

# EM133

## TOU SMART ENERGY METER



SATEC EM133 is a Smart DIN Rail TOU Energy Meter. It is based on SATEC's best seller PM130 PLUS with an off-the-shelf LCD display (similar to the BFM136 display). The EM133 provides the full functionality of the PM130EH PLUS combined with 2 Digital Inputs, 1 Digital Output, IR (Infra Red) communication and battery backup for the real time clock. It is fully compatible with all PM130 PLUS modules.

The EM133 can serve any application from residential energy metering, through industrial energy and harmonic analysis through utility comprehensive substation automation. It provides multifunctional 3-phase power metering, revenue metering and basic power quality information. The EM133 features an internal real time clock (RTC), battery backup and onboard non-volatile memory for event and data logging. The device includes 16 set points and 4 counters that operate the built in 2 DI/ 1RO or the various analog and digital I/O add-ons.

The EM133 offers a wide range of network configurations and versatile voltage and current connections: 57 to 400V AC, up to 100A direct current measurement, connection of standard CTs (1A, 5A) and a wide range of remote CTs (split or solid cores).

## Main Features

### Multifunctional 3-Phase Smart Meter

- ➔ True RMS, volts, amps, power, power factor, neutral current, voltage and current unbalance, frequency
- ➔ Ampere/Volt demand meter
- ➔ 25, 50, 60 and 400 Hz measurements
- ➔ 128 samples per cycle

### Billing/TOU Energy Meter

- ➔ Accuracy Class 0.5S
- ➔ Four-quadrant active and reactive energy poly-phase static meter
- ➔ Three-phase total and per phase energy measurements; active, reactive and apparent energy counters
- ➔ Time-of-Use, 4 totalization and tariff energy/demand registers x 8 tariffs, 4 seasons x 4 types of days, 8 tariff changes per day
- ➔ One-time easy programmable tariff calendar schedule
- ➔ Automatic daily energy and maximum demand profile log for total and tariff registers

## Harmonic Analyzer

- Voltage and current THD, TDD and K-Factor, up to 40<sup>th</sup> order harmonic
- Voltage and current harmonic spectrum and angles

## Real-time Waveform Capture (via PC)

- Real-time “scope mode” waveform monitoring capability
- Simultaneous 6-channel 8-cycle waveform capture at a rate of 64 samples per cycle

## Programmable Logical Controller

- Embedded programmable controller
- 16 control set points; programmable thresholds and delays
- Relay output control
- 1-cycle response time

## Event and Data Recording

- Non-volatile memory for long-term event and data recording for at least 90 days history storage capabilities
- Event recorder for logging internal diagnostic events and setup changes
- Two data recorders; programmable data logs on a periodic basis; automatic daily energy and maximum demand profile log

## Display

- Easy to read 2 x 16 Characters LCD display, adjustable update time
- Auto-scroll option with adjustable page exposition time; auto-return to a default page

## Real-time Clock

- Backup for 260 days

## Inputs/Outputs

- Built-in 2 Digital Inputs and 1 form A solid state digital output
- Optional module 4 Digital Inputs and 2 digital outputs (Solid State or Electro Mechanical)
- Optional module 4 Analog Outputs

## Communications

- Standard 2-wire RS-485 communication port
- Built-in IR communication port
- Optional multipurpose RS-232/422/485 port
- Optional 10/100Base T port
- Optional PROFIBUS port
- Optional RF module (available in certain regions only)
- Optional GPRS modem

## Communication protocols

- Modbus RTU
- SATEC ASCII
- DNP 3.0
- IEC 60870-5-101 (option)
- IEC 60870-5-104 (option)

## Meter Security

- 3 levels Password security for protecting meter setups and accumulated data from unauthorized changes

## Upgradeable Firmware

- Easy upgrading device firmware through a serial or Ethernet port.

## Software Support

- Includes comprehensive Power Analysis Software (PAS) for configuration and data acquisition
- Optional ExpertPower™ client for communicating with the SATEC proprietary ExpertPower™ Internet services

## Specifications

### VOLTAGE INPUTS

|                               |                                                                                                                                                                                                |
|-------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Voltage Connections           | 3 phases, 1 Neutral                                                                                                                                                                            |
| Voltage Ratings               | Direct voltage connection:<br>→ 220 to 400V (L-N)<br>→ 380 to 690V (L-L)<br>→ Range 0-800VAC<br>Via PT (Power Transformer):<br>→ 57.7 to 120V (L-N)<br>→ 100 to 207V (L-L)<br>→ Range 0-250VAC |
| Starting Voltage              | 0.2% $U_N$                                                                                                                                                                                     |
| Input Impedance               | $\geq 1M\Omega$                                                                                                                                                                                |
| Burden with Aux. Power supply | $\leq 0.2VA/\text{phase}$                                                                                                                                                                      |
| Overload withstand            | 4000 VAC (L-G) for 1 min.                                                                                                                                                                      |
| Impulse Voltage               | 6kV                                                                                                                                                                                            |
| Terminal Blocks               | 4 Sealed, pitch 7-10mm<br>2.5 to 4 mm <sup>2</sup>                                                                                                                                             |

### CURRENT INPUTS

|                       |                                                                                                                     |
|-----------------------|---------------------------------------------------------------------------------------------------------------------|
| Current Connections   | 3 galvanic isolated inputs                                                                                          |
| Current Ratings       | Choice of 4 options:<br>→ ../5A CT connection<br>→ ../1A CT connection<br>→ Direct up to 100A<br>→ Remote CT (40mA) |
| Starting Current      | 0.2% $I_N$                                                                                                          |
| Burden per phase      | $< 0.2 VA$ (../5A)<br>$< 0.05 VA$ (../1A)                                                                           |
| Overload (continuous) | $2 \times I_N$ ( $1.2 \times I_N$ for 100A model)                                                                   |
| Over current          | $50 \times I_N$ (for 1 second)                                                                                      |
| Galvanic isolation    | 4000 VAC (L-G) for 1 min.                                                                                           |
| Terminal Blocks       | 6 Sealed, pitch 7-10mm<br>4 to 16 mm <sup>2</sup>                                                                   |

### AUXILIARY POWER SUPPLY

|                                 |                                                    |
|---------------------------------|----------------------------------------------------|
| Rated Input                     | 40-300 V AC/DC                                     |
| Insulation Dielectric withstand | 4000 VAC for 1 min.                                |
| Output power                    | 4W                                                 |
| Terminal Blocks                 | 2 Sealed, pitch 7-10mm<br>2.5 to 4 mm <sup>2</sup> |

### BUILT IN COMMUNICATION

|                    |                                                                                       |
|--------------------|---------------------------------------------------------------------------------------|
| Communication Type | RS-485                                                                                |
| Max. Baud Rate     | 115.2 kb/s                                                                            |
| Isolation          | 4000 VAC (L-G) for 1 min.                                                             |
| Max. Cable Length  | 1000 m                                                                                |
| Protocols          | MODBUS RTU/ASCII<br>DNP 3.0<br>IEC 60870 -5-101 (option)<br>IEC 60870 -5-104 (option) |
| Terminal Blocks    | 3 Sealed, pitch 7-10mm<br>2.5 to 4 mm <sup>2</sup>                                    |

### INFRA RED COMMUNICATION

|           |                   |
|-----------|-------------------|
| Baud rate | Up to 19.200 kb/s |
| Protocols | MODBUS RTU/ASCII  |

### ADD-ON MODULES

|                   |                                                            |
|-------------------|------------------------------------------------------------|
| Max. # of Modules | 1                                                          |
| Available Modules | RS-232; PROFIBUS; ETHERNET;<br>Digital I/O; Analog Outputs |

### FRONT PANEL

|                |                                                                                               |
|----------------|-----------------------------------------------------------------------------------------------|
| Display type   | 2×16 Characters Transflective LCD with backlight                                              |
| Character size | 3.2×1.85 mm                                                                                   |
| Viewing area   | 46×11 mm                                                                                      |
| LEDs           | Total 6 LEDs:<br>→ 1 Pulse calibration output<br>→ 3 voltage indication<br>→ 2 RX/TX activity |
| Keypad         | 2 buttons                                                                                     |
| Nameplate      | According to IEC 60688 and IEC 62052-11                                                       |

### MECHANICAL

|                    |                                         |
|--------------------|-----------------------------------------|
| Enclosure          | DIN Rail mount<br>Complies with EN50022 |
| Dimensions [W×H×D] | 125 × 90 × 75mm                         |
| Enclosure Material | Reinforced Polycarbonate                |

### TEMPERATURE

|             |               |
|-------------|---------------|
| Operational | -25°C to 60°C |
| Storage     | -30°C to 85°C |



## Standards Compliance specifications

### EMC per IEC 60688 and IEC 62052-11:

#### Immunity:

- IEC61000-4-2: Electrostatic discharge, 15/- air/contact
- IEC61000-4-3: Electromagnetic RF Fields, 10V/m @ 80MHz – 1000MHz
- IEC61000-4-4: Fast Transients burst, 4KV on current and voltage circuits and 2 KV for auxiliary circuits
- IEC61000-4-5: Surge 4KV on current and voltage circuits and 1 KV for auxiliary circuits
- IEC61000-4-6: Conducted Radio-frequency, 10V @ 0.15Mhz – 80MHz
- IEC61000-4-8: Power Frequency Magnetic Field

#### Emission (radiated/conducted):

- EN55022: 2010 Class A (CISPR 22)
- FCC p.15 Class A mandatory

#### Safety

- UL/IEC 61010-1

#### Insulation

- IEC 62052-11: Insulation impulse 6KV/500Ω @ 1.2/50 μs
- IEC 62053-22: AC voltage tests related to ground, 4 kV AC @ 1mn, for power and signal ports (above 40V)
- 2.5KVAC r.m.s. @ 1mn, for other ports (below 40V)

### Atmospheric Environment

- Operational ambient temperature range: -25°C to +60 °C
- Long-term damp heat withstand according to IEC 68-2-3 <95% (non condensing), +40 °C
- Transport and storage temperature range: – 30°C to +85 °C
- IEC 60068-2-6: Vibration
- Frequency range: 10Hz to 150Hz
- Transition frequency: 60Hz
- Constant movement amplitude 0.075mm, f<60Hz
- Constant acceleration 9.8 m/s<sup>2</sup> (1g), f > 60Hz
- Additional Transport vibration and shocks:
- Longitudinal acceleration: 2.0 g
- Vertical acceleration: 1.2 g
- Transversal acceleration: 1.2 g
- Enclosure protection: IP20

### Accuracy according to:

- IEC 62053-22, class 0.5S – active energy
- IEC 62053-21, class 0.5 – reactive energy
- IEC 60688, class 0.5S – active energy
- IEC 60688, class 1 – reactive energy

## Order String

**EM133**        

| OPTIONS                                                                                                             |                 |
|---------------------------------------------------------------------------------------------------------------------|-----------------|
| <b>Current Inputs</b>                                                                                               |                 |
| 5 Ampere                                                                                                            | 5               |
| 1 Ampere                                                                                                            | 1               |
| Direct current measurement up to 100A                                                                               | 100             |
| High Accuracy Current Sensors (HACS). Requires ordering of 3 HACS - please refer to SATEC's <b>HACS Datasheet</b> . | HACS            |
| <b>Calibration at Frequency</b>                                                                                     |                 |
| 25 Hz                                                                                                               | 25HZ            |
| 50 Hz                                                                                                               | 50HZ            |
| 60 Hz                                                                                                               | 60HZ            |
| 400 Hz                                                                                                              | 400HZ           |
| <b>Resolution</b>                                                                                                   |                 |
| Low Resolution 1A, 1V                                                                                               | -               |
| High Resolution 0.01A, 0.1V                                                                                         | H               |
| <b>Power Supply</b>                                                                                                 |                 |
| 40-300V AC/DC                                                                                                       | ACDC            |
| <b>Communication Protocol</b>                                                                                       |                 |
| Modbus and DNP 3.0                                                                                                  | -               |
| Modbus and IEC 60870-101/104                                                                                        | 870             |
| <b>Expansion Module</b><br>(Max. 1 module per instrument, can be ordered separately)                                |                 |
| Analog Output: $\pm 1\text{mA}$                                                                                     | AO1             |
| Analog Output: 0-20mA                                                                                               | AO2             |
| Analog Output: 0-1mA                                                                                                | AO3             |
| Analog Output: 4-20mA                                                                                               | AO4             |
| Analog Output: 0-3mA                                                                                                | AO5             |
| Analog Output: $\pm 3\text{mA}$                                                                                     | AO6             |
| Analog Output: 0-5mA                                                                                                | AO7             |
| Analog Output: $\pm 5\text{mA}$                                                                                     | AO8             |
| Communication: Ethernet (TCP/IP)                                                                                    | ETH             |
| Communication: PROFIBUS                                                                                             | PRO             |
| Communication: RS232/422/485                                                                                        | RS232           |
| Communication: GPRS                                                                                                 | GPRS            |
| Communication: RF (see note)                                                                                        | RF-x            |
| Digital Input (Dry Contact) / Relay Output 250V / 5A AC                                                             | DIOR            |
| Digital Input (Dry Contact) / SSR Output 250V / 0.1A AC                                                             | DIOS            |
| 12 Digital Inputs (Dry Contact)/4 Relay Outputs 250V/5A AC                                                          | 12DIOR-DRC      |
| 12 Digital Inputs (250VDC) / 4 Relay Outputs 250V/5A AC                                                             | 12DIOR-250V     |
| 12DIOR-DRC with Ethernet                                                                                            | 12DIOR-DRC-ETH  |
| 12DIOR-250V with Ethernet                                                                                           | 12DIOR-250V-ETH |
| 12DIOR-DRC with RS-485                                                                                              | 12DIOR-DRC-485  |
| <b>RF Accessories (see note)</b>                                                                                    |                 |
| Concentrator - ROW                                                                                                  | CON-ROW         |
| Concentrator External for 2 x ETC2002                                                                               | CON-EXT         |
| Repeater                                                                                                            | REP             |
| Antenna 1: without cable (module or concentrator)                                                                   | AN-1            |
| Antenna 2: with 2M cable (module or concentrator)                                                                   | AN-2            |
| Antenna 3: external for concentrator only                                                                           | AN-3            |
| Antenna 4: external for module or concentrator                                                                      | AN-4            |

**Note:** The RF module and accessories are available in certain regions only. Please consult your local supplier.