

IEEE C37.118.1 P & M CLASS

IEC/IEEE 60255-118-1:2018

IEC 61850-9-2 SAMPLED VALUES

TVE < 0.05%

UL LISTED FILE E472110

[View the PMU PRO product page on satec-global.com.au](https://www.satec-global.com.au)

PMU PRO

Advanced P-Class and M-Class Phasor Measurement Unit for Wide Area Monitoring

The PMU PRO is an advanced phasor measurement unit built for distribution network operators, utilities, substations and renewable generators that need precise, time-aligned visibility of their grid. It measures synchronised voltage and current phasors, frequency and rate of change of frequency to IEEE C37.118.1 P-Class and M-Class performance, then streams that data over Ethernet via IEEE C37.118.2 or IEC 61850-9-2 sampled values.

Based on the familiar PRO Series look and feel, it combines 1 to 240 frames per second reporting and 1µs time stamp accuracy with IRIG-B or IEEE 1588 PTPv2 time synchronisation. Dual port Ethernet, RS-485, USB-C, a 1.77" colour display, 16GB of log memory and up to four side-by-side expansion modules complete a compact DIN rail package. Learn more about **phasor measurement units**.



PMU PRO 5A

5A nominal current inputs for connection to standard secondary CTs.

PMU PRO 1A

1A nominal current inputs for 1A CT secondary circuits.

Expansion Modules

Digital I/O, relay, analogue output and auxiliary power modules fitted side by side.

Main Features

- IEEE C37.118.1-2011, C37.118.1a-2014 and IEC/IEEE 60255-118-1:2018 P-Class and M-Class compliance
- Synchronised three-phase voltage, current and sequence phasors
- Synchronous frequency and ROCOF measurements
- Advanced IEEE C37.118.2 data streaming over UDP and TCP
- IEC 61850-9-2 multicast sampled value streaming
- Reporting rates from 1 to 200/240 frames per second at 50/60Hz
- Expected steady-state TVE below 0.05% and 1µs time stamp accuracy
- IRIG-B and IEEE 1588 PTPv2 time synchronisation
- Dual port Ethernet, RS-485 and USB-C communications
- Up to four expansion modules and 16GB log memory

Feature Capabilities

Phasor Measurement

P-CLASS & M-CLASS

- IEEE C37.118.1-2011, IEEE C37.118.1a-2014 and IEC/IEEE 60255-118-1:2018 P-Class and M-Class performance compliance
- Three-phase voltage, current, and positive and negative sequence phasor measurements synchronised to a common UTC time reference
- IEEE C37.118.1 synchronous frequency and rate of change of frequency (ROCOF) measurements
- Expected steady-state total vector error (TVE) below 0.05%
- Time-stamped measurements including phasor estimates, frequency deviation from nominal or actual frequency, and ROCOF, sent in synchrophasor data frames

IEC 61850-9-2 Sampled Values

- Streaming of phasor data over Ethernet using the IEC 61850-9-2 multicast sampled value (SV) service
- IEEE C37.118.2 compliant mapping of synchrophasor data, based on IEC 61850-9-2 and IEC 61850-9-5 guidelines
- IEC 61850 supported on both Ethernet ports alongside Modbus/TCP, DNP3/TCP and IEC 60870-5-104

Time Synchronisation

- Clock synchronisation to a UTC time reference using an IRIG-B timecode source or an IEEE 1588 PTPv2 master clock
- 1µs time stamp accuracy
- Optically isolated IRIG-B port with B004/B005 timecode format
- 1pps time synchronisation available via the digital inputs
- Built-in real-time clock with battery backup

IEEE C37.118.2 Data Streaming

ADVANCED PROTOCOL SUPPORT

- Commanded client-server UDP and TCP data transmission, plus spontaneous UDP data transmission over IP
- Reporting rates from 1 to 200 or 240 frames per second at 50 or 60Hz respectively
- Five data streaming slots for continuous synchrophasor streaming via unicast UDP and/or TCP connections
- 32-bit IEEE floating point or 16-bit scaled integer format, with conversion factors provided in configuration frames
- Optional frame extensions with analogue data (total fundamental active, reactive and apparent power and displacement power factor) and digital status data for up to 32 inputs
- Support for CFG-1, CFG-2 and CFG-3 configuration frames
- In spontaneous UDP mode, CFG-2 or CFG-3 frames can be sent every 30 seconds without an explicit user command

Logging, Recording & Programming

- Programmable controller with up to 32 control setpoints and half-cycle scan time
- OR, AND and arithmetical logic functions, extensive triggers, programmable thresholds and delays, relay control and event-driven data recording
- Event recorder for internal diagnostic events, power faults and operation of the logic controller and digital I/O
- Eight data recorders with programmable datasets, logging periodically or on any internal or external trigger
- 32 digital counters for internal events and external pulses
- 16 interval timers from half a cycle to 24 hours for periodic recording and timed operations
- 16GB memory for long-term data recording

Feature Capabilities (continued)

Measurement Inputs

- Voltage inputs: measurement category CAT III, operating range up to 277/480V AC +25%
- Variable current inputs: 5A or 1A nominal, selected at order
- Built-in power supply: 57.7 to 277V AC / 48 to 290V DC

Display

- High contrast 1.77" TFT colour graphics display with configurable backlight
- Multilanguage support
- Two diagnostic LEDs and four push buttons

Built-in I/O

- Two optically isolated digital inputs: 24V DC dry contact, programmable de-bounce from 1ms to 1s, control setpoints and 1pps time synchronisation, 1ms sampling
- One solid state relay output: unlatched, latched and pulse operation, fail-safe alarm operation, programmable pulse width and direct remote control through communications
- One optically isolated analogue input for 1mA to 20mA signals

Communications

- RS-485 serial port up to 115,200 bps with Modbus RTU/ASCII and DNP3
- Dual 10/100Base-T Ethernet ports supporting Modbus/TCP, DNP3/TCP, IEC 60870-5-104, IEC 61850, IEEE C37.118.2 and IEEE 1588 PTPv2
- Up to 10 simultaneous non-intrusive Ethernet connections
- USB 2.0 port (Type C)

Expansion Modules

OPTIONAL, ORDERED SEPARATELY

- Up to four expansion modules fitted side by side
- Up to two I/O modules are self-energised; a third I/O module requires an auxiliary power supply module
- 8 DI: eight optically isolated digital inputs, dry contact or 24/48/125/250V DC wet inputs, 1ms sampling, pulse counting and 1pps time synchronisation
- 4 RO: four electromechanical (EMR) or solid state (SSR) relay outputs with unlatched, latched, pulse and fail-safe operation
- 4 DI + 2 RO combo module
- 4 AO: four isolated universal analogue outputs configurable for ± 1 mA, 0 to 1mA, 0 to 5mA, ± 5 mA, 0 to 20mA or 4 to 20mA
- Auxiliary power supply modules (88 to 264V AC / 90 to 290V DC, or 24V DC) power the whole device including up to three extra I/O modules

Software Support

- **Power Analysis Software (PAS):** free configuration and data acquisition tool for remote configuration and monitoring
- **Expertpower™:** SATEC web platform for energy data, alarms and reporting through the built-in Expertpower client
- **eXpertConnect™ App:** mobile connection to the meter for configuration, readings and diagnostics

Applications

Suited to a wide range of grid and site monitoring applications.

WIDE AREA MONITORING

POWER QUALITY

SUBSTATION AUTOMATION

RENEWABLE ENERGY

ENERGY MANAGEMENT

INDUSTRIAL MONITORING

SCADA READY

Specifications

VOLTAGE INPUTS

Measurement category	CAT III
Operating range	277/480V AC +25%
Input impedance	4MΩ
Over-voltage withstand	1,000V AC continuous; 2,000V AC for 1 second
Burden	< 0.01VA at 120V; < 0.04VA at 400V
Isolation	4,000V AC for 1 minute
Wire size	Up to 10 AWG (4.5mm ²)
Connector type	4 pin, plug-in

CURRENT INPUTS

Measurement category	CAT III
Galvanic isolation	4,000V AC for 1 minute
Wire size	Up to 10 AWG (4.5mm ²)

5A INPUT

Operating range	10A RMS continuous
Burden	< 0.2VA at 5A (10 AWG wire, 1m long)
Overload withstand	15A RMS continuous; 200A RMS for ½ second (10 AWG wire)

1A INPUT

Operating range	2A RMS continuous
Burden	< 0.2VA at 1A (10 AWG wire, 1m long)
Overload withstand	3A RMS continuous; 40A RMS for ½ second (10 AWG wire)

POWER SUPPLY

Rated input	57.7 to 277V AC at 50/60Hz; 48 to 290V DC
Tolerance	±15%
Burden	11VA AC; 6VA DC
Isolation	4,000V AC for 1 minute
Wire size	Up to 14 AWG (1.5mm ²)

AUXILIARY POWER SUPPLY (OPTIONAL MODULE)

AC/DC MODULE

Rated input	88 to 264V AC / 90 to 290V DC
Output	5W
Burden	15VA
Withstand	4kV AC for 1 minute
Wiring	L/+, N/-
Terminal pitch	5mm
Wire size	Up to 12 AWG (2.5mm ²)

24V DC MODULE

Rated input	9 to 36V DC
Output	7W
Galvanic isolation	4,000V AC for 1 minute
Terminal pitch	5mm
Wire size	14 AWG (up to 1.5mm ²)

BUILT-IN DIGITAL INPUTS (2 DI)

Type	Dry contacts, internally wetted at 24V DC
Galvanic isolation	4,000V AC for 1 minute
Internal power supply	24V DC
Scan time	1ms
Connector type	Removable, 5 pin
Wire size	14 AWG (up to 1.5mm ²)
Terminal pitch	5mm

Specifications (continued)

BUILT-IN DIGITAL OUTPUT (1 DO)

Type	Solid state relay, 1 contact (SPST Form A)
Rating	0.15A / 250V AC/DC
Galvanic isolation	4,000V AC for 1 minute
Operate time	1ms max.
Release time	0.25ms max.
Update time	1 cycle
Connector type	Removable, 4 pin
Wire size	14 AWG (up to 1.5mm ²)

BUILT-IN ANALOGUE INPUT (1 AI)

Type	Universal, -1mA to 20mA
Configurable ranges	±1mA, 0 to 1mA, 0 to 20mA, 4 to 20mA
Accuracy	< 0.5% FS
Galvanic isolation	4,000V AC for 1 minute
Scan time	1ms
Connector type	Removable, 5 pin
Wire size	14 AWG (up to 1.5mm ²)
Terminal pitch	5mm

ADD-ON DIGITAL INPUTS (8 DI)

Type	Dry contacts, internally wetted at 24V DC, or wet contacts up to 250V DC
Sensitivity	Open: input resistance > 100kΩ; Closed: input resistance < 100Ω
Galvanic isolation	4,000V AC for 1 minute
Internal power supply	24V DC
Scan time	1ms
Connector type	Removable, 2 × 5 pin
Wire size	14 AWG (up to 1.5mm ²)

ADD-ON DIGITAL OUTPUTS (4 DO)

OPTION 1: ELECTROMECHANICAL RELAY, DRY CONTACT

Rating	4 relays, 5A / 250V AC; 5A / 30V DC, 1 contact (SPST Form A)
Isolation, contacts to coil	3,000V AC for 1 minute
Isolation, open contacts	750V AC
Operate time	10ms max.
Release time	5ms max.
Wire size	14 AWG (up to 1.5mm ²)

OPTION 2: SOLID STATE RELAY, DRY CONTACT

Rating	4 relays, 100mA / 800V AC, 1 contact (SPST Form A)
Isolation, contacts to coil	5,000V AC for 1 minute
Isolation, open contacts	800V peak
Operate time	5ms max.
Release time	5ms max.
Update time	1 cycle
Wire size	14 AWG (up to 1.5mm ²)

ADD-ON COMBO MODULE (4 DI + 2 RO)

Specification	Four digital inputs and two relay outputs, as per the 8 DI and 4 DO modules above
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ADD-ON ANALOGUE OUTPUTS (4 AO)

Type	Universal (configurable) isolated analogue outputs
Scan time	1ms
Ranges (manually or remotely programmed)	±1mA, max. load 10kΩ (100% overload); 0 to 20mA, max. load 510Ω; 4 to 20mA, max. load 510Ω; 0 to 1mA, max. load 10kΩ (100% overload)
Accuracy	0.5% FS
Wire size	14 AWG (up to 1.5mm ²)
Terminal pitch	5mm

Specifications (continued)

COMMUNICATION PORTS

COM1 RS-485

Type	Optically isolated RS-485 port
Baud rate	2,400 to 115,200 bps
Isolation	4,000V AC for 1 minute
Supported protocols	Modbus RTU, Modbus ASCII, DNP3
Connector type	2 pin, plug-in
Wire size	Up to 14 AWG (1.5mm ²)

ETHERNET (DUAL, 2 PORTS)

Type	Transformer-isolated 10/100Base-T, RJ45
Supported protocols	Modbus/TCP (port 502), DNP3/TCP (port 20000), IEC 60870-5-104 (port 2404), IEC 61850 (port 102), IEEE C37.118.2, PTPv2 (IEEE 1588) time sync
Simultaneous connections	10 (5 Modbus/TCP + 5 DNP3/TCP)
Isolation	4,000V AC for 1 minute

USB PORT

Type	Full speed USB 2.0, Type C
Isolation	4,000V AC for 1 minute
Supported protocols	Modbus

IRIG-B PORT

Type	Optically isolated IRIG-B port
Timecode signal	Unmodulated (pulse-width coded), 100pps
Signal level	5V unbalanced
Timecode format	B004/B005
Isolation	4,000V AC for 1 minute
Connector type	Plug-in
Recommended cable	50Ω low loss RG58A/U (Belden 8219 or equivalent)

REAL-TIME CLOCK

Type	Built-in real-time clock with battery backup
Accuracy, calibrated	< 5ppm at 23°C
Battery type	CR1632 3V lithium button cell
Time retention	5 years (typical)

LOG MEMORY & DISPLAY

Log memory	16GB for long-term data recording
Display	1.77" colour TFT LCD, 128 × 160 pixels
Indicators	2 diagnostic LEDs
Keypad	4 push buttons

ENVIRONMENTAL CONDITIONS

Operating temperature	-25°C to +55°C (-13°F to 131°F)
No hardware failure	-40°C to +70°C (-40°F to 158°F)
No display failure	-20°C to +70°C (-4°F to 158°F)
Storage temperature	-30°C to +85°C (-22°F to 185°F)
Humidity	0 to 95% RH non-condensing
Altitude	Up to 2,000m above sea level
Degree of protection	IP51

CONSTRUCTION

Mounting	DIN rail
Dimensions (without expansion modules)	89.5 × 72 × 90mm
Weight	0.70kg (1.54lb)
Case enclosure	PC/ABS plastic blend
Display body	PC/ABS plastic blend
Front panel	PC plastic
PCB	FR4 (UL94-V0)
Terminals	PBT (UL94-V0)
Plug-in connectors	Polyamide PA6.6 (UL94-V0)
Labels	Polyester film (UL94-V0)

Standards Compliance

Accuracy

- IEEE C37.118.1-2011 and IEEE C37.118.1a-2014 P-Class and M-Class performance
- IEC/IEEE 60255-118-1:2018 P-Class and M-Class performance

Electromagnetic Immunity

- Complies with IEC 61000-6-2
- IEC 61000-4-2 level 3: electrostatic discharge
- IEC 61000-4-3 level 3: radiated electromagnetic RF fields
- IEC 61000-4-4 level 3: electric fast transient
- IEC 61000-4-5 level 3: surge
- IEC 61000-4-6 level 3: conducted radio frequency
- IEC 61000-4-8: power frequency magnetic field
- Meets ANSI/IEEE C37.90.1: fast transient SWC

Communication Protocols

- IEEE C37.118.2 synchrophasor data transfer
- IEC 61850-9-2 sampled values, with mapping based on IEC 61850-9-5 guidelines
- IEEE 1588 PTPv2 and IRIG-B time synchronisation

Electromagnetic Emission

- Complies with IEC 61000-6-4: radiated and conducted, class A
- Complies with CISPR 22: radiated and conducted, class A

Safety

- Meets IEC 61010-1:2006
- UL listed, File No. E472110
- UL listing covers the base unit; optional modules are not part of the UL listing

AC and Impulse Insulation

- Meets AS/IEC 62052-11: 4,000V AC for 1 minute
- 6kV / 500Ω at 1.2/50μs impulse
- Degree of protection: IP51

Ordering Information

MODEL – CURRENT – CAL. FREQ. – POWER – I/O MODULES – AUX. POWER

MODEL

DESCRIPTION	ORDER CODE
PMU PRO DIN rail mount phasor measurement unit	PMU PRO

CURRENT INPUTS

DESCRIPTION	ORDER CODE
5 ampere	5A
1 ampere	1A

CALIBRATION FREQUENCY

DESCRIPTION	ORDER CODE
50Hz	50HZ
60Hz	60HZ

POWER SUPPLY

DESCRIPTION	ORDER CODE
88 to 320V AC / 40 to 290V DC	ACDC

OPTIONAL I/O MODULES (MAX. 3 PER DEVICE)

DESCRIPTION	ORDER CODE
4 relay outputs, 250V / 5A AC	EMR4
4 SSR outputs, 250V / 0.1A AC	SSR4
4 digital inputs (dry contact at 24V DC) + 2 SSR outputs	4DIOS-DRC
4 digital inputs (dry contact at 24V DC) + 2 EMR outputs	4DIOR-DRC
8 digital inputs, dry contact	DI8-DRC
8 digital inputs, 24, 48, 125 or 250V DC wet	DI8-24/48/125/250
4 analogue outputs, configurable range	4AO

AUXILIARY POWER SUPPLY (MAX. 1 PER DEVICE)

DESCRIPTION	ORDER CODE
AC/DC, 88 to 264V AC / 90 to 290V DC	AUX-ACDC
24V DC (9 to 36V DC)	AUX-24DC



Place an Order

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DOCUMENT REVISION HISTORY

VERSION	DATE
TBV1.0	28 September 2026