Machine To Cloud Solutions

M2C ENERGY METER

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E-Meter

Applications:

Smart Grid, submetering, datacenter

Features

- Up to 6 channels (2 three-phase or 3 single-phase) measurement
- Current, Voltage, Power, Energy and Frequency measurements
- SNMP interface
- RS485 - ModBUS interface
- RF interface

Mechanicals

- Dimensions: 140x67x41 mm
- Weight: 150 g

Characteristics

- Maximum current: 10A, 16A, 20A
- Operating voltage: 110/220 VAC
- Consumption: <1 W
- Accuracy >90%

Operating environment

- Operating temperature: -15ºC to +60ºC
- Operating humidity: 10% to 90% RH

Wireless interface

- ISM wireless
- 868 MHz (Europe) / 915 MHz
- Maximum RF power: 14dBm
- RF data range: Max. 200m. line of sight

Part numbers

I-EM6-W	6 Channels RF
I-EM6-IP	6 Channels SNMP
I-EM6-W-IP	6 Channels RF + SNMP
I-EM6-W-RS485	6 Channels RF + ModBUS

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Introduction

The powerful measurement solution for intelligent energy management. The M2C Energy Meter is suitable for both single-phase and three-phase network configuration, allowing to measure up to six single-phases or two three-phases different networks. A wide range of measurements, as well as recorded data from external sensors, can be accessed via either RF or wired communications (ethernet and rs485). This provides a full metering solution for different industrial environments.

Fig.1, Fig.2 and Fig.3 show different configurations. However, many others are also possible.

Fig.1 Is the typical configuration for data centers. Data is accessed via ethernet by the host system, and external sensors information is sent over RF.

Fig.2 It shows a traditional full wired network. External sensors and the M2C Energy Meter are connected to an existent RS485 bus. Most common factory configuration

Fig.3 It shows a full wireless network suitable for leading-edge industrial automation systems.
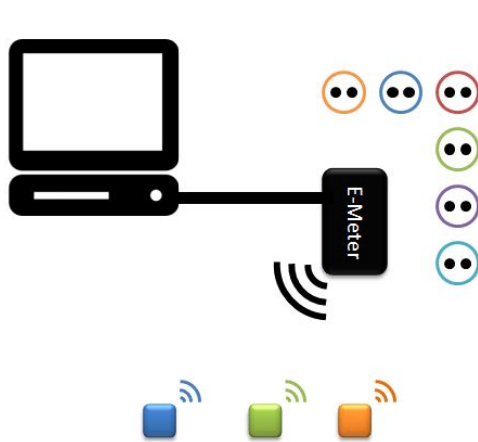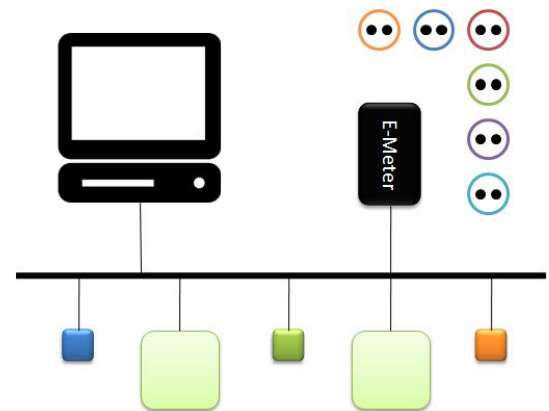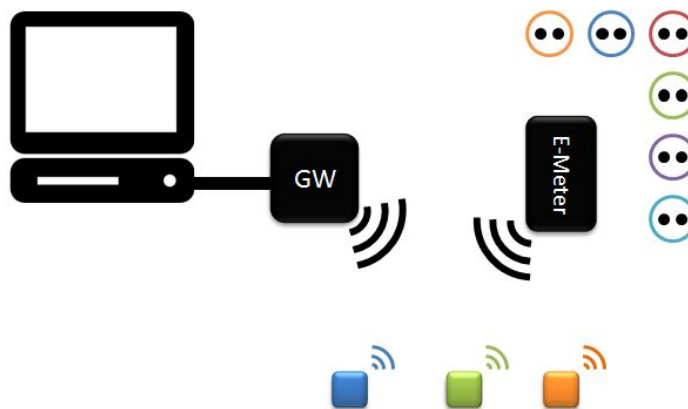
Fig. 1

Fig. 2

Fig. 3

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Communications

RF

The M2C Energy Meter supports wireless network communication. This allows the user to have more than one devices connected to one gateway, even if they are located very far away, due to their repeater capabilities. All data is managed by the gateway and can be accessed by the user via a cloud application with a friendly user interface. Please refer to "introduzca aquí el nombre del manual de usuario" for more details about this interface.

RS485 - ModBUS

Data can be accessed via RS485 standard bus following the ModBUS protocol. Check M2C Energy Meter ModBUS registers for more information.

The default physical address is 1.

Ethernet 10/100 Mbit/s

Data can be accessed via ethernet following the SNMP standard protocol. Check M2C Energy Meter MIB Three section in order to get more information.

The default IP address is 192.168.1.100. This parameter can be easily changed via SNMP

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Technical data

Input specifications

Current Input	Designed to use with CT. The maximum rms current that can be measured (I_{FS}) is a function of the input-to-output ratio of the CT (N). $I_{FS}= 0,00589 \times N$.
Voltage Input	Direct connection. 110/220 VAC 50/60 Hz are supported
Accuracy (25ºC)	Less than 0,1% error in voltage, current, power and energy. Take into account that this is supposing a perfect CT. Global error will be affected by CT accuracy.
Self-power supply	The device is self powered over the voltage measurement input. Total consumption is less than 1W. Please take into account that self-consumption could be measured depending on the place where CT are placed.

Output specifications

RS485 - ModBUS	Isolated output. 2-Wire. Max distance 1000 m, termination directly on the instrument. 247 selectable addresses. Data format: 1 start bit, 8 data bit, no parity, 1 stop bit. 9600 bits/s.
Ethernet	Isolated output. 10/100 Mbit/s. SNMP protocol
LED	Non-isolated. Three colors. Orange: starting system. Green: correct energy measurement unit operation. Red: Wrong energy measurement unit operation.

General specifications

Operating conditions	-15-60ºC @ 10-90%RH
Dimensions	140x67x41mm
Weight	150gr

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M2C Energy Meter MIB three

- M2C E-Meter OID iso.3.6.1.4.1.26381.1

  - Measured Data .1

    - Voltage .1
      - Phase n iso.3.6.1.4.1.26381.1.1.1.n with n between 1 and 6
    - Current .2
      - Phase n iso.3.6.1.4.1.26381.1.1.2.n with n between 1 and 6
    - Power .3
      - Phase n iso.3.6.1.4.1.26381.1.1.3.n with n between 1 and 6
    - Energy .4
      - Phase n iso.3.6.1.4.1.26381.1.1.4.n with n between 1 and 6
    - Freq .5
      - Phase n iso.3.6.1.4.1.26381.1.1.5.n with n between 1 and 6

  - Configuration parameters .3

    - Phase state .1 to .6
    - Periodic measurements dealy .7
    - eeprom .8
    - RESERVED .9
    - RESERVED .10
    - RESERVED .11
    - RESERVED .12
    - RESERVED .13
    - RESERVED .14
    - RESERVED .15
    - RESERVED .16
    - RESERVED .17
    - IP1 .18
    - IP2 .19
    - IP3 .20
    - IP4 .21
    - GW1 .22
    - GW2 .23
    - GW3 .24
    - GW4 .25
    - NM1 .26
    - NM2 .27
    - NM3 .28
    - NM4 .29

  - External sensor data .4

    - temp[index] .1
    - humidity[index] .2
    - count[index] .3
    - index .4
    - addr[i] .5

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Periodic **measured data** can be found within *Measured data* OID (iso.3.6.1.4.1.26381.1.1).

> <u>Voltage</u>: VRMS voltage (phase to neutral) in V*10
> <u>Current</u>: IRMS current in mA
> <u>Power</u>: Active power in mW
> <u>Energy</u>: Active energy in W·h
> <u>Freq</u>: Phase frequency in Hz*10

To access data from one specific phase of each category, a read operation to the corresponding OID must be performed.

> iso.3.6.1.4.1.26381.1.1.m.n R OID.

> with m between 1 and 5 for voltage, current, power, energy and freq repectively
> with n between 1 and 6 for phase 1 to 6 respectively

> *Example*:

> To get IRMS current from phase 4, a read operation to the OID iso.3.6.1.4.1.26381.1.1.2.4 must be performed.

Configuration parameters are within *Configuration parameters* OID (iso.3.6.1.4.1.26381.1.3).

> <u>Phase state</u>: .1 to .6 for phase 1 to 6 respectively. Write 0 to stop measuring this phase, write 1 to start. R/W OID.

> <u>Periodic measurements dealy</u>: OID (iso.3.6.1.4.1.26381.1.3.7). Time in seconds between measurements. R/W OID.

> <u>Eeprom</u>: OID (iso.3.6.1.4.1.26381.1.3.8). Write "SAVE" to save data in eeprom. Write "LOAD" to load eeprom values. R/W OID.

> <u>RESERVED</u>: OID's .9 to .17. R/W OID's. Do not change this values.

> <u>IP</u>: OID's .18 to .21. R/W OID's. It is possible to change IP address by writing a new one in these OID's following the next structure .18. .19. .20. .21

> > *Example*:

> > .18 = 192
> > .19 = 168
> > .20 = 1
> > .21 = 10

> > IP = 192.168.1.10

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GW: OID's .22 to .25. R/W OID's. It is possible to change the gateway address by writing a new one in these OID's following the next structure .22. .23. .24. .25

Example:

.22 = 192
.23 = 168
.24 = 1
.25 = 1

IP = 192.168.1.1

NM: OID's .26 to .29. R/W OID's. It is possible to change the netmask address by writing a new one in these OID's following the next structure .26. .27. .28. .29

Example:

.26 = 255
.27 = 255
.28 = 0
.29 = 0

NM = 255.255.0.0

NOTE:

All parameters will be restored after reset if "SAVE" is not written in eeprom OID.
IP, GW and NM changes will only be effective after reset.

External **sensor data** are within *External sensor* OID (iso.3.6.1.4.1.26381.1.4).

Temp[index]: OID (iso.3.6.1.4.1.26381.1.4.1). R OID. Temperature data from sensor "index"
Humidity[index]: OID (iso.3.6.1.4.1.26381.1.4.2). R OID. Humidity data from sensor "index"
count[index]: OID (iso.3.6.1.4.1.26381.1.4.3). R OID. Counter of sensor "index"
index: OID (iso.3.6.1.4.1.26381.1.4.4). R/W OID to change index
addr[i]: OID (iso.3.6.1.4.1.26381.1.4.5). R OID. Each read to this OID will increment "i" once so the list of sensor's addr is shown.

Example:

Let's assume we have three connected sensors with addr 100, 101 and 102. This is the procedure to get the temperature data measured by 101.

Write 101 to OID iso.3.6.1.4.1.26381.1.4.4
Read OID iso.3.6.1.4.1.26381.1.4.1

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M2C E-Meter ModBUS Registers

Introduction

The RS485 serial interface supports the ModBUS (RTU) protocol. Only the information necessary to read/write from/to the M2C E-Meter has been reported since not all the parts of the protocol have been implemented. For a complete description of the ModBUS protocol please refer to the "Modbus_Application_Protocol_V1_1a.pdf" document that is downloadable from the www.modbus.org web site.

ModBUS functions

These functions are available on the M2C E-Meter:

- Reading of n "Holding Registers" (code 0x03)
- Reading of n "Input Registers" (code 0x04)
- Writing of one "Holding Registers" (code 0x06)

Function 0x03 (Read Holding Registers):

This function is used to read the contents of a contiguous block of holding registers (word). The request frame is as follows:

Description	Length	Value	Note
Physical addr	1 byte	01h to F7h (1 to 247)	
Function code	1 byte	03h	
Starting addr	2 bytes	0000h to FFFFh	MSB,LSB
Quantity of registers (N word)	2 bytes	01h to 10h (1 to 11)	MSB,LSB
CRC	2 bytes		

It is possible to read a maximum of 12 registers with a single request.

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Response frame for correct answer:

Description	Length	Value	Note
Physical addr	1 byte	01h to F7h (1 to 247)	
Function code	1 byte	03h	
Quantity of requested bytes	1 byte	N word * 2	
Register value	N * 2 bytes		MSB,LSB
CRC	2 bytes		

Response frame for incorrect answer:

Description	Length	Value	Note
Physical addr	1 byte	01h to F7h (1 to 247)	Possible exception: 01h: illegal function 02h: illegal data addr 03h: illegal data value 04h: slave device failure
Function code	1 byte	83h	
Exception code	1 byte	01h, 02h, 03h, 04h	
CRC	2 bytes		

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Function 0x04 (Read Input Registers):

This function is used to read the contents of a contiguous block of holding registers (word). It is possible to read a maximum of 12 registers with a single request. The request frame is as follows:

Description	Length	Value	Note
Physical addr	1 byte	01h to F7h (1 to 247)	
Function code	1 byte	04h	
Starting addr	2 bytes	0000h to FFFFh	MSB,LSB
Quantity of registers (N word)	2 bytes	01h to 10h (1 to 11)	MSB,LSB
CRC	2 bytes		

Response frame for correct answer:

Description	Length	Value	Note
Physical addr	1 byte	01h to F7h (1 to 247)	
Function code	1 byte	04h	
Quantity of requested bytes	1 byte	N word * 2	
Register value	N * 2 bytes		MSB,LSB
CRC	2 bytes		

Response frame for incorrect answer:

Description	Length	Value	Note
Physical addr	1 byte	01h to F7h (1 to 247)	Possible exception:
Function code	1 byte	84h	01h: illegal function
Exception code	1 byte	01h, 02h, 03h, 04h	02h: illegal data addr 03h: illegal data value 04h: slave device failure
CRC	2 bytes		

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M2C E-Meter ModBUS Registers

Function 0x06 (Write Single Holding Register):

This function is used to write a single holding register (word).The request frame is as follows:

Description	Length	Value	Note
Physical addr	1 byte	01h to F7h (1 to 247)	
Function code	1 byte	06h	
Starting addr	2 bytes	0000h to FFFFh	MSB,LSB
Register value	2 bytes	0000h to FFFFh	MSB,LSB
CRC	2 bytes		

Response frame for correct answer:

Description	Length	Value	Note
Physical addr	1 byte	01h to F7h (1 to 247)	
Function code	1 byte	06h	
Starting addr	2 bytes	0000h to FFFFh	MSB,LSB
Register value	2 bytes	0000h to FFFFh	MSB,LSB
CRC	2 bytes		

Response frame for incorrect answer:

Description	Length	Value	Note
Physical addr	1 byte	01h to F7h (1 to 247)	Possible exception:
Function code	1 byte	86h	01h: illegal function
Exception code	1 byte	01h, 02h, 03h, 04h	02h: illegal data addr 03h: illegal data value 04h: slave device failure
CRC	2 bytes		

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M2C E-Meter ModBUS Registers

Registers

Read only registers (Function 04h)

Physical address	Length	Variable	Data format	Notes
0000h	2	V L1 - N	INT32	V x 10
0002h	2	V L2 - N	INT32	
0004h	2	V L3 - N	INT32	
0006h	2	V L4 - N	INT32	
0008h	2	V L5 - N	INT32	
000Ah	2	V L6 - N	INT32	
000Ch	2	A L1	INT32	mA
000Eh	2	A L2	INT32	
0010h	2	A L3	INT32	
0012h	2	A L4	INT32	
0014h	2	A L5	INT32	
0016h	2	A L6	INT32	
0018h	2	W L1	INT32	W
001Ah	2	W L2	INT32	
001Ch	2	W L3	INT32	
001Eh	2	W L4	INT32	
0020h	2	W L5	INT32	
0022h	2	WL6	INT32	

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