SATEC PM180

PM180 DATASHEET

Class A Multi-Purpose Analyzer

The PM180 is a high performance power quality analyzer which can simultaneously host several applications.

Versatile functionality is enabled by a unique modular design, allowing the hot-swap of a variety of add-on cards.

Thus, the analyzer combines and substitutes multiple other devices, saving cost and space and mitigating complexity.

HIGHLIGHTS

- **Accuracy**: Class 0.2 / 0.2S per IEC 62053-22 / ANSI (* Class 0.2S Revenue/Check Meter)
- **Communication**
  - IEC 61850; IEC 60870-5-101/104; DNP3; Modbus
  - Interfaces: RS485; ETH
  - Optional ports: IRIG-B; 2nd ETH; 3G/4G cellular; Fiber Optic ETH (TXFX)
- **Fast Transient Sampling**
  Transient Recorder: 1024 samples/cycle
- **Control**
  I/O: Up to 48 digital and analog I/O

APPLICATIONS

- Class A (Ed. 3) power quality analyzer
- IEC 61850 for the digital substation
- Fault Recorder (In X 40)
- Phasor Measurement Unit per IEEE C37.118.1, P-Class and M-Class
- Bay Controller
- Sequence of Events
- Class 0.2S Revenue grade accuracy for check meter functionality

SATEC PM180

Standard communication: Ethernet, RS-485, USB & IRIG-B

Wide range of digital & analog I/Os

Auxiliary PS

Four galvanically isolated voltage channels

Four galvanically isolated current channels up to 40xIn

PM180 + RGM180

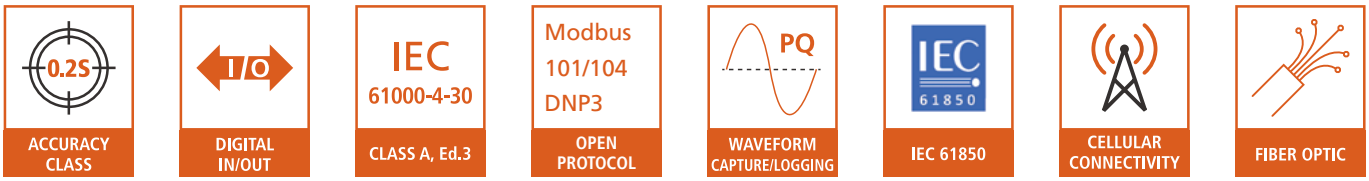
PM180 + RDM180

APPLICATIONS

- POWER QUALITY
- SUBSTATION AUTOMATION
- FAULT RECORDER
- PMU/WAMS
- INDUSTRIAL MONITORING
- RENEWABLE ENERGY
- SCADA READY

SATEC PM180

FEATURES



MULTI-FUNCTION POWER & ENERGY METER

- Real-time cycle-by-cycle measurement of true RMS voltage, current, power, demand & energy
- Exceeding Class 0.2S accuracy for energy metering (kWh, per IEC 62053-22 / ANSII C12.20)
- Advanced Time of Use (TOU) feature: 16 Energy sources, including external digital pulses, up to 4 seasons, 4 daily profiles and 8 Tariffs changes per day; flexible automatic 10-year calendar; suitable for complex billing schemes
- KYZ or KY output
- LED indicator for calibration and testing (via optional display)
- Vector diagram and symmetrical components
- IRIG-B / SNTP / DI time synchronization
- 256 MB memory for data-logging
- 4 decimal resolution for frequency readings

POWER QUALITY

- Power quality analysis in full compliance with IEC 61000-4-30 Class A, Edition 3 (2015)
- Sags/Swells (dips / overvoltage), interruptions, frequency variations, voltage variations
- Flicker (according to IEC 61000-4-15)
- Voltage unbalance
- Voltage and current individual harmonics (according to IEC 61000-4-7), interharmonics and directional power harmonics (load/source) up to the 63rd harmonic
- Voltage and current THD coefficients
- Symmetrical components
- Programmable thresholds and hysteresis
- Built-in statistics and reports per IEEE 1159, EN50160, GOST 13109 or GOST 54149 (market dependent)
- Redundant auxiliary power supply for recording major dips and interruptions
- V-I angle, current TDD coefficients and K-Factors
- Waveform, power factor & phasor data recorder
- Power quality event recorder
- Event recorder for logging internal diagnostic events, control events and I/O operations
- Selectable sampling rate up to 256 / 1024 (fast transients >78/65µs @ 50/60Hz)
- Disturbance Direction Detection: indicating upstream or downstream direction of sags and swells

IEC 61850

- IEC 61850 implemented per Edition 2
- Remote switch control and monitoring via IEC 61850 protocol
- Inter-device GOOSE communications for remote interlocking
- GOOSE Publisher Setup, GOOSE Subscriber Setup and Report Dead-bands
- Configuration of IEC 61850: IED properties, datasets and reports

BAY CONTROLLER (BCU)

- Monitoring and control capabilities for 2 circuit breakers and 14 circuit switches
- One-pole and three-pole switch position monitoring, using two or six contacts
- One control output for switch closing
- Two synchronous control outputs for switch opening devices with one and two opening coils
- Select-close control output for secure switch closing operations
- Two select-open control outputs for secure switch opening operations
- Configurable command pulse duration
- Option for adaptive pulses controlled via setpoint control logic
- Supervision of command execution & reporting on operation termination
- Interlocking logic
- Secure timed-out interlocking bypass logic
- Indication of non-controllable breaker trips
- Switch position substitution option
- Counting of breaker and switch operations
- Logging close / open operations and switch position changes
- Local switch control via setpoint control logic
- Configuration tools: PLC configurator based on IEC 61131-3 protocol, using Functional Block Diagram (FBD) or Ladder Diagram (LD)

DIGITAL FAULT RECORDER

- Programmable fault threshold and hysteresis
- Direct reading of fault currents of up to 200 Amps (40 X In, from CT secondary)
- Dual current inputs: from measurement CT and protection CT connection (optional)
- Zero-sequence currents and voltages
- Current and voltage unbalance
- Under-voltage, neutral current
- Ready-for-use fault reports—fault currents magnitude and duration, coincident volts magnitude, fault waveforms and RMS trace
- Selectable pre-fault / post-fault recording length
- Programmable post fault on any internal and/or external trigger condition
- Disturbance capture recording
- Distance to fault calculation
- Waveforms from multiple locations
- View faults and receive alerts via SATEC's Expertpower software platform: https://www.satec-global.com/ExpertPower

DISTANCE TO FAULT CALCULATION

Compensation for CT / PT errors, resulting in average accuracy of 0.5% (depending on PT, CT and time synchronization accuracy)

- Supported line configurations
  - Single line
  - Parallel lines
  - Partially parallel lines
  - A line with a branch
- Required parameters
  - Line/s configuration
  - Line/s parameters (impedance, length, etc.)
  - Compensation parameters for CT & PT
- Detected Faults
  - Three-phase short circuit
  - Two-phase short circuit
  - Two-phase short circuit to ground
  - Single-phase short circuit to ground
  - Single-phase open wire
- Fault detection information
  - Fault classification (type and phase/s)
  - Distance to fault (km or miles)
  - Duration of fault

PHASOR MEASUREMENT UNIT (PMU)

- IEEE C37.118.1 M-Class and P-Class
- IEEE C37.118.1 three-phase voltage and current phasor measurements synchronized to a common UTC time reference (e.g. GPS), using an IRIG-B timecode source or an IEEE 1588 PTPv2 master clock source
- IEEE C37.118.1 synchronous frequency and Rate of Change of Frequency (ROCOF) measurements
- Expected total vector error (TVE): less than 0.5%
- Streaming of phasor data over Ethernet using IEC 61850-9-2 multicast sampled value (SV)
- Streaming rate: from 1 to 50 or 60 frames/s @ 50 or 60Hz, respectively
- IEEE C37.118.2 commanded client-server UDP and TCP data transmission and spontaneous UDP data transmission over IP protocol
- Optional IEEE C37.118.2 frame extensions with analog data (total active, reactive and apparent power and power factor) and digital status data (up to 32 inputs)
- Streaming of phasor data over Ethernet using the IEC 61850-9-2 multicast sampled value (SV) service with IEEE C37.118.2 compliant mapping of synchrophasor data upon IEC 61850-9-2 and IEC 61850-90-5 guidelines

DATA LOGGING, WAVEFORM RECORDING & PLC PROGRAMMING

- Onboard memory: 256 MB
- Programmable controller: up to 64 control setpoints, up to 8 conditions OR, AND, arithmetical functions logic, extensive triggers, programmable thresholds and delays, relay control, event-driven data recording
- 8 fast waveform recorders: simultaneous 8 channel AC, one DC: up to 48 digital inputs in a single plot
- Waveform sampling rate: 32, 64, 128 or 256 samples per cycle; up to 20 pre-fault cycles (2 cycles of 1024 samples per cycle or 4 cycles with 512 samples per cycle with Transient Module)
- 3.5 min. of continuous waveform recording
- 1ms resolution for digital inputs
- 16 fast Data Recorders (16 parameters on each data log): From ½ cycle RMS to 2 hour RMS envelopes; up to 20 pre/post-fault cycles; programmable data logs on a periodic basis and on internal or external trigger
- 32 digital internal counters
- 16 programmable timers (½ cycle to 24 hours)

WIDE RANGE VOLTAGE INPUTS

- Three galvanically isolated AC voltage inputs. Impulse dielectric withstand: 6kV
- Nominal voltage: 100-828V AC (L-L)

WIDE RANGE CURRENT INPUTS

- 4 dual purpose current inputs (3 phase + Neutral current), calibrated to 1A or 5A nominal:
  - Class 0.2S revenue grade accuracy: up to 4 × nominal current (4A and 20A, respectively; designed for measurement CTs' secondary current)
  - Basic Fault current reading: up to 10 × nominal current (10A and 50A, respectively, designed for protection CTs' secondary current)
- Fault Recorder Modules:
  - Extended Fault Current reading: up to 40 × nominal current (200A, designed for protection CTs' secondary current)

COMMUNICATION INTERFACES

- Built-in: RS-485 and Ethernet
- Optional:
  - TXFX (fiber optic)
  - 2G/3G/4G cellular modem
  - 2nd Ethernet port

COMMUNICATION PROTOCOLS

- Modbus RTU, ASCII, DNP 3.0, IEC 60870-5-101/104
- Optional: IEC 61850

REAL-TIME CLOCK & SYNCHRONIZATION

- Real-Time Clock with maximum 5 seconds drift per month @ 25°C
- 1ms time resolution per IRIG-B time code input or satellite clock for common time base
- Periodic clock synchronization from an SNTP server, as SNTP client
- Time sync from digital input with 1ms accuracy

DIGITAL & ANALOG I/O MODULES

3 expansion slots for a wide range of plug-in modules, up to 48 DI / 24 DO / 12 AI / 12 AO or various combinations

- **DI16**: 16 high-speed digital inputs (dry contact or 24/125/250V DC)
- **RLY8**: 8
- **8DIOR**: 8 digital inputs (24/125/250V DC) and 4 digital outputs (Electro Mechanical Relay or Solid State Relay)
- **4AIO**: four analog inputs and four analog outputs (internal power supply); selection of 0-20mA, 4-20mA, 0-1mA or ±1mA output for inputs/outputs; ½ cycle update time

TECHNICAL SPECIFICATIONS

INPUT RATINGS

VOLTAGE INPUTS

MODEL WITH AUX. POWER SUPPLY	
Installation	Category III
Nominal voltage (L-N/L-L)	57/100V AC 277/480V AC 400/690V AC
Operating range	Direct input / input via PT up to 828V AC
Burden	480V L-N: 0.3VA 277V L-N: 0.1VA 120V L-N: 0.02VA
Over-voltage withstand	1000V AC continuous, 2500V AC @ 1 second
Galvanic isolation	4kV AC @ 1 min. Impulse dielectic withstand 6kV
Input impedance	1 MΩ
Wire size	up to 10 AWG (up to 6mm²)
Terminal Pitch	7.5 mm

CURRENT INPUTS

STANDARD INPUTS FROM CT SECONDARY	
Current ratings	» 1A input » 5A input
Guaranteed accuracy: » per IEC 62053-22 » per ANSI	 up to 2 X In @ Class 0.2S up to 4 X In @ Class 0.2
Continuous overload	up to 10 X above nominal currents
CONNECTION VIA SPLIT CORE SENSORS TO CT SECONDARY (HACS CS1S)	
Current ratings	» 1A input » 5A input
Continuous overload	up to 20 X above nominal currents
Burden	< 0.15 VA @ 5A < 0.02 VA @ 1A
HACS SENSORS	
40mA inputs, designated for SATEC's HACS (100-3,000A, see HACS product page)	
FLEX CLAMPS	
3V AC inputs for 3rd party flex clamps	

Attention: the device may house up to 3 additional modules of choice from those mentioned below.

POWER SUPPLY

MAIN POWER SUPPLY

Withstanding insulation	4kV AC @ 1mn
AD/DC POWER SUPPLY (STANDARD)	**L/+, N/- AND GND**
Rated input	50-290V AC (50/60 Hz) 90-290V DC Max. power 10W (Burden: <20VA)
Wire size	up to 12 AWG (2.5mm²)
Terminal pitch	7.5 mm, three pins

AUXILIARY POWER SUPPLY (MODULE)

Withstanding insulation	4kV AC @ 1mn
AC/DC Option	L/+, N/- and GND
Rated input	50-290V AC (50/60 Hz) 40-290V DC
Low DC/DC (12/24) option	(+), (-) and GND
Rated input	9.6-35V DC, Maximum Power 20W (Burden: <40VA)
Wire size	Up to 12 AWG (2.5 mm²)
Terminal pitch	7.5 mm, three pins

IRIG-B TIME SYNC

PORT ON CPU MODULE

Optically isolated IRIG-B port for GPS time synchronization	
Recommended cable	51Ω low loss - RG58A/U (Belden 8219 or equivalent)
Recommended GPS time code generator	Masterclock GPS-200A

BUILT IN COMMUNICATION

SERIAL COMMUNICATION (RS-485)

Max. baud rate	115.2 kb/s
Optical isolation	4000V AC (L-G) @ 1 min.
Max. cable length	1000 m
Protocols	» MODBUS RTU/ASCII » DNP 3.0 » IEC 60870 -5-101 (option)
2nd com (RS485)	available with GSM / fiber optic
Connector Type	removable, captured-wire, 4 terminals
Wire size	up to 12 AWG (up to 2.5 mm²)

ETHERNET PORT

Transformer-isolated 10/100BaseT Ethernet port	
Withstanding insulation	4kV AC @ 1 mn
Supported protocols	Modbus/TCP (Port 502), IEC 60870-5-104 (port 2404), IEC 61850, DNP3/TCP (Port 20000)
Num. of simultaneous connections	5 (2 Modbus/TCP + 2 DNP3/TCP + IEC 61850)
Connector type	RJ45 modular

USB PORT

Isolated USB 1.1 port	
Withstanding insulation:	4kV AC @ 1 mn
Connector type	A male, standard USB cable, max. Length 2 meters
Supported protocols	MODBUS RTU

OPTIONAL COMMUNICATION

CELLULAR PORT (MODULE)

3G/4G GSM Modem, supplied with bendable antenna. Second RS-422/485 COM port included.	
Supported protocols	Modbus/TCP (Port 502), DNP3/TCP (Port 20000)
Connector type	SMA
Withstanding insulation	2.5kV AC @ 1 mn

FIBER OPTIC ETH PORT (MODULE)

Transformer-isolated 10/100BaseT Ethernet port	
Withstanding insulation	4kV AC @ 1 mn
Supported protocols	Modbus/TCP (Port 502), IEC 60870-5-104 (port 2404), DNP3/TCP (Port 20000), IEC 61850
Num. of simultaneous connections	5 (2 Modbus/TCP + 2 DNP3/TCP + IEC 61850)
Connector type	RJ45 modular

INFRA RED COMMUNICATION

Optional optical IEC/ANSI head, available on-board RGM remote display	
Baud rate	Up to 15.200 kb/s
Protocols	MODBUS RTU/ASCII, DNP3.0

SECOND SERIAL COMMUNICATION (RS-485)

Available on IRIG-B module.
specs: identical to built-in serial port (above).

OPTIONAL I/O MODULES

8 RELAYS

Electromechanical; SPST Form A

Contact ratings	8A @ 250V AC 5A @ 30V DC 0.25A @ 250V DC 5A @ 24V DC
Galvanic isolation	4kV AC @ 1 min
Operate time	10ms max
release time	5ms max
Update time	½ cycle
Wire size	12 AWG (up to 2.5 mm²)
Terminal pitch	3.81mm

16 DIGITAL INPUTS

Optically isolated	
Sensitivity	open @ input resistance >16kΩ, closed @ input resistance <10kΩ
Galvanic isolation	4kV rms @1 min
Scan time	1 ms @ 60Hz, 1.25 ms @ 50Hz
Connector type	Removable, 5 pins
Wire size	12AWG (up to 2.5 mm²)
Terminal pitch	3.81 mm
WET CONTACT SENSING OPTIONS	
External power supply	24/48/125/250V DC
DRY CONTACT SENSING OPTION	
Internal power supply	24V DC

COMBO: 8 DIGITAL INPUTS + 4 RELAY OUTPUTS

Galvanic isolation	4kV rms @1 min
Wire size	12AWG (up to 2.5 mm²)
Terminal pitch	3.81 mm
DIGITAL INPUTS	
Sensitivity	open @ input resistance >16kΩ, closed @ input resistance <10kΩ
WET CONTACT SENSING OPTIONS	
External power supply	24/48/125/250V DC
DRY CONTACT SENSING OPTION	
Internal power supply	24V DC
RELAY OPTIONS	
EMR (Electro Mechanic Relay) @ 250V/5A	
SSR (Solid State Relay) @ 1500V/20mA	
operate time	10ms max
release time	5ms max

4 ANALOG INPUTS + 4 ANALOG OUTPUTS

Optically isolated	
Module rating (upon order) Identical for inputs/ outputs	» ±1 mA, max. load 10 kΩ (100% overload) » 0-20 mA, max. load 510Ω » 4-20 mA, max. load 510Ω » 0-1 mA, max. load 10 kΩ (100% overload)
Power supply	Internal
Accuracy	0.5% FS
Update time	2 cycles
Connector type	Removable, 5 pins
Wire size	12 AWG (up to 2.5 mm²)
Terminal pitch	3.81mm

ADDITIONAL MODULES

FAST TRANSIENT RECORDER

Measuring range	Up to 2kV AC
High impedance input	10 MΩ, withstanding insulation: 4kV AC @ 1mn
Wire size	Up to 10 AWG (up to 6 mm²)
Terminal pitch	7.5 mm

DIGITAL FAULT RECORDER

VIA SPLIT CORE SENSORS (HACS CS2S) CLAMPED ON TO PROTECTION CT SECONDARY	
Fault currents measured	Up to 200A RMS @ In = 5A (40 x In)
Accuracy	Class 1
Burden	< 0.15 VA
Wire size	10 AWG (2.5 to 6 mm²)
Terminal pitch	9.5mm
Overload	Continuous: 200A RMS 1 second: 1000A

IRIG B

Optically isolated IRIG-B port for GPS time synchronization	
Recommended cable	51Ω low loss - RG58A/U (Belden 8219 or equivalent), BNC connector
Recommended GPS time code generator	Masterclock GPS-200A
Second RS-422/485 COM port included	

PHASOR MEASUREMENT UNIT

Per IEEE C37.118.1-4
IMPORTANT NOTE: Should be assembled on unit with min. Version No. N3 and min. firmware version No. v31.x.38. Must be housed next to current module only.

OTHER CHARACTERISTICS

REAL-TIME CLOCK & SYNCHRONIZATION

Real-TimecClock with maximum 5 seconds drift per month @ 25°C
1ms time resolution per IRIG-B time code

CONSTRUCTION

Mounting	DIN Rail mount / panel mount / 19" rack installation. Complies with EN50022
Dimensions [W×H×D]	220 × 152 × 210mm
Weight	2.5kg (5.51 Lb)

ENVIRONMENTAL CONDITIONS

Operational	-25°C to 60°C / -13°F to 140°F
Storage	-30°C to 85°C / -22°F to 185°F

STANDARDS COMPLIANCE

- Directive complied with EMC: 89/336/EEC as amended by 92/31/EEC and 93/68/EEC
- Harmonized standards to which conformity is declared: EN55011:1991; EN50082 1:1992; EN61010-1:1993; A2/1995
- ANSI C37.90.1 Surge Withstand Capability (SWC)
- EN50081-2 Generic Emission Standard: Industrial Environment
- EN50082-2 Generic Immunity Standard: Industrial Environment
- EN55022: Class A
- IEC 61000-6-2
- IEC 61000-6-4
- IEC 60255-5
- IEC 60255-22

ACCURACY

- Active Energy: Class 0.2S per IEC/AS 62053-22
- Reactive Energy: Class 0.5S (under conditions as per IEC 62053-24:2014 @ $0 \leq |PF| \leq 0.9$)

POWER QUALITY

- EN50160: Power Quality in European Electricity Supply Networks
- IEEE 1159: Power Quality Recorder in US
- GOST 13109: Electric energy, Electromagnetic compatibility of technical equipment, Power quality limits in public electrical systems
- GOST 54149: 2010: Electric energy, Electromagnetic compatibility of technical equipment, Power quality limits in public electrical systems
- IEC 61000-4-7, Harmonics and inter-harmonics measurement
- IEC 61000-4-15, Flicker measurement
- IEC 61000-4-30 class A, Power quality measurement methods
- IEC 62054-21: Real time clock backup, RTC accuracy ± 2ppm @ 23°C

EMC IMMUNITY

- IEC 61000-4-2, IEC 60255-22-2: Electrostatic discharge, 15kV/8kV – air/contact
- IEC 61000-4-3, IEC 60255-22-3: Radiated Immunity, 10V/m and 30V/m @ 80 MHz – 1000 MHz
- IEC 61000-4-4, IEC 60255-22-4: Fast Transients burst, 4KV on current and voltage circuits and 2 KV for auxiliary circuits
- IEC 61000-4-5, IEC 60255-22-5: Surge 6KV on current, voltage circuits and power supply
- IEEE C62.41.2-2002: high voltage line surges
  - 100 kHz ring wave – 6kV @ 0.5kA
  - 1.2/50 microsecond – 8/20 microsecond Combination Wave – 6kV @ 3kA
- IEC 61000-4-6, IEC 62052-11: Conducted Radio-frequency, 10V @ 0.15 MHz – 80MHz
- IEC 61000-4-8: Magnetic Field
- IEC 61000-4-12, IEC 62052-11, IEEE C37.90.1: 2002: Oscillatory waves, CMM 2.5KV & DFM 1KV @ 100KHz and 1MHz

EMISSION (RADIATED / CONDUCTED)

- EN55022, IEC 60255-22: Class A

CONSTRUCTION

Safety

- Meets IEC/UL 61010-1 and UL94 V-0

Insulation

- IEC 62052-11:
  Insulation impulse 6KV/500Ω @ 1.2/50 μs
- IEC 62052-11, IEC 61010-1: AC voltage tests related to ground, 4 kV AC @ 1mn

Atmospheric Environment

- Operational ambient temperature range:
  –30°C to +70°C
- Long-term damp heat withstand according to IEC 68-2-3 <95%, +40°C
- Transport and storage temperature range:
  –40°C to +85°C

Vibration

- IEC 60255-21-1:
  Vibration Response, Table I, Class-2
- IEC 60255-21-1:
  Vibration Endurance, Table II, Class-1

Mechanical Shock

- IEC 60255-21-2: Shock, Table II, Class-1
- IEC 60255-21-2: Bump, Table III, Class-1

Seismic Vibration

- IEC 60255-21-3: Bump, Table III, Class-1

Panel Display protection

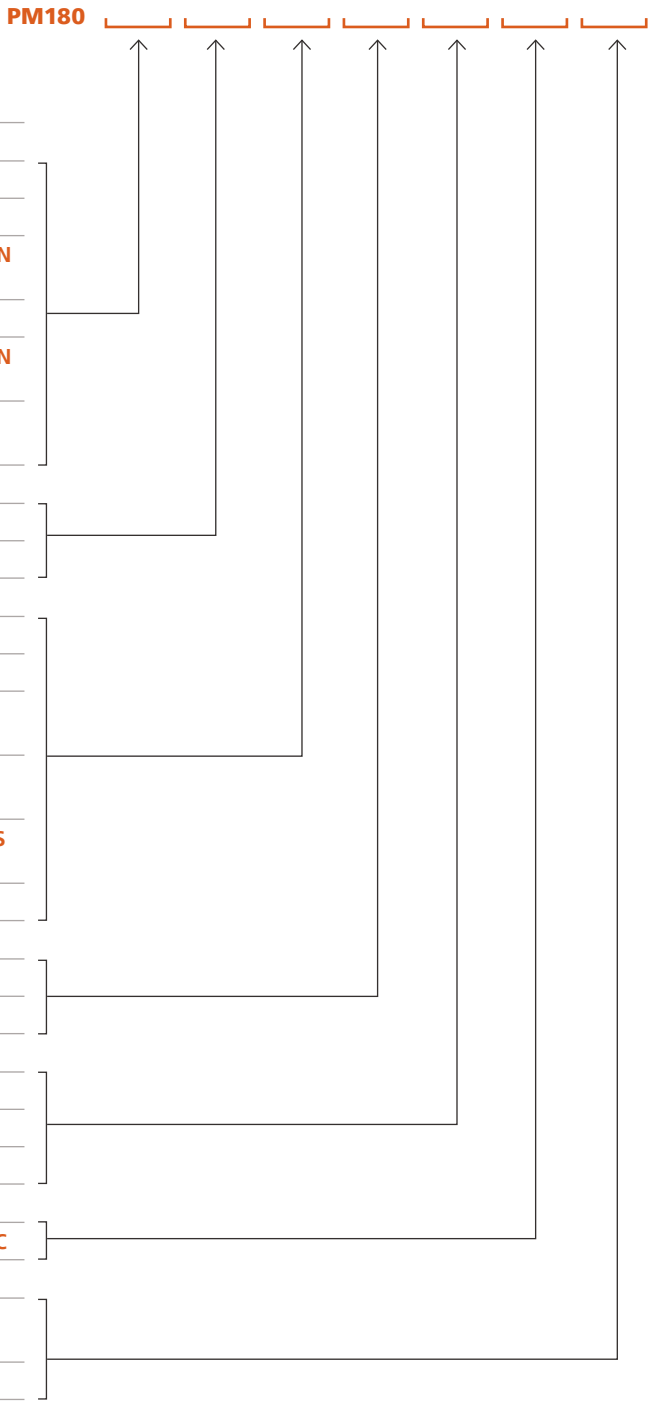
- IEC 60529: IP54 (NEMA type 13)

Instrument protection

- IEC 60529: IP30 (NEMA type 13)

1. Only for PM180-5A and PM180-1A models (internal CT), PM180-DFR model accuracy meets class 1

ORDER STRING



OPTIONS

DISPLAY	
Transducer version - no display. Includes DIN rail mounting kit	X
Graphic color display - 5.7" touchscreen	G
Graphic color display - 5.7" touchscreen with DIN rail mounting kit and 3m/10ft remote cable	G-DIN
3 line ultra bright LED display	D
3 line ultra bright LED display with DIN rail mounting kit and 3m/10ft remote cable	D-DIN
Multi window ultra bright LED display with 12 values and 1 text window. Includes DIN rail mounting kit	M
VOLTAGE INPUTS	
690V AC Nominal Voltage Input	-
120V AC Nominal Voltage Input	U
CURRENT INPUTS	
50A, calibrated to 5A (Class 0.2S Accuracy)	5
10A, calibrated to 1A (Class 0.2S Accuracy)	1
100A Split Core HACS (set of 4), Calibrated to 5A (Class 1 Accuracy)	CS1S
100A Split Core Handheld Clamp HACS (set of 4), Ø13mm opening, Calibrated to 5A (Class 1 Accuracy)	CS1H
Use of any High Accuracy Current Sensors (HACS), without overcurrent. Requires ordering of 4 HACS	HACS
Use of 3V AC current clamps (should be purchased locally)	FLEX
FREQUENCY	
50 Hz	50Hz
60 Hz	60Hz
ACCURACY AND POWER QUALITY STANDARD	
ANSI C12.20 - USA Standard IEEE1159 Full Power Quality	A
IEC 62053-22 - European Standard EN50160 Full Power Quality	E
GOST13109 / GOST54149 - Russian Standard	G
POWER SUPPLY - MAIN	
85-265V AC and 88-290V DC (Default)	ACDC
COMMUNICATION STANDARD	
Default: Modbus RTU, Modbus TCP, DNP 3.0, DNP/TCP, IEC 60870-5-101 and -104	-
Default communication plus IEC 61850 (SISCO)	850

ORDER STRING

OPTIONAL PLUG-IN MODULES

Maximum 3 additional modules per device	
PHASOR MEASURMENT UNIT (max. 1 module per device)	
PMU with Transient Recorder including PTP (IEEE 1588)	PMU
TRANSIENT RECORDER MODULE (max. 1 module per unit)	
4 voltage channels, up to 2kV and 1024 samples/cycle	TRM-180
FAULT RECORDER MODULE (max. 1 module per unit) 4 current channels, up to 200A, via 4 HACS CTs (included) as follows:	
4 × solid core CTs (Ø 23 aperture)	DFR-CS2-180
4 × split core CTs (Ø 23 aperture)	DFR-CS2S-180
4 × split core CTs (Ø 33 aperture)	DFR-CS2SL-180
DIGITAL INPUTS (max. 48 Digital Inputs per unit)	
DI 16 Dry Contacts	DI16-DRC-180
DI 16 24V DC	DI16-24V-180
DI 16 125V DC	DI16-125V-180
DI 16 250V DC	DI16-250V-180
RELAY OUTPUTS (max. 24 Relay Outputs per unit)	
8 Relays	RLY8-180
8DI/4RO EMR DRC	8DIOR-DRC
8DI/4RO SSR DRC	8DIOS-DRC
8DI/4RO EMR 24V	8DIOR-24
8DI/4RO SSR 24V	8DIOS-24
8DI/4RO EMR 125V	8DIOR-125
8DI/4RO SSR 125V	8DIOS-125
8DI/4RO EMR 250V	8DIOR-250
8DI/4RO SSR 250V	8DIOS-250
COMMUNICATION	
BNC IRIG-B and 2nd RS-422/485 port	IRIG-180
Fiber Optic Ethernet (TXFX), reduntant Ethernet and 2nd RS-422/485 port	TXFX-180
3G GSM Modem	T3G-180
4G Modem x: G=Europe; V=Verizon (US); A=AT&T (US); T=Telstra (AUS)	T4x-180
4 ANALOG INPUT / 4 ANALOG OUTPUT MODULE (max. 12AI/12AO per unit)	
+/- 1mA (0+/-1)	4AIO1-180
0-20 mA (0-10-20)	4AIO2-180
0-1 mA (0-0.5-1)	4AIO3-180
4-20 mA (4-12-20)	4AIO4-180
4 ANALOG INPUT (max. 12AI per unit)	
+/- 10V	4AIV-180
AUXILIARY POWER SUPPLY (max. 1 modules per unit)	
AUX. P.S. 85-265V AC and 40-300V DC	BACDC-180
AUX. P.S. 9.5-36 V DC	B21DC-180