MID-energy meters

User manual

UM EN EEM-EM357-EE
Order No. 1311985

User manual

MID-energy meters

UM EN EEM-EM357-EE, Revision 02   2024-05-31

This user manual is valid for:

Designation	Order No.
EEM-EM357-EE	1311985

Table of contents

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 (480V AC phase/phase or 276V AC phase/neutral conductor) and network frequency (50Hz).
– Ensure that the communication shield must be fitted before power on!

```
COMMUNICATION SHIELD
MUST BE FITTED
```

2 Device description

The device is a three-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. It supports single phase two wires (1p2w), three phase three wires (3p3w,) and three phase four wires (3p4w) applications.

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

The device supports maximum 100A direct measurement, with 2 pulse outputs and RS-485 interface.

2.1 Scope of supply

Figure 2-1   Scope of supply

COMMUNICATION SHIELD
MUST BE FITTED

1   Energy meter, certified in accordance with MID directive
2   2x covers
3   1x communication shield
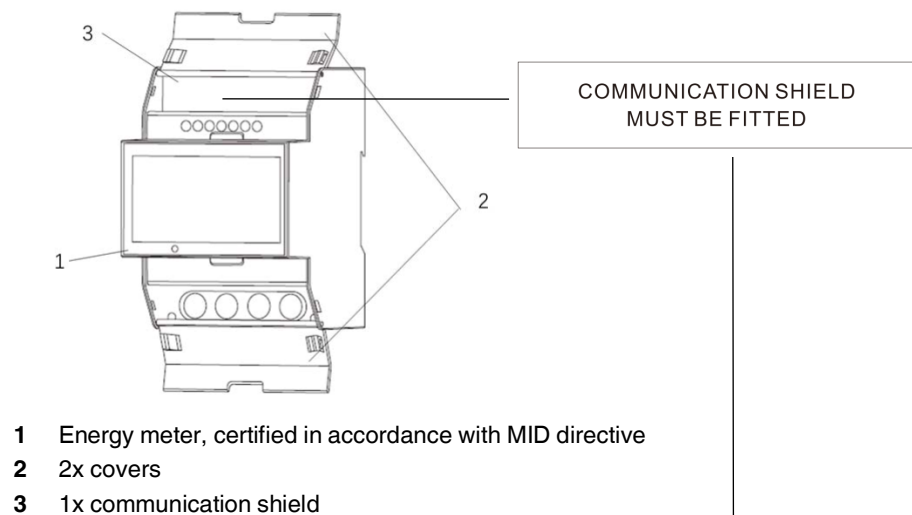
⚠ **Attention please!**

Communication shield must be fitted before power on!

That is:

After connecting the communication line and the load line, this isolation gasket must be fitted for shielding before power on!

2.2 Operating and indication elements
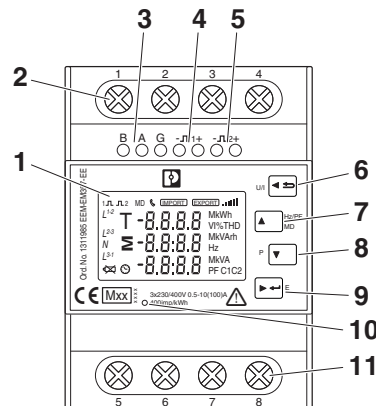
Figure 2-2   Operating and indication elements

1 LCD display
2 L1, L2, L3, Neutral conductor input↑
3 Modbus interface
4 Pulse output 1
5 Pulse output 2
6 U/I, Left/ESC key
7 Hz/PF MD, Up key
8 P, Down key
9 E, Right/Enter key
10 Pulse LED
11 L1, L2, L3, Neutral conductor 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.

Table 3-1   Navigation

U/I, Left/ESC key	– In operating mode: Scroll through the displayed pages – In setting mode: Back to previous level
Hz/PF MD, Up key	– In operating mode: Scroll through the displayed pages – In setting mode: Move to previous setting menu item Change setting value
P, Down key	– In operating mode: Scroll through the displayed pages – In setting mode: Move to next setting menu item Change setting value
E, Right/Enter key	– In operating mode: Scroll through the displayed pages Enter setting mode: long press * – In setting mode: Save setting value Enter edit mode: long press * Save setting menu item: long press *

* Long press means to keep pressing the key for at least 3 seconds.

ℹ️ In the default settings, the password for the configuration is set to 1000.

Configuring parameters

Parameters are configured in setting mode, see Section 5.1, "Setting mode".

1 Press Right/Enter key for at least 3 seconds to enter setting mode.
2 The PASS display page appears.
3 Enter the password.
4 Confirm the fourth digit with keeping pressing Right/Enter key for at least 3 seconds. The device checks the password.
Setting mode is opened if the password is right.
5 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
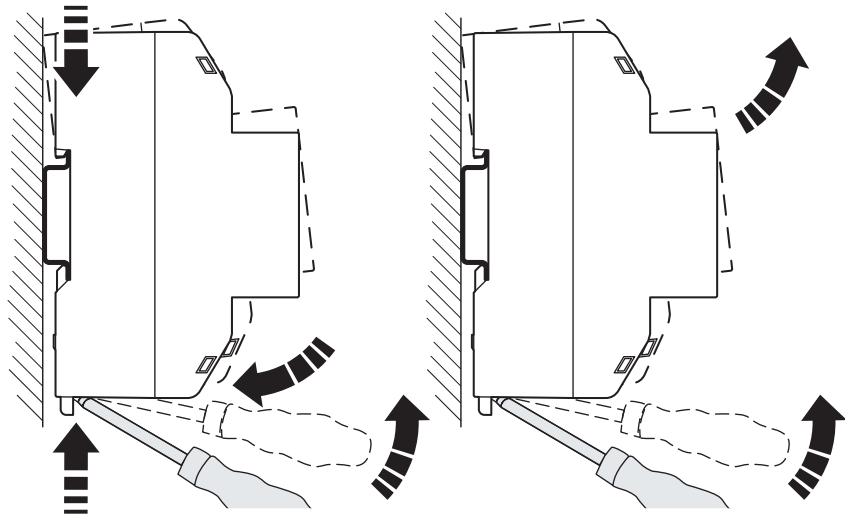
Figure 4-2   Connection 3P3W

Figure 4-3   Connection 3P4W
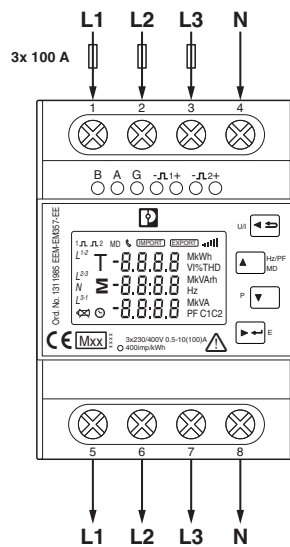
Figure 4-4   Connection 1P2W
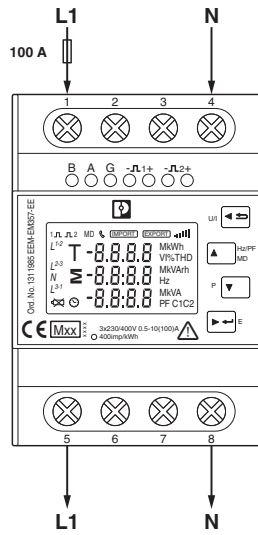
1,2,3,4: L1/L2/L3/Neutral conductor input ↑

5,6,7,8: L1/L2/L3/Neutral conductor output ↓

B,A,G: RS-485 (-,+,GND)

4.3   Modbus/RTU installation

Figure 4-5   Connection assignment of Modbus/RTU
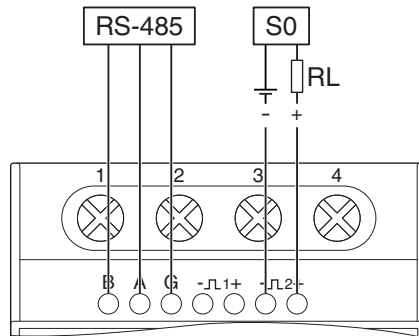
B, A, G RS-485(-, +, GND)

Figure 4-6   Modbus/RTU network
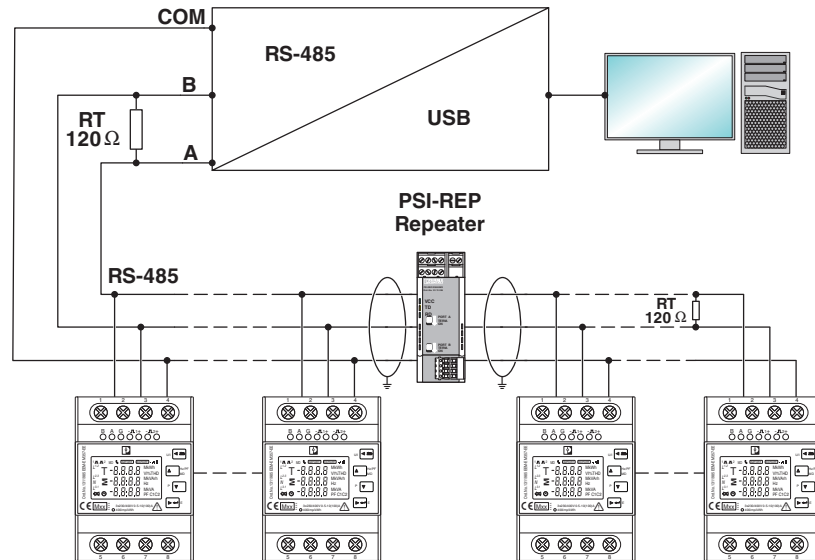
4.4   Sealing

1. Insert the upper cover (A).
2. Insert the seal cord through the front hole on the cover (B).
3. Guide the cord through the side hole on the device (C).
4. Tighten the cord so that the seal is located directly on the upper cover.
5. Repeat these steps for the other side of the upper cover and lower cover.

Figure 4-7   Sealing
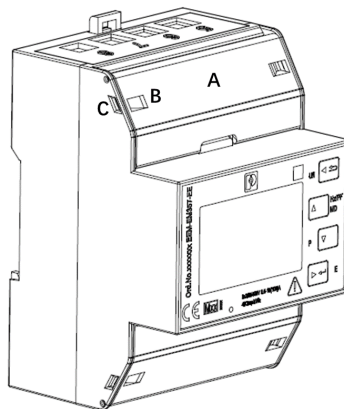
5   Configuration

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 Up and Down key.

To change the displayed value:

1   Keep pressing Right/Enter key for at least 3 seconds to enter edit mode.
    The value flashes.
2   Press Up and Down key to change setting value.
3   Press Right/Enter key to save current setting value of current setting menu item.
    The current setting value is saved and next setting value flashes automatically.
4   Keep pressing Right/Enter key for at least 3 seconds to save all settings of current setting menu item.
    It exits edit mode and no value flashes.

Figure 5-1   To change the displayed value
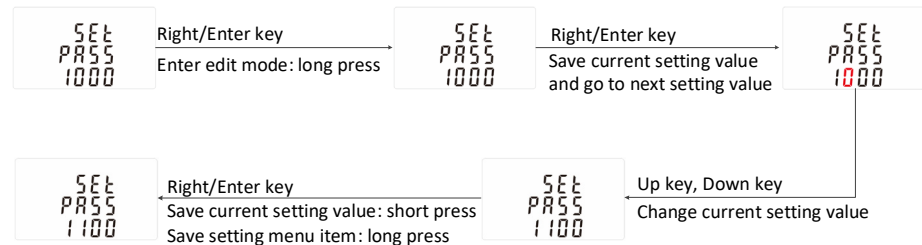
5.2   Opening setting mode

1   Press Right/Enter key for at least 3 seconds to enter setting mode. Then the PASS display page appears.
2   Enter the password.
3   Press Right/Enter key for at least 3 seconds to confirm.
    The device checks the password.
    If entered password is correct, setting mode is opened.
    If entered password is wrong, the display page will show PASS Err.

[i]   In the default settings, the password for the configuration is set to 1000.

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

PASS / **0000**	Password is correct — Yes	**SEt Addr 001** Set RS485 address Range: 1...247 Default 1	**SEt bAUd 9.6 k** Set baud rate Range: 2.4k, 4.8k, 9.6k, 19.2k, 38.4k Default 9.6k	**SEt PAri EUEN** Set parity Range: none, even, odd Default none

No → **PASS Err**

SEt rAtE 10
Set pulse1 rate
Range: dFt(2.5Wh/VArh), 100/10/1/0.1/0.01kWh/kVArh
Default dFt

SEt kWh rLY
Set pulse output1
Range: total/import/export kWh, total/import/export kVArh
Default export kWh

SEt StoP 1
Set stop bits
Range: 1,2
Default 1

SEt PULS 200
Set pulse 1 width
Range: 60/100/200ms
Default 100ms

SEt dit 10
Set demand period
Range: 0/5/8/10/15/20/30/60mins
Default 60mins

SEt LP 60
Set backlight lasting time
Range: 0(always on)/10/30/60/120mins
Default 60mins

SEt PASS 1000
Set password
Range: 0000...9999
Default 1000

CLr
Reset maximum demand value of current and power

SYS 3P3
Set type of supply system
Range: 1P2(W), 3P3(W), 3P4(W)
Default 3P4

* Password and backlight lasting time can only be changed via LCD screen and keys on the device. They can't be changed via RS485 communication.

5.4 Leave setting mode

To leave setting mode, press Left/ESC key to back to previous level.

If there is no operation in setting mode for more than 60 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.
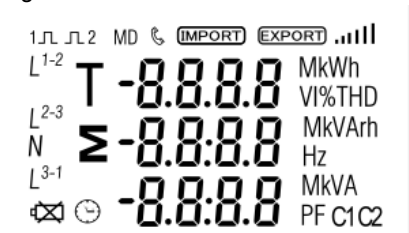
Figure 6-1   Full screen

Table 6-1   Display pages: Start mode

Menu item	Example	Description
Display segments	Figure 6-1	All display segments
SOFt	1.302 2014	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.

6.2.1 U/I

Voltage and Current display pages.

To scroll through the displayed pages, press U/I key.

Figure 6-2   Voltage and Current display pages

Phase to neutral voltages (3p4w)

Phase to phase voltages (3p3w)

Current on each phase

Current THD% for each phase

Phase to neutral voltage THD% (3P4W)
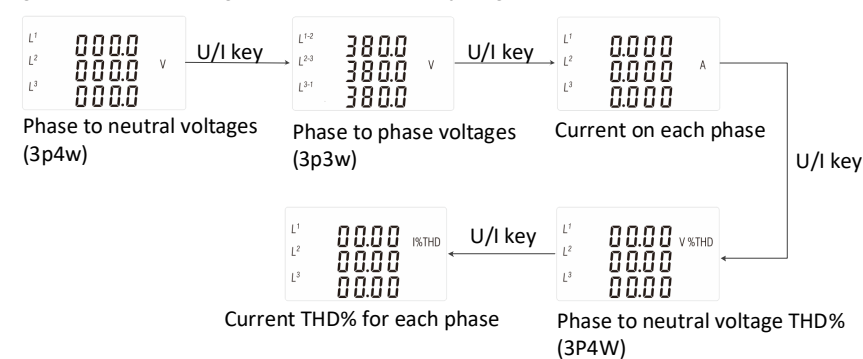
6.2.2 Hz/PF MD

Frequency, Power Factor and Maximum Demand display pages.

To scroll through the displayed pages, press Hz/PF MD key.

Figure 6-3   Frequency, Power Factor and Maximum Demand display pages
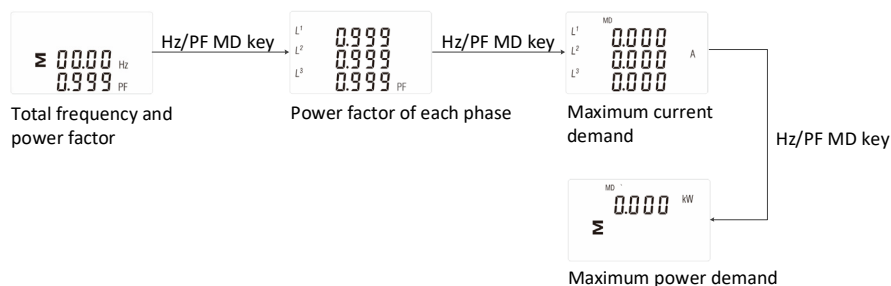
6.2.3 P

Power display pages.

To scroll through the displayed pages, press P key.

Figure 6-4   Power display pages

6.2.4 E

Energy display pages.

To scroll through the displayed pages, press E key.

Figure 6-5   Energy display pages

6.3 Communication

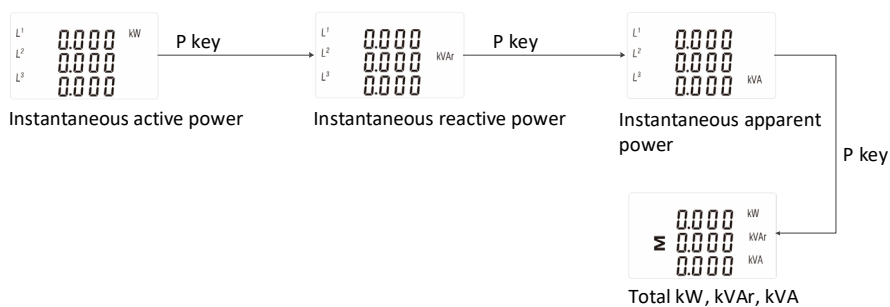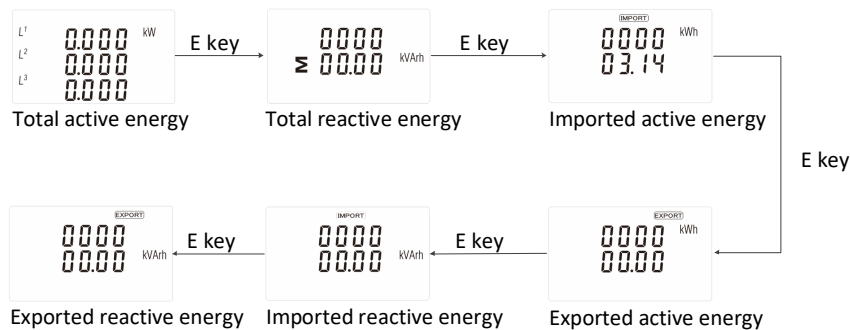The RS-485 interface is used for the local remote readout with the Modbus/RTU protocol. During this process, the measuring device is the server and the PC or controller is the client. Connect a terminal resistance RT=120Ω (0.25W min.) at the start and end of the network. The maximum length for transmission is 1000m at a speed of 2400 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	2400 bps, 4800 bps, 9600 bps, 19200 bps, 38400 bps	9600 bps
Parity	None, even, odd	None
Stop bit	1, 2	1

Figure 6-6   Modbus/RTU network
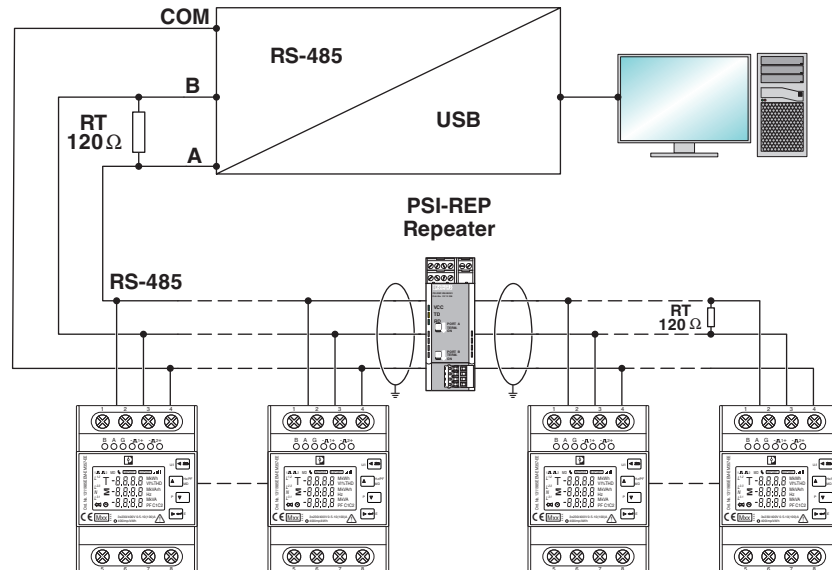
6.4 Outputs

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 kVArh.

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

dFt = 0.0025 kWh/kVArh (default)

0.01 = 0.01 kWh/kVArh

0.1 = 0.1 kWh/kVArh

1 = 1 kWh/kVArh

10 = 10 kWh/kVArh

100 = 100 kWh/kVArh

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

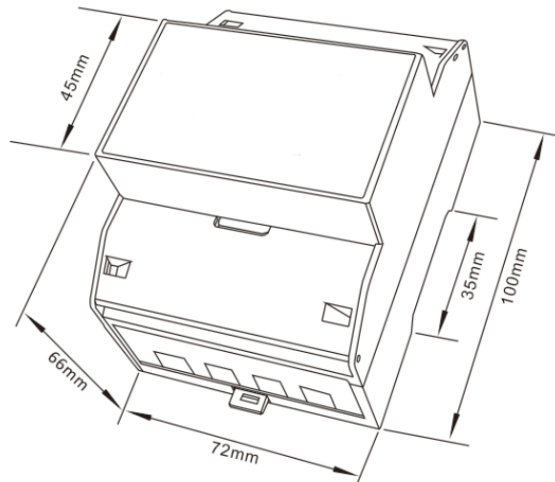Pulse output 2 is non-configurable. It is fixed at total kWh. The constant is 400imp/kWh. Its width is fixed at 100ms.

7 Technical data

7.1 Dimensions

Figure 7-1 Dimensions

7.2   Technical data

Measuring input data	
Voltage U_N	3x230/400V AC
Input voltage range	173...480 V AC (Ph/Ph)
	100...276 V AC (Ph/N)
Power consumption	10 VA (2 W)
Frequency	45...65 Hz
Auxiliary voltage	Device is supplied by the measuring circuit
Starting current I_{st}	0.04 A
Minimum current I_{min}	0.5 A
Transient current I_{tr}	1 A
Nominal current I_{ref}	10 A
Maximum current I_{max}	100 A
Measurement connection data	
Measurement connection	4...25 mm^2 (2.5 Nm)
Other connections	0.5...1.5 mm^2 (0.2 Nm)
Electric strength as per EN 50470-1	1.2 µs/50 µs at 6 kV
Electric strength as per EN 50470-3, 7.2	4 kV for 1 minute
Ambient conditions	
Mechanical environment	M1
Electromagnetic environment	E2
Operation temperature	-40 ℃...70 ℃
Storage temperature	-40 ℃...70 ℃
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
Safety	
Pollution degree	2
Protection class as per EN 50470-1	II
Flame resistance-housing	UL94 V0

Accuracy		
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	
Housing		
Standard	DIN 43880	
Metrological LED		
	Pulse output 1	Pulse output 2
Meter constant	Configurable	400 imp/kWh
Communication		
Standard	RS 485	
Protocol	Modbus/RTU	
Speed	2400...38400 bps	
Parameters	Address, speed, parity, stop	
Outputs		
	Pulse output 1	Pulse output 2
Meter constant	Configurable	400 imp/kWh
Pulse width	Configurable	100 ms
Type	Passive opto-isolated	
Maximum voltage	27 V DC	
Maximum current	27 mA DC	

7.3   MID data

Accuracy	Class B (EN 50470-3)
Voltage U_N	3x230/400 V
Rated frequency f_N	50 Hz
Cosine φ	0.5 inductive...0.8 capacitive
Starting current I_{st}	0.04 A
Minimum current I_{min}	0.5 A
Transient current I_{tr}	1 A
Nominal current I_{ref}	10 A
Maximum current I_{max}	100 A
Operation temperature	-40 ℃...70 ℃ (-40 ℉...158 ℉)
Relative humidity	≤90%, non-condensing
Electromagnetic ambient conditions	E2
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 except "reset"
	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 50 values in a single transaction. Therefore, the maximum number of registers requestable is 100. 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	3P4W	3P3W	1P2W
30001	0x0000	2	L1-N voltage	V	x	-	x
30003	0x0002	2	L2-N voltage	V	x	-	-
30005	0x0004	2	L3-N voltage	V	x	-	-
30007	0x0006	2	Phase 1 current	A	x	x	x
30009	0x0008	2	Phase 2 current	A	x	x	-
30011	0x000A	2	Phase 3 current	A	x	x	-
30013	0x000C	2	Phase 1 active power	W	x	-	x
30015	0x000E	2	Phase 2 active power	W	x	-	x
30017	0x0010	2	Phase 3 active power	W	x	-	-
30019	0x0012	2	Phase 1 apparent power	VA	x	-	x
30021	0x0014	2	Phase 2 apparent power	VA	x	-	-
30023	0x0016	2	Phase 3 apparent power	VA	x	-	-
30025	0x0018	2	Phase 1 reactive power	VAr	x	-	x
30027	0x001A	2	Phase 2 reactive power	VAr	x	-	-
30029	0x001C	2	Phase 3 reactive power	VAr	x	-	-
30031	0x001E	2	Phase 1 power factor*1	None	x	-	x
30033	0x0020	2	Phase 2 power factor*1	None	x	-	-
30035	0x0022	2	Phase 3 power factor*1	None	x	-	-
30037	0x0024	2	Phase 1 phase angle	Degrees	x	-	x
30039	0x0026	2	Phase 2 phase angle	Degrees	x	-	-
30041	0x0028	2	Phase 3 phase angle	Degrees	x	-	-
30043	0x002A	2	Avg. L-N voltage	V	x	-	-
30047	0x002E	2	Avg. current	A	x	x	x
30049	0x0030	2	Sum of currents	A	x	x	x
30053	0x0034	2	Total system active power	W	x	x	x
30057	0x0038	2	Total system apparent power	VA	x	x	x

30061	0x003C	2	Total system reactive power	VAr	x	x	x
30063	0x003E	2	Total system power factor*1	None	x	x	x
30067	0x0042	2	Total system phase angel	Degrees	x	x	x
30071	0x0046	2	Frequency of supply	Hz	x	x	x
30073	0x0048	2	Total import active energy	kWh	x	x	x
30075	0x004A	2	Total export active energy	kWh	x	x	x
30077	0x004C	2	Total import reactive energy	kVArh	x	x	x
30079	0x004E	2	Total export reactive energy	kVArh	x	x	x
30081	0x0050	2	Total apparent energy	kVAh	x	x	x
30083	0x0052	2	Ah	Ah	x	x	x
30085	0x0054	2	Total system active power demand*2	W	x	x	x
30087	0x0056	2	Max. total system active power demand*2	W	x	x	x
30101	0x0064	2	Total system apparent power demand	VA	x	x	x
30103	0x0066	2	Max. total system apparent power demand	VA	x	x	x
30105	0x0068	2	Neutral current demand	A	x	-	-
30107	0x006A	2	Max. neutral current demand	A	x	-	-
30201	0x00C8	2	L1-2 voltage	V	x	x	-
30203	0x00CA	2	L2-3 voltage	V	x	x	-
30205	0x00CC	2	L3-1 voltage	V	x	x	-
30207	0x00CE	2	Avg. L-L voltage	V	x	x	-
30225	0x00E0	2	Neutral current	A	x	-	-
30235	0x00EA	2	L1/N voltage THD	%	x	-	x
30237	0x00EC	2	L2/N voltage THD	%	x	-	-
30239	0x00EE	2	L3/N voltage THD	%	x	-	-
30241	0x00F0	2	Phase 1 current THD	%	x	x	x
30243	0x00F2	2	Phase 2 current THD	%	x	x	-
30245	0x00F4	2	Phase 3 current THD	%	x	x	-
30249	0x00F8	2	Avg. L-L voltage THD	%	x	-	x
30251	0x00FA	2	Avg. current THD	%	x	x	x
30259	0x0102	2	Phase 1 current demand	A	x	x	x

30261	0x0104	2	Phase 2 current demand	A	x	x	-
30263	0x0106	2	Phase 3 current demand	A	x	x	-
30265	0x0108	2	Max. phase 1 current demand	A	x	x	x
30267	0x010A	2	Max. phase 2 current demand	A	x	x	-
30269	0x010C	2	Max. phase 3 current demand	A	x	x	-
30335	0x014E	2	L1-2 voltage THD	%	x	x	-
30337	0x0150	2	L2-3 voltage THD	%	x	x	-
30339	0x0152	2	L3-1 voltage THD	%	x	x	-
30341	0x0154	2	Avg. L-L voltage THD	%	x	x	-
30343	0x0156	2	Total kWh*3	kWh	x	x	x
30345	0x0158	2	Total kVArh*3	kVArh	x	x	x
30347	0x015a	2	L1 import kWh	kWh	x	x	x
30349	0x015c	2	L2 import kWh	kWh	x	x	x
30351	0x015e	2	L3 import kWh	kWh	x	x	x
30353	0x0160	2	L1 export kWh	kWh	x	x	x
30355	0x0162	2	L2 export kWh	kWh	x	x	x
30357	0x0164	2	L3 export kWh	kWh	x	x	x
30359	0x0166	2	L1 total kWh*3	kWh	x	x	x
30361	0x0168	2	L2 total kWh*3	kWh	x	x	x
30363	0x016a	2	L3 total kWh*3	kWh	x	x	x
30365	0x016c	2	L1 import kVArh	kVArh	x	x	x
30367	0x016e	2	L2 import kVArh	kVArh	x	x	x
30369	0x0170	2	L3 import kVArh	kVArh	x	x	x
30371	0x0172	2	L1 export kVArh	kVArh	x	x	x
30373	0x0174	2	L2 export kVArh	kVArh	x	x	x
30375	0x0176	2	L3 export kVArh	kVArh	x	x	x
30377	0x0178	2	L1 total kVArh*3	kVArh	x	x	x
30379	0x017a	2	L2 total kVArh*3	kVArh	x	x	x
30381	0x017c	2	L3 total kVArh*3	kVArh	x	x	x

Notes:

1 *1. The power factor has its sign adjusted to indicate the direction of the current. Positive refers to forward current, negative refers to reverse current.

2 *2. The power sum demand calculation is for import – export.

3 *3. Total kWh / kVArh equals to Import + export.

8.2   Device information and configuration

Table 8-3   Device information and configuration

Decimal start address	Hexadecimal start address	Functions
40003	0x0002	03/16

Decimal address	Hexadecimal address	Number of registers	Description	Type	Data type
40003	0x0002	2	Demand period 0, 5, 8, 10, 15, 20, 30, 60 mins Default 60 mins	r/w	Float
40011	0x000A	2	System type 1=1P2W 2=3P3W 3=3P4W Default 3	r/w	Float
40013	0x000C	2	Pulse 1 width 60, 100, 200 ms Default 100 ms	r/w	Float
40015	0x000E	2	Password lock 0=locked 1=unlocked If there is no operation for 1 minute after password is unlocked, the password will be locked again.	ro	Float
40019	0x0012	2	Network parity stop 0=1 stop bit, no parity 1=1 stop bit and even parity 2=1 stop bit and odd parity 3=2 stop bits an no parity Default 0	r/w	Float
40021	0x0014	2	Meter ID 1...247 Default 1	r/w	Float

40023	0x0016	2	Pulse output 1	r/w	Float
			0=0.0025 kWh/kVArh		
			1=0.01 kWh/kVArh		
			2=0.1 kWh/kVArh		
			3=1 kWh/kVArh		
			4=10 kWh/kVArh		
			5=100 kWh/kVArh		
			Default 0		
40025	0x0018	2	Password confirmation	r/w	Float
			0000...9999		
			Default 1000		
40029	0x001C	2	Baud rate	r/w	Float
			0=2400 bps		
			1=4800 bps		
			2=9600 bps		
			3=19200 bps		
			4=38400 bps		
			Default 2		
40087	0x0056	2	Pulse output 1 energy type	r/w	Float
			1: import active energy		
			2: total active energy		
			4: export active energy		
			5: import reactive energy		
			6: total reactive energy		
			8: export reactive energy		
			Default 4		
461457	0xF010	1	Reset	wo	Hex
			00 00: reset the maximum demand		
464513	0xFC00	2	Serial number	ro	UInt32

A   Appendixes

A 1   List of figures

A 2   List of tables

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