BILLING & REVENUE METERING





SATEC

SMART SYSTEMS




SATEC

Time of Use (TOU) Billing Systems

Value Proposition

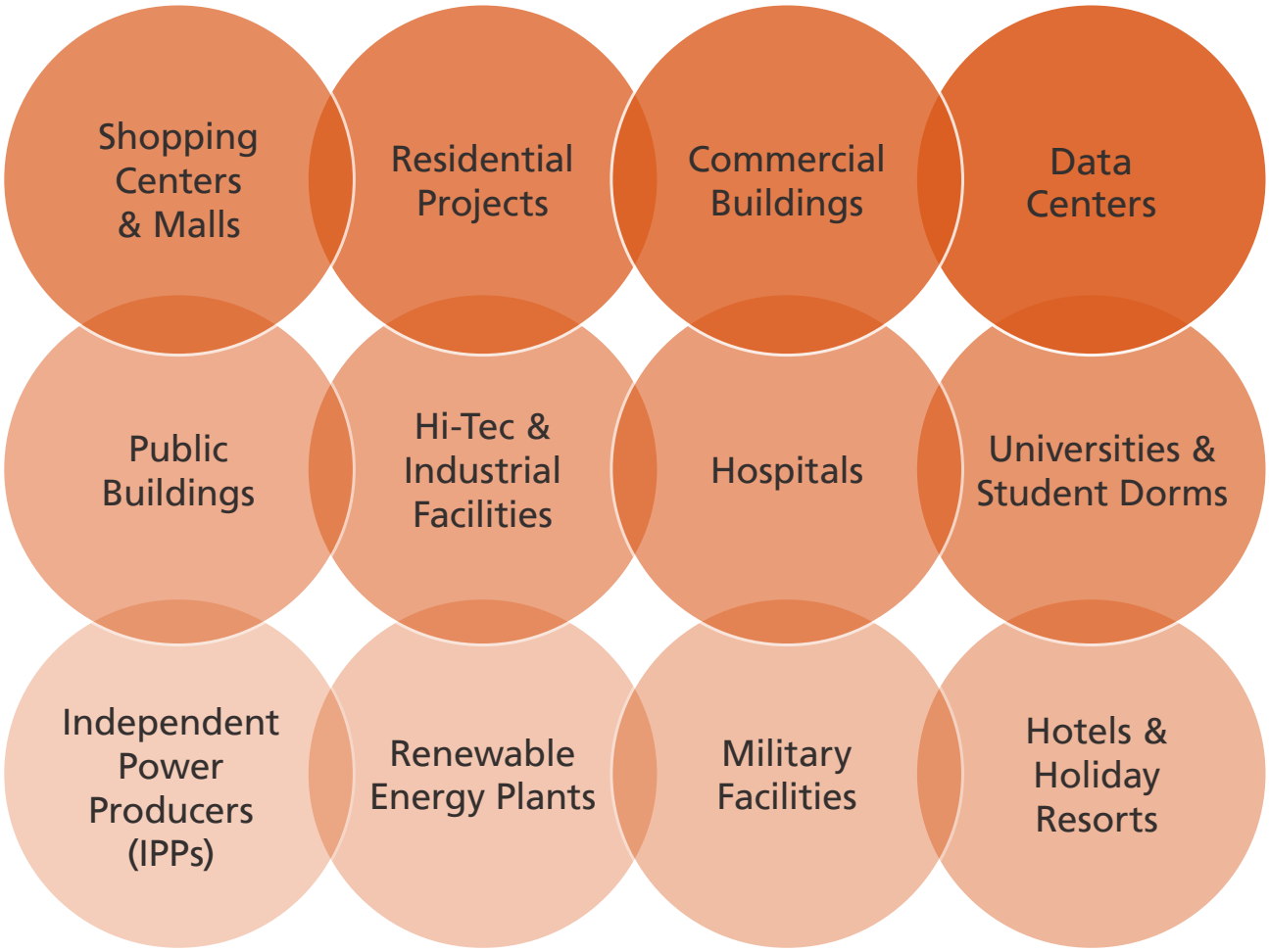
Energy distribution and tenant billing allows up to 40% markup and fast return on investment (ROI) with an effective techno-financial solution.

Solution

SATEC Automatic Meter Reading (AMR) system includes various energy meters, bi-directional communication and comprehensive software for remote management, online control and billing.

Advantages

- Additional profit center
- Space and cost savings
- Automatic Operation
- Energy Saving
- Complete outsourced service



SATEC

The Experts in Energy Billing

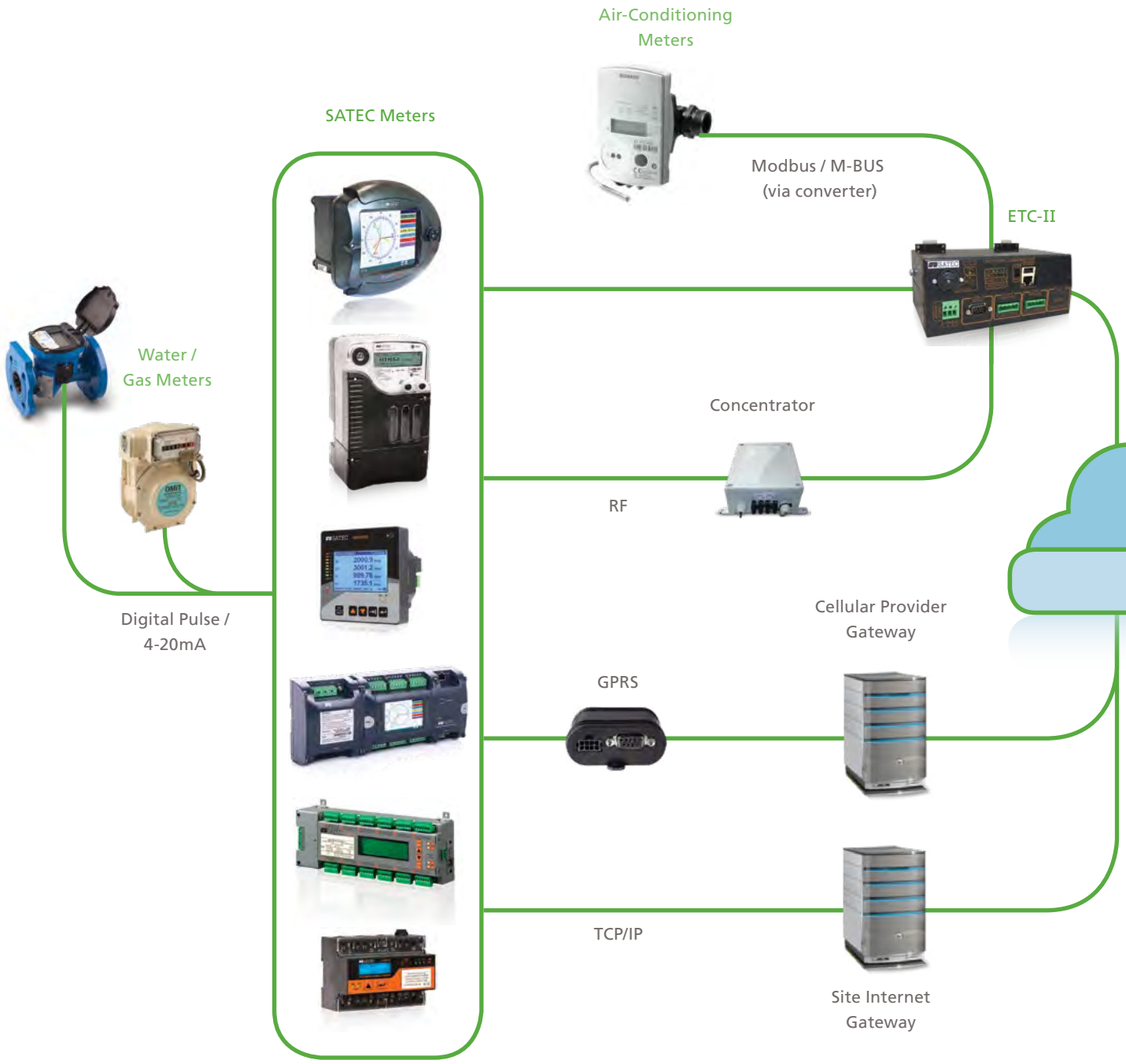
SATEC was established in 1987 and recently after introduced a multi-function digital electricity meter, which was a new concept at that time. Today the company is a world leader in the field of energy management, power quality monitoring and substation automation with offices in the USA, Israel, Spain, Russia, India, Singapore, Japan, China and Australia. In addition, SATEC solutions are promoted in over 60 countries via over 100 business partners.

In 2006 SATEC established the Billing department, which is dedicated to energy distribution and billing. The company provides energy billing solutions to shopping malls, hi-tech and industrial parks, office buildings, shopping centers, data centers and more. The solution is comprehensive – supply of all required equipment, installation, commissioning and routine operation, allowing the facility owner and the facility operator to focus on the management of the facility.

The solution includes the following major components, that can be omitted or added as required:

- High accuracy electrical energy meters (Class 0.2S for medium voltage, Class 0.5S for low voltage), including Time Of Use (TOU) monitoring. The meters are made by SATEC and have a proven track record for high reliability.
- Additional energy meters from various manufacturers (air conditioning, water, gas, steam, fuel etc.), which are carefully selected by SATEC to fit the system both technically and with accordance with regulations.
- Communication infrastructure for automatic continuous collection of data through various options – wired (RS-232, RS-485, Ethernet) or wireless (Cellular or license-free RF)
- The information is sent over the Internet to a secured central server running ExpertPower™ software on the cloud. This allows high availability and simultaneous access to all relevant personnel, based on personal access permissions.
- Dedicated project managers, together with SATEC's technical support team, carry out system setup, tenant definition and routine system operation. They verify correct operation of all devices, and in the unlikely case of communication failure they arrive on site to ensure the system is up and running
- At the end of the billing period (typically the first day of the month) the customer managers receive the utility bill, compare it with the system data, perform an energy balance and validate the accuracy of the data. Only then do they issue per tenant bills that are sent as secure PDF files. In addition, it is possible to automatically transfer the billing data to the accounting or the facility management software
- Customers receive comprehensive information about the energy total and sub-tenant consumption through the personal portal in the ExpertPower™ system or the manned SATEC call center
- To maximize benefits, customers may grant per tenant access to the ExpertPower™ system

System Configuration






End User / Owner /
Facility Manager

Printed
Utility Bills

Tenants TOU
Bills

expertpower™

Servers

INTERNET

eXpertPower™ Service

Phone & email
Service

System Operator

Automatic Bill
Data Retrieval

Utility Vault

BMS / SCADA /
Management System

Accounting
Software

Advantages for Property Owners & Facility Managers

Space and Cost Saving

A multi channel meter saves up to 75% space compared with separated meters and leaves more space for revenues.

Advanced Billing Services with ExpertPower™ System

SATEC provides advanced billing services using ExpertPower™ system for Automatic Meter Reading (AMR) of various energy meters (electricity, air conditioning, water, gas, fuel, steam, PV and more). The billing service starts with project management and consultance, followed by supply and installation of meters and communication devices, and finally periodical billing service. The periodical service includes: verification of correct system operation on a daily basis, consumption bills, energy balance and comparison with utility bills. On top of that, for high demand electricity consumers, the service can include energy efficiency monitoring with SATEC proven track record for efficiency improvement.

Financial Markup

The medium voltage electricity rate is 15%-30% lower than the low voltage rate, which allows net profit from the supply and distribution of electricity.

Fixed Charges

Electricity bills includes fixed charges, regardless of the consumption, to cover: meter reading; bill issue; bill delivery; collection; meter cost; meter maintenance; call center; advertising. The fixed charges per tenants are more than required to cover the system costs.

Penalties and Demands

When bills include surcharges such as low power factor (PF) or peak demand charges, charging collectively can reduce the total surcharge (e.g., one tenant has peak demands in the morning and the other in the afternoon).

Time of Use (TOU)

Large consumers are charged differently according to time and season; this is called TOU. SATEC's billing system allows facilities to charge tenants by TOU, thus avoiding the risk of subsidizing tenants (in cases where the facility is charged with TOU scheme and charge in flat rate).

Reducing Electricity Purchase Price

The system supports complex billing structures, including a what-if mechanism to compare plans. This allows for a better informed negotiation with energy providers, as well as creating a billing scheme for tenants.

Separate Cost Center

Creating a separate account for the financial markup on energy distribution allows additional trackable cost center.

Energy Savings

Energy management provides a typical 12% saving on electricity bills. This allows saving in public areas consumption, as well as the offices of the facility management.

Preventing Utility Errors

By measuring electricity independently of the utility, and generating an energy balance within the site, facility managers can easily detect utility errors and prevent overcharges.

Identifying Tenants Under Charges

The energy balance procedure ensures that no tenant can use electricity without being charged.

Accurate Forecasting

Our award winning proprietary consumption forecasting algorithm helps negotiate prices using short and long term forecasting.

Space and Cost Saving

The BFM-II multi-channel meter consumes up to 75% less space, leaving more area for the main purpose of the facility. Allocating the additional space required by utility meters is more expensive than utilizing the BFM-II.

Advantages for Consumers

Same Billing as the Utility

Consumers are charged exactly as they would be charged by the utility (in case that tariffs are regulated).

Charging Actual Consumption

Charging according to the actual consumption is the only fair choice. Charging per floor area is unfair and may cause some consumers to be unnecessarily charged for other consumers' actual consumption.

Accuracy

SATEC meters are up to 10 times more accurate than utility meters – Class 0.2S for medium voltage and Class 0.5S for low voltage. Periodic energy balances guarantee that the system accuracy is maintained at all times.

Tracking of Energy Expenses

Monitoring the system allows for continuous tracking of energy expenses, enabling cost reduction and accurate investment planning.

Better Service

A local electrician, who is usually on site, provides faster service than utility technicians.

Unified Bill

Energy expenses are incorporated in the rent bill. This enables easier managing and processing.

BFM136 / BFM-II

Multi-Tenant Submetering

BFM136

BFM-II

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: 3.81 mm

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

RELAY OUTPUTS

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

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

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

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. 11)
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. 11)
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. 17)
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. 12)/**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	

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. 17)

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 *

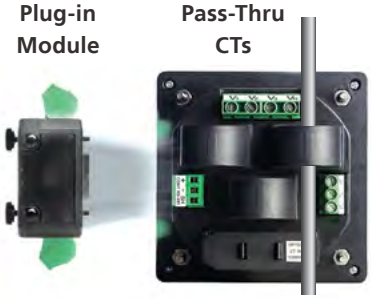
Communication protocols

- 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 10

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 contact)
- 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

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).

EDL174/5
Portable Power Quality Analyzer

Displays
The PM174/5 Series offers a selection of display modules.

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)

eXpertMeter™ EM720 / EM920

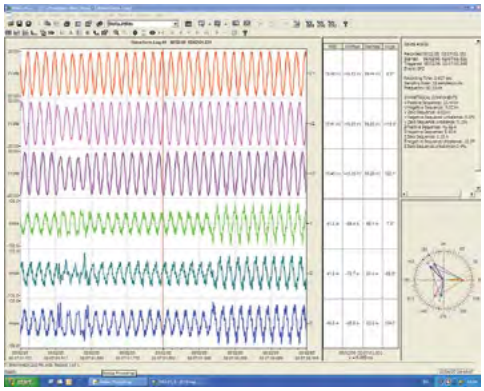
& High Performance Revenue Meter Cutting Edge Power Quality Analyzer Fast Transient and Fault Recorder

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.



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. 18)
- 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
- ITI (CBEMA) curves (via PAS)
- Four measured and recorded currents up to 50 A (10In)

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
- 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

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

ETC ONE PLUS Cost-Effective Communication Converter

The ETC ONE Plus converts serial RS-485 communication to Ethernet (TCP/IP) or 3G cellular communication. It supports connection of up to 32 devices over multi drop RS-485 Modbus communication. It can be mounted on a DIN rail or on a wall and supplied from 85-265V AC/DC power supply. **Construction**: **Weight**: 1.2 lbs / 0.53 kg, **H×W×D**: 3.5×4.9×2.7" / 90×125×68.5mm

RF Data Concentrator

Complete data concentrator for wireless communication, includes two SATEC ETC-II communication converters, RF router, RF antenna and 6-meter cable. Each ETC-II has Ethernet, RS-232 and RS-485 ports as well as Real Time Clock (RTC) with battery backup.

- Supports up to 247 devices
- Communication Repeater

Note: RF is available in certain regions only.

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:

EM133
PM130 PLUS
PM135
BFM136
BFM-II
PM174
PM175
PM180

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

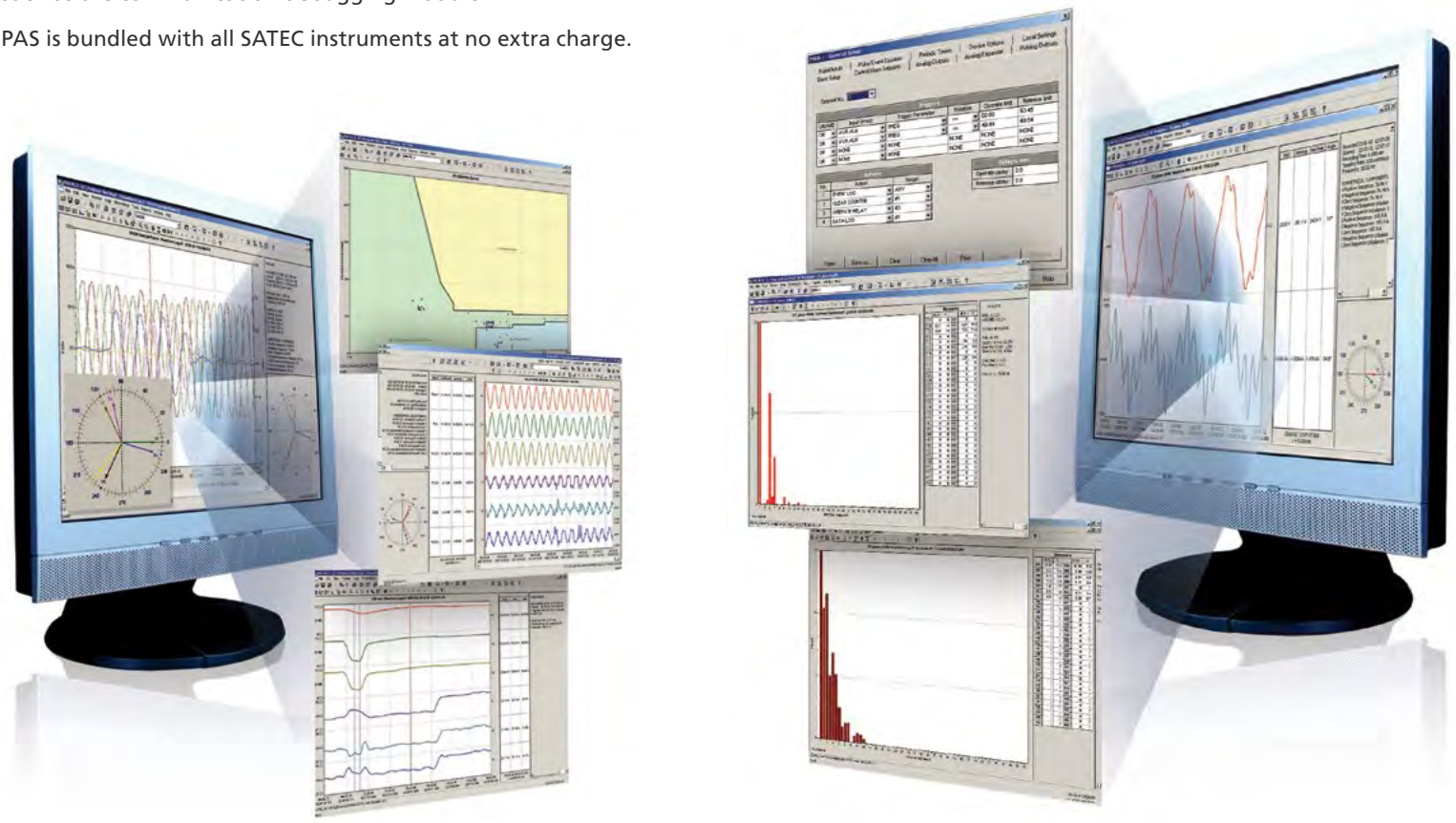
CS4 CS4S CS8 CS8S CS12S CS20S CS30S

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

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

Heatmap

Power Quality

Energy Billing

Energy Dashboard

Energy Intelligence: Live Data

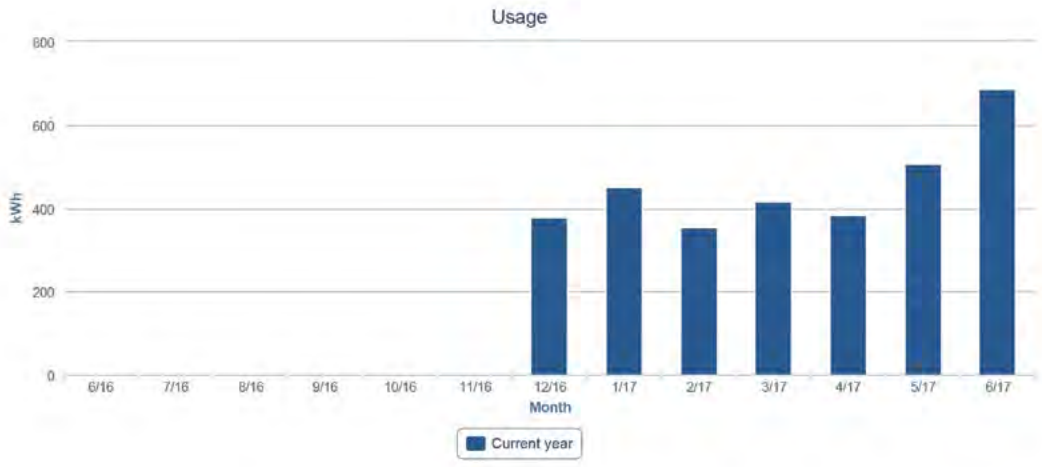
Executive Dashboard

Residential Electricity Bill

SATEC
Powerful Solutions

Computation No.	195622		
Meter No.	1149298-14	Invoice date	7/14/2017
Billing month	July 2017	Number of days in period	31
Metering period	6/2/2017 - 7/3/2017	Method of Charge	
To			
Customer Name			
Address			

Description	Previous	Present	Usage (kWh)	Price	Total Cost ($)
	Previous Reading	Present Reading			
Total kWh	4,707	5,411	705.00		
Sales Tax				**4.50%**	**7.43**
Electric Total			**705.00**		**173.23**
Total Charge					**180.66**



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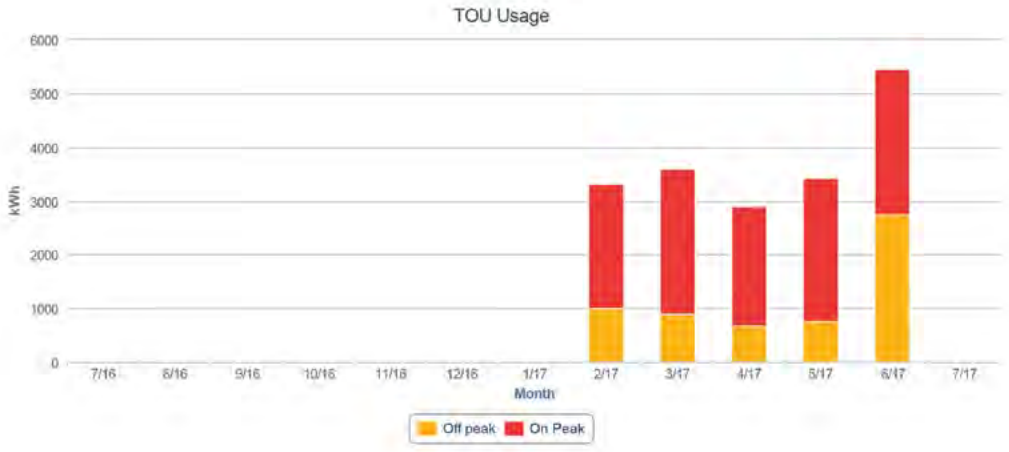
TOU Electricity Bill Example

SATEC
Powerful Solutions

Computation No.	197570		
Meter No.	C-111377	Invoice date	7/25/2017
Billing month	July 2017	Number of days in period	32
Metering period	6/16/2017 - 7/18/2017	Method of Charge	
To			
Customer Name			
Address			

Description	Usage (kWh / kvar / kW)	Price (cents)	Total Cost ($)
JCP&L : Fixed Customer Charge			56.29
JCP&L : CIEP Standby Fee KWH	4,678.00	0.016	0.748
JCP&L : Demand Charges KVAR	0.02	37	0.007
JCP&L : Delivery Charges KWH (Off Peak Summer)	2,098.00	0.3609	7.57
JCP&L : Delivery Charges KWH (On Peak Summer)	2,580.00	0.3609	9.31
JCP&L : Delivery Charges KW Demand Summer	14.53	587	85.29
JCP&L : Non-Utility Generation Charges KWH	4,678.00	0.1584	7.41
JCP&L : Societal Benefits Charges KWH	4,678.00	0.7625	35.67
JCP&L : RGGI Recovery Charges KWH	4,678.00	0.1164	5.45
JCP&L : System Control Charges KWH	4,678.00	0.3296	15.42
Direct Energy Business Charge per KWH	4,678.00	7.498	350.76
Monthly Billing Fee			10.00
Sub-Metering Monitoring Charge			42.00
Total Charge			**625.92**



Complex Tariff Electricity Bill Example

SATEC
Powerful Solutions

Computation No. 192270

Meter No. 1121782-4
Billing month June 2017
Metering period 6/6/2017 - 6/17/2017

Invoice date 7/11/2017
Number of days in period 11
Method of Charge

To
Customer Name
Address

Description	Usage (kWh)	Price (cents)	Total Cost ($)
Your Supply Charges			
Supply	182.00	7.80	14.19
Merchant Function Charge	182.00	0.436	0.794
Statement of Clean Energy Standard Supply Surcharge	182.00	0.327	0.596
Supply: GRT & Other tax Surcharges		**2.41%**	**0.375**
Total Supply Charges			**15.96**
Your Delivery Charges			
Basic Service Charge	11.00	52.53	5.78
Billing and Payment Processing Charge			1.20
Delivery	182.00	9.63	17.52
Delivery Revenue Surcharge	182.00	0.067	0.122
Statement of Monthly Adjustment Clause	182.00	0.347	0.632
Adjustment Factors - MSC I, MSC II & MAC	182.00	2.05	3.73
SBC/RPS Charges	182.00	0.67	1.22
Temporary NY State Surcharge	182.00	0.126	0.229
Delivery: GRT & Other Tax Surcharges		**5.05%**	**1.35**
Delivery Total			**28.05**
Sales Tax		**4.50%**	**1.98**
Subtotal for Avg	**182.00**	**26.23**	**47.74**
Total Charge			**49.72**

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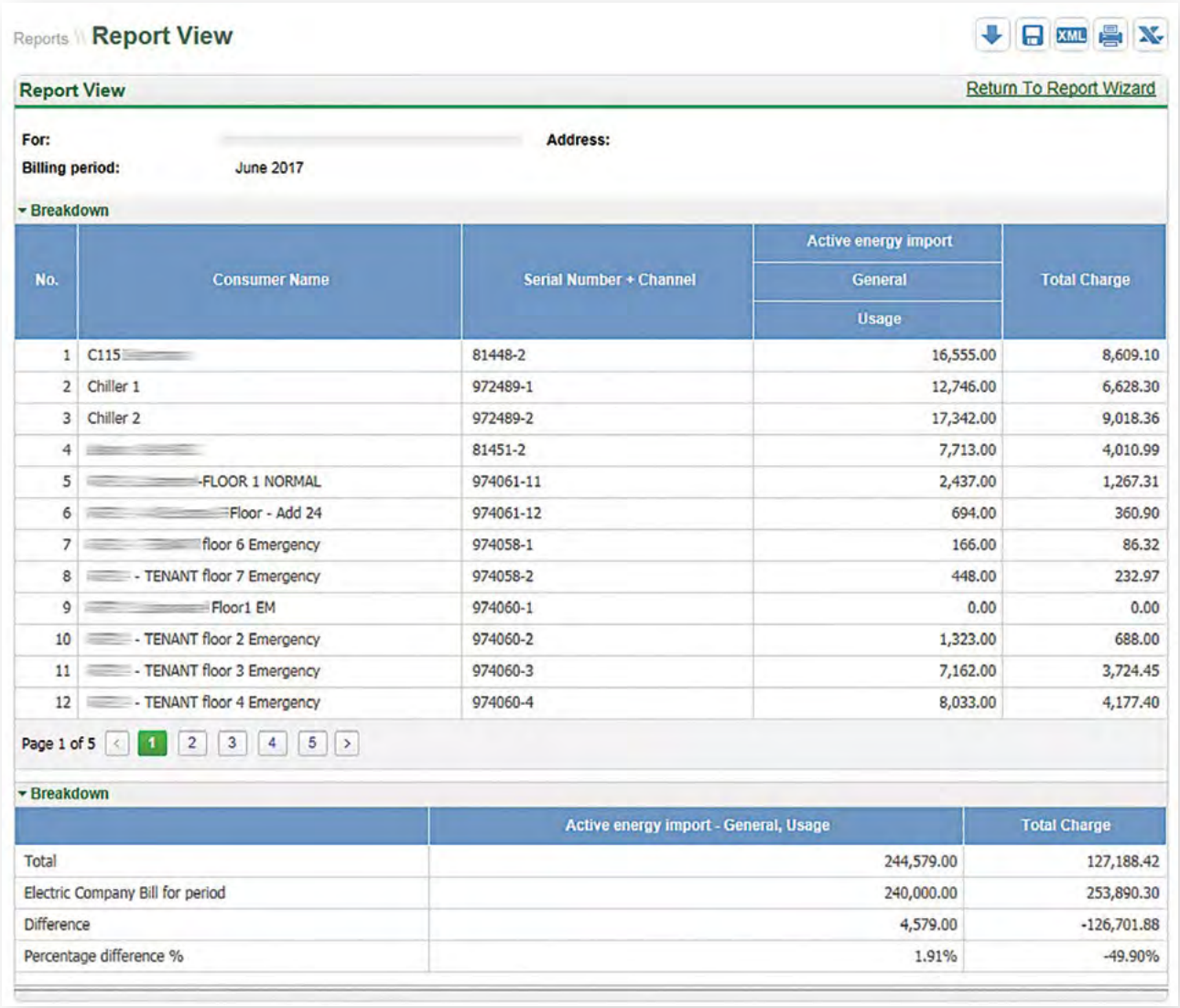
Energy Summary Report



Reports \\ **Report View**

Report View Return To Report Wizard

For: **Address:**

Billing period: June 2017

▾ Breakdown

No.	Consumer Name	Serial Number + Channel	Active energy import	Total Charge
			General	
			Usage	
1	C115	81448-2	16,555.00	8,609.10
2	Chiller 1	972489-1	12,746.00	6,628.30
3	Chiller 2	972489-2	17,342.00	9,018.36
4		81451-2	7,713.00	4,010.99
5	-FLOOR 1 NORMAL	974061-11	2,437.00	1,267.31
6	Floor - Add 24	974061-12	694.00	360.90
7	floor 6 Emergency	974058-1	166.00	86.32
8	- TENANT floor 7 Emergency	974058-2	448.00	232.97
9	Floor1 EM	974060-1	0.00	0.00
10	- TENANT floor 2 Emergency	974060-2	1,323.00	688.00
11	- TENANT floor 3 Emergency	974060-3	7,162.00	3,724.45
12	- TENANT floor 4 Emergency	974060-4	8,033.00	4,177.40

Page 1 of 5 < 1 2 3 4 5 >

▾ Breakdown

	Active energy import - General, Usage	Total Charge
Total	244,579.00	127,188.42
Electric Company Bill for period	240,000.00	253,890.30
Difference	4,579.00	-126,701.88
Percentage difference %	1.91%	-49.90%

HVAC Billing (hot and cold)

Readings > **Last Reading**

Customer: **Site:** **Location:** **Device:**

Total		History
Name	Value	Unit
Active Power	385	kW

Basic measurements		History
Name	Value	Unit
Cooling Energy	367,410	
Fabrication number	68,082,770	
Volume Flow	58.9	m³/h
Flow Temperature	11	
Return Temperature	5	
Temperature Difference	5.6	
Status:1,2 - No communication 3 - Communication	3	

Basic energy measurements

Billing of energy delivered through the HVAC system is performed via 3rd party ultra-sonic meters, that are installed in shopping centers, hi-tech parks, high-rise buildings, etc.

HVAC metering allows reading per consumer consumption of the energy out of the cooling/heating liquid. The meter measures the fluid flow and the temperature difference between the incoming and outgoing pumps, and calculates the energy consumption. The main pipe is also equipped with an energy meter, to allow monitoring the efficiency and public areas consumption. The electrical energy consumption is measured and the cost is divided among the consumers based on the liquid consumption.

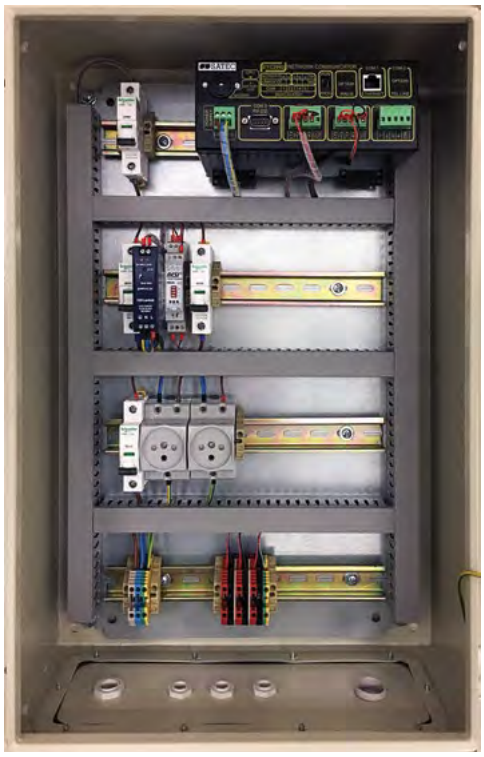
The use of individual HVAC monitoring is not only the fair solution, it also encourages consumers to reduce their consumption and improve efficiency.

ExpertPower™ monitoring system collects the HVAC consumption information and allows flexible use of the data, including charts, historical graphs and bills.

Energy Calculation Formula

$Q=k*V*(t_V-t_R)$

Q: heat flow volume
k: thermal coefficient $=f(t_r/t_v)$
V: volume
t_V: flow temperature
t_R: return temperature



Remote Data Collection Enclosure

For up to 96 HVAC billing meters (two loops of 48 meters)

HVAC Bill Example

SATEC
Powerful Solutions

Computation No.	209220		
Meter No.	C-103411	Invoice date	8/16/2017
Billing month	August 2017	Number of days in period	29
Metering period	7/6/2017 - 8/4/2017	Method of Charge	[redacted] Rate EL9 General Large (R2017)

To

Customer Name [redacted]

Address [redacted]

Description	Usage (kWh / kW)	Price (cents)	Total Cost ($)
Your Supply Charges			
Energy Supply	21,703.00	4.25	922.20
Capacity Charge	40.99	1,029.37	421.94
Merchant Function Charge	21,703.00	0.175	37.95
Supply: GRT & other tax surcharges		**2.41%**	**33.26**
Total Supply Charges			**1,415.35**
Your Delivery Charges			
Energy Delivery	21,703.00	2.96	641.87
Demand Delivery	40.99	2,251.53	922.90
System Benefit Charge	21,703.00	0.67	145.41
Meter Charges			128.80
Billing and Payment Processing Charge			1.20
Temporary NY State Surcharge	21,703.00	0.084	18.32
Delivery: GRT & other surcharges		**2.51%**	**46.66**
Total delivery charges			**1,905.16**
5% Meter Reading Fee		**5.00%**	**166.03**
Your sales tax		**8.88%**	**294.70**
Total electricity charge			**3,781.24**

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[redacted]

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W.A.G.E.S Billing

Water, Air, Gas, Electricity & Steam

ExpertPower™ incorporates all W.A.G.E.S. (Water, Air, Gas, Electricity & Steam) data in one system. The Automatic Meter Reading (AMR) collects information from remote meters, eliminating the need to read the data manually. Water, gas and steam meters communicate over RS-485 communication or provide pulse outputs. The data is transmitted to the ExpertPower™ server over Ethernet, cellular network or any other communication method being used. Conversion of pulses is performed using digital inputs of the electricity meters or with SATEC ETC2002 Intelligent Network Communicator.

The system provides accurate billing according to actual consumption and local regulation, in addition to real-time alerts for leakage detection, based on per consumer limits.

Steam Meters

Like water and gas, steam measurement is based on flow. However, steam is the most difficult fluid to measure due to the high pressure, high temperature and because the measurement parameters vary with the type of steam (wet, saturated or superheated). ExpertPower™ system supports different steam flow metering techniques, including Differential-pressure, Vortex, Variable-area, Target, Turbine, Coriolis and Ultrasonic. Choosing the best technology depends on various parameters, such steam type and cost.

Water Meter

Gas Meter

Gas Bill Example

SATEC
Powerful Solutions

Computation No.	191618		
Meter No.	1146084	Invoice Date	7/10/2017
Billing Month	June 2017	Number of days in period	31
Metering Period	5/26/2017 - 6/26/2017	Method of Charge	[redacted]

To

Customer Name [redacted]
Address [redacted]

Description	Usage (CCF) / (m³)	Price (cents)	Total Cost ($)
Gas Charge	416.00	102.70	427.23
Total Charge			427.23

Payment due upon receipt
Please make checks payable to:
[redacted]

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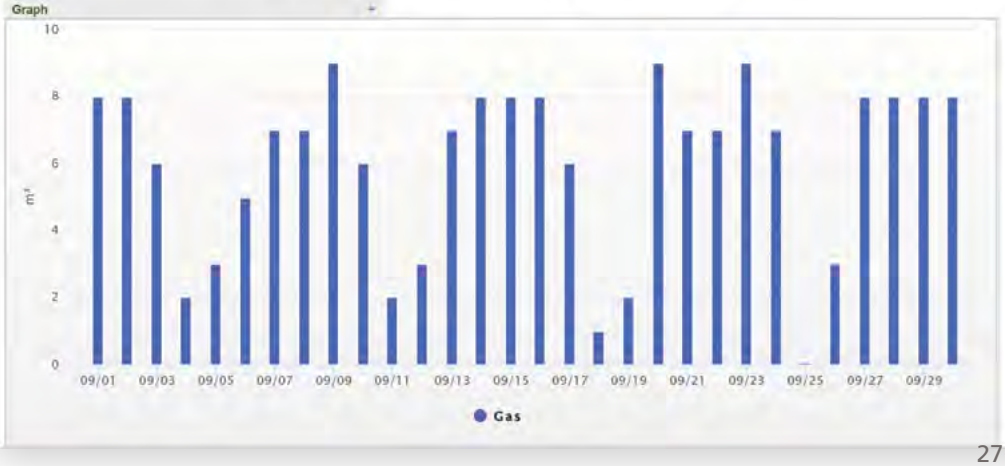
7 00:00 - 10/1/2017 00:00 **Current Date:** 10/20/2017 18:38
[redacted] **Device:** Pulse

	Factor	Usage	Cost ($)
	0.01	180	188.41

		Gas	Cost ($)
		8	8.374
		8	8.374
		6	6.28
		2	2.093
		3	3.14
		5	5.234
		7	7.327
		7	7.327
9/9/2017	Saturday	9	9.42
9/10/2017	Sunday	6	6.28
9/11/2017	Monday	2	2.093
9/12/2017	Tuesday	3	3.14
9/13/2017	Wednesday	7	7.327
9/14/2017	Thursday	8	8.374
9/15/2017	Friday	8	8.374
9/16/2017	Saturday	8	8.374
9/17/2017	Sunday	6	6.28
9/18/2017	Monday	1	1.047
9/19/2017	Tuesday	2	2.093
9/20/2017	Wednesday	9	9.42
9/21/2017	Thursday	7	7.327
9/22/2017	Friday	7	7.327
9/23/2017	Saturday	9	9.42
9/24/2017	Sunday	7	7.327
9/25/2017	Monday	0	0
9/26/2017	Tuesday	3	3.14
9/27/2017	Wednesday	8	8.374
9/28/2017	Thursday	8	8.374
9/29/2017	Friday	8	8.374
9/30/2017	Saturday	8	8.374

Graph



Improved Energy Efficiency in Multi-site Organizations

Real time energy management for improving energy efficiency is one of the major objectives of the energy manager and of CFOs of electricity consumers. Energy management is a common phrase for energy suppliers but it is a key issue for energy consumers as well, as it leads to improved energy efficiency.

Multi-site organizations need a real time energy management solution in order to improve the energy efficiency, reduce energy costs and reduce CO2 emission. By using Intelligent Electronic Devices (IEDs) and a powerful web-based solution, one can control each parameter in real time, predict peak demands, plan the energy consumption and manage faults in the electrical network.

Case Study

Israel's largest retail chain, operating 240 stores nationwide, has installed SATEC's energy management solution. With a total area of 520,000 square meters and more than 10,000 employees, a combination of central and de-centralized control is required.

An energy meter with Time Of Use (TOU) capabilities was installed in several locations of each store (main service, HVAC, lights etc.). The meters have a flash memory which logs the hourly consumption. The data is sent to the central server over TCP/IP where LAN is used or over a Cellular modem in other places. In addition to the energy consumption, the meters log on their non-volatile memory all electrical parameters including voltages, currents, powers, power factor and more.

The central server resides in SATEC's server farm running the revolutionary eXpertpower™ software. The system collects the data over the Internet and processes it in real time. The data can be securely accessed from anywhere at any time with different user access privileges. eXpertpower™ monitors data in real time, allows viewing of historical information and generates a variety of reports.

The system incorporates data from several sources into one complete expert system:

1. Energy usage files from the electric utility, automatically received with the end user's approval
2. Scanned electric bill from private energy suppliers
3. Data collected from the different meters

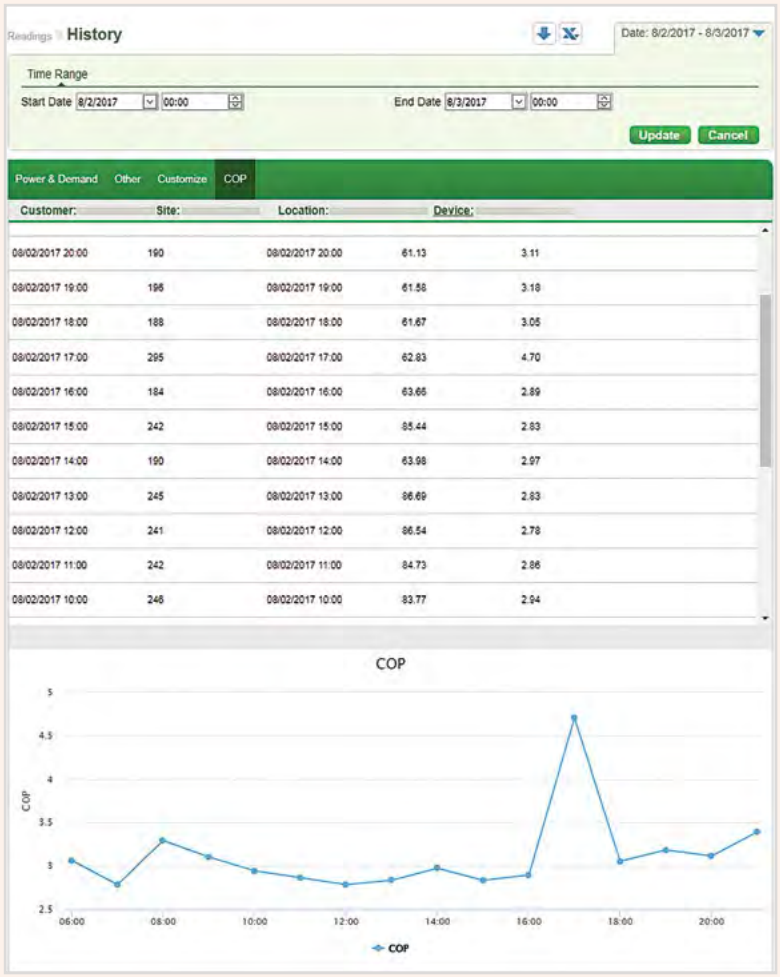
The system compares the data according to different criteria, according to the billing period of the utilities. It can generate the following reports:

1. Comparison between the measured energy and the utility charges
2. Power factor status report
3. Energy costs report, taken from SATEC meters
4. Summary of different stores and total for the whole network
5. Expected consumption, based on the season, last year's and last month readings
6. Comparing stores' consumption per square meter
7. Comparing consumption of different departments

As most users do not have internet access, eXpertpower™ delivers the information to the organization's portal to allow easy access for store managers, maintenance managers and other levels of users.

The System's Achievements

1. Continuous real time monitoring of the electrical parameters and initiating preventive maintenance for power factor issues, over voltages, phase imbalance and more
2. Monthly monitoring of the electric utility charges
3. User real consumption information for future plans – new stores, electricity budget etc.
4. Comparing the actual and expected consumption to determine sources of energy waste
5. And the bottom line – saving energy and reducing CO2 emissions.



ExpertPower™ Weekly Hourly HVAC Consumption

Report Type	Hourly Excess Consumption
Report name	Week 52 Hourly
Report dates	25/12/2016 - 01/01/2017
created on	01/01/2017
Start time	01:00
End time	04:00
kWh threshold	5

Device	25.12.2016	26.12.2016	27.12.2016	28.12.2016	29.12.2016	30.12.2016	31.12.2016
A/C Branch 102	81	81	81	82	82	82	82
A/C Branch 106	7	7	7	7	6	7	7
A/C Branch 115	8	7	7	7	8	27	6
A/C Branch 119	9	9	8	8	8	305	8
A/C Branch 144	20	21	21	21	34	22	21
A/C Branch 176	27	27	28	27	26	28	28
A/C Branch 203	14	13	15	14	15	4	2
A/C Branch 340	16	0	0	8	0	1	1

Energy Balance

Energy balance is an essential technique to manage energy effectively. It expresses all forms of energy in a common accounting unit. The balance shows the relationships between inputs to the system and the actual energy consumption (or generation) by different loads.

$$Energy\ Balance = 100\% \ \frac{kWh_{In} - \sum kWh_{Load}}{\mathrm{kWh}_{In}}$$

Energy balance is a multi-purpose tool for:

- Monitoring system efficiency
- Predictive maintenance
- Detection of undocumented energy usage
- Verifying the integrity of the system
- Ensuring complete monitoring

Monitoring System Efficiency

Typically, the incoming measurement is the primary side of a transformer, while the loads are on the secondary side. The energy balance indicates the transformer's actual efficiency.

Predictive Maintenance

The system creates a baseline for the energy balance and continuously compares it with the monitored value. As loads may become less efficient before they break down, tracking the energy balance may provide predictive failure notification.

Detection of Undocumented Energy Usage

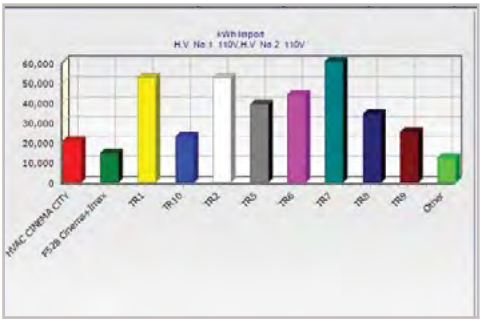
Constant monitoring of the balance may alert in case of undocumented usage of energy, whether legitimate or otherwise.

Verifying System Integrity

Any change, failure or wrong setup in the monitoring system affects the energy balance. For example, a wrong CT ratio setup, incorrect wiring or aging of a CT, will be notified.

Ensuring Complete Monitoring

Performing energy balance prevents situations of forgetting to monitor certain loads (e.g., they were added later without updating the drawings).



Device	kWh Export	kWh Import	kWh Total	PF	Max Demands, kW
		General			
H.V No.1 110V	0	160,821	160,821	0.964	2,928
H.V No.2 110V	0	218,360	218,360	0.962	3,779
Total Export	0				
Total of H.V No.1 110V,H.V No.2 110V	0	379,181	379,181		
D524 HVAC CINEMA CITY	0	20,623	20,623	0.953	889
F528 Cinema+Imax	0	14,728	14,728	1.000	259
TR1	0	52,648	52,648	0.965	817
TR10	0	22,885	22,885	0.963	567
TR2	0	52,658	52,658	0.952	779
TR5	0	39,194	39,194	0.984	604
TR6	0	43,914	43,914	0.960	730
TR7	0	60,788	60,788	0.959	942
TR8	0	34,326	34,326	0.960	601
TR9	0	25,209	25,209	0.960	655
Other		12,208	12,208		

Energy Balance Process

After a new monitoring system is installed, the energy balance is calculated. If the balance is more than a reasonable value (1%-5%, depending on the system), a corrective action is taken. The system is operational only after energy balance is satisfactory.

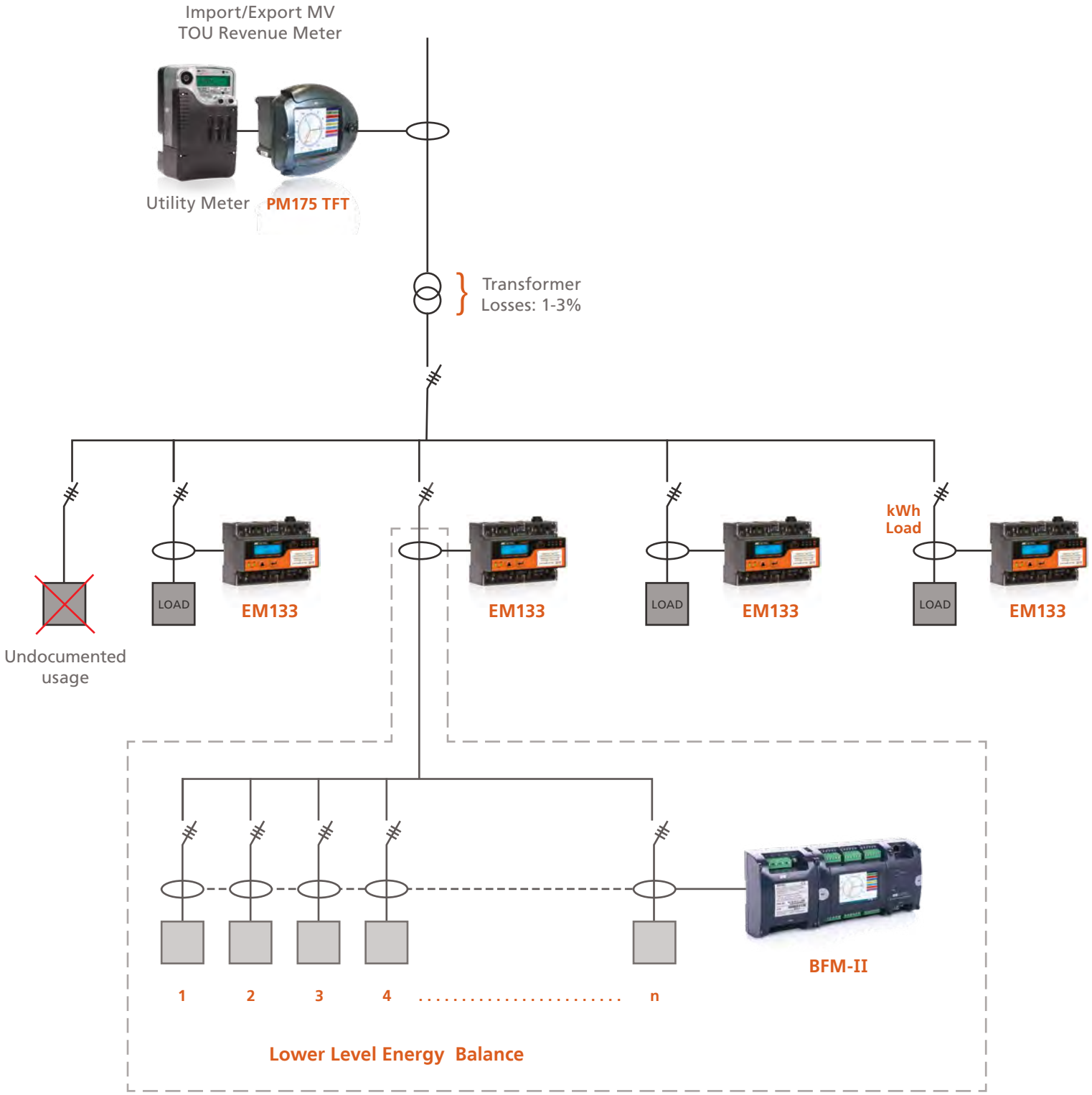
Creation of an energy balance baseline, to allow for future comparisons

ExpertPower™ automatically performs periodic comparison of the energy balance

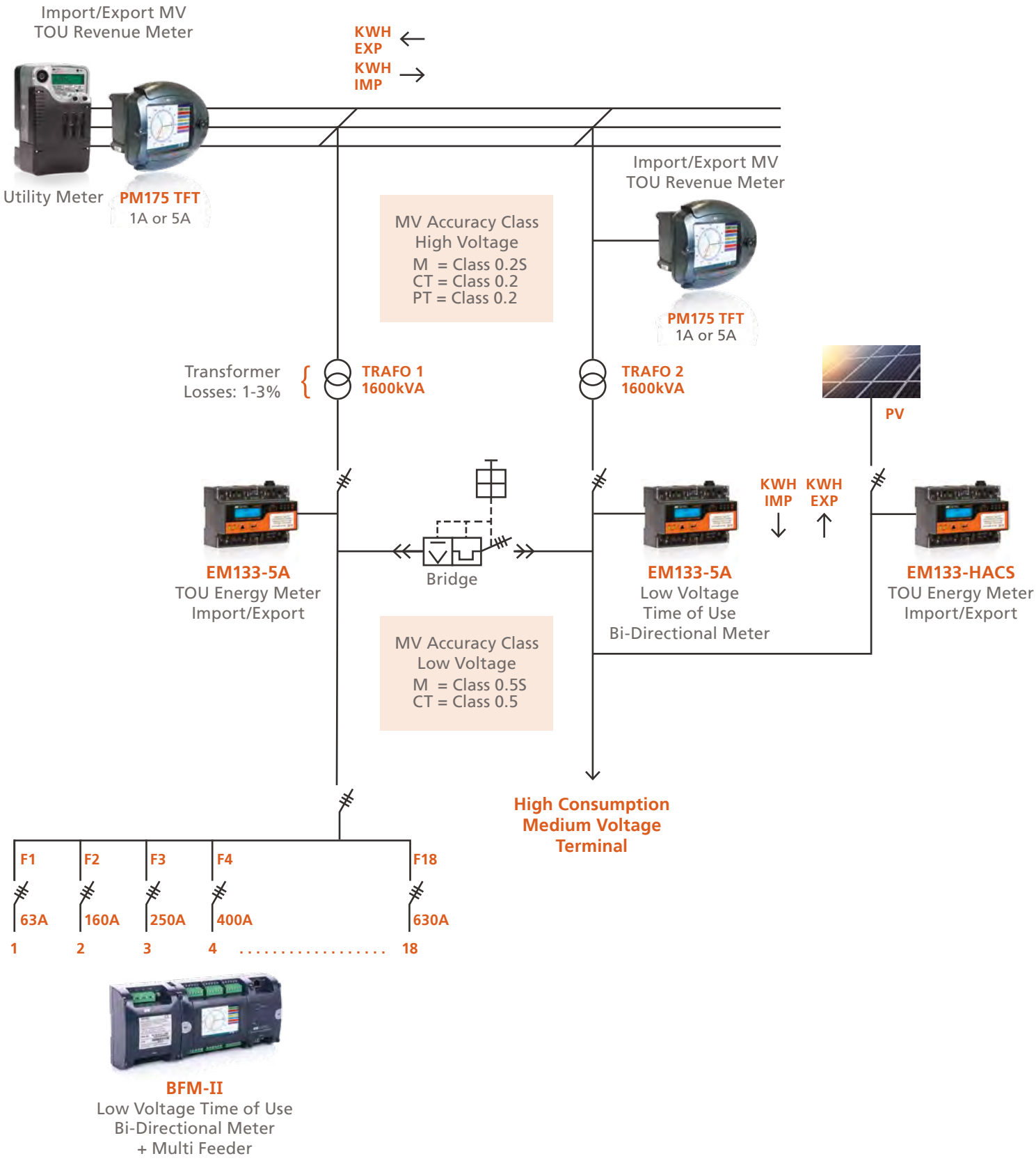
Checking the energy balance manually at the end of the billing period

If changes in the energy balance are detected, discover the root cause and take corrective action

Energy Balance Wiring Example



PV Application Wiring Example



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.

ISO 17025 Calibration

SATEC is certified by ILAC (International Laboratory Accreditation Cooperation) to perform calibration according to ISO/IEC 17025. This is the only international standard that guarantees accuracy, as well as 3rd party control validation of the calibration performance.

Calibration Lab Certificate

American UL Certificate

ISO 17025 Certificate

European MID Certificate

MET Lab Certificate

ISO 9001:2015 Certificate

THE STANDARDS INSTITUTION OF ISRAEL

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

Device Comparison Table

Note: □/* = Option

	EM133	PM130/135 EH	BFM136	BFM-II	PM174/5	EM720	EM920	PM180
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	0.2S	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		25	50	50	50	63
Max. Samples per Cycle	128	128	64	64	128	1024*	1024*	1024*
Directional Harm. Flows kW, kVAR								
Interharmonic Calculation					■	■	■	■
Event, Data, Waveform Logging								
Non-Volatile Memory (MB)	0.12	0.06 / 0.12	8	256	1	16	16	256
Event Log	■	■	■	■	■	■	■	■
Data Logs	■	■	■	■	■	■	■	■
PQ Log					■	■	■	■
Fault Log						■	■	■
Waveform Log					■	■	■	■
Time Stamps	■	■	■	■	■	■	■	■
1 Cycle RMS Calculation	■	■	■	■				
½ Cycle RMS Calculation					■	■	■	■

Sags, Swells & Interruptions Detection	■	■	■	■	■	■	■	■	Power Quality Analysis (PQA)
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	■	■	■	■	■	■	■		Trafo Calc.
Transformer/Line Loss Compensations						■	■		
Relay Outputs	1+4*	4*		18*	2+2*	4*	1+6*	24*	I/O Programmable
Analog Outputs	4*	4*			2*		4*	12*	
Digital Inputs	2+12*	12*		72*	2+2*	4+4*	2+8*	48*	
Analog Inputs	2*			16*	2*			12*	
Analog Output via Expander AX-8					■				
RS-485	■	■	■	■			■	■	Basic Communication
RS-232/485			□			■	□	■	
RS-422/485			□	□	■			□	
RS-232/422/485	□	□			□				
Dial-up Modem			□		□		□		Special Communications
Ethernet Port	□	□	□	■	□	□	□	■	
USB				■		□	■	■	
IR						■	■	□	
Profibus DP	□	□			□				
GSM/GPRS Wireless Modem	□	□	□	□	□	□	□		
Max. No. of Ports	2	2	2	5	2	4	5	5	
IRIG-B (GPS Time Synchronization)						□	□	□	GPS
Modbus RTU, ASCII, Modbus/TCP	■	■	■	■	■	■	■	■	Communication Protocols
DNP3.0, DNP3/TCP	■	■		■	■	■	■	■	
IEC 61850						□	□	□	
IEC 60870-5-101/104	□	□						■	
Voltage Channels	3	3	3	3	3	3+1*	3+1*	3AC+1AC/DC	Input Channels
Current Channels	3	3	36	18-54	3	4	3+1*	4/8*	
Back-up Power Supply				□		Aux. PS* 6h bat.*	□	□	Aux. PS

Note: □/* = Option

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