22 Class 0,2S

CLASS A POWER QUALITY MEASUREMENTS - IEC 61000-4-30 Ed. 3 Class A, Full Compliance Certification

Frequency	Range 40 Hz to 70 Hz and 320 Hz to 560 Hz, Accuracy ±0.01 Hz, steady state
Voltage amplitude	Range 10% to 200% of nominal - Accuracy ±0.1% U _{din} (U _{din} = 120 V, 230 V) Method: True single-cycle RMS, phase-locked to each channel, updated every ½ cycle. U _{RMS½} per IEC 61000-4-30 Class A. Also 10/12 cycle true-RMS per IEC 61000-4-30 Class A.
Flicker	P _{inst} , P _{st} , P _{lt} fully compliant and certified to IEC 61000-4-15 Ed. 2 Class F1
Voltage dips/swells/interruptions	Fully compliant and certified to IEC 61000-4-30 Ed. 3 Class A, Accuracy ±0.2% of nominal voltage, duration accuracy : ±½ cycle at beginning of event and ±½ cycle at end of event, hysteresis selectable
Rapid voltage changes (RVC)	Fully compliant and certified to IEC 61000-4-30 Ed. 3 AMd 1 Class A - Accuracy 0.2%
Unbalance	Fully compliant and certified to IEC 61000-4-30 Ed. 3 Class A Range 0.0% to 999.9%, method of symmetrical components, accuracy ±0.15%
Voltage harmonics and interharmonics	Fully compliant and certified to IEC 61000-4-30 Ed. 3 Class A Range 10% - 200% of Class 3 of IEC 61000-2-4 Accuracy : ±5% of reading for signals ≥ 1% of nominal, ±0.05% of nominal for signals < 1% nominal voltage Method IEC 61000-4-7 Class I, Gapless FFTs on L1-N, L2-N, L3-N, order up to 50 th
Mains signaling voltage	Fully compliant and certified to IEC 61000-4-30 Ed. 3 Class A Range 0% to 15% of nominal voltage Accuracy ±5% of reading for signals between 3% to 15% of nominal, 0.15% of nominal for signals between 1% and 3% of nominal, no requirements for signals < 1% nominal User-selectable detection threshold recording period mains signaling frequency
Under deviation and over deviation	Fully compliant and certified to IEC 61000-4-30 Ed. 3 Class A Range 10% to 150% of nominal voltage, Accuracy ±0.1% of nominal voltage

BEYOND CLASS A - 2 kHz-150 kHz CONDUCTED EMISSIONS MEASUREMENT

Measurement method	Fully compliant and certified to IEC 61000-4-30 Ed. 3, Annex C (informative) 200 Hz bin size for the range 2 kHz to 9 kHz, 2000 Hz bin size for the range 9 kHz to 150 kHz
Range	0 to 60 V _{pk}

BEYOND CLASS A - HIGH FREQUENCY IMPULSE

Sampling rate	4 MHz on single channel, the channel is user selected. 1 MHz on 4 channels L1-E, L2-E, L3-E and N-E.
Accuracy	±5% typical. 5% reading + 0.5% FS typical
Range	±6 kV _{pk} . User-selectable threshold through 2-pole 1.5 kHz high-pass filter, and 1.5 MHz low pass filter
Measurement	Fully compatible with ANSI/IEEE C62.41, C3 and B3 combination wave, ring wave and IEC 61000-4-5 waveforms

ENVIROSENSOR PROBES (TEMPERATURE/HUMIDITY/PRESSURE/ACCELERATION)

Connection	USB. Functional electrical isolation from PQube 3
Sampling rates	1 sample per second typical for temperature, humidity, barometric pressure 8, 16, 32 samples per second, user selected for acceleration
Temperature	Range: -20 °C to +80 °C (-4 °F to 176 °F)
Humidity	Range: 0 %RH to 100 %RH (useful range: 20 %RH to 80 %RH)
Barometric pressure	Indicative measurements, resolution better than 0.001 hPa
Acceleration	Full-scale acceleration ±2g, ±4g, ±8g, user selected Trigger on mechanical shock/vibration, seismic motion, or tilt

OPTIONAL ATT1 VOLTAGE ATTENUATOR MODULES FOR ANALOG INPUT CHANNELS

	ATT1-0600V	ATT1-1200V
Rated full-scale voltage	±600 Vdc/300 Vac to Earth	±1200 Vdc/600 Vac to Earth
Nominal measurement range	±825 V _{pk} to Earth	±1630 V _{pk} to Earth
Test voltage to earth	7250 Vdc	14500 Vdc
Accuracy	±0.2% reading typical at DC (>10% FS), plus uncertainty of PQube 3 analog input channels	

OPTIONAL ATT2 MODULE FOR DC POWER AND ENERGY

	ATT2-600V	ATT2-1200V
Maximum input voltage	±1000 V _{pk} differential	±2000 V _{pk} differential
Rated full-scale voltage	±600 Vdc	±1200 Vdc
Analog input ratio	100:1	200:1
Accuracy	+/- (0.1% rdg + 0.1% FS) (At 23°C ±3°C, 10% – 100% FS, not including uncertainty of PQube 3 analog channels)	
Current channel	With closed-loop sensors	With open-loop sensors

Rated full-scale current	50A to 600A (depending on sensor model)	50A to 3000A (depending on sensor model)
Maximum input current	150% to 200% FS (depending on sensor model)	110% to 200% FS (depending on sensor model)
Accuracy at rated current	±0.5% rdg typical at DC At rated current, not including uncertainty of PQube 3 analog channels	±1% rdg typical at DC
Linearity (from 10% to 100% FS)	<0.1% FS	<1% FS

INSTRUMENT POWER SUPPLY

PQube 3 power supply screw terminals – supports AC or DC PQube 3 P+ and P- pluggable screw terminals

AC input range 24 Vac ±10% at 50/60/400 Hz, 1.5A max

DC input range ±24 Vdc - 48 Vdc ±10% (polarity independent), 1A max

Power consumption 20W max

Isolation Internally electrically isolated from all other circuits to avoid ground loops.

PQube 3 - PoE - Power over Ethernet (standard)

Input voltage range 37 to 57 Vdc

Power consumption 15W max

PM1, PM2 Power Manager Modules (optional)

Rated AC input range 100 to 240 Vac ±10%, 50/60 Hz

AC input current rating 400 mA

Supported DC input range 120 to 370 Vdc

Auxiliary DC power output 24 Vdc isolated, up to 5.15W max (Available with PM2 only)

Power consumption 20W max

Isolation 3 kVac 1min, 4.2 kVdc 1 min

Surge immunity EN 61000-4-5 Criteria A

Installation category CAT II 300V

UPS1 BATTERY BACKUP MODULE

PQube 3 backup time 1 to 30 minutes, user selected.

Battery 7.4 V 2200mAh Li-ion battery pack

Life expectancy 4 years or 500 cycles (100% depth discharges), whichever comes first.

Operating temperature range	0° C to 45° C
Operating humidity	45 %RH to 85 %RH
Protection	Built-in hardware cutoff for over-voltage, under-voltage, and overcurrent.

UPS2 BATTERY BACKUP MODULE

PQube 3 backup time	1 to 60 minutes, user selected.
Battery	6.0 V , with one or several 2500mAh lead-acid external battery packs
Life expectancy	10 years or 300 cycles (100% depth discharges), whichever comes first.
Operating temperature range	-20 °C to 65 °C
Operating humidity	45 %RH to 85 %RH
Protection	Built-in hardware cutoff for over-voltage, under-voltage, and over-current.

STORAGE/COMMUNICATIONS

Internal memory	
Internal flash	32 GB
USB	
Connection	Three USB master ports: one high-speed USB2.0 port, two standard USB1.0 ports
Isolation	PQube 3 provides functional isolation to Earth (eliminates ground loops).
Removable External microSD Card	(Not Included)
Ethernet Port	
Connection	Standard RJ-45 socket (wired Ethernet). Transformer isolated. IP address can be assigned via DHCP or manually set fixed IP.
Email	Sends emails after every event with data attached; user request real-time meters via e-mail, PQube 3 firmware upgrade via email, change PQube 3 setup via email incoming e-mail filters. Includes GIF graphs, CSV spreadsheet files, PQDIF, HTML and XML summaries Protocols: POP3, SMTP, and SSL over SMTP
Web server	More than 30 real-time meters. All events, trends and statistics recordings. Includes GIF graphs, CSV spreadsheet files, PQDIF, HTML and XML summaries.
Modbus over TCP	More than 50 simultaneous (out of a set of more than 2000) real-time meters with update rate of approximately 0.5 seconds - see PQube 3 Modbus Specification document. Event/trend-statistics counters can be used for initiating file downloads (via FTP or web server).
DNP3.0	Level 1 and Level 2
BACnet over TCP	
FTP Server	File Transfer Protocol. Transfers files from PQube 3 External microSD Card to and from any computer.
SNTP	Simple Network Time Protocol for synchronizing PQube 3 real-time clock to UTC.

SNMP	Support for SNMP v2c and v3
Security	Secure FTP- FTPS, HTTPS.

CLOCK TIMING

Internal real-time clock	Fully compliant with IEC 61000-4-30 Ed. 3 Class A Drift: Typical ±30 seconds/yr. Temperature compensated. ±70 seconds/yr. max drift
SNTP	Accuracy: ±10 to 100 milliseconds absolute, UTC time. Dependent on network latency.
NTP	Accuracy: ±1 to 10 milliseconds absolute, UTC time. Dependent on network latency
GPS (with optional MS1 module and GPS receiver)	Intrinsic resolution 1microsecond Accuracy better than Class A requirement (by a factor of 10) < 1ms .

OPERATING ENVIRONMENT

Operating temperature	-20 °C to 65 °C with no load on 24V power supply terminals, Maximum 55°C with 5.15W load on 24V power supply terminals
Operating humidity	5% RH to 95% RH non-condensing, indoor use
Altitude	Maximum 2000 meters above sea level
Overvoltage category	For PQube 3 AC mains measuring terminals, Overvoltage Category III 600V. For PM1 input terminals, Overvoltage Category II 300V.
Pollution degree	2
Isolation	UL/IEC 61010:2010 - 3.6 kV AC 1 min, 5.1 kVdc 1 min, 5.4 kVac (5 sec), 9.6 kV _{pk} impulse.
Surge	UL/IEC 61010:2010 - 3.6 kV AC 1 min, 5.1 kVdc 1 min, 5.4 kVac (5 sec), 9.6 kV _{pk} impulse.
Installation category	CAT IV UL/IEC 61010 for voltages up to 300 Vac L-N (equivalent to 480 Vac L-L), CAT III for voltages up to 600 Vac L-N. Pollution degree 2.
Transient voltages	100 kHz ring wave, 6 kV _{pk} , IEC 61180, IEC 61000-4-5. Applied to voltage measuring terminals with Performance Evaluation Class 1. (When applied to optional power supply mains terminal, supply's fuse may operate in PE Class 3 at test levels greater than 4 kV.)
EFT burst immunity	4 kV _{pk} , IEC 61000-4-4, Performance Evaluation Class 1. Applied to power measuring terminals and optional PM1/PM2 power supply mains terminals.
RF field strength immunity	3 V/m, IEC 61000-4-3 Test Level 2.
Magnetic field strength immunity	30 A/m, IEC 61000-4-8 Test Level 4.
Ingress protection rating (IP rating)	IP20H, IEC 60529.

WEIGHT AND DIMENSIONS

Dimensions (L x W x H)	4.33 in X 2.89 in X 3.08 in (11.0 cm X 7.34 cm X 7.82 cm), 35 mm DIN rail mountable
Weight	10.5 oz (300g)

