



# MID energy meters

## User manual

UM EN EEM-EM157-EE

Order No. 1311993

# User manual

## MID energy meters

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## MID energy meters

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# 1 For your safety

Read this user manual carefully and keep it for future reference.

## 1.1 Labeling of warning notes



This symbol indicates hazards that could lead to personal injury.

There are three signal words indicating the severity of a potential injury.

### **DANGER**

Indicates a hazard with a high risk level. If this hazardous situation is not avoided, it will result in death or serious injury.

### **WARNING**

Indicates a hazard with a medium risk level. If this hazardous situation is not avoided, it could result in death or serious injury.

### **CAUTION**

Indicates a hazard with a low risk level. If this hazardous situation is not avoided, it could result in minor or moderate injury.



This symbol together with the **NOTE** signal word warns the reader of actions that might cause property damage or a malfunction.



Here you will find additional information or detailed sources of information.

## 1.2 Qualification of users

The use of products described in this user manual is oriented exclusively to:

- Electrically skilled persons or persons instructed by them. The users must be familiar with the relevant safety concepts of automation technology as well as applicable standards and other regulations
- Qualified application programmers and software engineers. The users must be familiar with the relevant safety concepts of automation technology as well as applicable standards and other regulations.

## 1.3 Field of application of the product

### 1.3.1 Intended use

MID energy meters may only be used to measure electric characteristic values in applications that meet the specified technical data.

### 1.3.2 Foreseeable misuse

MID energy meters with direct measurement are not suitable for use with voltage transformers or current transformers.

### 1.3.3 Product changes

Changes or modifications to hardware and software of the device are not permitted.

Incorrect operation or modifications to the device can endanger your safety or damage the device. Do not repair the device yourself. If the device is defective, please contact Phoenix Contact.

## 1.4 Safety notes

The "exclamation mark" on the device labeling means that you need to:

Read the installation note in its entirety. Follow the installation note to avoid impairing the intended protection.

- The installation, operation, and maintenance work must be completed by a qualified electrician. Follow the installation instructions as described. When installing and operating the device, the applicable regulations and safety directives (including national safety directives), as well as general technical regulations must be observed.
- Use an appropriate voltage measuring device to ensure that no voltage is present.
- Install the device in accordance with instructions described in the installation notes. Accessing circuits within the device is prohibited.
- Repairs may only be carried out by the manufacturer.
- Only clean the device with a suitable damp cloth. Switch the device off before cleaning and do not use abrasive agents or solvents.
- Ensure that all connection terminals are connected correctly to prevent the device from being damaged.
- Observe the maximum permissible voltages (276V AC ) and network frequency (50Hz).

## 2 Device description

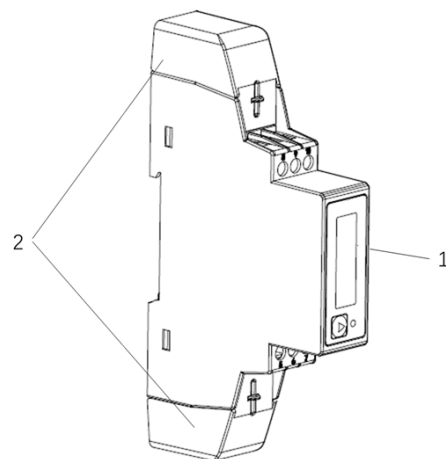
The device is a single-phase energy meter with backlight LCD display. It can measure voltage, current, frequency, power, power factor, active and reactive energy, imported and exported energy, etc.

The energy values provided by the energy meters can be used for billing purposes with MID approval.

The device supports maximum 45A direct measurement, with 2 pulse outputs and RS-485 interface.

### 2.1 Scope of supply

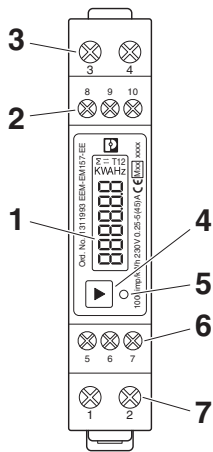
Figure 2-1 Scope of supply



- 1 Energy meter, certified in accordance with MID directive
- 2 2x covers

## 2.2 Operating and indication elements

Figure 2-2 Operating and indication elements



- 1 LCD display
- 2 Modbus interface
- 3 Neutral conductor input ↑ and output ↓
- 4 Next/Enter key
- 5 Pulse LED
- 6 Pulse outputs
- 7 Line conductor input ↑ and output ↓

## 2.3 MID conformity

- MID conformity refers to compliance with Directive 2014/32/EU.
- In terms of MID conformity, only Total import active energy and Total export active energy is calibrated.
- The device contains additional functions that are informative and do not play a role in the sense of MID conformity.
- The product label on the side seals the device in terms of MID conformity.
- After installation and commissioning, the covers with sealing must be applied. (see [Section 4.4, “Sealing”](#)).

## 3 Quick start guide

After the voltage is applied, the device enters start mode. It will do self-test and then display device information.

Following start mode, the device automatically switches to operating mode default display energy values.



Navigation

Next/Enter key	<ul style="list-style-type: none"> <li>- In operating mode:                             <ul style="list-style-type: none"> <li>Scroll through the displayed pages</li> <li>Enter setting mode: long press *</li> </ul> </li> <li>- In setting mode:                             <ul style="list-style-type: none"> <li>Change setting value</li> <li>Move to next setting menu item</li> <li>Enter edit mode: long press *</li> </ul> </li> </ul>
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\* Long press means to keep pressing the key for at least 3 seconds.

Configuring parameters

Parameters are configured in setting mode, see [Section 5.1, "Setting mode"](#)

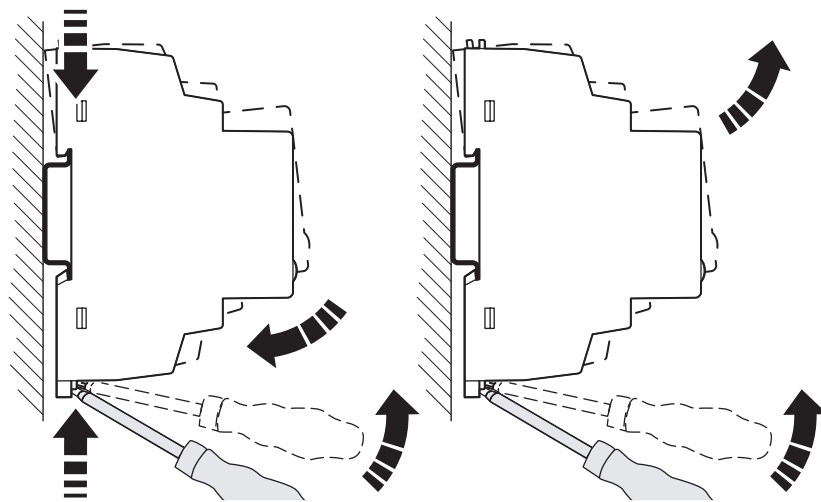
- 1 Press Next/Enter key for at least 3 seconds to enter setting mode.
- 2 Configure the parameters, see [Section 5.3, "Parameters in setting mode"](#)

## 4 Mounting and installation

### 4.1 Snapping the device onto the DIN rail

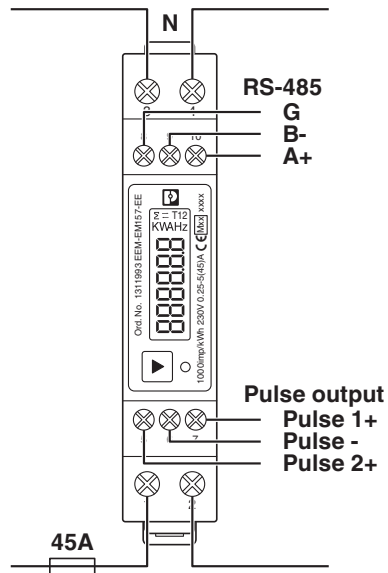
The device is snapped onto a DIN rail in the control cabinet. The measuring position can be freely selected, but will be determined by the readability of the LCD.

Figure 4-1 Snapping the device onto the DIN rail



## 4.2 Network type

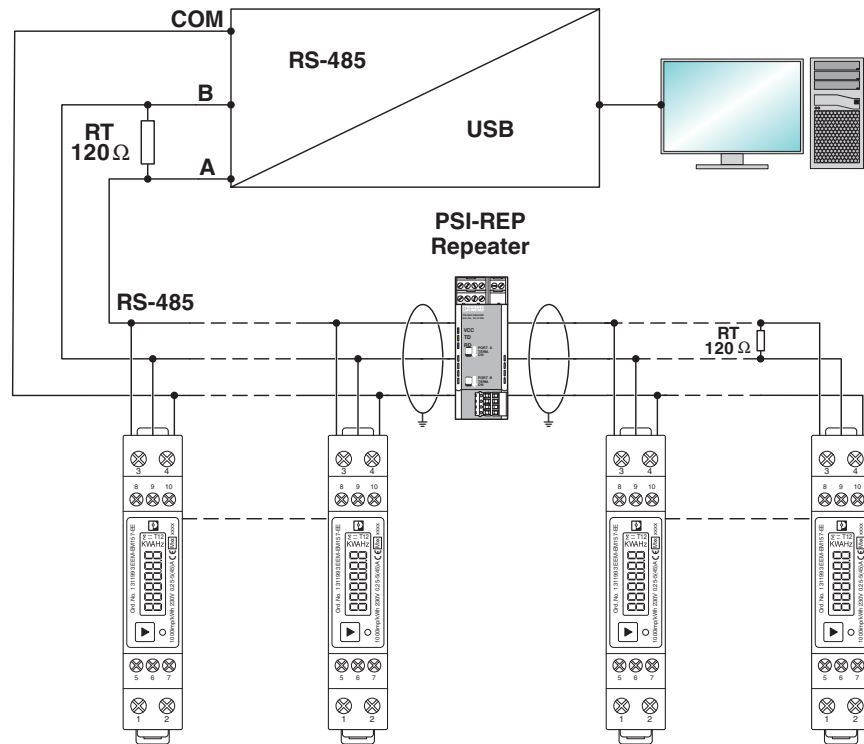
Figure 4-2 Connection



1. L input ↑
2. L output ↓
3. Neutral conductor input ↑ and output ↓
4. Neutral conductor input ↑ and output ↓
5. Pulse output 2+
6. Pulse output -
7. Pulse output 1+
8. RS-485 GND
9. RS-485 B-
10. RS-485 A+

### 4.3 Modbus/RTU installation

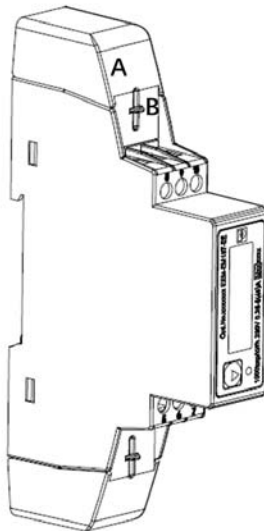
Figure 4-3 Modbus/RTU network



## 4.4 Sealing

- 1 Insert the upper cover (A).
- 2 Insert the seal cord through the hole on the device (B).
- 3 Tighten the cord so that the seal is located directly on the upper cover.
- 4 Repeat these steps for the lower cover.

Figure 4-4 Sealing



## 5 Configuration

This section describes how you can access the relevant setting mode and configure the parameters, e.g. the parameters of the integrated communication interface.

### 5.1 Setting mode

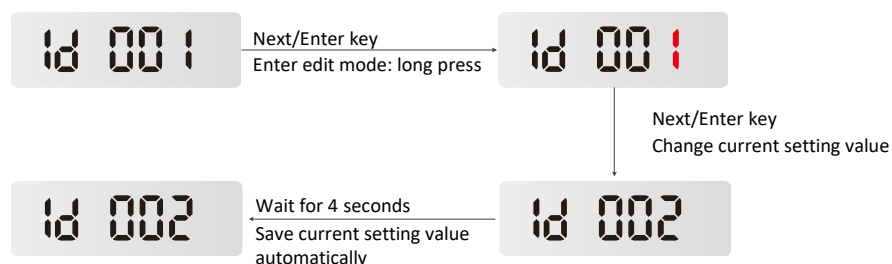
To scroll through setting menu items:

- 1 Press Next/Enter key.

To change the displayed value:

- 1 Keep pressing Next/Enter key for at least 3 seconds to enter edit mode.  
The value flashes.
- 2 Press Next/Enter key to change setting value.
- 3 Wait for 4 seconds to save current setting value of current setting menu item.  
Next setting value flashes automatically if there is more than one value in the setting menu item.
- 4 After all setting values of current setting menu item have been saved automatically, it exits edit mode and no value flashes.

Figure 5-1 To change the displayed values



## 5.2 Opening setting mode

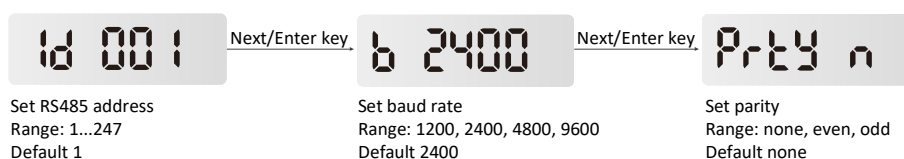
Press Next/Enter key for at least 3 seconds to enter setting mode.

## 5.3 Parameters in setting mode

The following display pages are available.

To scroll through setting menu items or change displayed values, see [Section 5.1, "Setting mode"](#).

Figure 5-2 Setting mode



\* Other parameters can be set via RS-485 Modbus RTU communication.

## 5.4 Leave setting mode

If there is no operation in setting mode for more than 10 seconds, it will back to operating mode default display automatically.

## 6 Operation

### 6.1 Start mode

After the voltage is applied, the device enters start mode. It will do self-test and then display device information.

Figure 6-1 Full screen



Table 6-1 Display pages: Start mode

Menu item	Description
Display segments	All display segments
0201.01	Software version information (subject to in kind)

### 6.2 Operating mode

Following start mode, the device automatically switches to operating mode default display energy page. The following display pages are shown in operating mode.

To scroll through the displayed pages, press Next/Enter key.

Figure 6-2 Operating mode



### 6.3 Communication

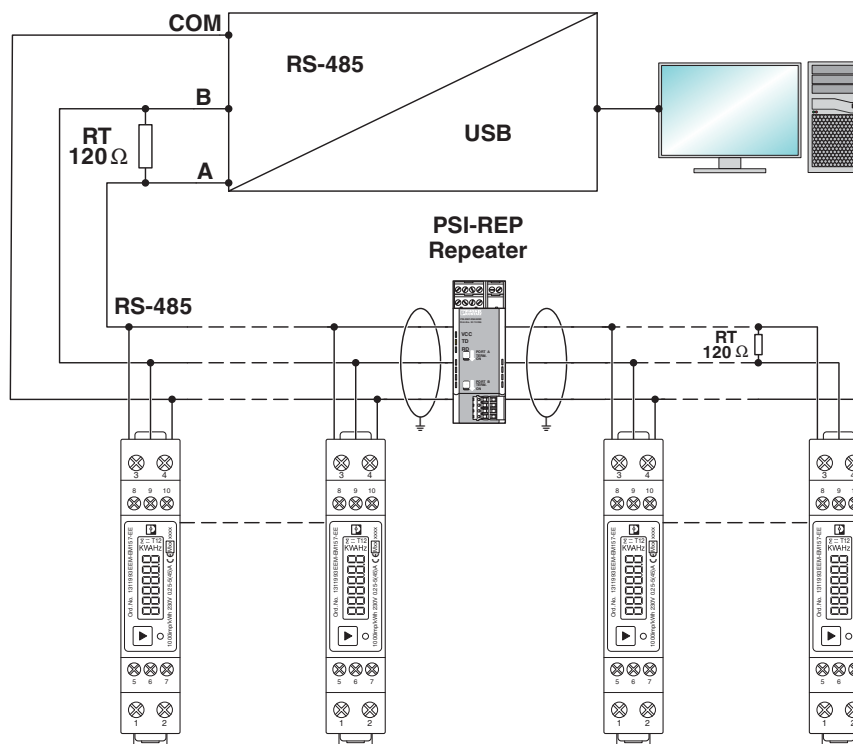
The RS-485 interface is used for the local remote readout with the Modbus/RTU protocol. During this process, the measuring device is the server and the PC or controller is the client. Connect a terminal resistance  $RT=120\Omega$  (0.25W min.) at the start and end of the network. The maximum length for transmission is 1000m at a speed of 1200 bps. A maximum of 32 electrical nodes can be connected, including the controller. Broadcast mode (address 0) is supported

Table 6-2 Setting range and default settings of Modbus RTU communication

Parameters	Setting range	Default settings
Address	1...247	1
Baud rate	1200 bps, 2400 bps, 4800bps, 9600 bps	2400
Parity	None, even, odd	none
Stop bit *	1, 2	1

\* For stop bit, it can't be configured directly in setting mode on the device, but can be set via RS-485 interface.

Figure 6-3 Modbus/RTU network



## 6.4 Outputs

The device provides two pulse outputs. Both pulse outputs are passive type.

Pulse output 1 is configurable. The pulse output 1 can be set to generate pulses to represent total / import / export kWh or kVAh.

The pulse constant can be set to generate 1 pulse per:

0.001 kWh/kVAh (default)

0.01 kWh/kVAh

0.1kWh/kVAh

1 kWh/kVAh

Pulse width: 200/100/60ms(default)

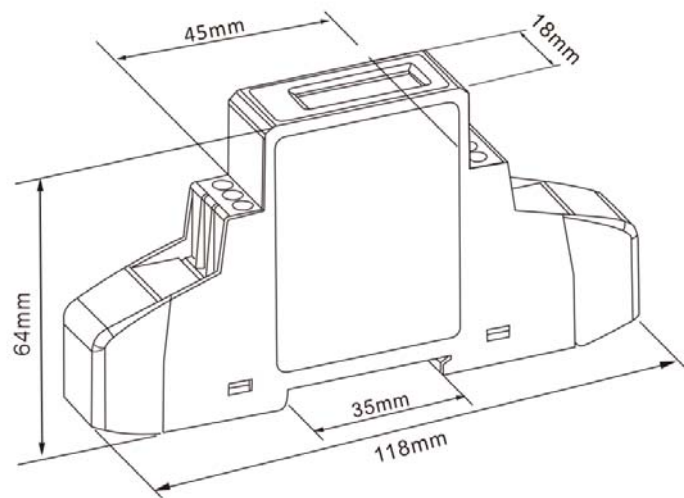
Pulse output 2 is non-configurable. It is fixed at total kWh. The constant is 1000imp/kWh. Its width is fixed at 60ms.

\* For pulse output 1, it can't be configured directly in setting mode on the device, but can be configured via RS-485 interface.

## 7 Technical data

### 7.1 Dimensions

Figure 7-1 Dimensions





## 7.2 Technical data

Table 7-1 technical data

<b>Measuring input data</b>	
Voltage $U_N$	230 V
Input voltage range	80%...120% $U_N$
Power consumption	10 VA (2 W)
Frequency	50 Hz
Auxiliary voltage	Device is supplied by the measuring circuit
Starting current $I_{st}$	0.02 A
Minimum current $I_{min}$	0.25 A
Transient current $I_{tr}$	0.5 A
Nominal current $I_{ref}$	5 A
Maximum current $I_{max}$	45 A
<b>Measurement connection data</b>	
Measurement connection	2.5...10 mm <sup>2</sup> (1.5 Nm)
Other connections	0.5...1.5 mm <sup>2</sup> (0.2 Nm)
Electric strength as per EN 50470-1	1.2 $\mu$ s/50 $\mu$ s at 6 kV
Electric strength as per EN 50470-3, 7.2	4 kV for 1 minute
<b>Ambient conditions</b>	
Mechanical environment	M1
Electromagnetic environment	E2
Operation temperature	-40 °C...70 °C
Storage temperature	-40 °C...70 °C
Humidity	Max. 90%, non-condensing
Degree of protection-front	IP51 if mounted in a control cabinet with IP51 degree of protection or higher
Degree of protection-connection	IP20
Internal/external meter type	Internal
Meter type	Bidirectional
<b>Safety</b>	
Pollution degree	2
Protection class as per EN 50470-1	II
Flame resistance-housing	UL94 V0

<b>Accuracy</b>		
Real energy as per EN 50470-3	Class B	
Real energy as per EN 62053-21	Class 1	
Reactive energy as per EN 62053-23	Class 2	
<b>Housing</b>		
Standard	DIN 43880	
<b>Metrological LED</b>		
	Pulse output 1	Pulse output 2
Meter constant	Configurable	1000 imp/kWh
<b>Communication</b>		
Standard	RS 485	
Protocol	Modbus/RTU	
Speed	1200...9600 bps	
Parameters	Address, speed, parity, stop	
<b>Outputs</b>		
	Pulse output 1	Pulse output 2
Meter constant	Configurable	1000 imp/kWh
Pulse width	Configurable	60 ms
Type	Passive opto-isolated	
Maximum voltage	27 V DC	
Maximum current	27 mA DC	

### 7.3 MID Data

Table 7-2 MID data

Accuracy	Class B (EN 50470-3)
Voltage $U_N$	230 V
Rated frequency $f_N$	50 Hz
Cosine $\phi$	0.5 inductive...0.8 capacitive
Starting current $I_{st}$	0.02 A
Minimum current $I_{min}$	0.25 A
Transient current $I_{tr}$	0.5 A
Nominal current $I_{ref}$	5 A
Maximum current $I_{max}$	45 A
Operation temperature	-40 °C...70 °C (-40 °F...158 °F)
Relative humidity	≤90%, non-condensing
Electromagnetic ambient conditions	E2

Table 7-2 MID data [...]

Mechanical ambient conditions	M1
Type of application	Interior space counter
Protection class	To ensure that protection against dust and water is provided in accordance with the specific standards as per MID, the energy meter must be installed in a housing or control cabinet with protection class IP51 (or higher).

## 8 Modbus register

Table 8-1 The format for each byte in RTU mode

Coding system:	8-bit per byte
Data format:	4 bytes (2 registers) per parameter Floating point format (to IEEE 754) if there is no special note. Most significant register first (Default). The default may be changed if required
Error Check Field:	2 byte Cyclical Redundancy Check (CRC)
Framing:	1 start bit 8 data bits, least significant bit sent first 1 bit for even/odd parity (or no parity) 1 stop bit if parity is used, 1 or 2 bits if no parity

The device can transfer a maximum of 10 values in a single transaction. Therefore, the maximum number of registers requestable is 20. Exceeding this limit will prompt the device to generate an exception response.

### 8.1 Measuring values

Table 8-2 Measuring values

Decimal start address	Hexadecimal start address	Type	Functions	Format
30001	0x0000	Read	04	Float

Decimal address	Hexadecimal address	Number of registers	Description	Unit	Data type
30001	0x0000	2	Voltage	V	Float
30007	0x0006	2	Current	A	Float
30013	0x000C	2	Active power	W	Float
30019	0x0012	2	Apparent power	VA	Float
30025	0x0018	2	Reactive power	VAr	Float
30031	0x001E	2	Power factor	None	Float
30071	0x0046	2	Frequency	Hz	Float
30073	0x0048	2	Import active energy	kWh	Float
30075	0x004A	2	Export active energy	kWh	Float
30077	0x004C	2	Import reactive energy	kVArh	Float
30079	0x004E	2	Export reactive energy	kVArh	Float

**Modbus register**

30085	0x0054	2	Total system power demand	W	Float
30087	0x0056	2	Maximum total system power demand	W	Float
30089	0x0058	2	Import system power demand	W	Float
30091	0x005A	2	Maximum Import system power demand	W	Float
30093	0x005C	2	Export system power demand	W	Float
30095	0x005E	2	Maximum Export system power demand	W	Float
30259	0x0102	2	Current demand	A	Float
30265	0x0108	2	Maximum current demand	A	Float
30343	0x0156	2	Total active energy	kWh	Float
30345	0x0158	2	Total reactive energy	kVArh	Float

## 8.2 Device information and configuration

Table 8-3 Device information and configuration

Decimal start address		Hexadecimal start address		Functions	
40003		0x0002		03/10	

Decimal address	Hexadecimal address	Number of registers	Description	Type	Data type
40003	0x0002	2	Demand period 0, 5, 8, 10, 15, 20, 30, 60mins Default 60 mins	r/w	Float
40013	0x000C	2	Pulse 1 width 60, 100, 200ms Default 60ms	r/w	Float
40019	0x0012	2	Network parity stop 1: stop bit 1, even parity 2: stop bit 1, odd parity 3: stop bit 2, none parity Default 1	r/w	Float
40021	0x0014	2	Meter ID 1...247 Default 1	r/w	Float
40029	0x001C	2	Baud rate 0: 2400 bps 1: 4800 bps 2: 9600 bps 5: 1200 bps Default 0	r/w	Float
40087	0x0056	2	Pulse output 1 energy type 0001: import active energy 0002: total active energy (import+export) 0004: export active energy 0005: import reactive energy 0006: total reactive energy (import+export) 0008: export reactive energy Default 0004	r/w	Float

**Modbus register**

461457	0xF010	1	Reset 00 00: reset demand info	wo	Hex
463745	0xF900	2	Time of scroll display 0...30s configurable Default 0s	r/w	BCD
463761	0xF910	2	Pulse output 1 0000: 0.001kWh/kVArh 0001: 0.01kWh/ kVArh 0002: 0.1kWh/ kVArh 0003: 1kWh/ kVArh Default 0000	r/w	Hex
463777	0xF920	2	Measurement mode 0001: mode 1, total=import 0002: mode 2, total=import+export 0003: mode 3, total=import-export Default 0002	r/w	Hex
464513	0xFC00	2	Serial number	ro	UInt32

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# A Appendixes

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