

## 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



ACCURACY CLASS



DIGITAL IN/OUT

Modbus  
101/104  
DNP3

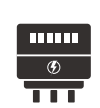
OPEN PROTOCOL



ETHERNET PORT



CELLULAR CONNECTIVITY



REVENUE GRADE



MID

## 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 40<sup>th</sup> 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

<b>EM133</b>	Standard
<b>EM133-XM</b>	Extended Memory version. Over 40-fold memory capacity than standard model. Features sensor for internal unit temperature
<b>EM133-MID</b>	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

## 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,  $\pm 1$ mA and  $\pm 5$ mA 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

- ▶ 2x 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

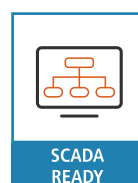
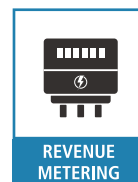
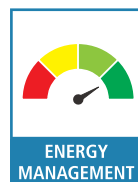
## UPGRADEABLE FIRMWARE

- ▶ 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 3<sup>rd</sup> 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 2.5mm <sup>2</sup> )

#### 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	
<b>HACS</b> model:	120/207V AC to 230/400V AC (L-N/L-L)
<b>1A/5A/RS5</b> 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% I <sub>N</sub>
Burden per phase	<0.2 VA (../5A) <0.05 VA (../1A)
Overload (continuous)	2×I <sub>N</sub> (1.2×I <sub>N</sub> for 100A model)
Over current	50×I <sub>N</sub> (for 1 second)
Galvanic isolation	4000V AC (L-G) for 1 min.
Terminal Blocks	6 Sealed, pitch 7-10mm 4 to 16 mm <sup>2</sup>

#### 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 4mm <sup>2</sup>

#### 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 mm <sup>2</sup> )

\* 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 mm <sup>2</sup> )

**DIGITAL INPUTS**

Dry Contacts, internally wetted @ 24V DC or Wet contact @ 250V DC (12DI/4DO only)	
Sensitivity	Open @ input resistance >100 k $\Omega$ , Closed @ Input resistance < 100 $\Omega$
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 mm <sup>2</sup> )

**ANALOG OUTPUTS**

Ranges (upon order)	<ul style="list-style-type: none"> <li>» <math>\pm 1</math> mA, max. load 5 k<math>\Omega</math> (100% overload)</li> <li>» 0-20 mA, max. load 510 <math>\Omega</math></li> <li>» 4-20 mA, max. load 510 <math>\Omega</math></li> <li>» 0-1 mA, max. load 5 k <math>\Omega</math> (100% overload)</li> </ul>
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 mm <sup>2</sup> )

**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	<ul style="list-style-type: none"> <li>» MODBUS RTU/ASCII</li> <li>» DNP 3.0</li> <li>» IEC 60870 -5-101 (option)</li> </ul>
Terminal Blocks	3 Sealed, pitch 7-10mm; 2.5 to 4mm <sup>2</sup>

**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 mm <sup>2</sup> )

## OTHER CHARACTERISTICS

### FRONT PANEL

Display type	2x16 Characters Transflective LCD with backlight
Character size	3.2x1.85 mm
Viewing area	46x11 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 [WxHxD]	125 x 90 x 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	<b>EM133</b>
EM133-XM-AR: Extended Memory Residential Energy Meter	<b>EM133-XM-AR</b>
EM133-MID: MID Certified Energy Meter	<b>EM133-MID</b>

### OPTIONS

#### CURRENT INPUTS

5 Ampere (mandatory for MID)	<b>5</b>
1 Ampere	<b>1</b>
Direct current measurement up to 63A *	<b>63</b>
Direct current measurement up to 100A * (up to 55°C ambient temperature)	<b>100</b>
5A split core remote High Accuracy Current Sensor (HACS)*	<b>RS5</b>
High Accuracy Current Sensors (HACS) **	<b>HACS</b>
High Accuracy Current Sensors (HACS), with wires	<b>HACS-SPDR</b>

#### CALIBRATION AT FREQUENCY

25 Hz (supports 1A and 5A models only)	<b>25HZ</b>
50 Hz (mandatory for MID)	<b>50HZ</b>
60 Hz	<b>60HZ</b>
400 Hz (supports 1A and 5A models only)	<b>400HZ</b>

#### RESOLUTION

Low Resolution 1A, 1V	<b>-</b>
High Resolution 0.01A, 0.1V	<b>H</b>

#### POWER SUPPLY

40-300V AC/DC (mandatory for MID)	<b>ACDC</b>
Powered from measured voltages (120-277 V L-N) *	<b>SE</b>
12V/24V DC power supply	<b>21DC</b>

#### MECHANICAL SEAL

Standard seal (mandatory for MID)	<b>-</b>
Special seal	<b>S</b>

#### ELECTRONIC SEAL

Energy register is accessible	<b>-</b>
Energy register is protected (mandatory for MID)	<b>P</b>

#### COMMUNICATION PROTOCOL (not available for EM133AR)

Modbus and DNP 3.0 (mandatory for MID)	<b>-</b>
Modbus and IEC 60870-5-101/104 ***	<b>870</b>

#### TESTING AND CERTIFICATE

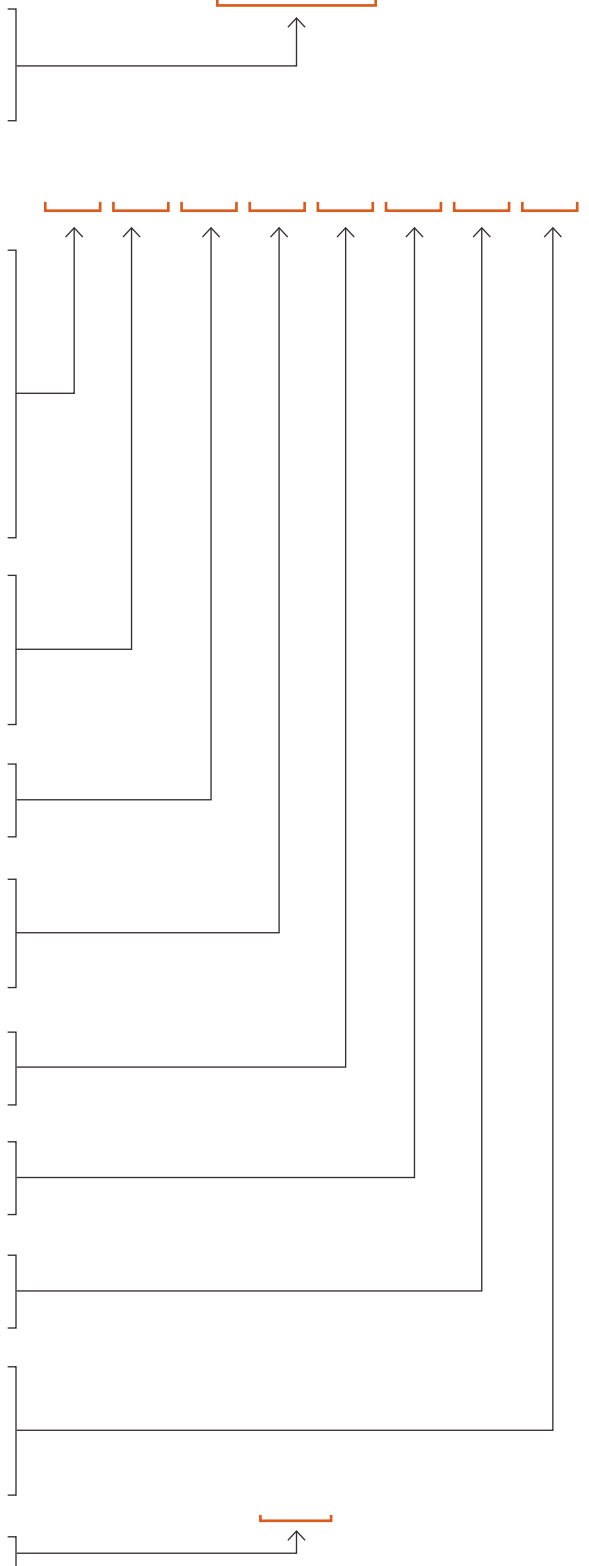
Full functional test, calibration at various work loads & detailed test report	<b>-</b>
All of the above, plus ISO 17025 & ILAC certified calibration certificate	<b>CC</b>

#### IR ADAPTER

Magnetic Adapter for IR port	<b>MA</b>
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#### 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	<b>AO1</b>
4 Analog Outputs: 0-20mA	<b>AO2</b>
4 Analog Outputs: 0-1mA	<b>AO3</b>
4 Analog Outputs: 4-20mA	<b>AO4</b>
4 Analog Outputs: 0-3mA	<b>AO5</b>
4 Analog Outputs: ±3mA	<b>AO6</b>
4 Analog Outputs: 0-5mA	<b>AO7</b>
4 Analog Outputs: ±5mA	<b>AO8</b>

**COMMUNICATION**

Ethernet (TCP/IP) for DIN rail	<b>ETHD</b>
PROFIBUS	<b>PRO</b>
RS232 (for DIN rail enclosure)	<b>RS232D</b>
RS232/422/485	<b>RS232</b>
2G/3G GSM DIN Rail Modem * y: T=Top Antennal; F=Front Antenna	<b>T3G-y</b>
2G/3G GSM DIN Rail Modem <b>with 2 Analog Inputs 4-20mA</b> * y: T=Top Antennal; F=Front Antenna	<b>T3G-y-2AI</b>
4G Modem * x: G=Europe; V=Verizon (US); A=AT&T (US); T=Telstra (AUS). y: T=Top Antennal; F=Front Antenna	<b>T4x-y</b>
CAN Bus (EM133 only, Doesn't support 870 protocol)	<b>CAN</b>
Communication: RF	<b>RF-x-y</b>

**DIGITAL INPUTS**

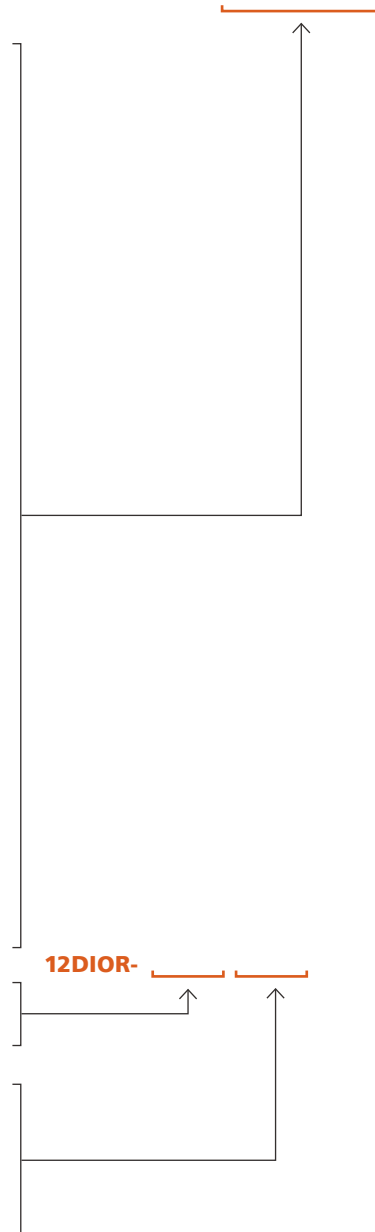
4 DI (Dry Contact) / 2 Relay Outputs 250V / 5A AC	<b>DIOR</b>
4 DI (Dry Contact) / 2 SSR Outputs 250V / 0.1A AC	<b>DIOS</b>
8 DI (Dry Contact). Not compatible with EM133-AR	<b>8DI</b>

**12 DIOR MODULE**

12 Digital Inputs / 4 Relay Outputs 250V/5A AC	<b>12DIOR</b>
Digital Inputs Rating - Dry Contact (DRC), 48V, 125V or 250V	<b>DRC or 48V or 125V or 250V</b>

12 DIOR module communication port:

None	<b>-</b>
RS-485	<b>485</b>
Ethernet	<b>ETH</b>
CAN	<b>CAN</b>


**NOTES**

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