SATEC

PRODUCT CATALOG

Factories

City & Buildings

Public Facilities

Electric Vehicle

Smart Houses

Nuclear Power Plant

Thermal Power Plant

Hydro Power Plant

Solar Power Plant

Wind Power Plant

SATEC

THE EXPERTS IN ENERGY MANAGEMENT

Founded in 1987, SATEC is a solution-oriented global leader in specialty solutions for power metering; from research to development and manufacturing. Over the past several decades, our high-quality power meters, analyzers and software have been implemented by leading utility and industrial icons worldwide, ever evolving by responding to continuously changing requirements set forth by our clients. Our greatest strength lies in our deep technological expertise, and our ability to provide flexible solutions for a wide range of customer applications.

SATEC exports to over 60 countries throughout the EMEA, NA, LATAM & APAC markets. Our worldwide distribution network provides local marketing services and prompt professional support.

SATEC AT A GLANCE

SATEC is a solution-oriented company, and we work hard to comply with requirements of the latest standards during the product design phase.

Power Quality Analysis

PQ
CLASS A, ED. 3

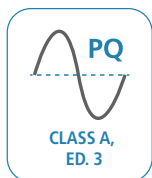The functionality of the Power Quality Analyzer lies at the heart of SATEC instruments, whether as the PM175 dedicated power analyzer or as the EM720/EM920 series, which combines power quality analysis with revenue grade metering.

With analyzers certified as Class A IEC 61000-4-30, Edition 3, SATEC takes pride in being a global leader of power quality metering.

Industrial Power Metering

ENERGY MANAGEMENT

Featuring advanced data-logging capabilities, measured and calculated parameters, and parameter-based setpoint triggers, our meters are ideal for monitoring industrial processes and optimizing power efficiency. Straightforward examples are smart transducer functionality for alerting and adjusting process loading to phase failures, and real-time energy management, allowed by SCADA-driven protocols (IEC 60870-5-101/104; DNP3).

Substation Monitoring

SUBSTATION AUTOMATION
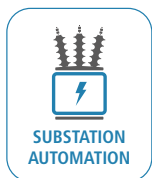
Since its establishment, SATEC has implemented the most up-to-date communication protocols and interfaces, making SATEC meters the go-to product for statistical metering and SCADA-driven control departments in utilities, for metering HV and MV substations. Combined with advanced I/O extensions and full connectivity, SATEC meters are often applied as "mini RTUs".

Commercial Revenue Metering
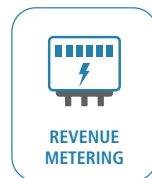
REVENUE METERING

All SATEC meters feature a minimum accuracy of Class 0.5S/0.2S per IEC 62053-22, and Class 0.5/0.2 per ANSI C12.20 for kWh readings, exceeding minimal revenue-meter requirements. Offering multi-channeled meters, UL and MID certified meters and unique SaaS billing platforms, SATEC caters to commercial users and property managers such as shopping centers, office buildings, etc.

SATEC STANDS OUT...

LET'S TELL YOU WHY:

Modularity

MODULARITY

Aspiring to tailor-fit our customers with the precise solution and features they need, SATEC takes modularity to the extreme, offering a selectable variety of communication options, digital and analog I/O options, selectable functionality and other features.

"All in One"

ALL IN ONE

Designed using a modular approach, our devices can host an astounding variety of functionalities. In addition to its base function, a power quality analyzer can serve simultaneously as a fault recorder, Phasor Measurement Unit (per IEEE C37.118) and Bay Controller or transducer, extensively utilizing modular I/O options. This allows revolutionary substation design, resulting in cost reduction.

Durability and Reliability

DURABILITY

As a global manufacturer, our products have continuously evolved over the past 30 years, incorporating the most stringent requirements of utilities and users from around the globe. Our products comply with harsh environmental requirements, maintaining functionality in temperatures as low as -40°C and as high as 70°C, or under humidity up to 98%. Galvanic (transformer) isolation and similar design provides resilience up to 4kV (RMS) and 12kV (impulse).

Connectivity

• MODBUS • 101/104 • DNP3 OPEN PROTOCOL	DUAL PORT ETHERNET	CELLULAR CONNECTIVITY	IEC 61850 IEC 61850
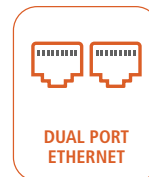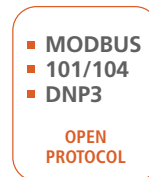
Featuring trending protocols, such as Modbus, DNP3, BACnet, IEC 61850 and IEC 60870-5-101/104, our devices aim for ultimate connectivity and SCADA compatibility. Cellular communication modules, dual port ethernet and PROFIBUS communication modules are examples for communication agility on the hardware level.

Accuracy

0.2S ACCURACY CLASS	0.5S ACCURACY CLASS	IEC 61000-4-30 CLASS A, ED. 3
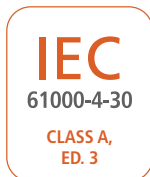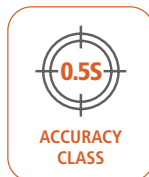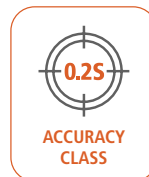
If you are measuring power, you want to do so accurately. Otherwise, why measure? SATEC takes accuracy to the next level, introducing a "one-CT" system in which our meters feature integral remote current sensors, metering loads directly, thus eliminating the extra error factor incurred by an external CT.

SATEC complies with the most advanced accuracy standard for Power Metering and Monitoring Devices (IEC 61557-12:2018, PMD), exceeding the standard kWh metering standard (IEC 62053-22).

CERTIFICATION

At SATEC we pay special attention to the quality and reliability of our products by a thorough verification of each product and system at every stage of its lifetime.

SATEC is committed to uncompromising compliance with the highest requirements in the energy field, and our devices comply with the most demanding international standards. Standard compliance is tested by world acknowledged independent labs. Our quality system is ISO9001:2015 certified, and our laboratory is certified in accordance with ISO/IEC 17025. As of 2021, SATEC is also ISO 27001 certified for Information Security Management.

*   Note: products may comply with some standards only

** For UL approved specifications: please see each individual product manual

13X SERIES Multifunctional Power Meters

MID CERTIFIED

PM130 PLUS	PM135	EM132*	EM133

SATEC's Powerful SCADA-Ready Series

The PM13x/EM13x family are multi-functional 3-phase power meters. Equipped with capabilities for revenue metering, harmonics analysis and data-logging, they are widely installed in a variety of different industrial and utility applications.

Featuring a variety of communication ports (in addition to a built-in RS485 port) and a wide range of communication protocols, the PM13x/EM13x are widely integrated in SCADA systems for industrial and substation power monitoring and revenue metering.

With extensive I/O module options, combined with measured and calculated parameters, these units act as extremely affordable "mini bay-controllers".

DC Metering

PM130: high accuracy (starting 0.2%)
Direct metering of DC systems is performed via shunt resistors. For further information .

* Not available for all markets

FEATURES

Measured/Calculated Parameters
- **Power & Energy**: V,I,Hz, cos φ (PF); V/I unbalance; kW/kVA, kWh/kVAh (active/reactive, import/export)
- **Hi-res Frequency:** 0.001 Hz reading resolution
- **Power Quality:** individual harmonics (V and I): up to the 40th. THD, TDD & K-Factor (unavailable for EM132)

Supported Frequencies
25, 50, 60, 400 Hz

Current Input Options
- Standard CT input (1A or 5A)
- 40mA input (SATEC HACS)
- Direct connection (63A; EM13X only)

Time-stamp: for event/data logging

Voltage Inputs
- Nominal: 0-690V AC; 0-670V DC*

- Operational: 15-828V AC; 0-804V DC*

* (DC @ PM130 PLUS; 0-1,500V DC with VRM)

Revenue Meter
- Exceeds Class 0.5S accuracy
- MID approved (EM133)
- Time of Use (TOU) tariffs
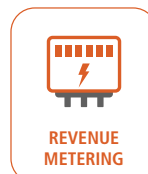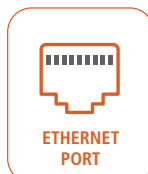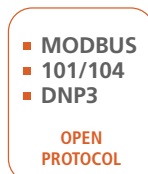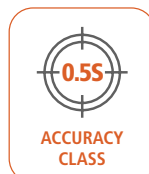- Anti-tamper design
- Built-in Infrared port

Built-in I/Os (EM133): 1 relay + 2 DI

Communication Protocols
- Modbus, IEC 60870-5-101/104, DNP3, PROFIBUS DP
- Supports MV-90 xi

Alarm, Control & Data-Logging
- 16 programmable setpoints
- Up to 8MB for data-logging

0.5S ACCURACY CLASS	I/O DIGITAL IN/OUT	MODBUS 101/104 DNP3 OPEN PROTOCOL	ETHERNET PORT	CELLULAR CONNECTIVITY	REVENUE METERING

6

2ⁿᵈ Comm. Port
Small form

One of the following:
- Ethernet (TCP/IP)
- PROFIBUS
- RS232/422/485
- Cellular Modem
  EM13x: 4G / CAT-M
- WiFi

Analog Outputs
Small form

4 analog outputs, selection of ranges upon order:
- ±1mA
- 0-20mA
- 0-1mA
- 4-20mA
- 0-5mA
- ±5mA

Digital I/O
Small form

- 4 Digital Inputs (dry contact), including:
  - 2 EM Relay outputs 250V AC / 5A
  - 2 SSR outputs 250V AC/DC / 0.1A
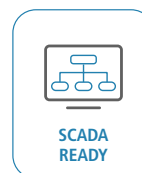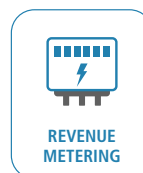 - RTC battery backup for TOU (PM130 PLUS only)
- 8 Digital Inputs (dry contact)

Digital I/O
Large form

Comprehensive expansion module that includes:
- 12 Digital Inputs (Dry Contact or 250 V DC)
- 4 EM Relay Outputs 250V/5A AC or 4 SSR outputs (20mA, 1500 V DC)
- Optional integrated 2ⁿᵈ com port: ETH or additional RS485

COMPARISON	PM130 PLUS / PM135		EM132 / EM133
Standard Power Supply	57.7-277V AC @ 50/60 Hz; 48-290V DC		
Optional Power Supply (replaces the standard PS)	12V DC or 24/48V DC		12/24V DC or Self-Energized (SE) from voltage inputs: 3 phase 120-277V AC 50/60 Hz
Mounting	Panel: 4" Round / Square 96×96; DIN (supplied kit)		DIN Rail mount
Weight	1.5 lbs / 0.7 kg		1.2 lbs / 0.53 kg
Dimensions H×W×D	4.5×4.5×4.3" / 114×114×109mm		3.5×4.9×2.7" / 90×125×68.5mm

APPLICATIONS

ENERGY MANAGEMENT

REVENUE METERING

SCADA READY

INDUSTRIAL MONITORING

RENEWABLE ENERGY

PRO SERIES Power Meters & Power Quality Analyzer

Class A Ed. 3.1

NMi CERTIFIED

PM335

EM235

+ IEC 61850
+ Dual port ethernet
+ Waveform capture
+ 16GB memory
+ USB C port
+ Class A, Ed. 3.1 (IEC 61000-4-30)
+ Leakage current detection

Ultimate Connectivity

Featuring **IEC 61850** communication protocol and **dual port ethernet**, the PRO meter meets and exceeds the needs of the modern digital substation, which is based on IEC 61850 topology.

PQ Monitoring

The PRO Series also serves as a power quality analyzer, with Class A / S compliance for power quality analysis, generating EN50160 power quality reports.

Ultimate Performance

The PRO Series is SATEC's newest, state of the art power meter series for advanced power applications. With waveform recording capabilities and **16GB** of storage, it is a powerful analyzer and event recorder, designed with special emphasis on user experience and ease of navigation.

DC Metering

High accuracy (0.2%*) direct metering of DC systems is performed via Hall Effect Sensors. For more information .

Ultimate Modularity

The PRO Series enables the utilization of up to **4 expansion modules** simultaneously, allowing the user to adjust the PRO meter to any required application. Modules are no longer mutually exclusive.

* Meter accuracy. System accuracy set by implemented sensors

APPLICATIONS

ENERGY MANAGEMENT	REVENUE METERING	SCADA READY
SUBSTATION AUTOMATION	INDUSTRIAL MONITORING	RENEWABLE ENERGY
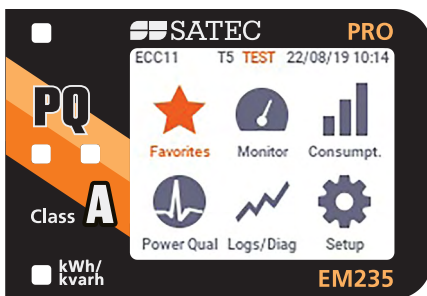
Main Menu with Favorites Area
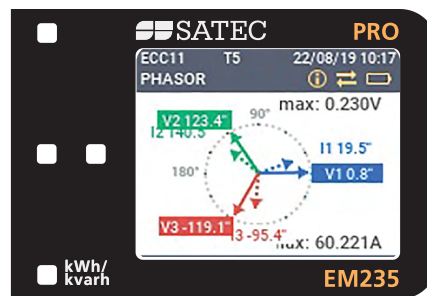
Phasor Screen
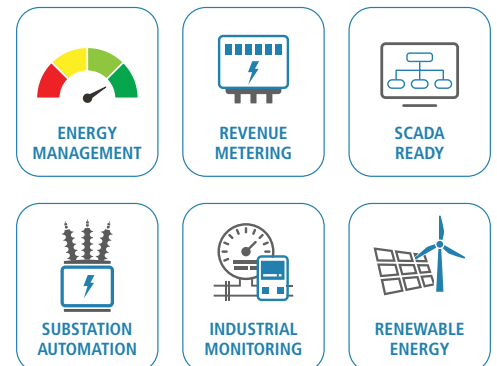
Add-on I/Os
Up to 3 add-on I/O modules:
up to a total of 28 I/O:
26 DI (dry/wet) / 13 DO / 1 AI / 8 AO

Auxiliary power supply
- AUX-ACDC: 88-264V AC / 90-290V DC
- AUX-DC: 24V DC (9-36V DC)

FEATURES

Revenue-Grade Precision Metering
- IEC 61557-12 class 0.2 (PMD standard)
- Accuracy (active energy): Class 0.2S/0.2 per IEC 62053-22 / ANSI C12.20
- Up to 16 TOU tariff profiles; internal or external tariff control
- Anti-tamper protection seals

Power Quality Monitoring & Power Measurement
- **Harmonics analysis**: THD of voltage and current, custom alarming, TDD, K factor, Crest factor. Individual harmonics up to the 63rd harmonic
- **Voltage calculation & analysis**: ½ cycle RMS calculation, symmetrical components, voltage dips/sags, swells, interruptions, THD & event recording
- Waveform capture and screen display of waveforms and Power Quality data
- Hi-res Frequency: 0.0001 Hz resolution
- EN50160 reports

Communication
- Ports
  2 × ETH (independent interfaces), USB, RS485, Optical Port (IR) supporting IEC 62056-21
- Protocols
  - IEC 61850 (MMS and Goose support)
  - Modbus RTU/TCP, MODBUS Master, DNP3 (level 2), IEC 60870-5-101/104
  - DHCP support

Current Input Options
- 1A or 5A inputs from CT secondary
- 40mA input (SATEC HACS, or DC Hall Effect Sensor)
- 4th current input (neutral current)
- LPCT inputs

Dual Panel Mounting (PM335)
4" Round; Square 96x96

Voltage Inputs
- Nominal: 400/690V AC (L-N/L-L)
- Operating range: 10-1000V AC / 10-820V DC*
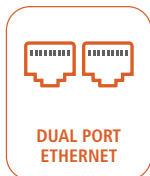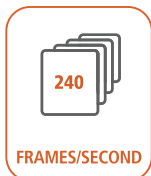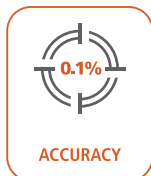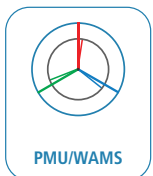- LPVT inputs

On-Board Inputs / Outputs
Built-in I/Os (optional): 2 digital input; 1 SSR output; 1 analog input

Programmable Logical Controller
- 64 control setpoints; programmable operate and release delays
- OR/AND logic, extensive triggers, programmable thresholds and delays
- 16 user-definable data logs

Power Supply
- 57.7-277V AC / 48-290V DC Tolerance: ±15%

* Extended range, up to 1,500V DC is possible with the VRM module. .

DC METERING ENABLED	ACCURACY CLASS 0.2S	DIGITAL IN/OUT	OPEN PROTOCOL (MODBUS, 101/104, DNP3)	DUAL PORT ETHERNET	CLASS A, ED. 3 (PQ)	IEC 61850	16GB MEMORY	REPORTS (EN 50160)
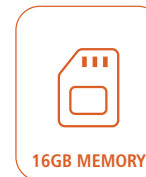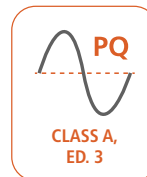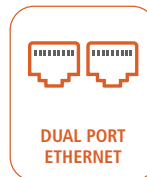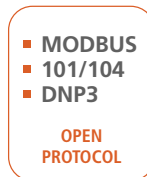
PM17x PRO SERIES Advanced PQ Analyzers

NMi+ CERTIFIED

Class A Ed. 3.1

+ Class A Ed. 3.1 (IEC 61000-4-30)
  PM175: EU Std. (EN50160)
  PM174: US Std. (IEEE 1159)
  PM172: Power meter version
+ IEC 61850, Ed. 2

+ 1μ-sec time-sync accuracy via IRIG-B/PTP v2 (IEEE1588)
+ 4th Voltage input (V_{ref})
+ Extra-wide voltage range: 1,000V AC (L-L)

The Energized Legacy

The PM17x PRO Series analyzers combine the familiar touch and feel of the PM17x legacy models with the advanced PRO Series capabilities. To top this, they introduce unique features, available only in the PM17x PRO Series, such as IRIG-B input and a fourth voltage input (V_{ref})

LPIT Sensor interface

The PM17x Series interfaces with a variety of commercial LPIT sensors, designed for MV metering. This unique application is available for both PT/CT inputs.

FEATURES

Multi-Functional 3-Phase Power Meter
- Voltage, current, power, energy, power factor, frequency, voltage/current unbalance, load profile
- 64 programmable setpoints
- Built-in: 2 DI + 1 DO
- Optional: 8 DI / 4 RO / 4AO

Multi-Tariff Revenue Meter
- Accuracy class 0.2 / 0.2S in accordance with ANSI C12.20 / IEC 62053-22
- Time of Use (TOU) tariffs

Advanced Power Quality Analysis
- EN50160, IEEE 1159 reports and statistics
- PQ event logging & waveform recording Harmonics & inter-harmonics per

IEC 61000-4-7 (up to the 63rd)
- Voltage and current THD, TDD, K-Factor
- Flicker per IEC 61000-4-15
- Dips, swells, interruptions and transient recording with waveforms

Event/Data Log
- Power quality event/data logging
- Logging more than 100 parameters
- Real-time stamp logging

Voltage Inputs
0 - 1,000V AC (L-L)

Multiple Current Input Options
- Standard 1A or 5A inputs
- RJ45 inputs (I/V) for LPIT interface
- 40mA inputs for SATEC HACS CTs

Power Supply
- AC/DC: 100-277V AC, 100-290V DC Tolerance: ±15%
- Optional: 24V DC (12-24V DC) Tolerance: ±20%

Communication
- Dual ETH port (2 x ETH); RS485; USB 2.0 (Type C)
- Protocols: Modbus, DNP3, IEC 61850; IEC 60870-5-101/104; 1588 PTPv2

Construction & Durability
- Full galvanic isolation of voltage and current measuring circuits: 6 kV Impulse
- Dual panel mount: 4" Round; 92×92 Sq.

DUAL PORT ETHERNET | **IEC 61850** | **CLASS A ED. 3** | **EN 50160 REPORTS** | **16GB MEMORY** | **LPIT INTERFACE** | **ACCURACY CLASS (0.2S)**
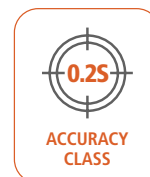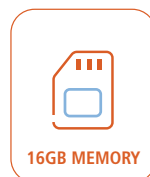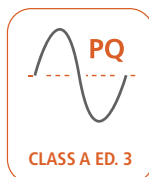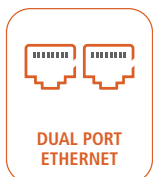
PMU PRO

A WAMS Revolution

- ✚ Highly compact, yet full-featured
- ✚ IEC 60255-118-1:2018 compliance
- ✚ Full IEEE C37.118.1 compliance, for both:
  - ▪ M – Class
  - ▪ P – Class
- ✚ High Accuracy: steady state TVE < 0.05%
- ✚ 5 streaming slots (UDP/TCP protocol)

The PMU PRO is a true game changer in the field of Wide Area Monitoring Systems. This is true especially for Distribution, where WAMS is still in its infancy, and is heavily budget-dependent. This is where the PMU is a cost-effective novelty.

M-Class (Metering Class)
Advanced filtering rejects harmonic components and other oscillations, leading to high accuracy.

P-Class (Protection Class)
Involves less filtering, increasing streaming speed and enabling responsive control.

FEATURES

PMU
- ▫ 1-us satellite-synchronized clock (IRIG-B/ PTP time-code input)
- ▫ IEEE C37.118.2 reporting rates: 1 to 200/240 frames/s

Communication
- ▫ Ports
  2 × ETH (independent interfaces), USB 2.0 (Type C),
- ▫ Protocols
  - ▫ IEC 61850-9-5
  - ▫ IEEE C37.118.2
  - ▫ Modbus RTU/TCP, MODBUS Master, DNP3 (level 2), IEC 60870-5-101/104
  - ▫ Up to 10 non-intrusive simultaneous connections per Ethernet port

Current Input Options
- ▫ 1A or 5A inputs from CT secondary

Voltage Inputs
- ▫ Nominal: 400/690V AC (L-N/L-L)
- ▫ Operating range: 10-1,000V AC

On-Board Inputs / Outputs
Built-in I/Os: 1 digital input; 1 SSR output; 1 analog input

Programmable Logical Controller
- ▫ 32 control setpoints; programmable operate and release delays
- ▫ OR/AND logic, extensive triggers, programmable thresholds and delays
- ▫ 8 user-definable data logs

Power Supply
- ▫ Built-in:
  57.7-277V AC @ 50/60 Hz
  48-290V DC
- ▫ Auxiliary (as module):
  88-264V AC @ 50/60 Hz
  125-300V DC
- ▫ 24V DC AUX (as module):
  24V DC (9-36V DC)
  Tolerance for all PS: ±15%

| PMU/WAMS | ACCURACY | FRAMES/SECOND | SAMPLES/CYCLE | IEC 61850 | DUAL PORT ETHERNET | 16GB MEMORY |

BFM-II Branch Feeder Monitor & Fault Recorder

- ✚ Up to **54 single-phase circuits** (18 three-phase)
- ✚ Individual harmonics analysis
- ✚ 36 channel distributed fault recorder and waveform capture
- ✚ SCADA-ready protocols (IEC 60870-5-101/104; DNP3; BACnet)
- ✚ Measures 2 independent voltage sources

Up to 2 independent 3ph voltage inputs (self energized power supply) 3x(120/208–277/480V AC)

Current-circuit modules: up to 18 channels: either 18 3-phase or 54 single phase
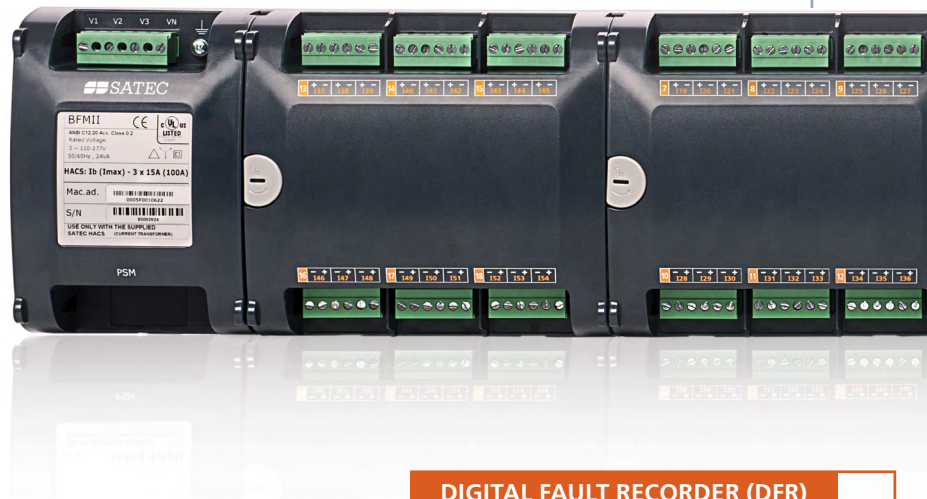
Multi-Circuit Meter for Substation Monitoring & Multi-tenant Billing

BFM-II

BFM136

With Class 0.5S accuracy, multi-tariff (TOU) metering and anti-tamper design, these multi-circuit meters an ideal revenue metering solution for multi-tenant facilities.

The number of metered circuits per device is selectable, as is the option of adding on digital and analog I/Os, used as status indicators or pulse counters for the integration of other pulse generating devices, such as water and gas meters.

Dual Voltage Input

Provided as an extra 3-phase voltage input module, this feature is intended for metering 2 independent power sources. For example, an MV transformer and parallel PV installation. This is a practical solution for distribution substations equipped with two transformers.

BFM136

The BFM136 (1st gen.) is a TOU energy meter, equipped with 12 three-phase current inputs (non-modular, no I/O).

DIGITAL FAULT RECORDER (DFR)
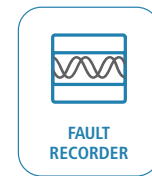
FAULT RECORDER

This advanced feature utilizes the BFM-II as a centralized fault recorder and monitors up to 12 three phase feeders, capturing complete waveforms and recording fault currents up to 40 × In.

The BFM-II-DFR combines multi-circuit fault-recording, metering and control functionality, providing a complete solution for substation and industrial automation.

Optional 4G modem

Up to 72 digital inputs (optional)

Up to 8 analog inputs (optional)

Redundant aux. AC/DC power supply (optional) 50-290V AC (50/60 Hz), 40-290V DC

Up to 18 relay outputs (optional)
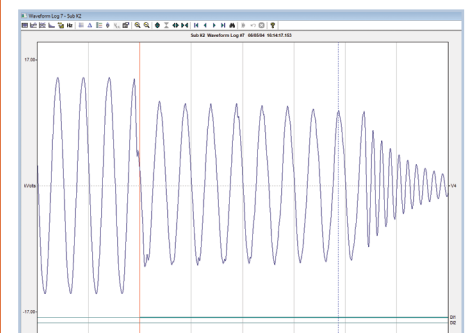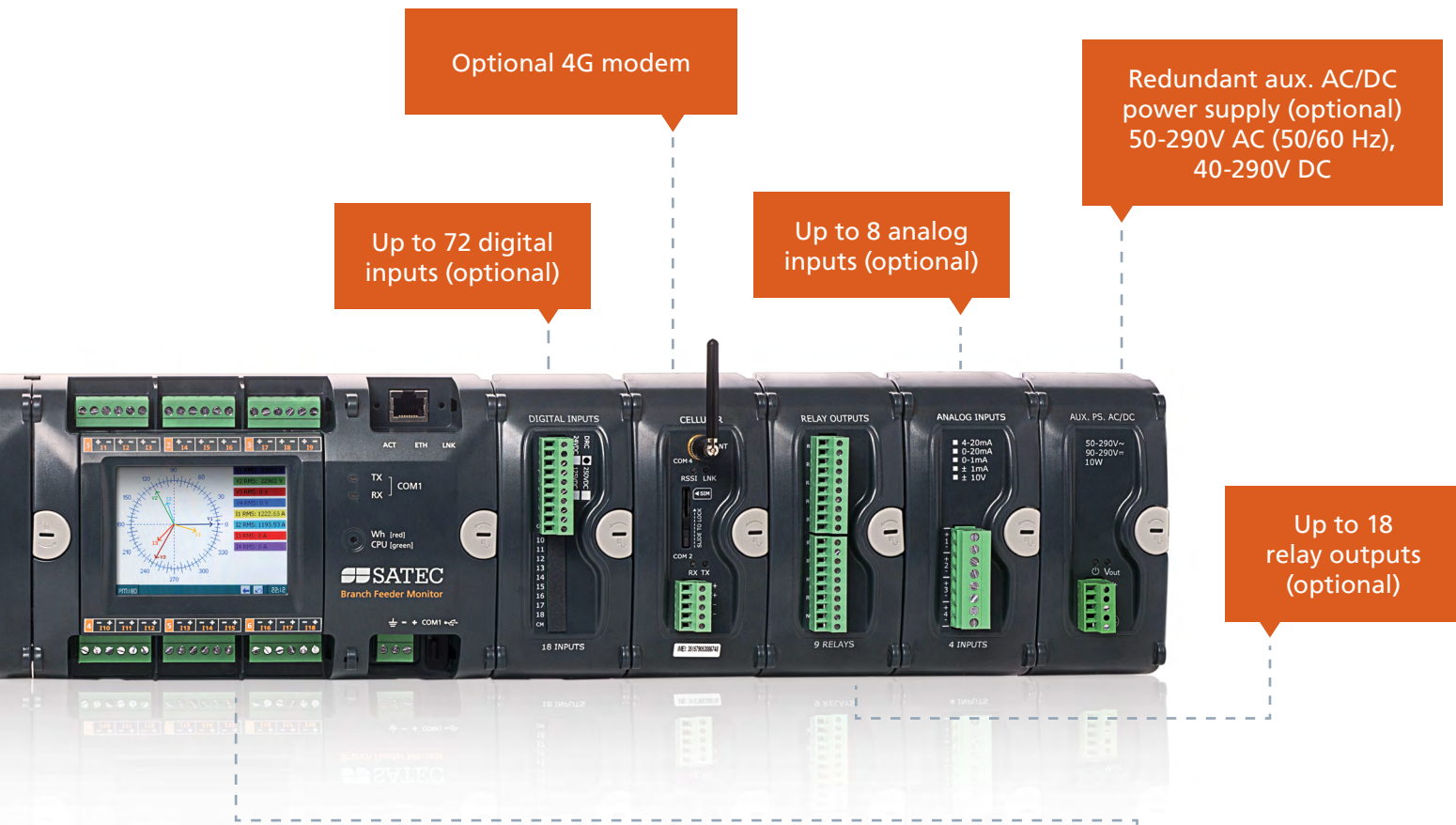
FEATURES

- **High Accuracy Current Sensors**: The BFM-II is designed to work with SATEC HACS CTs (see pg. 20) or flex clamps (Rogowski Coil)
- **Revenue Metering**: TOU enabled with 8 energy/demand registers × 8 tariffs, 4 seasons × 4 types of days, 8 tariff changes per day. Anti-tamper casing for current inputs
- **Energy Profiling**: Automatic 120-day profile for energy and maximum demand readings for each submeter
- **Power Quality**: Voltage and current harmonics (up to the 25th), voltage sags, voltage swells and interruptions

- **Event Recorder**: Logging internal diagnostic events and setpoint operations
- **Data-Logging**: Programmable periodical data logs for each submeter
- **Programmable Controller**: 4 programmable control setpoints for each submeter
- **Communication Ports**: Standard RS485, Ethernet and USB
- **Cellular Communication**: Optional
- **Communication Protocols**: Modbus RTU, DNP3.0,
- Supports MV-90 xi

0.5S ACCURACY CLASS

I/O DIGITAL IN/OUT

MODBUS
101/104
DNP3
OPEN PROTOCOL
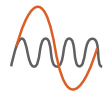
INDIVIDUAL HARMONICS

CELLULAR CONNECTIVITY

MV-90 xi SUPPORTED

Current Input Options

HACS: 100A-3,000A
RS5: 5A HACS
FLEX: 3V AC (Rogowski)

Input module types can be combined

APPLICATIONS

ENERGY MANAGEMENT

REVENUE METERING

SUBSTATION AUTOMATION

DATA CENTER
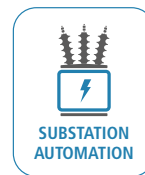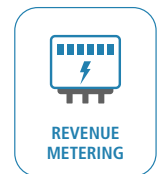
PM180 Multifunction Power Quality Analyzer

Standard communication:
Ethernet, RS485, USB & IRIG-B

Wide range of
digital & analog I/Os

Auxiliary PS

Class **A** Ed. 3

Four galvanically
isolated voltage
channels

Four galvanically isolated
current channels
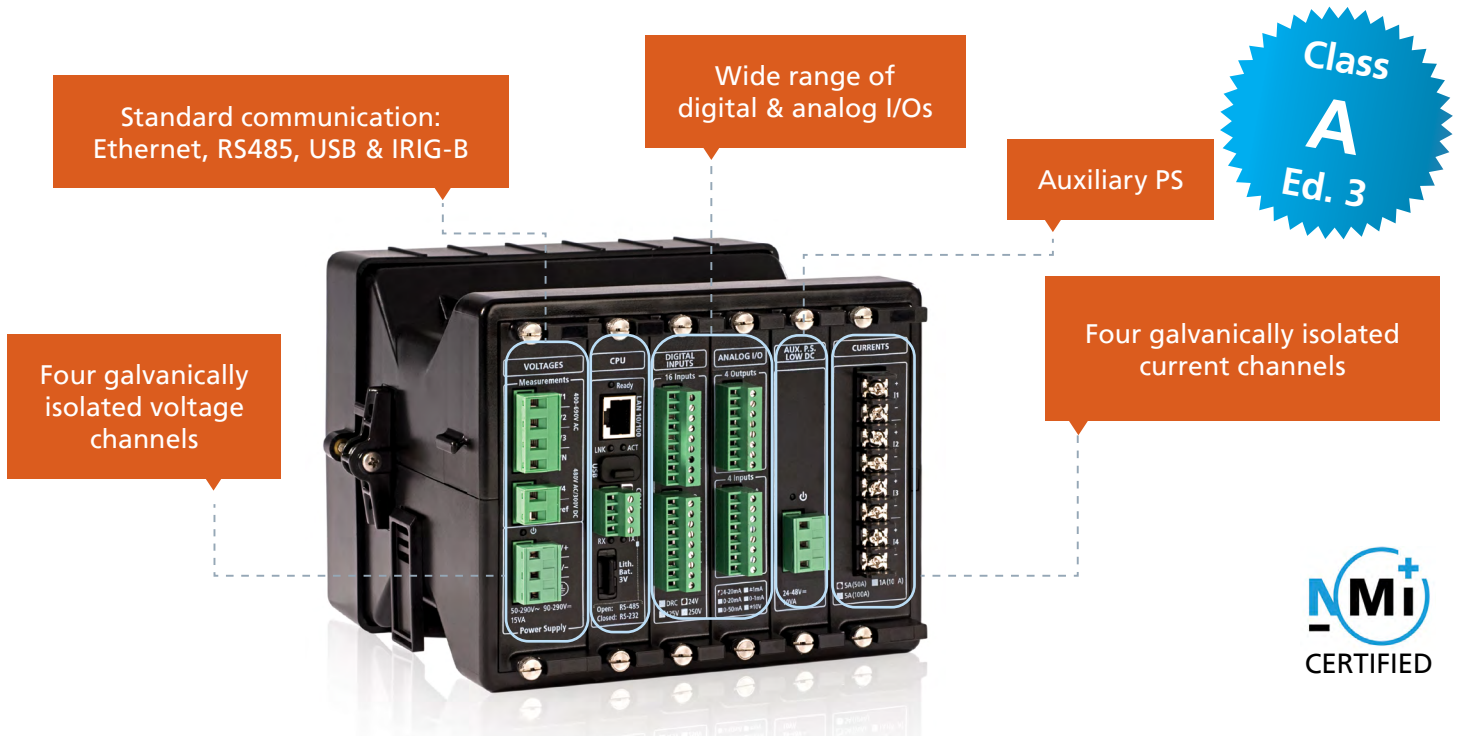
NMi CERTIFIED

The Heart and Backbone of SATEC Versatility and Functionality

An IEC 61000-4-30 Class A Edition 3 certified power quality analyzer, the PM180 is a modular device that can house up to 3 additional add-on cards, providing a variety of functionality. This "all in one" device enables a design that is economical in cost and space, enhancing versatility.

Functionality & Applications

SEQUENCE OF EVENTS
Viewing events in a timestamped sequence: digital input and relay output events, fault events and setpoint events. SoE Log reports establish links between the recorded events and other database records, indicating any existing correlation.
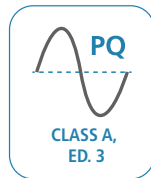
PQ CLASS A, ED. 3

POWER QUALITY ANALYZER
Class A, Edition 3 certified (IEC 61000-4-30:2015), the PM180 complies with the most up-to-date requirements of power quality analyzers, generating EN50160 reports and logging waveform captures.
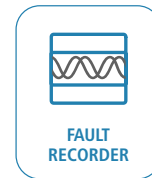
FAULT RECORDER

FAULT RECORDER / DISTANCE TO FAULT
Measuring currents rated at 40 × In, the PM180 serves as a distributed fault recorder, triggered by event or DI. Advanced algorithms enable Distance to Fault calculation.

SUBSTATION AUTOMATION
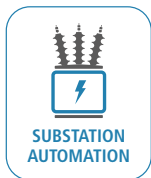
IEC 61850 DIGITAL SUBSTATION
IEC 61850 with GOOSE, MMS messaging and Interlocking Logic are becoming the default design for the modern substation. With the launch of the PM180, SATEC pioneered the implementation of this advanced communication platform, constantly keeping it up to date.

PMU/WAMS
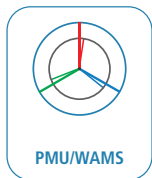
PHASOR MEASUREMENT UNIT (PMU)
Featuring both IEEE C37.118.2 protocol and IEC 61850-90-5, the SATEC PMU module is a unique solution communicating with 3rd party Phasor Data Concentrators. It is also known as the synchrophasor component of the Wide Area Monitoring System (WAMS). .

PORTABLE EDL180 ANALYZER
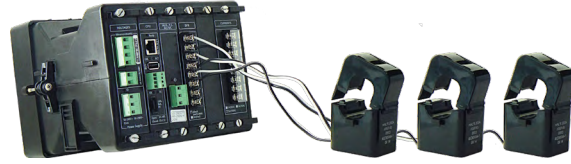
PM180 DFR: ZERO-OUTAGE RETROFIT

PHASOR MEASUREMENT UNIT

FEATURES

Multi-Functional 3-Phase Power Meter

- V/I (4 CH current), power, energy (Class 0.2S), PF, demands, unbalance, load profile
- Special additional AC/DC voltage input (up to 400V AC / 300V DC)
- Hi-res Frequency: 0.001 Hz
- Fast Transient detection (17 µs @ 60Hz / 20 µs @ 50Hz)

Digital Fault Recorder (DFR)

- Recording fault currents up to 20 × In (40 × In with DFR module)
- Pre and post fault recording
- Distance to fault calculations
- Fault reports
- Up to 48 fast DI (update every 1 ms)
- Sequence of events with 1 ms accuracy

Phasor Measurement Unit

- IEEE C37.118.1 compliance
- M-Class & P-Class functionality
- Multi-protocol: IEEEE C37.118.2 & IEC 61850-9-5 over UDP / TCP
- PTP / IRIG-B time sync

Advanced Power Quality Analysis

- IEC 61000-4-30 Class A compliance
- IEEE 1159, EN50160 or GOST 32144-2013 PQ analysis, statistics & reports
- Detection and logging of sags/swells, interruptions and transients
- Harmonics & inter-harmonics in accordance with IEC 61000-4-7
- Directional power harmonics
- Voltage and current THD, current TDD and K-factor
- Flicker measurement in accordance with IEC 61000-4-15
- Detection and logging of transients
- 4 voltage and 4 current inputs for fast waveform recording
- Up to 56 channel simultaneous recording (7 AC, 1V AC/DC, & 48 digital inputs)
- Disturbance Direction Detection: indicating upstream or downstream direction of sags and swells

Control & Alarm Functions

- 64 programmable setpoints

Module Configuration

- 3 slots for hot swap plug-in I/O modules
- Up to 3 modules of 16-channel DI
- Up to 3 modules of 8-channel RO
- Up to 2 modules of 4-channel AI/AO
- Accurate time sync. (SNTP, DI, IRIG-B)

Multiple Comm. Ports & Protocols

- Standard communication: Ethernet, USB, RS232/485
- Optional communication: IR, front USB, Fiber Optic Ethernet, second RS422/485
- Ethernet: optional 2 Ethernet ports for 10/100 Base-T redundancy with fiber optic module
- Standard protocols: Modbus, DNP3, IEC 60870-5-101/104
- Optional protocol: IEC 61850 ed. 2 (MMS and GOOSE Messaging)
- Supports MV-90 xi

0.2S
ACCURACY CLASS

I/O
DIGITAL IN/OUT

IEC 61000-4-30
CLASS A, ED. 3

- MODBUS
- 101/104
- DNP3
OPEN PROTOCOL

PQ
WAVEFORM CAPTURE

IEC 61850
IEC 61850

FIBER OPTIC

MV-90 xi
SUPPORTED

EM720/EM920 Revenue Meter & Power Quality Analyzer

The Ultimate Hybrid

The eXpertMeter™ Series are multi-functional power analyzers, delivering in a single device two functionalities that are present in every substation:

▫ **PQ Analyzer & Power Meter**, typically required by utility SCADA teams
▫ **Revenue Meter**, typically operated and read by the utility billing department

Combining these functions simplifies design and eliminates redundancy.

The **EM720** complies with IEC standards. The **EM920** is a socket meter compliant with ANSI standards.

Transformer/Line Losses Calculation

Based on parameters such as copper losses and iron losses, this unique economical feature enables the meter to establish accurately calculated transformer losses. This eliminates the need to construct a costly high-voltage metering point, which would require a metering cubicle, CT and PT.
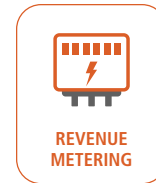
REVENUE METERING — Class 0.2S Revenue Meter
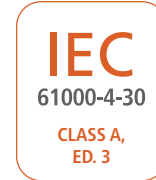
IEC 61000-4-30 CLASS A, ED. 3 — Cutting Edge Power Quality Analyzer
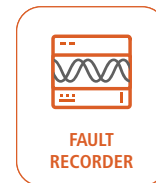
FAULT RECORDER — Fast Transient & Fault Recorder

FEATURES

Multi-Functional Power Meter
▫ Voltage, current (including neutral current), power, energy, power factor, frequency, voltage/current unbalance, load profile
▫ Precise 0.06% measurements for V/I

Multi-Tariff Revenue Meter
▫ Accuracy class 0.2S in accordance with IEC 62053-22 / ANSI C12.20
▫ Time of Use (TOU) tariffs to meet any billing requirements (8 tariffs, 4 seasons)
▫ Unique anti-vandalism, anti-tampering & self-test features
▫ Calculation of transformer and transmission line losses (8 points, PT & CT)

Advanced Power Quality Analysis
▫ Power Quality Analysis in accordance with IEC 61000-4-30 Class A
▫ Built-in EN50160 statistics & reports
▫ GOST 32144-2013 (EM720 only)
▫ Harmonics & Inter-harmonics in accordance with IEC 61000-4-7
▫ Flicker measurement in accordance with IEC 61000-4-15
▫ Waveform capture
▫ Three voltage & four current inputs for waveform records

▫ Dips, swells, interruptions
▫ Fault recording up to 10×In

Transient Recorder
▫ High Speed Transient detection as short as 17 μs @ 60Hz / 20 μs @ 50Hz

Communication Options
▫ RS232 / RS485 / Ethernet /IRIG-B/ USB / 4G / IR
▫ **Protocols**: Modbus, DNP3, IEC 61850, MV90 (EM920)

Durability
▫ I/O and Comm. Port isolation: 4 kV AC

0.2S — ACCURACY CLASS
I/O — DIGITAL IN/OUT
DUAL PORT ETHERNET
EN 50160 — REPORTS
IEC 61850 — IEC 61850
ALL IN ONE
MV-90 xi — SUPPORTED
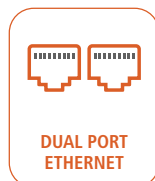
EM720

EM720 Wall Mount Meter

The unique "Add-On" hot-swap module concept of the EM720 allows you to configure the meter according to your changing needs, thus saving valuable time in the field or future costly replacements.

Models
EM720: Standard
EM720T: Includes Transient Recorder

Rechargeable battery
▫ Up to 6 hours of full operation

Dimensions
▫ **H×W×D**: 12×7×5.7" / 303×177×144 mm

OPERATIONAL BATTERY

Additional Hot Swap Modules

Auxiliary Power Supply Options
▫ 24V DC
▫ 88-265V AC and 90-290V DC
▫ 6H battery power supply option

Digital Input/Output: 2DI/2DO
▫ Form A Relay Output 5A / 250V AC
▫ Form A Solid State Relay Output 0.1A / 250V AC

EM920

EM920 Socket Meter

The EM920 eXpertMeter™ is an advanced energy meter, exceeding Class 0.2S revenue billing requirements. The EM920 includes advanced power quality analysis to detect and record waveform events and fault currents harmful to power systems.

Alarm and Control Functions
▫ 16 programmable setpoints
▫ 2 digital inputs with 1 ms sample rate
▫ Up to 8 digital inputs with ½ cycle sample rate
▫ 1 KYZ relay output
▫ Up to 6 programmable relay outputs
▫ Up to 4 programmable analog outputs

Dimensions
▫ **Depth × Diameter**: 8.5×7" / 214.3×176.7mm. Panel mount version available.

EM920 Modules

Transient Recorder
▫ Recording fast transients @ 1024 samples/cycle

Input/Output
▫ 6 relay outputs (2 form A, 4 form C)
▫ 8 digital inputs
▫ 4 analog outputs ±1mA
▫ 4 analog outputs 0-1 mA
▫ 4 analog outputs 0-20 mA
▫ 4 analog outputs 4-20 mA

Auxiliary Power Supply Options
▫ 50-288V AC and 90-290V DC

APPLICATIONS

ENERGY MANAGEMENT

REVENUE METERING

SCADA READY

SUBSTATION AUTOMATION

CLASS A

INDUSTRIAL MONITORING
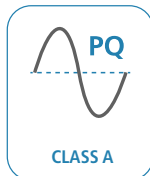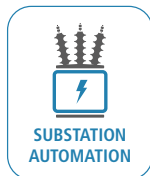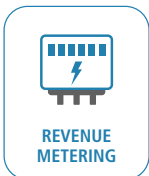
SMART GRID SOLUTIONS

Phasor Measurement Unit per IEEE C37.118.1   Wide Area Monitoring Systems

✚ Multi-protocol: IEEEE C37.118.2 & IEC 61850-9-5

✚ PTP / IRIG-B micro-second time sync

✚ High Accuracy: steady state TVE < 0.05%

✚ 5 streaming slots (UDP/TCP protocol)

PMU/WAMS   **IEC 61850**
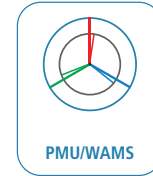
The electrical power grid is an ecosystem: the slightest disturbance generated in any specific location can instigate an event resulting in full power outage.

This raises the following needs:
▫ Prevention: responsive control
▫ Minimizing downtime–analysis and response
▫ Post-event analysis

The PMU concept, regulated in IEEE C37.118.1, provides just that and we have designed our units accordingly.

Based on the PM180 analyzer, SATEC's PMU offers two monitoring options:

M-Class (Metering Class): Advanced filtering rejects harmonic components and other oscillations, leading to high accuracy.

P-Class (Protection Class): Involves less filtering, increasing streaming speed and enabling responsive control.

For the detailed spec, please see our site

PTS174 / PTS175 / PTS180 / PTS PRO   Pole-Top MV Monitoring with Unique Sensors (PT/CT) for Smart Grid Deployment

The PM175, PM180 and PRO Series can be supplied with Line Post Sensors for replacement of existing pole isolators with voltage and current sensors for MV grids of 15kV, 25kV or 35kV.

Helps Manage:
▫ Line losses	▫ Load balance
▫ Capacitor controls	▫ Harmonics
▫ Voltage regulation	▫ Fault detection
▫ Outage detection	▫ Power theft
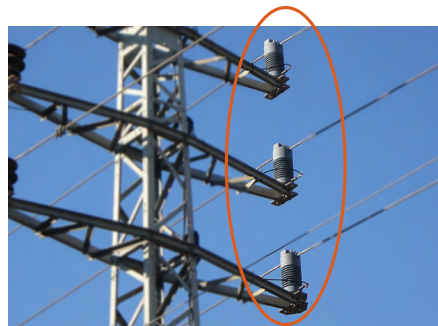
SENSOR OPTIONS

Available Models per Rating:

▫ Model LSY15 — 15kV
▫ Model LSY25 — 25kV
▫ Model LSY35 — 35kV

DC METERING

The PRO Series meters and analyzers (page 8) offer this unique feature. Direct Current metering provides an important solution for what has become the extremely commonplace infrastructures of DC systems. Such is the case in renewable energies, data centers, and many more.

✚ Average and Real Time values: Voltage, Current, Power, Bi-directional DC energy calculation

✚ Voltage range: 20-1,500V DC (VRM module is required above 820V DC)

✚ Current range: up to 3,000A DC*

✚ Revenue grade metering accuracy*

✚ Up to 3 voltage** and 4 current channels

* Depending on type of Sensor
** Sharing a common negative

APPLICATIONS

INDUSTRIAL MONITORING   **DATA CENTER**   **RENEWABLE & BESS**   **TRANSPORTATION**

U-HACS Revenue Grade DC current Sensors
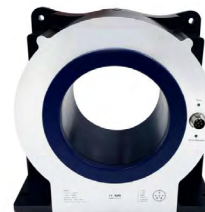
SATEC supplies unique high-accuracy sensors for DC metering, rated 100-3,000A DC.

HEPS - Sensor Power Supply Module

Power supply module necessary for powering U-HACS and Hall Effect Sensors. Powers up to 4 sensors.

Technical Specifications

▫ **Power Supply**
   90-264V AC (50/60Hz)
▫ **Output**
   ▫ Voltage: 4 × ±15V DC (+15; 0; -15)
   ▫ Power: 4 × 1.5W

VRM - Voltage Ratio Module for DC Applications

For DC systems involving rated voltage above 800V DC the VRM Module is required.

Technical Specifications

▫ Accuracy = 0.1%
▫ 3 Independent voltage inputs
▫ Input voltage: up to 1,500V DC
▫ DIN-rail installation

High Accuracy Current Sensors for HACS-Version SATEC Meters

+ Superior accuracy
+ No shorting blocks needed
+ Minimal cost for retrofit installation
+ Remote installation: up to 200M
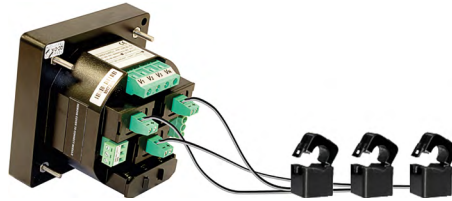
SATEC's HACS CTs are compatible with the HACS version meters, which are manufactured with corresponding unique current inputs. These meter versions exist for almost all SATEC products (see list below).

ULTIMATE ACCURACY: Acting as a primary CT, with a product range of up to 3000A, there is no need for further/external CTs for measurement. These CTs feature

milliamp outputs, feeding directly into the meter, making it a "one-CT" system, thus considerably increasing accuracy.

ULTIMATE SAFETY: Featuring an internal electronic switch, providing an automatic protection circuit, these CTs prevent fire hazards regularly associated with disconnected CT outputs. This also saves costs, by making the installation of shorting bars unnecessary.

REMOTE METERING: The milliamp output mentioned is also of very low burden, making it possible to run wiring for metering loads up to 200m away, without any compromise to accuracy.
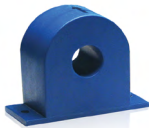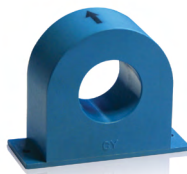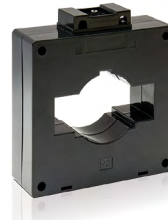
| CS05S | CS1 | CS1L | CS1H | CS8 | CS8S | CS30S |

The following products can be ordered with dedicated HACS inputs rather than with the standard 1A/5A CT input:

EM13x Series   PRO Series
PM13x Series   PM17x Series
BFM136/BFM-II   PM180

Note: the selection of HACS varies slightly depending on your choice of instruments. Accuracy: Solid Core: 0.1% / Split Core: 0.5%. All HACS are supplied with 8ft/2.5m cable. Maximum cable length: 650ft / 200m.

P/N	RATING	CORE	OPENING INCH	MM	P/N	RATING	CORE	OPENING INCH	MM
CS05S	10A	Split	Ø 0.6	Ø 16	CS4	400A	Solid	Ø 1	Ø 26
CS1	100A	Solid	Ø 0.5	Ø 12	CS4L	400A	Solid	Ø 1.77	Ø 45
CS1L	100A	Solid	Ø 0.9	Ø 23	CS4S	400A	Split	1.7×1.3	43×33
CS1S	100A	Split	Ø 0.6	Ø 16	CS8	800A	Solid	4×1.3	32×100
CS1H	100A	Split	Ø 0.5	Ø 13	CS8L	800A	Solid	Ø 2.36	Ø 60
CS2	200A	Solid	Ø 0.9	Ø 23	CS8S	800A	Split	1.9×3.1	50×80
CS2S	200A	Split	0.96×0.9	25×23	CS12S	1200A	Split	3.1×4.7	80×120
CS2SL	200A	Split	1.7×1.3	43×33	CS20S	2000A	Split	3.1×6.3	80×160
CS2.5S	250A	Split	0.96×0.9	25×23	CS30S	3000A	Split	3.1×6.3	80×160

DISPLAYS & ACCESSORIES

Displays

The display component is modular for several SATEC devices (see below), allowing the choice to implement these either as a transducer version with no screen or to choose from a variety of displays, such as 7-segment LED display, touch-screen or multi-window display.

Display Mounting

SATEC displays can be directly on to a meter or connected as a remote display up to 3m away from the device (up to 10m when supported by an independent power supply).

RDM174 / RDM175
For PM174/5 Series

RDM180
For PM180

RGM180 Graphic Touch Screen

Compatible Devices

EM13x	PM17x Series	EM720/920
PM13x	BFM136/BFM-II	PM180

This 5.7'' color graphic touch-screen takes energy metering and power quality monitoring to a new level, displaying comprehensive information including phasor diagrams and waveforms. The RGM180 can monitor up to 32 SATEC devices over serial communication, or up to 36 devices over 10/100 Base-T ethernet.

Communication Converters / Gateways

ETC-II Gateway and Data-logger

The ETC-II Data Server enables data accumulation from instruments in background mode, using Modbus protocol (as Modbus master). A total of 64 address ranges can be defined.

The data is stored in a buffer where 120 16-bit registers are reserved for each server address range. Users can specify up to 120 contiguous registers (per address range) in the connected instrument, which are continuously polled and updated in the server register array. Any number of device register ranges can be defined for each instrument.

The ETC-II supports M-Bus, interfacing up to 240 M-Bus devices.

ETC-I Gateway

The ETC I serves as a transparent gateway, connecting several serial-communication devices to the internet, either via ETH port or via cellular communication.

PAS

PAS is SATEC's comprehensive engineering and analysis software, designed to program, configure and monitor all SATEC devices. It includes a variety of additional tools to assist in system setup, such as the communication debugging module.

PAS is bundled with all SATEC instruments at no extra charge.

- Programming and control of all SATEC devices
- Automatic power quality reports for EN50160, IEEE 1159 & GOST 32144-2013
- Extensive graphic and reporting capabilities for waveforms and harmonics analysis
- Export COMTRADE
- PQDIF for waveforms and data logs
- Automatic device polling
- Simple off-line instrument setup

- Easy export to Word or Excel
- Self-test
- Remote device configuration
- Multiple TOU programming

Comprehensive Analysis
- Data logs—historical or current
- Trends
- Waveform analysis
- Harmonic spectrum

- Harmonics power direction
- Vector analysis/phasor diagram
- G5/4 comparison tables for HV and LV applications
- Automatic power quality and fault categorization
- Synchronized waveforms from multiple devices in a single plot
- ITI (CBEMA) curve
- Automatic sort and filter capabilities
- Alarms with variable setpoints

EXPERTPOWER

ENERGY MANAGEMENT & MDM CLOUD SERVICE

Expertpower is a versatile online web service (SaaS) platform for energy management.

In addition to interfacing SATEC meters, Expertpower supports any type of on-line third-party equipment (e.g. electricity /water / gas meters). It is a multifunction platform for on-line monitoring and analysis of the logged data.

Expertpower plays an important part in the Industrial Internet of Things (IoT), Industry 4.0 and in Smart Grid applications (MDM, AI). Advanced protection layers ensure the cybersecurity of your data.

Expertpower is ISO 27001 certified.
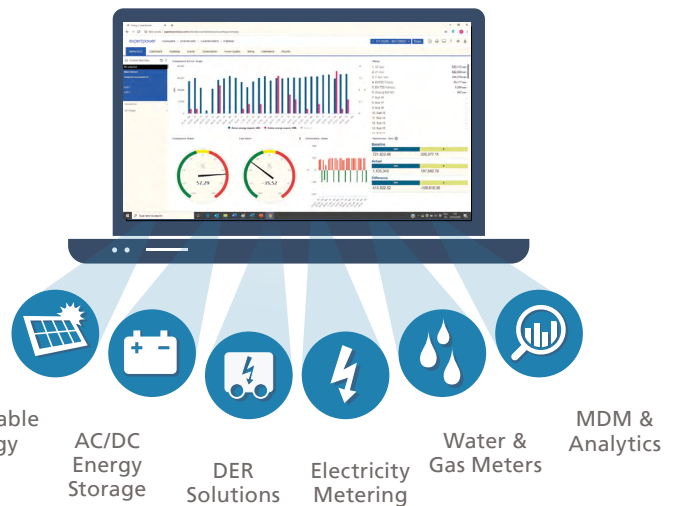
Energy Efficiency Optimization

Improve energy efficiency and reduce spending by generating alerts of consumption irregularities, as well as detailed monitoring and analysis.

Submetering, Billing & AMI

Provides a powerful solution for utility billing, commercial submetering, big data management and advanced analytics.

Power Quality Monitoring

Power quality events and waveforms can be viewed and analyzed, along with standardized reports (EN50160/IEEE1159).

Renewable Energy · AC/DC Energy Storage · DER Solutions · Electricity Metering · Water & Gas Meters · MDM & Analytics

ENERGY MANAGEMENT · REVENUE METERING · DATA CENTER

RENEWABLE ENERGY · POWER QUALITY

EXPERTPOWER

Energy Consumption Analysis

Energy Efficiency: Reduce spending, surcharges and penalties (PF, peak demand, etc.) via analysis of irregular consumption.

Features

- ▫ Energy intelligence dashboards with dynamic drilldown
- ▫ Online / Historical data
- ▫ Energy consumption
- ▫ Maximum demands
- ▫ Customized reports

Meter Data Management (MDM)

- ▫ VEE
- ▫ Meter readings
- ▫ Event & tamper reports
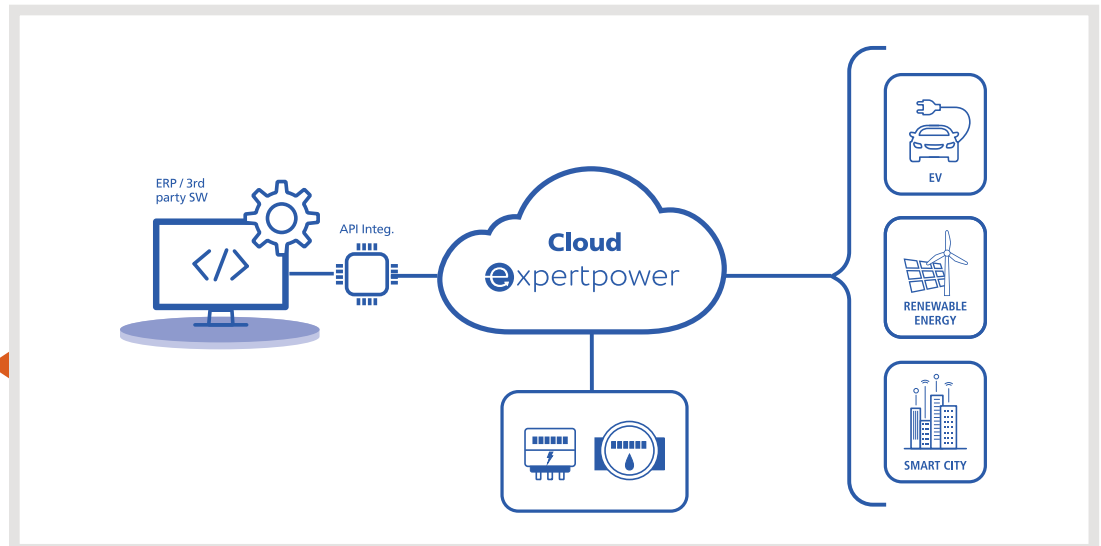
Distributed Energy Sources Management

- Generate daily production forecast
- Prepare regulatory reports and planned production for submission
- Manage client billing

Commercial Sub-Tenant Billing

- Total client billing for all utilities and consumption: Electricity, Gas, Water, HVAC
- TOU billing
- Shadow billing

Power Quality

- Monitor Events and generate reports per EN50160
- Perform waveform analysis
- Export in Comtrade and PQDIF formats
- ITI (CBEMA) curve analysis

Renewable Energy

Predict generation and monitor revenue

GENERAL FEATURES & SPECIFICATIONS

- Email and SMS alerts
- Open Architecture: Standard Web service API
- Export to Excel, PDF
- Connects to Modbus, BACnet, DLMS, 3rd party devices
- Integration with 3rd party applications: BMS, SCADA, ERP
- HTTPS TLS/SSL secured

Note: □/* = Option

Product	DIN Rail	Panel Mount	IEC 62053-22 / ANSI C12.20 (Accuracy)	kWh, kVARh Import & Export, kVAh	Pulse Inputs	TOU Tariffs	THD (Voltage / Current)	TDD (Total Distortion Demand)	K-Factor	Individual Harmonics	Max. Samples per Cycle	Directional Harm. Flows kW, kVAR	Interharmonic Calculation	Event Log	Data Logs	PQ Log	Fault Log	Waveform Log	Time Stamps	IEC 61000-4-30 (Class A)	EN50160 Reports	IEEE 1159 Reports	1 Cycle RMS Calculation	½ Cycle RMS Calculation	Transients	Flicker	Symmetrical Components
PM180	□	■	0.2S	■	■	■	■	■	■	63	1024*	■	■	■	■	■	■	■	■	Ed. 3	■	■	■	■	■	■	■
EM920	Socket	□	0.2S	■	■	■	■	■	■	50	1024*		■	■	■	■	■	■	■	■	■		■	■		■	■
EM720	Wall Mount		0.2S	■	■	■	■	■	■	50	1024*		■	■	■	■	■	■	■	■	■		■		■	■	■
PM17x PRO 174/5	□	■	0.2S	■	■	■	■	■	■	63	256	■	■	■	■	■		■	■	Ed. 3.1	PM175	PM174	■	■	■	■	■
PM17x PRO 172	□	■	0.2S	■	■	■	■	■	■	63	256	■	■	■	■			■	■				■				
BFM136/II — II	■		0.5S	■	□	■	□	□	□	25	64			■	■		■	■	■				■				
BFM136/II — 136	■		0.5S	■		■					64			■	■				■				■				
PRO SERIES	■	■	0.2S	■	■	■	■	■	■	63	256	■	■	■	■	■		■	■	Ed. 3.1	■		■	■	■	■	■
PM130/135 — EH		■	0.5S/0.2S	■	□	135: Built-in / 130: Optional	■	■	■	40	128			■	■				■				■				■
PM130/135 — P		■			□						128												■				■
EM133	■		0.5S	■	■	■	■	■	■	40	128			■	■				■				■				■
EM132	■		0.5S	■	□	■					128								■				■				■

26

Feature		EM132	EM133	PM130/135 P	PM130/135 EH	PRO SERIES	BFM136/II 136	BFM136/II II	PM17X 172	PM17X 174/5	EM720	EM920	PM180
Trafo Calc.	Transformer Correction	■	■	■	■	■	■	■	■	■			■
	Transformer / Line Loss Calculations										■	■	
I/O Programmable	Relay Outputs	4*	1+4*	4*	4*	1+12*		18*	1+4*	1+4*	4*	1+6*	24*
	Analog Outputs	4*	4*	4*	4*	12*			4*	4*		4*	8*
	Digital Inputs	12*	2+12*	12*	12*	2+24*		72*	2+8*	2+8*	4+4*	2+8*	48*
	Analog Inputs	2*	2*			1*		16*					12*
Special Communications	Ethernet Port	□	□	□	□	2	□	■	2	2	□	□	■
	Dual Port Ethernet					■			■	■		■	□
	USB					■		■	■	■	□	■	■
	IR		■			■					■	■	□
	PROFIBUS DP	□	□	□	□								
	Cellular Modem	□	□	□	□		□	□			□	□	□
	Max. No. of Ports	2	2	2	2	5	2	5	4	4	4	5	5
GPS	IRIG-B (GPS Time Synchronization)								■	■	□	□	■
Communication Protocols	Modbus	■	■	■	■	■	■	■	■	■	■	■	■
	DNP3	■	■	■	■	■		■	■	■	■	■	■
	IEC 61850					Ed. 2 *			Ed. 2 *	Ed. 2 *			Ed. 2 *
	IEC 60870-5-101/104	□	□	□	□	■		■	■	■	□	□	■
	BACnet						■	■					
Input Channels	Voltage Channels	3	3	3	3	3	3	3	4	4	3+1*	3+1*	3AC+1AC/DC
	Current Channels	3	3	3	3	4	36	18-54	4	4	4	3+1*	4/8*
	HACS Compatible	■	■	■	■	■	HACS Only	HACS Only	■	■			■
Aux. PS	Auxiliary / Back-up Power Supply					■		□	□	□	Aux. PS* 6h bat.*	□	□
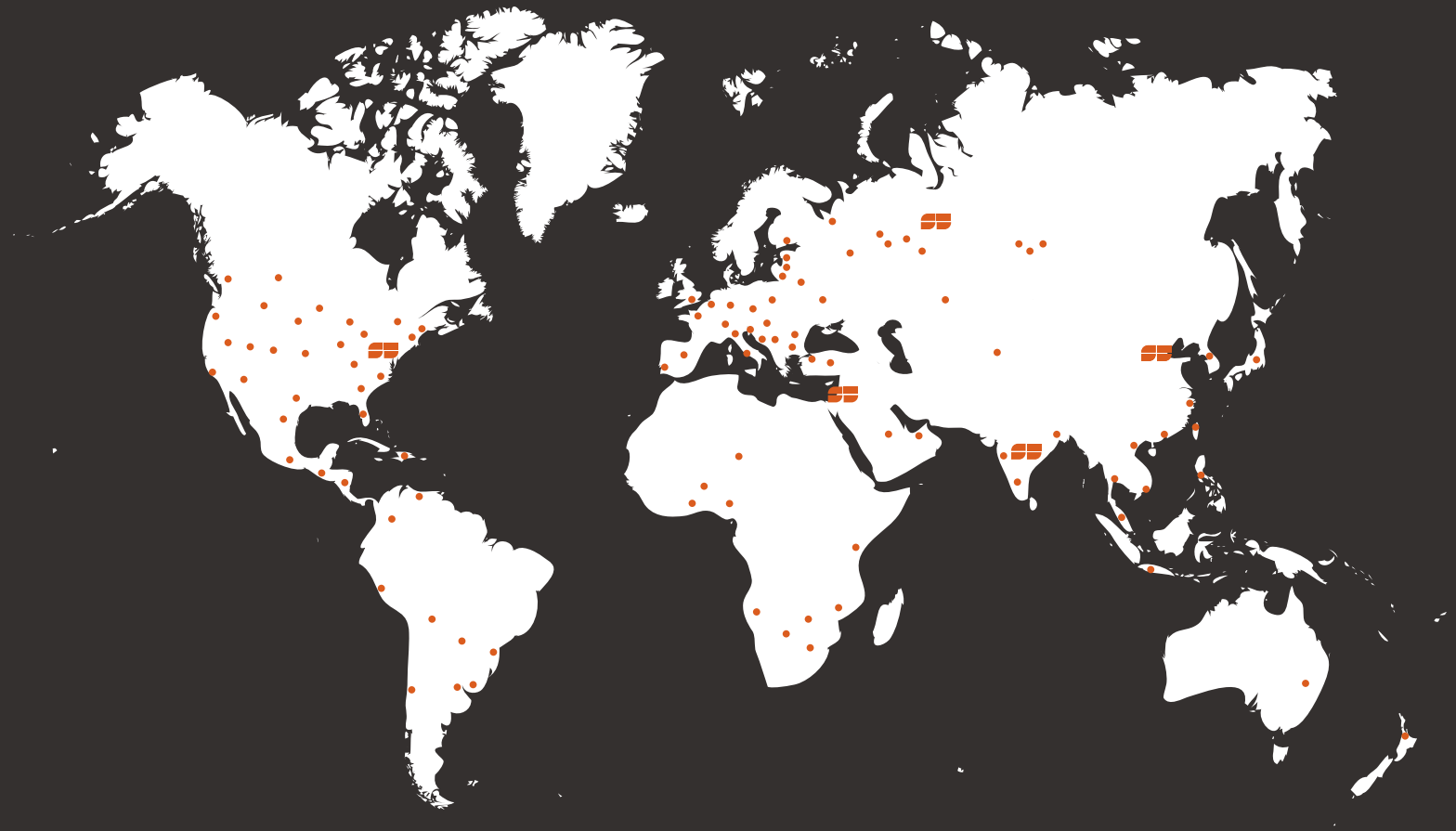
www.satec-global.com

North America	1 888 OK SATEC	sales@satecinc.com
EMEA & APAC	972 2 541 1000	satec@satec-global.com
Latin America	972 2 541 1000	ventas@satec-global.com
China	86 10 8559 0609	china@satec-global.com