PM135

MULTIFUNCTIONAL POWERMETER

The PM135 is a multi-functional three-phase power meter with basic revenue metering, power quality and harmonics analysis.

The PM135 provides a cost-effective substitute for numerous analog meters used by industrial, commercial and utility customers for basic power metering.

The PM135 is widely integrated in panel boards and SCADA systems. With the addition of the unique TOU module, the EH model answers the needs of revenue metering applications. It is also suitable for utility substation automation with its support of the industry standard DNP 3.0, Modbus RTU and IEC 60870-5-101/104 protocols, as well as its I/O capabilities (using the Digital Input/Output modules).

The PM135 series consists of two basic models providing digital measurements of more than 80 electrical parameters locally, and more than 100 electrical parameters via RS-485 interface. The PM135 has a 3x2” / 76x49mm backlit LCD display as well as SATEC’s unique bar graph loading indicator.

Measurement & Communication

The PM135 accurately measures over 100 parameters from basic frequency, voltages and currents, to all power parameters, four quadrant active, reactive and apparent energies, harmonics and time of use (TOU).

The PM135 has an integral RS-485 communication port for a wide range of protocols—Modbus, DNP 3.0 and IEC 60870. Its expansion module allows connection of a second communication port, including Ethernet, Profibus, RF or GPRS, as well as second RS-485 and RS-232 ports.

Models

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Features

Multifunctional 3-Phase Power Meter
- Voltage, current (including neutral current), power, energy, power factor, frequency, voltage/current unbalance
- Current range up to 200%
- Supported frequencies: 25, 50, 60 and 400 Hz
- Direct connection up to 690V L-L (up to 1.15 MV via PT)

Billing/TOU Energy Meter (E & EH Models)
- Class 0.5S IEC 62053-22 four-quadrant active and reactive energy polyphase static meter
- Three-phase total and per phase energy measurements; active, reactive and apparent energy counters
- Time-of-Use, 4 totalization and tariff energy/demand registers x 8 tariffs, 4 seasons x 4 types of days, 8 tariff changes per day,
- One-time easy programmable tariff calendar schedule
- Automatic daily energy and maximum demand profile log for total and tariff registers

Basic Power Quality Control (EH Model)
- Individual voltage and current harmonics (up to the 40th)
- Voltage and current THD, TDD & K-Factor
- Time stamped max/min values
- Waveforms 128 samples/cycle (via comm.)

Revenue Meter (EH Model)
- Exceeds accuracy class 0.5S
- Time Of Use (TOU) tariffs

Event/Data Log (EH Model)
- System events & data logging
- Real-time stamps

Communications
- Standard 2-wire RS-485 communication port
- Protocols: Modbus RTU, ASCII, DNP3.0, Optional IEC 60870-5-101; With Ethernet Modbus/TCP, DNP3/TCP; Optional IEC 60870-5-104 and with GPRS module: Modbus/TCP
- ExpertPower™ client for communicating with SATEC ExpertPower™ Internet services (with Ethernet or GPRS modules)
- TCP notification client for communicating with a remote Modbus/TCP server on events or periodically on a time basis (with the Ethernet or GPRS module)

Harmonic Analyzer (EH Model)
- Voltage and current THD, current TDD and K-Factor, up to 40th order harmonic
- Voltage and current harmonic spectrum and angles

Alarm and Control Functions
- 16 programmable set points
- 4 counters

Real-time Waveform Capture
- Real-time “scope mode” waveform monitoring
- Simultaneous 6-channel one-cycle waveform capture at a rate of 64 samples per cycle

Programmable Logical Controller
- Embedded programmable controller
- 16 control setpoints; programmable thresholds and delays
- Relay output control
- 1-cycle response time
Event and Data Recording (E & EH)
- Non-volatile memory for long-term event and data recording
- Event recorder for logging internal diagnostic events and setup changes
- Two data recorders; programmable data logs on a periodic basis; automatic daily energy and maximum demand profile log

I/O Options
- TOU+4DI module – four digital inputs with 1-ms scan time and battery backup for the real time clock; automatic recording of last five digital input change events with timestamps (see the PM135 Modbus Reference Guide)
- 4DIO – four digital inputs and two relay outputs with 1-cycle update time; unlatched, latched, pulse and KYZ operation; energy pulses, selection of solid state or electromechanical relays
- 12DIO – twelve digital inputs, 4 relay outputs and optional Ethernet or RS-485 communication port
- 4AO - four optically isolated analog outputs with an internal power supply; Selection of 0-20mA, 4-20mA, 0-1mA, and ±1mA output; 1-cycle update time

Real Time Clock
- Built-in clock and calendar functions
- Internal clock with 20-second retention time
- Optional battery backup (TOU+4DI module)

Power Supply
- Multi-purpose AC/DC power supply (85-265V AC, 88-290V DC)
- Special versions (12, 24-48V DC)

Measurement
- Direct voltage measurement of up to 690v
- Selection of current input connections:
  - 5A – measurement of up to 10A using conventional 5A CTs

Unique Design
- Pass-through CT connection provides minimal burden
- Auxiliary CT connection terminal for simple installation
- Add on modular design to add second communication port, digital I/O or Analog outputs

Meter Security
- Password security for protecting meter setups and accumulated data from unauthorized changes

Upgradeable Firmware
- Easy upgrading device firmware through a serial or Ethernet port

Software Support
- PAS™ – SATEC’s bundled software for meter configuration and data acquisition, including waveforms, phasors, harmonics and more
- ExpertPower™ – SATEC’s unique Internet services offer the industry leading energy management software (EMS) without client software installation

Construction
- Dual panel mounting: 4” Round; Square 96x96 DIN
- Weight: 1.5 lbs / 0.7 kg
- H×W×D: 4.5×4.5×4.3” / 114×114×109 mm
- One add-on module
Technical Specifications

**ENVIRONMENTAL CONDITIONS**
- Operating temperature: -30°C to 60°C (-22°F to 140°F)
- Storage temperature: -40°C to 85°C (-40°F to 185°F)
- Humidity: 0 to 95% RH non-condensing

**CONSTRUCTION**
- Weight: 0.70kg (1.54 lb.)
- Dimensions: 114×114×109mm (4.5×4.5×4.3”)

**MATERIALS**
- Case enclosure: plastic PC/ABS blend
- Front panel: plastic PC
- PCB: FR4 (UL94-V0)
- Terminals: PBT (UL94-V0)
- Connectors-Plug-in type: Polyamide PA6.6 (UL94-V0)
- Packaging case: Carton and Stratocell® (Polyethylene Foam) brackets
- Labels: Polyester film (UL94-V0)

**POWER SUPPLY**

- **120/230V AC-DC Option**
  - Rated input: 85-265V AC, 50/60/400 Hz, 88-290VDC, Burden 9VA
  - Isolation: 2500V AC (Input to ground)

- **12 VDC Option**
  - Rated input: 9.5-18V DC, Burden 4VA
  - Isolation: 1500V DC

- **24/48 VDC Option**
  - Rated input: 18.5-58 VDC, Burden 4VA
  - Isolation: 1500VDC
  - Wire size: up to 12 AWG (up to 3.5 mm²)

**INPUT RATINGS**

**VOLTAGE INPUTS**
- Operating range: 690VAC line-to-line, 400VAC line-to-neutral
- Direct input and input via PT: up to 790VAC line-to-line, up to 460VAC line-to-neutral
- Input impedance: 1000 kΩ
- Burden for 400V: < 0.4 VA
- Burden for 120V: < 0.04 VA
- Over-voltage withstands: 1000 VAC continuous, 2000 VAC for 1 second
- Wire size: up to 12 AWG (up to 3.5 mm²)

**CURRENT INPUTS (Via CT)**
- Wire size: 12 AWG (up to 3.5 mm²)
- Galvanic isolation: 3500 VAC

**5A SECONDARY or 5A REMOTE SENSOR (RSS)**
- Operating range: Continuous 10A RMS
- Burden: < 0.2 VA @ In=5A (with 12AWG wire and 1 m long)
- Overload withstand: 15A RMS continuous, 300A RMS for 1 second (with 12AWG section wire)

**1A SECONDARY**
- Operating range: Continuous 2A RMS
- Burden: < 0.02 VA @ In=1A (with 12AWG wire and 1 m long)
- Overload withstand: 3A RMS continuous, 80A RMS for 1 second (with 12AWG section wire)

**HACS REMOTE SENSORS**
- Depends on sensor rating. See HACS datasheet

**SAMPLING RATE MEASUREMENT**
- Sampling rate: 128 samples/cycle
### OPTIONAL RELAY OUTPUTS

#### ELECTROMECHANICAL RELAY

Dry Contact, Option (4DI/DO or 12DI/DO Optional module)

2 or 4 relays rated at 5A/250 VAC; 5A/30 VDC, 1 contact (SPST Form A)

- **Galvanic isolation**: Between contacts and coil: 3000 VAC 1 min  
  Between open contacts: 750 VAC
- **Operate time**: 10 ms max
- **Release time**: 5 ms max
- **Update time**: 1 cycle
- **Wire size**: 14 AWG (up to 1.5 mm²)

#### SOLID STATE RELAY OPTION

(4DI/2DO Optional Module)

2 relays rated at 0.15A/250 V AC/DC, 1 contact (SPST Form A)

- **Galvanic isolation**: 3750 VAC 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 mm²)

### OPTIONAL DIGITAL INPUTS

4 or 12 Digital Inputs (4DI/2DO or 12DI/4DO Optional module) Dry Contacts, internally wetted @ 24VDC or Wet contact @ 250VDC (12DI/4DO only)

- **Sensitivity**: Open @ input resistance >100 kΩ, Closed @ input resistance < 100 Ω
- **Galvanic isolation**: 3750 VAC 1 min
- **Internal power supply**: 24VDC, 4DI/2DO or 12DI/4DO
- **External power supply**: 250V DC (12DI/4DO only)
- **Scan time**: 1 ms
- **Connector type**: Removable, 5 pins
- **Wire size**: 14 AWG (up to 1.5 mm²)

### OPTIONAL ANALOG OUTPUTS

4 Analog Outputs optically isolated (AO Optional module)

- **Ranges** (upon order):
  - ±1 mA, maximum load 5 kΩ (100% overload)
  - 0-20 mA, maximum load 510 Ω
  - 4-20 mA, maximum load 510 Ω
  - 0-1 mA, maximum load 5 kΩ (100% overload)
- **Isolation**: 2500 VAC 1 min
- **Power supply**: Internal
- **Accuracy**: 0.5% FS
- **Update time**: 1 cycle
- **Connector type**: Removable, 5 pins
- **Wire size**: 14 AWG (up to 1.5 mm²)

### COMMUNICATION PORTS

#### COM1

RS-485 optically isolated port

- **Isolation**: 3000 VAC 1 min
- **Baud rate**: up to 115.2 kbps
- **Supported protocols**: Modbus RTU, DNP3, and SATEC ASCII
- **Connector type**: Removable, 3 pins
- **Wire size**: Up to 14 AWG (up to 1.5 mm²)

#### COM2 (Optional module)

ETHERNET PORT

Transformer-isolated 10/100BaseT Ethernet port.

- **Supported protocols**: Modbus/TCP (Port 502), DNP3/TCP (Port 20000)
- **Number of simultaneous connections**: 4 (2 Modbus/TCP + 2 DNP3/TCP)
- **Connector type**: RJ45 modular

GPRS PORT

- **Supported protocols**: Modbus/TCP (Port 502)
- **Connector type**: SMA
### Profibus DP (IEC 61158)

- **RS-485 optically isolated Profibus interface**
- **Connector type**: Removable, 5 pins
- **Baud rate**: 9600 bit/s – 12 Mbit/s (auto detection)
- **32 bytes input, 32 bytes output**
- **Supported protocols**: PROFIBUS DP

### RS-232/422-485 PORT

- **RS-232 or RS-422/485 optically isolated port**
- **Isolation**: 3000 VAC 1 min
- **Baud rate**: Up to 115.2 kbps
- **Supported protocols**: Modbus RTU, DNP3, and SATEC ASCII
- **Connector type**: Removable, 5 pins for RS-422/485 and DB9 for RS-232
- **Wire size**: Up to 14 AWG (up to 1.5 mm2)

### Standards Compliance

#### Accuracy

- Complies IEC62053-22, class 0.5S
- Meets ANSI C12.20 –1998, class 10 0.5%

#### Electromagnetic Immunity

- Comply 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

- Comply with IEC 61000-6-4: Radiated/Conducted class A
- Comply with IEC CISPR 22: Radiated/Conducted class A

#### Safety/Construction

- Meets IEC 61010-1: 2006

#### AC and Impulse Insulation

- Comply with IEC 62052-11: 2500 VAC during 1 minute
- 6KV/500Ω @ 1.2/50 µs impulse
### PM135 Order String

**MODEL**
- Power Version: PM135P
- Energy and Harmonic Version: PM135EH
- Energy Only: PM135E

**OPTIONS**

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<th>5 Ampere</th>
<th>5</th>
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<tr>
<td>1 Ampere</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>5A split core remote high accuracy current sensor (HACS)</td>
<td>RS5</td>
<td></td>
</tr>
<tr>
<td>High Accuracy Current Sensors (HACS). Requires ordering of 3 HACS (see HACS Order String on next page)</td>
<td>HACS</td>
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**Calibration at Frequency**
- 25 Hz: 25HZ
- 50 Hz: 50HZ
- 60 Hz: 60HZ
- 400 Hz: 400HZ

**Resolution**
- Low Resolution 1A, 1V: -
- High Resolution 0.01A, 0.1V: H

**Power Supply**
- 85-265V AC and 85-290V DC: ACDC
- 9.5-18V DC: 1DC
- 18.5-58V DC (24VDC, 48VDC): 23DC

**Communication Protocol**
- Modbus and DNP 3.0: -
- Modbus and IEC 60870-101/104: 870

**Display Language**
- English: EN
- Russian: RU
- Spanish: ES

**Mounting**
- Panel Mount (standard): -
- DIN Rail Mounting: DIN

**Expansion Module**
(Max. 1 module per instrument, can be ordered separately)
- 4 Analog Outputs: ±1mA: AO1, ±2mA: AO2, 0-20mA: AO3, 0-4mA: AO4, 0-3mA: AO5, ±3mA: AO6, 0-5mA: AO7, ±5mA: AO8
- Communication: Ethernet (TCP/IP): ETH
- Communication: PROFIBUS: PRO
- Communication: GPRS: GPRS
- Communication: RF (see note)*: RF-x
- 4 Digital Inputs (Dry Contact) / 2 Relay Outputs 250V / 5A AC: DIOR
- 4 Digital Inputs (Dry Contact) / 2 SSR Outputs 250V / 0.1A AC: DIOS
- 4 Digital Inputs (Dry Contact) / TOU / RTC Battery: TOD
- 12 Digital Inputs (Dry Contact) / 4 Relay Outputs 250V/5A AC: 12DIOR-DRC
- 12 Digital Inputs (250VDC) / 4 Relay Outputs 250V/5A AC: 12DIOR-250V
- 12DIOR-DRC with Ethernet: 12DIOR-DRC-ETH
- 12DIOR-250V with Ethernet: 12DIOR-250V-ETH
- 12DIOR-DRC with RS-485: 12DIOR-DRC-485
- 12DIOR-250V with RS-485: 12DIOR-250V-485
RF Accessories (see note)

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<tr>
<td>Concentrator - ROW</td>
<td>CON-ROW</td>
</tr>
<tr>
<td>Concentrator External for 2 x ETC2002</td>
<td>CON-EXT</td>
</tr>
<tr>
<td>Repeater</td>
<td>REP</td>
</tr>
<tr>
<td>Antenna 1: without cable (module or concentrator)</td>
<td>AN-1</td>
</tr>
<tr>
<td>Antenna 2: with 2M cable (module or concentrator)</td>
<td>AN-2</td>
</tr>
<tr>
<td>Antenna 3: external for concentrator only</td>
<td>AN-3</td>
</tr>
<tr>
<td>Antenna 4: external for module or concentrator</td>
<td>AN-4</td>
</tr>
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**Note:** RF module and accessories are available in certain regions only. Please consult your local supplier.

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**HACS (High Accuracy Current Sensors) Order String**

**High Accuracy Current Sensors**

SATEC Proprietary High Accuracy Current Sensors (HACS) designed to be used with our HACS-ready meters and analyzers.

SATEC current sensors have several benefits over CTs:
1. High accuracy
2. Wide bandwidth (for harmonics measurement)
3. Safe to use - no need for shorting bars
4. Longer cable - up to 200m without performance reduction

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<th>Ampereage</th>
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<th>Hole Dimension</th>
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<tr>
<td>100A</td>
<td>Solid Core HACS</td>
<td>Ø12mm hole</td>
<td>CS1</td>
</tr>
<tr>
<td>100A</td>
<td>Solid Core HACS</td>
<td>Ø23mm hole</td>
<td>CS1L</td>
</tr>
<tr>
<td>100A</td>
<td>Split Core HACS</td>
<td>Ø16mm hole</td>
<td>CS1S</td>
</tr>
<tr>
<td>200A</td>
<td>Split Core HACS</td>
<td>26x23.8mm hole</td>
<td>CS2S</td>
</tr>
<tr>
<td>200A</td>
<td>Split Core HACS</td>
<td>23x33mm hole</td>
<td>CS2SL</td>
</tr>
<tr>
<td>400A</td>
<td>Solid Core HACS</td>
<td>Ø26mm hole</td>
<td>CS4</td>
</tr>
<tr>
<td>400A</td>
<td>Split Core HACS</td>
<td>23x33mm hole</td>
<td>CS4S</td>
</tr>
<tr>
<td>800A</td>
<td>Solid Core HACS</td>
<td>100x32mm / Ø62mm hole</td>
<td>CS8</td>
</tr>
<tr>
<td>800A</td>
<td>Split Core HACS</td>
<td>80x50mm hole</td>
<td>CS8S</td>
</tr>
<tr>
<td>1200A</td>
<td>Split Core HACS</td>
<td>80x121mm hole</td>
<td>CS12S</td>
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