SATEC EM133

EM133 DATASHEET

Smart TOU Energy Meter and Transducer

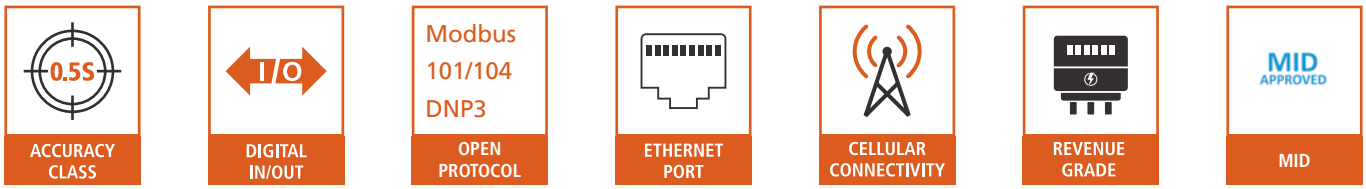
SATEC EM133 is an energy meter, ideal for a wide range of applications such as revenue metering, industrial power monitoring and for interfacing SCADA in utility substations.

Based the SATEC PM13X family functionality, it is a version designed as DIN-rail mount, equipped with built-in communication ports, digital I/Os and anti-tamper enclosures.

HIGHLIGHTS

- **Accuracy**: Class 0.5/0.5S per ANSI / IEC 62053-22
- **Revenue Meter**: anti-tamper design; can bill 3 individual single phase clients; IR interface
- **MID certified**
- **Communication**
  - Built-in ports: RS485; IR (optical)
  - Optional ports: ETH; Wi-Fi; cellular; Profibus
  - Open protocol: Modbus RTU; DNP3.0; IEC 60870-5-101/104
- **Digital & Analog I/O**
  - Built-in I/O: 1 RO; 2 DI
  - Modular I/O: up to 16 I/O
  - Smart Transducer: 4 analog outputs
- **Broad-range frequency measurement**: 25-400 Hz

MODULAR VERSATILITY



SATEC EM133

FEATURES

MULTIFUNCTIONAL 3-PHASE SMART METER

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

BILLING/TOU ENERGY METER

- Accuracy Class 0.5S per IEC 62053-22 / ANSI
- MID certified EN50470-3 Class B or C (5A)
- 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
- Easy programmable tariff calendar schedule
- Automatic logging of daily energy and maximum demand profiles (total & TOU)

HARMONIC ANALYZER

- individual voltage & current harmonic spectrum and harmonic angles up to 40th order harmonic
- Voltage and current THD, TDD and K-Factor

REAL-TIME WAVEFORM CAPTURE (VIA PC)

- Real-time “scope mode” waveform monitoring via PAS software

PROGRAMMABLE LOGICAL CONTROLLER

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

MODELS

EM133	Standard
EM133-XM	Extended Memory version. Over 40-fold memory capacity than standard model. Features sensor for internal unit temperature
EM133-MID	MID certified (5A)

EVENT AND DATA RECORDING

- Non-volatile memory for timestamped event and data logging: over 90 days for 2 daily TOU records, half-hourly writing of 4 parameters and recording over 200 events
- Optional extended memory version: 40 times the capacity of the standard model. Reads and displays additional utility meter pulses as customized labels (water, gas etc.). This version includes a sensor for internal unit temperature and a battery status monitor
- Event recorder for logging internal diagnostic events and setup changes
- Two data recorders; programmable data logs on a periodic basis

VOLTAGE INPUTS

- Direct measurement 0-690V AC

CURRENT INPUT OPTIONS

- 1A or 5A inputs from CT secondary
- 40mA input designed for SATEC HACS CTs (100-3000A options)
- 63A Direct connection
- RS: unique input for 5A rated split-core HACS CTs, ideal for retrofit installation

SATEC EM133

DIGITAL AND ANALOG I/O

- Built-in: 2 Digital Inputs and 1 form A SSR
- Available I/O modules
  - **4DIO:** four digital inputs and two relay outputs (as SSR or EM relay). 1-cycle update time; unlatched, latched, pulse and KYZ operation; energy pulses
  - **12DIO**: twelve digital inputs, 4 relay outputs (incl. optional port: ETH or additional RS485)
  - **4AO**: four analog outputs (internal power supply); selection of 0-20mA, 4-20mA, 0-1mA, 0-3mA, 0-5mA, ±1mA and ±5mA output; 1 cycle update time
  - **8DI**: eight digital inputs with 1-ms scan time
  - **2AI**: 2 analog inputs (4-20mA. available with T3G-y-2AI cellular module)

COMMUNICATION

- On-board interfaces
  - Standard 2-wire RS-485
  - IR (optical) port
- Optional interfaces
  - Multipurpose RS-232/422/485
  - 10/100Base T
  - PROFIBUS
  - RF (certain regions only)
  - 2G/3G/4G cellular modem
  - CANopen
- Client (Modbus/TCP over ETH or 3G/4G)
  - TCP notification client for communicating events or periodic reports to remote server
  - Expertpower client on subscription basis
- Communication protocols
  - Modbus RTU
  - SATEC ASCII
  - DNP 3.0
  - IEC 60870-5-101 (optional)
  - IEC 60870-5-104 (optional)

DISPLAY

- 2 x 16 characters LCD display; adjustable update time
- Auto-scroll option; auto-return to a default page

METER SECURITY

- 3-level password access to meter setups and data

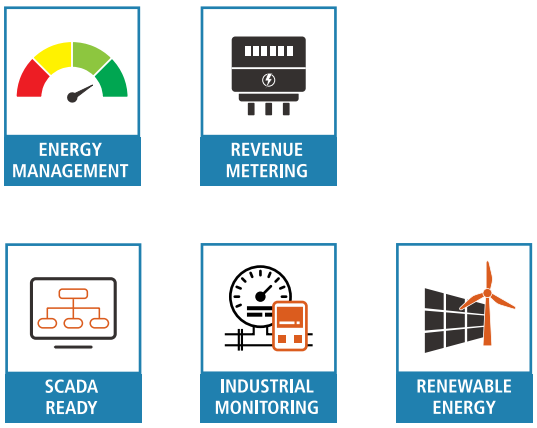
UPGRADEABLE FIRMWARE

- Easy upgrading via serial or ETH ports

SOFTWARE SUPPORT

- Includes comprehensive Power Analysis Software (PAS) for configuration and data acquisition
- SATEC's Expertpower web-based energy management platform (subscription)
- Any 3rd party software supporting open-protocol

APPLICATIONS



TECHNICAL SPECIFICATIONS

INPUT RATINGS

VOLTAGE INPUTS

Installation	Category III
Over-voltage withstand	1000V AC continuous, 2000V AC for 1 second
Input impedance	1 MΩ
Wire size	up to 12 AWG (up to 2.5mm²)

MODEL WITH POWER SUPPLY INPUT

Nominal voltage	400/690V AC (L-N/L-L)
Measurement range	15-480/828V AC (L-N/L-L)
Measurement frequency range	25-400 Hz
Burden for 400V	< 0.4 VA
Burden for 120V	< 0.04 VA

MODEL SELF ENERGIZED FROM VOLTAGE INPUTS

Nominal voltage	
HACS model:	120/207V AC to 230/400V AC (L-N/L-L)
1A/5A/RS5 models:	120/207V AC to 277/480V AC (L-N/L-L)
Frequency range measurement	50/60 Hz
Burden for 277V	< 1.5 VA
Burden for 120V	< 2 VA

CURRENT INPUTS

Current Connections	3 galvanic isolated inputs
Current Ratings	Choice of 4 options: » ../5A CT connection » ../1A CT connection » Direct up to 63A * » Remote CT (40mA)
Starting Current	0.2% In
Burden per phase	<0.2 VA (../5A) <0.05 VA (../1A)
Overload (continuous)	2×I_N (1.2×I_N for 100A model)
Over current	50×I_N (for 1 second)
Galvanic isolation	4000V AC (L-G) for 1 min.
Terminal Blocks	6 Sealed, pitch 7-10mm 4 to 16 mm²

POWER SUPPLY

Rated Input	57.7-277V AC; 48-290V DC
Tolerance	@V AC = ±15%; @V DC= ±10%
Insulation dielectric withstand	4000V AC for 1 min.
Burden	5VA
Terminal Blocks	2 Sealed, pitch 7-10mm 2.5 to 4mm²

OPTIONAL POWER SUPPLY

Rated input	12-24V DC
Tolerance	±20%

BUILT-IN I/O

SOLID STATE RELAY STANDARD

1 relay rated at 0.15A/24V AC/DC, 1 contact (SPST Form A)	
Galvanic isolation	4000V AC 1 min
Operate time	1 ms max.
Release time	0.25 ms max.
Update time	1 cycle

DIGITAL INPUT (STANDARD)

1 Digital Inputs Dry Contact, internally wetted @ 5V DC	
Sensitivity	Open @ input resistance >100 k Ω Closed @ Input resistance < 100 Ω
Galvanic isolation	4000V AC 1 min
Internal power supply	5V DC
Scan time	1 ms

OPTIONAL MODULAR I/O

ELECTROMECHANICAL RELAY

Dry Contact	1 contact (SPST Form A)
Rating	5A/250V AC; 5A/30V DC
Galvanic isolation	» Between contacts and coil: 3000V AC 1 min » Between open contacts: 750V AC
Operate time	10 ms max
Release time	5 ms max
Update time	1 cycle
Wire size	14 AWG (up to 1.5 mm²)

* Connecting up to 100A is possible under certain conditions

SOLID STATE RELAY

Dry contact, 1 contact (SPST Form A)	
Rating	0.15A/250V AC/DC
Galvanic isolation	3750V AC 1 min
Operate time	1 ms max
Release time	0.25 ms max
Update time	1 cycle
Connector type	Removable, 4 pins
Wire size	14 AWG (up to 1.5 mm²)

DIGITAL INPUTS

Dry Contacts, internally wetted @ 24V DC or Wet contact @ 250V DC (12DI/4DO only)	
Sensitivity	Open @ input resistance >100 kΩ, Closed @ Input resistance < 100 Ω
Galvanic isolation	3750V AC 1 min
Internal power supply	24V DC, 4DI/2DO or 12DI/4DO
External power supply	250V DC (12DI/4DO only supply)
Scan time	1 ms
Connector type	Removable, 5 pins
Wire size	14 AWG (up to 1.5 mm²)

ANALOG OUTPUTS

Ranges (upon order)	» ±1 mA, max. load 5 kΩ (100% overload) » 0-20 mA, max. load 510 Ω » 4-20 mA, max. load 510 Ω » 0-1 mA, max. load 5 k Ω (100% overload)
Isolation	2500V AC 1 min
Power supply	Internal
Accuracy	0.5% FS
Update time	1 cycle
Connector type	Removable, 5 pins
Wire size	14 AWG (up to 1.5 mm²)

BUILT IN COMMUNICATION

SERIAL COMMUNICATION (RS-485)

Max. Baud Rate	115.2 kb/s
Optical Isolation	3000V AC (L-G) for 1 min.
Max. Cable Length	1000 m
Protocols	» MODBUS RTU/ASCII » DNP 3.0 » IEC 60870 -5-101 (option)
Terminal Blocks	3 Sealed, pitch 7-10mm; 2.5 to 4mm²

INFRA RED COMMUNICATION

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

COM2 (OPTIONAL MODULE)

ETHERNET PORT

(as independent module OR add-on to 12DIOR module)

Transformer-isolated 10/100BaseT Ethernet port	
Supported protocols	Modbus/TCP (Port 502) IEC 60870-5-104 DNP3/TCP (Port 20000)
Num. of simultaneous connections	4 (2 Modbus/TCP + 2 DNP3/TCP)
Connector type	RJ45 modular
Isolation	1,500V DC @ 1min

CELLULAR PORT

Supported protocols	Modbus/TCP (Port 502), DNP3/TCP (Port 20000)
Connector type	SMA

PROFIBUS DP (IEC 61158)

RS-485 optically isolated Profibus interface	
Connector type	Removable, 5 pins
Baud rate	9600 bit/s – 12 Mbit/s (auto detection)
32 bytes input, 32 bytes output	
Supported protocols	PROFIBUS DP

RS-232/422-485 PORT

RS-232 or RS-422/485 optically isolated port	
Isolation	3000V AC 1 min
Baud rate	Up to 115.2 kbps
Supported protocols	Modbus RTU, DNP3, SATEC ASCII, IEC 60870-5-101
Connector type	Removable, 5 pins for RS-422/485 and DB9 for RS-232
Wire size	Up to 14 AWG (up to 1.5 mm²)

OTHER CHARACTERISTICS

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: » 1 Pulse calibration output » 3 voltage indication » 2 RX/TX activity
Keypad	2 buttons
Nameplate	According to IEC 60688 & IEC 62052-11

CONSTRUCTION

Enclosure	DIN Rail mount Complies with EN50022
Dimensions [W×H×D]	125 × 90 × 75mm
Enclosure Material	Reinforced Polycarbonate
Enclosure protection	IP20

ENVIRONMENTAL CONDITIONS

Operational	-25°C to 60°C / -13°F to 140°F
Storage	-30°C to 85°C / -22°F to 185°F

STANDARDS COMPLIANCE

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
- UL 916

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)
- 2.5KV AC r.m.s. @ 1mn, for other ports (below 40V)

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
- EN 50470-3, class B or C (5A version)
- ANSI C12.20, Class 0.5

ORDER STRING

MODELS

EM133: Energy Meter	EM133
EM133-XM-AR: Extended Memory Residential Energy Meter	EM133-XM-AR
EM133-MID: MID Certified Energy Meter	EM133-MID

OPTIONS

CURRENT INPUTS	
5 Ampere (mandatory for MID)	5
1 Ampere	1
Direct current measurement up to 63A *	63
Direct current measurement up to 100A * (up to 55°C ambient temperature)	100
5A split core remote High Accuracy Current Sensor (HACS)*	RS5
High Accuracy Current Sensors (HACS) **	HACS
High Accuracy Current Sensors (HACS), with wires	HACS-SPDR
CALIBRATION AT FREQUENCY	
25 Hz (supports 1A and 5A models only)	25HZ
50 Hz (mandatory for MID)	50HZ
60 Hz	60HZ
400 Hz (supports 1A and 5A models only)	400HZ
RESOLUTION	
Low Resolution 1A, 1V	-
High Resolution 0.01A, 0.1V	H
POWER SUPPLY	
40-300V AC/DC (mandatory for MID)	ACDC
Powered from measured voltages (120-277 V L-N) *	SE
12V/24V DC power supply	21DC
MECHANICAL SEAL	
Standard seal (mandatory for MID)	-
Special seal	S
ELECTRONIC SEAL	
Energy register is accessible	-
Energy register is protected (mandatory for MID)	P
COMMUNICATION PROTOCOL (not available for EM133AR)	
Modbus and DNP 3.0 (mandatory for MID)	-
Modbus and IEC 60870-5-101/104 ***	870
TESTING AND CERTIFICATE	
Full functional test, calibration at various work loads & detailed test report	-
All of the above, **plus** ISO 17025 & ILAC certified calibration certificate	CC
IR ADAPTER	
Magnetic Adapter for IR port	MA

NOTES
* For 50/60Hz only
** For 50/60Hz only, requires ordering of 3 HACS
*** -104 requires ETH; not compatible with AR version, does NOT work over cellular network

ORDER STRING

EXPANSION MODULE

Max. 1 module per instrument, can be ordered separately

ANALOG OUTPUTS	
4 Analog Outputs: ±1mA	AO1
4 Analog Outputs: 0-20mA	AO2
4 Analog Outputs: 0-1mA	AO3
4 Analog Outputs: 4-20mA	AO4
4 Analog Outputs: 0-3mA	AO5
4 Analog Outputs: ±3mA	AO6
4 Analog Outputs: 0-5mA	AO7
4 Analog Outputs: ±5mA	AO8
COMMUNICATION	
Ethernet (TCP/IP) for DIN rail	ETHD
PROFIBUS	PRO
RS232 (for DIN rail enclosure)	RS232D
RS232/422/485	RS232
2G/3G GSM DIN Rail Modem * y: T=Top Antennal; F=Front Antenna	T3G-y
2G/3G GSM DIN Rail Modem **with 2 Analog Inputs 4-20mA** * y: T=Top Antennal; F=Front Antenna	T3G-y-2AI
4G Modem * x: G=Europe; V=Verizon (US); A=AT&T (US); T=Telstra (AUS). y: T=Top Antennal; F=Front Antenna	T4x-y
CAN Bus (EM133 only, Doesn't support 870 protocol)	CAN
Communication: RF	RF-x-y
DIGITAL INPUTS	
4 DI (Dry Contact) / 2 Relay Outputs 250V / 5A AC	DIOR
4 DI (Dry Contact) / 2 SSR Outputs 250V / 0.1A AC	DIOS
8 DI (Dry Contact). Not compatible with EM133-AR	8DI
12 DIOR MODULE	
12 Digital Inputs / 4 Relay Outputs 250V/5A AC	12DIOR
Digital Inputs Rating - Dry Contact (DRC), 48V, 125V or 250V	DRC or 48V or 125V or 250V
12 DIOR module communication port:	
None	-
RS-485	485
Ethernet	ETH
CAN	CAN

12DIOR-

NOTES

* Does not support 870 protocol. Supplied with bendable antenna.

