PRO PM335/EM235

IEC 61850 Advanced Power Meter

The PM335/EM235 PRO series compact intelligent electronic device (IED) in panel mounting on both 4-inch round and 92x92mm square cutouts form factor design and the EM235 DIN-rail form factor design, are combined metering and control devices that provide a suitable solution for substation, industrial automation and commercial energy management. It incorporates a unique collection of features commonly found in numerous specialized measurements and recording equipment utilized in substation and industrial environments. Although the device is primarily designed as an inexpensive add-on to expand the capabilities of the existing substation protection equipment, it is well suited for a wide range of industrial applications with high input currents whenever extensive power quality monitoring is required.

Highlighted Features

- Class 0.2S accuracy per IEC 62053-22
- AC / DC Measurements
- 8GB on-board memory
- IEC 61850 protocol
- Dual Port Ethernet

- USB port (Type C)
- Waveform capture and recording
- Add on modules (DI/RO/AI etc.)
- On Board 2xDI, 1xRO & 1xAI

Models

PM335 PRO: Panel mounted meter offering standard voltage, current, power, frequency with Power Quality analysis capabilities and energy measurements, data logging and control capabilities (see Features). features a 3.5' TFT color display.

EM235 PRO: All features as above, in DIN-rail form factor with 1.77' TFT display.

Current Inputs

1A/5A universal input

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

Hall Effect DC Sensors: 0-20 mA inputs for DC Current Measurements using Hall Effect Sensors

Flex Clamp: 200A/2V, 30A-300A-3000A/3V Rogowski coil

Features

- Up to 26 external digital triggers from protection relays; onboard zero-sequence currents and volts, current and voltage unbalance; coincident volt magnitude, fault waveforms and fast RMS trace; cross triggering between multiple devices via digital inputs for synchronous event capture and recording
- Event recorder for logging internal diagnostics events, control events and I/O operations.
- Eight 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
- 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 the Ethernet for synchronous event capture and recording – up to sixteen triggering channels

- High-Class 3-phase Power meter: true RMS, volts, amps, powers, power factors, unbalance, and neutral current
- Class 0.2S IEC 62053-22/Class 0.2 C12.20 four-quadrant active and reactive energy polyphase static meter
- Demand Meter: amps, volts, harmonic demands
- Precise Energy and 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: up to 63rd harmonic 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 enable communication port
- ➔ Up to 8GB FLASH disk Memory for long-term waveform and data recording
- ➔ Real Time Clock; Internal clock with battery backup for three years Real-Time Clock retention time

AC Inputs

The PRO series is provided with a set of fully isolated AC inputs for connecting to the AC feeders:

- ➔ Three isolated AC voltage inputs (10 to 1000 VAC direct line-to-line input voltage)
- ➔ Three standard isolated AC current inputs as standard and fourth as option, with an extended input range 0.01A to 10A
- ➔ 50/60/400 Hz frequency range

DC Measurements

The PRO series can measure DC Voltage and DC Current and calculate DC Power and DC Energy

- ➔ Three isolated DC voltage inputs (from 10 to 820 VDC). Optional capability to connect up to 2500 VDC.
- ➔ Four standard isolated DC current inputs, possibility to connect DC Hall Effect Sensors and measure up to 2500A DC.
- ➔ DC Voltage Accuracy - 0.2%
- ➔ DC Current Accuracy - 0.5%

Communication and I/O Modular Expansion Options

The PRO SERIES has extensive modular capabilities:

Up to 4 Expansion Modules Side by Side:

- ➔ Up to 2 expansion modules: self-energized
  Note: Cellular module requires additional module of AUX power supply
- ➔ 3 expansion modules: requires additional module of AUX power supply

Optional Built-in I/O Ports

- ➔ 2 optically isolated inputs, 24VDC dry contact; programmable de-bounce time from 1 ms to 1 s; control setpoints, 1pps time synchronization; 1ms sampling rate
- ➔ 1 Solid State Relay output; unlatched, latched and pulse operations, failsafe 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 inputs; options for 24V dry contacts
- ➔ 24/48/125/250V AC/DC wet inputs. programmable de-bounce time from 1 ms to 1 sec; 1ms sampling rate; control setpoints, pulse counters and Energy/TOU subsystem, 1pps time synchronization; 1ms sampling rate

➔ 4RO: 4 relays: Electro-Mechanic (EMR) or Solid State (SSR) relay option. unlatched, latched and pulse operations, failsafe operation for alarm notifications; programmable pulse width; direct remote relay control through communications

Optional Analog Module

➔ 4 AI/AO: 4-channel AI/AO modules: four optically isolated analog outputs/inputs per module with internal power supply.

Auxiliary Power Supply Module

➔ Auxiliary Power Supply: 5W AC/DC backup device power

Current Inputs Module

➔ 6 CI: two sets of 3P current inputs: 6 HACS current inputs / 6 DC current inputs per module
(up to two CI modules per meter)

Voltage Inputs Module

➔ 3 VI: 3 high impedance voltage inputs
(up to one VI module per meter)

Communication Options

The PRO SERIES has extensive communication capabilities:

Standard Communication Ports

➔ Serial communication port; RS-485, up to 115,200 bps, MODBUS RTU/ASCII, DNP3.0 and IEC 60870-5-101 protocols
➔ Infrared port 19,200 bps, MODBUS RTU/ASCII, DNP3.0 protocols and IEC 62056-21 (DLMS) protocol (*future release*)
➔ Optional built-in Ethernet 10/100Base-T port; MODBUS/TCP, DNP3.0/TCP, IEC 60870-5-104 protocols and IEC 61850 protocol, up to 10 non-intrusive simultaneous connections per Ethernet port
➔ Built-in second Ethernet 10/100Base-T port; daisy chain capability or 2 independent Ethernet port
➔ USB 2 port; Device Full speed, USB-C connector

Optional Communication Ports

The following COM module options are available:

➔ Embedded Cellular module; 3G/4G communication through public cellular network; MODBUS/TCP, DNP3.0/TCP and IEC 60870-5-104 protocols

Technical Specifications

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 x 74,7 x 113,3 mm
Dimensions (EM235)	89,5 x 72 x 90 mm

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

POWER SUPPLY
Rated input: 90-332 VAC 50/60/400Hz, 40-290VDC, Burden 6VA
Isolation: 4000VAC @ 1mn
Wire size: up to 12 AWG (≤2.5 mm2)

Input Ratings

VOLTAGE INPUTS
Operating range: 10VAC (L-L) to 1000 VAC (L-L)
Operating range for DC Voltage: 10 VDC to 820 VDC
Input impedance: 8 Mega Ohm
Burden for 400V: ≤ 0.02 VA
Burden for 120V: < 0.002VA
Isolation: 4000VAC @ 1mn
Wire size: up to 12 AWG (≤ 2.5 mm2)

CURRENT INPUTS
1A/5A secondary (standard)
Operating range: continuous 10A RMS
Burden: < 0.2 VA @ In=1A/5A
Overload withstands:
15A RMS continuous, 200A (20 x Imax) RMS for ½ second
Option: 0-20 mA input for DC Hall Effect Sensors
Option: External Solid or Split core CT (HACS option)

RELAY OUTPUTS (optional)
Built-in Solid-State relay 1 relays rated at 0.15A/250 V AC/DC, 1 contact (SPST Form A)
Operate time: 1ms max.
Galvanic isolation: 4000VAC @ 1mn

DIGITAL INPUTS (optional)
Built-in: 2 digital Inputs: Dry Contacts, Internal power supply: 24VDC
Galvanic isolation: 4000VAC @ 1mn
Scan period: 1ms

Communication Ports

COM1
RS-485 optically isolated port. Baud rate up to 115200bps
Isolation: 4000VAC @ 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, IEC 62056-21 (future)
Isolation: 4000VAC @ 1mn

ETHERNET PORT (dual / 2 ports)
Transformer-isolated 10/100BaseT 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:	**LOG MEMORY**
10 (2 MODBUS/TCP + 2 DNP3/TCP)	8GB FLASH disk Memory for long-term waveform and data recording
Isolation: 4000VAC @ 1mn	
REAL-TIME CLOCK	**DISPLAY**
Accuracy: typical error 15 seconds per month / < 5 minutes/year @ 25C	PM335 - 3.5" LCD TFT color Display, 320 x 480 dots resolution
	EM235 -1.77" LCD TFT color Display, 120 x 160 dots resolution

Standards Compliance

Accuracy

➔ Meets IEC62053-22:2003, class 0.2S
➔ Meets IEC 62053-24:2014, class 0.5S
➔ Meets ANSI C12.20 –2015, class 10 (0.2%)

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

Electromagnetic Emission

➔ Complies with IEC 61000-6-4: Radiated/Conducted class B
➔ Complies with IEC CISPR 22: Radiated/Conducted class B

Safety/Construction

➔ Meets IEC/UL 61010-1, 3rd ed.
➔ AC Impulse Insulation: Meets IEC 62052-11:4000 VAC for 1 minute, 12KV/500Ω @ 1.2/50 µs impulse