

## microPMU



### OVERVIEW

Measure and understand the complex and dynamic power flows in distribution grids and microgrids with the microPMU.

The microPMU is like a microscope that has micro-second resolution and ultra-precise accuracy needed for distribution grid applications.

The microPMU is ideal for projects that need ultra-precise synchrophasor measurements for investigating stability and impedance questions. The microPMU can also be used for real-time control applications using the IEEE C37.118.2-2011 protocol.

### APPLICATIONS

- Monitor and understand stability of microgrids or distribution grids, and backup power systems
- Event identification and characterization
- Topology change detection (open/closed state of switches)
- Detection of cyber attacks rehearsals at substations

### FEATURES

- Ultra-accurate phasor measurements:  
TVE 0.01%
- Simultaneous recording and streaming of synchrophasors
- Fast recording / streaming rate:  
100/sec at 50Hz and 120/sec at 60Hz
- Voltage and current phasors, frequency, active / reactive powers, power factor
- Compliant with IEEE C37.118.1-2011 and C37.118.2-2011
- Compatible with OpenPDC, and with Powerside microPMU plotting application software
- 30 days of micro-synchrophasor measurement stored in internal memory
- Download recordings via FTP
- Configuration / firmware update via FTP or Web
- Ultra precise mode for grid stability analysis or low latency mode for control applications
- Easy to install. Can be installed on electrical panels, on distribution poles, pad mount transformers and more
- Supports connections via PTs and CTs
- Fully isolated GPS receiver / antenna with cable delay auto-compensation

| MAINS VOLTAGE INPUT CHANNELS                 |                                                                                                                                                                                                                 |
|----------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Connection                                   | L1, L2, L3, N PQube 3 screw terminals (max torque 5 inch-pounds (0.6Nm))                                                                                                                                        |
| Voltage Measurement Range                    | 0 VAC ~ 750VAC L-E (0 VAC ~ 1300 VAC L-L)                                                                                                                                                                       |
| Voltage Measurement Channels                 | Line-to-Earth, Neutral-to-Earth                                                                                                                                                                                 |
| Mains Configuration                          | 3-phase delta, 3-phase wye/star, single-phase, split-single-phase                                                                                                                                               |
| Frequency Range                              | Nominal 50 Hz, 60 Hz                                                                                                                                                                                            |
| Sampling Rate                                | 25,600 samples/s @ 50Hz and 30,720 samples/s @ 60Hz                                                                                                                                                             |
|                                              | PQube 3 tested up to 5100VAC isolation to Earth                                                                                                                                                                 |
| Installation Category                        | UL/IEC 61010 tested, approval pending<br>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 approved       |
| TVE (Total Vector Error)                     | Typical TVE   $\pm 0,01\%$<br>Typical short-term TVE stability for differential measurements: $\pm 0.002\%$                                                                                                     |
| Amplitude Resolution                         | 0,0002%FS (2 PPM)                                                                                                                                                                                               |
| Amplitude Accuracy ( $\pm\%$ rdg $\pm\%$ FS) | $\pm 0,050\%$ (10VAC ~ 750VAC L-E).<br>Typical: $\pm 0,010\%$ (120VAC ~ 600VAC L-E)                                                                                                                             |
| Angle Resolution                             | 0.001°   (noise floor - useful for short-term difference measurements)                                                                                                                                          |
| Angle Accuracy ( $\pm\%$ rdg $\pm\%$ FS)     | $\pm 0,010^\circ$ 1 Standard Deviation<br>Typical: $\pm 0,003^\circ$                                                                                                                                            |
| CURRENT INPUT CHANNELS                       |                                                                                                                                                                                                                 |
| Measurement Channels                         | 8 inputs differential voltage inputs (range 0.333Vrms or 10Vpk, input impedance 33.3 k $\Omega$ , crest factor 3.5)<br><i>Note: 3 phase current channels streamed via IEEE C37.118-2 communication protocol</i> |
| Current range                                | 0-6000A with split-core CT's (Call us for ranges > 6000A)                                                                                                                                                       |
| Sampling Rate                                | 25,600 samples/s @ 50Hz and 30,720 samples/s @ 60Hz                                                                                                                                                             |
| Wire Connection                              | Screw terminal (Max torque 2 inch-pounds (0,25Nm))<br>Min. 28AWG (0,8 mm <sup>2</sup> ), Max. 16AWG (1,31mm <sup>2</sup> ). 600V UL- recognized insulation required                                             |
| POWER MEASUREMENTS                           |                                                                                                                                                                                                                 |
| DEFINITIONS                                  |                                                                                                                                                                                                                 |
| Watts (power)                                | Sum of per-phase active fundamental power                                                                                                                                                                       |
| Volt-Amps (apparent power)                   | Sum of per-phase product of RMS voltage and RMS current, taken over the measurement interval                                                                                                                    |
| Power Factor                                 | Fundamental power factor—ratio of Watts to Volt-Amps                                                                                                                                                            |
| VARs (volt-amps reactive)                    | Fundamental VARs                                                                                                                                                                                                |
| MODES OF OPERATION                           |                                                                                                                                                                                                                 |
| ULTRA PRECISE MODE                           | Recordings to Internal Memory                                                                                                                                                                                   |
|                                              | Streaming according to C37.118.2-2011 (both simultaneously)                                                                                                                                                     |
| Parameters                                   | 3 voltage and 3 current phasor angle and magnitude, frequency, ROCOF<br>Active / reactive powers, power factor (recorded only)                                                                                  |
| LOW LATENCY MODE                             | Using P-Filter* (streaming IEEE C37.118.2 only)                                                                                                                                                                 |
|                                              | Using M-Filter* (streaming IEEE C37.118.2 only)                                                                                                                                                                 |
|                                              | Latency: 50 ms typical                                                                                                                                                                                          |
| Parameters                                   | 4 voltage and 8 current phasors, frequency, 4 analog channels                                                                                                                                                   |
| TECHNICAL SPECIFICATIONS                     |                                                                                                                                                                                                                 |
| Dimensions (L x W x H)                       | 4.33 in X 2.89 in X 3.08 in (metric: 11.0 cm X 7.34 cm X 7.82 cm), 35 mm DIN rail mountable                                                                                                                     |
| Operating Environment (temp., hum., alt.)    | -20 ~ 65 °C (55 °C with PM2 AUX load), 5 ~ 95% RH (inside use), <2000 m above sea level<br>(for EMC immunity, overvoltage, and other conditions, see full specs)                                                |
| Power Supply (AC)                            | 24 VAC $\pm 10\%$ at 50/60/400 Hz, 1.5A max (PSL's PM1 and PM2 modules supply microPMU compatible power at 100-240 VAC 50/60 Hz, and 120-370 VDC)                                                               |
| (DC)                                         | $\pm 24 \sim 48$ VDC $\pm 10\%$ (polarity independent), 1A max. Power over Ethernet (PoE) compatible                                                                                                            |
| Internal memory                              | 32 GB up to 30 days of synchrophasor data                                                                                                                                                                       |
| Data backup                                  | 16 GB (up to 128GB) micro SD card or USB 2.0 thumb drive                                                                                                                                                        |
| Clock Synchronization                        | GPS receiver and antenna provided with the microPMU                                                                                                                                                             |
| Communication                                | Ethernet port RJ-45, 10/100 (optional wireless and cell modem)                                                                                                                                                  |
| Communication protocols                      | FTP or HTTP (secure FTPS and HTTPS), IEEE C37.118-2.2011                                                                                                                                                        |

\*Amplitude & angle accuracies are dependent when using the low latency mode

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