This operational manual is designed to study the CE101 single-phase single-tariff active electric energy meter (hereinafter, the meter), and contains a description of its operation principle, as well as information necessary for its correct operation.

Only persons who have received special training for working with voltages up to 1,000 V and who have studied this operational manual are allowed to work with the meter.

1 SAFETY REQUIREMENTS

1.1 In terms of operational safety, the meter meets the safety requirements of GOST 22261-94 and GOST R 51350-99.

1.2 In terms of human protection against electric shock, the meter complies with class II as per GOST R 51350-99.

1.3 Insulation resistance between the case and the electric circuits is at least 20 MΩ under conditions of par. 2.1.4, and 7 MΩ at an ambient air temperature of (40 ± 2) °C and a relative air humidity of 93 %.

1.4 The meter must be mounted and operated in accordance with the applicable rules for technical operation of electric installations.

2 DESCRIPTION OF THE METER AND ITS OPERATION PRINCIPLE

2.1 Application

2.1.1 The meter is direct connected and designed for single-tariff active electric energy metering in single-phase AC circuits.

2.1.2 The meter meets the requirements of GOST 31819.21-2012, GOST 31818.11-2012.

Meter designation structure

CE 101 XX XXX X XX

- **Additional modifications:**
  Z2 - IP54.
- **Readout unit type:**
  M6 – six-digit mechanical;
  M7 – seven-digit mechanical;
  – LCD.
- **Base (maximum) current:**
  5 – 5 (60) A;
  8 – 10 (100) A.
- **Nominal voltage:**
  4 – 230 V.
- **Accuracy class according to GOST 31819.21-2012:**
  1 – 1;
  2 – 2.
- **Case type:**
  S6 - for mounting in a switchboard and on a DIN rail;
  R5 - for mounting on a DIN-rail.

2.1.4 The meter is connected to an AC network and is installed at locations that have additional protection against environmental influences (rooms, racks, cabinets, switchboards), with the following operating conditions:

- ambient air temperature: minus 40 to plus 70 °C (for meters with a mechanical counting mechanism);
- ambient air temperature: minus 30 to plus 70 °C (for meters with an electronic counting mechanism);
- relative ambient air humidity: 30 to 98 %;
- atmospheric pressure: 70 to 106.7 kPa (537 – 800 mm Hg);
- measuring network frequency: (50 ± 2.5) or (60 ± 3) Hz;
- measuring network voltage waveform: sinusoidal with a nonsinusoidal factor of not more than 12 %.

***Attention! When using the meters along with a powerful non-linear load that can degrade the power quality (for example, an electric drive with a frequency converter), special filtering devices should be used. Otherwise, overheating and failure of the meter are possible. Failure of the meters due to poor power quality is not a warranty case. The manufacturer is not responsible for damage to the consumer's property resulting from violation of operating conditions described in this operational manual, including due to poor power quality.**

2.1.5 The installation dimensions of the meter comply with DIN EN50022-35 for installation on a DIN rail.

2.1.6 Possible modifications of the meter are indicated in Table 1.

Table 1

Meter designation	Accuracy class	Base - maximum current, A	Voltage, V	Position of the decimal point
CE 101S6 145 M6 (M7)	1	5 – 60	230	...000.0
CE 101 S6 148 M6 (M7)	1	10 – 100	230	...000.0
CE 101 R5 145 M6 (M7)	1	5 – 60	230	...000.0
CE 101 R5 148 M6 (M7)	1	10 – 100	230	...000.0
CE 101 S6 145	1	5 – 60	230	...00.00
CE 101 S6 148	1	10 – 100	230	...00.00
CE 101 R5 145	1	5 – 60	230	...00.00
CE 101 R5 148	1	10 – 100	230	...00.00

2.2 Specifications

2.2.1 Accuracy class of the meter is 1 according to GOST 31819.21-2012;

2.2.2 The maximum current is 60 A or 100 A.

2.2.3 Apparent (active) power consumed by the voltage circuit of the meter, at a nominal voltage, normal temperature, and nominal frequency is not more than 9 V·A (0.8 W).

2.2.4 Apparent power consumed by the current circuit does not exceed 0.1 V·A at a base current, normal temperature, and nominal frequency.

2.2.5 The meter has a counting mechanism that measures electric energy directly in kilowatt-hours and displays it to the left from the decimal point with tenths or hundredths of a kilowatt-hour to the right from the decimal point.

2.2.6 The meter constant is 3,200 or 2,000 imp./(kW•h), for meters with a base current of 5 A and 1,600 imp./(kW•h) for meters with a base current of 10 A.

2.2.7 Initial start. The meter functions normally not later than 5 s after the nominal voltage is applied to the meter terminals.

2.2.8 At an open current circuit and voltage equal to 1.15 of the nominal value, the test output device of the meter does not generate more than one impulse over a period of Δt, min, calculated using the following formula:

$$\Delta t \geq \frac{R \cdot 10^6}{k \cdot Unom \cdot Imax}$$

where R is a coefficient equal to 600 for a meter of accuracy class 1, k is the meter constant, imp./(kW·h),

U_{nom} is the nominal voltage, V,

I_{max} is the maximum current, A.

2.2.9 Starting current. The meter with a base current of 5 A turns on and continues to record the readings at a current of 0.01 A. The meter with a base current of 10 A turns on and continues to record the readings at a current of 0.02 A.

2.2.10 The limits of permissible values of the basic error δ_D, in percent, are indicated in Table 1. The limit of permissible value of the additional error at a voltage below 0.75 U_{nom} does not exceed plus 10 minus 100%.

Table 2

Current	Power factor	Error limits, %
$0.05\ I_b \leq I < 0.10\ I_b$	1.0	±1.5
$0.10\ I_b \leq I \leq I_{max}$		±1.0
$0.10\ I_b \leq I < 0.20\ I_b$	0.5 (ind.), 0.8 (cap.)	±1.5
$0.20\ I_b \leq I \leq I_{max}$	0.5 (ind.), 0.8 (cap.)	±1.0

2.2.11 Average time between failures: not less than 220,000 hours (set for the conditions of par. 2.1.4).

2.2.12 Average service life: 30 years.

2.2.13 Meter weight: not more than 0.6 kg.

2.2.14 General view of the meter is given in Annex A.

2.2.15 Overall dimensions of the case, max., mm:
S6: 183 x 115 x 53; R5: 110 x 89 x 72.5.

2.3. Design and Operation of the Device

2.3.1 The operation principle of the meter is based on the multiplication of input current and voltage signals using the sigma-delta modulation method with subsequent conversion of the signal into an impulse recurrence rate proportional to the input power. The summation of these impulses by the readout unit gives the amount of active energy. The meter also has a test output for connection to AMI systems or for verification.

2.3.2 The meter is designed to be enclosed in a plastic case. The case contains a printed circuit board, on which the entire meter circuit is located. A shunt connected to the terminals of the block is used as an input current sensor. The terminals for connecting the meter to the network and the test output are closed with a plastic cover.

2.3.3 The test output is implemented on a transistor with an "open" collector; for its operation, it is necessary to supply a DC supply voltage of 5 to 24 V. The value of nominal current passing through the test output contacts in the "closed" state is (10 ± 1) mA; the maximum allowable value is 30 mA.

2.3.4 The meter has LED indicators on the panel designed to display the operating modes: one or two indicators in the S6 cases and one indicator in the R5 case.

The meters in the S6 case can have three types of indication:

1) The "Power" LED turns on when there is voltage in the meter voltage circuit. When the load is connected, the "3200 (imp/kW•h)" ("1600 imp/(kW•h)") LED periodically turns on for (30...90) ms with a frequency directly proportional to the load current.

2) The "$P_{rev.}$" LED turns on at a reverse power. The "3200 (imp/kW•h)" ("1600 imp/(kW•h)") LED performs a double function: when there is voltage in the meter voltage circuit and there is no load, it is constantly lit, operating as an indicator of the presence of power; when the load is connected, it periodically turns off for (30...90) ms with a frequency directly proportional to the load current.

3) The "3200 (imp/kW•h)" ("1600 imp/(kW•h)") LED performs a double function: when there is voltage in the meter voltage circuit and there is no load, it is constantly lit, operating as an indicator of the presence of power; when the load is connected, it periodically turns off for (30...90) ms with a frequency directly proportional to the load current.

The meters in the R5 case can have two types of indication:

1) The "3200 (imp/kW•h)" ("1600 imp/(kW•h)") LED performs a double function: when there is voltage in the meter voltage circuit and there is no load, it is constantly lit with a reduced brightness, operating as an indicator of the presence of power; when the load is connected, it periodically turns on brightly for (30...90) ms with a frequency directly proportional to the load current.

2) The "3200 (imp/kW•h)" ("1600 imp/(kW•h)") LED performs a double function: when there is voltage in the meter voltage circuit and there is no load, it is constantly lit, operating as an indicator of the presence of power; when the load is connected, it periodically turns off for (30...90) ms with a frequency directly proportional to the load current.

3 PREPARATION AND OPERATION PROCEDURE

3.1 Unpacking

3.1.1 After unpacking, inspect the meter visually, verify that there is no mechanical damage, and check the presence of the seal (of the verification officer).

3.2 Installation procedure

3.2.1 The meter must be connected in accordance with the diagram shown on the terminal block cover or on the front panel of the device and in Annex B.

The meter should be installed on sites with conditions according to par. 2.1.4.

When installing the meter, the wire (cable) must be stripped of insulation by approximately 27 mm. The stripped part of the wire must be smooth, without bends. Loosen both screws of each terminal of the terminal block until you can insert the wire into the terminal. Insert the wire into the terminal without tilts. It is not allowed to insert a wire with insulation into the terminal, as well as to protrude the stripped area outside the block. First, tighten the top screw. Pull the wire lightly to make sure that it has been clamped. Then tighten the bottom screw. After several minutes, tighten the connection again.

The diameter of the wires connected to the meter is selected depending on the value of the maximum load current in accordance with the Requirements for Electric Installations (1÷8) mm.

ATTENTION! Loose tightening of the terminal block screws can cause the meter to fail and provoke a fire! The manufacturer does not accept claims in case of damage to the meter, as well as in the event of a fire as a result of a loose tightening of the screws.

3.2.2 Power up the meter. When the load is connected, the readings on the counting mechanism should change.

ATTENTION! The presence of readings on the counting mechanism is the result of the meter verification by the manufacturer and does not attest to its wear or operation.

After making sure that the meter operates normally, fix the terminal cover with a screw. Seal the meter by connecting the hole of the cover and the hole of the screw with a sealing wire and by attaching a seal.

4 DEVICE VERIFICATION

4.1 The meter is verified upon release from production, after repair and in operation in accordance with the document "CE101 Single-phase Single-tariff Active Electricity Meters. Verification Method INES.411152.082 D1" approved by the State Centre for Testing Measuring Instruments Federal State Unitary Enterprise "All-Russian Research Institute of Metrological Service".

5 MAINTENANCE

5.1 Maintenance of the meter at the installation site consists in systematic monitoring of its operation.

5.2 Periodic verification of the meter is carried out to the extent specified in section 4 of this operational manual once every 16 years or after a medium repair.

5.3. In case of negative verification results, the repair and adjustment of the meter is carried out by an organization authorized to repair the meter.

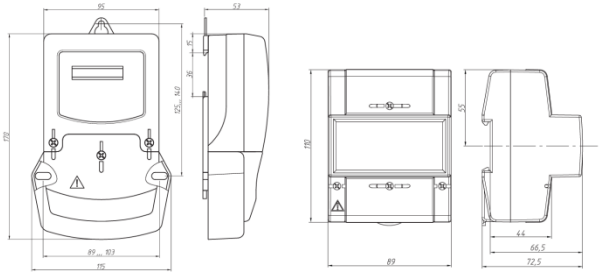
6 STORAGE AND TRANSPORTATION CONDITIONS

6.1 The meters are stored in the manufacturer's packaging at an ambient air temperature of 5 to 40 ˚C and a relative humidity of 80 % at a temperature of 25 ˚C.

6.2 The meters are transported in closed vehicles of any kind. Limiting transportation conditions:

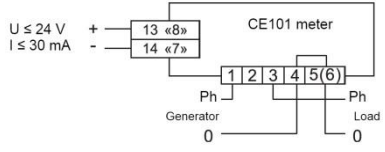
- ambient air temperature: minus 50 to 70 ˚C;
- relative humidity: 98 % at a temperature of 35 ˚C.

General view of the CE101 meter



(case type: S6) (case type: R5)

Annex B
(mandatory)
Marking of the CE101 meter connection diagram



Notes.

Pins "13" and "14" are used for meters with the case type S6, and "8" and "7" are used for case type R5.

The pins in the neutral circuit (4, 5 or 4, 6 depending on the case type) are connected on the terminal block.

Annex A (mandatory)

30.06.18

Rev. 5

Single-phase Single-tariff
Active Electric Energy Meter

CE101

case types: S6, R5

Operational Manual
INES.411152.082 OM

RCP 42 2861 5

Manufacturer:
JSC Electrotechnical Factories Energomera
415 Lenin str., Stavropol, Russia 355029
tel.: (8652) 35-75-27, fax: 56-66-90,
Free hotline: 8-800-200-75-27
e-mail: concern@energomera.ru
www.energomera.ru

Warranty service:
217 Gagarin street, Nevinnomyssk,
Stavropol Krai 357106

ENERGOMERA