







# SATEC

## PRODUCT CATALOG



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# THE EXPERTS IN ENERGY MANAGEMENT



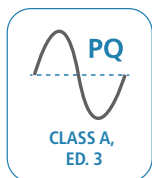
Founded in 1987, SATEC is a solution-oriented global leader in specialty solutions for power metering; from research to development and manufacturing. Over the past several decades, our high-quality power meters, analyzers and software have been implemented by leading utility and industrial icons worldwide, 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



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.

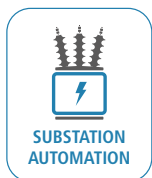
### Industrial Power Metering



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).

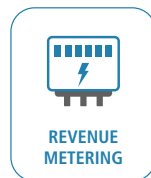
### Substation Monitoring



Since its establishment, SATEC has 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



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. 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.

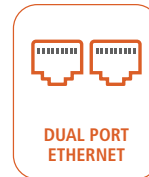
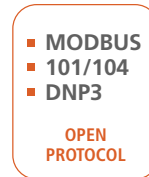
### Durability and Reliability



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

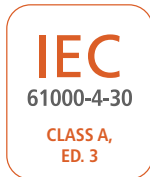
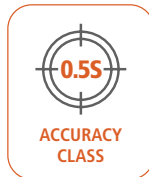
as low as -40°C and as high as 70°C, or under humidity up to 98%. Galvanic (transformer) isolation and similar design provides resilience up to 4kV (RMS) and 12kV (impulse).

### Connectivity



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



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



PM130 PLUS



PM135



EM132\*



EM133

## SATEC's Powerful SCADA-Ready Series

The PM13x/EM13x family are multifunctional 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 [see page 13](#).

### FEATURES

#### Measured/Calculated Parameters

- ▣ **Power & Energy:** V, I, Hz,  $\cos \phi$  (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 40<sup>th</sup>. 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 HAC5)
- ▣ 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

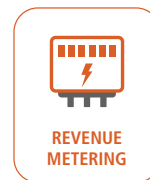
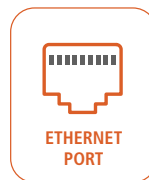
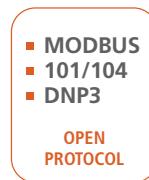
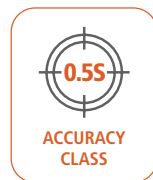
**Built-in I/Os (EM133):** 1 relay + 2 DI

#### 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



\* Not available for all markets



## 2<sup>nd</sup> 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)

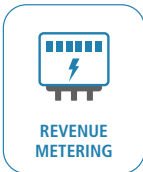
## Digital I/O

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 2<sup>nd</sup> 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 96x96; DIN (supplied kit)	DIN Rail mount
Weight	1.5 lbs / 0.7 kg	1.2 lbs / 0.53 kg
Dimensions HxWxD	4.5x4.5x4.3" / 114x114x109mm	3.5x4.9x2.7" / 90x125x68.5mm

## APPLICATIONS



# PRO SERIES Power Meters & Power Quality Analyzer



- + 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.

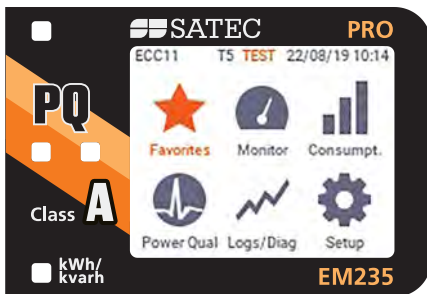
## DC Metering

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

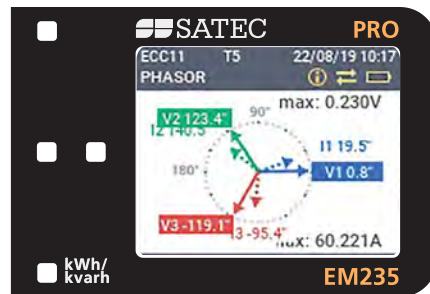
## Ultimate Modularity

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

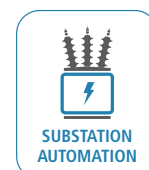
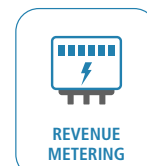


Main Menu with Favorites Area



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

### Auxiliary power supply

- AUX-ACDC: 88-264V AC / 125-300V 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 63<sup>rd</sup> 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)
- 4<sup>th</sup> 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

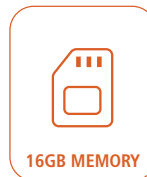
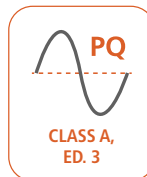
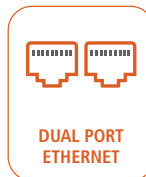
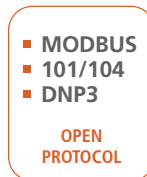
### Programmable Logical Controller

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

### Power Supply

- 90-332V AC / 40-290V DC

\* Extended range, up to over 3,000V DC is possible with the VRM 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) 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.

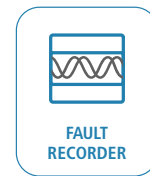
### Dual Voltage Input

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

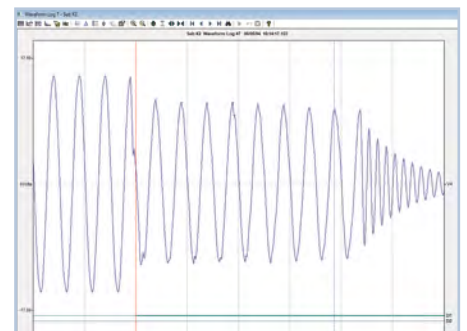
The BFM136 (1<sup>st</sup> gen.) is a TOU energy meter, equipped with 12 three-phase current inputs (non-modular, no I/O).

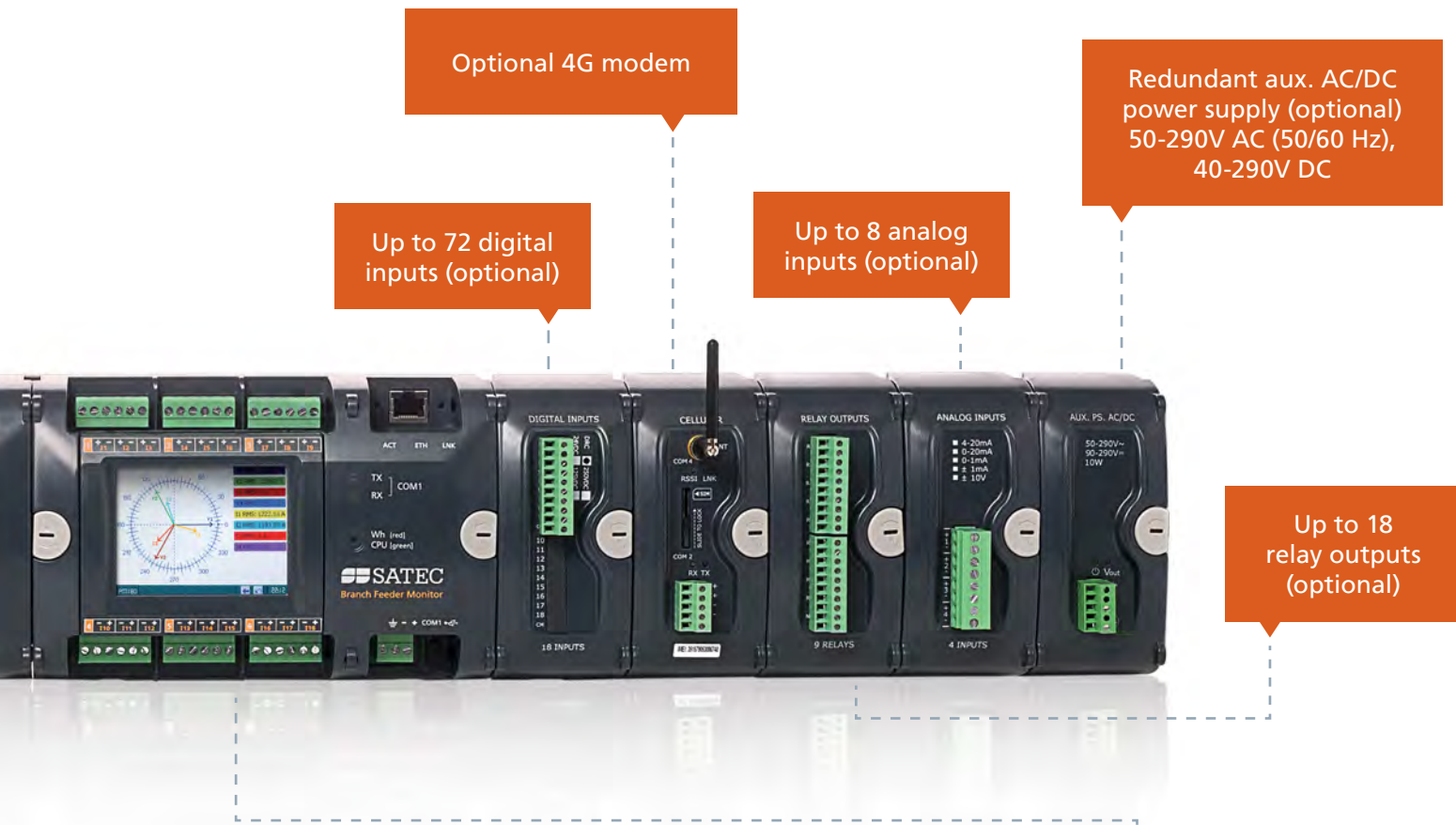
### DIGITAL FAULT RECORDER (DFR)



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 x In.

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





## 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 25<sup>th</sup>), 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



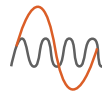
ACCURACY CLASS



DIGITAL IN/OUT

- ▣ MODBUS
- ▣ 101/104
- ▣ DNP3

OPEN PROTOCOL



INDIVIDUAL HARMONICS



CELLULAR CONNECTIVITY

**MV-90 xi**

SUPPORTED

## Current Input Options

**HACS:** 100A-3,000A

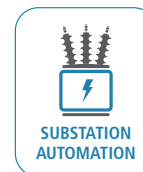
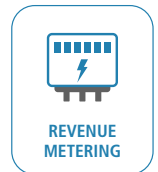
**RS5:** 5A HACS

**FLEX:** 3V AC (Rogowski)



Input module types can be combined

## APPLICATIONS



# 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.

### LPIT 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.

### 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.

## 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 setpoints
- Built-in: 2 DI + 2 DO
- Optional: 2 AO / 2 AI / 2 DI + 2 DO

### 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 63<sup>rd</sup>)
- 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)

### Fault Recorder (PM174)

- Recording faults up to 20 x In

### 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

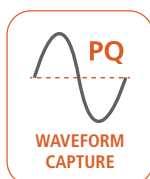
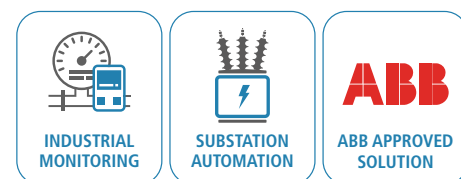
### Communication

- 2 independent communication ports (RS232/422/485, ETH, PROFIBUS DP)
- Protocols: Modbus, DNP3

### Construction & Durability

- Full galvanic isolation of voltage and current measuring circuits: 6 kV Impulse
- Dual panel mount: 4" Round; 96x96 Sq.

## APPLICATIONS



# DC METERING

Systems that 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 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, wind turbines, and battery energy storage (BESS) are growing sources of energy involving production of DC electricity. 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 making considerable investment 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, datacenter operators constantly strive for better Power Usage Effectiveness of the energy consumed by the servers. Datacenters based on DC system architecture are a trend that 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. Battery charging is another commonplace example for a DC application.

## FEATURES

- Average and Real Time values: Voltage, Current, Power, Bi-directional DC energy calculation
- Events & Data logs
- Voltage range: 20-3,000V DC\*
- Current range: up to 3,000A DC\*\*
- Energy metering accuracy: starting 0.2%\*\*
- External power supply is required

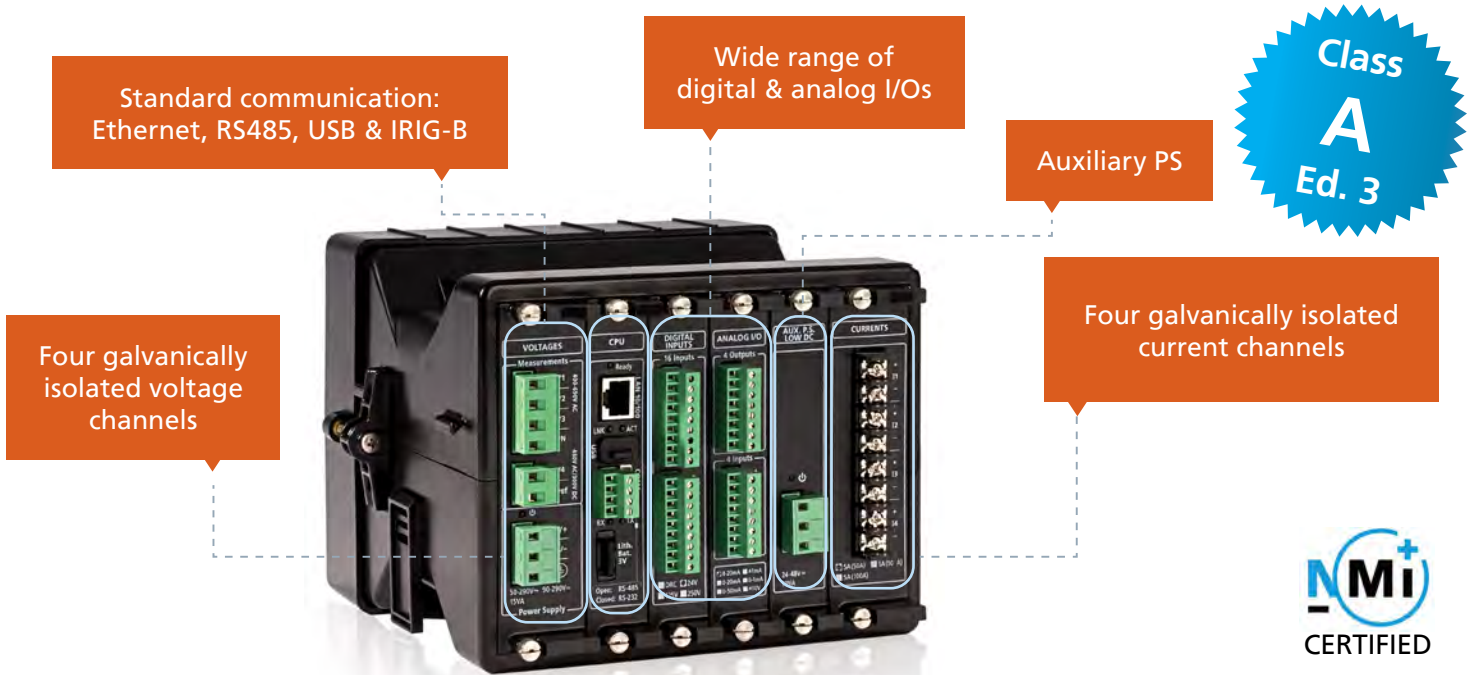
\* Additional adaptor is required for voltage measurement above 800V DC

\*\* Depending on type of DC Hall Effect Sensor

## APPLICATIONS



# PM180 Multifunction Power Quality Analyzer



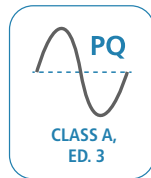
## The Heart and Backbone of SATEC Versatility and Functionality

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

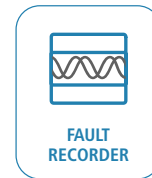
Viewing events in a timestamped sequence: digital input and relay output events, fault events and setpoint events. SoE Log reports establish links between the recorded events and other database records, indicating any existing correlation.



#### POWER QUALITY ANALYZER

Class A, Edition 3 certified (IEC 61000-4-30:2015), the PM180 complies with the most

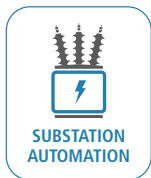
up-to-date requirements of power quality analyzers, generating EN50160 reports and logging waveform captures.



#### FAULT RECORDER / DISTANCE TO FAULT

Measuring currents rated at  $40 \times I_n$ , the PM180 serves as a distributed fault

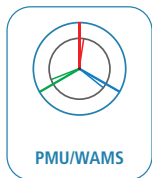
recorder, triggered by event or DI. Advanced algorithms enable Distance to Fault calculation.



#### 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)

Featuring both IEEE C37.118.2 protocol and IEC 61850-90-5, the SATEC PMU module is a unique

solution communicating with 3<sup>rd</sup> 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: 0.001 Hz
- Fast Transient detection (17  $\mu$ s @ 60Hz / 20  $\mu$ s @ 50Hz)

### Digital Fault Recorder (DFR)

- Recording fault currents up to 20  $\times$   $I_n$  (40  $\times$   $I_n$  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: IEEE 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



ACCURACY CLASS



DIGITAL IN/OUT

**IEC**  
61000-4-30

CLASS A,  
ED. 3

- MODBUS
- 101/104
- DNP3

OPEN PROTOCOL



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:

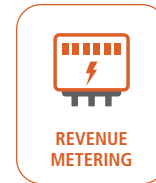
- **PQ Analyzer & Power Meter**, typically required by utility SCADA teams
- **Revenue Meter**, typically operated and read by the utility billing department

Combining these functions simplifies design and eliminates redundancy.

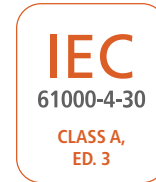
The **EM720** complies with IEC standards. The **EM920** is a socket meter compliant with ANSI standards.

### Transformer/Line Losses Calculation

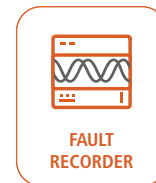
Based on parameters such as copper losses and iron losses, this unique economical feature enables the meter to establish accurately calculated transformer losses. This eliminates the need to construct a costly high-voltage metering point, which would require a metering cubicle, CT and PT.



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
- 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 10xIn

### Transient Recorder

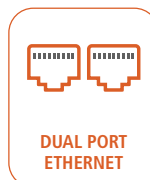
- High Speed Transient detection as short as 17  $\mu$ s @ 60Hz / 20  $\mu$ s @ 50Hz

### 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







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

- HxWxD: 12x7x5.7" / 303x177x144 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 1/2 cycle sample rate
- 1 KYZ relay output
- Up to 6 programmable relay outputs
- Up to 4 programmable analog outputs

### Dimensions

- Depth x Diameter: 8.5x7" / 214.3x176.7mm. Panel mount version available.

## EM920 Modules

### Transient Recorder

- Recording fast transients @ 1024 samples/cycle

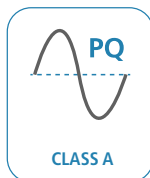
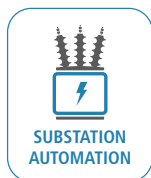
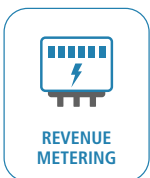
### Input/Output

- 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



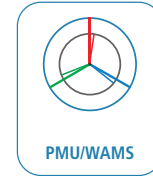
# SMART GRID SOLUTIONS

## Phasor Measurement Unit per IEEE C37.118.1

## Wide Area Monitoring Systems



- + Multi-protocol: IEEE 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)



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
  - ▣ 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 3,000V DC and above.

#### Technical Specifications

- Accuracy = 0.1%
- 3 Independent voltage inputs
- Terminals: Wire size: 12 AWG (up to 3.5 mm<sup>2</sup>)
- 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 100-3,000A 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<sup>2</sup>
- 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 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.

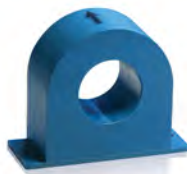
**REMOTE METERING:** The milliamp output mentioned is also of very low burden, making it possible to run wiring for metering loads up to 200m away, without any compromise to accuracy.



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		P/N	RATING	CORE	OPENING	
			INCH	MM				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	1.7x1.3	43x33
CS1S	100A	Split	Ø 0.6	Ø 16	CS8	800A	Solid	4x1.3	32x100
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	1.9x3.1	50x80
CS2S	200A	Split	0.96x0.9	25x23	CS12S	1200A	Split	3.1x4.7	80x120
CS2SL	200A	Split	1.7x1.3	43x33	CS20S	2000A	Split	3.1x6.3	80x160
CS2.5S	250A	Split	0.96x0.9	25x23	CS30S	3000A	Split	3.1x6.3	80x160

# 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.



**RDM174 / RDM175**  
For PM174/5 Series



**RDM180**  
For PM180

## Compatible Devices

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

## 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).



**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.

## 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

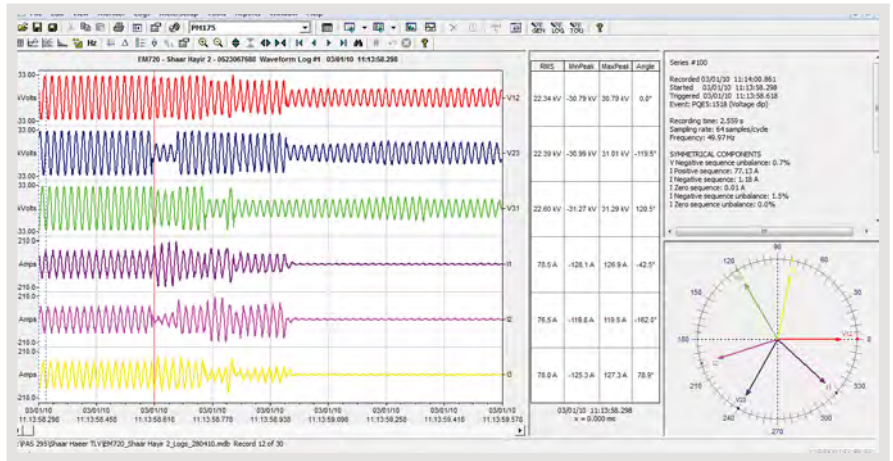


The ETC I serves as a transparent gateway, connecting several serial-communication devices to the internet, either via ETH port or via cellular communication.

PAS 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.

The screenshot displays the PAS software interface. On the left, there are tabs for 'Display Setup', 'Relay Outputs', 'Counters', 'Transformer Correction', 'Periodic Timers', and 'Local Settings'. Below these are sections for 'Basic Configuration' and 'Demand Setup'. The 'Basic Configuration' section includes settings for PT Ratio (1.2), CT Primary (5), and Nominal Frequency (60 Hz). The 'Demand Setup' section includes Power Block Demand Period (15 min) and Volt Demand Period (900 s). The main window shows a 'Fault Log - Sub #2' table with columns for No., Date/Time, Event, Fault Category, Phase, Amps Magnitude, PU, Volts Magnitude, PU, and Duration. The table lists various fault events such as 'Zero seq. Voltage', 'External Trigger', 'Current Unbalance', and 'Overcurrent'.



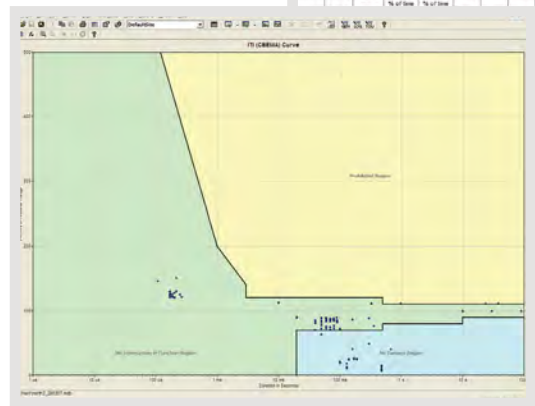
EN50160 Compliance Report  
19-05-04-29-05-04

Thursday, September 11, 2014

From	To	In-service time, %	Compliance <math>\leq 0.1\%</math>, % of time	Compliance <math>\leq 0.5\%</math>, % of time	Min Frequency, Hz	Max Frequency, Hz	Standard compliance
05-20-10	06-05-10	100.00	100.00	100.00	49.78	50.22	OK
07-05-10	12-05-10	100.00	100.00	100.00	49.78	50.22	OK
10-05-10	08-05-11	100.00	100.00	100.00	49.81	50.20	OK
01-05-12	07-05-12	100.00	100.00	100.00	49.82	50.18	OK
08-05-12	07-05-13	100.00	100.00	100.00	49.81	50.20	OK

From	To	In-service time, %	Compliance <math>\leq 0.1\%</math>, % of time	V1 min, V1 max, V2 min, V2 max	V3 min, V3 max	Standard compliance
05-20-10	06-05-10	100.00	100.00	234.3, 239.4, 234.8	234.7, 234.4, 234.1	OK
07-05-10	12-05-10	100.00	100.00	233.9, 239.2, 233.8	234.9, 234.1, 233.7	OK



## 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 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

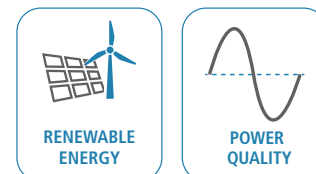
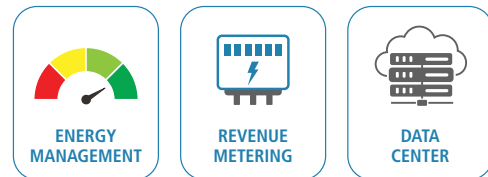
Improve energy efficiency and reduce spending by generating alerts of consumption irregularities, as well as detailed monitoring and analysis.

### 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).





## Energy Consumption Analysis

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

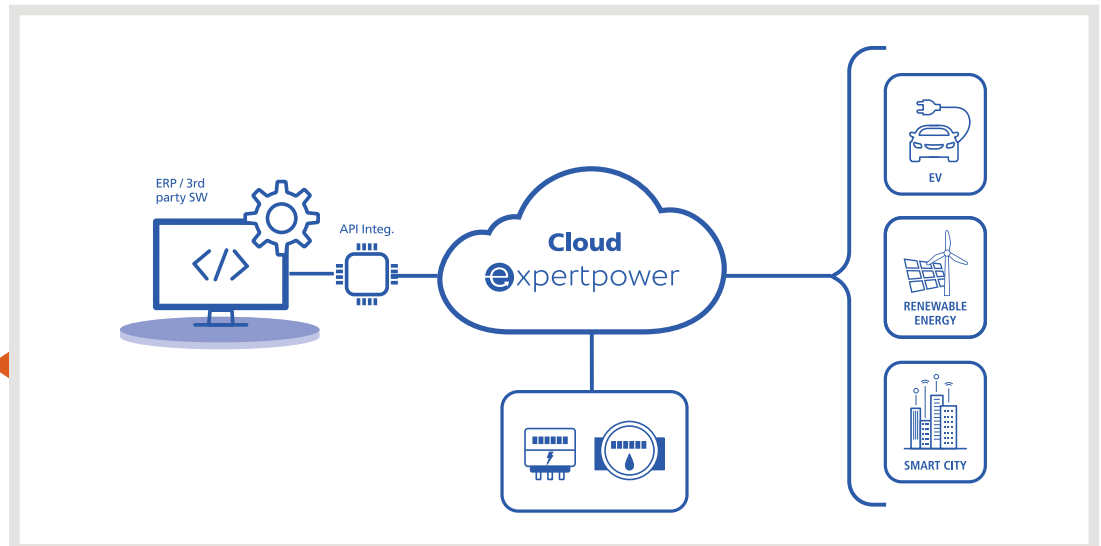


## Features

- 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

Time	Forecasted Energy (kWh)	Cost	Number of Batching Cycles	Plant Status	Plant Name	Plant Size	Production capacity (kWh/year)	Actual Plant Capacity (kWh/year)	Subs. In Operation (MW)	Production capacity (MW/year)	All consumption plan (MW)	Self-consumption (MW)	Rate of Purchased Energy from Producers (kWh/kWh)	ETC Energy (MW)
00:00 - 00:30	10.8	6.0	1	Uncommissioned	Generation Site	448.17	452.52	0.46	388.9	4.23	4.23		4.23	0
00:30 - 01:00	10.8	6.0	1	Uncommissioned	Generation Site	448.17	452.52	0.46	388.9	4.23	4.23		4.23	0
01:00 - 01:30	11	6.0	1	Uncommissioned	Generation Site	448.17	452.26	0.46	388.4	4.23	4.23		4.23	0
01:30 - 02:00	11.6	6.0	1	Uncommissioned	Generation Site	448.17	451.2	0.44	388	4.22	4.22		4.22	0
02:00 - 02:30	11.1	6.0	1	Uncommissioned	Generation Site	448.17	452.98	0.46	388.3	4.23	4.23		4.23	0
02:30 - 03:00	10.1	6.0	1	Uncommissioned	Generation Site	448.17	452.87	0.46	388.6	4.23	4.23		4.23	0
03:00 - 03:30	11.2	6.0	1	Uncommissioned	Generation Site	448.17	451.89	0.46	389.2	4.23	4.23		4.23	0
03:30 - 04:00	10.1	6.0	1	Uncommissioned	Generation Site	448.17	452.87	0.46	388.6	4.23	4.23		4.23	0
04:00 - 04:30	10.3	6.0	1	Uncommissioned	Generation Site	448.17	453.38	0.46	388.9	4.24	4.24		4.24	0
04:30 - 05:00	8.9	6.0	1	Uncommissioned	Generation Site	448.17	454.28	0.4	388.1	4.26	4.26		4.26	0
05:00 - 05:30	10.1	6.0	1	Uncommissioned	Generation Site	448.17	453.83	0.46	389	4.24	4.24		4.24	0



## Renewable Energy

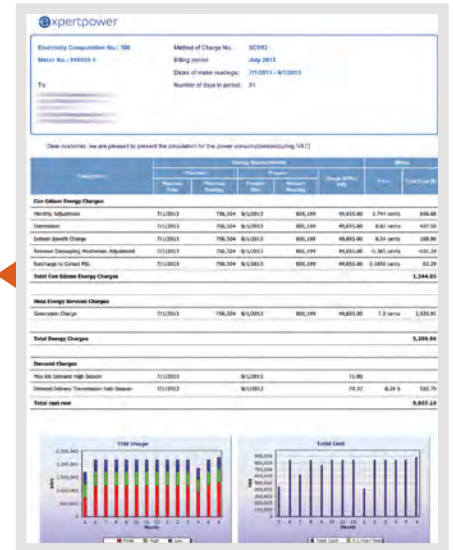
Predict generation and monitor revenue

### GENERAL FEATURES & SPECIFICATIONS

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

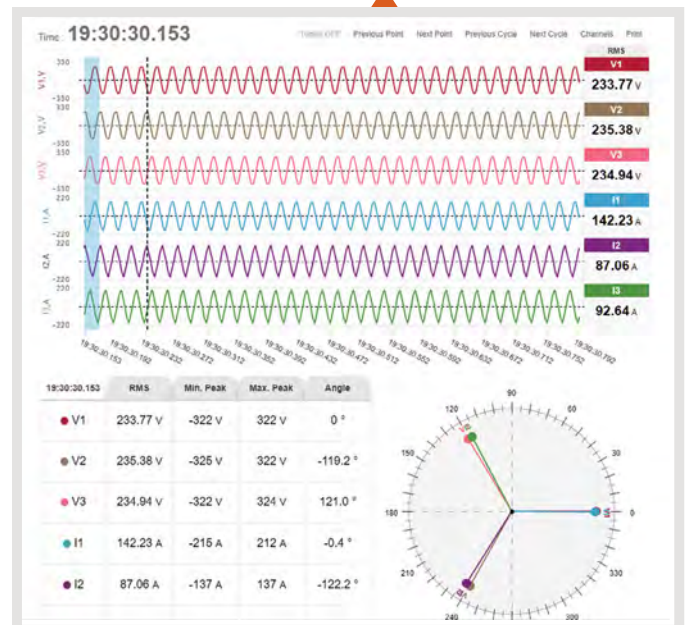
## Commercial Sub-Tenant Billing

- 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



# COMPARISON TABLE

Note: /\* = Option

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

Note: /\* = Option

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



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