PSL

TRUSTED, HIGH PRECISION

POWER QUALITY & ENERGY MONITORING

PQube® 3

POWER QUALITY & ENERGY ANALYZER

- AC AND DC MONITORING
- LAB-GRADE PRECISION
- MODULAR AND EMBEDDABLE
- FAST PLUG-AND-PLAY FUNCTIONALITY
- DIRECT/REMOTE COMMUNICATION
- **INSTANT NOTIFICATIONS, NO SOFTWARE REQUIRED**

Specification Sheet

PQube® 3 *Specifications*

PRELIMINARY – Reference conditions for factory tests: 19~25°C, 10%~60% RH, steady-state 10/12 cycle signals. ±1/2 display count on all accuracies

MAINS VOLTAGE MEASURING CHANNELS

Connection	L1, L2, L3, N PQube3 screw terminals (max torque 5 inch-pounds (0,6Nm))
Frequency Range	40 Hz ~ 70 Hz and 320 Hz ~ 560 Hz. Nominal 50 Hz, 60 Hz, or 400 Hz auto-selected, 320-560 Hz user-selected.
Mains Configuration	Single-phase, split-single-phase, delta, wye/star. User selected or auto-selected.
Range of Nominal Input Voltage	100 VAC ~ 960 VAC L-L (69 VAC ~ 480 VAC L-N). User selected or auto-selected.
Measurement Channels	Line-to-Neutral, Line-to-Line, Line-to-Earth, Neutral-to-Earth
Sampling Rate	512 samples per cycle, phase-locked to input frequency on reference channel (L1-N)*
Measurement Range	0 VAC ~ 750VAC L-N (0 VAC ~ 1300 VAC L-L)
Accuracy	±0.05% rdg ±0.05% FS typical between 10%~200% of nominal, up to a maximum of 750VAC L-N.
RMS Measurement Method	True single-cycle RMS, phase-locked to each channel, updated every cycle or every 1/2 cycle. $U_{RMS½}$ per IEC 61000-4-30 Class A. Also 10/12 cycle true-RMS per IEC 61000-4-30 Class A.
Isolation	PQube3 tested up to 5100VAC isolation to Earth. UL/IEC 61010 test pending.
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 600VAC L-N. Pollution degree 2. UL/IEC 61010 test pending.

CURRENT INPUT CHANNELS - 5 or 8 CURRENT CHANNELS

Measurement Type	External current transformer, voltage-type secondary – PQube3 screw terminal (Max torque 2 inch-pounds (0,25Nm))
CT Input Ratio Range	1:1 to 50000:1
Nominal Input	0.333 V RMS
Input Impedance	33.3kΩ
Crest Factor	3.5 (±1.17 Vpk)
Sampling Rate	Same rate as mains voltage measuring channels
Accuracy - excluding external CT's	±0.05% rdg ±0.05% FS typical (1% ~ 200% FS). NOTE: FS = 0.333V
Wire Connection	Min. 28AWG (0,8 mm²), Max. 16AWG (1,31mm²). 600V UL- recognized insulation required

ANALOG INPUT CHANNELS

Connection	AN1, AN2, AN3, AN4 PQube3 screw terminals
Nominal Input	High range: ±60 VDC to Earth. Low range: ±10VDC to Earth.
Input impedance	1MΩ to Earth
Internal Pull-Up Voltage	2.5VDC
Full Scale	High range: ±100 VDC, Low range ±10 VDC.
Measurement Channels	Standard: AN1-E, AN2-E, AN3-E, AN4-E. DC Energy Mode includes DC Power and DC Energy.
Analog Ratio Range	1:1 to 10000:1
Accuracy	±0.05% rdg ±0.05% FS typical (1% ~ 100% FS), ANx-Earth.

DIGITAL INPUT

Connection	DIG1 PQube3 screw terminal
Rating	60 VDC differential input
Wetting	2.4 VDC*
Threshold	1.5 V ±0.2 V across differential terminals, with 0.1 V hysteresis typical.
Sampling Rate	Same rate as mains voltage measuring channels

POWER MEASUREMENTS

Definitions	
Watts (power)	Sum of true instantaneous per-phase power.
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
Inputs	
Voltages	L-N or L-Nm for delta configurations. Nm defined as measurement neutral, the instantaneous average L-E voltage.
Currents	L1, L2, L3, L4, L5, L6, L7, L8 currents.
Measurement interval	Phase-locked, 10-cycles (50 Hz nominal) or 12-cycles (60 Hz nominal).
Accuracy excluding external CTs	
Watts (power)	±0.1% rdg typical at unity power factor, nominal voltage, 10% ~ 100% FS current. ±0.2% rdg typical at 0.5 power factor, nominal voltage, 10% ~ 100% FS current.
Volt-Amps (apparent power)	Better than ±0.1% rdg, 10% ~ 100% FS current

POWER QUALITY MEASUREMENT

IEC 61000-4-30 Class A

Frequency	Range 40 Hz to 70 Hz and 320 Hz to 560 Hz, Accuracy ±0.01 Hz, steady state
Voltage Amplitude	Range 10%~200% of nominal – Accuracy ±0.1% Udin (Udin=120V,230V) Method: True single-cycle RMS, phase-locked to each channel, updated every cycle or 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	Range 0.2 ~ 10 IEC 61000-4-15 Ed. 2 Class A
Voltage dips/swells/interruptions	IEC 61000-4-30 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)	Method IEC 61000-4-30 Class A Ed 3 – Accuracy 0.2%
Unbalance	Range 0.0% ~ 999.9%, ANSI C84.1 or method of symmetrical components, accuracy ±0.15%,
Voltage Harmonics and Interharmonics	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 63rd
Mains Signalling voltage	Range 0% ~ 15% of nominal voltage, Accuracy ±5% of reading for signals between 3% ~ 15% of nominal, 0.15% of nominal for signals between 1% and 3% of nominal, no requirements for signals < 1% nominal Method: Detection Threshold- user selectable, Recording Period – user selectable, Mains Signalling Frequency User-selectable
Underdeviation and Overdeviation	Range 10% ~ 150% of nominal voltage, Accuracy ±0.1% of nominal voltage, Method : IEC 61000-4-30 Class A Ed. 2

POWER QUALITY - 2-150kHz CONDUCTED EMISSIONS MEASUREMENT

Measurement Method	IEC 61000-4-30 Class A Ed. 3, Annex C
Range	±60Vpk

HIGH FREQUENCY TRANSIENTS (coming soon)

Sampling Rate	1 MHz sampling per phase, up to 4Mhz* (*) on single channel
Range	Up to 6kV. User-selectable threshold through 2-pole HPF with 1.5kHz nominal corner frequency.

OPTIONAL ENVIRONMENT (TEMPERATURE/HUMIDITY/PRESSURE) PROBES

Connection	USB. Functional electrical isolation from PQube3.
Location	Optional probes plug into the PQube3 directly or through PSL-provided extension cable.
Scan Time	5 seconds max.
Temperature Accuracy	Typical: ±0.5°C. Max: ±2°C (-20 ~ +80°C).
Humidity Accuracy	Typical: ±4.5% RH (20 ~ 80% RH), max: ±7.5% (0 ~ 100% RH). Note: For optimal ambient temperature and humidity accuracy, use extension cable to avoid self-heating of probe by PQube3.

INSTRUMENT POWER SUPPLY

PQube 3 Main power supply (Screw Terminals)	(AC or DC) PQube3 POWER screw terminals
AC/DC Input Ranges	Input range : 24VAC ± 10% 50/60 Hz or ±24-48VDC ± 10% (polarity independent)
Power Consumption	20VA max.
Isolation	>150VDC isolation to all other circuits
PQube 3 – POE - Power Over Ethernet	Input Voltage range : 37-57VDC
PM1 Power Manager Module (optional)	
AC Input Range	100~240VAC ± 10%. 50/60 Hz
DC Output	24VDC isolated
Power Consumption	25VA max

COMMUNICATIONS

USB	
Connection	USB master: 1 hi-speed USB2.0 port, 2 standard USB1.0 ports
Isolation	PQube3 provides at least 150VDC isolation to Earth (eliminates ground loops).
RJ-45 Ethernet	
Connection	Standard RJ-45 socket (wired Ethernet).
Protocols	.
Email	Sends emails after every event with data attached; user request real-time meters via e-mail, PQube3 firmware upgrade via email, change PQube3 setup via email, incoming e-mail filters. Includes GIF graphs, CSV spreadsheet files, PQDIF, HTML and XML summaries
Web Server	Real-time meters. All events, trends and statistics recordings. Includes GIF graphs, CSV spreadsheet files, PQDIF, HTML and XML summaries.
Modbus over TCP	Real-time meters with update rate of approximately 1 second – see PQube3 Modbus Specification document. Event/trend-statistics counters can be used for triggering downloads via FTP or web server.
FTP Server	File Transfer Protocol. Transfers files from PQube3 SD card to and from any computer.
SNTP	Simple Network Time Protocol for synchronizing PQube3 real-time clock to UTC.
SNMP	Support for SNMP v2c and v3

CLOCK TIMING

Internal Real-Time Clock	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.
GPS (with optional Sync module)	Accuracy <1 microsecond
Microsynchrophasor (coming soon)	Accuracy 0.1° or better

OPERATING ENVIRONMENT

Ambient Conditions - Operating	-20°C ~ 50°C, 5% RH ~ 95% RH non-condensing
Transient Voltages	100kHz 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 PS1 power supply mains terminals.
RF Field Strength Immunity	3V / m, IEC 61000-4-3 Test Level 2.
Magnetic Field Strength Immunity	30A / m, IEC 61000-4-8 Test Level 4.
Ingress Protection Rating (IP Rating)	IP20H, IEC 60529.