SATEC

PM130 PLUS
DATASHEET

MULTI-FUNCTIONAL POWER METER

The PM130 PLUS is a compact, multi-function power-meter, designed for metering three-phase AC current or three DC current circuits.

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

DC METERING

The meter features unique high-accuracy direct metering of DC systems (via shunt resistors).

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
- **DC Enabled:** metering DC loads via shunt resistors
- **Broad-range frequency measurement:** 25-400 Hz
- **LED Bar-graph**: Displays load as percentage of nominal current

MODULAR VERSATILITY

0.5S ACCURACY CLASS

DIGITAL IN/OUT

MODBUS
101/104
DNP3
OPEN PROTOCOL

ETHERNET PORT

DC METERING ENABLED

MODULARITY

FEATURES

MULTI-FUNCTIONAL 3-PHASE POWER METER

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

BILLING/TOU ENERGY METER (PM130E & PM130EH)

- **Accuracy:**
  - Class 0.5S per IEC 62053-22
  - Class 0.2 per IEC 61557-12
  - Class 0.5 per ANSI C12.20, 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 (PM130EH)

- 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

MODELS

PM130P Basic model offering voltage, current, power and frequency measurements

PM130E Offers all the features above, as well as energy measurements and data logging (available in certain regions only)

PM130EH 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 (PM130E & PM130EH)

- 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
  0-670V DC*
  * extended range up to 1500V DC is possible via SATEC VRM

CURRENT OPTIONS

- 1A or 5A inputs from CT secondary
- 40mA input designed for SATEC HACS CTs (100-3000A options)
- DC metering: current measurements using Hall Effect Sensors. meter accuracy: 0.5%. System accuracy set by implemented sensor
- RS: unique input for 5A rated HACS CT

DIGITAL AND ANALOG I/O

Available I/O modules:

- **TOD (TOU+4DI)**: four digital inputs with 1-ms scan time and battery backup for real time clock; automatic recording of last five digital input change events with timestamps (see the PM130 PLUS Modbus Reference Guide)
- **DIOR**: 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, and ±1mA 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)
  - Multipurpose RS-232/485
  - PROFIBUS
- Client (Modbus/TCP over ETH)
  - 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

- Easy to read 3-row (2x4 digits + 1x5 digits) bright LED 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): https://www.satec-global.com/products/pas/
  Always make sure to update .exe file with latest version on webpage

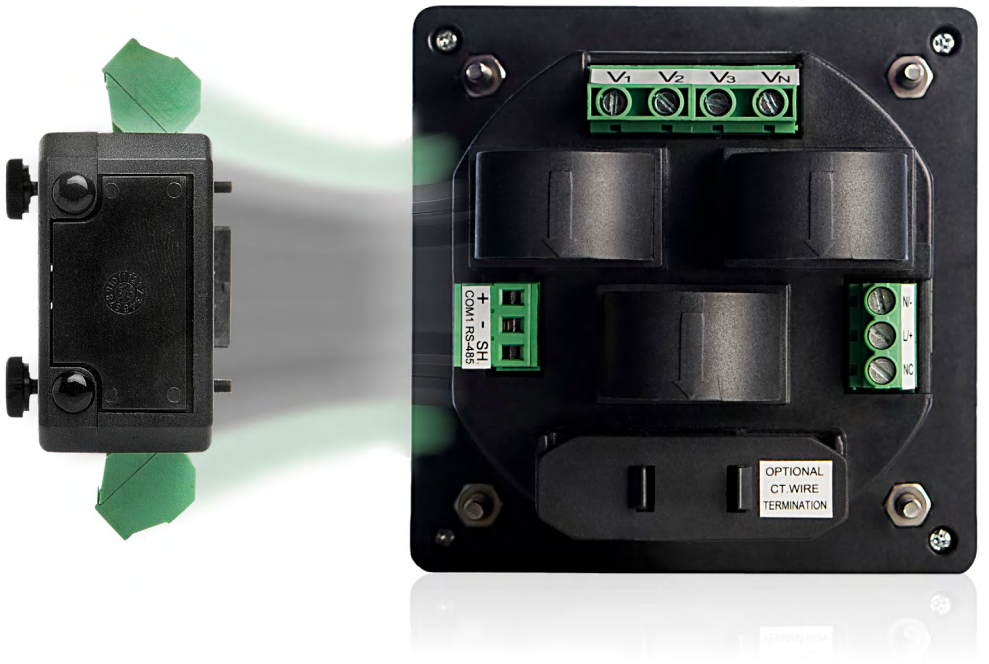
- Expertpower web-based energy management platform (subscription)
  Please visit https://www.satec-global.com/products/expertpower/
- Any 3rd party software supporting open-protocol

REAL-TIME CLOCK

- Internal clock with 20-second retention time
- Optional battery backup (TOU+4DI module)

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

RENEWABLE ENERGY | ENERGY MANAGEMENT | REVENUE METERING | SCADA READY | INDUSTRIAL MONITORING

TECHNICAL SPECIFICATIONS

INPUT RATINGS

VOLTAGE INPUTS

Nominal voltage (L-N/L-L)	57.7/100V AC 120/208V AC 120/240V AC 230/400V AC 277/480V 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)

REMOTE SENSORS (HACS) / DC

HACS: Depends on sensor rating.
For details see HACS web page (datasheet available online)

DC: 40mA for Hall Sensors.
Current range is determined by sensor rating

SAMPLING RATE MEASUREMENT

Sampling rate	128 samples/cycle

* Measuring up to 3000V DC is possible via adapter

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 MODULAL 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

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 mm²)

ADDITIONAL SPECIFICATIONS

REAL TIME CLOCK

Standard Meter Clock	» Non-backed clock » Accuracy—typical error: @ 1 minute per month @ 25°C » Typical clock retention time: 30 seconds
TOU Module Meter Clock	» Battery-backed clock » Accuracy—typical error: 7 seconds per month @ 25°C (±2.5ppm) » Typical clock retention time: 36 months

DISPLAY

High-brightness seven-segment digital LEDs, two 4-digit + one 5 digit windows	
3 color LED load bar graph (40-110%)	
Keypad	6 push buttons

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% non-condensing
Front panel IP	54

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	**PM130P-PLUS**
Energy Only	**PM130E-PLUS**
Energy and Harmonic Version	**PM130EH-PLUS**

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**
DC current measurement; designed for shunt resistor output, up to 100 mV	**DCC**

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

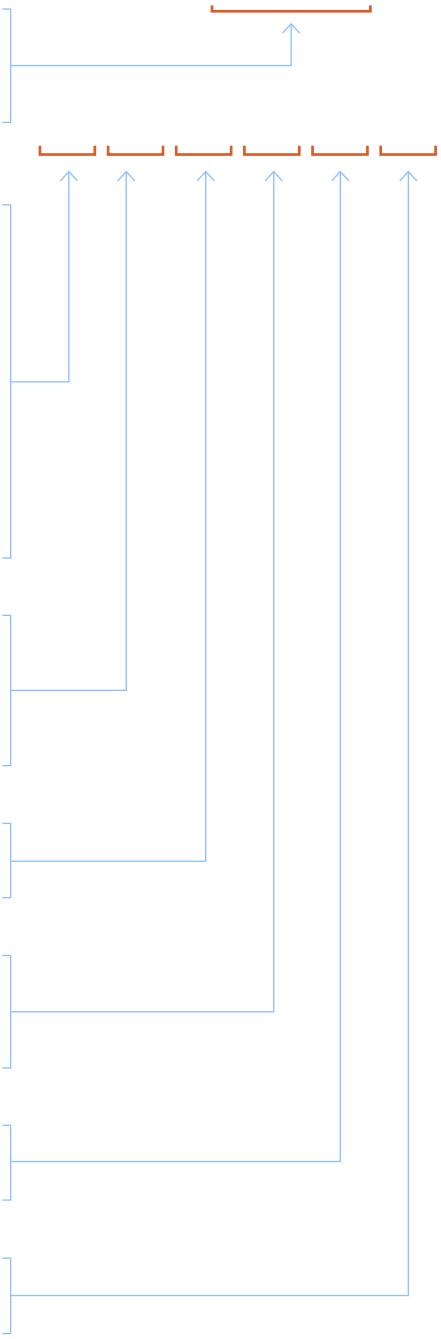
85-265V AC and 85-290V DC	**ACDC**
9.5-18V DC	**1DC**
18.5-58V DC (24V DC, 48V DC)	**23DC**

COMMUNICATION PROTOCOL

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

MOUNTING

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



NOTES

* Supports 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**
4 Digital Inputs (Dry Contact) / TOU / RTC Battery	**TOD**
8 Digital Inputs (Dry Contact)	**8DI**

12 DI 4 RO MODULE

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**

12DIOR-

NOTES

* Max. 1 module per instrument. Can be ordered separately.

** Does not support 870 protocol. Supplied with bendable antenna.