

LE-01MQ

Electric energy meter

1-phase

Bidirectional with network parameters analysis



User manual
v. 4.4 (170203)

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1. Purpose

LE-01MQ is a static (electronic), calibrated electricity meter of single-phase alternating current in direct system. It is used for reading and recording of imported electricity and parameters of the power supply with the ability of remote reading through a wired RS-485 network. Configuration of the meter is done through the configuration menu accessible from the front panel and through the communication port according to the software features of the Modbus RTU.

2. Unit characteristics

2.1. Measured value

The unit can measure and display:

- ✓ voltage
- ✓ frequency
- ✓ current
- ✓ power, maximum power demand and power factor
- ✓ active energy imported and exported
- ✓ reactive energy imported and exported

2.2. Modbus RTU protocole and RS-485 communication port

Meter has a RS-485 port with support for Modbus RTU protocol.

The RS-485 communication port allows you to combine the counters in the remote reading network.

2.3. Pulse output

The meter has two pulse outputs for mapping the counting of active and reactive energy.

Output 1 - terminals 6/5 - programmable, can be set to work for active or reactive energy and parameters: impulsing and pulse length.

Output 2 - terminals 4/5 - for active energy, impulsing is 1000 pulse/kWh.

3. Operator panel

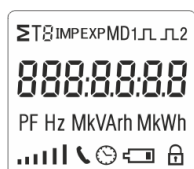
3.1. LCD description



No.	Description
1	7 digits used to display measured values or RTC
2	Total value
3	Tariff information
4	Energy: imported / exported
5	Maximum power or current demand
6	Pulse outputs 1 and pulse outputs 2
7	Measurement units
8	PF - power factor
9	Power indicator
10	Communication indicator
11	Low battery warning
12	Lock symbol

3.2. Start-up screen

After turning on the power, the meter performed a series of automatic indications:



All display segments light up, display check.



Software version (please check the real software version on the product as the final).



Modbus address



Baud rate



Total kWh

3.3. Buttons features

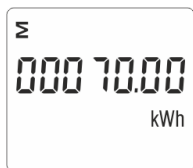


- toggles between subsequent meter indications and meter configuration menu items
- entering digits 0-9
- long press to exit the settings menu and proceed to indications of the meter
- long press in the indications panel to enter the settings menu

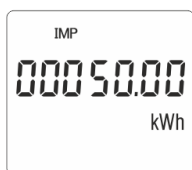


- short press in the indications panel toggles on/off the Modbus communication lock  for configuration parameters
- short press in the settings menu to switch to the next digit of the configured parameter
- long press in the settings menu to enter the setting of a given parameter and to accept it

3.4. Meter indication



Total active energy [kWh]



Import (input) active energy [kWh]



Export (output) active energy [kWh]



Total reactive energy [kVarh]



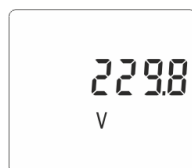
Import reactive energy [kVarh]



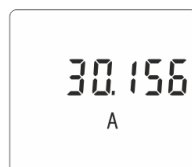
Export reactive energy [kVarh]



Max power demand



Voltage



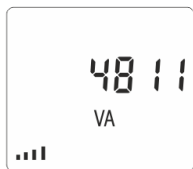
Current



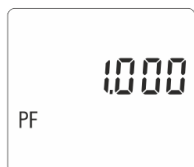
Active power [W]



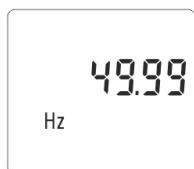
Reactive power [Var]



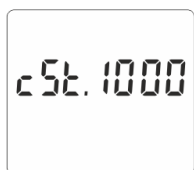
Apparent power [VA]



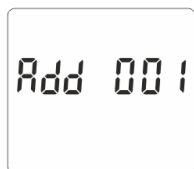
Power factor



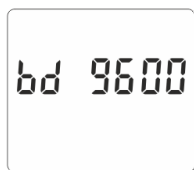
Frequency



Pulse 2 constant



Modbus address

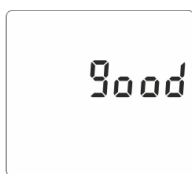


Baud rate

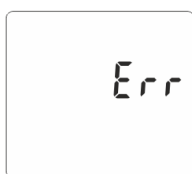
4. Setup

4.1. Setup entry methods

Some menu items, such as password, require a four-digit number entry while others, such as supply system, require selection from a number of menu options. After confirming the settings the meter confirms the adoption of a new parameter by displaying for a moment the word "good".



The error is signaled by the word "Err".



4.2. Number entry procedure

When setting up the unit, some screens require the entering of a number. In particular, on entry to the setting up section, a password must be entered. Digits are set individually, from left to right.

The procedure is as follows:

1. The current digit to be set flashes and is set using the  button.
2. Press  button, to confirm each digit setting.
3. After setting the last digit, press  button, to exit the numer setting routine press  button.

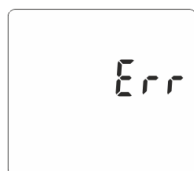
4.3. Configuration menu

To enter setup mode, pressing the  button for 2 seconds, until the password screen appears.



Setting up is password-protected so you must enter the correct password (default "1000") before processing

Press the  button for 2 seconds.



If an incorrect password is entered, the display will show:

PASS Err

To exit setting-up mode, press  button repeatedly until the measurement screen is restored.

4.3.1. RS-485 communication

Setting the communication port parameters.

Add 001

Address: Modbus ID

Default: 001

Range: 001÷247

bd 9600

Baud rate

Default value: 2400 kbps;

Values: 1200, 2400, 4800, 9600 kbps

Prty n

Parity

Default: NONE

Options: NONE, ODD, EVEN.

4.3.2. Pulse output

Pulse output 1 configuration

PLS out
kWh

Energy type

Default: kWh

Option: kWh / kWh / kVarh / Imp. kWh / Exp. kWh / Imp.kVarh / Exp.kVarh

PLS cst

Pulse constant

Default: 1000 pulse

Option: 1000 / 100 / 10 / 1 pulse

PLS t

Pulse time

Default: 100 msec

Option: 200 / 100 / 60 msec

4.3.3. DIT - Demand Integration Time



Default: 15 minutes

Options: OFF (0) / 5 / 10 / 15 / 30 / 60 minutes

4.3.4. Automatic scrolling parameters indication



Default: 0 sec

Range: 0÷30 sec

Value 0 – No automatic scrolling

4.3.5. Password changing



Default: 1000

Range: 0000÷9999

5. Technical specification

5.1. Measuring system

1P2W – 1-phase 2-wire system (230V+N)

5.2. Measured parameters

Reference voltage:	230V AC
Frequency:	50 Hz
Base current I_b :	5A
Maximum current I_{max} :	100A
Minimum current measured	0.25A
I_{min} : Starting current:	0.4% of I_b/I_{ref}
Overload:	$30 \times I_{max}/10\text{msec}$
Voltage measuring range:	176÷276 V AC
AC surge voltage:	4 KV per 1 minute
Pulse surge voltage:	6 KV-1.2 μS
Power:	<2W/10VA

5.3. Terminal

Measuring inputs	16 mm ² screw terminals
Measuring outputs	1.5 mm ² screw terminals
RS-485 port	1.5 mm ² screw terminals

5.4. Accuracy

Measurement class	B
Voltage	0.5% of range maximum
Current	0.5% of nominal
Frequency	0.2% of mid-frequency
Power factor	1% of unity (0.01)
Active power (W)	±1% of range maximum
Reactive power (VAr)	±1% of range maximum
Apparent power (VA)	±1% of range maximum
Active energy (Wh)	±1% 1 IEC 62053-21
Reactive energy (VArh)	±1% of range maximum

5.5. Pulse outputs

Output type: OC (open collector); 27V DC/27 mA

Pulse:

Pulse output 1 is configurable: for kWh or kVAh.

Value set kWh/kVAh per 1 pulse:

1 = 1 kWh/kVAh

10 = 10 kWh/kVAh

100 = 100 kWh/kVAh

1000 = 1000 kWh/kVAh.

Pulse output 2 is non-configurable for kWh: 3200 pulse/kWh

Pulse width:

Output 1 - configurable: 200 / 100 / 60 msec

Output 2 - non-configurable: 200 msec

5.6. RS-485 output for Modbus RTU

Baud rate: 2400, 4800, 9600, 19200 (default), 38400 bps;

Parity: NONE - default / ODD / EVEN;

Stop bits: 1 / 2

Network address: 1÷247

5.7. Reference conditions of influence quantities

Influence quantities are variables that effect measurement errors to a minor degree.

Accuracy is verified under nominal value (within the specified tolerance) of these conditions.

Ambient temperature	23°C ±1°C
Input frequency	50 or 60 Hz ±2%
Input waveform	sinusoidal (distortion factor <0.005)
Auxiliary supply voltage	nominal ±1%
Auxiliary supply frequency	nominal ±1%
Auxiliary supply waveform (if AC)	sinusoidal (distortion factor <0.05)
Magnetic field of external origin	terrestrial flux

5.8. Environment

Operating temperature	-25÷55°C
Storage temperature	-40÷70°C
Relative humidity	0÷95%, without condensation
Installation category	CAT II
Mechanical environment	M1
Degree of pollution	E2

5.9. Structure

Mounting	on DIN rail
Cover	UI94 V-0 self-extinguishing material
Protection level	IP51 (inside)

5.10. Compliance and sealing

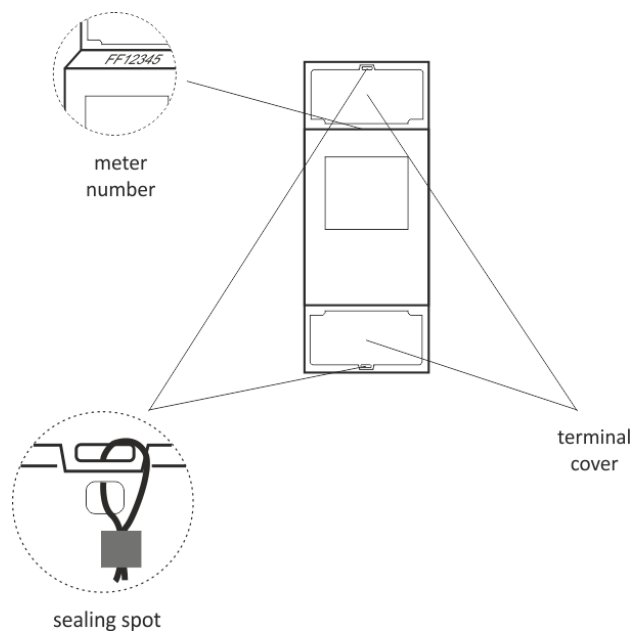
2004/22/EC Directive

Certificate number: 0120/SGS0214

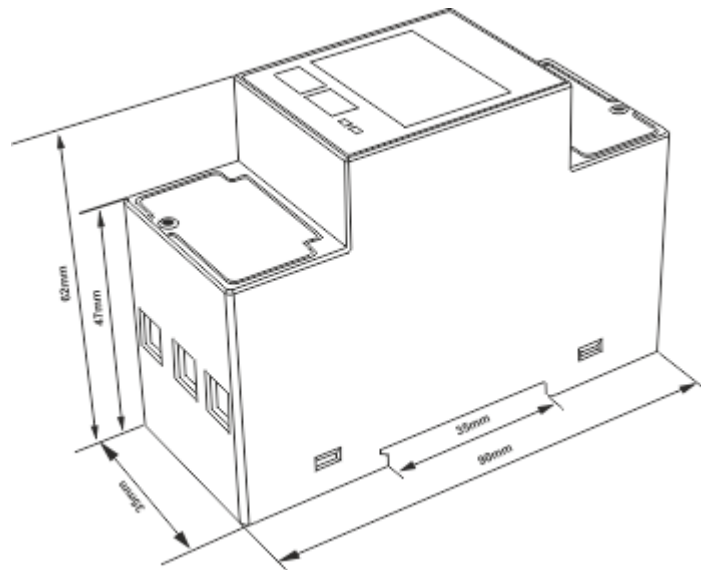
The meter is marked with individual serial number allowing its explicit identification.

The marking is laser engraved and cannot be removed.

The meter has sealable input and output terminal cover to prevent any attempts to bypass the meter.

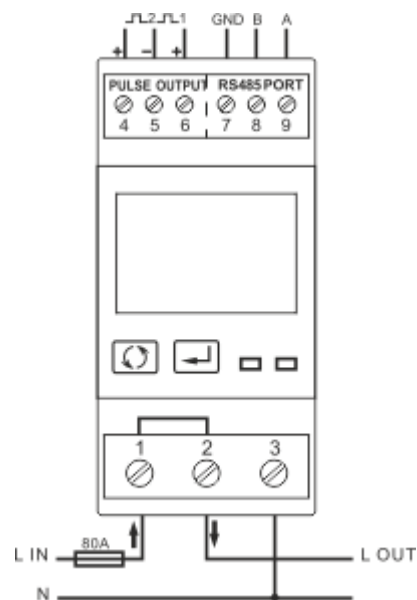


6. Dimensions



7. Wiring diagram

Single-phase 2-wire system



8. Modbus protocol registers

8.1. Input registers

Input registers are used to indicate the present values of the measured and calculated electrical quantities. Each parameter is held in two consecutive 16-bit register (FLOAT). The table below shows the map of registers available for function code 04. The "Measuring parameter" column indicates which parameter is available for the given measurement network configuration. Any parameter with a cross (X) will return the value zero. The meter can send up to 40 values in a single data exchange, therefore the maximum number of requested registers may be 80. Exceeding the 80 parameter limit will cause a Modbus Protocol exception code to be returned.

For example, to request:

Amps 1 Start address = 0006
 No. of registers = 0002
 Amps 2 Start address = 0008
 No. of registers = 0002

Each request for data must be restricted to 40 parameters or less. Exceeding the 40 parameter limit will cause a Modbus Protocol exception code to be returned.

Register addresss (Dec/Hex)	Measuring parameter	
	Description	Units
0 / 00	Phase voltage	V
6 / 06	Current strength	A
12 / DC	Active power	W
18 / 12	Apparent power	VA
24 / 18	Reactive power	Var
30 / 1E	Power factor	-
36 / 24	Phase angle	Degree
70 / 46	Frequency	Hz
72 / 48	Imported active energy	kWh

	Description	Units
74 / 4A	Exported active energy	kWh
76 / 4C	Imported reactive energy	kVarh
78 / 4E	Exported reactive energy	kVarh
86 / 56	Maximum total system power demand	W
342 / 156	Total active energy	kWh
344 / 158	Total reactive energy	kVarh

8.2. Setup registers

Holding registers are used to store and display instrument configuration settings. Each parameter is held in two consecutive 16-bit register (FLOAT). Any registers not listed in the table below should be considered as backup registers for the manufacturer's use and there should be no attempt to change their value. The table below shows the map of registers available for function code 03. Modbus Protocol Function Code 03 is used to read the parameter and Function Code 16 is used to write. Write to only one parameter per message. Write to only one parameter per message.

Register address (Dec/Hex)	Parameter	Description	Mode
12 / 0C	Output pulse length OC no. 1	Puls time: 60, 100 or 200msec (default 200).	r/w
63760 / F910	Pulse constant	0: 0.001 kWh (kVarh) /pulse (default) 1: 0.01 kWh (kVarh) /pulse 2: 0.1 kWh (kVarh) /pulse 3: 1kWh (kVarh) /pulse	r/w
18 / 12	Stop bits and parity	Write parity and stop bits: 0: stop bit 1, parity NONE (default). 1: stop bit 1 / parity EVEN. 2: stop bit 1 / parity ODD. 3: stop bit 2 / parity NONE. Requires a restart to become effective.	r/w
20 / 14	Device address	Write device address: 1÷247 (default 1). Requires a restart to become effective.	r/w
28 / 1C	Network baud rate	Write network baud rate for Modbus protocole [kbps], where: 0: 2400 (default) 1: 4800 2: 9600 3: 19200 4: 38400. Requires a restart to become effective.	r/w
63776 / F920	Mode of calculation of the total active energy value (total)	1: total = import kWh 002: total = import kWh + export kWh 3: total = import kWh - export kWh	r/w
63792 / F930	Operating mode of the LED indicators of the pulse outputs	0: indication of imported energy consumption (1) and exported (2) - both LED flashes (default) 1: indication of imported energy consumption (1) - LED flashes 2: indication of exported energy consumption (2) - LED 2 flashes	r/w

9. Manufacturer's warranty

1. The product is covered by 24 month warranty from the date of purchase.
2. The warranty is valid only with a proof of purchase.
3. The notification of the complaint must be made at the place of purchase or directly at the manufacturer:
(phone: +48 (42) 227 09 71; e-mail: reklamacje@fif.com.pl)
4. During the warranty period in the case of a justified complaint the manufacturer commits in accordance with the provisions of the consumer rights to repair the product, replace it with a new one or refund.
5. The complaint will be processed within 14 days from the date of delivering the product to the service point.
6. Warranty does not cover:
 - mechanical and chemical damages;
 - damages resulting from improper use or from the use inconsistent with the user manual;
 - damages incurred after the sale as a result of accidents or other events for which nor the producer, nor the place of sale are responsible, for example damages in transit, etc.
7. Warranty does not cover actions that user should perform in accordance with the user manual, for example installing multi-meter, building electrical installation, installing other required electrical protection, checking, etc.

Warning!

Do not make any changes in the device by yourself. This may cause damage or improper operation of the device, which can lead to damage to the controlled device and may pose a danger to the operators. In such cases, the manufacturer is not liable for consequential events and may refuse the guarantee in case of complaint.