ELECTRICITY METERS

NIK 2100 A...P6...

OPERATIONS MANUAL

ААШХ.411152.072 НЕ

CONTENTS

1. Introduction

This operations manual (hereinafter referred to as manual) applies to electricity meters NIK 2100 A...P6... (hereinafter referred to as the meters).

This manual covers the operation of the meters, intended use, maintenance, verification, storage, and transportation.

Service personnel must be specially trained and have at least a third group of electrical safety to work with the devices that operate under 1000 V.

2. Description of the meters and their operation principle

2.1. Designation

The single-phase multi-rate electricity meters NIK 2100 A...P6... (hereinafter referred to as the meters) has an electronic display and one or two measuring elements. The meters are designated to measure active or active and reactive energy in the forward or the forward and reverse directions at several rates. The accuracy class for the active energy of the meter is B (EN 50470-3). The accuracy class for the reactive energy of the meter is 2 (EN 62053-23).

The meters are equipped with an optical port and may have additionally electrical PLC or PLC G3 interface. Depending on the version, the meters can be equipped with one or two measuring elements in the current circuit, with case opening sensors, with terminal cover opening sensor, with load control relay, with magnetic and/or electromagnetic field sensors, with a service connector. The service connector is designed to connect an external DC power supply with a voltage of 6 ... 8 V to a disconnected meter for reading of the information. The main test output is a pulse output. The contacts of the pulse output are connected to a special connector.

According to climatic and mechanical requirements, the meter meets the requirements of EN 50470-1, EN 50470-3 and EN 62053-23 when used in rooms without aggressive vapors and gases.

According to the results of studies of stability and metrological reliability, the meters meet the requirements of the EN 62059-32-1.

The meters can be used for the organization of electricity metering in communal and other spheres. It is possible to use the meters in automatic electricity control and accounting systems.

The meters meet the requirements of the Directive 2014/32/EU of the European Parliament and of the Council of 26 February 2014.

The meters made in modification 2, correspond to the set of design documentation AAIIIX.411152.072.

2.2. Technical parameters of meters

The main technical parameters are given in Table 1.

Table 1 The main technical parameters of the meters NIK 2100 A…P6…

Accuracy class for measurement of active energy (according to EN 50470-3)	B
Accuracy class for measurement of reactive energy (according to EN 62053-23)	2
Reference voltage U_n, V	See Table 2
Voltage operating range, % of U_n	-20 to +15
Starting current, I_{st} A for active energy	0,0125
Starting current, I_{st} A for reactive energy	0,0156
Minimum current I_{min}, A	0,25
Transient current I_{tr}, A	0,5
Reference current, I_{ref}, A	5
Maximum current, I_{max}, A	80
Meter constant for direct connection, imp/(kWt·h)	6400
Power consumption of meter without PLC interface in voltage circuits, less than, V·A (W)	10 (2)
Power consumption of meter with PLC interface in voltage circuits, less than, V·A (W)	20 (5)
Power consumption of meter current circuit (at Iref), not more than, V·A	0,2
Reference frequency f_{ref}, Hz	50
The number of LCD digits to display basic information	6+2
Reading device capacity, kWh	999999,99
Number of rates, up to	4
Storage of a load profile with the integration period of 60 minutes, days	180
Storage of data on consumed energy at all rates at the end of the day, days	180
Storage of data on consumed energy at all rates at the end of the month, months	48
Storage of average voltage values with an integration period of 10 minutes, days	10
Verification interval, years	16
Working temperature range, °C	-40 to +70
Storage temperature range, °C	-40 to +70
Relative humidity at a temperature +30 °C, not more than, %	95
Degree of protection	IP54
Mechanical class	M2
Electromagnetic class	E2
Weight, not more, kg	1
Mean lifetime, not less than, years	30
Average failure time, not less than, hours	200 000

2.2.1. Limits of error in the load current range

If the meter is in normal conditions (see "Table 3. Normal conditions"), but the current and power factor change, the relative errors do not exceed the limits normalized in "Table 2. Limits of relative error for measuring energy".

Table 2. Limits of relative error for measuring energy

Current value	Power factor, cos φ	Limits of the main relative error, %
0,05 Ib ≤ I < 0,1 Ib	+1	± 1,5
0,1 Ib ≤ I ≤ Imax	+1	± 1,0
0,1 Ib ≤ I < 0,2 Ib	+0,5 (with inductive load)	± 1,5
	+0,8 (with capacitive load)	
0,2 Ib ≤ I ≤ Imax	+0,5 (with inductive load)	± 1,0
	+0,8 (with capacitive load)	

The additional error of the meters does not exceed ± 3% in the presence of a constant component in the AC circuit.

2.2.2. Current overload

The meters can withstand short-term overloads exceeding 30 times I_{max}, for one half-period by rated frequency.

2.2.3. Resistance to magnetic fields and electric discharges

Meters are resistant to the effect of a constant magnetic field generated by a permanent magnet with a cross-section of not less than 5.0 cm^2 and induction not less than 300 mT on a pole.

Meters are resistant to an external magnetic field created by a current frequency equal to the mains frequency with induction not less than 100 mT.

The meters are resistant to electrostatic and spark discharges.

The meters are resistant to high-frequency electromagnetic fields.

2.2.4. Reliability indicators

The meters have an average failure time, including maintenance - at least 200,000 hours.

The average service life before the first overhaul of meters is at least 30 years.

Table 3. Normal conditions

Parameter	Values under normal conditions	Tolerances for meters
Ambient temperature	23 °C, unless otherwise stated	± 2 °C
Voltage	Nominal voltage value	± 1,0 %
Frequency	Nominal voltage value	± 0,3 %

Curve shape	Sinusoidal voltages and currents	The nonlinear distortion coefficient is less than 2%
The external continuous magnetic field	N/A	–
The external magnetic field of industrial frequency	N/A	The value of induction, which causes a change in error is less than 0.2%
Radiofrequency electromagnetic fields with frequency 30 kHz to 2 GHz	N/A	< 1 V/m
Operation of auxiliary devices	Auxiliary devices are disabled	–
Conductive interference induced by 150 kHz to 80 MHz radiofrequency fields	N/A	< 1 V

2.1. Versions of the meters and their functionality

The versions of meters and the structure of their markings are given in Table 4.

Table 4. Versions of the meters and the structure of their markings

NIK 2100		X	P6	T	.	2	X	0	X	.	X	.	X	X
													Reference voltage	
													1	220 V
													2	230 V
													3	240 V
												Ability to measure energy		
												1	In the forward direction	
												2	In the forward and reverse direction	
											Sensors			
											0	Without sensors		
											C	The electromagnetic field sensor is installed		
											M	The magnetic field sensor is installed		
											MC	Magnetic field and electromagnetic field sensors are installed		
										Relay availability				
									0	Without load control relay				
									2	The load control relay is installed				
								The third interface is unavailable						
							Second interface availability							
							0	The module is not installed						
							8	PLC interface is installed						
							9	PLC G3 interface is installed						
						Design								
						2	Multi-rate meter with optical port and additional sealed function button							
					T	Indication of multi-rate meters								
				Direct connection with rated and maximal current 5(80) A										
			Type of the measured energy											
		A	Measurement of the active energy											
		AR	Measurement of the active and reactive energy											

The markings of the meters present in documentation (including one's of the other products, where the meters can be used) and during order consist of the name of the meter, its type, and features of the meter. For example "Electricity meter NIK 2100 AP6T.2902.MC.21".

2.2. The composition of the meters

2.2.1. General view of meters

A general view of the meter NIK2100 A...P6... is shown in Figure 1. The left part of the figure shows The meters with the terminal cover and without it are shown on the left and right part of Figure 1 respectively.The Figure 1. General view of the meter NIK 2100 A…P6… shows the following elements and components:

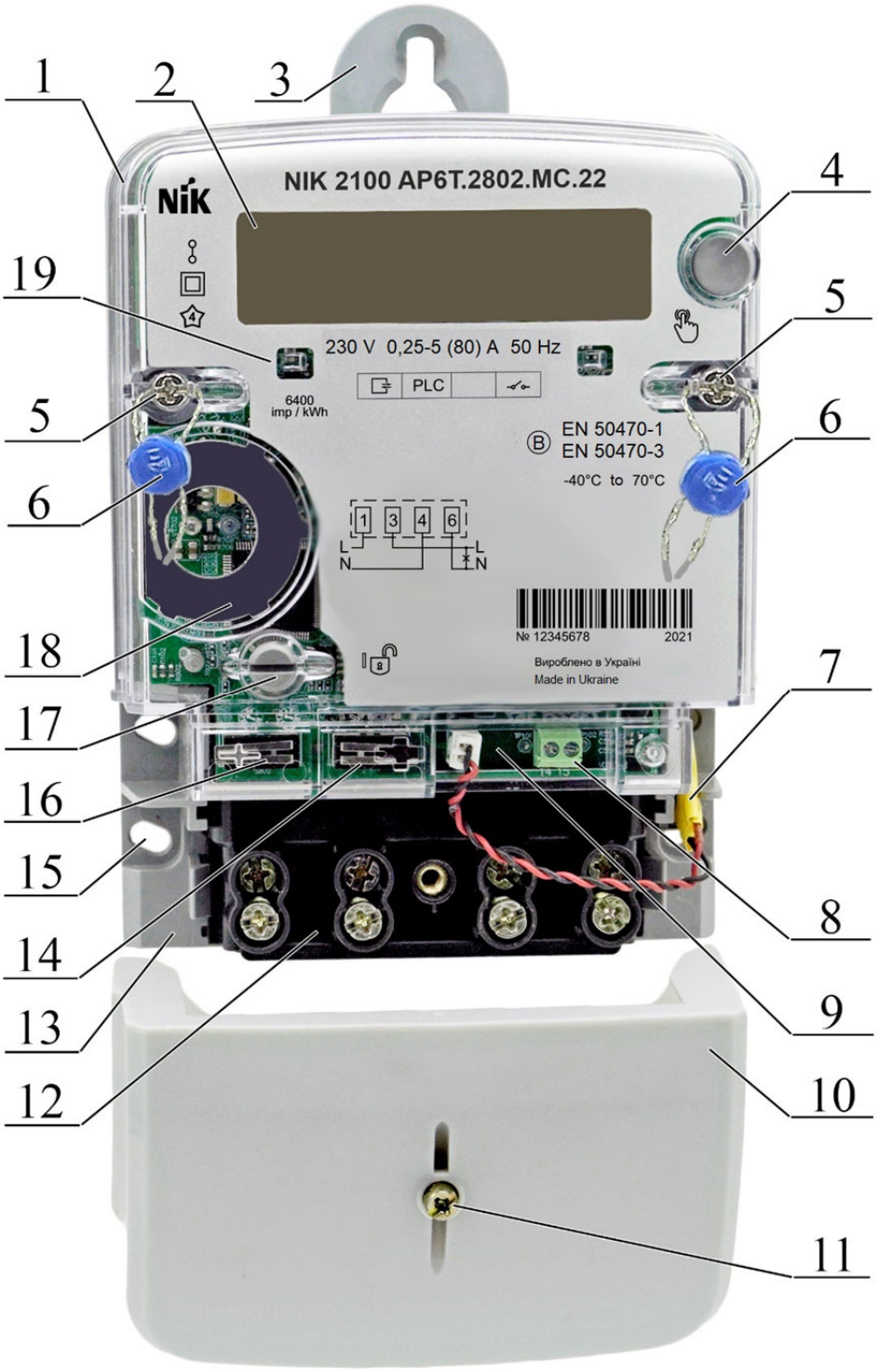


Figure 1. General view of the meter NIK 2100 A…P6…

1. The cover of the meter;
2. Liquid crystal indicator;
3. Clamp for mounting the meter;
4. "View" button;
5. Sealing screws of the meter casing;

6. Seals of the meter casing;

7. Backup power battery;

8. Connector of the electrical test output;

9. Printed circuit board with electronic components;

10. Terminal cover;

11. Sealing screw of the terminal cover;

12. The block of clamps;

13. Base of the meter;

14. Sensor for detection of the terminal cover opening;

15. Holes in the base for mounting the meter;

16. Sensor for detection of the meter cover opening;

17. Functional button;

18. Optoport;

19. LED test output when measuring active energy and its designation (the constant of main pulse test output of the meter).

2.2.2. The design of the case of the meters

The meters have a plastic case, which consists of a base and a transparent cover. A printed circuit board is installed in the base, as well as a terminal block with primary current converters. The terminal block is closed by a terminal cover. The socle and the casing of the meters are connected by sealing screws.

2.2.3. Dimensions of meters

Overall and installation sizes of the meters are given in the appendix «Appendix A. Overall and installation sizes of the meters».

2.2.4. The «View» button

The meters are equipped with a "View" button (see Figure 1, item 9). The button is used to switch the menu on the electronic display when the meter is connected to the mains. In the absence of mains voltage, the meter operates in battery mode. Pressing the "View" button in the battery mode turns on the meter for a while in the display mode. Switching of the menu also allows to read the measured and saved values. The duration of operation of the meters in the display mode and the list of displayed windows depends on the parameterization of the meters.

Note: only the optical port works in the display mode, and other additional communication interfaces do not work.

2.2.5. Calendar and clock

The meters have a real-time clock and a calendar. The real-time clock is used for multi-rate metering of electricity, determination of the average power for the period of integration, and registration of events with a time stamp. The real-time clock can switch to summer and winter time in automatic mode or on a date that is set during parameterization.

A temperature sensor is built into the meter to reduce the dependence of the clock error on the ambient temperature. The meter has a built-in battery to ensure the continuity of the built-in clock when the mains voltage is switched off. The meter microcontroller switches to battery saving mode in the absence of mains voltage. Only the internal clock of the meter works in the battery saving mode. The energy of the built-in battery is not used when the mains voltage is switched on. The meter can operate for at least 16 years without main voltage.

2.2.6. Functional button with the possibility of sealing

The meters are equipped with a function button (see **Error! Reference source not found.**, item 19) that can perform various functions depending on the software settings:

- Cleaning the event log;
- Cleaning of half-hour, daily, monthly profiles, and the adjusted individually profile;
- Cancel the indication on the LCD triggering of the magnetic field sensor. Cancellation of the indication is possible only if the cause of the indication is eliminated;
- Cancel the indication on the LCD triggering of the electromagnetic field sensor. Cancellation of the indication is possible only if the cause of the indication is eliminated;
- Switch on the load control relay after it's triggering. Switching on the relay is possible only if the reason for switching off the relay is eliminated;
- Unconditional disconnection of the load control relay;
- Restart the meter;
- Cleaning of registers that fixate the excess of the maximally allowed value of instantaneous power;
- Locking and unlocking the optical port.

Use of the function button is possible only when its slot is in vertical position (see. **Error! Reference source not found.**, position 19. If the slot of the button is turned to the horizontal position, it becomes impossible to press it. The button can be sealed in this position through a hole in the button and special recesses in the meter cover. The sealing of the button is performed similarly to the sealing of the meter cover. This eliminates the unauthorized use of the button and the opening of the cover without damaging the seals.

2.2.7. Load control relay

The meters may have a load control relay. With the relay, it is possible to disconnect or connect the load of the consumer through any communication interface. Depending on the parameterization, the relay can be switched off automatically when the maximum allowable values of voltage, current, power, are achieved, or after triggering magnetic or electromagnetic field sensors.

2.2.8. Sensors

The meters have sensors for opening the meter cover and the terminal cover. When the meter casing or the terminal cover is being opened the corresponding sensor is triggered. An entry about this event is then made in the event log of the meter. The recorded event has the mark of its date and time. Similarly, the log records about the closure of the meter cover or terminal the cover are made.

The magnetic field sensor (if one is installed in the meter) is activated by a constant magnetic field higher than 100 mT. When the duration of exposure is longer than 3 s, the message "MAGN" begins to appear periodically on the display of the meter. A record of this event is recorded in the event log of the meter. The total duration of magnetic field exposure will be recorded any time the sensor will be triggered by the magnetic field of the same lever within 60 seconds of the last exposure. If the pause between the effects of the magnetic field is more than 60 seconds, then each of them will be recorded in the log as a separate record with the corresponding duration.

The electromagnetic field sensor (if one is installed in the meter) is activated when exposed to an electromagnetic field with a voltage higher than 10 V/m in the frequency range from 80 to 2000 MHz. When the duration of exposure is longer than 3s, the message "rAd, 0" begins to appear periodically on the display of the meter. A record of this event is recorded in the event log of the meter. The total duration of electromagnetic field exposure will be recorded any time the sensor will be triggered by the electromagnetic field of the same intensity within 60 seconds of the last exposure. If the pause between the effects of the electromagnetic field is more than 60 seconds, then each of them will be recorded in the log as a separate record with the corresponding duration.

The sensor operation message is reset using the "NIK Parameterization" program via any available password communication interface.

2.3. Scope of supply

The meter scope of supply is given in Table 2.

Table 2. Scope of supply

Name	Quantity
Energy meter (version according to the order)	1 pc.
Passport*	1 copy
Operation manual	1 copy
Software*	1 pc.
Packaging	1 pc.
Certificate of conformity	1 copy
Other options of operational documentation are specified in the delivery contract. *According to the delivery contract.	

2.4. Operation principle

2.4.1. Measurement of energy parameters, their indication, and data storage

Measurement of the active and reactive electrical energy is accomplished through analog-to-digital conversion of electrical signals which come from the primary current and voltage sensors onto the input of the built-in analog-to-digital converter (ADC) of the power measurement IC. It converts signals into a sequence of digital samples and transmits them to the microcontroller. This microcontroller computes values of the voltage, power, active and reactive energy in total and for each rate.

The microcontroller provides the operation of the electronic display, communication interfaces, pulse outputs, case opening sensor, and terminal cover opening sensor.

Non-volatile memory is used to store data in the meters. The accumulated values of the electric power and parameters of the meters are stored in memory. The measured energy values and parameters of the meters are stored for entire life in the absence of voltage at the terminals.

2.4.2. LCD description

The meters have a liquid crystal display (hereinafter - LCD), which is shown in Figure 2.

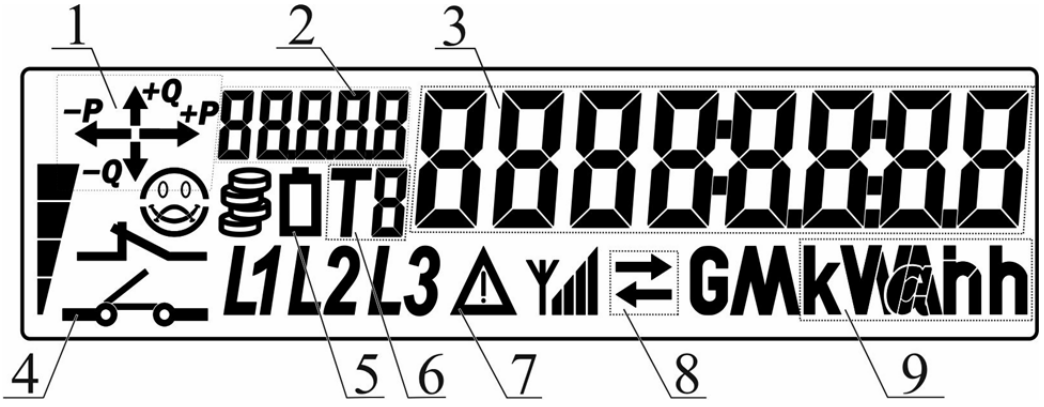


Figure 2. View of meters LCD.

The figure shows the following elements of the LCD:

1. The indicator group of energy angle quadrant:

1.1. «+P» active energy (A+);

1.2. «-P» active energy (A-);

2. The indicator group of the OBIS code of the displayed parameter.

3. The group displaying the value of the parameter being measured.

4. The load control relay status indicator. The symbol «» indicates the open relay.

5. Battery charge indicator «». The battery requires replacement if the symbol is displayed on the indicator.

6. «T8» The number of currently active rate.

7. Internal error indicator «» flashes when an error occurs or during the emergency rate.

8. Data exchange through interfaces indicator «».

9. Unit indicator group:

9.1. «A» current in amperes;

9.2. «V» voltage in volts;

9.3. «kW» active power in kilowatts;

9.4. «kVar» reactive power in kilowars;

9.5. «kW h» active energy in kilowatt-hours;

9.6. «kVarh» reactive energy in kilowar-hours;

9.7. «h» network frequency.

Unmarked and undescribed indicator elements in meters of this type are not applied.

2.5. Meters parametrization

During parameterization, the configuration constants of the meters are entered into the non-volatile memory. Parameterization of meters is conventionally divided into 2 types: factory parameterization and consumer parameterization.

The serial number, necessary for the functioning of the meters and additional modules constants are written down in the memory of the meters at factory parametrization. These constants do not change during the lifetime of the meters. Factory parameterization of meters is possible only in factory conditions.

The constants that adapt the meter to the operating conditions are written to the memory of the meters through any communication channel during the consumer parametrization. The information that is written to the memory of the meters is given in Table 3.

The consumer parameterization of meters is carried out by the power supply organizations or other authorized organizations utilizing the special software. The use of the software is possible only with the password.

Table 3. Consumer parametrization data

Parameter	Value	
	Default value	Valid values
Data transfer rate: - for optical port - for PLC or PLC G3 electrical interface*	9600 baud	do not change
The time until disconnect when the interface is inactive	120 s	30 to 300 s
Meter address: – senior «HIGH» – junior «LOW»	generated based on the serial number of the meter	 16 to 16383 16 to 16383
User password Operator password	1111111111111111 2222222222222222	0 to 16 symbols 0 to 16 symbols
Place of the meter installation (1 field) Place of the meter installation (2 field) Place of the meter installation (3 field) Place of the meter installation (4 field)	– – – –	0 to 100 symbols 0 to 100 symbols 0 to 100 symbols 0 to 100 symbols
Daylight saving time parameters	Automatic transition	- automatic transition; - transition to the specified month, day; - no transition.
Number of rates Number of week profiles Number of seasons rates Number of day profiles Holidays	By the customer request	1 to 4 1 to 10 1 to 12 1 to 16 0 to 30
* - depending on the version		

2.6. Interfaces description

The meters have a main interface (optical port) and may have one additional PLC or PLC G3 interface. The type and availability of the interface are reflected in the version of the meter,

which is indicated on the nameplate and in the passport (see «**Error! Reference source not found.**»). Data from the meter can be read simultaneously through all available interfaces. The descriptions of the PLC interfaces are given in Table 4.

Table 4. PLC interface description.

Interface	Description
PLC	Interface for data transmission with a modulated signal on power lines. 1. First-generation PLC interface: 1.1. Marked as "PLC" on the nameplate. 1.2. Exchange rate up to 150 Kbps. 1.3. CENELEC-A frequency band (10kHz to 95kHz). 1.4. DCSK modulation.
PLC G3	Interface for data transmission with a modulated signal on power lines. 1. Third-generation PLC interface: 1.1. Marked as "PLC3" on the nameplate. 1.2. Exchange rate up to 150 Kbps. 1.3. CENELEC-A frequency band (10 kHz to 500 kHz). 1.4. OFDM modulation.

Table 5. Interfaces and relays markings on the meter nameplate

Marking	Description
PLC, PLC3	– PLC interface is present;
	– optical port is present;
	– load control relay is present;

2.7. Rate module

The programmable meters rate module distributes the data of measured by meters energy in corresponding to the rate model of meters registers of active energy (single- or multi-rate metering). Rate seasons, the corresponding profiles of the week, and profiles of the day are entered into the meters during parametrization. The time of switching rates is set in these profiles.

The rate program analyzes the data of the internal real-time clock and compares them with the beginning of the rate season data that was set during meter parameterization.

Rate seasons allow using several variants of registers of energy accumulation on rates during a calendar year. Up to 12 rate seasons can be used in the meter. The beginning of the rate season corresponds to the date of activation of the season. The profile number of the week will be used during this season.

The week profile assigns a specific order of day profiles during the calendar week, including an additional holiday. The meter supports up to 10 week profiles.

The day profile is the order of switching the active rate during the day with the corresponding switching time. The meter supports up to 16 day profiles with the possibility of using up to 12 active rate switches during the day.

List of holidays. Up to 30 public holidays can be specified on the meter. Holiday date format: month - day.

Rate registers. The accumulated energy values are written to the appropriate registers in the memory of the meter. The meter has a separate set of energy registers for each rate.

Emergency rate. In case of failure of the internal clock, the meters automatically turn on the emergency rate, recording all calculated energy values in the emergency rate register. The electronic display flashes the corresponding symbol ⚠ and the corresponding rate number while the emergency rate is turned on (see Figure 2, items 6 and 7 and «Table 7. Data showed on the meter's display »). The emergency rate number is set during parameterization.

2.8. Meters unauthorized interference protection

The casing and the terminal cover are attached to the socle with sealing screws. The groove on the perimeter of the socle provides at least a 4 mm connection overlap. The overlap eliminates unauthorized penetration into the measuring part of the meters without damaging the housing. In addition to the sealing screws, laser welding can be used to attach the casing to the socle.

Depending on the version the meters have a sensor for opening the terminal cover and a sensor for opening the meter cover. The meters provide a recording of 65635 triggers of each sensor and can record the last 20 dates of their activation (opening and closing) in the meter event log.

In the meters, the information is available for reading through the optical port and the PLC or PLC G3 electrical interface (if either of them are available in the version of the meter).

Access to data is possible through special software only after entering the password.

The user password only allows reading data from the meters. Data cannot be written to the meter with the user's password.

The operator password allows to enter and read data.

2.9. Marking

2.9.1. General requirements

Marking of meters corresponds to EN 50470-1, EN 50470-3, EN 62053-23 and manufacturer blueprints.

Fonts and signs used for marking comply with GOST 26.020 and manufacturer blueprints.

The quality of the inscriptions and symbols ensures their clear image during the meter service life.

Marking is performed in Ukrainian or in the language specified in the supply contract.

The marking is applied to the meter by offset printing or in another way that does not impair the quality.

An example of the meter NIK 2100 A...P6... nameplate is shown in Figure 4.

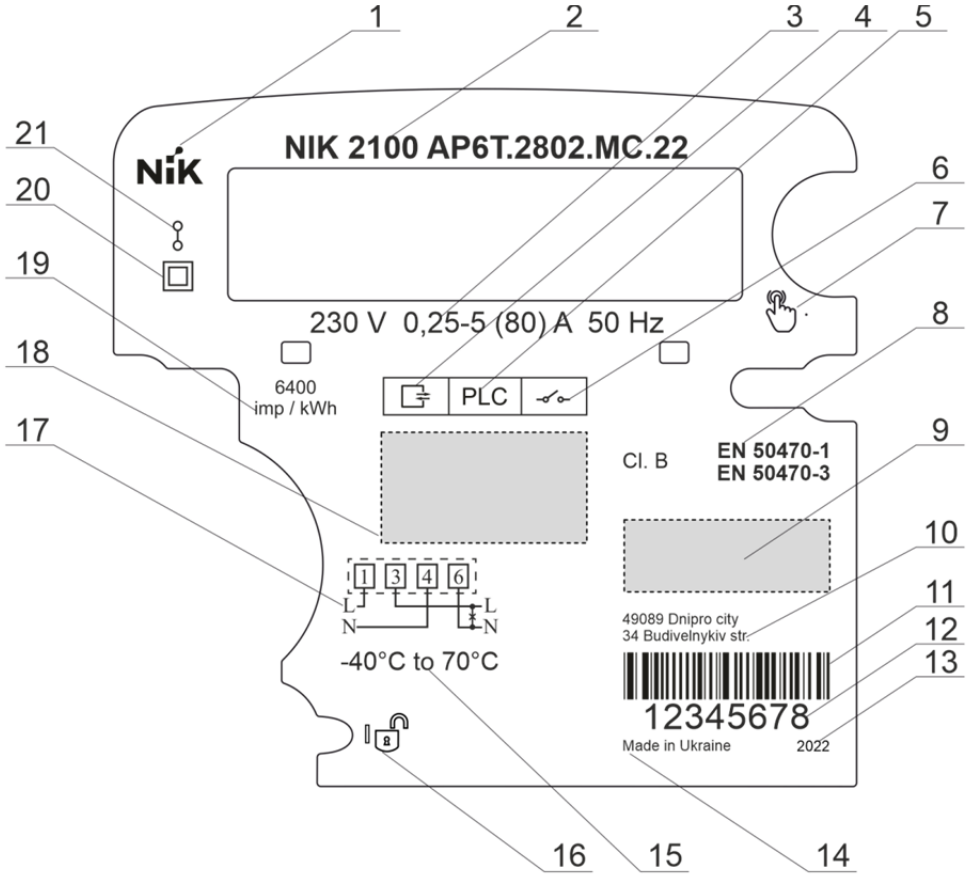


Figure 3. Example of marking on the meter nameplate.

The following elements can be seen:

1. Registered trademark.
2. Meter version
3. Main technical characteristics (reference voltage, minimum, reference, and maximum current, reference frequency).

Interface and relay plate:

4. Indication of the "Optical Port" interface.
5. Indication of the second interface; the marking shown in the figure corresponds to the PLC interface.
6. Indication of the load control relay.
7. Mark of the "View" button.

8. Symbol of the accuracy class of the meter for measuring active energy and corresponding standards.The first position for the certification marks.
9. Area for the certification marks.
10. Manufacturer’s address
11. Barcode.
12. Factory number according to the numbering system of the manufacturer
13. Indication of the issue year of the meter.
14. The inscription "Made in Ukraine".
15. The operating temperature range
16. The function button marking  .
17. The connection diagram of the meter.
18. Place for additional marking at the request of the consumer.
19. Pulse output constant of the meter.
20. Marking of the II class of meter case protection.
21. Marking of the number of measuring elements.

Notes:

1. The inscriptions on the nameplate may be in other languages at the request of the customer.

2. Additional elements can be applied to the nameplate at the request of the customer.

3. The list of elements on the nameplate may change compared to the figure depending on the design of the meter.

4. The relative position of the elements and their dimensions on the nameplate may be changed when meter geometry or meter casing is changed and for other production reasons.

5. The nameplate can be executed on a casing of the meter by a tampon printing at the request of the customer. The placement of design elements will be similar.

2.9.2. Marking of the terminal cover

The meter connection diagram is marked on the terminal cover of the meters. The connection scheme of meters is given in «Appendix B. The connection scheme of the meters». The aluminum wires must be pressed into special sleeves during the connection of the meters to the mains. The sleeves should prevent corrosion of the connections in the terminal cover.

2.9.3. Marking of containers

The marking of containers corresponds to the manufacturer blueprints and contains the following information:

- trademark of the manufacturer;

- name and symbol of the meter;
- year of packaging;
- QC stamp.

The marking is applied on the container label or on the container itself.

Marking of transport containers complies with GOST 14192, the requirements of the contract, and blueprints of the manufacturer.

There is a label on the transport container made by printing with manipulation signs "Fragile", "Caution", "Protect from moisture", "Top", and a label with basic, additional and informational inscriptions according to GOST 14192.

Labels on transport containers are located according to GOST 14192.

It is possible to mark the containers at the customer's request with an indication in the supply contract.

2.10. Packaging

Packaging of meters, operating and shipping documentation is carried out in accordance with the blueprints of the manufacturer. Type of shipments - low tonnage.

Consumer container for meters is made of cardboard according to the blueprints of the manufacturer.

One meter with operating documentation (according to the delivery set) and the declaration of conformity are enclosed in the consumer packaging.

The container with a packed meter is pasted with adhesive tape. A packing list is pasted on the upper part of the consumer container.

It is possible to carry out the meter packaging at the customer's request with an indication in the supply contract.

The meters packed in consumer containers are placed in transport containers. No more than 20 meters are placed in the transport packaging according to the blueprints of the manufacturer.

The box is also accompanied by shipping documents, including a packing list containing the following information:

- name and symbol of the meter;
- number of meters;
- date of packing;
- QC stamp.

The overall dimensions of the transport container do not exceed 390 mm x 252 mm x 310 mm.

Net weight, less than 24 kg.

Gross weight, less than 48 kg.

3. Intended use

3.1. Operational limitations

The operational limitations are shown in Table 6.

Table 6. Operational limitations.

Parameter	Value
Reference voltage range, V	For U_n=220 V: 176 to 253 For U_n=230 V: 184 to 264 For U_n=240 V: 192 to 276
Reference current, A	For NIK 2100 A...P6... is 0,0125 to 80
The maximum allowable voltage at the terminals of the main test terminal in the open state, V	30
The maximum allowable current of the output circuit of the main test terminal in the closed state, mA	30
Working temperature range, °C	-40 to +70
Maximum working temperature range, °C	-45 to +70
Range of changes in relative humidity (at a temperature +30 °C), %	0 to 95
The range of changes in atmospheric pressure, kPa	70 to 106,7

Note: information on the meter electronic display at temperatures below -25 °C changes once per minute.

3.2. Preparation of the meter for use and installation procedure

3.2.1. Installation

Installation, de-installation, and calibration of the meter should be performed only by organizations with the appropriate authority. Installation and de-installation of the meter must be performed by personnel with at least the third qualification group according to the rules of safe operation of electrical installations of consumers.

The meter must be installed in rooms without aggressive vapors, dust, and gases

Before installing the meter, it is necessary to conduct an external inspection of the meter, make sure there is no mechanical damage and the seals are present.

The meter should be secured at the metering point with three screws, or installed on a DIN rail.

3.2.2. Backup battery

A built-in backup battery is used to power the meter clock (depends on the meter's version). The battery powers the clock for the entire lifetime of the meter. Replacement of the battery is possible only in the service center of the manufacturer.

If the low battery indicator on the electronic display flashes (see Figure 2, symbol , item 5), this means that the battery charge is low. A service center should be contacted for battery replacement.

3.2.3. Connecting the meter

The meter must be connected in accordance with the diagram shown on the meter nameplate, the terminal cover, in the meter passport, and the appendix «Appendix B. The connection scheme of the meters». All screws of the clamp block must be tightened with a screwdriver (blade thickness 1 mm) to the stop point with a torque of at least 3.5 ± 0.5 N·m.

The aluminum wires must be pressed into special sleeves during the connection of the meters to the mains. The sleeves should prevent corrosion of the connections in the terminal cover.

To make sure that the electronic display indicates the normal operation of the meter (described below) the voltage should be applied. The connection should be corrected or the meter replaced if the normal operation of the meter is not achieved.

After applying a voltage to the meter clamp, it is necessary to ensure that the indicators work properly, then the terminal cover should be fixed with a screw and the thread should be passed through a special tide in the cover and the hole in the screw head. Finally, the seal is applied.

The screws of the terminal cower should be tightened with a screwdriver (blade thickness 1 mm) to the stop point with a torque of at least 0.5 ± 0.1 N · m.

3.2.4. Indication of the meters operating modes

The «6400 imp/kW·h» LED indicator (depending on the meter version) of active energy measurement is installed on the meters to display the meters operating modes. The indicator flashes at a frequency proportional to the power consumption and operates synchronously with the main electrical test output. The electronic display also shows the additional symbols described in section 2.6.2 «LCD description».

The symbol ⚠ (Figure 2, item 7) starts flashing on the electronic display in case of meter failures. In the field of the measured parameter value (Figure 2, position 3) error codes are periodically displayed. All errors that occurred in the meter are displayed first when the "View" button is pressed. The calculated and measured by the meter data displayed afterward. The list of error codes is given in the appendix «Appendix D. Table of meters errors» of this manual.

The emergency rate is activated in case of a rate system or the meter internal clock failure.

The effect of the emergency rate in the meters is displayed on the electronic display by flashing the ⚠ symbol (Figure 2, item 7), and by flashing the emergency rate number (Figure 2, item 6). A window «Err 006» periodically appears when pressing the "Browse" button with the active emergency rate or when the windows are automatically switched.

The current rate number is displayed in Figure 2, item 6., The rate number under review, as well as other measured and calculated by the meter parameters, are displayed in Figure 2, item 2 (for meters that measure active energy in two directions). This information is displayed in the form of OBIS codes. The list of OBIS codes that the meter supports is given in the appendix «Appendix C. Table of OBIS codes».

The versions of the meters that measure active energy in two directions display the quadrant of the energy angle on the electronic display with the symbols displayed in Figure 2 position 1.

3.3. The meters utilization

The meter measures active or active and reactive electrical energy with a cumulative total in the operating mode.

Energy consumption (depending on the load) is displayed on the LED indicator «6400 imp/kW·h» on the nameplate of the meters for measuring active energy and «6400 imp/kvar·h» for measuring reactive energy.

The electrical test output is implemented on an electronic key with optical isolation. The maximum allowable key voltage in the open state is 30 V. The maximum allowable key current in the closed state is 30 mA.

3.4. Data reading

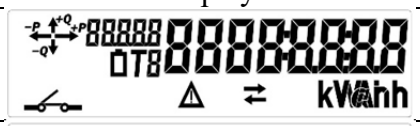
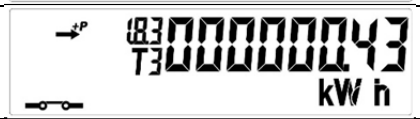
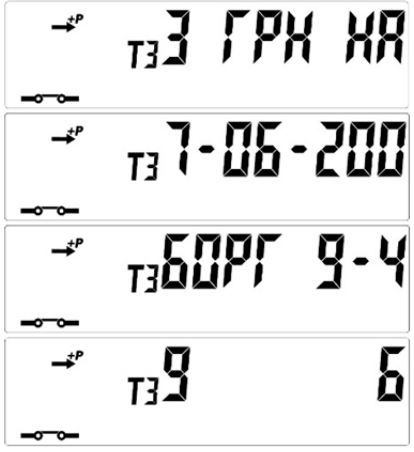
The measured values or calculated from the measurement results stored in the memory of the meter (depending on the version of the meter) can be read via:

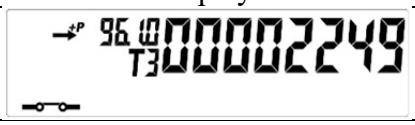
- the electronic display;
- the optical port;
- the PLC or PLC G3 interface.

The data shown in «Table 7» in form of "windows" is formed in sequence after power is supplied to the meters (depends on the parametrization).

Initially, after turning on the meter, all segments of the LCD are lit. The indication time of each data type is 10 seconds. The data type in the window is set during the meter parametrization.

Table 7. Data showed on the meter's display

№	Data type	Windows showed on the electronic display
1	Indication of all segments of the electronic display.	
2	Active energy A + (imported) in total at all rates, kW·year.	
3	Active energy A + (imported) at rate 1, kW·year.	
4	Active energy A + (imported) at rate 2, kW·year.	
5	Active energy A + (imported) at rate 3, kW·year.	
6	Active energy A + (imported) at rate 4, kW·year.	
7	Instantaneous power value, kW.	
8	Instantaneous voltage value, V.	
9	Instantaneous current value, A.	
10	A moving line that carries information about the consumer's debt in UAH, and the date in the format day - month – year.	

№	Data type	Windows showed on the electronic display
14	Meter serial number.	

The manual data view function allows displaying most of the stored data on the electronic display using the "View" button (see Figure 1, item 4).

The appropriate converter and software are required to read data through additional communication interfaces. An optical head developed in accordance with IEC 62056-21 and software that can be downloaded from the official website https://nik-el.com are required to read data via the optical communication interface.

By connecting to the meter, it is possible to:

- view or change the rate model of the meter;
- view the load profile or meter readings for each type of measured energy for the last 180 days;
- view the value of each type of energy measured by the meter for each rate, and in total for all rates for the last day or month;
- view the number of occurred events;
- view the last 20 dates of the WDT (watchdog timer);
- view the last 20 dates of turning on the meter;
- view the last 20 dates of the meter shutdown;
- view the last 20 dates of the terminal cover opening;
- view the last 20 dates of a casing opening;
- view the last 20 dates of setting the clock;
- view the last 20 dates of the magnetic field sensor activation;
- view the last 20 dates of the magnetic field sensor deactivation;
- view the last 20 dates of resetting the magnetic field sensor;
- view the last 20 dates of the electromagnetic field sensor activation;
- view the last 20 dates of the electromagnetic field sensor deactivation;
- view the last 20 reset dates of the electromagnetic field sensor;
- view the last 15 dates of the overvoltage of the network;
- view the last 15 dates of the undervoltage of the network;
- view the last 15 dates of state change for the load control relay;
- view the last 15 dates of triggering the low battery indicator;
- view the last 15 dates of entering the wrong password;
- adjust the clock of the meter;
- view the values of all parameters measured by the meter;

- view or change interface settings, voltage or power threshold parameters at which the load control relay is switched off;
- view information about the location of the meter;
- change the access password;
- change the rate number or time intervals of the relay output triggering;
- change the number and order of windows on the electronic display.

Note: the meters store energy values up to the third decimal place, and the electronic display shows the values up to the second decimal place (the third character is discarded).

As a result, the value of the total energy for all rates $T_{\Sigma ed}$, which is displayed on the electronic display of the meter may be greater than the value of the total energy $T_{\Sigma c}$ calculated by the formula (2.1). But the difference should not be higher than 0.04 (2.2).

$$T_{\Sigma c} = T1+T2 + T3 + T4 \quad (2.1)$$

$$T_{\Sigma ed} - T_{\Sigma c} \leq 0{,}04 \quad (2.2)$$

where T1, T2, T3, T4 are energy values shown on the electronic display of the meter for the first, second, third, and fourth rates, respectively.

The maximum value of subtraction of the sum of the values of energies of 30-minute intervals $W_{\Sigma 30}$ (read from the meter using the parametrization program) from the energy for a certain period W_p is 0.48 (2.3):

$W_p - W_{\Sigma 30} \leq 0.48$ (2.3).

Both values W_p and $W_{\Sigma 30}$ are within the same period.

The magnetic field sensor (if one is installed in the meter) is triggered by a constant magnetic field with an induction of more than 100 mT. A message MAGN starts to appear periodically on the meter display when the exposure to the field lasts more than 3 s. A record of this event is then recorded in the meter event log.

The electromagnetic field sensor (if one is installed in the meter) is triggered by the influence of an electromagnetic field with an intensity of more than 10 V/m and a frequency range of 80 to 2000 MHz. When the exposure lasts more than 3 s, a message rAd 0 starts to appear periodically on the meter display. A record of this event is then recorded in the meter event log.

The total duration of electromagnetic field exposure will be recorded any time the sensor will be triggered by the electromagnetic field of the same intensity within 60 seconds of the last exposure. If the pause between the effects of the electromagnetic field is more than 60 seconds, then each of them will be recorded in the log as a separate record with the corresponding duration.

Sensor activation messages can only be switched off using the "NIK Parameterization" program (password is required) by sending a special command via any available meter interface.

4. Maintenance

4.1. General instructions

Maintenance includes mandatory verification operations and meter calibration and repair if necessary. The periodicity of verification is indicated in Table 1.

Repair and calibration operations are performed at the factory.

The verification operation is performed by an authorized body or an authorized laboratory.

The meters meet safety requirements in accordance with GOST 22261 in terms of operation safety.

The meters correspond to class II of the protection method of a person from electric shock according to EN 50470-3, EN 50470-1, EN 62053-23.

The insulation between all current, voltage, and "ground" circuits can withstand a test voltage of 4 kV (RMS value) with a frequency of (50 ± 2.5) Hz for 1 min.

The meter is fireproof and meets the requirements for fire safety.

5. Storage

The meter must be stored in the warehouse of the consumer (supplier) in consumer packaging according to GOST 22261-94.

6. Transportation

6.1. Requirements to transportation conditions

The transportation and storage conditions of the meters in the manufacturer transport packaging meet conditions 3 according to GOST 15150. The type of shipment is small low-tonnage.

The meter can be transported in covered railway cars, transported by road with protection from rain and snow, by water transport, as well as transported in sealed heating compartments of aircraft.

Transportation is carried out in accordance with the rules of transportation that apply to each type of transport.

The meter in a transport container can withstand the influence of ambient temperature -45 °C to +70 °C, the influence of relative humidity of ambient air 95% at a temperature +30 °C, and atmospheric pressure 70 to 106,7 kPa (537 to 800 mmHg).

The meter in a transport container can withstand the influence of a transport shaking with 80 to 120 shakes per minute with an acceleration of 30 m/s^2.

7. Requirements for environmental protection and disposal of the device

The device must not be disposed of with household waste after the end of its service life. Disposal must be carried out in compliance with all applicable requirements of the legislation.

In order to eliminate possible damage to the environment by uncontrolled waste disposal, this product should be separated from other waste for further use of the device or its components.

Production waste must be disposed of in accordance with local regulations.

8. Manufacturer warranty

If the consumer complies with the conditions of operations, storage, and installation of EN 50470-3, EN 50470-1, EN 62053-23 the manufacturer guarantees the compliance of the meters to these standards.

The warranty period of operation of the meters is 5 years from the moment of their sale. In the absence of a sale date mark, the warranty period is determined from the date of issue.

The manufacturer guarantees the quality of exported meters and their compliance with the requirements of the operating instructions for 5 years starting from crossing the State Border of Ukraine. The warranty is active if the customer follows the operating and storage conditions requirements of the current operating instructions and manufacturers sealing staying intact.

In the event of failure or non-compliance of meters with the requirements of these operating instructions during the warranty period, the meters must be replaced by the manufacturer or repaired by an organization authorized to carry out warranty repairs.

The warranty is canceled when the control seal of the manufacturer is violated, the mechanical damage of the socle or casing is present, traces of intense heating of the terminal is present, or the operating rules outlined in this manual are violated. In the case of violations, the repairs of the meters are at the expense of the consumer.

The manufacturer is not responsible for meters that failed due to violations of the requirements of this operations manual, committed during the installation, connection, or operation of the meters.

Post-warranty repairs are carried out by an organization authorized to carry out repairs or by the manufacturer under a separate agreement.

The warranty period of storage is 1 year from the moment of shipment of meters.

Appendix A. Overall and installation sizes of the meters

(mandatory)

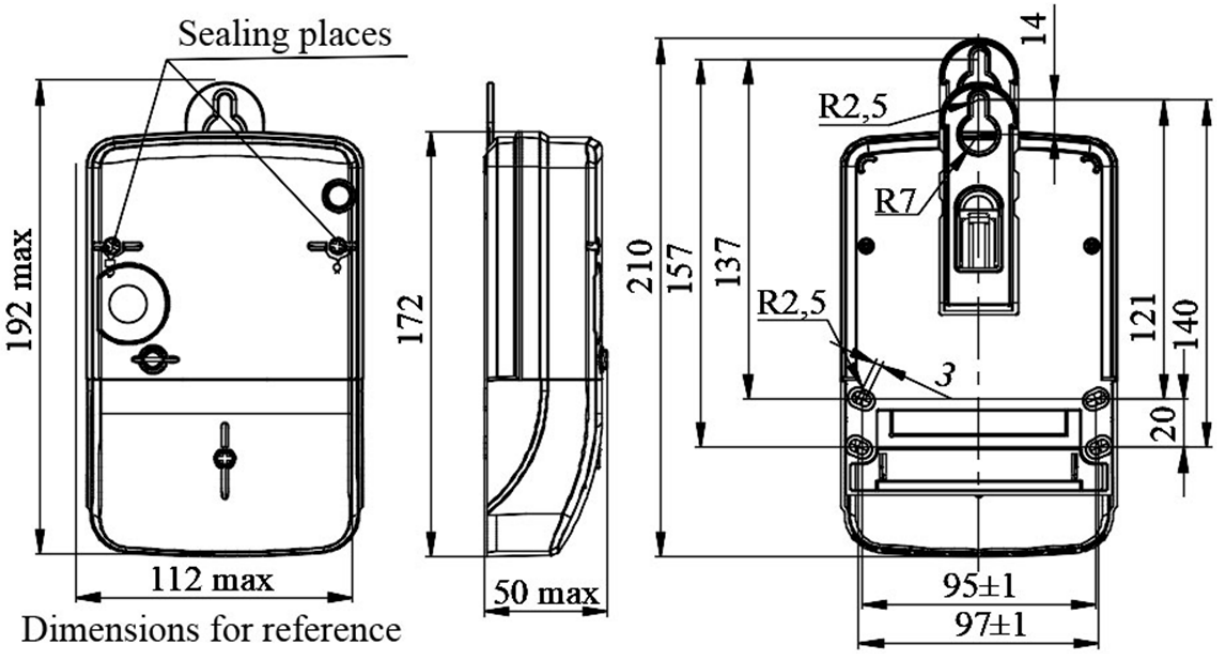


Figure A 1. Overall and installation dimensions

Overall and installation dimensions are shown in Figure A.1.

Appendix B. The connection scheme of the meters

(mandatory)

The connection diagram of the meter is shown in Figure B.1.

Figure B. 1. The meters wiring diagram

Note: "14" and "15" are the contacts of the electrical test output.

Appendix C. Table of OBIS codes

(recommended)

Table B.1 lists all OBIS codes that the meters support (depending on the version). Column designation: «A» corresponds to a meter that measures active energy in two directions.

Table C. 1. OBIS codes of the meters

OBIS code	Parameter name	A
1.8.0	Active energy A + (imported) in total for all rates, kW·year	+
1.8.1	Active energy A + (imported) at rate 1, kW·year	+
1.8.2	Active energy A + (imported) at rate 2, kW·year	+
1.8.3	Active energy A + (imported) at rate 3, kW·year	+
1.8.4	Active energy A + (imported) at rate 4, kW·year	+
2.8.0	Active energy A- (exported) in total for all rates, kW·year	+
2.8.1	Active energy A- (exported) at rate 1, kW·year	+
2.8.2	Active energy A- (exported) at rate 2, kW·year	+
2.8.3	Active energy A- (exported) at rate 3, kW·year	+
2.8.4	Active energy A- (exported) at rate 4, kW·year	+
15.8.0	Active energy | A + | + | A- | total for all rates, kW·year	+
15.8.1	Active energy | A + | + | A- | at rate 1, kW·year	+
15.8.2	Active energy | A + | + | A- | at rate 2, kW·year	+
15.8.3	Active energy | A + | + | A- | at rate 3, kW·year	+
15.8.4	Active energy | A + | + | A- | at rate 4, kW·year	+
16.8.0	Active energy | A + | - | A- | total for all rates, kW·year	+
16.8.1	Active energy | A + | - | A- | at rate 1, kW·year	+
16.8.2	Active energy | A + | - | A- | at rate 2, kW·year	+
16.8.3	Active energy | A + | - | A- | at rate 3, kW·year	+
16.8.4	Active energy | A + | - | A- | at rate 4, kW·year	+
0.9.1	Current time	+
0.9.2	Current date	+
96.1.0	The meter’s serial number	+
96.1.10	Software version	+
96.1.11	Software checksum	+
1.7.0	Instant values of active power A + (imported), kW	+
2.7.0	Instant values of active power A- (exported), kW	+
15.7.0	Instantaneous values of active power | A + | + | A- |, kW	+
16.7.0	Instantaneous values of active power | A + | - | A- |, kW	+
12.7.0	Instantaneous voltage values, V	+
11.7.0	Instant value of current, A	+
13.7.0	Power factor	+
14.7.0	Network frequency, Hz	+

Appendix D. Table of meters errors

(recommended)

The meter error codes are given in Table D.1.

Table D. 1. The meters error codes

Error code	Description	Solution
Err 006	Real-time clock failure.	Check whether the backup battery is low. Set the correct clock settings via the optical head or one of the interfaces. Check whether the rate grid parameterization is performed correctly.
Err 040	The meter terminal cover is open.	Install the terminal cover, or tighten the terminal cover screw.
Err 044	The cover of the meter is open.	Contact your power company and service center.
Err 051	Internal system failure.	Contact your power company and service center.
Err 090	Inequality of currents in phase and neutral circuits.	Check the meter connection diagram.
Err 091	Reverse current (does not appear the meters that measure active electrical energy in the forward and reverse directions).	Check the meter connection diagram.
Err 205	Internal system failure.	Contact your power company and service center.
Err 206	Internal system failure.	Contact your power company and service center.
Err 230	Internal system failure.	Contact your power company and service center.
Err 231	Internal system failure.	Contact your power company and service center.
Err 232	Internal system failure.	Check whether the rate grid parameterization is performed correctly.
rAdio	The electromagnetic field sensor was activated.	Contact your power company.
MAGN	The magnetic field sensor was activated.	Contact your power company.