Three-phase electronic electricity meter AIST A300

USER MANUAL

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1. Purpose

The three-phase electronic electric energy meter "AIST A300" is used to measure and record active and reactive energy in three-phase AC circuits and transmit telemetry information on consumed electricity when used in automated data collection systems (hereinafter referred to as ADS).

To display information, the meter uses a liquid crystal display (LCD), which indicates:

- current tariff numbers (up to 4 tariffs);
- displays active and reactive energy of forward and reverse directions, combined values, as well as total energy values for each tariff and total for all tariffs;
- current value of active and reactive power;
- network voltage (V);
- current consumption (A);
- network frequencies;
- current time;
- current date - day, month, year;

The meter can be used either as part of a system together with other devices and components, or independently.

The structure of the symbol for the AIST A300 meter is shown in Figure 1.

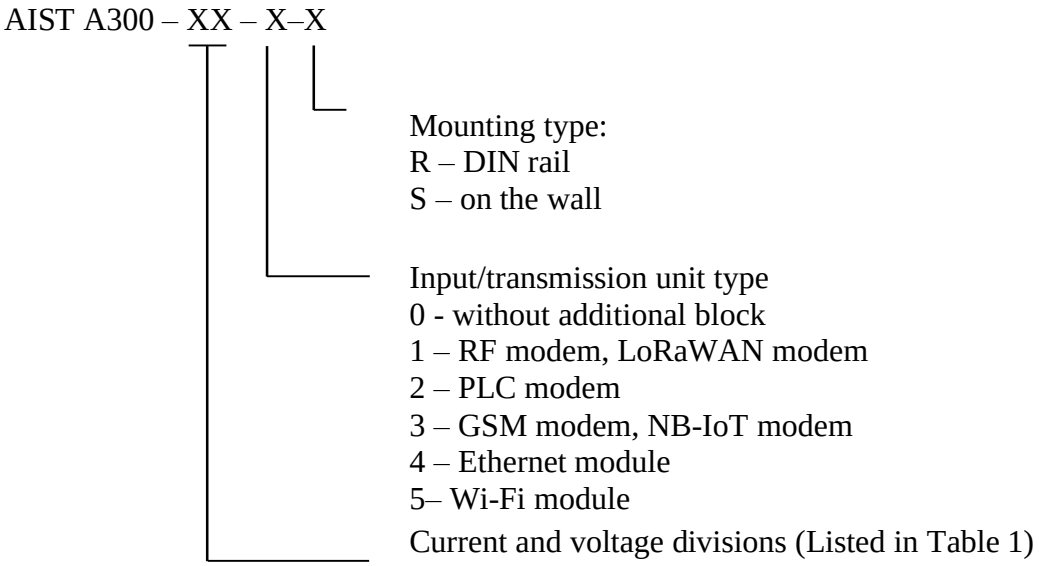


Figure 1 - Structure of the counter symbol

The meter can be additionally equipped with a data input/transmission unit: a PLC modem, GSM modem, RF modem, Ethernet module, or Wi-Fi module. Meters are also categorized by current and voltage. Current and voltage classifications are shown in Table 1.

Table 1. Current and voltage meter modifications

Modification counter (XX)	**Nominal voltage, V**	**Nomin.(max) current, A**	**Active energy accuracy class**	**Reactive energy accuracy class**
01	3*57.7/100	5(10)	0.5S	1
02	3*230/400	5(60)	1	2
03	3*230/400	10(100)	1	2
04	3*230/400	5(7.5)	0.5S	1
05	3*57.7/100	1 (2)	0.5S	1
06	3*230/400	1 (2)	0.5S	1

An example of a meter entry is a three-phase active and reactive energy meter (AIST A300) with a nominal voltage of 3*230/400, with a nominal 5A and maximum 60A current (02), with a PLC-modem data transmission unit (2), with a wall mount (S):

"Three-phase active and reactive electric energy meter AIST A300-02-2- S

2. Safety requirements

Before beginning use necessary get acquainted with operational documentation for the meter.

Only persons who have undergone special training and have a certificate entitling them to perform technical maintenance and repair of meters are allowed to perform installation, maintenance and repair of meters.

All work related to the installation of the meter must be carried out with the power turned off. networks.

3. Technical and metrological characteristics

The main technical and metrological characteristics of the AIST A300 meter are given in Table 2.

Table 2. Main technical and metrological characteristics of the meter

Name of the characteristic	Meaning
Accuracy classes: ▪ by active electrical energy ▪ for reactive electric energy	 ▪ 0.5S or 1 ▪ 1 or 2
Basic, I_b, (maximum) current for direct inclusions, A	5 (60); 10 (100)
Nominal, I_n, (maximum) current for transformer connection, A	5 (10); 5 (7.5); 1 (2)
Nominal voltage values (U_{nom}), IN	3×57.7/100; 3×230/400

Starting current (sensitivity threshold): ▪ to directly turn on the meter: • accuracy class 0.5S • accuracy class 1 • accuracy class 2 ▪ to turn on the meter via current transformers: • accuracy class 0.5S • accuracy class 1 • accuracy class 2	 - ▪ $0.004 \cdot I_b$ ▪ $0.005 \cdot I_b$ ▪ $0.001 \cdot I_{nom}$ ▪ $0.002 \cdot I_{nom}$ ▪ $0.003 \cdot I_{nom}$
Set operating voltage range, V	from 0.9 to $1.1 \cdot U_{nom}$
Extended voltage range, V	0.8 to $1.15 \cdot U_{nom}$
Power consumption, V·A, no more than: ▪ along the voltage circuit ▪ along the current circuit	 ▪ 5 ▪ 0.2
Nominal value of the electrical network frequency, Hz	50
Maximum number of tariffs	4
Minimum tariff duration, min	15
Exchange rate via RS-485 interface, bit/s	1200~9600
Accuracy of the built-in clock with the counter turned on and at normal temperature, better, c/day.	± 0.5
Liquid crystal display (LCD): ▪ number of indicated digits ▪ price per unit of the least significant digit when displaying energy, kWh (kVarh)	 ▪ 8 ▪ 0.01
Mean time between failures, h	at least 160,000
Service life of the power supply of the counter clock, years	at least 10
Additional data input/transmission blocks	RF modem, PLC modem, GSM modem, Ethernet module, Wi-Fi module
Temperature range, °C	from - 40 to +55
At temperatures from - 20 to - 40 □C, partial loss of LCD functionality is allowed.	
Overall dimensions (height×width×depth), mm:	292×174×88
Weight of meters, kg	no more than 2.8

4. Completeness

The meter complete set is shown in Table 3.

Table 3 Counter completeness

Name	Quantity, pcs.
1. Electronic electricity meter "AIST A300" (one of the versions)	1
2. Operation manual	1
3. Passport	1
4. Packaging	1

5. Main functions

The three-phase electronic electric energy meter "AIST A300" performs the following functions:

- Measurement of current and voltage in each phase.
- Calculation of active and reactive energy.
- Registration of energy consumption.
- Counting time and calendar date.
- Exchange of information with the hub via data transfer blocks.
- Accumulation of data in volatile memory.

Consumer and service data are displayed on the liquid crystal display (LCD) located on the front panel of the meter.

The meter can be operated autonomously or in an automated system for collecting data on consumed electricity.

Exists opportunity configuration parameters counter with using a computer.

The meter allows you to monitor electricity consumption taking into account the developed tariff structure.

6. The design and operation of the counter

6.1 Design and appearance

Counter made in a plastic case.

The appearance of the counter is shown in Figure 2.

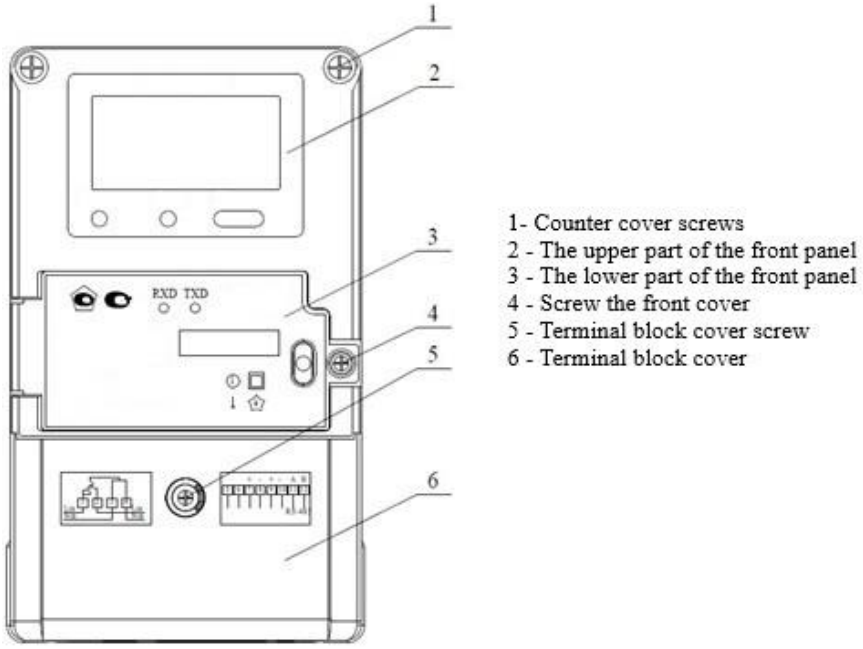


Figure 2 - External appearance of the meter

Overall dimensions are shown in Figure 3.

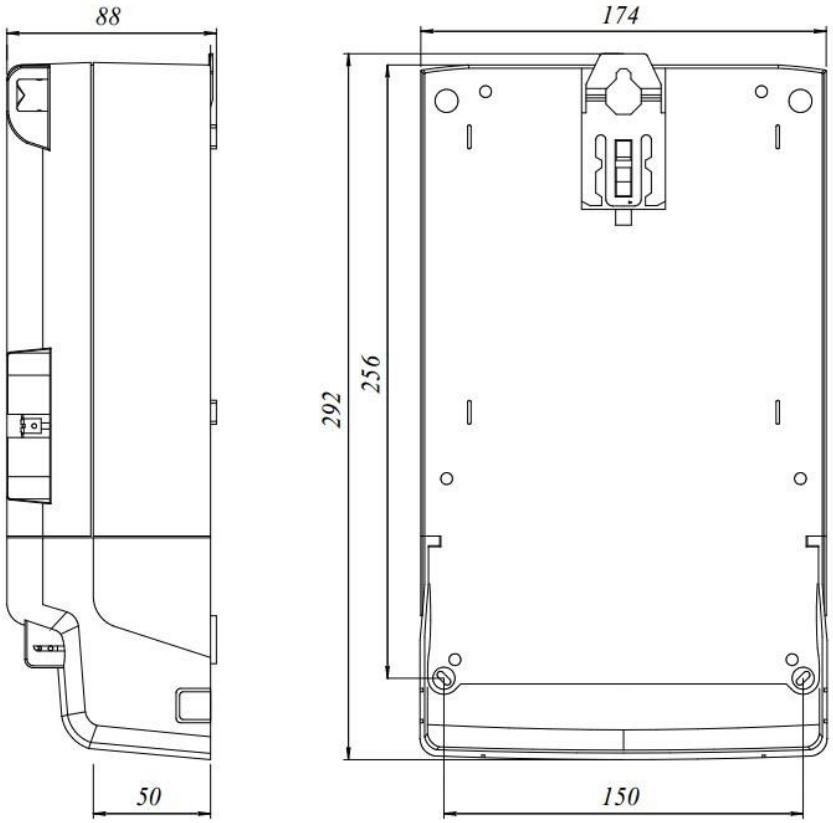
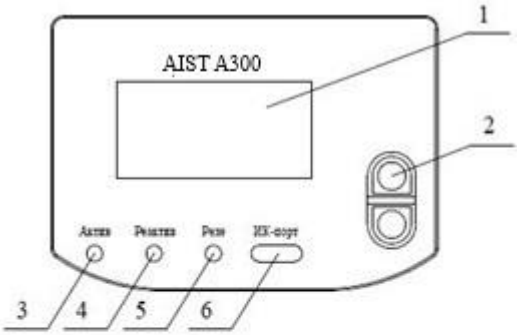


Figure 3 - Overall dimensions

The meter has a modern, convenient and safe housing, allowing it to be installed in virtually any electrical cabinet using the standard location of mounting holes.

The appearance of the upper and lower parts of the front panel of the meter are shown in Figures 4 and 5.



1 - Liquid crystal display
2 - Control buttons
3 - Active power measurement indicator
4 - Indicator for measuring reactive electricity
5 - Indicator of the control relay
6 - The IR port

Figure 4 - Front panel of the meter (upper part)

The meter's main terminals, designed for connection to the electrical network, are made of a highly conductive electrical alloy. They are housed in a housing made of impact-resistant, fire-resistant plastic, which ensures high insulation resistance.

The external appearance of the terminal block of a direct connection meter is shown in Figure 6, and of a transformer connection meter – in Figure 7.

Additional contacts of the terminal block are intended for pulse outputs and digital interfaces (Figure 8).

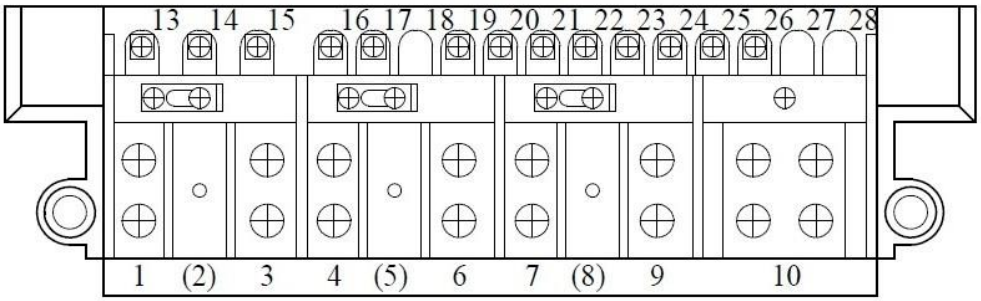


Figure 6 - Direct connection meter terminal block

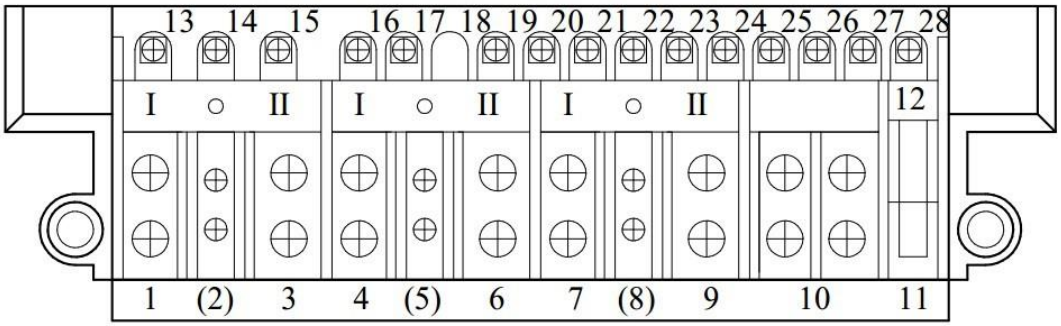


Figure 7 - Terminal block of the transformer connection meter

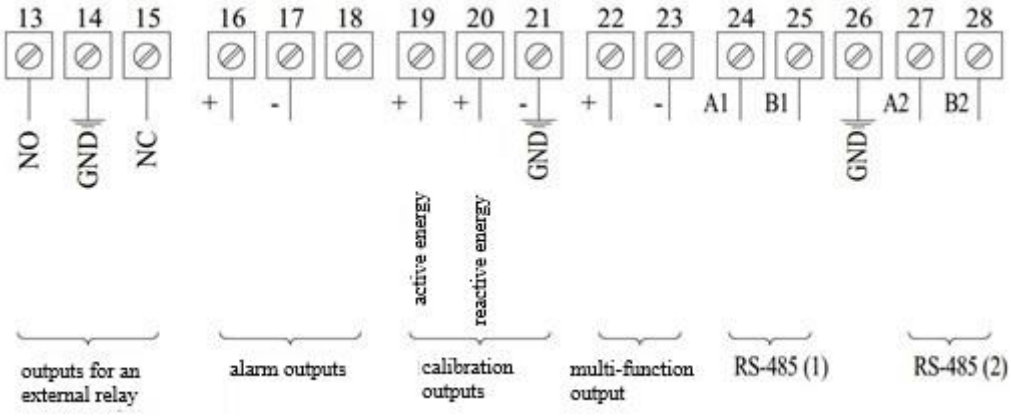


Figure 8 - Additional terminal block contacts

The calibration outputs can be tested using an open collector transistor; to ensure its operation, it is necessary to apply the supply voltage according to the circuit shown in Figure 9.

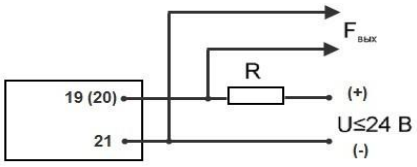


Figure 9 – Connection to the test output device

The signal form Fout is rectangular pulses of negative polarity with an amplitude equal to the supplied supply voltage U.

The value of electrical resistance R, in kOhm, in the load circuit of the test output device is determined by the formula:

$R = \frac{U}{I}$, where U ≤ 24 V is the supply voltage; I ≤ 30 mA is the current.

6.2 Operating principle

The operating principle of the counter is explained by the structural diagram shown in Figure 13.

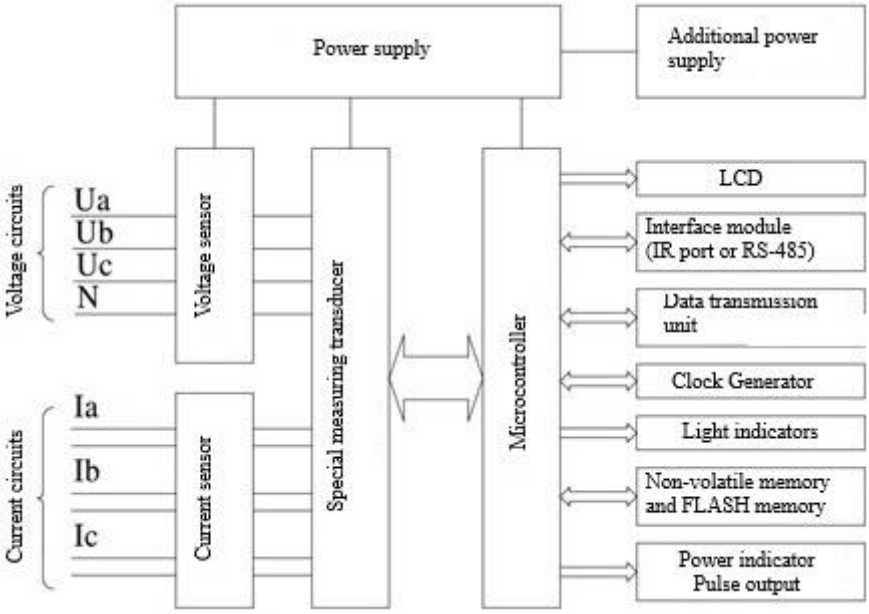


Figure 13 - Structural diagram of the counter

Currents and voltages of the measured three-phase network are fed through the corresponding terminals and input elements to the corresponding inputs of the analog-to-digital converter (ADC). The measuring converter converts the analog voltage and current signals into digital values and also calculates the energy consumed.

The central processor receives measurement results and stores them in non-volatile memory, maintains communication via the IR port, and displays information on the display.

Measured data, configuration parameters, status and other information are stored in non-volatile memory and can be displayed on the meter's liquid crystal display.

The AIST Meter Configurator software allows you to configure meter parameters and read data. The computer can communicate with the meter via either an optical or digital port. To ensure safety and reliability, an identification procedure is required before configuring the meter parameters.

The meter allows for multi-tariff metering of active and reactive energy.

The power supply is used to convert the alternating voltage of the network into direct voltage, which is necessary to power the microcontroller and operate the microcircuits.

6.3 Control relay

The meter has a built-in power relay, which can be controlled remotely via a command in the meter's protocol format. The relay on/off command is sent via the RS-485 interface or via an additional data input/transmission unit installed in the meter.

During the switching-on procedure, after the corresponding command has been sent to the meter, it is also necessary to press the control button on the meter panel and hold it for two seconds - this is an additional measure of protection against erroneous switching on of the meter.

Thanks to the power relay built into the meter, remote control of consumers is possible.

7. Preparation for operation

It is necessary to remove the meter from the transport packaging.

After unpacking, you should inspect the meter externally, ensure there is no mechanical

damage, and check the specification and model of the device.

Install the meter at the operating location in accordance with the diagrams shown in Figures 14, 15.

ATTENTION! All installation work must be performed with the power disconnected.

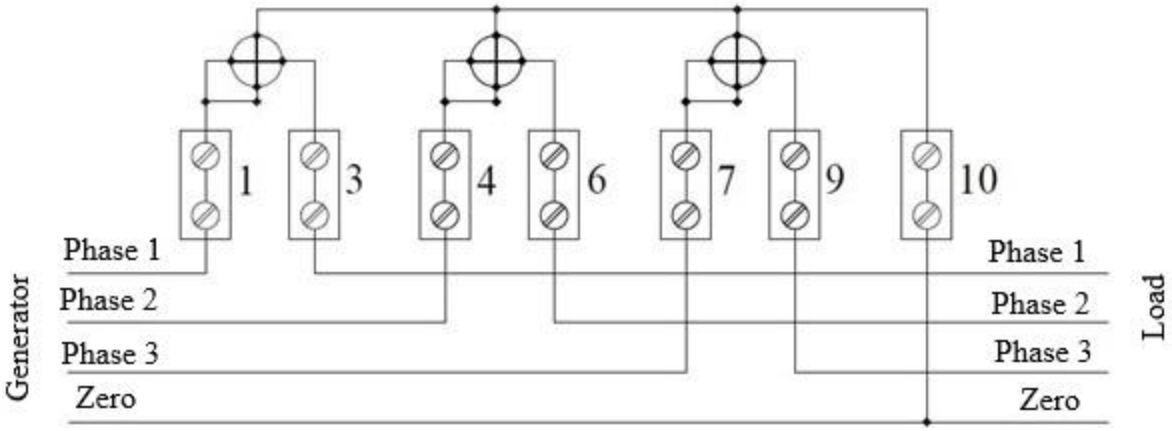


Figure 14 - Direct connection diagram of the meter

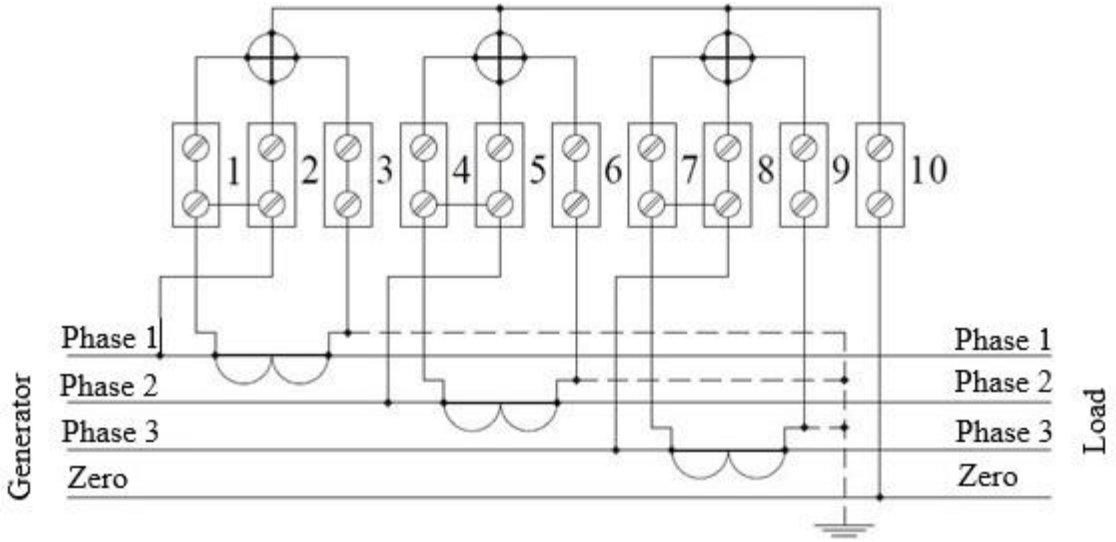


Figure 15 - Transformer connection diagram of the meter

8. Reading information from the meter indicators

8.1 Liquid crystal display

The meter is equipped with a liquid crystal display (LCD), which is used to display a programmable set of measured and calculated values.

The meters operate by calculating the effective values of current and voltage, active or active and reactive energy, power, power factor, and AC grid frequency based on measured instantaneous values of input current and voltage signals. The meters also provide time and date counting and display data on an LCD.

Each displayed parameter is accompanied by a symbolic explanation (hint).

The appearance of the LCD with the designation of its information fields is shown in the figure. 16.

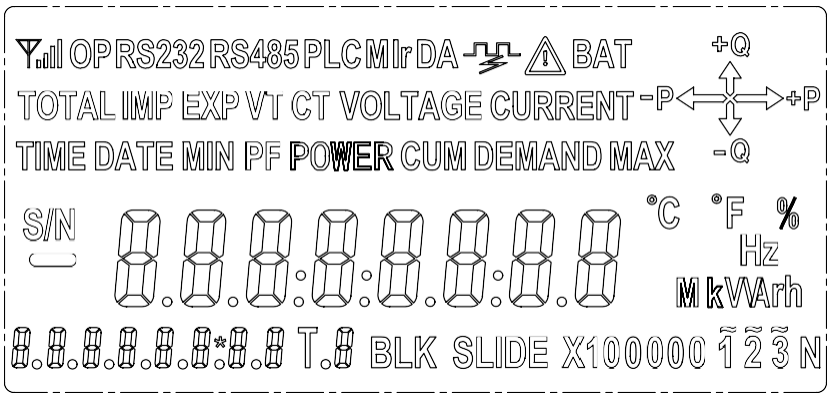
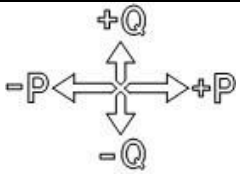
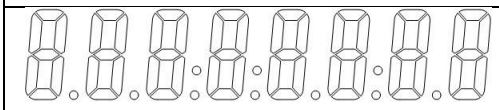


Figure 16 - General view of the LCD meter

The readings on the LCD meter change in manual mode by pressing the control button. The main symbols displayed on the display are presented in Table 4.

Table 4 LCD symbol table

Conventional designation	Description
	Energy flow direction indicator The position of the arrows means: +P – active energy consumption; -P – output (reverse) of active energy; +Q – reactive energy consumption; -Q – output (reverse) of reactive energy.
 Signs available for indication: 1) TOTAL – total. 2) IMP forward direction, EXP reverse. 3) VOLTAGE – voltage, CURRENT – current. 4) PF – power factor. 5) POWER - power 6) DEMAND – peak consumption.	
	The main LCD field for displaying parameters.
	Code of the displayed parameter.
  - Indication of strong/weak wireless signal in Internet status.	

- Indication of programming permission status.
If the password is incorrect, this indicator flashes three times.

- Indication of connection via interfaces.

- An informational message alerting you to possible changes in network parameters (low power supply voltage, power surges, phase sequence errors). Detailed information about the event can be viewed using the AIST meter configuration software.

- The internal clock battery voltage is low. To fix this, replace the meter's internal battery.

- Voltage phase presence indicators.

- Tariff indication (1 2 3 4).

The counter has 3 display states: automatic cyclic display state, display state when pressing the display button, and internal control state.

8.2 LED indicator statuses

The front panel of the meter contains LED indicators, the meanings of which are described in Table 6.

Table 6. Counter indicators

Indicator	Description
Pulse	The LED duplicates the signal on the pulse output of the meter, i.e. it indicates that the next kWh has been consumed.
Relay	Indication of relay operation (consumer disconnected from the network)
Assets	Active energy indication
Reagent	Reactive energy indication

9. Verification of the meter

Verification of the meter is carried out upon release from production, after repairs and during operation according to the verification methodology.

The inter-verification interval of the meter is 16 years.

10. Maintenance

Maintenance must be carried out by persons who have read this operating manual.

Maintenance of the meter at the installation site consists of systematic monitoring of its operation and eliminating errors and malfunctions in the meter's operation.

11. Filling

The outside of the meter has special locations for attaching verification seals. Upon release

from the factory, the meter bears the manufacturer's seal and a seal certifying state verification.

After installing the meter on-site, the installation company affixes its seal, preventing unauthorized access to the terminal block and data transmission unit.

12. Storage and transportation rules

Climatic conditions for transporting the meter:

– ambient air temperature from minus 40°C to plus 55°C;
– atmospheric pressure from 84.0 to 106.0 kPa (from 630 to 800 mmHg).

Transportation on aircraft must be carried out in accordance with the rules for the carriage of baggage and cargo by air.

Transportation counter sea transport should be produced V in accordance with the rules for the safe carriage of general cargo by sea.

The meter must be stored in its packaging in the consumer’s warehouse:

– ambient air temperature from plus 5°C to plus 40°C;
– relative air humidity from 5% to 80%;
– solar radiation, 700 W/m2.
– There is no condensation of moisture, frost formation, or wind-driven precipitation.

A short-term increase in humidity up to 98% at a temperature of no more than +25°C, without moisture condensation, is permitted, but in total, no more than 1 month per year.

13. Disposal

The meter does not contain any hazardous or toxic substances that could harm human health or the environment, so disposal of the meter can be carried out in accordance with the rules for the disposal of general industrial waste.

When disposed of, the meter body, which is made of plastic, can be recycled.

The remaining components of the meter (electronic boards, connectors, etc.) contain extremely small amounts of precious metals and therefore, their recycling is not practical.