

**SINGLE-PHASE  
MULTI-TARIFF  
ACTIVE ENERGY METER**

# CE102

Case type R5.1

CAHT.411152.165.1 PЭ  
Operation manual



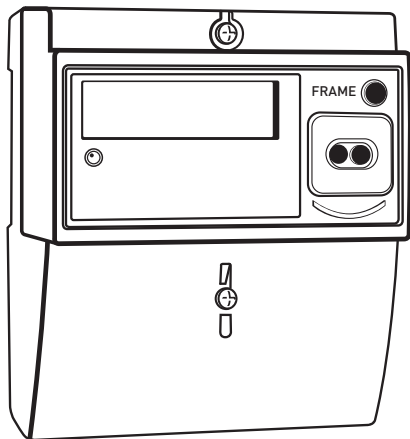
Russian National  
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**ENERGOMERA**





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This operation manual (hereinafter – ПЭ) contains description of meter functioning principle and information required to ensure the correct and safety operation of single-phase multi-tariff electricity meter CE102 (hereinafter – meter). Detailed technical parameters, information required to ensure the full use of its technical capabilities and maintenance is provided in the САHT.411152.165 РП (hereinafter – User Manual), which is located on the following Internet address [www.energomera.ru/ru/products/meters/ce102r5\\_1](http://www.energomera.ru/ru/products/meters/ce102r5_1).

Information about certificates, manufacturer warranties and factory settings is provided in the Technical passport ИHEC.411152.090 ФO (hereinafter – Technical passport).

Only persons who studied this operation manual are allowed to take meter readings.

## **1 SAFETY REQUIREMENTS**

1.1 By the requirements of operating safety, the meter meets the safety requirements in accordance with GOST 22261-94 and IEC 61010-1:2001.

1.2 By methods of person protection against electric shock, the meter corresponds to the class II IEC 61010-1:2001.

1.3 The meter installation and operation should be carried on according to the actual rules of electric installation technical operation.

## **2 APPLICATION AND OPERATING CONDITIONS**

Meter is designed for active energy measurement in single-phase AC circuits, multi-tariff metering organization and network parameters measurement.

The meter has communication interfaces and may be used both locally and in automated information and measuring system of commercial energy metering (AMR system) for measured or calculated parameters transmission to the electric energy control, metering and distribution dispatch center .

The meter is designed for installation inside buildings or in cabinets, which protects against environmental influences.

## **2.1 Functionality**

2.1.1 The meter has an electronic register and performs metering per four +1 (emergency) tariffs. The meter has an opportunity to program up to 16 tariff zones within a day (one daily schedule) in steps of one minute, individually per every day in a week in a seasonal program.

2.1.2 In a case of clock fault, error or absence of tariff schedule, the meter accumulates readings per «emergency tariff». «Emergency tariff» is 5 by default.

The meter archives consumed active energy values per (4+1) tariffs and in total:

- on a cumulative total (in total from zeroing);
- for the current and 12 previous months;
- at the end of the month for 12 months;
- for the current and 36 previous days;
- at the end of the day for 44 days.

2.1.3 Time of register readings changing complies with requirements of IEC 62053-21:2003, IEC 62052-11:2003.

2.1.4 Network parameters measurement

Meter measures mean square values of current and voltage, network frequency and active power.

2.1.5 Impulse output

The meter has an electric test output. Telemetric pulse frequency is proportional to consumed power. Meter constant is a number of pulses per kW•h, depends on meter modification and is shown on the front panel.

2.1.6 Meter logs

The meter keeps events/states logs, logs of parameters programming. The events are recorded in the logs with the time / date of their occurrence.

### 2.1.7 Display

The meter has a liquid-crystal display (LCD) for measured energy, measured values, current date and time and other parameters displaying and «FRAME» control button.

### 2.1.8 Communication interfaces

The meter has an optical port and EIA-485 interface (EIA-485 interface depends on meter modification).

Work with the meter through the communication interfaces can be performed using the technological software «AdminTools» (hereinafter – TS).

The meter provides the ability to read archival data and measured parameters via the communication interfaces, as well as to read / write the programmable parameters specified in the User Manual.

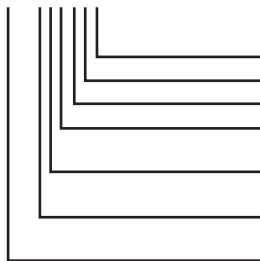
For information exchange via optical interface optical probe which meets GOST IEC 61107-2011 requirements is used.

Access to parameters and data via the communication interfaces is protected by a password.

### 2.1.9 Meter modifications

Meters modifications are specified by designation structure, given in the Figure 2.1.

**CE 102 R5.1 145 JAN**



**Interfaces and additional options:**

**N** – Interface external supply

**A** – EIA-485

**J** – optical port

**Base (max.) current:**

**5** – 5 (60)

**Nominal voltage:**

**4** – 230 V

**Accuracy class according to IEC 62053-21:2003:**

**1** – 1

**Case type:**

**R5.1** – for Din-rail mounting

Figure 2.1 – Designation structure

## **2.2 Operating conditions**

The meter is connected to a single-phase AC circuit and is designed for indoor mounting with following operating conditions:

- ambient temperature from  $-45$  to  $+70^{\circ}\text{C}$ ;
- relative humidity (30-98) %;
- atmospheric pressure 70 to 106,7 kPa (537-800 mm of mercury);
- measuring network frequency ( $50\pm 2,5$ ) Hz;
- measuring network current and voltage waveform – sinusoidal with non-sinusoidal ratio not more than 8 %.

## **2.3 Environmental conditions**

2.3.1 In terms of resistance to the climatic influence the meter belongs to group 4 according to GOST 22261-94, with expanded temperature and humidity range, meets T-design of category 3 according to GOST 15150-69.

2.3.2 The meter is protected against dust and water. The protection rate is IP51 according to GOST 14254-96.

2.3.3 The meter is resistant to single impacts and vibration according to GOST 31818.11-2012.

## **2.4 Specifications**

2.4.1 The meters meet the requirements of IEC 62052-11:2003 and IEC 62053-21:2003 in terms of active energy measuring.

2.4.2 The basic specifications are given in Table 2.1.



**Table 2.1**

<b>Name of characteristic</b>	<b>Item</b>	<b>Note</b>
Active energy accuracy class according to IEC 62053-21:2003	1	
Base (max.) current, A	5(60)	
Nominal phase voltage ( $U_{nom}$ ), V	230	
Operation phase voltage	from 0,75 to 1,15 $U_{nom}$	
Nominal network frequency, Hz	(50 ±2,5)	
Measuring network current and voltage non-sinusoidality ratio, %, not more than	5	
Threshold sensitivity, mA	10	
Apparent power consumed in current circuit, not more than V*A	0,1	
Apparent (active) power consumed in voltage circuit, not more than V*A (W)	10,0 (2,0)	Under the nominal voltage
Clock rate basic absolute error limit, sec/day	± 0,5	
Manual clock rate correction, sec	± 29	
Clock rate temperature complementary error limit, sec/°C·day	±0,15	From minus 10 to 45 °C
	±0,2	From minus 45 to 70 °C
Data storage without external supply voltage, years	30	

**Table 2.1**

<b>Name of characteristic</b>	<b>Item</b>	<b>Note</b>
Number of tariffs	Up to 4	+ 1 emergency
Number of seasonal programs	Up to 12	
Number of exceptional days	Up to 32	
Number of daily tariff programs	Up to 36	
Number of tariff areas per daily tariff program	Up to 12	
Storage depth of month consumption per tariff	Up to 13	
Storage depth of day consumption per tariff	Up to 44	
Nominal (permissible) voltage of electrical pulse outputs, not more than, V	10 (24)	DC voltage
Nominal (permissible) current of electrical pulse outputs, not more than, mA	10 (30)	DC voltage
Output pulse width, milliseconds	35	
Exchange rate via optical port and via EIA-485 interface, baud	9600	
Meter readings updating time, sec	1	
Initial start-up, not more than, sec	5	

**Table 2.1**

<b>Name of characteristic</b>	<b>Item</b>	<b>Note</b>
Meter weight, not more than, kg	0,5	
Average time before failure, h	220000	
Average service life, years	30	
Unauthorized access protection	password	

## **2.5 Meter design and operation**

2.5.1 Power metering principle is based on transformation of current and voltage input signals into digital signals and their digital multiplication with signal transformation into pulse recurrence frequency that is proportional to input power. These pulses summation by microcontroller gives consumed active power. Microcontroller performs connection between all scheme parts.

2.5.2 Meter design complies with the requirements of IEC 62052-11:2003 and the manufacturer design documentation. Meter is made in the plastic case.

The meter case generally consists of the top and bottom parts, fitting on perimeter, the transparent window and removable terminals cover. On the meter front panel are located: LCD display; LED indicator of active energy metering; optical port elements; «FRAME» button.

2.5.3 Terminals for meter connection to the network, interface lines, pulse outputs are closed by the plastic cover. Meter external view, image of the terminal plate and numbering of terminal is shown in the Figure 2.2.

Overall and mounting dimensions are given in ANNEX A.

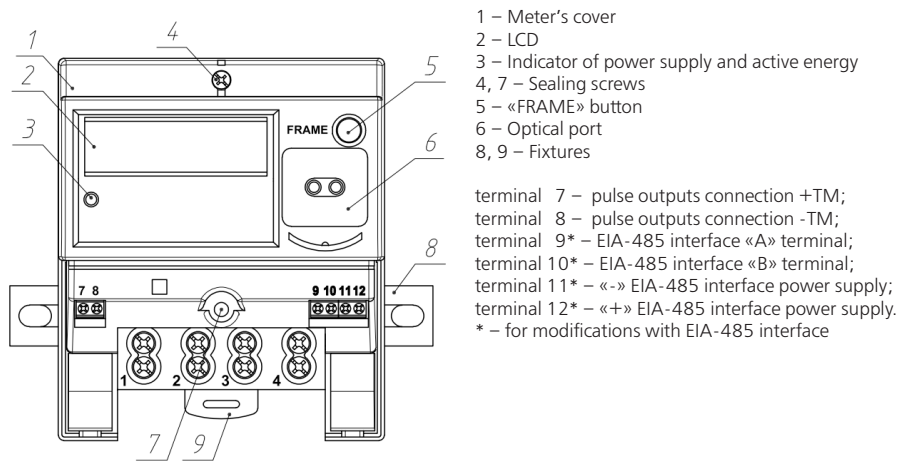


Figure 2.2 – External view and terminals numbering of CE102 R5.1

### 3 METER PRE-OPERATION

#### 3.1 Unpacking

Visual examination should be carried out after unpacking to make sure that there is no mechanical damage, check the seals existence and their safety.

#### 3.2 Pre-operation

Meters produced by the manufacturer have the factory default settings in accordance with the list given in the Technical passport. Before installing the meter on the object, it is necessary to change the factory settings if they do not meet the customer's requirements according to User Manual.

#### 3.3 Installation procedure

Connect the meter for electric energy metering to the single-phase AC network with the nominal voltage indicated on the meter panel. For this purpose, remove the terminal cover and connect the lead wires fastening them in the terminals in accordance with the connection diagram given on the terminal cover or in the Annex B.

**ATTENTION! METER CONNECTION SHOULD BE DONE WITHOUT POWER SUPPLY! ONLY PERSONS, WHO SPECIALLY TRAINED FOR WORK WITH VOLTAGES UP TO 1000 V AND HAVE STUDIED CAHT.411152.165.1 ПИ, ARE ALLOWED TO WORK WITH THE METER.**

In case if the meter is to be connected to AMR system, signal wires should be connected to the telemetry or interface outputs in compliance with the connection diagram specified in User Manual.

In case if additional sliding fixators are used for meter installation it is necessary to provide limitation of user's access to these fixators.

Apply the mains voltage and make sure that the meter is turned on (test LCD is started: all LCD segments are turned on during 2 seconds, then the current information is displayed).

### **3.4 Time setting and correction**

Time setting/correction and tariff schedule changing should be performed by authorized representatives of utility companies.

User has an opportunity to correct time manually according to item 4.2.2 with the FRAME button. Total correction time is not more than 29 seconds per calendar day. If the clock error is more than 29 s, then the correction should be carried out within a few days or use the time setting command. Time-back correction is carried out by seconds zeroing if current second value is not more than 29. Time-forward correction is performed by setting the value of 59 if the current value of seconds was 30 and more. Date/time of correction and correction value are fixed in a corresponding event log.

## **4 OPERATIONAL PROCEDURE**

### **4.1 Meter reading modes**

After meter is switched on and load is connected the meter measures consumed energy, saves measured values in memory and displays them on the LCD. The data on the LCD changes cyclically in automatic mode or may be scrolled by the «FRAME» button.

Information location on the LCD is shown in the Figure 4.1

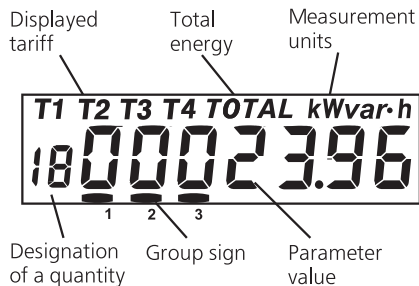


Figure 4.1 – Information location on the LCD

Information displayed on the LCD is divided into three groups of parameters:

- 1 – energy accumulation on a cumulative total;
- 2 – network parameters;
- 3 – service information.

Choice of group and parameter is performed by the «FRAME» button pressing:

- short button press (less than 1 second) switches parameters in group;
- long button press (more than 1 second) switches groups;
- constant press – auto repeat of long press switches displaying of parameters' groups.

#### 4.2 Group 1 – «Consumption on a cumulative total, date/time»

Data about consumption on a cumulative total in kWatt•hours [kW•h]; number of displayed tariff: T1, T2, T3, T4, T1 T2 T3 T4 (fifth tariff) or sign of total energy indication: TOTAL. Depending on meter configuration energy values are displayed in formats: 5+2 or 6+2.

Short press of the «FRAME» button sequentially switches displaying of energy values accumulated per active tariffs and totally.



4.2.1 Data about energy consumption accumulated on a cumulative total per all tariffs in kWatt•hours is displayed.



4.2.2 Data about energy consumption on a cumulative total per 1 tariff in kWatt•hours is displayed.





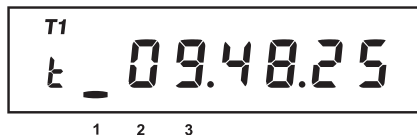
4.2.3 Data about energy consumption on a cumulative total per 2 tariff in kWatt•hours is indicated. Similarly data per tariffs 3 and 4 is displayed.



4.2.4 Data about energy consumption on a cumulative total per 5 tariff in kWatt•hours is displayed.



4.2.5 Current date in a format day, month, year and current (active) tariff are v. Current tariff – energy is accounted per this tariff at the moment



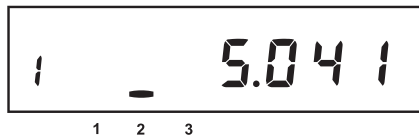
4.2.6 Current time in format of hh.mm.ss and current (active) tariff. Long press of the «FRAME» button leads to the next group transition.

#### 4.3 Group 2 – «Network parameters»

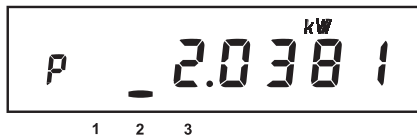
Short press of the «FRAME» button sequentially switches displaying of screens in the group.



4.3.1 **RMS voltage value** in Volts [V] is displayed



4.3.2 **RMS current value** in Amperes [A] is displayed.



4.3.3 Consumed active power value in kWatts [kW] is displayed.



4.3.4 Network frequency value [Hz] is displayed.

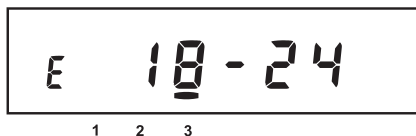
#### 4.4 Group 3 – «Service information»

Short press of the «FRAME» button sequentially switches displaying of screens in the group.



4.4.1 Check sum of firmware (metrological part of software) is displayed.

Message about error in checksum means that there is an unintended change of metrological part of software occurred and it is necessary to send the meter to repair.



4.4.2 Manual time correction is ALLOWED

Meter real time clock can be corrected manually. Daily total clock correction limit – 29 seconds. Long press of the «FRAME» button in this window if the allowed sign «E» is displaying changes the time for not more than 29 seconds.

Correction permission sign disappears when the daily limit is reached and appears on the next calendar day.

Time-back correction is carried out by seconds if it does not exceed 29 seconds. Time-forward correction is performed by setting the value of 59 if the current value of seconds was 30 and more.

So to obtain the correct result, correction should be done at zero minutes of the exact time, provided that the difference between the exact time and the meter time clock does not exceed 29 seconds. Also it should be considered that the correction is done of about a second after pressing the button.



#### 4.4.3 Optical interface activation

Long push of the «FRAME» button in meters with EIA-485 interface switches data exchange to optical port with displaying on the LCD of «OPT0XX» where XX is a countdown of optical port activity in seconds. Short press of the «FRAME» button switches to the EIA-485 interface.



#### 4.4.4 LCD test mode. All LCD segments switch on.

#### 4.5 Automatic reading mode

1 minute after the last button's press the meter switches to the mode of cycle indication of the Group 1 «Consumption on a cumulative total and date/time» information.

To exit from the automatic mode or switch between the groups and parameters the «FRAME» button should be used.

#### 4.6 No-voltage reading mode

If there is no voltage in the network it is possible to read the consumption on a cumulative total and date/time by the «FRAME» button pressing. Switching between the screens is controlled by the short press of the «FRAME» button.

#### 4.7 Information messages

During the meter operation mnemonic and text messages are displayed on the meter LCD.

**Current tariff** is displayed in group 1 – «Consumption on a cumulative total date/time» viewed in date and time windows as signs T1, T2, T3, T4 or T1T2T3T4.

Blinking of current tariff sign means that the tariff program is incorrect or is not specified and metering data is recorded in the emergency tariff.

Blinking of the sign  on LCD does not depend of the current group/screen and shows the necessity of lithium cell replacement.

During the operating meter displays on the LCD information messages and messages about errors and failures: **«Err XXX», where XXX – errors code**. Errors codes and consumer's activity described in the User Manual.

#### 4.8 Automated mode

In the automated mode, complete information about the energy consumption can be obtained with the help of a PC via the optical interface and/or by operating in system via EIA-485 interface.

Protocol of the data exchange via interfaces is described in the User Manual.

## **5 METER VERIFICATION**

Meter verification is carried out while manufacturing, after repair and while operating according to the document «Single-phase multi-tariff active energy meter CE102. Verification procedure ИНЕС.411152.090 Д1».

**ATTENTION: LITHIUM CELL REPLACEMENT IS RECOMMENDED AT THE TIME OF METER VERIFICATION**

## **6 TECHNICAL MAINTENANCE**

6.1 Meter technical maintenance in places of installation consists of systematic monitoring over the meter operation, its time accuracy and monitoring of the secure network wires clamping.

6.2 Periodic meter verification is to be done according to procedure described in the paragraph 5 of the present operation manual, every 16 years or after the repair

6.3 In case of malfunctions or negative results of verification the meter should be sent to repair. Meter repair and adjustment is provided by authorized repairing organization.

6.4 Lithium battery replacement should be done according to the present User Manual.

## **7 STORAGE AND TRANSPORTATION**

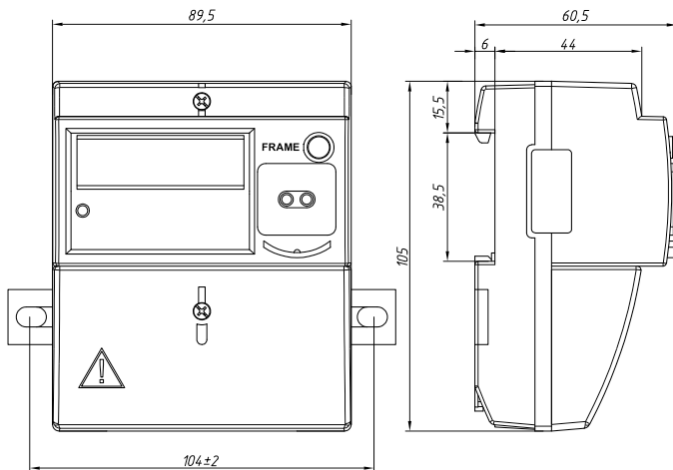
7.1 Meters storage is performed in the manufacturer packaging at an ambient temperature from 5 to 40 °C, the relative humidity of 80% at the temperature of 25 °C.

7.2 Meters are to be transported in the closed vehicles of any kind.

Extreme conditions of transportation:

- ambient air temperature – from -50 to +70°C;
- relative humidity 98% at 35°C.

**ANNEX A**  
**Overall and mounting dimensions**





**ANNEX B**  
**Connection diagram for CE102 R5.1**

