SATEC

PM135

DATASHEET

HIGHLIGHTS

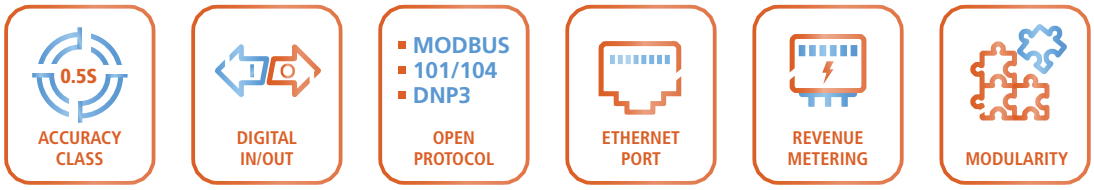
- **Accuracy**: Class 0.5/0.5S per ANSI / IEC 62053-22
- **Communication**:
  - Built-in port: standard RS-485
  - Optional ports: ETH; Profibus
  - Open protocol: Modbus RTU, DNP3.0, IEC 60870-5-101/104
- **Digital and Analog I/O Modules**: up to 16 I/O
- **Dual Mounting**: suitable for 4'' round and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

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.

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

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.

HARMONIC ANALYZER (PM135EH)

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

REAL-TIME WAVEFORM CAPTURE

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

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.
  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
- Any 3rd 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:
  92×92mm square or 4" round cutout

APPLICATIONS

TECHNICAL SPECIFICATIONS

INPUT RATINGS

VOLTAGE INPUTS

Installation	Category III
Nominal voltage (L-N/L-L)	100/400V AC 230/400V AC 400/690V AC
Operating range (L-N/L-L)	Nominal voltage + 25% tolerance
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	2,500V

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	up to 256

POWER SUPPLY

120/230V AC-DC Option	» Rated input: 88-290V DC 220V AC @ 50/60 Hz » with +20% / -50% tolerance 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 mm²)

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 k Ω (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 mm²)

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 mm²)

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
Isolation	1,500V DC @ 1min

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 mm²)

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 [H×W×D]	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)

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	**PM135P**
Energy Only	**PM135E**
Energy and Harmonic Version	**PM135EH**

OPTIONS

CURRENT INPUTS	
5 Ampere	**5**
1 Ampere	**1**
5A split core remote high accuracy current sensor (HACS), 50/60Hz only	**RS5**
High Accuracy Current Sensors (HACS), 50/60Hz only. Requires ordering of 3 HACS	**HACS**
CALIBRATION AT FREQUENCY	
25 Hz*	**25HZ**
50 Hz	**50HZ**
60 Hz	**60HZ**
400 Hz*	**400HZ**
DISPLAY 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 (24V DC, 48V DC)	**23DC**
COMMUNICATION PROTOCOL	
Modbus and DNP 3.0	**-**
Modbus and IEC 60870-5-101/104**	**870**
MOUNTING	
Panel Mount (standard)	**-**
DIN Rail Mounting	**DIN**
TESTING AND CERTIFICATE	
Full functional test, calibration at various work loads & detailed test report	**-**
All of the above plus ISO 17025 and ILAC certified calibration certificate	**CC**

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: 0-5mA	**AO7**
4 Analog Outputs: ±5mA	**AO8**
ADDITIONAL COMMUNICATION PORTS	
Communication: Ethernet (TCP/IP)	**ETH**
Communication: PROFIBUS	**PRO**
Communication: RS232/422/485	**RS232**
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**

12DIOR- ____ ____

NOTES

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