Simultaneous, Synchronized DC and AC Monitoring

PQube® 3 supports simultaneous, synchronized DC and AC voltage, current and power measurements, with power quality, event detection, waveform digitization, and alert capabilities for all data channels

System and site monitoring applications frequently require simultaneous, synchronized multi-channel collection of AC *and* DC signals in order to fully assess and document equipment status and trends. Whether monitoring DC voltages, such as in energy storage banks, solar strings, or lower voltage sensors (e.g. pressure, flow, temperature, fluid level, battery charging current, or vibration) PQube 3 has a full range of analytic capabilities for both AC and DC signals.

Synchronized data is often critical to ascertaining time-based cause and effect relationships, for example in determining whether a grid transient gave rise to a system effect or not; such information can accelerate fault detection, fault isolation, and root cause analysis.

PQube 3 includes long term trend monitoring and a comprehensive range of automated on-condition event triggers, including AC and DC triggers (e.g. transients, thresholds, interruptions) and sends email alerts containing complete data snapshots and waveforms to support remote troubleshooting.

AC and DC Monitoring Applications

Table 1 lists some representative applications for simultaneous AC and DC monitoring.

Application	Monitored AC and DC Data Channels
Uninterruptible Power Systems	AC: Grid and output power quality DC: battery voltage and charging/discharging current
Solar Systems	AC: Grid and output power quality, power factor DC: Ground referenced array voltage, insolation and temperature sensors
Remote facilities & Military	AC: Grid and Genset power quality, ATS performance DC: fuel tank level sensor, fuel flow, Genset starter battery voltage, and charging/discharging current

Medical Imaging Systems	AC: Grid power quality DC: Coolant flow, temperature, environmental sensors
Power conversion, EV chargers	AC: Grid and Output power quality, DC: Power bus, Output Power Quality, Utility power supplies
Transportation, Locomotives	AC: Transformer and Grid power quality, earth leakage, switches DC: DC rails, regenerative breaking
Data Centers	AC: Incoming power quality, genset, DC: DC 380 system bus, DC loads

Table 1: Applications for AC and DC monitoring using PQube 3

Low Voltage DC Sensing

In addition to its multi-channel AC power metering and power quality analysis capabilities, the compact PQube 3 includes 4 ground-referenced DC or AC I/O channels, each with +/- 10 Vdc (low) and +/- 100Vdc (high) input range, Table 2.

Analog Input Channels	Specifications
Input Channels	User selected Standard Mode or DC Energy Mode: • Standard – AN1, 2,3,4 --Ground (common mode), AN1-AN2, AN3-AN4 (differential mode) • DC Energy – AN1 x AN2, AN3 x AN4 (bidirectional DC power), AN1 x AN2 x hours, AN3 x AN4 x hours (DC energy)
Measurement range	High: ±100 V DC or 60V AC, Low ±10 V DC or 6 V AC
Accuracy	±0.05% FS typical (ANx-E)
Internal pull-up voltage	2.5 V DC
Analog ratio range	1:1 to 10000:1
Input impedance	1 MΩ to Earth
Physical	Pluggable screw terminal (Max torque 2 inch-pounds)

Table 2: PQube 3 Analog Input Specifications

Dual channel power sensing can also be accomplished with a suitable DC current sensor. PQube 3 can calculate the product of the analog channels to calculate power for DC systems when monitoring voltage and current, or the difference between inputs if a differential measurement is desired, for example for pressure or temperature.

High Voltage Sensing

Higher DC voltages, current and power calculations can be obtained by using the ATT1 or the ATT2 attenuator modules, which enable voltage measurements up to 600 V and 1200 V (special versions are available up to 4800 V) respectively as well as DC current (and thus Power) using Powersides range of Hall Effect sensors, Figure 1.

Note that ATT1 and ATT2 are not galvanically isolated, having respectively 5 MΩ and 10 MΩ impedance to ground, which must be considered before measuring floating ground DC systems. Detailed ATT2 specifications are in Table 3, and setup options are illustrated in Figure 2. Figure 3 shows an example wiring diagram for combined AC and DC monitoring of a solar generation and storage system, and loads.

ATT2 Interface Module
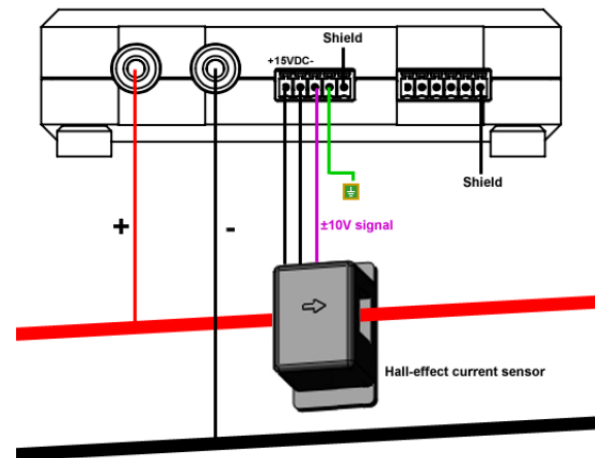
Figure 1: DC Voltage & Current Measurements using ATT2 interface module with PQube 3

Optional ATT2 Module for DC Power and Energy		
Voltage Channel	**ATT2-600V**	**ATT2-1200V**
Maximum input voltage	±1000V V differential	±2000 V
Rated full-scale voltage	±600 VDC/300 VAC differential	±1200 VDC/600 VAC differential
Analog input ratio	100:1	200:1
Accuracy	DC: ±0.1% rdg ±0.1% FS 50/60Hz: ±0.15% rdg ±0.15% FS typical @23°C ±3°C (XX°F ±X°F), 10 to 100% FS**	
Current Channel	**With Closed-loop Sensors**	**With Open-loop Sensors**
Rated full-scale current	50 to 600A*	50 to 3000A*
Maximum input current	150 to 200% FS*	110 to 200 FS*
Accuracy at calibration current	±0.5% rgd typical at DC**	±1% rgd typical at DC**
Linearity from 10-100% FS)	<0.1% FS	<1% FS

Table 3: ATT2 DC measurement module detailed specifications

*Depending on sensor model
**At rated current, not including uncertainty of PQube analog channels
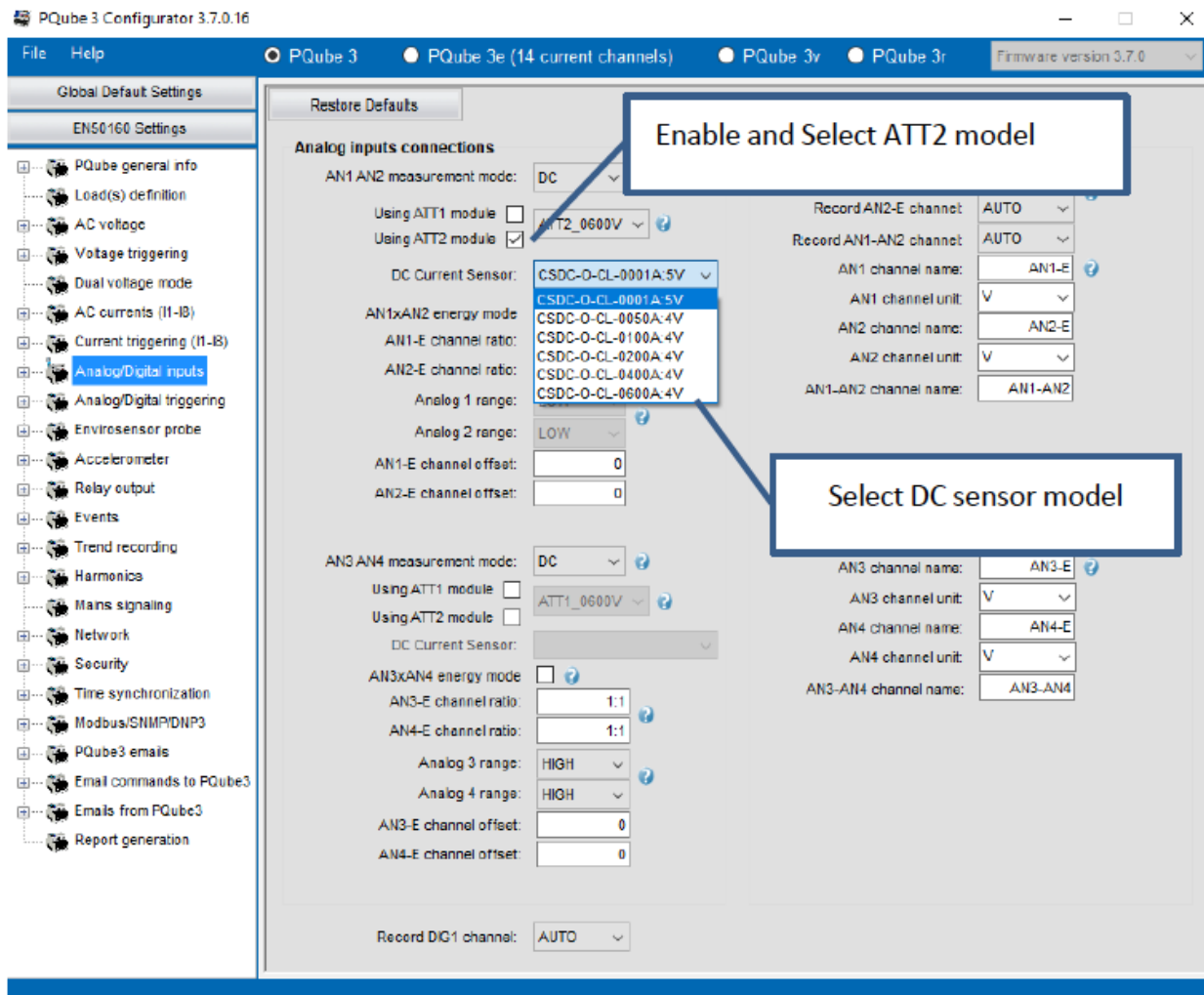
Setup Options

Figure 2: DC measurement configuration settings for ATT1 & 2

Figure 3 shows an example wiring diagram for combined AC and DC monitoring of a solar generation and storage system, and loads.

Figure 3: Example of AC & DC solar generation, storage and load monitoring using PQube 3.

Conclusion

Simultaneous, synchronous monitoring, metering, event detection, and alerting on DC and AC signals are standard capabilities of the highly versatile PQube 3, and invaluable for remote monitoring of complex, high value systems. Please contact info@powerside.com to discuss your unique applications.

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References: ATT1, ATT2 & PQube 3 Specifications and Installation Manual