

# Circutor

Communications interface

**CEM M-ETH**



**INSTRUCTION MANUAL**


(M060B01-03-21A)







## SAFETY PRECAUTIONS


Follow the warnings described in this manual with the symbols shown below.

	<p><b>DANGER</b> Warns of a risk, which could result in personal injury or material damage.</p>
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	<p><b>ATTENTION</b> Indicates that special attention should be paid to a specific point.</p>
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If you must handle the unit for its installation, start-up or maintenance, the following should be taken into consideration:

	<p>Incorrect handling or installation of the unit may result in injury to personnel as well as damage to the unit. In particular, handling with voltages applied may result in electric shock, which may cause death or serious injury to personnel. Defective installation or maintenance may also lead to the risk of fire.</p> <p>Read the manual carefully prior to connecting the unit. Follow all installation and maintenance instructions throughout the unit's working life. Pay special attention to the installation standards of the National Electrical Code.</p>
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	<p><b>Refer to the instruction manual before using the unit</b></p> <p>In this manual, if the instructions marked with this symbol are not respected or carried out correctly, it can result in injury or damage to the unit and / or installations.</p>
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CIRCUTOR, SA reserves the right to modify features or the product manual without prior notification.


## DISCLAIMER

CIRCUTOR, SA reserves the right to make modifications to the device or the unit specifications set out in this instruction manual without prior notice.

CIRCUTOR, SA on its web site, supplies its customers with the latest versions of the device specifications and the most updated manuals.

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	<p><b>CIRCUTOR</b>, recommends using the original cables and accessories that are supplied with the device.</p>
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*Note: The images of the units are solely for the purpose of illustration and may differ from the original unit.*

**REVISION LOG**

Table 1: Revision log.

Date	Revision	Description
11/14	M060B01-03-14A	Initial Version
04/21	M060B01-03-21A	Circuitron logo change

## 1.- VERIFICATION UPON RECEPTION

Check the following points upon receiving the unit:

- a) The unit meets the specifications described in your order.
- b) The unit has not suffered any damage during transport.
- c) Perform an external visual inspection of the unit prior to switching it on.
- d) Check that it has been delivered with the following:
  - An installation guide,.



If any problem is noticed upon reception, immediately contact the transport company and/or **CIRCUTOR's** after-sales service.

## 2.- PRODUCT DESCRIPTION

The **CEM M-ETH** optical-electric interface converts the optical service port of any unit of the **CEM** range into an Ethernet port with **MODBUS/TCP** protocol.



The unit features:

- 3 indicator **LEDs**: **POWER**, **LINK** and **LINK/ACT**.

The unit is installed on 2-step DIN rails, on the left of any unit of the **CEM** range.

### 3.- UNIT INSTALLATION

#### 3.1.- PRELIMINARY RECOMMENDATIONS



In order to use the unit safely, it is critical that the individuals who handle it follow the safety measures set out in the standards of the country where it is being used, use the necessary personal protective equipment and pay attention to the various warnings indicated in this instruction manual.

The **CEM M-ETH** unit must be installed by authorised and qualified staff.

The power supply plug must be disconnected before handling, altering the connections or replacing the unit. It is dangerous to handle the unit while it is powered.

Also, it is critical to keep the cables in perfect condition in order to avoid accidents, personal injury and damage to installations.

The manufacturer of the unit is not responsible for any damage resulting from failure by the user or installer to observe the warnings and/or recommendations set out in this manual, nor for damage resulting from the use of non-original products or accessories or those made by other manufacturers.

If an anomaly or malfunction is detected in the unit, do not use the unit to take any measurements.

Inspect the work area before taking any measurements. Do not take measurements in dangerous areas or where there is a risk of explosion.



Disconnect the unit from the power supply (unit and measuring system power supply) before maintaining, repairing or handling the unit's connections.  
Please contact the after-sales service if you suspect that there is an operational fault in the unit.

### 3.2.- INSTALLATION

On the side of the unit are all of the indications adjusted to the CEI 62052-11 standard.

The unit is installed on a DIN rail.

Before connecting the unit, you must couple it to a **CEM** energy meter as shown in **Figure 1** and **Figure 2**.

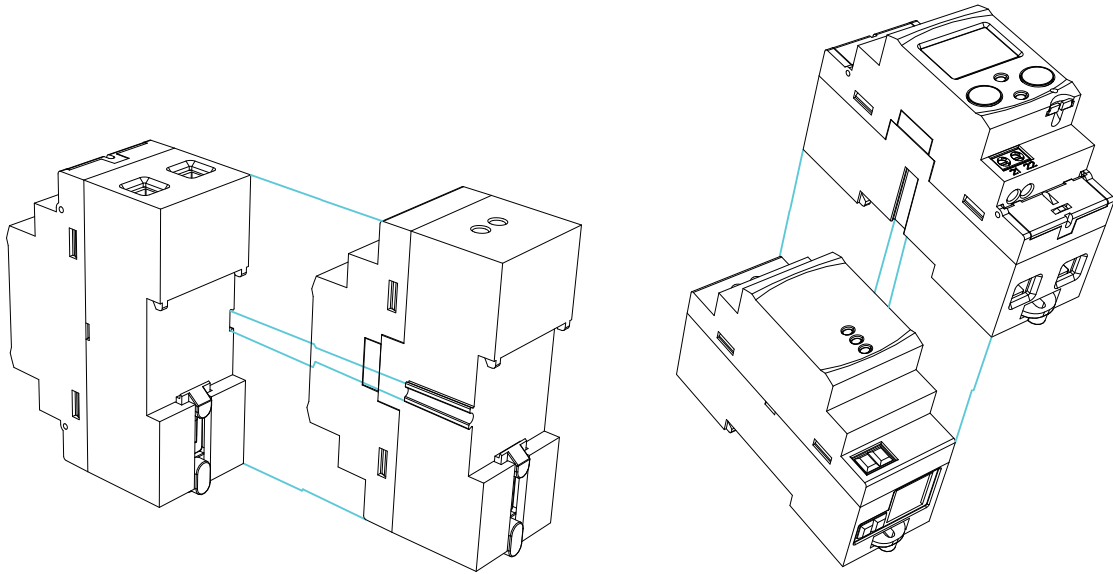


Figure 1: Coupling the CEM M-ETH to a CEM energy meter

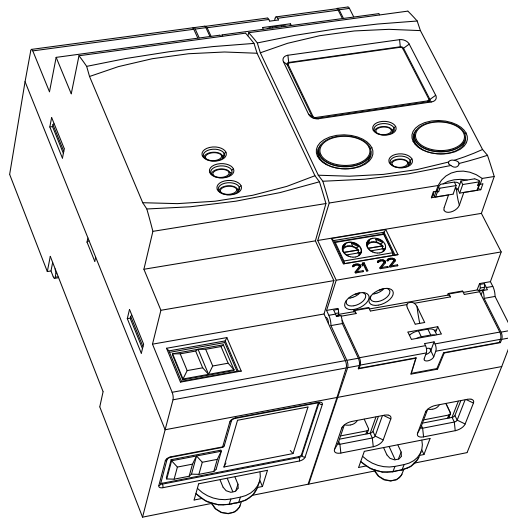


Figure 2: Coupled CEM M-ETH and CEM



Terminals, opening covers or removing elements can expose parts that are hazardous to the touch while the unit is powered. Do not use the unit until it is fully installed.



The unit must be connected to a power circuit that is protected with gL fuses (IEC 269) or M fuses, with a rating of 0.5 to 2 A. It must be fitted with a circuit breaker switch or equivalent device for disconnecting the unit from the power supply mains.

The RCCB or equivalent device must be in the immediate vicinity of the unit and must be easily accessible.

The power circuit is connected with a cable with a section measuring up to 2.5 mm<sup>2</sup>.



The unit's operating temperature is between -25°C and +70°C; always use connection cables that can withstand these temperatures.

### 3.3.- UNIT TERMINALS

Table 2:List of CEM M-ETH terminals

Unit terminals
1: Auxiliary power supply.
2: Auxiliary power supply.
3: Ethernet.

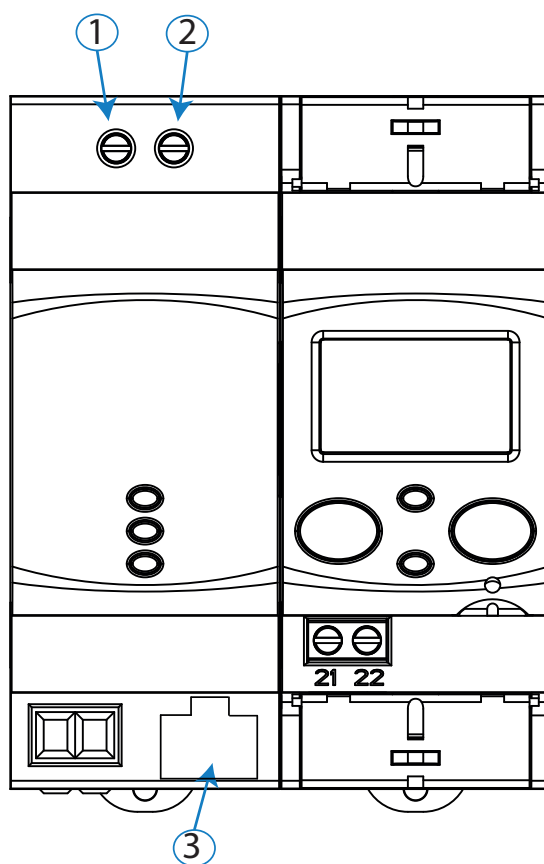


Figure 3:CEM M-ETH terminals

## 3.4.- CONNECTION DIAGRAM

The connection between the **CEM M-ETH** and the Ethernet network must be made with a twisted pair cable (100Base-TX: 100Mbit/s on two pairs of wires of Category 5 or higher). The segment length of the 100Base-T, 10BaseT and 1000Base-T cables is limited to 100 m.

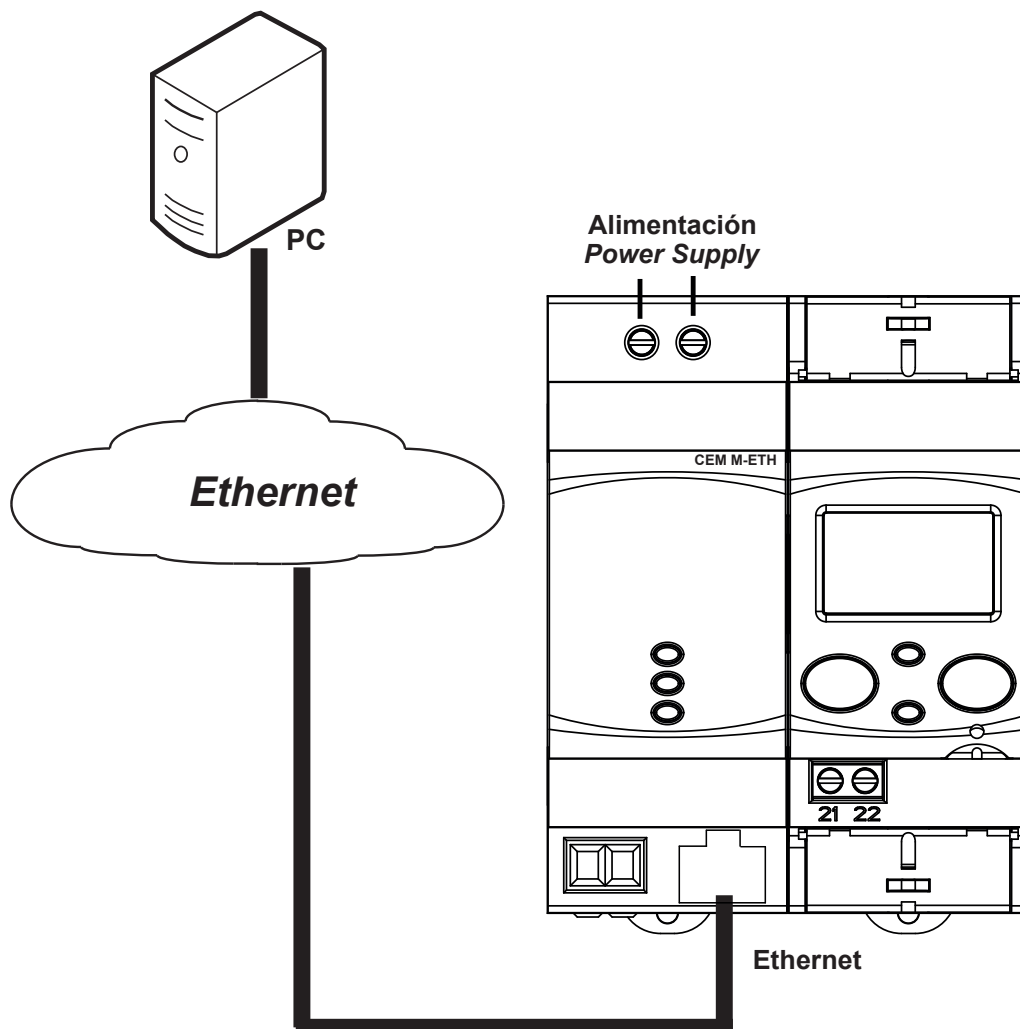


Figure 4: CEM M-ETH connection diagram

## 4.- OPERATION

The **CEM M-ETH** is designed to be used as a Ethernet port for any device in the **CEM** family, using the mechanical coupling next to the optical port.

### 4.1.- OPERATING PRINCIPLE

The **CEM M-ETH** is an optional accessory for electrical energy meters from the **CEM** range that are mounted on DIN rails.

The **CEM M-ETH** provides **CEM** units with Ethernet communications with the **MODBUS/TCP** protocol.

Once the unit is coupled to the **CEM** energy meter (See "**3.2.- INSTALLATION**") the **LINK** LED turns green to let the user know that the link has been made correctly.

From this point onward, the new **CEM** energy meter + **CEM M-ETH** assembly functions as a single device.

### 4.2.- LED INDICATORS

The unit has three indicator LEDs:

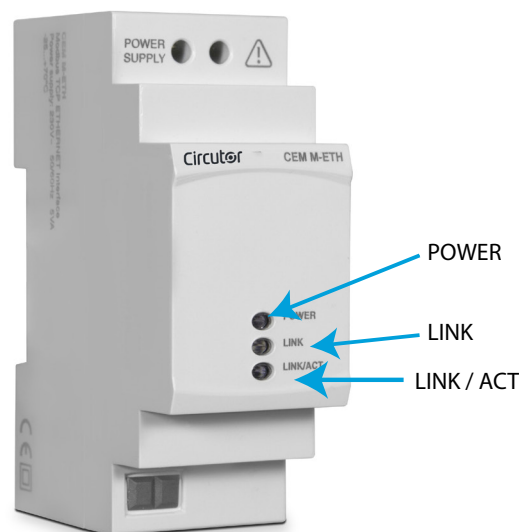


Figure 5:CEM M-ETH indicator LEDs

- ✓ **POWER** LED: Indicates that the unit is connected to a power supply.
- ✓ **LINK** LED: Indicates the status of the link with the **CEM** unit. (Table 3)

Table 3: LINK LED, colour codes

LINK LED	
Colour	Status
Flashing red	Unit not linked
Steady green	Unit linked

✓ LED LINK/ACT, indicates the state of the Ethernet connection, Table 4.

Table 4: LED LINK/ACT

LED LINK/ ACT	
Colour	Status
On	Ethernet link
Off	No Ethernet link
Flashing	Activity on this port

### 4.3.- OPTICAL COMMUNICATIONS PORT

The unit has an optical serial communications port on its right side, in accordance with the UNE EN 62056-21:2003 standard, in order to communicate with other devices in the CEM family.

### 4.4- RS-485 COMMUNICATIONS

#### 4.4.1.- MODBUS/TCP PROTOCOL

The MODBUS/TPC protocol is the MODBUS RTU protocol with a TCP interface that runs on Ethernet.

MODBUS/TCP uses TCP/IP and Ethernet to manage the data of MODBUS messages between compatible devices.

The MODBUS/TCP protocol embeds a standard MODBUS data frame in a TCP frame without the Modbus checksum, as shown in the diagram in the figure.

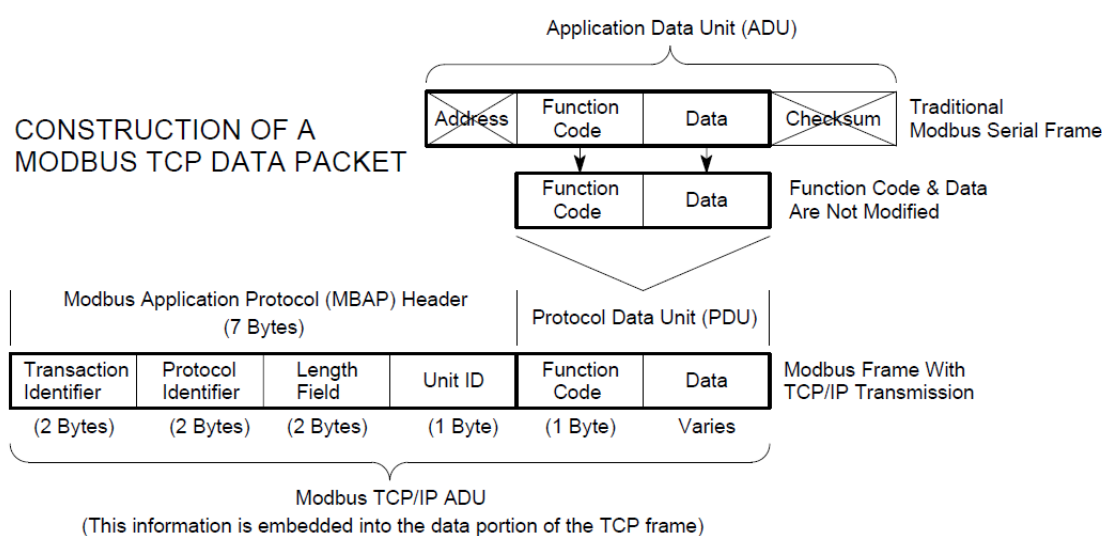


Figure 6:Construction of a MODBUS/TCP data frame

Table 5 shows the format of the **MODBUS/TCP** frame.

Table 5: MODBUS/TCP frame format

Name	Length	Function
Transaction identifier	2	For message synchronisation between the server and client.
Protocol identifier	2	Value 0 for <b>MODBUS/TCP</b>
Field length	2	Number of bytes remaining in the frame
Unit identifier	1	Peripheral number
Function code	1	Modbus function number
Data bytes	n	Response or command data

The **MODBUS** functions implemented in the unit are:

**Functions 03 and 04.** Reading of logs.

**Function 10.** Writing of multiple logs.

#### 4.4.2.- VARIABLES MODBUS

All **MODBUS** map addresses are hexadecimal.

##### 4.4.2.1.- Configuration variables

The **Read** and **Write** functions are implemented for these variables.

Table 6: Modbus configuration variables CEM M-RS485.

Description	Address	Size	Valid data range	Default value
Impulse output type	0x0080	16 bits	0: Active energy, 1: Reactive energy	0
Impulse output weight	0x0081	16 bits	Wh/impulse 0 ... 99999	-
Cost per kWh	0x00B0	32 bits	0.0000 ... 9999.9999 with 4 decimal places of resolution	-
KgCO <sub>2</sub>	0x00B2	32 bits	0.0000 ... 9.0000 with 4 decimal places of resolution	-

**Note:** Some **MODBUS** variables may not be available depending on the **CEM** energy meter coupled to the **CEM M-ETH**. See "4.4.2.7.- Available addresses by unit"

#### 4.4.2.2.- Energy

The **Read** function is implemented for these variables.

Table 7: Modbus variables: Energy

Description	Address	Size	Units
<b>Total values</b>			
Imported active energy	0x0000	32 bits	Wh
Exported active energy	0x0002	32 bits	Wh
Q1 reactive energy	0x0004	32 bits	varh
Q2 reactive energy	0x0006	32 bits	varh
Q3 reactive energy	0x0008	32 bits	varh
Q4 reactive energy	0x000A	32 bits	varh
<b>Partial values</b>			
Partial imported active energy	0x0030	32 bits	Wh
Partial exported active energy	0x0032	32 bits	Wh
Q1 partial reactive energy	0x0034	32 bits	varh
Q2 partial reactive energy	0x0036	32 bits	varh
Q3 partial reactive energy	0x0038	32 bits	varh
Q4 partial reactive energy	0x003A	32 bits	varh

**Note:** Some **MODBUS** variables may not be available depending on the **CEM** energy meter coupled to the **CEM M-ETH**. See "**4.4.2.7.- Available addresses by unit**"

#### 4.4.2.3.- Operating time, cost and KgCO<sub>2</sub> atmospheric emissions

The **Read** function is implemented for these variables.

Table 8: Modbus variables: Operating time, costs and KgCO<sub>2</sub>

Description	Address	Size	Units
Cost of the partial consumption	0x00C0	32 bits	-
KgCO <sub>2</sub> atmospheric emissions of the partial consumption	0x00C2	32 bits	-
Hours of partial operation	0x00C4	32 bits	( 1 decimal place)
Hours of total operation	0x00C6	32 bits	( 1 decimal place)

**Note:** Some **MODBUS** variables may not be available depending on the **CEM** energy meter coupled to the **CEM M-ETH**. See "**4.4.2.7.- Available addresses by unit**"

#### 4.4.2.4.- Instantaneous values

The **Read** function is implemented for these variables.

Table 9: Modbus variables: Instantaneous values.

Description	Address	Size	Units
Phase 1 voltage	0x0732	32 bits	V (1 primary decimal place)
Phase 2 voltage	0x0734	32 bits	V (1 primary decimal place)
Phase 3 voltage	0x0736	32 bits	V (1 primary decimal place)
Phase 1 current	0x0738	32 bits	A (2 primary decimal places)
Phase 2 current	0x073A	32 bits	A (2 primary decimal places)
Phase 3 current	0x073C	32 bits	A (2 primary decimal places)
Phase 1 cos φ	0x073E	32 bits	2 decimal places

Table 9 (Continuation): Modbus variables: Instantaneous values.

Description	Address	Size	Units
Phase 2 $\cos \varphi$	0x0740	32 bits	2 decimal places
Phase 3 $\cos \varphi$	0x0742	32 bits	2 decimal places
Phase 1 active power	0x0746	32 bits	W
Phase 2 active power	0x0748	32 bits	W
Phase 3 active power	0x074A	32 bits	W
Total active power	0x074C	32 bits	W
Phase 1 reactive power	0x074E	32 bits	var
Phase 2 reactive power	0x0750	32 bits	var
Phase 3 reactive power	0x0752	32 bits	var
Total reactive power	0x0754	32 bits	var
Phase 1 apparent power	0x0756	32 bits	VA
Phase 2 apparent power	0x0758	32 bits	VA
Phase 3 apparent power	0x075A	32 bits	VA
Total apparent power	0x075C	32 bits	VA

**Note:** Some **MODBUS** variables may not be available depending on the **CEM** energy meter coupled to the **CEM M-ETH**. See "4.4.2.7.- Available addresses by unit"

#### 4.4.2.5.- Other parameters

The **Read** function is implemented for these variables.

Table 10: Modbus variables: Other parameters.

Description	Address	Size	Units
Energy meter model <sup>1)</sup>	0xF010	6x16 bits	12 bytes in ASCII format
Serial no	0x2710	32 bits	-
<b>Transformation ratios</b>			
Voltage primary	0x044C	32 bits	V (1 decimal place)
Voltage secondary	0x044E	32 bits	V (1 decimal place)
Current primary	0x0450	32 bits	A (1 decimal place)
Current secondary	0x0452	32 bits	A (1 decimal place)
<b>Energy meter firmware version</b>			
Higher firmware version	0x0050	16 bits	-
Lower firmware version	0x0051	16 bits	-
Revised firmware version	0x0052	16 bits	-
<b>Communications module firmware version</b>			
Higher firmware version	0x0578	16 bits	-
Lower firmware version	0x0579	16 bits	-
Revised firmware version	0x057A	16 bits	-

**Note:** Some **MODBUS** variables may not be available depending on the **CEM** energy meter coupled to the **CEM M-ETH**. See "4.4.2.7.- Available addresses by unit"

<sup>(1)</sup> Energy meter model description table, **Table 11**.

Table 11: Energy meter model description table.

Options		C10	C20	C30	bytes in ASCII format
Connection mode	2 wires	✓			2
	4 wires		✓	✓	4
Accuracy	Class B active / Does not measure reactive energy	✓	✓	✓	10
	Class B active / Class 2.0 reactive	✓	✓	✓	12
Measurement voltage	1x230	✓			E
	1x127	✓			B
	3x127/220 ... 3x230/400 V		✓		U
	3x127/220 V		✓	✓	N
	3x230/400 V		✓	✓	Q
	3x57/100 ... 3x230/400 V			✓	V
	3x57/100 V			✓	L
	3x63.5/110 V			✓	M
Current measurement	Shunt 10(60) A	✓			S4
	Shunt 5(65) A	✓			S7
	Direct 10(60)A		✓		D4
	Direct 5(65)A		✓		D7
	Transformer 5(10) A			✓	T5
	Transformer 5(6) A			✓	T6
Frequency	50Hz	✓	✓	✓	A
	60 Hz	✓	✓	✓	B
	Automatic (50/60Hz)	✓	✓	✓	C
Communications	Without communications	✓	✓	✓	0
	Side optical service port	✓	✓	✓	1
Expansion	Without inputs/outputs	✓	✓	✓	0
	Input/Output (Optocoupler)	✓	✓	✓	1
Model	Box for assembly on DIN rail	✓	✓	✓	E
Number of quadrants	2 quadrants	✓	✓	✓	0
	4 quadrants	✓	✓	✓	1
	Storage in both directions	✓	✓	✓	2
Additional features	No special features	✓	✓	✓	0

#### 4.4.2.6.- Partial energy reset

The 0x05 function is implemented for this variable.

Table 12: Modbus variables: Energy

Description	Address	Activation
Partial energy reset	0x0800	0xFF00



## 4.4.2.7.- Available addresses by unit

Table 13: Modbus variables: Available addresses by unit.

Address	C10	C20	C30	Description
0x03E8	✓	✓	✓	Modbus Address
0x03E9	✓	✓	✓	Transmission speed
0x03EA	✓	✓	✓	Communications configuration
0x0080	✓	✓	✓	Impulse output type
0x0081	✓	✓	✓	Impulse output weight
0x00B0	✓	✓	✓	Cost per kWh
0x00B2	✓	✓	✓	KgCO <sub>2</sub>
0x0000	✓	✓	✓	Imported active energy
0x0002	✓	✓	✓	Exported active energy
0x0004	✓	✓	✓	Q1 reactive energy
0x0006	✓	✓	✓	Q2 reactive energy
0x0008	✓	✓	✓	Q3 reactive energy
0x000A	✓	✓	✓	Q4 Reactive energy
0x0030	✓	✓	✓	Partial imported active energy
0x0032	✓	✓	✓	Partial exported active energy
0x0034	✓	✓	✓	Q1 partial reactive energy
0x0036	✓	✓	✓	Q2 partial reactive energy
0x0038	✓	✓	✓	Q3 partial reactive energy
0x003A	✓	✓	✓	Q4 partial reactive energy
0x00C0	✓	✓	✓	Cost of the partial consumption
0x00C2	✓	✓	✓	KgCO <sub>2</sub> atmospheric emissions of the partial consumption
0x00C4	✓	✓	✓	Partial operating time
0x00C6	✓	✓	✓	Total operating time
0x0732	✓	✓	✓	Phase 1 voltage
0x0734		✓	✓	Phase 2 voltage
0x0736		✓	✓	Phase 3 voltage
0x0738	✓	✓	✓	Phase 1 current
0x073A		✓	✓	Phase 2 current
0x073C		✓	✓	Phase 3 current
0x073E	✓	✓	✓	Phase 1 cos $\varphi$
0x0740		✓	✓	Phase 2 cos $\varphi$
0x0742		✓	✓	Phase 3 cos $\varphi$
0x0746	✓	✓	✓	Phase 1 active power
0x0748		✓	✓	Phase 2 active power
0x074A		✓	✓	Phase 3 active power
0x074C	✓	✓	✓	Total active power
0x074E	✓	✓	✓	Phase 1 reactive power
0x0750		✓	✓	Phase 2 reactive power
0x0752		✓	✓	Phase 3 reactive power
0x0754	✓	✓	✓	Total reactive power
0x0756	✓	✓	✓	Phase 1 apparent power
0x0758		✓	✓	Phase 2 apparent power
0x075A		✓	✓	Phase 3 apparent power

Table 13 (Continuation): Modbus variables: Available addresses by unit.

Address	C10	C20	C30	Description
0x075C	✓	✓	✓	Total apparent power
0xF010	✓	✓	✓	Energy meter model
0x2710	✓	✓	✓	Serial no.
0x044C			✓	Voltage primary
0x044E			✓	Voltage secondary
0x0450			✓	Current primary
0x0452			✓	Current secondary
0x0050	✓	✓	✓	Higher firmware version
0x0051	✓	✓	✓	Lower firmware version
0x0052	✓	✓	✓	Revised firmware version

## 5.- TECHNICAL FEATURES

Power supply	
Rated voltage	230 V~ ± 20%
Maximum power consumption	4 VA
Frequency	50/60 Hz with no differentiation
Insulation	
AC voltage	4kV RMS 50Hz during 1 minute
Overimpulse	
1.2/50ms 0Ω source impedance	6 kV at 60° and 240°, with positive and negative polarization
Memory	
Setup, events, load curve	Non-volatile EEPROM memory
User interface	
LED	3 LEDs (POWER - LINK - LINL/ACT)
Communication	
Communications protocol	Modbus/TCP
Environmental features	
Operating temperature	-25°C... +70°C
Storage temperature	-35°C... +80°C
Relative humidity (non-condensing)	5 ... 95%
Maximum altitude	2,000 m
Mechanical features	
Dimensions (mm)	<b>Figure 7</b>
Enclosure	ABS + V0 polycarbonate
Weight	115 gr
Protection degree	IP 51 installed IP 40 in the terminal area
Standards	
Safety requirements for electrical units for measurement, control and laboratory use. Part 1: General requirements.	EN 61010-1: 2010
Electromagnetic compatibility (CEM). Part 6-2: Generic standards. Immunity for industrial environments.	EN 61000-6-2: 2005
Electromagnetic compatibility (CEM). Part 6-3: Generic standards. Emission standard for residential, commercial and light industry environments.	EN 61000-6-3: 2007

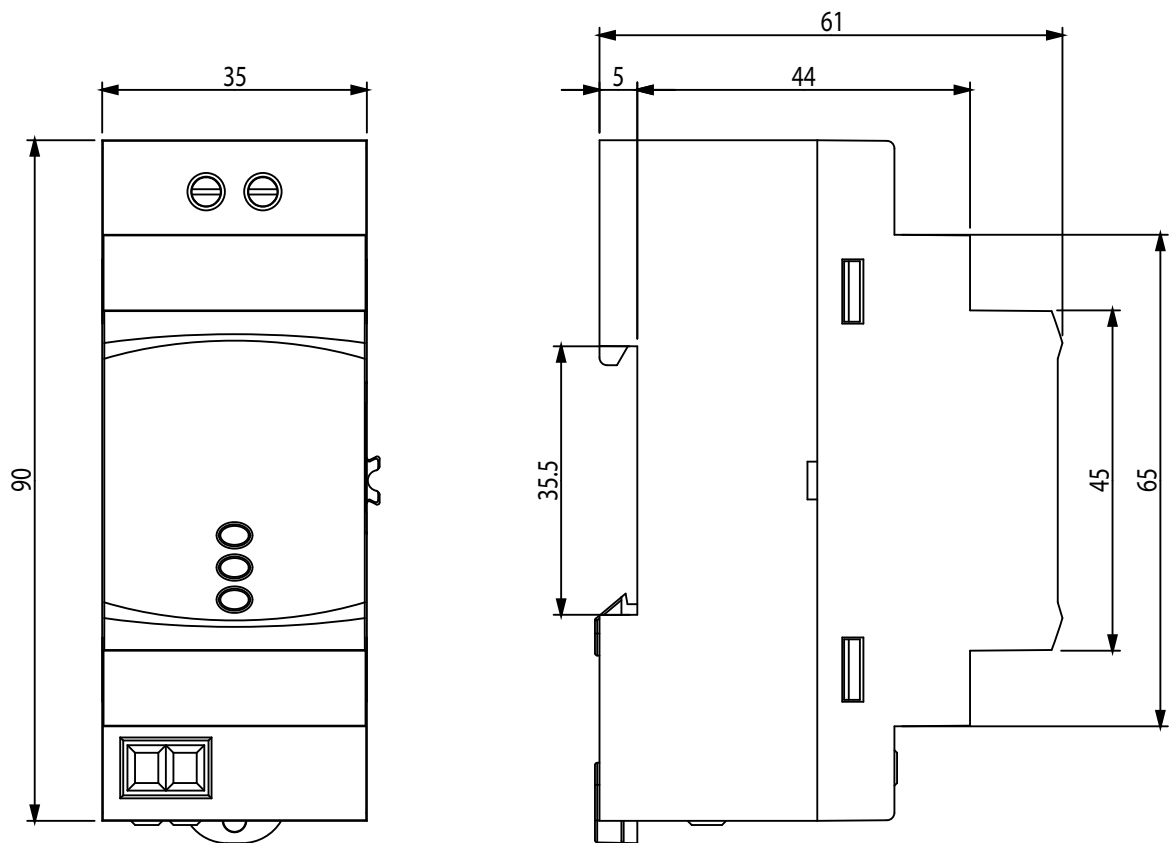


Figure 7: CEM M-ETH dimensions

## 6.- MAINTENANCE AND TECHNICAL SERVICE

The unit does not need any type of maintenance.

In the case of any query in relation to device operation or malfunction, please contact the **CIRCUTOR SA** Technical Support Service.

### Technical Assistance Service

Vial Sant Jordi, s/n, 08232 - Viladecavalls (Barcelona)

Tel: 902 449 459 ( España) / +34 937 452 919 (outside of Spain)

email: sat@circutor.com

## 7.- GUARANTEE

**CIRCUTOR** guarantees its products against any manufacturing defect for two years after the delivery of the units.

**CIRCUTOR** will repair or replace any defective factory product returned during the guarantee period.



- No returns will be accepted and no unit will be repaired or replaced if it is not accompanied by a report indicating the defect detected or the reason for the return.
- The guarantee will be void if the units has been improperly used or the storage, installation and maintenance instructions listed in this manual have not been followed. "Improper usage" is defined as any operating or storage condition contrary to the national electrical code or that surpasses the limits indicated in the technical and environmental features of this manual.
- **CIRCUTOR** accepts no liability due to the possible damage to the unit or other parts of the installation, nor will it cover any possible sanctions derived from a possible failure, improper installation or "improper usage" of the unit. Consequently, this guarantee does not apply to failures occurring in the following cases:
  - Overvoltages and/or electrical disturbances in the supply;
  - Water, if the product does not have the appropriate IP classification;
  - Poor ventilation and/or excessive temperatures;
  - Improper installation and/or lack of maintenance;
  - Buyer repairs or modifications without the manufacturer's authorisation.

8.- CE CERTIFICATE



**CIRCUTOR, SA**

Vial Sant Jordi, s/n

08232 -Viladecavalls (Barcelona)

Tel.: (+34) 93 745 29 00 - Fax: (+34) 93 745 29 14

[www.circutor.es](http://www.circutor.es) [central@circutor.com](mailto:central@circutor.com)