

CLASS 0.2S ACCURACY

AS/IEC 62053-22 COMPLIANT

AEMO FCAS COMPLIANT

0.0001HZ FREQUENCY RESOLUTION

20MS REAL-TIME DATA

[View FCAS metering on satec-global.com.au ↗](https://satec-global.com.au)
[PM335 product page ↗](#)
[EM235 product page ↗](#)

PM335 & EM235 PRO Series FCAS

Advanced FCAS Power Meter or Power Quality Analyser

The PRO Series FCAS range meters Frequency Control Ancillary Services (FCAS) for battery storage, generation and large load sites that take part in AEMO FCAS markets. Each model is available as an advanced FCAS power meter or as a Class A or Class S power quality analyser per IEC 61000-4-30.

Real-time data is available every 20 milliseconds (one cycle) via Modbus registers, with 0.2% power accuracy and 0.002% frequency accuracy at 0.0001Hz resolution. An optional FCAS Mode adds internal high-speed recording around each frequency deviation. Dual port Ethernet, optional IEC 61850 Ed. 2, 16GB of memory and up to four add-on modules complete the package.



PRO-PM335 / EM235-FCAS

FCAS power meter with AEMO FCAS data logging and basic PQ functions (no waveform, sag/swell capture or EN 50160 reports).

PRO-PM335 / EM235-PQ

Class A or Class S power quality analyser per IEC 61000-4-30, panel-mount or DIN-rail, with standard data logging.

PRO-RPM035

Transducer version of the PRO Series meter.

Main Features

- AEMO FCAS compliant metering with real-time 20ms (one cycle) data via Modbus
- Optional FCAS Mode: internal 20ms and 1s recording around the frequency deviation time
- Power accuracy 0.2% and frequency accuracy 0.002% with 0.0001Hz resolution
- Class 0.2S four-quadrant energy metering to AS/IEC 62053-22 and ANSI C12.20 Class 0.2
- IEC 61000-4-30 Class A or Class S power quality analysis on PQ models, with EN 50160 and IEEE 519
- AC inputs to 1,000V AC (L-L) and direct DC voltage from 10 to 820V DC
- Leakage and residual current detection via a fourth current input
- Flexible current inputs for 1A/5A CTs, HACS, DC sensors, LPCT and Rogowski clamps
- 16 programmable data recorders with 16GB of onboard memory
- Dual Ethernet, RS-485, infrared and USB-C with Modbus, DNP3, IEC 60870-5-101/104 and optional IEC 61850
- Up to four add-on I/O, analogue output and auxiliary power modules side by side

Feature Capabilities

FCAS Measurements

AEMO COMPLIANT

- Real-time data (default) at 20 milliseconds (one cycle) via Modbus registers
- Power accuracy 0.2% with 1W/var/VA resolution (PT = 1) or 1kW/kvar/kVA (PT < 1)
- Frequency accuracy 0.002% with 0.0001Hz resolution
- FCAS Mode (option): internal **data recording** at 20ms for Very Fast and Fast services and 1s for Slow and Delayed services, before and after the Frequency Deviation Time (FDT)

Billing and Energy Metering

- Four-quadrant active and reactive energy polyphase meter: Class 0.2S AS/IEC 62053-22 and Class 0.2 ANSI C12.20
- Time-of-Use (TOU) with 16 summary (totalisation) and TOU energy and demand registers for substation energy management
- Accumulation of energy pulses from external watt-meters
- Block and sliding demands for up to 64 energy sources
- Demand meter for amps, volts and harmonic demands

Multi-functional Power Meter

- Three-phase true RMS volts, amps, powers, power factors, unbalance and neutral current
- Phasors and symmetrical components
- Frequency readings with three and four decimal resolution
- 32 digital counters for pulses from external sources and internal events
- 16 programmable timers from ½ cycle to 24 hours for periodic recording and triggering

Harmonic Analyser

- Per IEC 61000-4-7, up to the 63rd harmonic for volts and amps
- THD for volts and amps, TDD and K-factor
- Interharmonics for volts and amps
- Directional power harmonics (load or source) and harmonic power factor

Power Quality

PQ MODELS (CLASS A OR CLASS S)

- Power quality analysis in full compliance with IEC 61000-4-30 Class A or Class S
- Built-in statistics and reports per EN 50160
- IEEE 519 harmonic analysis

ALL MODELS

- Sags and swells (dips and overvoltages), interruptions, frequency and voltage variations
- Flicker per IEC 61000-4-15 and voltage unbalance
- V-I angle, current TDD coefficients and K-factors
- Programmable thresholds and hysteresis
- Power quality event recorder with waveform and data recording
- Selectable sampling rate up to 256 samples per cycle
- Redundant auxiliary power supply for recording major dips and interruptions

Fault Recorder

- Up to 26 external digital triggers from protection relays
- Onboard zero-sequence currents and volts plus current and voltage unbalance
- Fault waveforms and fast RMS trace
- Cross triggering between devices via digital inputs for synchronous event capture

Waveform and Data Recorders

- Eight fast waveform recorders with seven-channel (V1-V3, I1-I4) simultaneous recording
- Selectable AC sampling rate of 32, 64, 128 or 256 samples per cycle with 20 pre-fault cycles
- Synchronised waveforms from multiple devices in a single plot
- Export to COMTRADE and PQDIF formats via PAS software
- 16 programmable data recorders, periodic or on any internal or external trigger
- Event recorder for internal diagnostics, control events and I/O operations

Feature Capabilities (continued)

AC Measurements

- Three fully isolated AC voltage inputs rated 10–1,000V AC (L-L) at 50/60Hz
- Four isolated AC current inputs (see Current Inputs in Specifications)
- Leakage current detection: residual current calculated via the fourth current input monitoring the neutral line, with configurable alerts and control thresholds

DC Measurements

- Three isolated DC voltage inputs from 10 to 820V DC, or up to 1,500V DC via an optional adapter
- DC voltage accuracy: 0.2%
- Four isolated DC current inputs up to 3,000A DC using SATEC U-HACS or Hall Effect sensors
- DC current accuracy: 0.2%
- DC power calculated from measured voltage and current

Embedded Programmable Controller

- 64 control setpoints with OR/AND logic and extensive triggers
- Programmable thresholds and delays with relay control
- Event-driven data recording with up to 16 triggering channels
- Cross triggering between devices via Ethernet for synchronous event capture

Software Support

- **Power Analysis Software (PAS)** for configuration, data retrieval and waveform analysis
- **Expertpower™** client over Modbus/TCP to SATEC's Expertpower cloud SaaS server
- **eXpertConnect™ App** for mobile configuration, readings and diagnostics

Applications

- Energy management and revenue metering
- SCADA and substation automation
- Industrial monitoring and power quality
- Renewable energy

Communications

- RS-485 serial port up to 115,200 bps: Modbus RTU/ASCII, DNP3.0, SNTP and IEC 60870-5-101
- Two 10/100 Base-T Ethernet ports: Modbus/TCP, DNP3/TCP, IEC 60870-5-104 and optional IEC 61850, with up to 10 non-intrusive simultaneous connections per port
- Infrared port (19,200 bps) with Modbus and DNP3 for local data exchange
- USB 2.0 port (type C)
- TCP notification client to a remote Modbus/TCP server, on events or periodically

Expansion Modules and I/O

UP TO FOUR MODULES SIDE BY SIDE

- Up to two expansion modules are self-energised
- Three I/O modules require the auxiliary power supply module
- Three daisy-chain slots for plug-in I/O and communication modules

OPTIONAL BUILT-IN I/O

- Two optically isolated 24V DC dry contact inputs with 1 ms sampling and 1 pps time synchronisation
- One solid state relay output for alarms, pulses and remote control
- One universal analogue input ($\pm 1\text{mA}$, 0–1mA, 0–20mA, 4–20mA)

ADD-ON MODULES

- 8 DI: dry contact or 24/48/125/250V wet inputs
- 4 RO: electromechanical (EMR) or solid state (SSR) relays
- 4 DI + 2 RO combination module
- 4 AO: isolated universal analogue outputs
- Auxiliary power supply: 88–264V AC / 90–290V DC or 24V DC (9–36V DC)

Time Synchronisation and Clock

- High precision time synchronisation via SNTP or 1 pps through a digital input
- IRIG-B time-code input (future release)
- Real-time clock with battery backup and three-year retention

Specifications

VOLTAGE INPUTS

Operating range ¹	0-600V AC (L-N) 0-1,000V AC (L-L)
Direct DC voltage range ²	10-820V DC
Input impedance	4MΩ
Burden at 400V	≤ 0.04VA
Burden at 120V	< 0.01VA
Isolation	4,000V AC for 1 min
Wire size	Up to 14 AWG (≤ 2.5 mm ²)

CURRENT INPUTS

1A OR 5A FROM CT SECONDARY (STANDARD)	
Operating range	Continuous 10A RMS
Burden	< 0.2VA at I _n = 1A or 5A
Overload withstand	15A RMS continuous, 200A (20 × I _{max}) RMS for ½ second
OPTIONAL INPUTS	
DC	0-20mA input for DC Hall Effect sensors
HACS	0-20mA inputs for solid or split core SATEC High Accuracy Current Sensors

LPCT SENSOR INTERFACE (V/I)

Voltage input	(3.25/√3) V
Voltage input burden	200kΩ ±1%
Current input	225mV
Current input burden	> 20kΩ
Connector type	2 wires

POWER SUPPLY

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

¹ UL listing covers nominal voltage up to 277/480V AC (L-N/L-L). Minimum value for accurate detection is 6V L-N and 10V L-L.

² Measuring up to 1,500V DC is possible via an adapter.

BUILT-IN I/O (OPTIONAL)

DIGITAL INPUTS (2 DI)

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

DIGITAL OUTPUT (1 DO)

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

ANALOGUE INPUT (1 AI)

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

Specifications (continued)

ADD-ON MODULES: DIGITAL I/O

DIGITAL INPUTS (8 DI)

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

Rating	4 relays, 5A / 250V AC and 5A / 30V DC, 1 contact (SPST Form A)
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Isolation, contacts to coil	3,000V AC for 1 min
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Isolation, open contacts	750V AC
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Operate time	10 ms max.
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Release time	5 ms max.
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DIGITAL OUTPUTS (4 DO): SOLID STATE RELAY

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

Four digital inputs and two relay outputs, per the specifications above

ADD-ON MODULES: ANALOGUE OUTPUTS (4 AO)

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

AC/DC MODULE

Rated input	88-264V AC / 90-290V DC
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Output	5W
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Burden	15VA
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Withstand	4kV AC for 1 min
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Wiring	L/+, N/-
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Terminal pitch	5 mm
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Wire size	Up to 12 AWG (≤ 2.5 mm ²)
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24V DC MODULE

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

COMMUNICATION PORTS

SERIAL

Type	RS-485 optically isolated, up to 115,200 bps
Supported protocols	Modbus RTU, DNP3, SATEC ASCII, IEC 60870-5-101

Isolation	4,000V AC for 1 min
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ETHERNET (DUAL, 2 PORTS, DAISY CHAIN)

Type	Transformer-isolated 10/100 Base-T, RJ45
Supported protocols	Modbus/TCP (port 502) DNP3/TCP (port 20000) IEC 60870-5-104 (port 2404) IEC 61850 (port 102) SNTP

Simultaneous connections	10 (5 Modbus/TCP + 5 DNP3/TCP)
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Isolation	4,000V AC for 1 min
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INFRARED (IR)

Type	Front panel IR port with magnetic head
Supported protocols	Modbus RTU, DNP3 and IEC 62056-21 for local meter data exchange

Isolation	4,000V AC for 1 min
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USB

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

REAL-TIME CLOCK

Accuracy	Typical error ± 15 seconds per month, < 5 minutes per year at 25°C
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Retention	Battery backup, three years
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LOG MEMORY

Capacity	16GB for long-term waveform and data recording
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DISPLAY

PM335	3.5" TFT colour LCD, 320 × 480 dots
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EM235	1.77" TFT colour LCD, 120 × 160 dots
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ENVIRONMENTAL CONDITIONS

Operating temperature	-40°C to +70°C (-40°F to 158°F)
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Display operating temperature	-25°C to +70°C (-13°F to 158°F)
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Storage temperature	-40°C to +85°C (-40°F to 185°F)
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Humidity	0 to 95% RH non-condensing
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Degree of protection	IP51
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CONSTRUCTION

Weight	0.70kg (1.54 lb)
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Dimensions (PM335)	108.6 × 74.7 × 113.3 mm
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Dimensions (EM235)	89.5 × 72 × 90 mm
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Mounting (PM335)	Panel mount, 4" round or 92 × 92 mm square cutout, 50 mm deep
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Mounting (EM235)	DIN-rail
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Enclosure	Anti-tamper sealed; power connections at bottom, communications and I/O at top
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MATERIALS

Case enclosure	Plastic PC/ABS blend
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Display body	Plastic PC/ABS blend
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Front panel	Plastic PC
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PCB	FR4 (UL94-V0)
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Terminals	PBT (UL94-V0)
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Plug-in connectors	Polyamide PA6.6 (UL94-V0)
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Labels	Polyester film (UL94-V0)
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Standards Compliance

Electromagnetic Immunity

- AS/IEC 62052-11, CLC/TR 50579 (conducted disturbances 2-150kHz), IEEE C62.41 and C37.90.1
- 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
- ANSI/IEEE C37.90.1: Fast Transient SWC

Electromagnetic Emission

- IEC 61000-6-4*: Radiated/Conducted Class B
- IEC CISPR 22*: Radiated/Conducted Class B
- Emission per EN 55011/22 Class B and FCC Part 15 Class B

Environmental

- IEC 60529: Protection
- IEC 60068-2-1: Cold
- IEC 60068-2-2: Dry Heat
- IEC 60068-2-30: Damp Heat
- IEC 60068-2-5: Solar Radiation

Accuracy

- AS/IEC 62053-22:2003, Class 0.2S
- IEC 62053-24:2014, Class 0.5S
- ANSI C12.20-2015, Class 10 (0.2%)

Power Quality

- Designed to comply with EN 50160: Power Quality in European Electricity Supply Networks
- IEC 61000-4-7: Harmonics and interharmonics measurement
- IEC 61000-4-15: Flicker measurement
- IEC 61000-4-30 Class A (Ed. 3.1): Power quality measurement methods

Safety and Construction

- IEC 61010, AS/IEC 62052-11* and IEC 61557-12
- UL 61010-1, Safety Requirements for Electrical Equipment for Measurement, Control and Laboratory Use, Part 1: General Requirements, Edition 3, revision date 07/19/2019
- CSA C22.2 No. 61010-1, Safety Requirements for Electrical Equipment for Measurement, Control and Laboratory Use, Part 1: General Requirements, Edition 3, revision date 11/2018
- AC impulse insulation: meets AS/IEC 62052-11, 4,000V AC for 1 minute and 6kV/500Ω at 1.2/50 μs impulse
- IEC 60068-2-6: Vibration (sinusoidal)
- IEC 60068-2-27: Shock Test
- IEC 60068-2-75: Hammer Test
- NMI M6-1*

* Meets standard requirements.

MODEL - CURRENT - CAL. FREQ. - POWER - BUILT-IN I/O - LANGUAGE - PROTOCOL

MODEL	CODE	BUILT-IN I/O	CODE
EM235 DIN-rail FCAS power meter	PRO-EM235-FCAS	2 × DI (dry contact) + 1 × SSR output + 1 × universal AI (-1mA to 20mA)	IOS
EM235 DIN-rail PQ analyser, Class A or S (x)	PRO-EM235-PQ-x		
PM335 panel-mount FCAS power meter	PRO-PM335-FCAS		
PM335 panel-mount PQ analyser, Class A or S (x)	PRO-PM335-PQ-x		
Transducer version	PRO-RPM035-xxx		
		DISPLAY LANGUAGE	CODE
		English	EN
		OPTIONAL PROTOCOLS	CODE
		IEC 61850 communication protocol	850

x = A for Class A (Ed. 3.1) or S for Class S.

CURRENT INPUTS	CODE
5 Ampere	5A
1 Ampere	1A
5A split core remote HACS, 50/60Hz only	RS5
High Accuracy Current Sensors (HACS), 50/60Hz only	HACS
Pole top sensor interface, 0-10V (voltage and current)	PTS
Pole top sensor interface, 0-10V (voltage), current 5A	PTS-5
LPCT: dedicated low voltage interface for MV sensors	LPCT
3V AC inputs for Rogowski current clamps	FLEX
CALIBRATION AT FREQUENCY	CODE
50Hz	50HZ
60Hz	60HZ
POWER SUPPLY	CODE
88-320V AC / 40-290V DC	ACDC

Optional Modules

Maximum of three I/O modules and one auxiliary power supply module per device.

I/O MODULES	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	DI8-24 / 48 / 125 / 250
4 analogue outputs, configurable range	4AO

AUXILIARY POWER SUPPLY	CODE
AC/DC, 88-264V AC / 90-290V DC	AUX-ACDC
24V DC (9-36V DC)	AUX-24DC

An auxiliary power supply module is required when three I/O modules are fitted.



Place an Order

Talk to our team about configuration, pricing and lead times, or scan the code to reach us online.

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Document Version

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