SATEC

PRODUCT CATALOG

SATEC

THE EXPERTS IN ENERGY MANAGEMENT

Founded in 1987, SATEC is a solutions-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 Europe, North and South America, Asia, Oceania and Africa. 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 latest standards requirements during the product design phase.

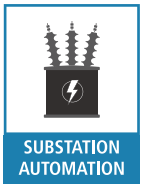
Power Quality Analysis

At the heart of SATEC instruments lies the functionality of the Power Quality Analyzer. Whether as the PM175 dedicated power analyzer or as the EM720/EM920 series which combines power quality analysis with revenue grade metering.
With our PM180 now 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

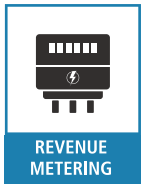
Featuring advanced data-logging capabilities, measured and calculated parameters and parameter-based setpoint triggers, our meters are ideal for monitoring industrial processes and optimizing power efficiency. Straightforward examples are smart transducer functionality for alerting and adjusting process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

Substation Monitoring



Since its establishment, SATEC has been implementing 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



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

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.

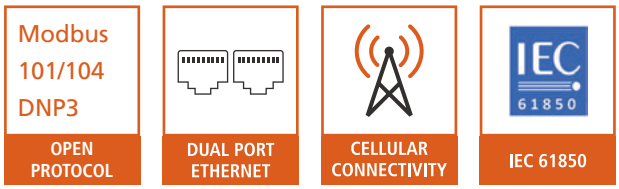
"All in One"

Designed using a modular approach, our devices can host an astounding variety of functionalities. A power quality analyzer can perform not only as such, but rather serve simultaneously as a Fault Recorder, Phasor Measurement Unit (per IEEE C37.118) and Bay Controller or transducer, utilizing extensively modular I/O options. This allows revolutionary substation design, resulting in cost reduction.

Durability and Reliability

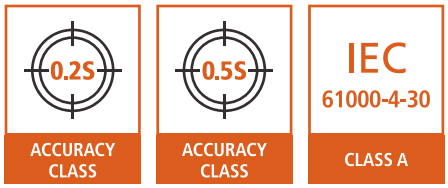
As a global manufacturer, our products have continuously evolved over the past 30 years, incorporating the most stringent requirements of utilities and users from all over the globe. Our products comply with harsh environmental requirements, maintaining functionality in temperatures as low as -40˚C and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

Connectivity



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

Accuracy



If you are measuring power, you want to do so accurately. Otherwise, why measure? SATEC takes accuracy to the next level, by 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

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

SATEC is committed to uncompromising compliance with the highest requirements in the energy field. SATEC 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

13x SERIES MULTIFUNCTIONAL POWER METERS

PM130 PLUS

PM135

EM132

EM133

MID CERTIFIED

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 Hall Effect Sensors. For further information see page 13.

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, or DC Hall Effect Sensor)
- 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*

* (PM130 PLUS; 0-1500V DC with VRM)

Revenue Meter

- Exceeds Class 0.5S accuracy (PM13x: optional calibration for 0.2S)
- MID approved (EM133)
- Time of Use (TOU) tariffs
- Anti-tamper design
- Built-in Infrared port

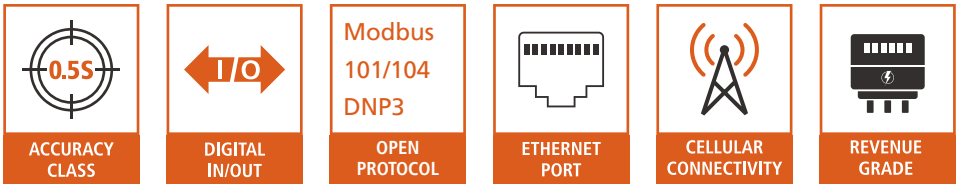
Built-in I/Os (EM133): 1 relay + 2 DI

Communication Protocols

- Modbus RTU, IEC 60870-5-101/104, DNP 3.0, PROFIBUS DP, DLMS

Alarm, Control & Data-Logging

- 16 programmable set-points
- Up to 8MB for data-logging



2nd Comm. Port

Small form

One of the following:

- Ethernet (TCP/IP)
- PROFIBUS
- RS232/422/485
- Cellular Modem * 2G/3G/4G or CAT-M (EM133)
- CANopen (CAN Bus)
- WiFi / RF **

* Optional: 2 AI in module

** Module & accessories available in certain regions only

Analog Outputs

Small form

4 analog outputs, selection of ranges upon order:

- ±1mA
- 0-20mA
- 0-1mA
- 4-20mA
- 0-3mA
- ±3mA
- 0-5mA
- ±5mA

Digital I/O

Small form

- 4 Digital Inputs (dry contact) / 2 EM Relay Outputs 250V AC / 5A
- 4 Digital Inputs (dry contact) / 2 SSR outputs 250V AC/DC / 0.1A8 Digital Inputs (dry contact)
- 4 Digital Inputs (dry contact) with RTC battery backup for TOU (PM130 PLUS only)

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

PRO SERIES NEXT GENERATION POWER METERS

PM335

EM235

- IEC 61850
- Dual port ethernet
- Waveform capture
- 16GB memory
- USB C port
- PQ Class S / EN50160
- 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 serves also as a power quality analyzer, with Class 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.

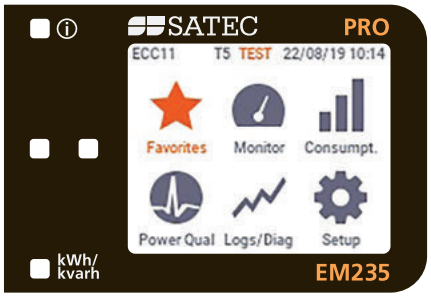
DC Metering

High accuracy (0.2%*) direct metering of DC systems is performed via Hall Effect Sensors. For more information see pg. 13.

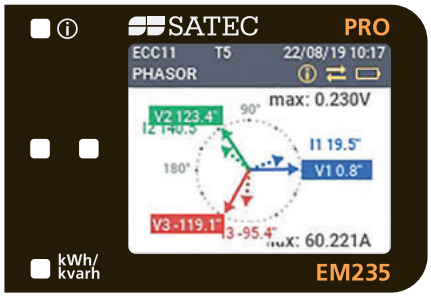
Ultimate Modularity

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

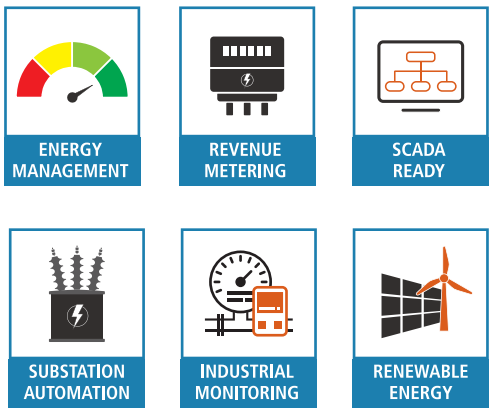


Main Menu with Favorites Area



Phasor Screen

APPLICATIONS



AVAILABLE MODULES

- **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
- **Additional modules**
  - Auxiliary power supply
  - Cellular 3G/CAT-M modem
  - 2nd set of voltage inputs (AC/DC)
  - Additional current inputs (AC/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 tariffs profile; 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

Communication

- Ports
  - 2 × ETH (independent interfaces), USB, RS485, Optical Port (IR) supporting IEC 62056-21
  - Optional 3G/CAT-M modem
- Protocols
  - IEC 61850 (MMS and Goose support)
  - Modbus RTU/TCP, MODBUS Master
  - DNP3/DNP3.0/TCP (level 2)
  - IEC 60870-5-101/104
  - IEC 62056-21
  - DHCP support, PRP

Current Input Options

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

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*

On-Board Inputs / Outputs

- Built-in I/Os (optional): 2 digital inputs; 1 SSR output; 1 analog inputs

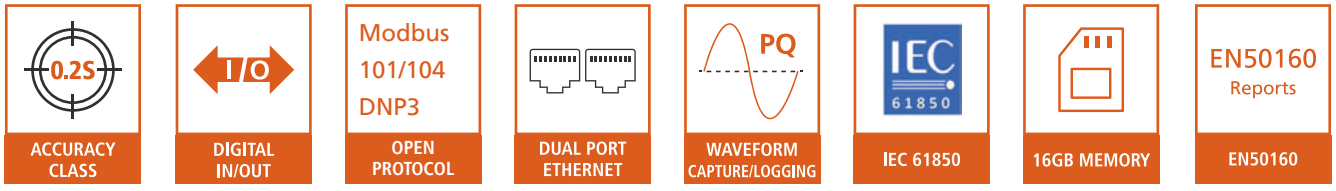
Programmable Logical Controller

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

Power Supply

- 90-332V AC / 40-290V DC
- Optional aux. power supply module: 88-264V AC / 125-300V DC

* Extended range, up to over 2,500V DC is possible with HEPS module. See page 19.



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) 3x120/208–277/480V AC

Current-circuit modules: up to 18 channels: either 18 3-phase or 54 single phase

Multi-Circuit Meter for Substation Monitoring & Sub-Tenant Billing

BFM-II

BFM136

With Class 0.5S accuracy, multi-tariff (TOU) metering and anti-tamper design, these multi-circuit meters are ideal as a 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

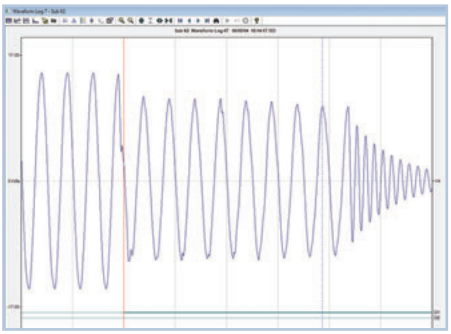
The BFM136 (1st gen.) is a TOU energy meter, equipped with 12 three-phase current inputs (non-modular, no I/O).

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 20 × In.

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



Optional cellular modem & 2nd COM port

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

Up to 72 digital inputs (optional)

Up to 8 analog inputs (optional)

Up to 18 relay outputs (optional)

Current Input Options

HACS: 100A-3000A
RS5: 5A HACS
FLEX: 3V AC (Rogowski)

Combining input module types is possible

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, IEC 60870-5-101/104, BACnet

ACCURACY CLASS

DIGITAL IN/OUT

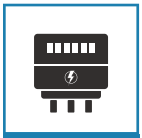
Modbus
101/104
DNP3
OPEN PROTOCOL

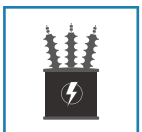

INDIVIDUAL HARMONICS


CELLULAR CONNECTIVITY

APPLICATIONS


ENERGY MANAGEMENT


REVENUE METERING


SUBSTATION AUTOMATION


DATA CENTER

PM17x SERIES PQ ANALYZERS & POWER METERS

PM174/5

Power Quality Analyzer & Class 0.2S Power Meter IEEE 1159 / EN50160 / GOST 32144

PM175 / PM174 POWER ANALYZERS

PM175 provides the full range of power quality monitoring, logging and statistics according to EN50160 and GOST 32144. **PM174** provides the same performance in accordance with IEEE 1159, with optional fault recorder functionality.

PM172 POWER METER

PM172 is a highly accurate (Class 0.2S) power meter with basic PQ monitoring, such as harmonics, THD, TDD and K-factor.

ABB MV SENSOR INTERFACE

Tested and approved by ABB for this application, the PM174/5 interface with a variety of ABB MV sensors serving as PTs, CTs or PT/CT combos, via RJ45 V/I inputs.

FEATURES

Multi-Functional 3-Phase Power Meter

- Voltage, current, power, energy, power factor, frequency, voltage/current unbalance, load profile
- ABB KEVA/KECA/KEVCY sensor interface. See SATEC website for detailed list
- 16 programmable set-points
- 2 DI, 2 DO (+2 AO / 2 AI)

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 or GOST 32144-2013 reports and statistics
- PQ event logging & 6-channel waveform recording (3 voltage + 3 current)
- 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

Measured Voltage Range

- Nominal: 0-690V (L-L)

Current Input Options

- Standard 1A or 5A inputs
- 40mA inputs for SATEC HACS CTs

Power Supply

- AC/DC: 85-264V AC, 88-290V DC
- Optional: 12V DC, 24V DC, 48V DC

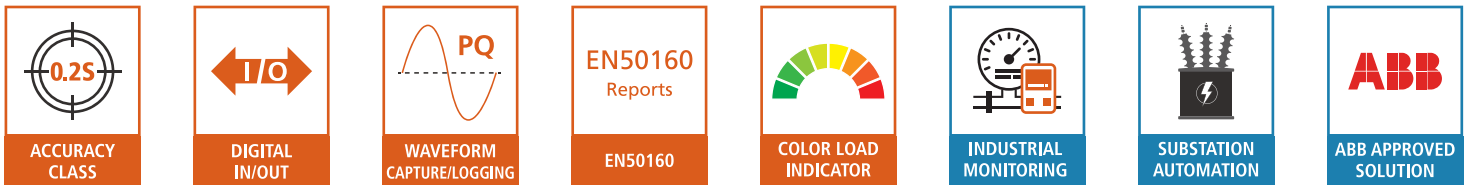
Communication

- 2 independent communication ports (RS232/422/485, ETH, PROFIBUS DP, 2G/3G)
- Protocols: Modbus RTU, ASCII, DNP 3.0

Construction & Durability

- Full galvanic isolation of voltage and current measuring circuits—6 kV Impulse
- Dual panel mount: 4" Round; 96×96 Sq.

APPLICATIONS



DC Metering

Systems which either produce or consume direct current are becoming commonplace. This includes commercial clients and industrial applications, raising the demand for accurate metering of DC systems. SATEC has adapted several products for compatibility with DC metering via Hall Effect Sensors. This now enables accurate metering of DC systems, combining the familiar SATEC features of data-logging, high-accuracy and our advanced communication protocols and control options.

Compatible Meters

PRO Series
PM130 PLUS

Supporting Devices

HEPS
SATEC Hall Effect Power Supply Module
(see pg. 19)

VRM
SATEC Voltage Ratio Module
(see pg. 19)

RENEWABLE ENERGY

Solar PV panels and wind turbines are a growing source of energy which involves DC electricity production. The need to monitor these systems, providing accurate energy measurement before conversion to AC, is crucial for reflecting true efficiency and conversion losses.

TRANSPORTATION

Countries are investing considerably in mass transportation infrastructure, including railway transit. Electrification is the modern norm, with systems designed quite often for DC current, making DC power measurement of paramount importance.

DATACENTERS

Running 24/7, operators are in a constant drive for a better Power Usage Effectiveness of the energy consumed by the servers. Datacenters based on DC system architecture are a trend which is more economical with equipment, requiring less space and maintenance, while at the same time improving reliability and efficiency.

INDUSTRIAL PROCESSES

Electrochemical processes, such as aluminum smelting, are conducted in direct current. Consuming an extraordinary amount of energy, these processes are extremely sensitive to changes in current supply, making accurate metering critical. Another commonplace example for a DC application is battery charging.

FEATURES

- Average and Real time values: Voltage, Current, Power, Bi-directional DC energy calculation
- Events & Data logs
- Voltage range: 20-3000V DC*
- Current range: up to 3000A DC**
- Energy metering accuracy: starting 0.2%**
- External power supply is required

* Additional adaptor is required for voltage measurement above 800V DC
** Depending on type of DC Hall Effect Sensor

APPLICATIONS

INDUSTRIAL MONITORING

DATA CENTER

RENEWABLE ENERGY

PM180 MULTIFUNCTION POWER QUALITY ANALYZER

Class A Ed. 3

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

Wide range of digital & analog I/Os

Auxiliary PS

Four galvanically isolated voltage channels

Four galvanically isolated current channels up to 40 x In

NMi CERTIFIED

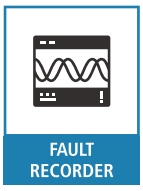
The Heart and Backbone of SATEC Versatility and Functionality

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

POWER QUALITY ANALYZER

Certified as Class A, Edition 3 (IEC 61000-4-30:2015), the PM180 complies with the most current requirements of power quality analyzers, generating EN50160 reports and logging waveform captures.

FAULT RECORDER / DISTANCE TO FAULT



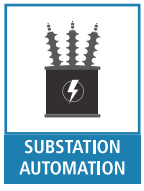
Measuring currents rated at 40 × In, the PM180 can record fault waveforms, serving as a distributed fault recorder, triggered by event or DI.
Advanced algorithms enable Distance to Fault calculation as well.

Functionality & Applications

SEQUENCE OF EVENTS

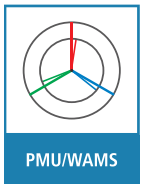
Viewing events in a timestamped sequence. Logged events: digital input events, relay output events, fault events and setpoint events. SoE Log reports establish links between the recorded events and other database records, indicating any existing correlation.

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.

PHASOR MEASUREMENT UNIT (PMU)



Designed as an add-on card, featuring both IEEE C37.118.2 protocol and IEC 61850-90-5, the SATEC PMU 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). See page 18.

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: 0.0001 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 (update every 1 ms) DI
- 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
- Sags/swells detection and logging
- Interruptions detection and logging
- 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
- Transient detection and logging
- 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

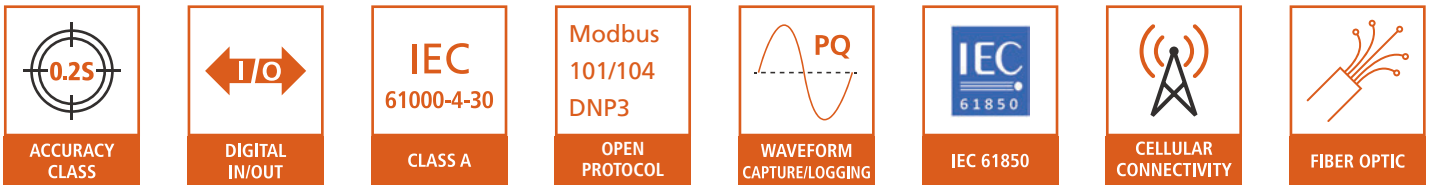
- 64 programmable set-points

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, Cellular Modem
- Ethernet: optional 2 Ethernet ports for 10/100 Base-T redundancy with fiber optic module
- Standard protocols: Modbus RTU, ASCII, Modbus/TCP, DNP 3.0, DNP3/TCP
- IEC 60870-5-101/104
- Optional protocol: IEC 61850 ed. 2 (MMS and GOOSE Messaging)



EM720/EM920 REVENUE METER & POWER QUALITY ANALYZER

The Ultimate Hybrid

The eXpertMeter™ Series are multi-functional power analyzers. This series was designed to deliver two functionalities that are present in every substation, in a single device:

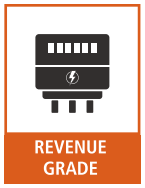
- **PQ Analyzer & Power Meter**, typically required by utility SCADA teams
- **Revenue Meter**, typically operated and read by the utility billing department

Combining these functions simplifies design and eliminates redundancy.

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



Class 0.2S Revenue Meter

Cutting Edge Power Quality Analyzer

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
- Transformer and transmission line losses calculation (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

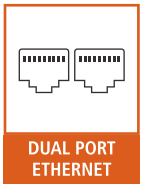
- High Speed Transient detection as short as 17 µs @ 60Hz / 20 µs @ 50Hz

Communications

- RS232 / RS485 / Ethernet /IRIG-B/ USB / Cellular / IR
- **Protocols**: Modbus RTU, ASCII, DNP 3.0, Modbus/TCP, DNP3/TCP, IEC 62056-21/61 (OBIS), IEC 61850, MV90 (EM920)

Durability

- I/O and Comm. Ports isolation—4 kV AC



EM720

EM720 Wall Mount Meter

The EM720's unique "Add-On" hot-swap module concept 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

Construction

- **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

MV90 COMPATIBLE

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 set-points
- 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

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

Construction

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

APPLICATIONS

ENERGY MANAGEMENT | REVENUE METERING | SCADA READY | SUBSTATION AUTOMATION | POWER QUALITY | 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 over UDP / TCP
- PTP / IRIG-B time sync

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 ours 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

Pole-Top MV Monitoring with Unique Sensors (PT/CT) for Smart Grid Deployment

The PM175 and PM180 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
- Capacitor controls
- Voltage regulation
- Outage detection
- Load balance
- Harmonics
- Fault detection
- Power theft

SENSOR OPTIONS

Available Models per Rating:

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

DC APPLICATION ACCESSORIES

DC Voltage Measurement

VRM - Voltage Regulator Module for DC Applications

For various reasons pertaining to system optimization, it is quite common for direct current applications to involve voltage levels as high as 1,500V DC.

The SATEC VRM Module is designed to comply with such systems, connecting SATEC meters to DC voltage systems above meter rating (800-820V DC) ranging as high as 1500V DC and above.

Technical Specifications

- Accuracy = 0.1%
- 3 Independent voltage inputs
- Terminals: Wire size: 12 AWG (up to 3.5 mm^2)
- DIN-rail installation
- Dimensions: 127 × 75 × 52 mm
- Weight: 80 grams
- Installation: DIN-Rail only

DC Current Measurement

Hall Effect Sensors

SATEC supplies Hall Effect Sensors for current measurement in DC applications. This range of sensors is supplied with ratings from 100-4,000A DC.

HEPS - Hall Effect Power Supply Module

This power supply module is necessary for powering the Hall Effect Sensors and powers up to 4 sensors per unit.

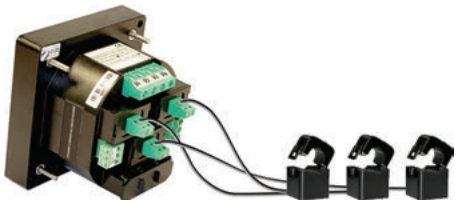
Technical Specifications

- **Input**
  - Voltage: 90-264V AC (50/60Hz)
  - Burden: 30 VA
- **Connector Type**
  - Terminals: 2 × 7.5mm
  - Wire Size: 1.5-0.25mm^2
- **Output**
  - Voltage: 4 × ±15V DC (+15; 0; -15)
  - Power: 4 × 1.5W per each
- **Environmental**
  - -40°C to 60°C / -40°F to 140°F

HACS HIGH ACCURACY CURRENT SENSORS

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 nearly each of the SATEC products (see list below).

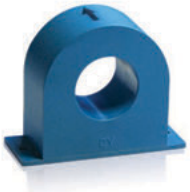
ULTIMATE ACCURACY: Acting as a primary CT, with a product range of up to 3000A, there is no need for further/external CTs for measurement. These CTs feature milliamp outputs, feeding directly into the meter, making it a "one-CT" system, thus considerably increasing accuracy.

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, enabling running 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
PM13x Series
BFM136/BFM-II
PRO Series
PM17x Series
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
CS05S	10A	Split	Ø 0.6	Ø 16
CS1	100A	Solid	Ø 0.5	Ø12
CS1L	100A	Solid	Ø 0.9	Ø 23
CS1S	100A	Split	Ø 0.6	Ø 16
CS1H	100A	Split	Ø 0.5	Ø 13
CS2	200A	Solid	Ø 0.9	Ø 23
CS2S	200A	Split	0.96×0.9	25×23
CS2SL	200A	Split	1.7×1.3	43×33

P/N	RATING CORE		OPENING	
			INCH	MM
CS2.5S	250A	Split	0.96×0.9	25×23
CS4	400A	Solid	Ø 1	Ø 26
CS4S	400A	Split	1.7×1.3	43×33
CS8	800A	Solid	4×1.3	32×100
CS8S	800A	Split	1.9×3.1	50×80
CS12S	1200A	Split	3.1×4.7	80×120
CS20S	2000A	Split	3.1×6.3	80×160
CS30S	3000A	Split	3.1×6.3	80×160

DISPLAYS & ACCESSORIES

Displays

For several SATEC devices (see below), the display component is modular, allowing the user a choice to implement them 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.

RGM180 Graphic Touch Screen

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.

Display Mounting

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

Compatible Devices

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

RDM174 / RDM175
For PM174/5 Series

RDM180
For PM180

RDM312
Multi-window display module for PM17x, PM180

Accessories

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.

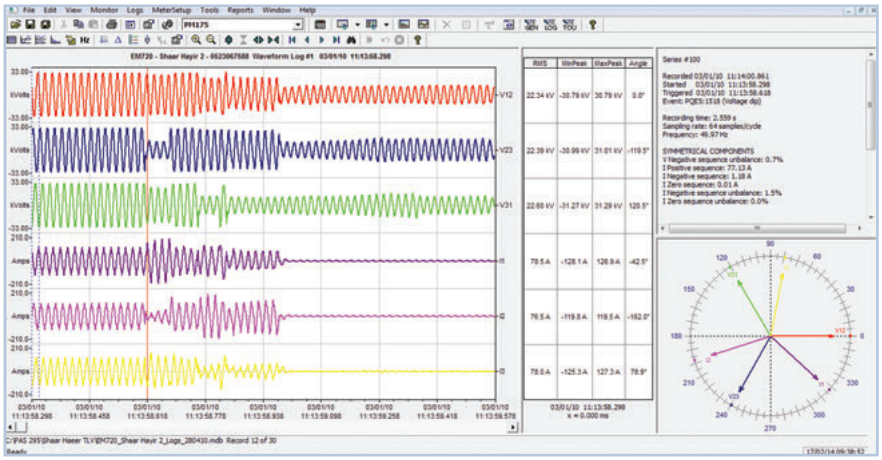
ETC-I Gateway

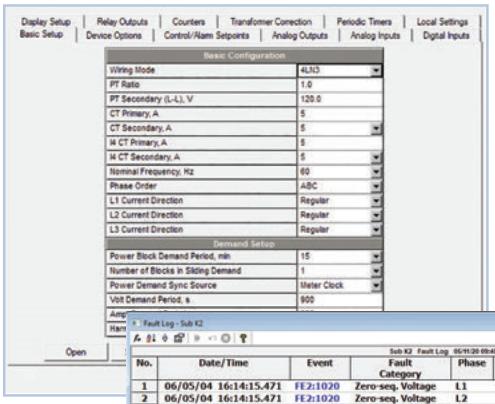
The ETC I serves as a transparent gateway, connecting several serial-communication devices to the internet, either via ETH port or via cellular communication.

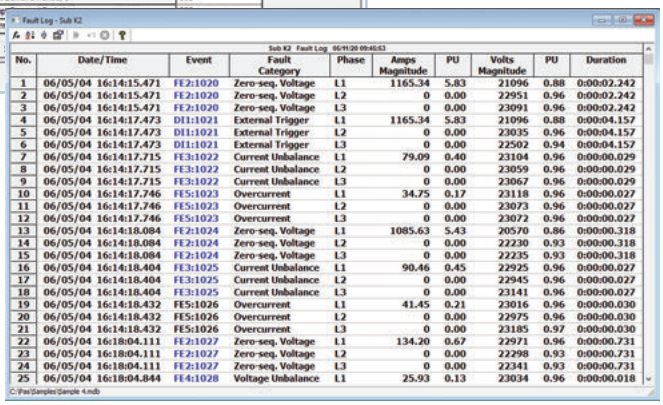
PAS

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.

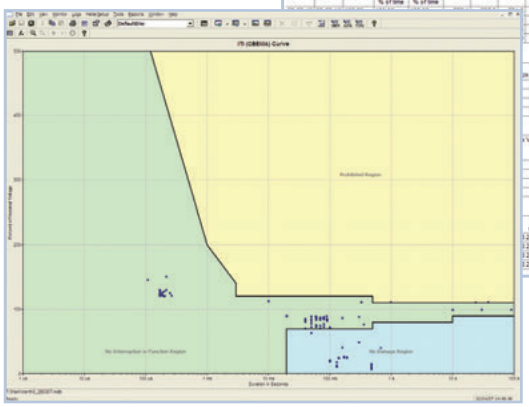
PAS is bundled with all SATEC instruments at no extra charge.







No.	Date/Time	Event	Fault Category	Phase	Amps Magnitude	PU	Volts Magnitude	PU	Duration
1	06/05/04 16:14:15.471	FE2:1020	Zero-seq. Voltage	L1	1165.34	5.83	21096	0.88	0:00:02.242
2	06/05/04 16:14:15.471	FE2:1020	Zero-seq. Voltage	L2	0	0.00	22951	0.96	0:00:02.242
3	06/05/04 16:14:15.471	FE2:1020	Zero-seq. Voltage	L3	0	0.00	23091	0.96	0:00:02.242
4	06/05/04 16:14:17.473	DI1:1021	External Trigger	L1	1165.34	5.83	21096	0.88	0:00:04.157
5	06/05/04 16:14:17.473	DI1:1021	External Trigger	L2	0	0.00	23035	0.96	0:00:04.157
6	06/05/04 16:14:17.473	DI1:1021	External Trigger	L3	0	0.00	22502	0.94	0:00:04.157
7	06/05/04 16:14:17.715	FE3:1022	Current Unbalance	L1	79.09	0.40	23104	0.96	0:00:00.029
8	06/05/04 16:14:17.715	FE3:1022	Current Unbalance	L2	0	0.00	23059	0.96	0:00:00.029
9	06/05/04 16:14:17.715	FE3:1022	Current Unbalance	L3	0	0.00	23067	0.96	0:00:00.029
10	06/05/04 16:14:17.746	FE5:1023	Overcurrent	L1	34.75	0.17	23118	0.96	0:00:00.027
11	06/05/04 16:14:17.746	FE5:1023	Overcurrent	L2	0	0.00	23073	0.96	0:00:00.027
12	06/05/04 16:14:17.746	FE5:1023	Overcurrent	L3	0	0.00	23072	0.96	0:00:00.027
13	06/05/04 16:14:18.084	FE2:1024	Zero-seq. Voltage	L1	1085.63	5.43	20570	0.86	0:00:00.318
14	06/05/04 16:14:18.084	FE2:1024	Zero-seq. Voltage	L2	0	0.00	22230	0.93	0:00:00.318
15	06/05/04 16:14:18.084	FE2:1024	Zero-seq. Voltage	L3	0	0.00	22235	0.93	0:00:00.318
16	06/05/04 16:14:18.404	FE3:1025	Current Unbalance	L1	90.46	0.45	22925	0.96	0:00:00.027
17	06/05/04 16:14:18.404	FE3:1025	Current Unbalance	L2	0	0.00	22945	0.96	0:00:00.027
18	06/05/04 16:14:18.404	FE3:1025	Current Unbalance	L3	0	0.00	23141	0.96	0:00:00.027
19	06/05/04 16:14:18.432	FE5:1026	Overcurrent	L1	41.45	0.21	23016	0.96	0:00:00.030
20	06/05/04 16:14:18.432	FE5:1026	Overcurrent	L2	0	0.00	22975	0.96	0:00:00.030
21	06/05/04 16:14:18.432	FE5:1026	Overcurrent	L3	0	0.00	23185	0.97	0:00:00.030
22	06/05/04 16:18:04.111	FE2:1027	Zero-seq. Voltage	L1	134.20	0.67	22971	0.96	0:00:00.731
23	06/05/04 16:18:04.111	FE2:1027	Zero-seq. Voltage	L2	0	0.00	22298	0.93	0:00:00.731
24	06/05/04 16:18:04.111	FE2:1027	Zero-seq. Voltage	L3	0	0.00	22341	0.93	0:00:00.731
25	06/05/04 16:18:04.844	FE4:1028	Voltage Unbalance	L1	25.93	0.13	23034	0.96	0:00:00.018



FEATURES

- 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 polling of devices
- 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 SYSTEM (SaaS) FOR EVERY APPLICATION

Expertpower is SATEC's versatile software platform for energy management, available either as an online web service (SaaS) or as a stand-alone installation (Pro edition).

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, Industry 4.0 and in Smart Grid applications (MDM, AI). Advanced protection layers ensure the cybersecurity of your data.

Energy Efficiency Optimization

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

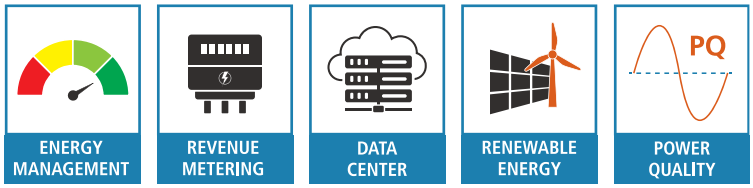
Sub-metering, Billing & AMI

Providing a powerful solution for utility billing, commercial construction sub-metering, 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).

APPLICATIONS



EXPERTPOWER

Energy Consumption Analysis

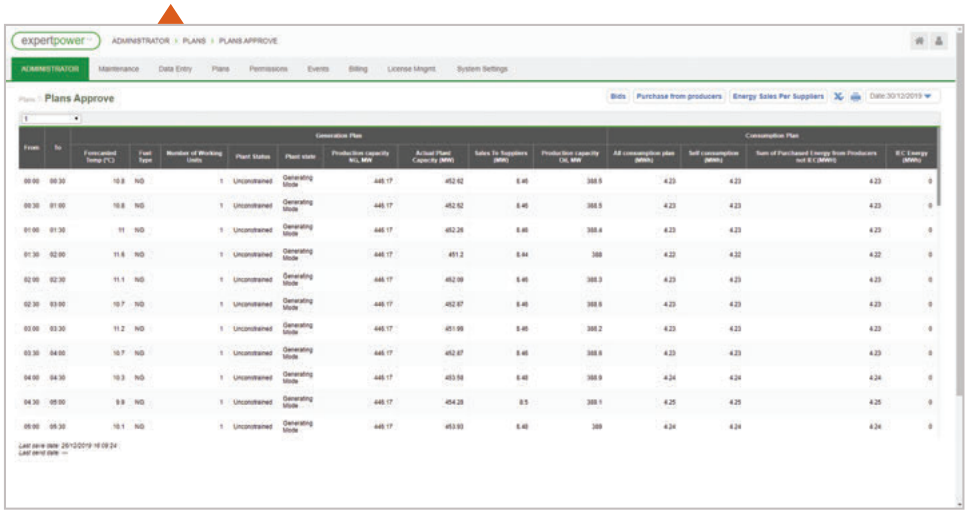
Energy Efficiency: Reduce spending, surcharges and penalties (PF, peak demand, etc.) via analysis of irregular consumption

Features

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

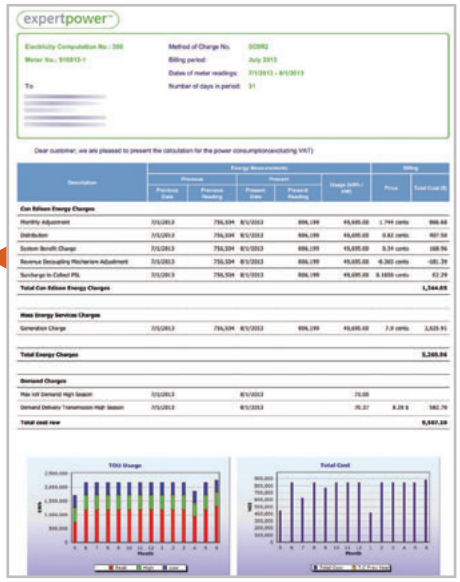
Distributed Energy Sources Management

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



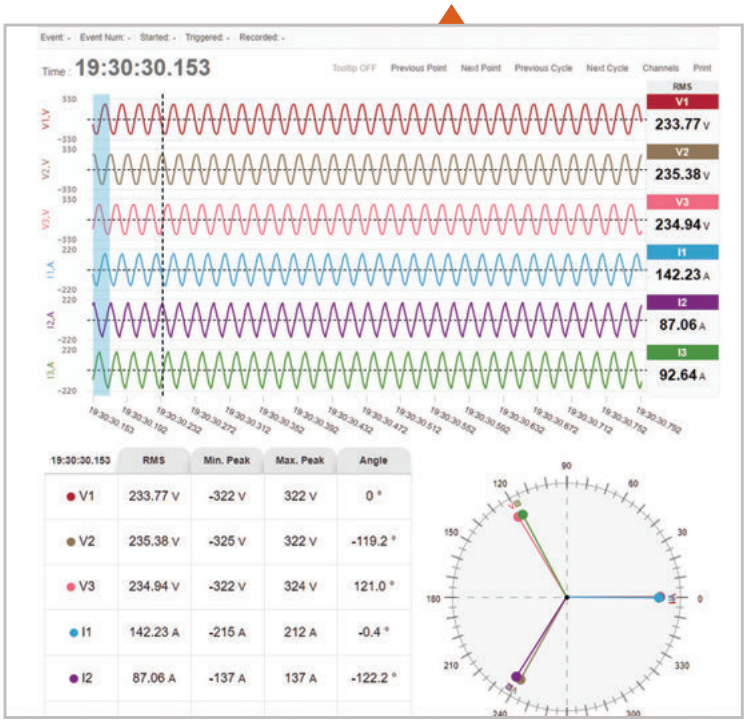
Commercial Sub-Tenant Billing

- 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

COMPARISON TABLE

			PM130/135		PRO SERIES	BFM136/II		PM17X Series				
	EM132	EM133	P	EH		136	II	172EH	174/5	EM720	EM920	PM180
DIN Rail	■	■			■	■	■			Wall Mount	Socket	□
Panel Mount			■	■	■			■	■		□	■
IEC 62053-22 / ANSI C12.20 (Accuracy)	0.5S	0.5S		0.5S/0.2S	0.2S	0.5S	0.5S	0.2S	0.2S	0.2S	0.2S	0.2S
kWh, kVARh Import & Export, kVAh	■	■		■	■	■	■	■	■	■	■	■
Pulse Inputs	□	■	□	□	■		□	■	■	■	■	■
TOU Tariffs	■	■		135: Built-in 130: Optional	■	■	■	■	■	■	■	■
THD (Voltage / Current)		■		■	■		□	■	■	■	■	■
TDD (Total Distortion Demand)		■		■	■		□	■	■	■	■	■
K-Factor		■		■	■		□	■	■	■	■	■
Individual Harmonics		40		40	50		25	40	50	50	50	63
Max. Samples per Cycle	128	128	128	128	256	64	64	128	128	1024*	1024*	1024*
Directional Harm. Flows kW, kVAR					■							■
Interharmonic Calculation									■	■	■	■
Event Log		■		■	■	■	■	■	■	■	■	■
Data Logs		■		■	■	■	■	■	■	■	■	■
PQ Log					■				■	■	■	■
Fault Log							■			■	■	■
Waveform Log					■		■	■	■	■	■	■
Time Stamps	■	■		■	■	■	■	■	■	■	■	■
1 Cycle RMS Calculation	■	■	■	■		■	■	■				
½ Cycle RMS Calculation					■				■	■	■	■
Transients									■	■	■	■
Flicker									■	■	■	■
Symmetrical Components		■	■	■	■				■	■	■	■
EN50160 Reports					■				PM175	■	■	■
IEEE 1159 & IEEE 519 Reports									PM174			■
GOST 13109 / GOST R 54149-2010									□	□		□

Instal.

Energy Measurements

Total Harm. Distortion

Individual Harmonics

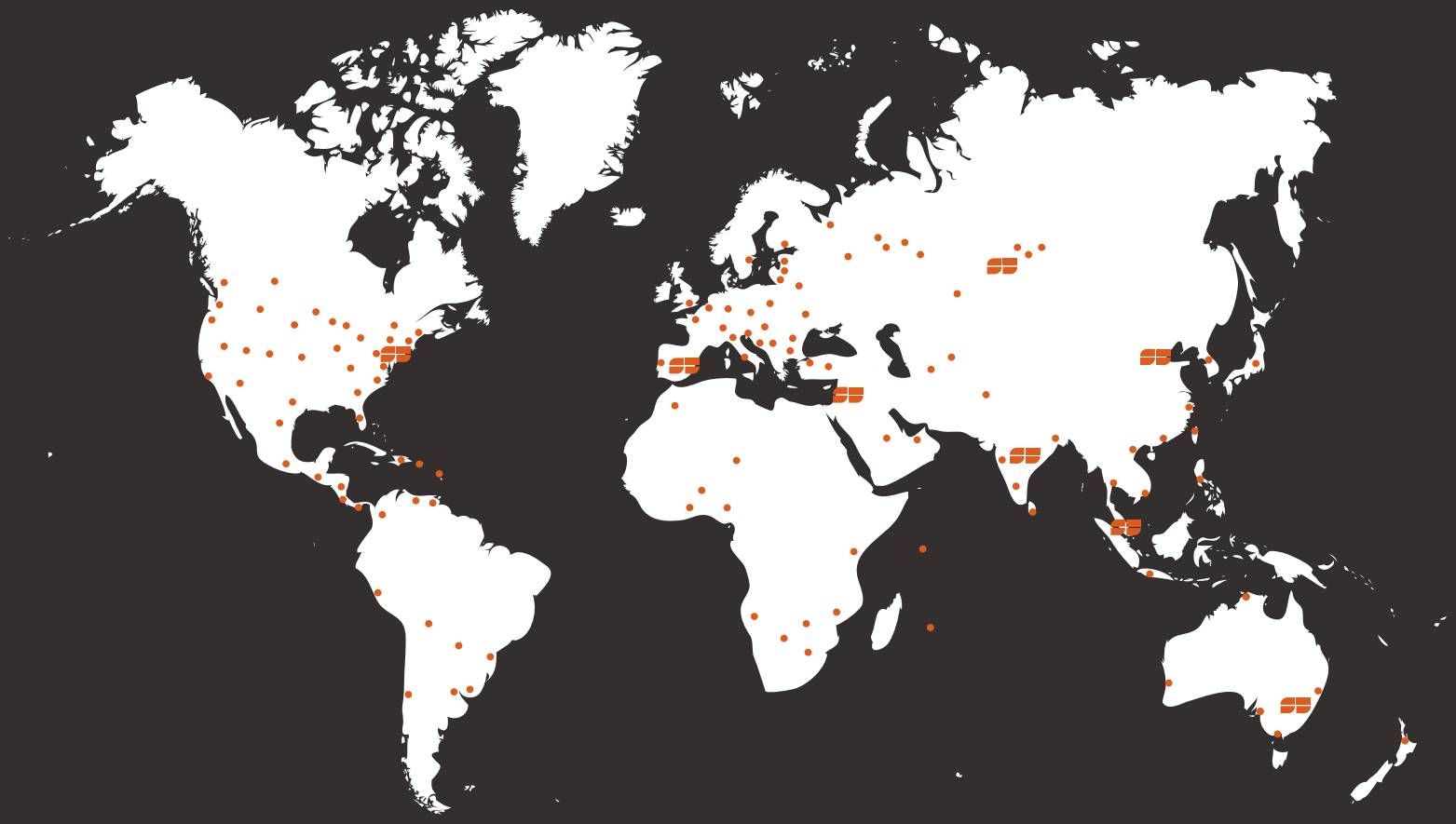
Event, Data, Waveform Logging

Power Quality Analysis (PQA)

Note: □/* = Option

	EM132	EM133	PM130/135 P	PM130/135 EH	PRO SERIES	BFM136/II 136	BFM136/II II	PM17X Series 172EH	PM17X Series 174/5	EM720	EM920	PM180	
Transformer Correction	■	■	■	■	■	■	■	■	■			■	Trafo Calc.
Transformer/Line Loss Calculations										■	■		
Relay Outputs	4*	1+4*	4*	4*	1+8*		18*	2+2*	2+2*	4*	1+6*	24*	I/O Programmable
Analog Outputs	4*	4*	4*	4*				2*	2*		4*	8*	
Digital Inputs	12*	2+12*	12*	12*	2+24*		72*	2+2*	2+2*	4+4*	2+8*	48*	
Analog Inputs	2*	2*			1*		16*	2*	2*			12*	
Ethernet Port	□	□	□	□	2	□	■	□	□	□	□	■	Special Communications
Dual Port Ethernet					■						■	□	
USB					■		■			□	■	■	
IR		■			■					■	■	□	
PROFIBUS DP	□	□	□	□				□	□				
Cellular Modem	□	□	□	□		□	□	□	□	□	□	□	
Max. No. of Ports	2	2	2	2	6	2	5	2	2	4	5	5	
IRIG-B (GPS Time Synchronization)										□	□	□	GPS
Modbus RTU, ASCII, Modbus/TCP	■	■	■	■	■	■	■	■	■	■	■	■	Communication Protocols
DNP3.0, DNP3/TCP	■	■	■	■	■		■	■	■	■	■	■	
IEC 61850					■					□	□	□	
IEC 60870-5-101/104	□	□	□	□	■		■					■	
BACnet						■	■						
Voltage Channels	3	3	3	3	3	3	3	3	3	3+1*	3+1*	3AC+1AC/DC	Input Channels
Current Channels	3	3	3	3	4	36	18-54	3	3	4	3+1*	4/8*	
HACS Compatible	■	■	■	■	■	HACS Only		■	■			■	
Back-up Power Supply					■		□			Aux. PS* 6h bat.*	□	□	Aux. PS

Note: □/* = Option



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