

PRO SERIES

PM335/EM235

DATASHEET



PM335



EM235

The PRO Series power analyzers are available in the PM335 panel mount (4-inch round / 92x92mm square cutouts) form factor design and the EM235 DIN-rail form factor design.

This series combines metering and control in one device, providing the ultimate solution for substation / industrial automation, and commercial energy management.

The PRO Series bundles multiple capabilities into one physical device, which ordinarily would be found in several different pieces of equipment.

Featuring a variety of communication interfaces and supporting a multitude of SCADA-driven protocols, these analyzers are extremely versatile and adaptive.

HIGHLIGHTED FEATURES

- Class 0.2S accuracy (IEC / ANSI)
- AC/DC metering
- Power Quality Analyzer Class A, per IEC 61000-4-30 (Ed. 3.1)
- EN50160 Reports
- IEC 61850
- Dual port Ethernet
- Extra wide range input rating: 1,000V AC/820V DC
- Leakage/residual current detection
- Waveform capture and recording

PM335: Panel mounted meter monitoring voltage, current, power, frequency, and energy measurements, combined with power quality analysis and data logging capabilities. Features a 3.5" TFT color display

EM235: All features as above, in DIN-rail form factor with a 1.77" TFT display

1A or 5A: from CT secondary (standard)

HACS: 40mA inputs for SATEC's High Accuracy Current Sensors

Hall Effect DC Sensors: utilizing the 40mA HACS inputs for DC Current Measurements

GWP MV Sensors: 225mV inputs, interfacing Greenwood Power's MV sensors (current & voltage)



3.5" (49x73mm) LCD

1.8" (28x35mm) LCD

Dual TCP/IP, RS-485, USB-C, 2DI, 1DO, 1AI

Fastening latch

Up to 4 add-on modules

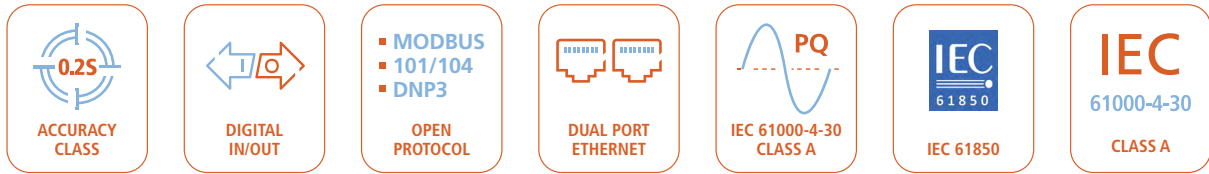
50mm deep, 92x92 square or 4" round cutout fits type-tested switchboards with add-on modules

Anti-tamper sealed enclosure

Additional modules compatible with all PRO Series models

Top: Communication & I/Os
Bottom: All power connections

FEATURES



- **Up to 26 external digital triggers** from protection relays; onboard zero-sequence currents and volts, current and voltage unbalance; fault waveforms and fast RMS trace; cross triggering between multiple devices via digital inputs for synchronous event capture and recording
- **Three and 4 decimal resolution** for frequency readings
- **Event recorder** for logging internal diagnostics events, control events, and I/O operations
- **16 Data recorders:** Programmable Data Logs on a periodic basis and on any internal or external trigger
- **8 Fast Waveform recorders:** 7-channel (V1-V3, I1-I4) simultaneous recording; selectable AC sampling rate of 32, 64, 128 or 256 samples per cycle; 20 pre-fault cycles; synchronized waveforms from multiple devices in a single plot; exporting waveforms in COMTRADE and PQDIF file formats is possible via PAS software
- **Embedded Programmable Controller:** 64 control setpoints, OR/AND logic, extensive triggers, programmable thresholds and delays, relay control, event-driven data recording, cross triggering between multiple devices via ethernet for synchronous event capture and recording – up to sixteen triggering channels
- **3-phase Power meter:** true RMS, volts, amps, powers, power factors, unbalance, and neutral current
- **Four-quadrant active & reactive energy** polyphase meter: Class 0.2S IEC 62053-22 / Class 0.2 C12.20
- **Demand Meter:** amps, volts and harmonic demands
- **Precise Energy & Power Demand Meter:** Time-of-Use (TOU), 16 Summary (totalization) and TOU energy and demand registers for substation energy management; accumulation of energy pulses from external watt-meters; block and sliding demands; up to 64 energy sources
- **Harmonic Analyzer, per IEC 61000-4-7:** Up to 63rd harmonic for volts and amps; THD for volts and amps, TDD, K-factor, interharmonics for volts and amps, directional power harmonics and power factor
- **Phasor, symmetrical components**
- **32 digital counters** for counting pulses from external sources and internal events
- **16 programmable timers** from 1/2 cycle to 24 hours for periodic recording and triggering operations on a time basis
- **1-ms satellite-synchronized clock** (IRIG-B time-code input - future release)
- **Backup power supply unit**
- **4 daisy-chain slots** for plug-in I/O/COM modules
- **Expertpower client** for MODBUS/TCP communication with either a Remote or Local (Stand Alone) SATEC's Expertpower server
- **TCP notification client** for communicating with a remote MODBUS/TCP server on

events or periodically on a time basis, with any IP enabled communication port

- **16GB memory** for long-term waveform and data recording
- **Real Time Clock**; Internal clock with battery backup for three years of retention time

POWER QUALITY

- Power quality analysis in full compliance with IEC 61000-4-30 Class A, Edition 3.1
Built-in statistics and reports per EN50160
- Sags/Swells (dips / overvoltage), interruptions, frequency variations, voltage variations
- Flicker (according to IEC 61000-4-15)
- Voltage unbalance
- Voltage and current individual harmonics (according to IEC 61000-4-7), interharmonics and directional power harmonics (load/source) up to the 63rd harmonic
- Voltage and current THD coefficients
- Vector diagram and symmetrical components
- Programmable thresholds and hysteresis
- Redundant auxiliary power supply for recording major dips and interruptions
- V-I angle, current TDD coefficients and K-Factors
- Waveform and data recording; phasor display
- Power quality event recorder
- Event recorder for logging internal diagnostic events, control events and I/O operations
- Selectable sampling rate up to 256 samples per cycle

AC MEASUREMENTS

The PRO Series is provided with fully isolated AC inputs for connecting to AC feeders:

- Three isolated AC voltage inputs (Rating: 10-1000V AC (L-L) @ 50/60 Hz)
- Four isolated AC current inputs (see pg. 2 for options)
- Leakage current detection: accurate calculation of residual current is enabled via a 4th current input to monitor the neutral current line. Accordingly, alerts and control thresholds can be configured in response to leakage current detected

DC MEASUREMENTS

The PRO Series measures DC voltage and current, calculating DC Power.

- Three isolated DC voltage inputs (from 10 to 820V DC). Optional: up to 1,500V DC (via adapter)
- DC Voltage Accuracy - 0.2%
- Four isolated DC current inputs up to 3000A DC (via Hall Effect sensors)
- DC Current Accuracy - 0.2%

COMMUNICATION AND I/O MODULAR EXPANSION OPTIONS

The PRO Series meters feature a large range of communication capabilities, as below:

UP TO 4 EXPANSION MODULES SIDE BY SIDE

- Up to 2 expansion modules: self-energized
- 3 expansion modules: requires AUX power supply module

OPTIONAL BUILT-IN I/O PORTS

- **2 optically isolated inputs:** 24V DC dry contact; programmable de-bounce time from 1ms to 1s; control setpoints, 1pps time synchronization; 1ms sampling rate
- **1 Solid State Relay output:** unlatched, latched and pulse operations, fail-safe operation for alarm notifications; programmable pulse width; direct remote relay control through communications
- **1 optically isolated analog input:** 1mA to 20mA

OPTIONAL DIGITAL I/O MODULES

- **8 DI: 8 optically isolated digital input options**
 - Dry contacts
 - 24/48/125/250V AC/DC wet inputs. Programmable de-bounce time from 1ms to 1s; 1ms sampling rate; control setpoints, pulse counters and Energy / TOU sub-system, 1pps time synchronization; 1ms sampling rate
- **4RO: 4 relays:** Electro-Mechanic (EMR) or Solid State (SSR) relay option. Unlatched, latched and pulse operations, fail-safe operation for alarm notifications, programmable pulse width, and direct remote relay control through communications
- **4DI + 2RO Combo:** per above specifications

OPTIONAL ANALOG OUTPUT MODULE

4 AO: 4 isolated universal analog outputs configurable for the following ranges:
±1mA, 0-20mA, 0-1mA, 4-20mA,
0-5mA, ±5mA

OPTIONAL AUXILIARY POWER SUPPLY MODULES

These power supply modules are designed to successfully power the whole device on their own, including up to three extra modules (I/O)

Options:

- 88-264V AC / 90-290V DC
- 24V DC (9-36V DC)

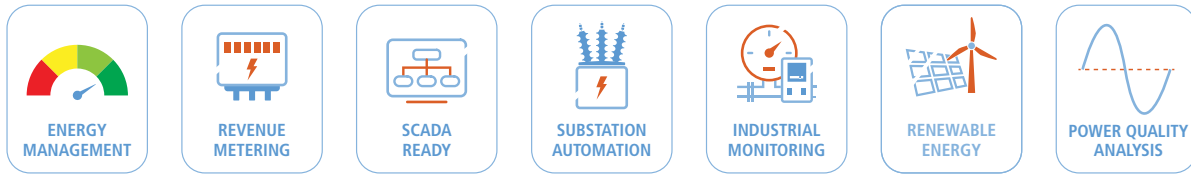
COMMUNICATION OPTIONS

The PRO Series has extensive communication capabilities, including:

STANDARD COMMUNICATION PORTS & PROTOCOLS

- Serial communication port; RS-485, up to 115,200 bps, MODBUS RTU/ASCII, DNP3.0 and IEC 60870-5-101 protocols
- 2 x Ethernet 10/100 Base-T port, supporting Modbus/TCP, DNP3/TCP, IEC 60870-5-104, and IEC 61850 protocols, up to 10 non-intrusive simultaneous connections per Ethernet port
- Infrared port (19,200 bps) supporting Modbus and DNP3 protocols for local meter data exchange
- USB 2.0 port (type C)

APPLICATIONS



TECHNICAL SPECIFICATIONS

INPUT RATINGS

VOLTAGE INPUTS

Operating range *	10-1000V AC (L-L)
Operating range for direct DC Voltage**	10-820V DC
Input impedance	4M Ω
Burden for 400V	$\leq 0.04VA$
Burden for 120V	$< 0.01VA$
Isolation	4000V AC @ 1mn
Wire size	up to 14 AWG ($\leq 2.5 \text{ mm}^2$)

CURRENT INPUTS

1. 1A or 5A from CT secondary (standard)

Operating range	Continuous 10A RMS
Burden	$< 0.2 \text{ VA @ } I_n=1A \text{ or } 5A$
Overload withstands	15A RMS continuous, 200A ($20 \times I_{max}$) RMS for $\frac{1}{2}$ second

OPTIONAL INPUTS

2. DC	0-20 mA input for DC Hall Effect Sensors
3. HACS	0-20mA inputs for solid or split core CTs (SATEC High Accuracy Current Sensors)

GWP SENSOR INTERFACE (V/I)

Voltage input	$(3.25/\sqrt{3}) \text{ V}$
Burden	$200k\Omega \pm 1\%$
Connector type	2 wires
Current input	225mV
Burden	$>20k\Omega$
Connector type	2 wires

DIGITAL/ANALOG I/O

BUILT-IN (OPTIONAL)

DIGITAL INPUTS (2 DI)

Dry Contacts, internally wetted	@ 24V DC
Galvanic isolation	4000V AC @ 1mn
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	5mm

DIGITAL OUTPUT (1 DO)

Solid State relay	
1 relays rated at 0.15A/250 V AC/DC, 1 contact (SPST Form A)	
Galvanic isolation	4000V AC @ 1mn
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)

ANALOG INPUT (1 AI)

Universal (-1mA to 20mA; range configurable: $\pm 1mA$, 0...1mA, 0...20mA, 4...20mA etc.)	
Galvanic isolation	4000VAC @ 1mn
Scan time	1 ms
Connector type	removable, 5 pins
Wire size	14 AWG (up to 1.5mm^2)
Accuracy	$< 0.5\% \text{ FS}$
Terminal pitch	5mm

* UL listing covers nominal voltage up to 277/480V AC (L-N/L-L)

** Measuring up to 1,500V DC is possible via adapter

ADD-ON MODULES

DIGITAL INPUTS (8 DI)

Dry Contacts, internally wetted	@ 24V DC
Wet contact	@ 250V DC (8DI only)
Sensitivity	Open @ input resistance >100 k Ω Closed @ Input resistance < 100 Ω
Galvanic isolation	4000V AC @ 1mn
Internal power supply	24V DC
Scan time	1 ms
Connector type	removable, 2 x 5 pins
Wire size	14 AWG (up to 1.5 mm ²)

DIGITAL OUTPUTS (4 DO)

Electromechanical relay - DRY contact (option 1)

4 relays rated at 5A/250V AC; 5A/30V DC, 1 contact (SPST Form A)

Galvanic isolation:	
Between contacts & coil	3000V AC @ 1mn
Between open contacts	750V AC
Operate time	10 ms max.
Release time	5 ms max.
Wire size	14 AWG (up to 1.5 mm ²)

Solid state relay - DRY contact (option2)

4 relays rated at 100mA/800V AC, 1 contact (SPST Form A)

Galvanic isolation	
Between contacts & coil	5000V AC @ 1mn
Between open contacts	800V peak
Operate time	5 ms max.
Release time	5 ms max.
Wire size	14 AWG (up to 1.5 mm ²)
Update time	1 cycle
Wire size	14 AWG (up to 1.5 mm ²)

DIGITAL INPUTS + DIGITAL OUTPUTS (4 DI + 4RO)

4DI + 2RO combo, per above specifications

ANALOG OUTPUTS (4 AO)

Universal (configurable) isolated analog outputs

Scan time: (manually or remotely programmed)	1 ms
Ranges (manually or remotely programmed)	± 1 mA, maximum load 10 k Ω (100% overload) 0-20 mA, maximum load 510 ohm 4-20 mA, maximum load 510 ohm 0-1 mA, maximum load 10 kohm (100% overload)

Accuracy	0.5% FS
Wire size	14 AWG (up to 1.5 mm ²)
Terminals Pitch	5 mm

POWER SUPPLY

Rated input	57.7-277V AC @ 50/60 Hz, 48-290V DC
Tolerance	$\pm 15\%$
Burden	11VA@V AC, 6VA@V DC
Isolation	4000V AC @ 1mn
Wire size	Up to 14 AWG (≤ 1.5 mm ²)

AUXILIARY POWER SUPPLY (AS MODULE)

AC/DC MODULE

Rated input	88-264V AC / 90-290V DC
Output	5W
Burden	15VA
Withstanding	4kV AC @ 1min
Wiring	L/+, N/-
Terminals Pitch	5 mm
Wire size	up to 12 AWG (≤ 2.5 mm ²)

24V DC MODULE

Rated input	9-36V DC
Output	7W
Galvanic isolation	4,000V AC @ 1min
Isolation	4KV
Terminals Pitch	5 mm
Wire size	14 AWG (up to 1.5 mm ²)

COMMUNICATION PORTS

COM1

RS-485 optically isolated port. Baud rate up to 115200bps

Isolation	4000V AC @ 1mn
Supported protocols	MODBUS RTU DNP3 SATEC ASCII IEC 60870-5-101

COM4

InfraRed COM port, Front Panel access with magnetic head

Supported protocols	MODBUS RTU & DNP3 IEC 62056-21 (for local meter data exchange)
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* Meets standard requirements

Isolation	4000V AC @ 1mn
ETHERNET PORT (DUAL / 2 PORTS)	
Transformer-isolated 10/100 Base-T Ethernet port – RJ45	
Supported protocols:	MODBUS/TCP (Port 502) DNP3/TCP (Port 20000) IEC 60870-5-104 (Port 2404) IEC 61850 (Port 102)
Number of simultaneous connections	10 (5 MODBUS/TCP + 5 DNP3/TCP)
Isolation	4000V AC @ 1mn

ADDITIONAL SPECIFICATIONS

REAL-TIME CLOCK

Accuracy	Typical error ±15 seconds per month / < 5 minutes/year @ 25°C
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LOG MEMORY

16GB memory for long-term waveform and data recording

DISPLAY

PM335 - 3.5" LCD TFT color Display, 320×480 dots resolution

EM235 - 1.77" LCD TFT color Display, 120×160 dots resolution

ENVIRONMENTAL CONDITIONS

Operating temp.	-40°C to +70°C (40°F to 158°F)
Display op. temp.	-20°C to +70°C (4°F to 158°F)
Storage temperature	-40°C to +85°C (40°F to 185°F)
Humidity	0 to 95% RH non condensing
Degree of protection	IP51

CONSTRUCTION

Weight	0.70kg (1.54 lb.)
Dimensions (PM335)	108.6 × 74.7 × 113.3 mm
Dimensions (EM235)	89.5 × 72 × 90 mm

STANDARDS COMPLIANCE

ELECTROMAGNETIC IMMUNITY

- 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

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

- IEC62053-22:2003, class 0.25
- IEC 62053-24:2014, class 0.55
- ANSI C12.20 –2015, class 10 (0.2%)

ELECTROMAGNETIC EMISSION

- IEC 61000-6-4* Radiated/Conducted class B
- IEC CISPR 22* Radiated/Conducted class B
- Emission per EN55011/22 class B, FCC p.15 class B

* Meets standard requirements

POWER QUALITY

Designed to comply with:

- EN50160: Power Quality in European Electricity Supply Networks
- IEC 61000-4-7, Harmonics and inter-harmonics measurement
- IEC 61000-4-15, Flicker measurement
- IEC 61000-4-30 class A (Ed. 3.1), Power quality measurement methods

SAFETY/CONSTRUCTION

- IEC 61010, IEC 62052-11 & IEC 61557-12
- UL61010-1, 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 IEC 62052-11:4000V AC for 1 minute, 6KV/500Ω @ 1.2/50 μs impulse
- IEC 60068-2-6: Vibration (sinusoidal)
- IEC 60068-2-27: Shock Test
- IEC 60068-2-75: Hammer Test
- AS 62052-11*
- NMI M6-1*

ORDER STRING

MODELS

PM335 Panel Mount Power Meter	PRO-PM335-PQ
EM235 DIN-rail Mount Power Meter	PRO-EM235-PQ
Transducer Version	PRO-RPM035-PQ
PM335 Panel Mount PQ Analyzer, Class A (Ed. 3.1)	PRO-PM335-PQ-A
EM235 DIN-rail Mount PQ Analyzer, Class A (Ed. 3.1)	PRO-EM235-PQ-A
Transducer Version PQ Analyzer, Class A (Ed. 3.1)	PRO-RPM035-PQ-A

OPTIONS

CURRENT INPUTS

5 Ampere	5A
1 Ampere	1A
5A split core remote high accuracy current sensor (HACS), 50/60Hz only	RS5
High Accuracy Current Sensors (HACS), 50/60Hz only	HACS
Pole Top Sensor Interface - 0-10V (Voltage& Current)	PTS
Pole Top Sensor Interface - 0-10V (Voltage), Current - 5A	PTS-5
GWP: dedicated low voltage interface for GWP sensors	GWP
3V AC inputs for Rogowski current clamps	FLEX

CALIBRATION AT FREQUENCY

50 Hz	50HZ
60 Hz	60HZ

POWER SUPPLY

88-320V AC / 40-290V DC	ACDC
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BUILT-IN I/Os

2 x DI (dry contact) + 1 x SSR output + 1 x Universal AI (-1mA to 20mA)	IOS
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DISPLAY LANGUAGE

English	EN
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OPTIONAL PROTOCOLS

IEC 61850 Communication Protocol	850
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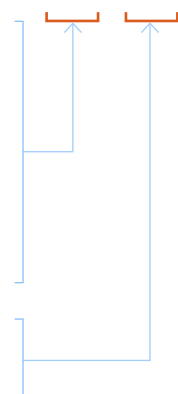
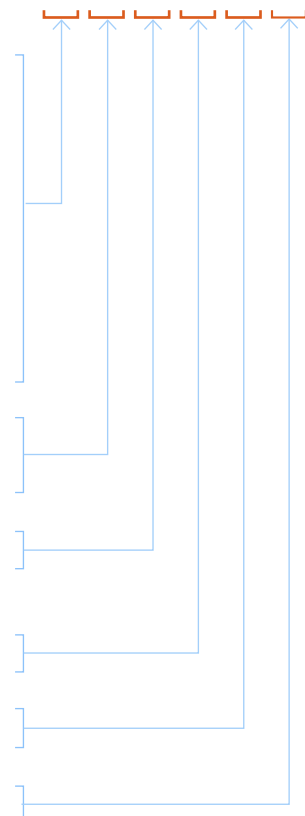
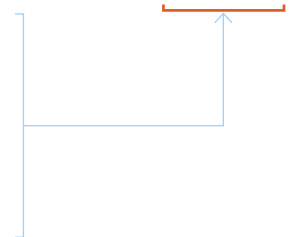
OPTIONAL MODULES *

I/O (MAX. 3 MODULES PER DEVICE)

4 Relay Outputs - 250V / 5A AC	EMR4
4 SSR Outputs - 250V / 0.1A AC	SSR4
4 Digital inputs (Dry Contact @ 24V DC) + 2 SSR outputs	4DIOS-DRC
4 Digital inputs (Dry Contact @ 24V DC) + 2 EMR outputs	4DIOR-DRC
8 Digital Inputs - Dry Contact	DI8-DRC
8 Digital Inputs - 24, 48, 125, 250 V DC	DI8-24, 48, 125, 250 V
4 Analog Outputs; configurable range	4AO

AUXILIARY POWER SUPPLY (MAX. 1 PER DEVICE)

AUX. P.S. AC/DC 88-264V AC / 90-290V DC	AUX-ACDC
24V DC (9-36V DC)	AUX-24DC



* Auxiliary power supply required when configured with 3 modules