

## PM135 DATASHEET



### Multi-Functional Power Meter

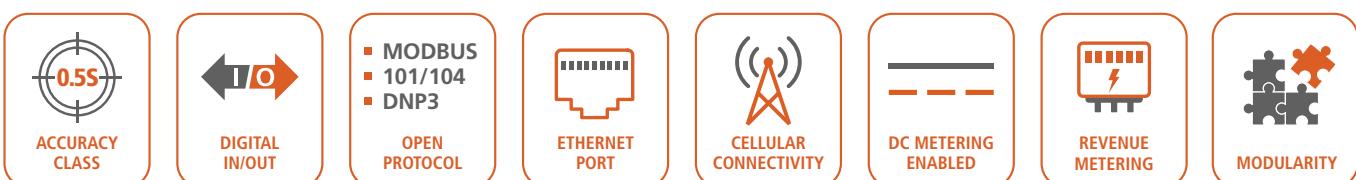
The PM135 is a compact multi-function power-meter, designed for metering three-phase AC current circuits.

Featuring versatile I/O options, communication ports and protocols it is suitable for integration in utility substation or industrial SCADA systems.

### HIGHLIGHTS

- **Accuracy:** Class 0.5/0.5S per ANSI / IEC 62053-22
- **Communication:**
  - Built-in port: standard RS-485
  - Optional ports: ETH; 3G/4G cellular; Profibus
  - Open protocol: Modbus RTU, DNP3.0, IEC 60870-5-101/104
- **Digital and Analog I/O Modules:** up to 16 I/O
- **Dual Mounting:** suitable for 4-inch round and 92x92mm square cutouts
- **Broad-range frequency measurement:** 25-400 Hz
- **LED Bar-graph:** Displays load as percentage of nominal current

### MODULAR VERSATILITY



## FEATURES

### MULTIFUNCTIONAL 3-PHASE POWER METER

- ▶ True RMS volts, amps, power, power factor, neutral current, angles and unbalance for voltage and current, frequency, symmetrical components and many more
- ▶ Ampere/Volt demand meter
- ▶ 25, 50, 60 and 400 Hz measurements @ 3 decimal digit values
- ▶ 128 samples per cycle

### BILLING/TOU ENERGY METER (PM135E & PM135EH)

- ▶ Accuracy Class 0.5S per IEC 62053-22 and Class 0.2 per IEC 61557-12
- ▶ 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,
- ▶ Easy programmable tariff calendar schedule
- ▶ Automatic daily energy and maximum demand profile log for total energy and tariff registers

### HARMONIC ANALYZER (PM135EH)

- ▶ individual voltage & current harmonic spectrum and harmonic angles up to 40<sup>th</sup> order harmonic
- ▶ Voltage and current THD, TDD and K-Factor

### REAL-TIME WAVEFORM CAPTURE

- ▶ Real-time “scope mode” waveform monitoring via PAS software

## MODELS

**PM135P** Basic model offering voltage, current, power and frequency measurements

**PM135E** Offers all the features above, as well as energy measurements and data logging (available in certain regions only).

**PM135EH** Offers all the features above, as well as harmonic analysis

All models offer identical communication and control features.

### PROGRAMMABLE LOGICAL CONTROLLER

- ▶ Embedded programmable controller
- ▶ 16 control setpoints; programmable thresholds and delays
- ▶ Relay output control
- ▶ 1-cycle response time

### EVENT AND DATA RECORDING (PM135E & PM135EH)

- ▶ Non-volatile memory for timestamped event and data recording: 48 days for 2 daily TOU records, half-hourly writing of 4 parameters and recording over 100 events during the entire period
- ▶ Event recorder for logging internal diagnostic events and setup changes
- ▶ Two data recorders; programmable data logs on a periodic basis; automatic daily energy log and maximum demand profile

## VOLTAGE INPUT OPTIONS

- ▶ Direct Measurement: 0-690V AC

## CURRENT OPTIONS

- ▶ 1A or 5A inputs from CT secondary
- ▶ 40mA input designed for [SATEC HACS CTs](#) (100-3000A options)
- ▶ RS: unique input for 5A rated HACS CT

## I/O OPTIONS

- ▶ **4DIOR:** 4 digital inputs and 2 relay outputs with 1-cycle update time; unlatched, latched, pulse and KYZ operation; energy pulses, selection of solid state or electromechanical relays
- ▶ **12DIOR:** 12 digital inputs, 4 relay outputs (incl. optional ETH port or additional RS485 port)
- ▶ **4AO:** four optically isolated analog outputs with an internal power supply; selection of 0-20mA, 4-20mA, 0-1mA, ±1mA, 0-3mA, ±3mA, 0-5mA and ±5mA output; 1 cycle update time.
- ▶ **8DI:** eight digital inputs with 1-ms scan time

## COMMUNICATION

- ▶ On-board interface
  - Standard 2-wire RS-485
- ▶ Optional interfaces
  - ETH (10/100Base T)
  - 2G/3G cellular modem
  - Multipurpose RS-232/422/485
  - PROFIBUS
  - RF (certain regions only)
- ▶ Client (Modbus/TCP over ETH or 3G/4G)
  - TCP notification client for communicating events or periodic reports to remote server
  - Expertpower client on subscription basis
- ▶ Communication protocols
  - Modbus RTU
  - SATEC ASCII
  - DNP 3.0 (Level 2)
  - IEC 60870-5-101 (optional)
  - IEC 60870-5-104 (optional)

## DISPLAY

- ▶ 3x2" / 76x49mm backlit LCD display
- ▶ Adjustable display brightness and update rate
- ▶ Auto-scroll option with adjustable page; auto-return to a default page
- ▶ LED bar-graph displaying load as percentage of nominal load current (user-definable)

#### METER SECURITY

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

#### UPGRADEABLE FIRMWARE

- ▶ Device firmware is easily upgraded through the serial or Ethernet port

#### SOFTWARE SUPPORT

- ▶ SATEC's Power Analysis Software (PAS) for comprehensive configuration and data acquisition is available for download (free): [www.satec-global.com/power-analysis-software](http://www.satec-global.com/power-analysis-software). Always make sure to update .exe file with latest version on webpage
- ▶ SATEC's Expertpower web-based energy management platform (subscription). Please visit [www.satec-global.com/Expertpower](http://www.satec-global.com/Expertpower)
- ▶ Any 3<sup>rd</sup> party software supporting open-protocol

#### REAL-TIME CLOCK

- ▶ Internal clock with 20-second retention time with battery backup

#### UNIQUE DESIGN

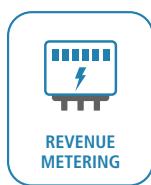
- ▶ Pass through CT connection
- ▶ Built-in auxiliary terminal for loose CT wires.
- ▶ Dual panel mounting:  
92x92mm square or 4" round cutout



#### APPLICATIONS



ENERGY MANAGEMENT



REVENUE METERING



SCADA READY



INDUSTRIAL MONITORING



RENEWABLE ENERGY

## TECHNICAL SPECIFICATIONS

### INPUT RATINGS

#### VOLTAGE INPUTS

Installation	Category III
Nominal voltage (L-N/L-L)	57/100V AC 230/400V AC 400/690V AC
Operating range (L-N/L-L)	Direct input and input via PT 15- 480V AC / 15-828V AC
Burden for 400V	< 0.4 VA
Burden for 120V	< 0.04 VA
Over-voltage withstand	1000V AC continuous, 2000V AC for 1 second
Input impedance	1 MΩ
Wire size	up to 12 AWG (up to 3.5mm²)

#### CURRENT INPUTS (VIA CT)

Wire size	12 AWG (up to 3.5 mm²)
Galvanic isolation	3500V AC

#### 5A SECONDARY

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/RS5 REMOTE SENSORS

Depends on sensor rating. See HACS datasheet

### SAMPLING RATE MEASUREMENT

Sampling rate	128 samples/cycle
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### POWER SUPPLY

120/230V AC-DC Option	» Rated input: 88-290V DC 85-265V @ 50/60/400 Hz Burden: 9VA Isolation: 1500V DC » Input to ground: 2500V AC
12V DC Option	» Rated input: 9.5-18V DC, Burden 4VA » Isolation: 1500V DC
24/48V DC Option	» Rated input: 18.5-58V DC, Burden 4VA » Isolation: 1500V DC » Wire size: up to 12 AWG (up to 3.5 mm²)

### OPTIONAL MODULAR I/O

#### ELECTROMECHANICAL RELAY

Dry Contact: 1 contact (SPST Form A)

Rating	5A/250V AC 5A/30V DC
Galvanic isolation	» Between contacts and coil: 3000V AC @ 1 min » Between open contacts: 750V AC
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

Dry contact, 1 contact (SPST Form A)

Rating	0.15A/250V AC/DC
Galvanic isolation	3750V AC @ 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)

**DIGITAL INPUTS**

Dry Contacts, internally wetted @ 24V DC or Wet contact @ 250V DC (12DI/4DO only)

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

**ANALOG OUTPUTS**

Ranges (upon order)	» ±1 mA, max. load 5 kΩ (100% overload) » 0-20 mA, max. load 510 Ω » 4-20 mA, max. load 510 Ω » 0-1 mA, max. load 5 kΩ (100% overload)
Isolation	2500V AC @ 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 mm <sup>2</sup> )

**COMMUNICATION PORTS****COM1**

(built in)

RS-485 optically isolated port	
Isolation	3000V AC @ 1 min
Baud rate	up to 115.2 kbps
Supported protocols	Modbus RTU, DNP3, SATEC ASCII, IEC 60870-5-101
Connector type	Removable, 3 pins
Wire size	Up to 14 AWG (up to 1.5 mm <sup>2</sup> )

**COM2 (OPTIONAL MODULE)****ETHERNET PORT**

(as independent module OR add-on to 12DIOR module)

Transformer-isolated 10/100BaseT Ethernet port	
Supported protocols	Modbus/TCP (Port 502), IEC 60870-5-104, DNP3/TCP (Port 20000)
Num. of simultaneous connections	4 (2 Modbus/TCP + 2 DNP3/TCP)
Connector type	RJ45 modular

**CELLULAR PORT**

Supported protocols	Modbus/TCP (Port 502), DNP3/TCP (Port 20000)
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	3000V AC @ 1 min
Baud rate	Up to 115.2 kbps
Supported protocols	Modbus RTU, DNP3, SATEC ASCII, IEC 60870-5-101
Connector type	Removable, 5 pins for RS-422/485 and DB9 for RS-232
Wire size	Up to 14 AWG (up to 1.5 mm <sup>2</sup> )

**REAL TIME CLOCK**

- » Battery-backed clock
- » Accuracy—typical error:  
7 seconds per month @ 25°C (±2.5ppm)
- » Typical clock retention time: 36 months

**DISPLAY**

3x2" / 76x49mm backlit LCD display
3 color LED load bar graph (40-110%)
Keypad                            6 push buttons

**ENVIRONMENTAL CONDITIONS**

Operating range:	
- Unit (stand-alone)	-30°C to 70°C (-22°F to 158°F)
- Unit with add-on modules	-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% non-condensing

**CONSTRUCTION**

Weight	0.70kg (1.54 lb.)
Dimensions [HxWxD]	114x114x109mm (4.5x4.5x4.3")

**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)

**STANDARDS COMPLIANCE****ACCURACY**

- Complies with IEC62053-22, class 0.5S
- Meets ANSI C12.20 –1998, class 10 0.5%
- Complies with IEC 61557-12 (PMD):
  - Total Apparent Power      0.2%
  - Total Active Energy       0.5/0.2%
  - Total Reactive Energy     0.5%
  - Frequency                  0.05%
  - Current                    0.2%
  - Neutral Current          0.2%
  - Voltage                   0.2%
  - Power Factor            0.2%
  - THDV, THDI                1%

**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 A
- Complies with IEC CISPR 22:
  - Radiated/Conducted class A

**SAFETY/CONSTRUCTION**

- UL File no. E236895
- Meets IEC 61010-1: 2006

**AC AND IMPULSE INSULATION**

- Complies with IEC 62052-11:
  - 2500V AC during 1 minute
- 6KV/500Ω @ 1.2/50 μs impulse

## ORDER STRING

## MODELS

Power Version	<b>PM135P</b>
Energy Only	<b>PM135E</b>
Energy and Harmonic Version	<b>PM135EH</b>

## OPTIONS

## CURRENT INPUTS

5 Ampere	<b>5</b>
1 Ampere	<b>1</b>
5A split core remote high accuracy current sensor (HACS), 50/60Hz only	<b>RS5</b>
High Accuracy Current Sensors (HACS), 50/60Hz only. Requires ordering of 3 HACS	<b>HACS</b>

## CALIBRATION AT FREQUENCY

25 Hz*	<b>25HZ</b>
50 Hz	<b>50HZ</b>
60 Hz	<b>60HZ</b>
400 Hz*	<b>400HZ</b>

## DISPLAY RESOLUTION

Low Resolution 1A, 1V	<b>-</b>
High Resolution 0.01A, 0.1V	<b>H</b>

## POWER SUPPLY

85-265V AC and 85-290V DC	<b>ACDC</b>
9.5-18V DC	<b>1DC</b>
18.5-58V DC (24V DC, 48V DC)	<b>23DC</b>

## COMMUNICATION PROTOCOL

Modbus and DNP 3.0	<b>-</b>
Modbus and IEC 60870-5-101/104**	<b>870</b>

## MOUNTING

Panel Mount (standard)	<b>-</b>
DIN Rail Mounting	<b>DIN</b>

## TESTING AND CERTIFICATE

Full functional test, calibration at various work loads & detailed test report	<b>-</b>
All of the above plus ISO 17025 and ILAC certified calibration certificate	<b>CC</b>

## NOTES

\* Supported by 1A and 5A models only

\*\* -104 requires ETH, does NOT work over cellular network

**EXPANSION MODULE \*****ANALOG OUTPUTS**

4 Analog Outputs: ±1mA	AO1
4 Analog Outputs: 0-20mA	AO2
4 Analog Outputs: 0-1mA	AO3
4 Analog Outputs: 4-20mA	AO4
4 Analog Outputs: 0-3mA	AO5
4 Analog Outputs: ±3mA	AO6
4 Analog Outputs: 0-5mA	AO7
4 Analog Outputs: ±5mA	AO8

**ADDITIONAL COMMUNICATION PORTS**

Communication: Ethernet (TCP/IP)	ETH
Communication: PROFIBUS	PRO
Communication: RS232/422/485	RS232
Communication: 2G/3G GSM Modem**	T3G
Communication: 4G Modem ** x: G=Europe; V=Verizon (US); A=AT&T (US); T=Telstra (AUS)	T4x
Communication: RF	RF-x-y

**DIGITAL INPUTS**

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
8 Digital Inputs (Dry Contact)	8DI
12 Digital Inputs / 4 Relay Outputs 250V/5A AC	12DIOR
Digital Inputs Rating - Dry Contact (DRC), 48V, 125V or 250V	DRC or 48V or 125V or 250V

**12 DIOR module communication port:**

None	-
RS-485	485
Ethernet	ETH
CAN	CAN

**NOTES**

- \* Max. 1 module per instrument. Can be ordered separately.
- \*\* Does not support 870 protocol. Supplied with bendable antenna.