

CLASS 0.2S ACCURACY

AS/IEC 62053-22 COMPLIANT

IEC 61000-4-30 CLASS A ED. 3

IEEE C37.118.1 PMU

IEC 61850 ED. 2

1024 SAMPLES/CYCLE

[View the PM180 product page on satec-global.com.au](https://www.satec-global.com.au)

PM180

High Performance Power Quality Analyser with PMU and Fault Recording

The **PM180** is a multi-microprocessor power quality analyser that combines a Class A power quality analyser, a Class 0.2S energy meter, a digital fault recorder, a phasor measurement unit and a programmable bay controller in one instrument. It is designed for substation and industrial automation, where one IED can replace several separate devices and save cost, panel space and wiring.

Four voltage inputs (the fourth AC/DC) and four current inputs are standard. Three hot-swap expansion slots take transient recorder, fault recorder, PMU, digital input, relay, analogue I/O, communication and auxiliary power supply modules. Built-in RS-485, Ethernet, USB and IRIG-B ports support Modbus, DNP3, IEC 60870-5-101/104 and optional IEC 61850.



PM180-X

Transducer version with no display. Includes a DIN rail mounting kit.



PM180-G

PM180 with a 5.7" colour graphic touch screen display (RGM180).



PM180-D

PM180 with a 3-line ultra-bright LED display (RDM180).

Main Features

- Power quality to IEC 61000-4-30 Class A, Edition 3
- Active energy Class 0.2S per AS/IEC 62053-22
- Harmonics and interharmonics to the 63rd order
- EN 50160 and IEEE 1159 statistics and reports
- Disturbance direction detection for sags and swells
- Fast transient recorder up to 2 kV at 1024 samples per cycle
- Digital fault recorder for currents up to 200 A (40 x In)
- Distance to fault calculation
- IEEE C37.118.1 M-Class and P-Class PMU
- IEC 61850 Edition 2 with GOOSE messaging
- Bay controller for 2 circuit breakers and 14 switches
- 256 MB memory with 3.5 min of continuous waveform recording

Feature Capabilities

Multi-function Power and Energy Meter

- Real-time cycle-by-cycle true RMS voltage, current, power, power factor, demand and energy
- Class 0.2S active energy per AS/IEC 62053-22 and Class 0.2 per ANSI C12.20
- Class 0.5S reactive energy per IEC 62053-24
- Time of Use with 16 energy sources including external pulse inputs, 4 seasons, 4 daily profiles and 8 tariff changes per day
- KYZ or KY pulse output and a calibration LED (via the optional display)
- Suited to check metering alongside primary meters

Power Quality

- Analysis in full compliance with IEC 61000-4-30 Class A, Edition 3 (2015)
- Sags, swells, interruptions, frequency and voltage variations
- Flicker per IEC 61000-4-15 and voltage unbalance
- Individual voltage and current harmonics per IEC 61000-4-7, interharmonics and directional power harmonics (load or source) to the 63rd
- Voltage and current THD, current TDD, K-factors and V-I angles
- Vector diagram and symmetrical components; frequency to 3 decimal places
- Built-in statistics and reports per EN 50160 and IEEE 1159
- Disturbance direction detection showing whether sags and swells come from upstream or downstream
- Programmable thresholds and hysteresis
- Optional redundant auxiliary power supply to capture major dips and interruptions

Distance to Fault Calculation

- Compensation for CT and PT errors, for an average accuracy of 0.5%
- Single lines, parallel lines, partially parallel lines and lines with a branch
- Detects three-phase, two-phase, two-phase to ground and single-phase to ground short circuits, and single-phase open wire
- Reports fault classification, distance to fault (km) and fault duration

Digital Fault Recorder

DFR MODULE FOR 200 A FAULT CURRENTS

- Direct reading of fault currents up to 200 A (40 x In from the CT secondary)
- Dual current inputs for separate metering and protection CT connections (optional)
- Programmable fault threshold and hysteresis
- Zero-sequence currents and voltages, unbalance, undervoltage and neutral current
- Ready-to-use fault reports with fault current magnitude and duration, coincident voltage magnitude, waveforms and RMS trace
- Selectable pre-fault and post-fault recording length, triggered by any internal or external condition
- Disturbance capture and waveforms from multiple locations
- View faults and receive alerts in **Expertpower**

Phasor Measurement Unit (PMU)

PMU MODULE

- IEEE C37.118.1 M-Class and P-Class
- Three-phase voltage and current phasors synchronised to a common UTC time reference
- Synchronous frequency and rate of change of frequency (ROCOF)
- Expected steady-state total vector error (TVE) below 0.5%
- Streaming from 1 to 50 or 60 frames per second at 50 or 60 Hz
- IEEE C37.118.2 commanded client-server UDP and TCP and spontaneous UDP transmission
- Optional frame extensions with total power, power factor and digital status data
- Phasor streaming via the IEC 61850-9-2 sampled value (SV) service
- PTP (IEEE 1588) time synchronisation; includes the transient recorder

Fast Transient Recorder

TRM-180 OR PMU MODULE

- Records voltage transients up to 2 kV (line to ground) at 1024 samples per cycle per channel
- Four voltage channels with 10 MΩ high-impedance inputs

Feature Capabilities (continued)

Bay Controller (BCU)

- Monitoring and control of 2 circuit breakers and 14 circuit switches
- One-pole and three-pole switch position monitoring using two or six contacts
- Select-close and select-open outputs for secure switching, with configurable command pulse duration
- Supervision of command execution and reporting on operation termination
- Interlocking logic with secure timed-out interlocking bypass
- Indication of non-controllable breaker trips and switch position substitution
- Counting and logging of breaker and switch operations
- PLC configurator based on IEC 61131-3 using Function Block Diagram or Ladder Diagram

IEC 61850 Substation Communications

ORDER CODE 850

- IEC 61850 implemented per Edition 2
- Remote switch control and monitoring
- Inter-device GOOSE messaging for remote interlocking
- GOOSE publisher and subscriber setup and report dead-bands
- Configurable IED properties, datasets and reports

Data Logging, Waveforms and PLC

- 256 MB memory for data logging
- 8 fast waveform recorders: 8 AC channels plus one DC channel and up to 48 digital inputs in a single plot
- Waveform sampling at 32, 64, 128 or 256 samples per cycle with up to 20 pre-fault cycles
- 3.5 min of continuous waveform recording
- 16 fast data recorders (16 parameters each) from ½-cycle to 2-hour RMS envelopes
- Power quality, event and diagnostic recorders; 1 ms resolution for digital inputs
- Up to 64 control setpoints with OR, AND and arithmetic logic
- 32 internal counters and 16 programmable timers (½ cycle to 24 hours)
- COMTRADE and PQDIF file export

Time Synchronisation

- Real-time clock with a maximum drift of 5 seconds per month at 25°C
- 1 ms time resolution from an IRIG-B time code input or satellite clock
- Periodic synchronisation from an SNTP server as an SNTP client
- Time sync from a digital input with 1 ms accuracy
- PTP (IEEE 1588) with the PMU module

Communications

- Built-in RS-485, Ethernet, USB and IRIG-B
- Optional fibre optic Ethernet (TXFX), redundant 2nd Ethernet and 2nd RS-422/485 port
- Modbus RTU, Modbus TCP, DNP3, DNP3/TCP and IEC 60870-5-101/104 as standard
- Optional IEC 61850 (SISCO) with MMS and GOOSE
- IEEE C37.118.2 synchrophasor streaming with the PMU module
- Cross triggering between multiple devices via Ethernet

Modular Hardware and Displays

- Three hot-swap expansion slots for plug-in I/O and function modules
- Up to 48 digital inputs, 24 relay outputs and 12 analogue inputs and outputs
- Optional redundant power supply and Ethernet port
- Compact half 19" 3U form factor for DIN rail, panel or 19" rack installation
- Choice of 5.7" colour touch screen or 3-line LED remote display

Software Support

- **Power Analysis Software (PAS)** for setup, real-time monitoring, waveform and event analysis and data retrieval
- **Expertpower™** web platform for dashboards, fault alerts and energy reporting
- **eXpertConnect™ App** for mobile connection to the meter for configuration, readings and diagnostics

Specifications

ENVIRONMENTAL CONDITIONS

Operating temperature	-25°C to +60°C
Storage temperature	-30°C to +85°C
Humidity	0 to 95% non-condensing; long-term damp heat withstand per IEC 68-2-3 <95%, +40°C
Altitude	Up to 2000 m

CONSTRUCTION

Dimensions (W x H x D)	220 x 152 x 210 mm
Weight	2.5 kg
Mounting	DIN rail, panel mount or 19" rack installation; complies with EN 50022
Enclosure and panels	Polycarbonate
PCB and terminals	FR4 (UL94-V0); PBT terminals (UL94-V0)
Protection	Panel display IP54, instrument IP30 per IEC 60529

POWER SUPPLY (MAIN)

Rated input	50-290V AC (50/60 Hz), 90-290V DC
Maximum power	10W (burden <20VA)
Insulation	4kV AC @ 1 min
Wire size	Up to 10 AWG (up to 6 mm ²)

AUXILIARY POWER SUPPLY (MODULE)

AC/DC module	50-290V AC (50/60 Hz), 40-290V DC, maximum power 20W
Low DC module (12/24V)	9.6-35V DC, maximum power 20W

VOLTAGE INPUTS (V1, V2, V3, VN)

Nominal voltage (L-N/L-L)	57/100V AC, 277/480V AC, 400/690V AC
Operating range	Direct input or via PT, up to 828V AC
Input impedance	1 MΩ
Burden	480V L-N: 0.3VA; 277V L-N: 0.1VA; 120V L-N: 0.02VA
Overvoltage withstand	1000V AC continuous, 2500V AC for 1 second
Galvanic isolation	4kV AC @ 1 min; impulse dielectric withstand 6kV
Wire size	Up to 10 AWG (up to 6 mm ²)

AC/DC VOLTAGE INPUT (V4, VREF)

Operating range	400V AC; DC voltage measurement up to 290V DC
Input impedance	>10 MΩ

CURRENT INPUTS (I1, I2, I3, I4)

Current ratings	1A or 5A input
Guaranteed accuracy	Per AS/IEC 62053-22 and ANSI: Class 0.2S up to 2 x In, Class 0.2 up to 4 x In
5A input	Fault currents up to 50A RMS (10 x In); burden <0.15VA; overload 50A RMS continuous, 250A for 1 second
1A input	Continuous 4A RMS; fault currents up to 10A RMS; burden <0.02VA; overload 10A RMS continuous, 50A for 1 second
HACS inputs	40mA inputs for SATEC High Accuracy Current Sensors (100-3000A)
HACS 100A (CS1S)	Nominal 5A RMS; fault currents up to 100A RMS (20 x In)

DIGITAL FAULT RECORDER MODULE

Channels	4 current channels via 4 HACS
Fault currents measured	Up to 200A RMS @ In = 5A (40 x In)
Accuracy	Class 1
Burden	<0.15VA
Overload	200A RMS continuous, 1000A for 1 second

FAST TRANSIENT RECORDER

Measuring range	Up to 2kV AC, 4 voltage channels
Sampling	1024 samples per cycle
Input	High impedance 10 MΩ; insulation withstand 4kV AC @ 1 min

PHASOR MEASUREMENT UNIT

Compliance	IEEE C37.118.1 M-Class and P-Class
Total vector error	Expected steady-state TVE less than 0.5%
Streaming rate	1 to 50 or 60 frames per second @ 50 or 60 Hz
Data transfer	IEEE C37.118.2 over UDP and TCP; IEC 61850-9-2 sampled values
Time reference	PTP (IEEE 1588) or IRIG-B

Specifications (continued)

DIGITAL INPUTS (16 PER MODULE)

Inputs	16 optically isolated inputs per module, up to 48 per unit
Sensitivity	Open @ input resistance >16 kΩ, closed @ input resistance <10 kΩ
Galvanic isolation	4kV RMS @ 1 min
Scan time	1 ms @ 60 Hz, 1.25 ms @ 50 Hz
Wire size	12 AWG (up to 2.5 mm ²)

RELAY OUTPUTS (8 PER MODULE)

Relays	8 SPST Form A relays per module, up to 24 per unit
Contact rating	8A @ 250V AC, 5A @ 30V DC, 0.25A @ 250V DC, 5A @ 24V DC
Operate and release time	10 ms max. operate, 5 ms max. release
Update time	½ cycle

ANALOGUE I/O (4 AI + 4 AO PER MODULE)

Ranges (upon order)	±1 mA (100% overload), 0–20 mA, 4–20 mA, 0–1 mA
Maximum load	±1 mA: 10 kΩ; 0–20 mA: 510 Ω
Accuracy	0.5% FS
Scan and update time	2 cycles
Voltage input module	4 analogue inputs, ±10V

COMMUNICATION PORTS

COM1	RS-485 (RS-232 selectable), optically isolated 4kV AC @ 1 min, up to 115.2 kb/s, max. cable length 1000 m; Modbus RTU/ASCII, DNP3
Ethernet	Transformer-isolated 10/100Base-T, 4kV AC @ 1 min; Modbus TCP (port 502), DNP3/TCP (port 20000); 5 simultaneous connections
USB	Isolated USB 1.1 port, 4kV AC @ 1 min; Modbus RTU
COM2 (module)	RS-422/485 optically isolated, up to 115.2 kb/s
ETH2 (module)	10/100Base-T or 100Base-FX fibre optic

TIME AND CLOCK

IRIG-B	Optically isolated port, unbalanced 5V level; 1 ms time resolution
Real-time clock	Maximum drift 5 seconds per month @ 25°C
SNTP / digital input	SNTP client; digital input sync with 1 ms accuracy

DISPLAY MODULES

Graphic display (G)	5.7" touch panel TFT colour display, 320 x 240; operating -20°C to +70°C
LED display (D)	High-brightness seven-segment LEDs, two 4-digit windows and one 6-digit window
Distance	3 m cable, up to 500 m with an external 12V DC supply

MEASUREMENT ACCURACY

Parameter	% Reading	% FS	Conditions	Range
Voltage V1-V3, VN	0.05	0.01	10% to 120% FS	0 to 99,999,999 V
Line current I1-I4	0.05	0.01	1% to 120% FS	0 to 29,999 A
Fault current (standard inputs)	2.0		400% to 1000% FS	0 to 29,999 A
Fault current (DFR module)	2.0		400% to 4000% FS	0 to 29,999 A
DC voltage	0.3		10% to 120% FS	0 to 290V DC
Active power	0.2	0.002	PF ≥ 0.5	±2,000,000 kW
Reactive power	0.3	0.002	PF ≤ 0.9	±2,000,000 kvar
Apparent power	0.2	0.002	PF ≥ 0.5	0 to 2,000,000 kVA
Power factor	0.35		PF ≥ 0.5, I ≥ 2% FSI	-0.999 to +1.000
Frequency	0.002		40 to 70 Hz	40.000 to 70.000 Hz
Voltage and current THD	1.5	0.2	THD ≥ 1% FS	0 to 999.9%
Active energy	Class 0.2S per AS/IEC 62053-22			0 to 999,999,999 MWh
Reactive energy	Class 0.5S per IEC 62053-24			0 to 999,999,999 Mvarh

Accuracy is expressed as ± (percentage of reading + percentage of full scale) ± 1 digit, calculated at 1 second average. It does not include errors introduced by external potential and current transformers.

Standards Compliance

Accuracy

- Active energy: Class 0.2S per AS/IEC 62053-22
- Active energy: Class 0.2 per ANSI C12.20
- Reactive energy: Class 0.5S under conditions per IEC 62053-24:2014 @ $0 \leq |PF| \leq 0.9$

Power Quality

- IEC 61000-4-30 Class A, Edition 3: power quality measurement methods
- IEC 61000-4-7: harmonics and interharmonics measurement
- IEC 61000-4-15: flicker measurement
- EN 50160: power quality in European electricity supply networks
- IEEE 1159: power quality recording
- GOST 13109 and GOST R 54149-2010 (order option G)
- IEC 62054-21: real-time clock backup, RTC accuracy ± 2 ppm @ 23°C

Phasor Measurement

- IEEE C37.118.1: M-Class and P-Class synchrophasor measurement
- IEEE C37.118.2: synchrophasor data transfer
- IEEE 1588: Precision Time Protocol

Communications

- IEC 61850 Edition 2 (optional)
- IEC 60870-5-101 and IEC 60870-5-104
- DNP3 and Modbus

Safety and Insulation

- Meets IEC/UL 61010-1 and UL94 V-0
- AS/IEC 62052-11: insulation impulse 6kV/500 Ω @ 1.2/50 μ s
- AS/IEC 62052-11, IEC 61010-1: AC voltage tests related to ground, 4kV AC @ 1 min

EMC Immunity

- IEC 61000-4-2, IEC 60255-22-2: electrostatic discharge, 15kV/8kV air/contact
- IEC 61000-4-3, IEC 60255-22-3: radiated immunity, 10V/m and 30V/m @ 80 MHz to 1000 MHz
- IEC 61000-4-4, IEC 60255-22-4: fast transient burst, 4kV on current and voltage circuits, 2kV on auxiliary circuits
- IEC 61000-4-5, IEC 60255-22-5: surge 6kV on current and voltage circuits and power supply
- IEEE C62.41.2-2002: 100 kHz ring wave 6kV @ 0.5kA; 1.2/50 μ s and 8/20 μ s combination wave 6kV @ 3kA
- IEC 61000-4-6, AS/IEC 62052-11: conducted radio frequency, 10V @ 0.15 MHz to 80 MHz
- IEC 61000-4-8: magnetic field
- IEC 61000-4-12, AS/IEC 62052-11, IEEE C37.90.1-2002: oscillatory waves, CMM 2.5kV and DFM 1kV @ 100 kHz and 1 MHz
- ANSI C37.90.1: surge withstand capability (SWC)
- IEC 61000-6-2, IEC 60255-5, IEC 60255-22

Emission

- EN 55022, IEC 60255-22: Class A (radiated and conducted)
- IEC 61000-6-4

Environmental and Mechanical

- IEC 68-2-3: long-term damp heat withstand <95%, +40°C
- IEC 60255-21-1: vibration response Table I Class 2; vibration endurance Table II Class 1
- IEC 60255-21-2: shock Table II Class 1; bump Table III Class 1
- IEC 60255-21-3: seismic, Class 1

Ingress Protection

- IEC 60529: panel display IP54 (NEMA type 13)
- IEC 60529: instrument IP30

Ordering Information

MODEL	DISPLAY	VOLTAGE	CURRENT	FREQ.	STANDARD	POWER	COMMS	MODULES
MODEL				CALIBRATION FREQUENCY				
PM180 power quality analyser				PM180				
				50 Hz				
				60 Hz				
DISPLAY				ACCURACY AND POWER QUALITY STANDARD				
Transducer version, no display. Includes DIN rail mounting kit				X				
Graphic colour display, 5.7" touch screen				G				
Graphic colour display, 5.7" touch screen with DIN rail mounting kit and 3 m remote cable				G-DIN				
3-line ultra-bright LED display				D				
3-line ultra-bright LED display with DIN rail mounting kit and 3 m remote cable				D-DIN				
VOLTAGE INPUTS								
690V AC nominal voltage input				-				
120V AC nominal voltage input				U				
CURRENT INPUTS								
50A, calibrated to 5A (Class 0.2S accuracy)				5				
10A, calibrated to 1A (Class 0.2S accuracy)				1				
100A split core HACS (set of 4), calibrated to 5A (Class 1 accuracy)				CS1S				
100A split core handheld clamp HACS (set of 4), Ø13 mm opening, calibrated to 5A (Class 1 accuracy)				CS1H				
Any High Accuracy Current Sensors (HACS) , without overcurrent. Requires ordering of 4 HACS				HACS				
3V AC current clamps (purchased locally)				FLEX				
				50Hz				
				60Hz				
				E				
				A				
				G				
				ACDC				
				-				
				850				
Optional plug-in modules are listed on the next page. A maximum of three modules can be fitted to each PM180.								

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Hardware Layout



Ordering Information (continued)

Optional plug-in modules. Maximum of three modules per unit.

PHASOR MEASUREMENT UNIT (MAX. 1)

PMU with transient recorder, including PTP (IEEE 1588)	PMU
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TRANSIENT RECORDER (MAX. 1)

4 voltage channels, up to 2kV and 1024 samples per cycle	TRM-180
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FAULT RECORDER (MAX. 1)

4 current channels up to 200A via 4 x solid core CTs (Ø23 mm aperture)	DFR-CS2-180
4 current channels up to 200A via 4 x split core CTs (Ø23 mm aperture)	DFR-CS2S-180
4 current channels up to 200A via 4 x split core CTs (Ø33 mm aperture)	DFR-CS2SL-180

DIGITAL INPUTS (MAX. 48 PER UNIT)

16 digital inputs, dry contacts	DI16-DRC-180
16 digital inputs, 24V DC	DI16-24V-180
16 digital inputs, 125V DC	DI16-125V-180
16 digital inputs, 250V DC	DI16-250V-180

COMMUNICATION

BNC IRIG-B and 2nd RS-422/485 port	IRIG-180
Fibre optic Ethernet (TXFX), redundant Ethernet and 2nd RS-422/485 port	TXFX-180

RELAY OUTPUTS (MAX. 24 PER UNIT)

8 relays	RLY8-180
8 DI / 4 RO, electromechanical relays, dry contact inputs	8DIOR-DRC
8 DI / 4 RO, solid state relays, dry contact inputs	8DIOS-DRC
8 DI / 4 RO, electromechanical relays, 24V inputs	8DIOR-24
8 DI / 4 RO, solid state relays, 24V inputs	8DIOS-24
8 DI / 4 RO, electromechanical relays, 125V inputs	8DIOR-125
8 DI / 4 RO, solid state relays, 125V inputs	8DIOS-125
8 DI / 4 RO, electromechanical relays, 250V inputs	8DIOR-250
8 DI / 4 RO, solid state relays, 250V inputs	8DIOS-250

ANALOGUE I/O (MAX. 12 AI / 12 AO PER UNIT)

4 AI / 4 AO, ±1 mA	4AI01-180
4 AI / 4 AO, 0-20 mA	4AI02-180
4 AI / 4 AO, 0-1 mA	4AI03-180
4 AI / 4 AO, 4-20 mA	4AI04-180
4 analogue inputs, ±10V	4AIV-180

AUXILIARY POWER SUPPLY (MAX. 1)

Auxiliary power supply, 85-265V AC and 40-300V DC	BACDC-180
Auxiliary power supply, 9.5-36V DC	B21DC-180



Place an Order or Get Support

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DOCUMENT VERSION

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