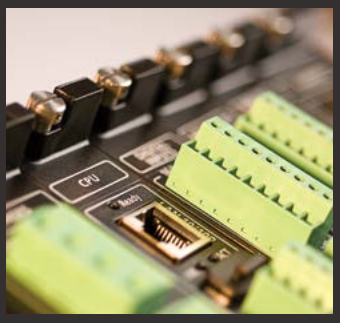
SATEC

PRODUCT CATALOG



The Full Range of Electricity Management Solutions for Every Application

Asset Management
Power Measurement
Energy Efficiency & Cost Allocation
Energy Management & Billing
Multi-Tenant Submetering

PM130 PLUS Pg. 4

PM135 Pg. 4

EM132/3 Pg. 5

PM172 Pg. 7

BFM136 Pg. 8

BFM-II Pg. 8

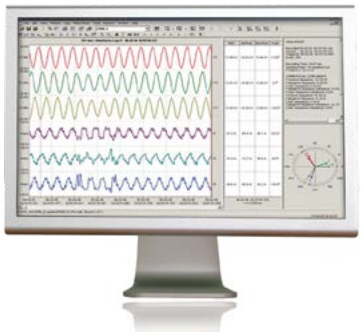
PM174/5 Pg. 10

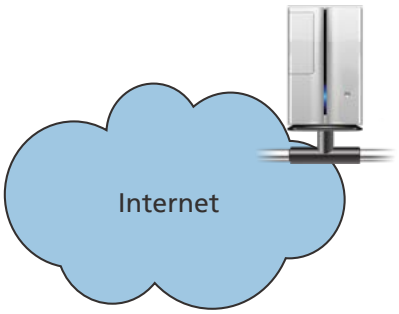
PM180 Pg. 11

EM720 Pg. 12

EM920 Pg. 12

RS-232/422/485, Profibus, Ethernet, Dialup modem, GPRS, RF


PAS Pg. 20



ExpertPower™ Pg. 18

Modules Pg. 6

Displays Pg. 14

HACS (High Accuracy Current Sensors) Pg. 15

ETC-II Pg. 17

AX-8 Pg. 17

RSC232 Pg. 17

Smart Grid & Demand Response
Revenue Metering
Fault Recording
Substation Automation
Power Quality Analysis

Commercial & Industrial
Utilities & Renewable

SATEC
Powerful Solutions

The Experts in Energy Management

Company Profile

Technological excellence, innovation, quality and a commitment to customer service place SATEC at the forefront of the energy industry.

SATEC has been a proven solutions-oriented global leader in the research, development and manufacturing of energy management systems since 1987. With two decades of rich experience in energy management, SATEC provides total solutions for customer applications worldwide. 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 worldwide throughout Europe, North and South America, Asia, Oceania and Africa. Our worldwide distribution network provides local marketing service and prompt professional support.

Application-Based Solutions

SATEC's device product line serves both energy utilities and energy consumers in various fields. Our application-based product line includes devices spanning from basic power meters up to high performance revenue meters with advanced power quality analysis capabilities. All SATEC devices comply with world-acknowledged regulations and are supported by our energy management software.

Our cutting-edge power quality analysis capabilities provide a rewarding solution enabling energy utilities to take timely corrective action and permitting energy consumers to prevent equipment failures.

Our Expertise at Your Service

Our team of scientists and industry experts are available to dispense expert technical support, and provide technical solutions to questions ranging from generic to complex. SATEC's support team is closely involved in the development process, to assure a product of the highest quality that is also tailored to our customer's needs.

SATEC Calibration Lab

Our calibration lab is certified by ILAC (International Laboratory Accreditation Cooperation) for compliance with ISO/IEC 17025. ISO/IEC 17025 is general requirements for the competence of testing and calibration laboratories and is the main ISO standard used by testing and calibration laboratories. In most major countries, ISO/IEC 17025 is the standard for which most labs must hold accreditation in order to be deemed technically competent.

100% of our products are tested and calibrated with automatic test calibrator and test and calibration report is generated with option for ISO/IEC 17025 calibration certificate.

SATEC and the Environment

SATEC is committed to protecting the environment. SATEC products help our customers save energy and reduce CO_2 as well as other greenhouse gas emissions, while our unique renewable energy management solutions increase the performance of solar and wind power generation plants. SATEC products are RoHS compliant and are lead free.

Customer Satisfaction

We at SATEC regard our clients as our most valuable asset. We consider excellence of products and service as a key to gaining customer loyalty and satisfaction. Our customer base consists of industrial facilities, commercial enterprises, government and public services, and major power utilities.

SATEC takes pride in catering to the unique needs of our varied customer base. As a leader in the field, we at SATEC set the standard by continuously developing and upgrading our products and services, to perfect our clients' energy management systems. Our products are user-oriented and designed for easy installation and operation.

PM130 PLUS & PM135

Multi-Functional Power Meter

The PM130/135 are multi-functional 3-phase power meters with basic revenue metering, power quality and harmonics analysis.

The PM130/135 are widely integrated in panel boards and SCADA systems, with integral RS-485 communication port and a wide range of protocols, such as Modbus, DNP 3.0 and IEC 60870. With the addition of the unique TOU module, the EH model answers the needs of revenue metering applications. It is also suitable for utility substation automation with its support of industry standard protocols DNP 3.0, Modbus RTU and IEC 60870-5-101/104, as well as its I/O capabilities (using the Digital Input/Output modules).

The PM130/135 consist of two basic models providing digital measurements of more than 80 electrical parameters locally, and more than 100 electrical parameters via communication: from basic frequency, voltages and currents, to four quadrant power parameters (active, reactive and apparent). The EH models also measure harmonics, energies (active, reactive and apparent) and Time of Use (TOU).

The PM130/135 expansion module allows connection of a second communication port, including Ethernet, Profibus, RF or 2G/3G, as well as second RS-485 and RS-232 ports.

Models

PM130 PLUS

Extra bright 7-segment LEDs, 3 lines of 4-5 digits plus unique bar graph loading indicator

PM135

3.5" backlit LCD plus unique bar graph loading indicator

Measurement Features

P	Multi-functional 3-phase power meter functionality (see Features)
EH	All the features of the **P** model, plus Revenue Meter and Power Quality control (see Features)

Current Inputs

1A	Standard 1A CT
5A	Standard 5A CT
RS5	Remote Split Core for Standard 5A CT
HACS	High Accuracy Current Sensors (see pg. 15)

PM13X / EM13X Features

Multi-Functional 3-Phase Power Meter

- Voltage, current (including neutral current), power, energy, power factor, frequency, voltage/current unbalance
- Supported frequencies: 25, 50, 60 and 400 Hz
- Direct connection up to 690V L-L (up to 1.15 MV via PT)
- Current range up to 200% (max. 1 min. for EM13X-63A model)

Basic Power Quality *

- Individual voltage and current harmonics (up to the 40th)
- Voltage and current THD, TDD & K-Factor
- Time stamped max/min values
- Waveforms (via communication)

Revenue Meter *

- Exceeds accuracy class 0.5S
- Time Of Use (TOU) tariffs

Event/Data Log *

- System events & data logging
- Real-time stamps

Alarm and Control Functions

- 16 programmable set-points
- 4 counters

Real Time Clock

- Built-in clock and calendar functions
- RTC battery backup *

Communication protocols

- Modbus RTU, ASCII, DNP 3.0, Modbus/TCP, DNP3/TCP, Profibus DP, IEC 60870-5-101, IEC 60870-5-104 (EM133-AR supports Modbus protocols only)

* See comparison table on page 5

EM132/133 Series

EM132

Multi-Function Transducer

The EM132 is a cost-effective multi-function transducer with local display, designed to replace analog or digital transducers. Its local display allows setup and verification of installation, without the hassle of using computers. One device supports all network configurations (i.e., 3 wire, 4 wire, wye, delta, etc.) and is field configurable.

The unique field installable add-on feature allows adding digital and analog I/Os. When using the 4 analog output add-on, the EM132 can replace 4 analog 4-20mA transducers. Each one can be freely programmed to any parameter and scaling.

EM133 / EM133-AR

TOU Smart Energy Meter

Comprehensive multi-functional energy meter, providing a complete range of energy measurement and management. The EM133 measures the electrical energy and connects via digital inputs to water, gas or air condition meters. A built-in relay output can be freely programmed to remotely disconnect the supply (using external contactors), raising alarms or pulsing. The information is displayed locally and is available via communication.

The field-installable add-on feature allows adding digital and analog I/Os to facilitate any control scheme (up to 14 digital inputs and 5 relay outputs).
The AR model (Advanced Residential) also displays and stores present, previous and before previous day, week, month and quarter of all energy, hot and cold water and gas, with customized pulse multiplication factors and labels.

Models

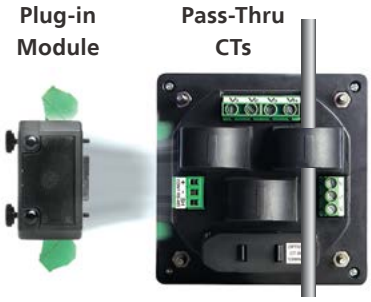
Measurement Features	
EM132	Multi-functional 3-phase power transducer functionality (see Features on pg. 4)
EM132-TP	All the features of the EM132, plus two integral RS-485 ports
EM133	All the features of the EM132 model, plus TOU, 2xDI, DO and Harmonic measurements (see Features on pg. 4)
EM133-AR	Similar to the EM133 plus detailed energy display and accumulation

Current Inputs	
1A	Standard 1A CT
5A	Standard 5A CT
RS5	Remote Split Core for standard 5A CT
HACS	High Accuracy Current Sensors (see pg. 15)
63A	Direct Connection

COMPARISON	PM13X-P	PM13X-EH	EM132	EM133
Basic Power Quality		■		■
Revenue Meter		■		■
Event/Data Log		■		■
Real Time Clock	■	■	■	■
RTC battery backup	**130**: with TOU module (see pg. 4) / **135EH**: included		■	■
Standard Power Supply	85-265V AC 50/60 Hz, 88-290V DC		40-300V AC 50/60 Hz, 40-300V 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	
Standard Communication	RS-485		RS-485 (x2 for EM132-TP)	RS-485, Infra-Red
Standard Digital I/O				2DI, 1DO
Display	**PM130**: 3-line LED / **PM135**: graphic LCD		2x16 characters LCD	
Mounting	Dual panel mounting: 4" Round; Square 96x96 DIN		DIN Rail sealable connection	
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	

Plug-In Modules

PM130 PLUS / PM135 / EM132 / EM133



The 13X modular approach enables users to assemble a system that meets their specific needs.

Dimensions (HxWxD):
Small form: 2.8×1.8×1.3" / 72×46×34 mm
Large form: 3.7×3×1.7" / 95×77×45 mm

The wide choice of plug-in modules includes:

2nd Comm. port
Small form

One of the following:
- Ethernet (TCP/IP)
- PROFIBUS
- RS-232/422/485
- Cellular Modem
- CANopen (CAN Bus)
- RF *

* 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 Relay Outputs 250V / 5A AC
- 4 Digital Inputs (dry contact) / 2 SSR outputs 250V / 0.1A AC
- 8 Digital Inputs (dry contactor)
- 4 Digital Inputs (dry contact) with RTC battery backup for TOU (PM13X models only)

Digital I/O
Large form

Comprehensive expansion module that includes:
- 12 Digital Inputs (Dry Contact or 250V DC)
- 4 Relay Outputs 250V/5A AC
- Optional selection of Ethernet or RS-485

PM172

Advanced Power & Revenue Meter

The PM172 is a high performance feeder monitoring instrument that includes revenue class measurements and logging capability. With over 100 electrical measurements, long term memory logging capability and breaker contact status inputs, this series is an economical approach to distribution automation for utilities. The PM172 series is widely integrated in panel boards and SCADA systems by commercial and industrial facilities. It is also successfully used for electric generator applications.

Revenue class metering and the built-in TOU function provide a solid background for commercial and industrial submetering applications. The event and data log on the basis of programmable set-points is a differentiating feature of the PM172 series. This capability facilitates a wide range of commercial and industrial applications demanding data analysis as well as corrective actions for specific recorded events. The recorded data is a valuable asset for energy management.

The PM172 series includes a choice of built-in communication platforms, such as modem, Ethernet, Profibus DP and serial communication.

Models

Measurement Features

P	Multi-functional 3-phase power meter functionality (see Features)
E	All the features of the **P** model + revenue meter (see Features)
EH*	All the features of the **E** model + power quality monitoring (see Features)
	* Available in certain regions only

Current Inputs

1A	Standard 1A CT
5A	Standard 5A CT
RS5	Remote Split Core for Standard 5A CT
HACS	High Accuracy Current Sensors (pg. 15)

Displays

The PM172 Series offers a selection of display modules: see pg. 14

Features

Multi-functional 3-Phase Power Meter

- Voltage, current (incl. neutral current), power, energy, power factor, frequency, voltage/current unbalance, load profile

Multi-Tariff Revenue Meter (E/EH Models)

- Exceeds accuracy class 0.2S
- Built-in Time of Use (TOU) tariffs to meet any billing requirements
- Sealing option

Power Quality Monitoring (EH Model)

- Individual voltage and current harmonics (up to the 40th via display / 63rd via PAS)
- Voltage and current THD, TDD & K-Factor
- Total Harmonic Powers
- Total Harmonic Energies
- Waveform recording with 6 channels (3 voltage inputs, 3 current inputs)

Real Time Clock

- Built-in clock and calendar functions with back-up battery
- Time synchronization via communication port or digital input

Event/Data Log

- Logging capability for more than 100 parameters
- Logging parameters with real-time stamps

Alarm and Control Functions

- 16 programmable set-points
- 2 programmable relay outputs 3A, 250V
- 2 digital inputs
- Optional 2AI or 2AO
- Optional 2DI+2DO (total 4DI+4DO)

Power Supply

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

Communication

- 2 independent communication ports (RS-232, RS-422, RS-485, modem, Ethernet, Profibus DP, GPRS)
- Protocols: Modbus RTU, ASCII, DNP 3.0, Modbus/TCP, DNP3/TCP

Construction

- Full galvanic isolation of voltage and current measuring circuits—6 kV Impulse
- Dual panel mounting: 4" Round; Square 96×96 DIN
- **Weight** (LED display): 2.7 lbs / 1.23 kg
- **H×W×D** (LED display): 5×5×5.6" / 127×127×143 mm

BFM136 / BFM-II

Multi-Tenant Submetering

SATEC's Branch Feeder Monitor™ (BFM) products provide energy management for multi-point power solutions. The BFM product line includes the well established BFM136, with an install base of over a million channels, and the modular BFM-II. See next page for the differences.

Ideal for both new and retrofit projects, the BFMs automatically provide metering, demand and energy readings, logging and multi-tariff (TOU) data. The BFM-II monitors up to 18 three-phase circuits, 54 single-phase circuits, or any combination of single or three-phase circuits. This flexibility makes the BFM-II perfect for multi-tenant facilities such as residential projects, office buildings and shopping malls as well as substation automation and industrial control. Its modular design offers a selection of 18, 24, 30, 36, 42 or 54 channels to fit any requirement and to easily fit into existing panel boards or be flush mounted nearby, thus eliminating the need for expensive retrofit projects or for allocating extra space for the device.

The BFM-II supports power quality monitoring to identify existing and potential operation problems, such as overloading or malfunctioning due to voltage or current harmonics, or voltage sags and swells (contact SATEC for availability).

The BFM-II utilizes High Accuracy Current Sensors (HACS), which measure and report the current consumed by each of the branch circuits at the panel board. For billing purposes, single or multiple circuits can be defined for each customer. This flexibility allows for a simple reassignment of circuit groups without wiring changes, and enables easy changes when tenants move in and out. Main panel board or load center installation makes for a valuable saving of both time and money.

The BFM's user-defined and easily configured alarm system enables users to take predictive maintenance action in order to avoid unnecessary outages.

Split Core HACS

Features

- Multi-channel submetering – up to 54 single-phase, 27 two-phase or 18 three-phase meters in a single device. Any combination of single-, two-, and three-phase consumers can be chosen up to a total of 54 current inputs.
- Automatic totalization energy from different consumers
- Modular design allows selection of 18, 24, 30, 36, 42 or 54 submeters
- Supports high accuracy current transformers with Class 0.5S accuracy
- 3-phase/2-phase/single-phase meters (true RMS, volts, amps, power, power factor, neutral current)
- Ampere/Volt demand meter
- Time-of-Use, 8 energy/demand registers x 8 tariffs, 4 seasons x 4 types of days, 8 tariff changes per day, easy programmable tariff schedule
- Automatic 120-day daily profile for energy and maximum demand readings (total and tariff registers) for each submeter
- Power quality monitoring including voltage and current harmonics (up to the 25th), voltage sags, voltage swells and interruptions (contact SATEC for availability)
- Event recorder for logging internal diagnostic events and setpoint operations
- Data recorders: programmable periodical data logs for each submeter
- Embedded programmable controller (4 control setpoints, programmable thresholds and delays) for each submeter
- Optional 3.5" 320×240 pixels touch screen display with backlight
- Internal clock, keeping the clock running for years without external power
- Standard RS-485, Ethernet and USB ports
- Optional cellular communication port plug-in module
- Optional 9/18 digital inputs or 4 analog inputs module
- Modbus RTU, Modbus TCP, DNP3.0 and DNP/TCP communication protocols
- Easy field upgrading device firmware

BFM-II Add-On Modules

9 OR 18 DIGITAL INPUTS

- Optically isolated input, dry contact sensing (voltage-free)
- Internal power supply 5V DC
- Sensitivity:
  Open @ input resistance >16kOhm,
  Closed @ input resistance <10kOhm
- Scan time: 1cycle.
- Withstanding insulation: 4kV AC@1min
- Wire: 28-16 AWG (0.1-1.5 mm²), 600V isolation
- Terminal pitch: 3.81mm

4 ANALOG INPUTS

- Ranges (upon order):
  - ±1 mA (100% overload)
  - 0-20 mA
  - 4-20 mA
  - 0-1 mA (100% overload)
- Accuracy: 0.5% FS
- Scan time: 2 cycles
- Withstanding Insulation: 4kV AC@1min
- Wire: 28-16 AWG (0.1-1.5 mm²), 600V isolation
- Terminal pitch: 5 mm

CELLULAR COMMUNICATION

- Cellular Modem
- Technologies (upon order):
  - GSM
  - CDMA
- Withstanding Insulation: 4kV AC@1min
- Connector type: SMA
- Supported Protocols: MODBUS TCP (Port 502), DNP 3.0/TCP (Port 20000)

AUXILIARY POWER SUPPLY

- Withstanding Insulation: 4kV AC@1min
- AC/DC Power Supply: L/+, N/- and GND
- Rated input: 50-290V AC 50/60Hz, 40-290V DC (between -20°C to 60°C. In other temperatures from 90V DC), max. 10W
- Wire: 28-16 AWG (0.1-1.5 mm²), 600V isolation
- Terminal pitch 7.62 mm, three pins

RELAY OUTPUTS

- 9 relays (Total up to 18 RO)
- 9 relays rated at 5A/250V AC, 3A/30V DC

COMPARISON		BFM136	BFM-II
Number of Channels		36	18-54
Memory		8MB	256MB
Power Quality		-	Harmonics (25), sags, swells, interruptions
Standard Power Supply		Self-energized 88-544VL-L	Self-energized 96-576VL-L
Optional Power Supply		-	50-290V AC, 40/90-290V DC
Standard Communication		RS-485	RS-485 / ethernet / USB
Optional Communication		RS-232 / cellular / RF / ethernet	Cellular modem RS-422/485
I/O		-	Up to 72 DI / 18 DO
Display		2x16 characters LCD	3.5" graphic touch screen
Construction		Compact ruggedized metal enclosure	Configurable, modular polycarbonate units
Certification		Manifold worldwide certifications	CE approved, more under testing
Weight		4.2 lbs / 1.9 kg	3.5 lbs / 1.6 kg
Dimensions H×W×D	**Base**	4.2×13×2.3" / 107×331×58 mm	5×10.9×2.8" / 128×278×72.5 mm
	Expansion Modules	Via built-in communication slot	**[W] 18 ch.:** +5.5"/138 mm, **Add-on:** +2.2"/55 mm

PM174 / PM175

IEEE1159 / EN50160 / GOST 13109 / GOST 32144-2013

Advanced Power Quality Analyzers

The Advanced Power Quality Analyzers PM174/5 are compact, multi-functional three-phase power and revenue meters equipped with advanced power quality analysis capabilities.

The analyzers have been developed to answer the needs of a wide range of users: substation operators, electrical energy system integrators, generator users, industrial and commercial energy consumers. These analyzers cover the entire range of applications demanding high performance power quality monitoring and root cause analysis.

The PM174 provides the full range of power quality monitoring, logging and statistics according to IEEE1159. The PM175 provides similar performance according to EN50160, GOST 13109 or GOST R 32144-2013.

The PM174/5 allows both suppliers and consumers to monitor the quality of outgoing or incoming electric power. This enables power suppliers to prepare timely corrective action, and helps consumers prevent equipment damages caused by power quality issues.

Two independent communication ports allow local and remote data acquisition.

Pole-Top MV Monitoring

PM175 Smart grid solution with unique sensors (PT/CT): see pg. 16.

EDL174/5

Portable Power Quality Analyzer

Displays

The PM174/5 Series offers a selection of display modules: see pg. 14.

Features

Multi-Functional 3-Phase Power Meter

- Voltage, current (incl. neutral current), power, energy, power factor, frequency, voltage/current unbalance, load profile

Multi-Tariff Revenue Meter

- Accuracy class 0.2S according to ANSI C12.20 / IEC 62053-22
- Built-in Time of Use (TOU) tariffs to meet any billing requirements
- Sealing option
- Built-in clock and calendar functions with back-up battery
- Time synchronization via communication port or digital input

Advanced Power Quality Analysis

- Monitoring, statistics & reports according to EN50160, IEEE1159, GOST 13109 or GOST 32144-2013 specifications
- Power Quality event logging with waveform recording
- Directional power harmonics (via PAS)
- Waveform recording with 6 channels (3 voltage inputs, 3 current inputs)
- Harmonics & inter-harmonics according to IEC 61000-4-7 (up to the 40th via display / 63rd via PAS)
- Voltage and current THD, current TDD, K-Factor
- Flicker according to IEC 61000-4-15
- Dips, swells, interruptions and transient recording with waveforms

Event/Data Log

- Power quality event/data logging
- Logging capability for more than 100 parameters
- Logging parameters with real-time stamps

Alarm and Control Functions

- 16 programmable set-points
- 2 programmable relay outputs 3A, 250V
- 2 digital inputs
- Optional 2AI or 2AO
- Optional 2DI+2DO (total 4DI+4DO)

Power Supply

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

Communication

- 2 independent communication ports (RS-232/422/485, modem, Ethernet, Profibus DP, GPRS)
- Protocols: Modbus RTU, ASCII, DNP 3.0, Modbus/TCP, DNP3/TCP

Construction

- Full galvanic isolation of voltage and current measuring circuits—6 kV Impulse
- Dual panel mounting: 4" Round; Square 96×96 DIN
- **Weight**: 2.7 lbs / 1.23 kg (LED display)
- **H×W×D**: 5×5×5.6" / 127×127×143 mm (LED display)

PM180

High Performance Analyzer for Versatile Uses

SATEC eXpertMeter™ PM180 is a high performance analyzer that allows versatile uses. The high performance of the PM180, together with the unique flexible design of the expansion cards, enables its use in a large variety of applications, in which it can substitute several other devices—saving costs, space and complexity.

Examples of Applications

Each function of the PM180 uses cutting edge technologies to provide maximum performance and flexibility while keeping it cost-effective:

- IED with IEC 61850 protocol
- Industrial and Substation Automation controller
- High accuracy Power Quality Analyzer (PQA)
- Revenue grade Check Meter
- Digital Fault Recorder (DFR)
- Sequence of Events (SoE)
- Motors and Large Loads Monitoring

Displays

For a choice of displays, see pg. 14.

Modular Design

- Transient Recorder Module (4 voltage channels, up to 2kV and 1024 samples per cycle per channel)
- Fault Recorder Module (4 current channels, up to 200A)
- Digital Inputs (16 DI/Card, Max. 48 DI)
- Relay Outputs (8 RO/Card, Max. 24 RO)
- 4 Analog Input / 4 Analog Output Module (4AI/4AO/Card, Max. 12AI/12AO)
- IRIG-B and RS-422/485 port
- TXFX (Fiber Optic) and RS-422/485 port
- Auxiliary Power Supply (85-265V AC / 40-300V DC or 9.5-36V DC)

ezPAC™ SA300

The ezPAC™ SA300, the PM180 predecessor, offers up to 128 DI, 64 RO or 16 AIO, but without few of PM180's features. Contact SATEC for details.

Features

Multi-Functional 3-Phase Power Meter

- Accuracy class 0.2S Revenue Meter
- Voltage, current (including neutral), power, energy, power factor, demands, frequency, voltage/current unbalance, load profile
- 1 AC/DC voltage input (up to 400V AC / 300V DC)

Fault Recorder

- Up to 100A fault currents (200A with DFR module)
- Pre and post fault recording
- Fault distance calculations
- Fault reports
- Up to 48 fast (1 ms) digital inputs
- Sequence of events with 1 ms accuracy

Advanced Power Quality Analysis

- Power quality according to IEC 61000-4-30 Class A
- Power quality analysis, statistics & reports according to IEEE1159, EN50160, GOST 13109 or GOST 32144-2013
- Sags/swells detection and logging
- Interruptions detection and logging
- Harmonics & inter-harmonics according to IEC 61000-4-7
- Directional power harmonics
- Voltage and current THD, current TDD and K-factor
- Flicker measurement according to 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 input channels)

Transient Recorder

- High Speed Transient detection as little as 17 µs @ 60Hz / 20 µs @ 50Hz
- Transients measured relative to ground
- Measures up to 2 kV pulses

Event/Data Log

- Built-in 256 MB logging memory
- Synchronized waveforms from multiple devices in a single plot (via PAS—pg. 20)
- Power Quality events with waveforms
- Multiple parameter logging with real-time stamps

Control & Alarm Functions

- 64 programmable set-points
- 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, RS-232/485
- Optional communication: IR, front USB, Fiber Optic Ethernet, RS-422/485. To be released: WiFi and 2G/3G 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 and -104
- Optional protocol: IEC 61850 (MMS and GOOSE Messaging)

Construction

- **Weight**: 5.51 lbs / 2.5 kg
- **H×W×D**: 6x8.7x8.3" / 152x220x210 mm

eXpertMeter™ EM720 / EM920

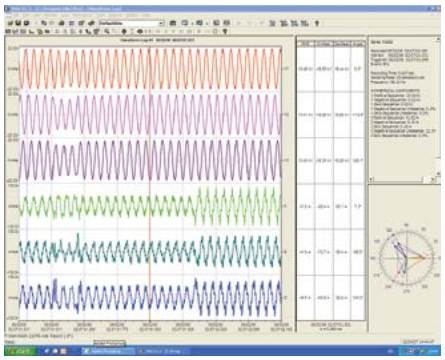
High Performance Revenue Meter & Cutting Edge Power Quality Analyzer Fast Transient and Fault Recorder

The eXpertMeter™ EM720 and EM920 are 4-in-1 multi-functional energy analyzers that include Class A power meter, high precision revenue meter, unsurpassed power quality analyzer and unique digital fault recorder. They differ in their mechanical construction (the EM720 is built to comply with IEC standards while the EM920 is a socket meter), I/O and add-ons.

The eXpertMeter™ all-in-one solution was developed to comply with the most demanding customer requirements in energy generation and distribution (power stations, electric companies, substation operators, electric energy system integrators) and in energy consumer segments (industrial and commercial).

The eXpertMeter™ can serve as a main revenue meter or test meter to manage advanced energy supply contracts that include a commitment to the most demanding power quality standards. The eXpertMeter™ can be used to resolve disputes between electric energy suppliers and consumers regarding power quality EN50160 standard violations.

The EM720/EM920 take the AMI (or AMR) to a new level, by adding power quality and fault recording to gain complete control over the smart grid.



Waveform analysis via PAS

Features

Multi-Functional 3-Phase Power Meter

- Voltage, current (including neutral current), power, energy, power factor, frequency, voltage/current unbalance, load profile

Multi-Tariff Revenue Meter

- Precise 0.05% measurement
- Accuracy class 0.2S according to 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 features
- Transformer and transmission line losses calculation (8 points, PT & CT)

Advanced Power Quality Analysis

- Power Quality Analysis according to IEC 61000-4-30 Class A
- Built-in EN50160 statistics & reports
- GOST 13109
- GOST 32144-2013 (EM720 only)
- Back-up battery and/or auxiliary power supply for recording major dips and interruptions
- Harmonics & Inter-harmonics according to IEC 61000-4-7
- Directional power harmonics (via PAS—see pg. 20)
- Voltage and current THD, current TDD, k-factor
- Flicker measurement according to IEC 61000-4-15
- Waveform recording, up to 1024 samples/cycle (Transient model only)
- Three voltage & four current inputs for waveform records
- Dips, swells, interruptions
- Fault recording
- Four measured and recorded currents up to 50 A (10In)
- ITI (CBEMA) curves (via PAS)

Transient Recorder

- High Speed Transient detection as little as 17 µs @ 60Hz / 20 µs @ 50Hz
- Transients measured relative to ground
- Measures up to 2 kV pulses

Event/Data Log

- Power Quality events with waveforms
- Logging capability for more than 100 parameters with real-time stamps
- Logging memory 16 MB built-in
- Time synchronization—IRIG-B (GPS), Ethernet (SNTP) or Digital Input

Additional Features

- I/O and Comm. Ports isolation—4 kV AC
- Optional Remote Display Module (RDM) LED front panel display (see pg. 14)
- Anti-tampering and self test functions

eXpertMeter™ EM720

The EM720's unique "Add-On" hot-swap module concept allows you to configure the meter to your changing needs, thus saving valuable time in the field or future costly replacements. Technological advancements revitalize legacy applications to rapidly and cost-efficiently respond to changing market conditions.

Models

EM720: Standard
EM720T: Transient Power Master

Alarm and Control Functions

- 16 programmable set-points
- 4 digital inputs with 1 ms sample rate
- Up to 4 programmable relay outputs
- Up to 4 digital inputs with ½ cycle sampling rate

Rechargeable battery

- Up to 6 hours full operation

Communications

- RS-232/RS-485/Ethernet/USB/GPRS/IR
- **Protocols**: Modbus RTU, ASCII, DNP 3.0, Modbus/TCP, DNP3/TCP, IEC 62056-21/61 (OBIS), IEC 61850

Construction

- **Weight**: 3.39 lbs / 2.9 kg
- **H×W×D**: 12×7×5.7" / 303×177×144 mm

Field Replaceable Hot Swap Modules

Communication Modules

- RS-232/485 / IRIG-B
- Ethernet / USB / RS-232/485
- GPRS/GSM

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 250V AC/5A
- Form A Solid State Relay Output 250V AC/0.1A

eXpertMeter™ EM920

The Model EM920 eXpertMeter™ is an advanced energy meter that exceeds Class 0.2S class revenue billing requirement. It provides long term memory for load and trend profiles, as well as battery backup and auxiliary power supply that allow logging even during power outages. The EM920 also 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

Communications

- Ethernet/IRIG-B, GPRS/GSM, USB, RS-485, RS-232/485, Dial-up Modem, IR
- **Protocols**: Modbus RTU, ASCII, DNP 3.0, Modbus/TCP, DNP3/TCP, MV90, IEC 61850

Display Customization

- Customized display screens
- Customized logo import

Construction

- **Weight**: 3.3 lbs / 1.5 kg
- **H×Diameter**: 8.5×7" / 214.3×176.7 mm

EM920 Modules

Transient

- Transient module

Communications

- Ethernet / IRIG-B / RS-232/485
- GPRS/GSM
- Dial-up Modem

Input/Output

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

Auxiliary Power Supply Options

- 50-288V AC and 90-290V DC

Displays

RGM180 Graphic Touch Screen

The RGM180 is a 5.7" large color graphic touch screen that takes power quality and energy monitoring to a new level.

The RGM180 displays comprehensive information in an easy to read screen that allows monitoring complex information at a glance.

Compatible Devices

EM132/133	BFM136/BFM-II
PM130 PLUS/PM135	EM720/920
PM172	PM180
PM174/175	ezPAC™

RGM180-G1

The RGM180-G1 controls and monitors data from a single SATEC Instrument. The RGM180-G1 adds to existing SATEC meter devices full speed USB 2.0 capabilities.

RGM180-G3

The RGM180-G3 controls and monitors data from up to 32 SATEC eXpertMeters™ over RS-485, or up to 36 SATEC eXpertMeters™ over 10/100 Base-T Ethernet.

RGM180 Features

- 5.7" color graphic display with touch panel, TFT technology with LED backlight
- High speed RS-485 communication port at up to 480kb/s
- 10/100 MB RJ45 Ethernet
- Wide range operating temperature: –4°F to +158°F / –20°C to +70°C
- More than 500,000 touch screen operation lifetime
- Programmable system setup, including multi-language support
- Plug & Play device display detecting SATEC device type for device monitoring and configuration
- Programmable screen saver
- Extends SATEC eXpertMeters™ with full speed USB 2.0 port
- Dual power source (RGM180-G3): power over Ethernet (PoE) or external AC/DC-DC/DC. Can be connected in parallel
- **Weight**: 1.54 lbs / 0.7 kg
- **H×W×D**: 7.1×8.7x1.9" / 181×221×48 mm

Remote Display Monitors

Remote displays for SATEC RPM Transducers or second display for SATEC instruments via RS-485, with 3-Phase-at-Once bright LED display. The remote monitors display measured parameters and allow menu driven set up.

RDM172
For PM172 Series

RDM174 / RDM175
For PM174/5 Series

RDM174 Green
Green Solar Monitoring for PM174

RDM180
For PM180

RDM300
For ezPAC™ (SA320 / SA330)

RDM312
Multi-window display module for PM17X, PM180 and ezPAC™

Transducers

Non-display Remote Power Meters for panel/wall or DIN rail mounting.

RPM072
PM172 transducer

RPM074
PM174 transducer

RPM075
PM175 transducer

HACS

High Accuracy Current Sensors

The following products can be ordered with dedicated High Accuracy Current Sensors (HACS) rather than with the standard 1A/5A CT input:

EM132/133 Series
PM130 PLUS Series
PM135
BFM136/BFM-II
PM172 Series
PM174/175
PM180
SA330 ezPAC™

All HACS have a built-in automatic protection circuit for maximum safety, eliminating the need to use shorting bars.

Note: the selection of HACS varies according to 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	Ø 12
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	0.96x0.9	24.5x23.1
CS2SL	200A	Split	1.7x1.3	43x33

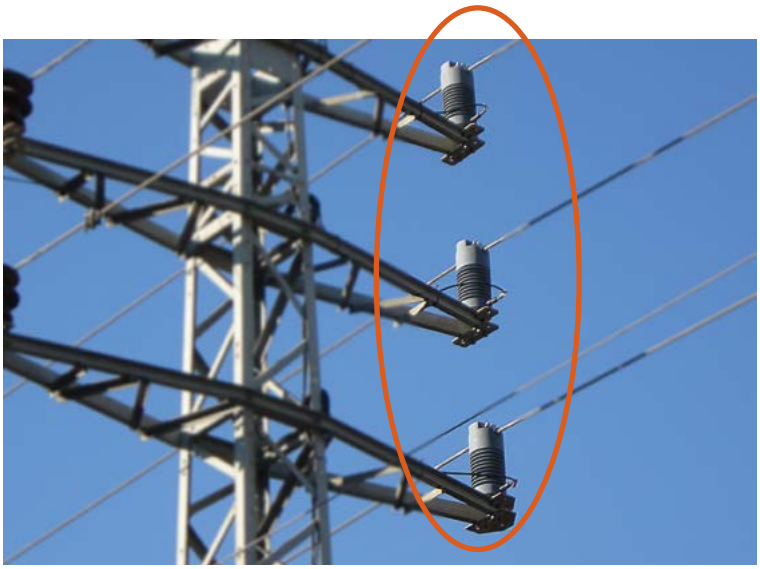
P/N	RATING	CORE	OPENING	
			INCH	MM
CS4	400A	Solid	Ø 1	Ø 26
CS4S	400A	Split	1.7x1.3	43x33
CS8	800A	Solid	4x1.3	100x32
CS8S	800A	Split	1.9x3.1	50x80
CS12S	1200A	Split	3.1x4.7	80x120
CS20S	2000A	Split	3.1x6.3	80x160
CS30S	3000A	Split	3.1x6.3	80x160

CS05S CS1 CS1L CS1S CS1H CS2 CS2S CS2SL

CS4 CS4S CS8 CS8S CS12S CS20S CS30S

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 replacing 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 location
- Power theft

The MV Sensors are designed for Distribution Automation to provide:

- Compact, economical power-line sensing
- No line cutting
- Not for dead-end use
- Linear outputs up to fault levels
- Accurate performance
- Non-hazardous voltage on output
- Completely sealed against moisture

Features

SENSORS

Electrical Ratings

- Insulation Class
  - Model 9650/E1104 — 15kV
  - Model 9660/E1304 — 25kV
  - Models 9670/C14C0 — 35kV
- Impulse
  - Model 9650/E1104 — 110kV
  - Model 9660/E1304 — 150kV
  - Models 9670/C14C0 — 200kV

Construction

- Materials: molded from POLYSIL, a high dielectric strength, anti-tracking polymer concrete
- Weight
  - Model 9650/E1104 — 39 Lbs / 17.7 kg
  - Model 9660/E 1304 — 49 Lbs / 22.2 kg
  - Models 9670/C14C0 — 59 Lbs / 26.7 kg
- Conductor Diameter: 0.25" to 1.25" / 6.35mm to 31.7mm

ANALYZER

PM174/5—See pg. 10

ENCLOSURE

- Protection: IP 65
- **Weight**: 18.7 lbs / 8.5 kg
- **H×W×D**: 19.7x15.7x7.9" / 500x400x200 mm

Accessories & Add-Ons

ETC-II Intelligent Network Communication Device

The ETC-II offers full control of entire power systems, from anywhere, anytime, via an Internet/Ethernet connection, and supports several protocols. Its compact design and easy DIN/Rail wall mounting allow for ease of use.

Operation Modes

1. **Transparent**
   From serial communication to TCP/IP communication

2. **Data Server Applications**
   The ETC-II Data Server provides the user with a mechanism that allows data accumulation from instruments in a background mode, using Modbus protocol (Modbus master). The instruments and register range for polling are defined in the polling tables. 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 that would be continuously polled and updated in the server register array. Any number of device register ranges can be defined for each instrument.

   Important features include:
   - Memory logging
   - Reduction of network traffic
   - Backup memory for Internet and other applications

Features

- Ethernet 10/100 MBit port
- USB port
- Two RS-422/RS-485 ports—Master
- One RS-232 port—Slave
- Provides support for communication protocols Modbus/TCP, Modbus RTU
- Real Time Clock
- Large non-volatile memory
- Terminal connection
- Telnet service
- Field setup
- Wide range of power supply options
- Compact design
- Table top (DIN rail and wall mounting option)
- **Weight**: 1.76 lbs / 0.8 kg
- **H×W×D**: 3.7×7.3×5.6" / 95×186×144 mm

RSC232 Communications Converter

The RSC232 communications converter, with a built-in power supply, is designed to handle up to 31 IEDs connected via RS-485 up to 1200 meters/4000 feet. It can be powered from AC/DC power supply, and permits easy conversion of RS-232 PC signals into full duplex (RS-422) or half duplex (RS-485) communication. DIN/Rail Wall Mounting. **Construction**: **Weight**: 0.55 lbs / 0.25 kg, **H×W×D**: 6×1.6×3.3" / 154×41×84 mm

AX-8 Analog Expander

The AX-8 Analog Expander enables power meters to interface with other devices that require analog signals. The AX-8 can be connected to any power meter equipped with an RS-422 communication port and an analog expander option. 8 channels are provided for high-resolution analog output. Two units can be connected in sequence, providing as many as 16 analog outputs with the use of one power meter. A wide range of options offers current output or voltage output. **Construction**: **Weight**: 1.54 lbs / 0.7 kg, **H×W×D**: 3×7.3×5.1" / 76×186×130 mm.

expertpower™

Energy Management System (EMS)
Comprehensive Power Quality Analysis
Customer Billing and Invoicing

ExpertPower™ comprehensive energy management software solution provides actionable insight and easy consumption visibility. It fully supports Billing, Demand response, Power quality analysis and Generator control. ExpertPower™ is available either as an online service (SaaS – Software as a Service) or as a standalone package (Pro).

ExpertPower™ fast and intuitive online web interface makes it easy to control comprehensive electrical data. It reduces the total cost of ownership (TCO) by eliminating the need for training or using special hardware or software. Its scalability allows starting with a small installation and expanding as you grow your business.

SATEC's complete solution includes our wide range of power analyzers combined with ExpertPower™ software, providing all the information and analytics necessary to improve your energy system efficiency, reliability and profitability.

Applications

Real time & History Visibility
- Electrical data
- Max demands
- Data logs

Energy Consumption
- Import, Export and Total
- TOU (Time of Use)

Power Quality
- Events and notifications
- EN50160 Compliance reports
- Waveforms analysis

Billing & Sub-metering
- Dynamic tariff definitions
- Accurate cost calculations
- Invoice generation

Demand response
- Calculate facility usage and energy distribution
- Automatic generator operation

Advanced Reporting
- Scheduled distribution
- Multi-dimensional comparisons

Open Architecture
- Standard Web service API

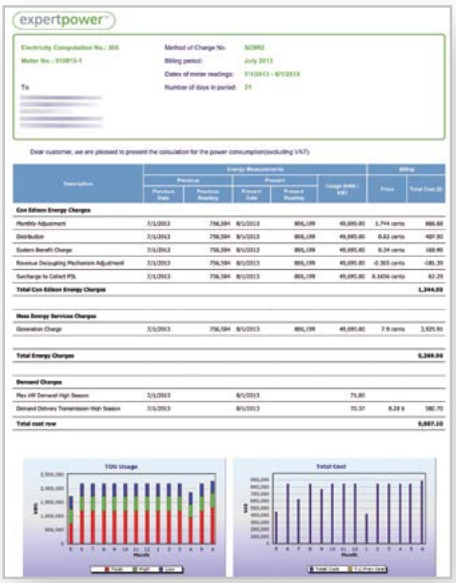
Features

State-of-the-art user interface:
- Simple web based multi browser support
- Energy Intelligence BI dashboards with dynamic drilldown
- Customizable reports, charts and calculations
- User defined graphic maps, one-line diagrams and themes
- Events and Notifications
  - Configurable email and SMS notifications
  - Flexible criteria and thresholds
- Live real-time monitor
- Built-in export to Excel, PDF
- Remote device configuration for all SATEC products
- Connects to Modbus, BACnet, DLMS or SNMP compatible 3rd party devices
- Integration with 3rd party applications: BMS, SCADA, ERP
- Controlled access permissions per user or group
- HTTPS TLS/SSL Secured

Selected Screenshots

Heatmap

Power Quality



Energy Billing

Energy Dashboard

Energy Intelligence: Live Data

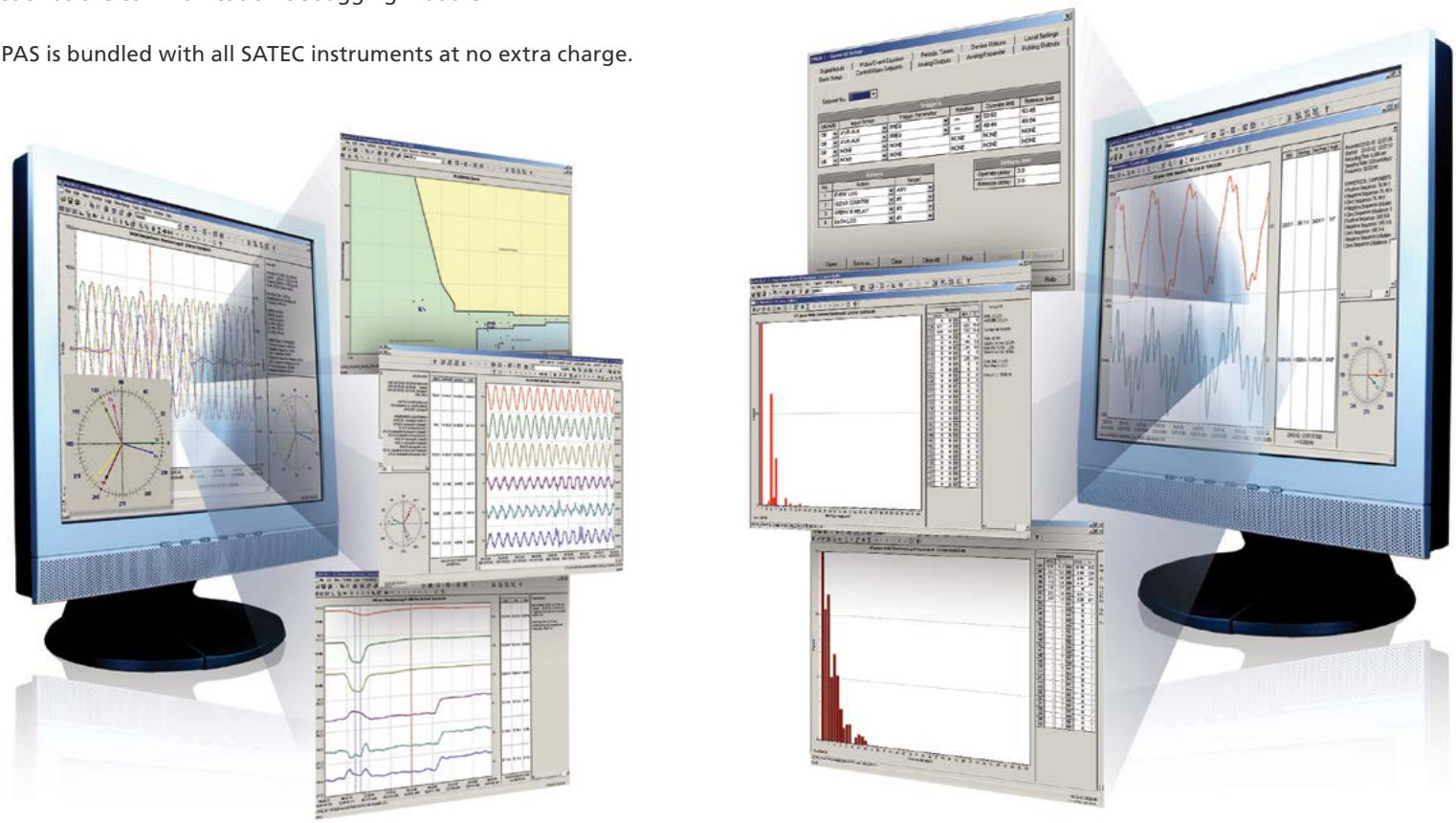
Executive Dashboard

PAS

Power Analysis Software

PAS is SATEC's comprehensive analysis and engineering software designed to program 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.



Features

- Programming and control for all SATEC devices
- Automatic power quality reports for EN50160, IEEE1159, GOST 13109 and GOST 32144-2013
- Automatic polling of devices
- Simple off-line instrument setup
- Direct data access for status monitoring or analysis
- **Wide range of communication platforms:**
  - RS standard serial lines
  - TCP/IP over cellular communication
  - USB
  - Telephone/Modem
- Easy export to spreadsheet, Word, Excel or database
- Self-test
- Extensive graphic and reporting capabilities for waveforms and harmonics
- Export COMTRADE (IEEE standard common format for transient data exchange)
  - Export PQ
  - PQDIF for waveforms and data logs
- Remote device configuration
- User-defined line diagram
- Multiple TOU programming

Comprehensive analysis

- Data logs—historical or current
- Trends—individual or 3 phases together
- Trend over time data log or waveform
- Trend based on user-selected parameters or limits
- 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
- Uploading TOU settings
- Uploading with variable setpoints
- Alarms with variable setpoints
- Delta measurement

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.

Some of SATEC's Certificates*

* Note: products may comply with some standards only

THE STANDARDS INSTITUTION OF ISRAEL

ISRAC Israel Laboratory Accreditation Authority ISO/IEC 17025 No. 0357

Device Comparison Table

Note: ▫/* = Option

	PM130/135				BFM136/II		PM172 Series			ezPAC SA3x0	PM180	EM920	EM720	PM174/5
Basic Measurements														
V / A / Hz (50/60)	■	■	■	■	■	■	■	■	■	■	■	■	■	■
25/400 Hz	■	■	■	■	■		■	■	■					
Max/Min V / A / Hz	■	■	■	■			■	■	■	■	■	■	■	■
V/A Demands, Max. Demands	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Neutral Current	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Unbalance V/A	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Power Measurements														
kW, kVAR, kVA	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Max/Min kW, kVAR, kVA	■	■	■				■	■	■	■	■	■	■	■
kW / kVAR / kVA Demands, Max. Demand	■	■			■	■	■	■	■	■	■	■	■	■
PF (Power Factor)	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Energy Measurements														
IEC 62053-22 / ANSI C12.20 (Accuracy Class)	0.5S	0.5S	0.5S		0.5S	0.5S	0.2S	0.2S	0.2S	0.2S	0.2S	0.2S	0.2S	0.2S
kWh, kVARh Import & Export, kVAh	■	■	■	■	■	■	■	■	■	■	■	■	■	■
KYZ Pulse Outputs	▫	▫	▫	▫	▫	▫	▫	▫	▫	■	■	■	■	■
KYZ Pulse Inputs	▫	▫	▫	▫	▫	▫	▫	▫	▫	■	■	■	■	■
Pulse Inputs	▫	▫	▫	▫	▫	▫	▫	▫	▫	■	■	■	■	■
TOU Tariffs	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Total Harm. Distortion														
THD (Voltage / Current)	■		■	■	▫		■	■	■	■	■	■	■	■
TDD (Total Distortion Demand)	■		■	■	▫		■	■	■	■	■	■	■	■
K-Factor	■		■	■	▫		■	■	■	■	■	■	■	■
Power Harm.														
Total Harmonic Powers kW, kVA									■					
Total Harmonic Energies kWh, kVAh									■					
Individual Harmonics														
Indiv. Harm. (Voltage/Current): up to order	40	40	40		25				40	63	63	50	50	50
Max. Samples per Cycle	128	128	128	128	64	64	128	128	128	256	1024*	1024*	1024*	128
Directional Harm. Flows kW, kVAR										■	■			
Interharmonic Calculation										■	■	■	■	■
Event, Data, Waveform Logging														
Non-Volatile Memory (MB)	0.12	0.06 / 0.12			8	256	1		1	256	256	16	16	1
Event Log	■	■	■		■	■	■	■	■	■	■	■	■	■
Data Logs	■	■	■		■	■	■	■	■	■	■	■	■	■
PQ Log										■	■	■	■	■
Fault Log										■	■	■	■	
Waveform Log									■	■	■	■	■	■
Time Stamps	■		■	■	■	■	■	■	■	■	■	■	■	■
1 Cycle RMS Calculation	■	■	■	■	■	■	■	■		■				■
½ Cycle RMS Calculation										■	■	■	■	■

Sags, Swells & Interruptions Detection		■		■	■	■		■	■	■	■	■	■	■
Sags, Swells, Interruptions & Transient Recording						□			■	■	■	■	■	■
Flicker										■	■	■	■	■
Symmetrical Components										■	■	■	■	■
EN50160 Reports										PM175	■	■	■	■
IEEE1159 & IEEE519 Reports										PM174			■	■
GOST 13109 / GOST R 54149-2010										□	□		□	□
Fault Current										PM174*	■	■	■	■
Transformer Correction	■	■	■	■	■	■	■	■		■	■	■		
Transformer/Line Loss Compensations											■	■		
Relay Outputs	4*	1+4*	4*	4*		18*	2+2*	2+2*	2+2*	2+2*	4*	1+6*	24*	64*
Analog Outputs	4*	4*	4*	4*			2*	2*	2*	2*		4*	12*	16*
Digital Inputs	12*	2+12*	12*	12*		72*	2+2*	2+2*	2+2*	2+2*	4+4*	2+8*	48*	128*
Analog Inputs						16*	2*	2*	2*	2*			12*	16*
Analog Output via Expander AX-8							■	■	■	■				
RS-485	■	■	■	■	■	■						■	■	
RS-232/485					□						■	□	■	
RS-422/485					□	□	■	■	■	■			□	
RS-232/422/485	□	□	□	□			□	□	□	□				■
Dial-up Modem					□		□	□	□	□		□		□
Ethernet Port	□	□	□	□	□	■	□	□	□	□	□	□	■	■
USB						■					□	■	■	■
IR											■	■	□	□
Profibus DP	□	□	□	□			□	□	□	□				
GSM/GPRS Wireless Modem	□	□	□	□	□	□	□	□	□	□	□	□		
Max. No. of Ports	2	2	2	2	2	5	2	2	2	2	4	5	5	6
IRIG-B (GPS Time Synchronization)											□	□	□	■
Modbus RTU, ASCII, Modbus/TCP	■	■	■	■	■	■	■	■	■	■	■	■	■	■
DNP3.0, DNP3/TCP	■	■	■	■		■	■	■	■	■	■	■	■	■
IEC 61850											□	□	□	□
IEC 60870-5-101/104	□	□	□	□									■	
Voltage Channels	3	3	3	3	3	3	3	3	3	3	3+1*	3+1*	3AC+1AC/DC	4AC+1DC
Current Channels	3	3	3	3	36	18-54	3	3	3	3	4	3+1*	4/8*	4/8
Back-up Power Supply						□					Aux. PS* 6h bat.*	□	□	■

Power Quality Analysis (PQA)
Trafo Calc.
I/O Programmable
Basic Communication
Special Communications
GPS
Communication Protocols
Input Channels
Aux. PS

Note: □/* = Option

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