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LE-01MQ

Electric energy meter

1-phase

Bidirectional with network parameters analysis



User manual

v. 4.4 (170203)



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CONTENTS

| | |
|--|-----------|
| 1. PURPOSE..... | 4 |
| 2. UNIT CHARACTERISTIC | 4 |
| 2.1. Measured values..... | 4 |
| 2.2. RS-485 communication port and Modbus RTU protocole | 4 |
| 2.3. Pulse output..... | 4 |
| 3. OPERATOR PANEL | 5 |
| 3.1. LCD description | 5 |
| 3.2. Start-up screen | 5 |
| 3.3. Buttons features..... | 6 |
| 3.4. Meter indication..... | 6 |
| 4. SETUP..... | 8 |
| 4.1. Setup entry methods | 8 |
| 4.2. Number entry procedure | 9 |
| 4.3. Configuration menu | 9 |
| 4.3.1. RS-485 communication | 10 |
| 4.3.2. Pulse output | 10 |
| 4.3.3. DIT - Demand Integration Time | 11 |
| 4.3.4. Automatic scrolling parameters indication..... | 11 |
| 4.3.5. Password changing | 11 |
| 5. TECHNICAL SPECIFICATION | 12 |
| 5.1. Measuring system | 12 |
| 5.2. Measured parameters | 12 |
| 5.3. Terminal | 12 |
| 5.4. Accuracy | 12 |
| 5.5. Pulse outputs..... | 13 |
| 5.6. RS-485 output for Modbus RTU | 13 |

| | |
|--|-----------|
| 5.7. Reference conditions of influence quantities | 13 |
| 5.8. Environment | 14 |
| 5.9. Structure..... | 14 |
| 5.10. Compliance and sealing | 14 |
| 6. DIMENSIONS | 15 |
| 7. WIRING DIAGRAM | 15 |
| 8. MODBU PROTOCOLE | 16 |
| 8.1. Measurement registers | 16 |
| 8.2. Configuration registers | 17 |
| 9. MANUFACTURER'S WARRANTY..... | 19 |

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: impulsion and pulse length.

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

3. Operator panel

3.1. LCD description



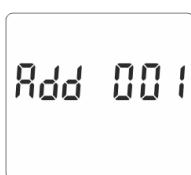
| No. | Description |
|-----|---|
| 1 | 7 digits used to display measured values or RTC |
| 2 | Total value |
| 3 | Tariff information |
| 4 | Energy: imported / exported |
| 5 | Maximum power or current demand |
| 6 | Pulse outputs 1 and pulse outputs 2 |
| 7 | Measurement units |
| 8 | PF - power factor |
| 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:



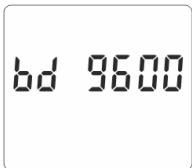
All display segments light up, display check.



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



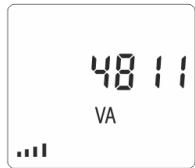
Current



Active power [W]



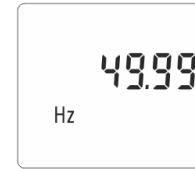
Reactive power [Var]



Apparent power [VA]



Power factor



Frequency



Pulse 2 constant



Modbus address

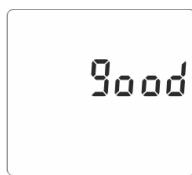


Baud rate

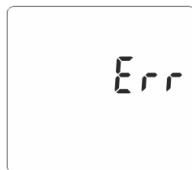
4. Setup

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.



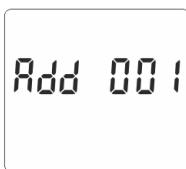
If an incorrect password is entered, the display will show:

PASS Err

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

4.3.1. RS-485 communication

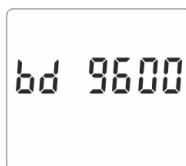
Setting the communication port parameters.



Address: Modbus ID

Default: 001

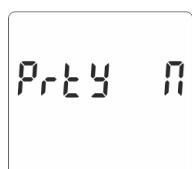
Range: 001÷247



Baud rate

Default value: 2400 kbps;

Values: 1200, 2400, 4800, 9600 kbps



Parity

Default: NONE

Options: NONE, ODD, EVEN.

4.3.2. Pulse output

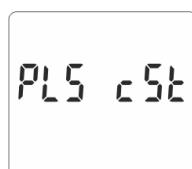
Pulse output 1 configuration



Energy type

Default: kWh

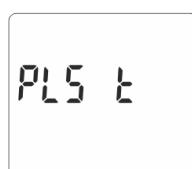
Option: kWh / kWh / kVarh / Imp. kWh / Exp. kWh / Imp.kVarh / Exp.kVarh



Pulse constant

Default: 1000 pulse

Option: 1000 / 100 / 10 / 1 pulse



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 Ib: | 5A |
| Maximum current I _{max} : | 100A |
| Minimum current measured | 0.25A |
| I _{min} : Starting current: | 0.4% of Ib/I _{ref} |
| Overload: | 30×I _{max} /10msec |
| Voltage measuring range: | 176÷276 V AC |
| AC surge voltage: | 4 KV per 1 minute |
| Pulse surge voltage: | 6 KV-1.2 uS |
| 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 kVArh.

Value set kWh/kVArh per 1 pulse:

1 = 1 kWh/kVArh

10 = 10 kWh/kVArh

100 = 100 kWh/kVArh

1000 = 1000 kWh/kVArh.

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 | $23^{\circ}\text{C} \pm 1^{\circ}\text{C}$ |
| Input frequency | 50 or 60 Hz $\pm 2\%$ |
| Input waveform | sinusoidal (distortion factor <0.005) |
| Auxiliary supply voltage | nominal $\pm 1\%$ |
| Auxiliary supply frequency | nominal $\pm 1\%$ |
| 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

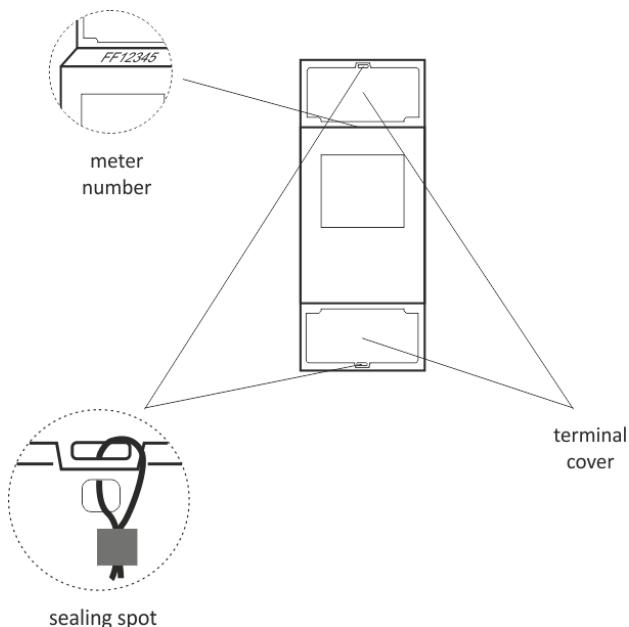
2004/22/EC Directive

Certificate number: 0120/SGS0214

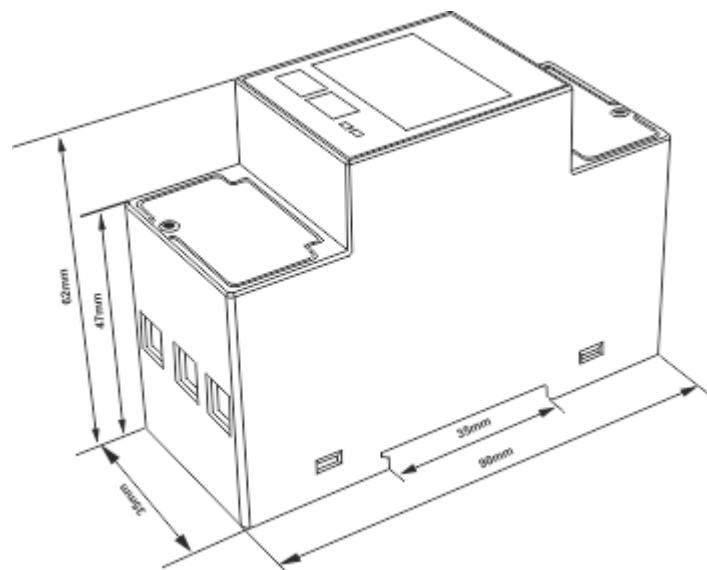
The meter is marked with individual serial numer allowing its explicit identification.

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.

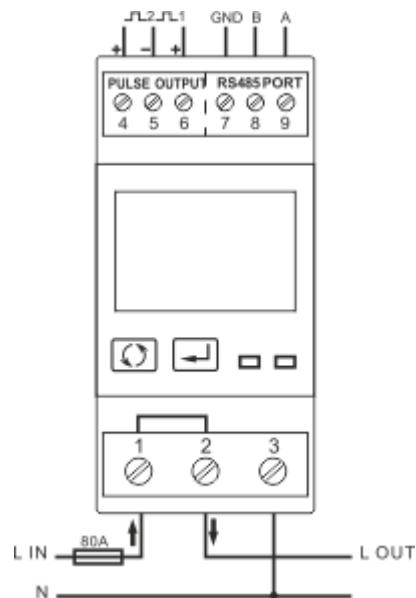


6. Dimensions



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 address (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.