

## MNT 32 WATT-HOUR METERS

OPERATING MANUAL AASHH.411152.095 NE

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This operation manual (hereinafter referred to as the “OM”) covers MNT 32...A... watt-hour meters (hereinafter referred to as the “meters”).

The OM describes the operation of the meters, their intended use, maintenance, storage and transportation.

When working on installations up to 1000 V, operating personnel shall be specially trained and have electrical safety permits of at least group III.

## 1 Description of meters and their operation

### 1.1 Compliance with standards

Table 1 contains a list of standards to which MNT 32...A meters comply. Table

#### 1. Standards

DSTU EN 62052-11	Measuring instruments for alternating current electrical energy. General requirements, tests and test conditions. Part 11. Watt-hour meters.
DSTU EN 62053-21	Measuring instruments for alternating current electrical energy. Special requirements. Part 21. Static active energy meters (accuracy classes 1 and 2).
DSTU EN 62053-22	Measuring instruments for alternating current electrical energy. Special requirements. Part 22. Static active energy meters (accuracy classes 0.2 S and 0.5 S).
DSTU EN 62053-23	Measuring instruments for alternating current electrical energy. Special requirements. Part 23. Static active energy meters (accuracy classes 2 and 3).
DSTU EN 62059-32-1	Electricity measuring instruments. Reliability. Part 32-1. Durability. Checking the stability of metrological characteristics by means of elevated temperature.
DSTU IEC 60721-3-3	Classification of environmental impacts. Part 3-3. Classification of groups of environmental parameters and their severity. Operation under stationary conditions protected against atmospheric impacts.
DSTU IEC 62053-52	Measuring instruments for alternating current electrical energy. Special requirements. Part 52. Symbols.
DSTU EN 61140:2019	Protection against electric shock. General aspects of installations and equipment.
DSTU 8828:2019	Fire safety. General requirements.
DSTU EN 60529	Protection degrees provided by enclosures (IP code)
IEC 62056-53	Electricity metering - Data exchange for meter reading, tariff and load control - Part 53 Part: COSEM Application layer
IEC 62056-61	Electricity metering - Data exchange for meter reading, tariff and load control - Part 61 Part: Object identification system (OBIS)
IEC 62056-62	Electricity metering - Data exchange for meter reading, tariff and load control - Part 62: Interface classes
DSTU EN 62056-21	Electricity metering - Data exchange for meter reading, tariff and load control. Part 21. Direct local data exchange (EN62056-21:2002, IDT; IEC 62056-21:2002, IDT)

#### 1.1.1 Purpose

Depending on the version, the meters are designed for:

non-tariff or tariff measurement of active and reactive energy in the forward and reverse directions in three-phase four-wire AC grids, with transformer or direct connection by voltage and current;

recording and indication of active, reactive and total energy, power factor, rms voltage and current, phase angle in three-phase four-wire AC circuits.

#### 1.1.2 General description of the measuring instrument

Watt-hour meters MNT 32...A... (hereinafter referred to as the meters) are static three-phase electronic meters with an electronic display and three measuring elements designed for non-tariff or tariff measurement of active and reactive electricity in the forward and reverse directions in three-phase AC grids with transformer or direct connection by voltage and current.

Meters are used to organize electricity metering in the public utilities sector and other industries. The meters can be used in automated electricity control and metering systems (AECMS). For this purpose, they have implemented the DLMS/COSEM standard with and without data encryption (and/or authentication).

A complete list of values measured by the meters, depending on the version, is given in Table 3 and Table 4.

The meters meet the requirements of DSTU EN 62052-11, DSTU EN 62053-21, DSTU EN 62053-22, DSTU EN 62053-23.

The meters are produced for active energy measurement with accuracy class 1 according to DSTU EN 62053-21 and accuracy class 0.5 S according to DSTU EN 62053-22. When measuring reactive energy, they correspond to accuracy class 2 according to DSTU EN 62053-23.

The meters meet the requirements of the national standard DSTU EN 62059-32-1 in terms of stability and metrological reliability.

The meters comply with the requirements of the Technical Regulations for Legally Regulated Measuring Instruments, approved by the Resolution of the Cabinet of Ministers of Ukraine dd. January 13, 2016, no. №94.

The design of the meters corresponds to the set of design documentation AASHH.411152.095. The meter versions differ in the rated voltage, maximum current, ability to measure reactive energy, ability to measure energy using several tariffs, availability and type of additional interface, availability of magnetic and electromagnetic field sensors, availability of load disconnect relay, ability to measure active energy in the reverse direction, and the number of measured values. All meters are equipped with an optical port, electrical test pulse outputs, optical test pulse outputs, which also serve as LED indicators for energy measurement (active or active and reactive). The meters are equipped with a case opening sensor and a terminal cover opening sensor. Tariff meters are equipped with a built-in backup battery.

Depending on the version, meters can be equipped with an interface for remote data transmission: the first additional interface (either RS-485 or 4G/LTE) and the second additional RS-485 interface.

Different versions of the meters can be equipped with a relay output or a load shedding relay; a magnetic field and/or electromagnetic field sensor and outputs for discrete inputs. Different versions of meters can measure energy only in the forward direction or in both forward and reverse directions. Resistance dividers are used as primary converters in the voltage circuit of each phase, and shunts or current transformers are used in the current circuit of each phase. All meters are equipped with an electronic display, which is a liquid crystal display (hereinafter - LCD). The sequence of data display on the display is programmable. The meters use non-volatile memory to store data.

To power the meters in the absence of mains voltage, a backup battery can be installed, and it is also possible to connect a service DC backup power supply (installed upon agreement with the customer). The use of the 4G/LTE interface module in the meters (see tables of versions) allows to transmit a notification about this event after the power supply voltage is lost. This feature is provided by the use of an ultra capacitor that maintains the module operation for some period after the supply voltage is lost. The notification generated in this case makes it possible to understand that the communication with this meter was interrupted due to the lack of power. All possible versions of the meters are described in Table 2.

	A	X	X	X	1	X	X	X	X	X	X	X	Voltage		
														1	3x220/380 V
														2	3x230/400 V
														3	3x240/416 V
														4	Wide voltage range <sup>1</sup> 3x57.7/100 V... 3x240/416 V
														5	3x57.7/100 V <sup>1</sup>
														<b>Active energy measuring</b>	
														1	In forward direction
														2	In forward and reverse directions
														<b>Sensors</b>	
														0	Version without sensors
														M	Magnetic field sensor available
														C	Electromagnetic field sensor available
														MC	Magnetic and electromagnetic field sensors available
														<b>Relay</b>	
														0	Version without relay
														1	Relay output available
														2	Load shedding relay available <sup>2</sup>
														<b>Second additional interface</b>	
														0	No interface
														2	RS-485 installed
														<b>First additional interface</b>	
														0	No interface
														2	RS-485 installed
														6	4G/LTE installed
														<b>Main interface</b>	
														1	Optical port interface installed T
														Can be added only to indicate tariff meters Space, can be added only to indicate tariff meters	
														<b>Mains connection diagram</b>	
														P3	Direct connection 5(120)A
														P6	Direct connection 5(80) A
														T	Transformer connection 5(10) A
														<b>Measured energy</b>	
														R	Can be added only to indicate reactive energy meters
														A	Active energy
														<b>Accuracy class of meters</b>	
0.5s	Meters of accuracy class 0.5 S (only for transformer connection))														

<sup>1</sup> – only for transformer connection meters  
<sup>2</sup> – only for direct connection meters

## 1.2 General Specification:

Three phase energy smart meters, designed for measuring and registration of active, reactive and apparent energy for direct connection network, and to be remotely controlled from a main data collection center.

The customer can get the consumption information timely by (HAN) and IHD (In-Home Display/option) in order to make a policy decision for efficient use of energy.

### 1.2.1 Environmental Conditions:

#### - Ambient temperature:

Highest max. (in the shade):	+55 deg.C, about 6 hours a day
Lowest min.	-10 deg.C Max. Yearly average
+30 deg.C	

#### -Sun Temperature:

Black Object under direct Sunshine may attain a temp. of: 85 deg.c

#### -Air Humidity:

Max .	92% at 40 deg.C Min.
12%	
Yearly average	44%

#### -Altitude:

Erom sea level up to	1000 m
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## 1.3 Features:

The smart energy meters should have many features including those related to (AMI) functions as follows:

### 1.3.1 Measurement:

- Metering Import/Export, active/reactive energy in four quadrants and demand.
- Measuring the instantaneous voltage, current, active power, reactive power, apparent power, power factor, Vrms, Irms and frequency.
- Support maximum 8 tariffs. TOU of total import/export active energy, reactive energy.
- Metering data will be refreshed every second.
- Metering data is stored in EEPROM.
- Store the maximum active demand with time and data stamps.
- Cumulative demand indication.

### 1.3.2 Firmware upgrade:

Firmware can be updated locally by optical port as well as remotely upgraded in accordance with the DLMS/COSEM or OSGP Identification System and Interface Classes.

### 1.3.3 Service Disconnect /Reconnect:

- Switch relay ON/OFF 10000 times with I<sub>max</sub> current.
- The meter can be remotely Off & On electricity supply from a central data center.

### 1.3.5 Load control:

- If the overcurrent higher than the configurable threshold is detected, the disconnect switch shall be disconnected immediately.

### 1.3.6 Anti-tampering:

- The meter should be sealed with no hardware interface or component exposed.
- Various anti-tamper events such as terminal cover/ top cover opening, magnetic fields disturbance, Phase and neutral Swapping, reverse run caused by cable swapping, neutral current unbalanced, neutral disturbance, Jammer, and bypassing Meter should be detected with time stamp. When these events happen, alarm should be triggered and corresponding events should be recorded, and the meter should be disconnected for customize cases.
- Stored programs and registers should have full tamper and fraud protection.
- Meter should detect terminal cover removal in case of power off.

#### **1.3.7 Calendar and clock:**

- Calendar and clock are related to a time control and management system. All data related to date and time, including leap years and the deviation of the local time to generalized time reference (Greenwich Mean Time (GMT)), are controlled by this module. Time deviation between local time and standard time could vary with seasons.
- Real time clock has 0.5s per day accuracy according to IEC 62054-21. This clock could be synchronized with HES (Head-End System) by remote communication.
- Display format for date information is "DD/MM/YY" and for time is "HH/MM/SS".
- In case of power outage, the calendar clock shall be powered by an internal super- capacitor and then by battery whose minimum standby life is over 10 years without any user's operations.
- If the battery is failed or in low level voltage, low battery icon on LCD screen shall flash and this event should be recorded.
- Load surveys and event logs shall always use standard time for the date stamp .
- If the time is changed for DST (Daylight Saving Time) start or end, the meter conducts TOU metering function the adjusted time.

#### **1.3.8 Time of Use (TOU):**

- The meter supports programmable 2 sets of tariff structure, up to 8 tariffs for maximum demand, kWh and kVAh energy, etc.
- According to IEC 62056-62, active season, week, day table, tables for different selectable.
- Each tariff rate programmable for different periods of the day.
- User who has sufficient permission can read TOU scheme by communication port. But only the user who has highest security authorization with password can set the TOU scheme. If the scheme is incorrectly programmed, such as time set overlap in same Day-ID or tariff exceeds 8, the setting should be rejected.
- The new programmed TOU scheme shall be activated at the designated time, and the meter shall immediately register metering data by the new tariff. - Meters supports with calendar clock capability & memory to support TOU& outage recording functions, demand management functions, logic capability for advanced applications of the integrated disconnect, self-diagnostic features as well as tamper

—evident features& communication interfacing facility with security features.

#### **1.3.9 Billing:**

- The information collected from smart meters shall be used to issue bills through: -
- Only users with correct password can set the billing date/time.
- Energy and maximum demand.
- Consumption and accumulated dept.
- When the designated date/time arrives, monthly billing and daily billing would execute according to preset billing time.
- If a monthly billing happens in power failure, the meter should execute billing after power restore.
- More than 12 months of billing data for tracking, billing period is programmable.
- Bidders should also make suggestions on the most appropriate methods off bill delivery.

#### **1.3.10 Profiles for energy and power quality:**

- Up to 8 programmable channels for energy and demand load profiles storage capacity :260 days for 1 channel (15 min period).
- Programmable profiles period (typically 5, 10, 30 or 60 minutes).

#### **1.3.11 Event record:**

- The meter should support more than 20 kinds of event record with time stamp.
- Power off and power on.
- Disconnected/Reconnected remotely /locally or over threshold.
- Multiple utility-controlled password protection with access records with both correct and incorrect password.
- Communication module change.

#### **1.3.12 Stand-alone Operation**

Capability to operate on a stand –alone basis in case of loss of remote connection.

**1.3.13 LED:**

Three LEDs for active energy to be available, reactive energy and alarm signal output.

**1.3.14 LCD:**

- The meter has segment type LCD with configurable backlight brightness.
- Not less than 8 digits display for data display.
- After full meter counting/ consumption cycle is complete (all digits are reach 9), the meter shall support changing from KWh to MWh.
- The content of display shall be clearly indication on the nameplate of the meter.
- The parameters that display in LCD should be customized by utility.

\* NOTE: This specification is updated according to the MoE requirements to keep pace with developments in the field of communications.

**Table 3. Values measured by tariff meters**

No.	Measured values	AR	A
1.	Active energy (A+), kWh for each tariff and in total for all tariffs; for each phase and in total for all phases.	+	+
2.	Active energy (A-), kWh for each tariff and in total for all tariffs; for each phase and in total for all phases.	+	+
3.	Reactive inductive energy (A+R+), kvar-hours: for each tariff and in total for all tariffs; for each phase and in total for all phases.	+	-
4.	Reactive capacitive energy (A-R+), kvar-hours: for each tariff and in total for all tariffs; for each phase and in total for all phases.	+	-
5.	Reactive inductive energy (A-R-), kvar-hours: for each tariff and in total for all tariffs; for each phase and in total for all phases.	+	-
6.	Reactive capacitive energy (A+R-), kvar-hours: for each tariff and in total for all tariffs; for each phase and in total for all phases.	+	-
7.	Total energy S+, kvar-hours: for each phase and in total for all phases	+	-
8.	Total energy S-, kvar-hours: for each phase and in total for all phases	+	-
9.	Active energy  A+ + A- , kWh: for each tariff and in total for all tariffs; for each phase and in total for all phases.	+	+
10.	Active energy  A+ - A- , kWh: for each tariff and in total for all tariffs; for each phase and in total for all phases.	+	+



11.	Instantaneous voltage value for each phase, V	+	+
12.	Instantaneous current value for each phase, A	+	+
13.	Instantaneous power factor value $\cos \phi$ for each phase. The arrows indicate the quadrant of the located vector	+	Only A+ or A- quadrant is displayed
14.	Instantaneous frequency value for each phase, Hz	+	+
15.	Instantaneous value of active power passing through the meter for each phase and in total for all phases, kW	+	+
16.	Instantaneous value of reactive power passing through the meter for each phase and in total for all phases, kvar	+	-
17.	Total power S+ and S- passing through the meter for each phase and in total for all phases, kVA	+	-
18.	Active power $ A+  +  A- $ and $ A+  -  A- $ passing through the meter for each phase and in total for all phases, kW	+	+
19.	Current time value	+	+

AR – version that measures active and reactive energy, A - version that measures only active energy; The “+” symbol indicates that this value is measured (displayed) by the meter;  
The “-” symbol indicates that this value is not measured (displayed) by the meter.

**Table 4. Values measured by non-tariff meters**

No	Measured values	AR	A
1.	Active energy (A+), kWh for each phase and in total for all phases.	+	+
2.	Active energy (A-), kWh for each phase and in total for all phases.	+	+
3.	Reactive inductive energy (A+R+), kvar-hours: for each phase and in total for all phases.	+	-
4.	Reactive capacitive energy (A-R+), kvar-hours: for each phase and in total for all phases.	+	-
5.	Reactive inductive energy (A-R-), kvar-hours: for each phase and in total for all phases.	+	-
6.	Reactive capacitive energy (A+R-), kvar-hours: for each phase and in total for all phases.	+	-
7.	Total energy S+, kvar-hours: for each phase and in total for all phases	+	-
8.	Total energy S-, kvar-hours: for each phase and in total for all phases	+	-
9.	Active energy $ A+  +  A- $ , kWh: for each phase and in total for all phases.	+	+
10.	Active energy $ A+  -  A- $ , kWh: for each phase and in total for all phases.	+	+
11.	Instantaneous voltage value for each phase, V	+	+
12.	Instantaneous power factor value $\cos \phi$ for each phase. The arrows indicate the quadrant of the located vector	+	Only A+ or A- quadrant is displayed
13.	Instantaneous current value for each phase, A	+	+
14.	Instantaneous frequency value for each phase, Hz	+	+
15.	Instantaneous value of active power passing through the meter for each phase and in total for all phases, kW	+	+

AR – version that measures active and reactive energy, A - version that measures only active energy; The “+” symbol indicates that this value is measured (displayed) by the meter;

The “-” symbol indicates that this value is not measured (displayed) by the meter.

#### 1.4. Technical data

1.4.1 Dimensions The overall and installation dimensions of the meters are given in “Appendix A. Overall and installation dimensions of the meters”.

#### 1.4.2 Connection diagrams

Connection diagrams of meters are given in “Appendix B. Connection diagrams of meters” and “Appendix C. Connection of meters to the consumer grid”.

#### 1.4.3. Technical data

The main technical data of the meters are given in Table 5, and the data of the LTE (E-UTRA) interface are given in Table 6.

Table 5. Main technical characteristics of meters

Item	Technical Description
Service type	Three-phase Four-wire (3P4W), Direct-connected
Terminal connection	Bottom-connected
Nominal voltage (Un)	AC 3 x 240/416 V
Operating voltage	70% ~ 120% Un
Basic current (Ib)	5A
Max. current (Imax)	100 A
Starting current	20 mA
Frequency	50 Hz ± 5 %
Accuracy class	Class 1 for kWh, Class 2 for kvarh
Meter constant	1600 imp/kWh (default) Configurable from 1000 imp/kwh to 8000imp/kwh
Real-time clock	≤ 0.5 seconds per day (< 5 ppm)
Display	LCD with backlight
Disconnect switch	One-coil latch relay / 100 A / 10,000 operations
Power consumption (per phase)	Voltage circuit: ≤ 1.8 W (or 4.0 VA) (w/o modem) Current circuit: ≤ 0.5 VA
temperature range	from -40 ~ 70 °C
temperature of storage	from -40 ~ 85 °C
Relative humidity	≤ 95%, non-condensing
Ingress protection	IP 54 without suction
Insulation protection	Class II
Meter life	≥ 15 years
Battery life/ type	15 years (internal built-in battery)/ Lithium type or other advance technology
Read-without-power	Charge cycle : 1000 times
Internal Super Capacitor	72 hours without power
Data retention	> 20 years
Enclosure material	Poly carbonate + Glass fiber
Dimensions (W x H x D)	To be filled by supplier
Weight	To be filled by supplier
Cable connector /Terminal size	Should be withstand for Max. Current (100 A)

**Table 6. Technical data of LTE (E-UTRA)**

Parameter	Value
GSM/WI-FI communication technology	
Transmitter/receiver frequency ranges, MHz	
– GSM-900	880.1 – 915/925.1 – 960
– WI-FI -2.4GHz	1710 – 1785/1805 – 1880
GPRS communication class	B
Maximum output power of the transmitter, not more than, W	
– GSM-900	2
– DSC-1800	1
LTE (E-UTRA) cellular radio communication technology	
Transmitter/receiver frequency ranges, MHz	
– Band 3	1710-1785/1805-1880
– Band 5	824-849/869-894
– Band 7	2500-2570/2620-2690
– Band 8	880-915/925-960
– Band 20	832-862/791-821
Maximum output power of the transmitter, not more than, W	0.2 (23)
Communication speed, baud	9600
type of antenna	Structural

**1.4.4 Communication interface:**

- Optical communication port complies with IEC 62056-21 module-E protocol and supports local data exchange and reading.
- RS485 port or UART interfaces, compliant with DLMS/COSEM, IEC 62056
- Detachable (removable) or Built-in bidirectional communication modem, the meter should provide with the isolated signal interface for data exchange and supplies the power source to the modem
- The meter should connect to the modem such as GPRS 2G/3G/4G/5G, Wi-fi or RF, or IoT.
- The meter provides AES, SHA, DLMS/HLS-5 (AES-128-GCM) security.
- Meters shall use a protocol that allows it to be automatically detected (Plug-and-Play) when connected to a communication bus using IEC 62056, DLMS/COSEM Protocol.

**1.4.5 Test: Routine test:**

The tests should be carried out and pass according to latest issue of IEC standard for each unit of the production and for all types of meters.

**1.4.6 Type test:**

- All meter types must pass type test according to latest issue of IEC standard.
- All meters and modems should pass Accelerated life testing.

**1.4.7 Factory Acceptance Test (FAT):**

Factory Acceptance Test (FAT) by certified 3rd party inspector with the participation of MoE Engineers (as a witness) is required to perform all type of tests mentioned above and all required functionalities according to IEC standards.

**1.4.8 Data Exchange Protocol (DLMS)**

Test for Smart meter Communicability

- Standard shall provide for use of suitable communication technologies in the design of Smart Meters.
- Communication Modems shall be tested according to the standard.

**1.5. Resistance to mechanical impact and fire**

In terms of resistance to mechanical impacts, the meters are included into class M2 of the basic requirements of Technical Regulation No. 94.

The protection degree of the meter case against penetration of solid objects and water is IP 54 (according to DSTU EN 60529:2018).

The material of the base, terminal cover and terminal board complies with UL94 - V0 standard - self-extinguishing within 10 seconds on a vertically installed sample, drops of non-burning particles are allowed.

The material of the meter case complies with the UL94-V2 standard - self-extinguishing within 30 seconds on a vertically mounted sample, drops of burning particles are allowed.

## 1.6. Requirements to operating conditions

The meters can be operated in regions with “cold” and “moderately cold” climate types, under climatic conditions of category 3K7 according to the classification provided for by DSTU IEC 60721-3-3 (except for the possibility of moisture condensation and ice build-up in the environment where they are operated)

The meters are designed to be installed in an explosion-proof environment, free of conductive dust and corrosive gases. The meters can be placed in unheated rooms, as well as in outdoor cabinets that provide protection against daily climatic changes and prevent moisture condensation and ice build-up. Do not install the meters in direct sunlight.

Relative humidity value at 30 °C is not more than 95 %. Temperature range:

operation: minus 40 to plus 70 °C;

storage: minus 40 to plus 85 °C;

## 1.7. Composition

### 1.7.1. Appearance

An example of the appearance of MNT 32...A... meters and the arrangement of their controls is shown in Figure 1.

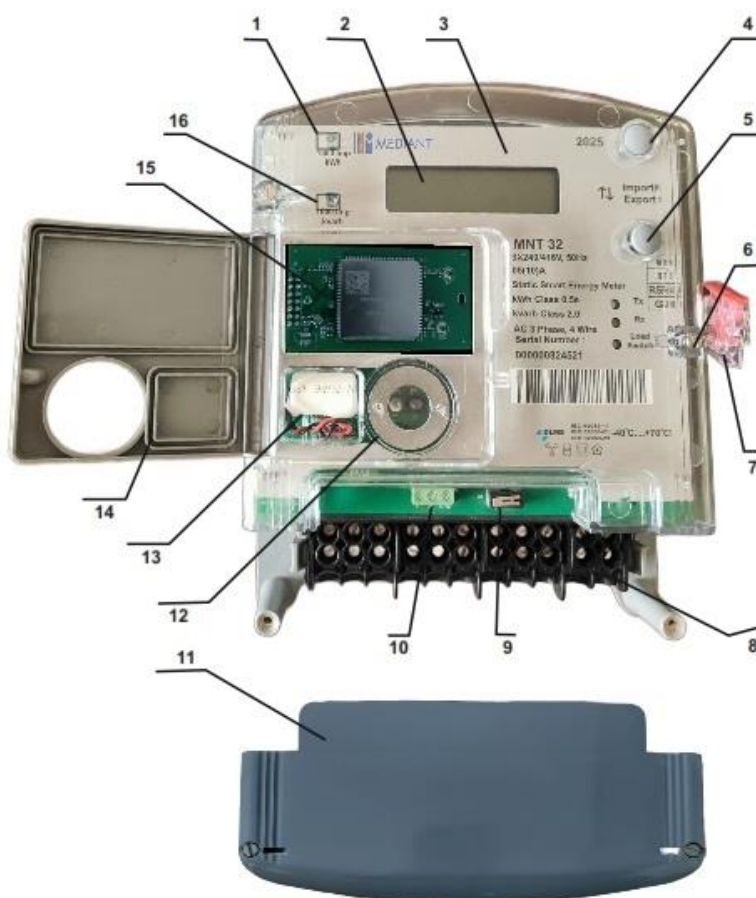


Figure 1. General view of the meter

The figure shows the following elements:

1. Optical pulse test led for active energy (kwh).
2. Electronic display.
3. Meter case.
4. Push button Up.
5. Push button Down.
6. Sealing screws.
7. Seals.
8. Terminal block.
9. Sensor for opening the cover of the terminal block.
10. RS-485 port.
11. Terminals cover
12. Optical port..
13. External backup battery.
14. Optical and Module flip cover.
15. Gsm module
16. Optical pulse test led for reactive energy (kvarh)

#### **1.7.2. Design**

The meters are manufactured in a plastic insulating housing of protection class II, which consists of a base and a transparent or opaque case (according to customer requirements). The design of the meter base has holes and a clamp for mounting the meters at the installation site. A printed circuit board with a display, LED indicators, sensors, other electronic components and connectors is attached to the base. Under the transparent case there is a nameplate with meter data. The nameplate is applied to the opaque case by laser engraving.

The case is attached to the base with two screws with the possibility of sealing them, for which purpose special holes are provided in the meter case. In addition, the meter case and the base are fastened with a continuous seam using laser welding.

A terminals block with primary voltage and current converters is also installed on the base. Protective partitions between the phase terminals of the terminals block ensure that a short circuit between phases is impossible.

The design of the housing ensures that the meter case cannot be removed without removing the terminals cover.

Under the case there is a compartment for the optical port and a SIM card slot. This compartment is closed with a cover that can be sealed with another seal. In the upper right corner of the meter case there are mechanical View and Select buttons, designed to navigate through the meter display menu.

### 1.8.1. Electricity measurement

### 1.8.2. Interaction of components.

### 1.8.3. Data storage





#### 1.8.4. Data display

Diagram illustrating the layout of a digital display with numbered callouts:

- 1: Top status bar area.
- 2: Power status icon (battery and plug).
- 3: Temperature status icon (thermometer).
- 4: Signal strength icon (bars).
- 5: Network status icon (GSM symbol).
- 6: Time and date display (12:00, 12/12/2012).
- 7: Network mode indicator (GSM).
- 8: Network mode indicator (K).
- 9: Network mode indicator (W).
- 10: Network mode indicator (H).
- 11: Network mode indicator (h).
- 12: Bottom status bar area.

**Figure 2. LCD appearance**

6.1. **A** current in amperes. The following symbols and groups of symbols are shown in the figure:  
1. Group of indicators of the energy angle quadrant:

- 1.1.  total power vector in the first quadrant (A+R+).  
1.2.  total power vector in the second quadrant (A-R+).  
1.3.  total power vector in the third quadrant (A-R-).  
1.4.  total power vector in the fourth quadrant (A+R-).

2. Display group for the OBIS





6.2. **V** voltage in volts.


6.3. **kW** active power in kilowatts.

6.4. **kVar** reactive power in kilovars.

6.5. **kWh** active energy in kilowatt-hours.



7. Indicator of data exchange via interfaces .

8. GPRS or 4G connection status indicator. The number of dashes indicates the quality of the connection:  – 25%,  – 50%,  – 75% and  – 100% .

9. Internal error indicator , blinks in case of an error or during the emergency tariff.

10. Indicators of the direction of current flow on phases L1, L2, L3.

11. Load shedding relay status indicator:  – relay is open,  – relay is closed.

12. Relay output status indicator:  – relay output is closed,  – relay output is open. The LCD symbols not shown in the figure are not used in these meters.

### 1.8.5. Controls

There are two mechanical buttons on the front panel of the meters: View and Select (see Figure 1), designed to control the meter display menu. The button operation is accompanied by a sound signal from the internal speaker of the meters. The sound signal can be disabled during parameterization.

### 1.8.6. Relay output

Transformer-connected meters can have a relay output that allows switching AC voltage not exceeding 300 V, with a current not exceeding 100A. Its connection diagram is shown in Figure 3, where Rn is the load connected to the relay output.

Relay operation is programmed in the following modes:

- normally open contacts are closed when the selected tariff is active;
- normally open contacts are closed in 24 programmable intervals of the day;

- contacts open at the request of the set thresholds (voltage, current, power);
- contacts open when magnetic or electromagnetic field sensors are triggered (possible only if these sensors are available);
- contacts open and close at the operator's command.

#### **1.8.7. Load shedding relay**

Depending on the version, the meters can be equipped with a load shedding relay. The triggering of this relay is programmed in the following modes:

- normally open contacts are closed when the selected tariff is active;
- normally open contacts are closed in 24 programmable intervals of the day;
- contacts open at the request of the set thresholds (voltage, current, power);
- contacts open when a magnetic or electromagnetic field sensor is triggered (possible only if these sensors are available);
- contacts open and close at the operator's command.

Possible versions of the meters with the installed load disconnect relay are given in Table 2.

#### **1.8.8. Built-in clock**

Tariff meters have a real-time clock (stabilized by a quartz resonator) with a calendar built into the microcontroller. The clock data is used to operate the tariff system, generate average power integration periods, and register time-stamped events. The clock has the function of switching to winter and summer time. Time change can be performed automatically or by the date set during parameterization. To reduce the dependence of the clock error on the ambient temperature, the meters are equipped with a temperature sensor.

#### **1.8.9. Power supply of meters**

The meters are powered by a switching power supply that converts the rectified input voltage into the voltage required to power all meter components and modules.

A backup battery is used to power the meter in the absence of mains voltage. The meters can operate under extreme conditions without mains voltage for at least 24 months.

Tariff meters can be additionally equipped with an external backup battery.

#### **1.8.10. Peculiarities of the LTE cellular interface module**

The use of the LTE cellular interface module in the meters (see the table of versions) allows to transmit a notification about this event after the power supply voltage is lost. This feature is provided by the use of an ultra capacitor that maintains the module operation for some time after the supply voltage is lost. The message generated in this case makes it possible to understand that the communication with this meter was interrupted due to the lack of power.

#### **1.8.11. Push notifications**

The meters have the ability to send push notifications to the server due to the design features of the LTE modem and the advanced functions of the device software. Push notifications are sent during the following events:

- switching the meter on or off;
- voltage loss on one, several or all phases;
- voltage on any of the three phases.

The sent notification contains the following parameters:

- meter serial number;
- active and reactive energy;
- voltage and current of each phase as of the time of sending the notification;
- current errors in the meter.

These parameters can only be changed during the meter's factory parameterization. The IP address and port of the server can be changed via the UNIK 3.0 software.



When any of the above events is triggered, except for the meter switching on, one notification is sent. When the meter is switched on, there will be two notifications. The first notification is sent when the meter is powered on, the second - when the voltage on three phases appears, after the metrology is fully started.

#### **1.8.12. Grid quality analysis**

The meter software allows you to keep a profile of the average voltage values for a given period (you can set from 1 to 86,400 seconds, the default is 10 minutes). It is also possible to monitor and record in the appropriate logs the occurrence of events in the grid related to voltage quality. Thus, the meters can monitor voltage quality, namely:

- record the number of short-term and long-term undervoltage events for each phase when the voltage drops below the specified threshold during the specified recording periods for short-term and long-term events, respectively;
  - record the number of short-term and long-term overvoltage events for each phase when the voltage exceeds the specified threshold during the specified recording periods for short-term and long-term events, respectively;
  - record the duration of the last short-term and total duration of long-term undervoltage for each phase when the voltage drops below the specified threshold during the specified recording periods for short-term and long-term events, respectively;
  - record the duration of the last short-term and the total duration of long-term overvoltage for each phase when the voltage is above the specified threshold during the specified recording periods for short-term and long-term events, respectively;
  - record the average value of the last short-term undervoltage for each phase when the voltage drops below the specified threshold during the specified recording period for short-term events;
  - record the average value of the last short-term voltage overvoltage for each phase when the voltage is above the specified threshold during the specified recording period for short-term events;
  - record in the event log up to 295 events of voltage loss, undervoltage, overvoltage, restoration for each phase when the voltage is over or under the specified threshold during the specified recording period (the date and time of the event start, as well as the average voltage, current, power factor at which the corresponding trigger was triggered are recorded);
- The threshold values and the duration of the recording periods of these events are configured during the meters parameterization using the appropriate software.

#### **1.9 Parameterization of meters**

During the parameterization, the meter configuration constants are entered into the meter memory. Parameterization is performed via the optical port in two stages:

- factory parameterization;
- customized parameterization.

The meter has two access levels for changing and reading data and settings, which can be accessed only after entering a password:

- Operator access level - all parameters can be changed except for the barcode and meter version, the user password can be changed, but the factory password cannot be changed.
- User access level - you can only read data from the meter about its parameters and settings.

##### **1.9.1 Customized parameterization**

During parameterization at the consumer's site, constants are written to the meter memory via the electrical interface or radio channel to adapt the meter to local operating conditions.

An example of the information written to the meter memory is shown in Table 7. The parameterization of meters at the consumer's site is carried out by the energy supply company or an authorized organization using special software. Parameterization is possible only using a password with operator access rights.

Table 7. Data stored in the meter memory

Parameter	Value	
	default	Permissible
Exchange rate between the meter and the installed interface: RS-485 LTE	9600 baud	1200 to 19200 baud
Exchange rate for optical port	9600 baud	9600 baud
Meter address: - high «HI» - low «LOW»	generated based on a meter serial number	0 to 65535 11 to 26
User password	1111111111111111	1 to 16 symbols
Operator password	2222222222222222	1 to 16 symbols
Meter location (Street)	-	0 to 100 symbols
Meter location (House) Meter location (Suite)	-	0 to 100 symbols
Meter location (Owner)	-	0 to 100 symbols
	-	0 to 100 symbols
Values of voltage thresholds for which, when exceeded for a period of time not less than the set one, the indication is switched on		
- for directly and combined connected Meters		
Umax	288 V	40 to 600
Umin	168 V	40 to 600
Umax	288 V	40 to 600
Umin	168V	40 to 600
Time after which the voltage exceeding the thresholds is indicated and the event is recorded in the meter memory	5 s	1 to 250 s
Relay triggering	Off	On or off
Sound signal in the meter	On	On or off
Daylight saving time settings	automatic switching	- automatic transition; - switching on the specified date;
Number of tariffs	4	
Number of week profiles	10	
Number of tariff seasons	12	
Number of day profiles	16	
Holidays	30	

### 1.10 Description of interfaces

The meters have electrical pulse test leads, an optical port interface, optical pulse test leads that also serve as LED energy measurement indicators and pins for digital inputs. Up to two additional interfaces can be installed in the meters, depending on the version. The type and availability of interfaces is coded in the meter modification indicated on the nameplate and in the data sheet (see Table 2).

The description of possible meter interfaces is given in Table 8.

Data from the meters can be read simultaneously via all available interfaces.

**Table 8. Possible interfaces**

Interface	Description
RS-485	Asynchronous interface for a half-duplex multipoint "common bus" communication line, in which data is transmitted using differential signals. The interface has galvanic isolation of the communication line.  The interface is compliant with ANSI TIA/EIA-485-A:1998 standard. Communication rate is 9600 baud.
LTE	The interface is designed for LTE cellular networks 3. Communication rate is 9600 baud.

Discrete inputs:

Insulation strength of discrete inputs: for the power supply mains - 4kVac for low-voltage interfaces - 1kVdc. Maximum frequency of the signal sent to the digital input: 4 Hz. Passive state: the input is not connected to the common wire (COM). Active state: the input is connected to the common wire (COM).

### 1.11 Tariff module

The tariff module of the meter software can support up to 4 tariffs and records the energy measured by the meters in the active and reactive energy registers separately for each of the 4 tariffs.

The validity of each tariff during the year is scheduled in time using an annual tariff plan. The annual tariff plan consists of daily tariff plans, weekly tariff plans, and seasonal tariff plans.

#### 1.11.1. Active tariff

All tariffs are numbered from 1 to 4. At any given time of the day, only one rate out of four possible rates can be active. This rate is called active, unlike other rates that are not active at this moment.

#### 1.11.2. Daily tariff plan

A daily tariff plan is a numbered sequence and time of activation of a particular tariff during the day. The tariff module allows you to configure up to 12 changes of the active tariff during the day and supports up to 16 different tariff plans. The numbering of the tariff plans is from 1 to 16. Each tariff change during the day is set using the moment of tariff activation (hours, minutes, seconds) and the number of this tariff (from 1 to 4).

#### 1.11.3. Weekly tariff plan

The weekly tariff plan allows you to assign one of the 16 possible daily tariff plans to each day of the week. The tariff module of the meter supports up to 10 different tariff plans. Weekly tariff plans are numbered from 1 to 10. For each day of the week, the number of the selected daily tariff plan is indicated. The change of daily tariff plans during the week occurs when the day changes, at 00:00:00 according to the built-in real-time clock. The currently valid weekly tariff plan is called the active one.

To communicate with the meter, you need to get from the cellular provider a static IP address.

#### **1.11.4 Seasonal tariff plan**

The tariff module of the meter allows you to divide the calendar year into seasons (up to 12 different tariff seasons are supported), and assign a tariff plan to each of them. A seasonal tariff plan (or tariff season) describes the sequence and time of change of weekly tariff plans during the season. Tariff seasons are numbered from 1 to 12. The tariff season that is currently in effect is considered active. A tariff season is set using the date and time of season activation and its tariff plan number.

#### **1.11.5. Lists of holidays**

The tariff module allows you to support up to 30 special tariff plans for special days (they are numbered from 1 to 30), the activation moment of which is set for a specific date in the month-day format, unlike regular daily tariff plans, which change sequentially when the day of the week changes. Such tariff plans allow you to set up tariff switching for special days, such as holidays. When a holiday occurs on the built-in clock and calendar, the tariff change will be performed according to the holiday daily plan, i.e. the holiday daily plan will be active, not the regular plan, which should be activated on the corresponding day of the week.

#### **1.11.6. Setting up tariff plans**

The daily, weekly, seasonal and holiday tariff plans are configured when the meters are parameterized using special software. When setting up, you set the parameters of each tariff plan for a day, week, season, and holiday, and thus set the sequence and time of activation of a particular tariff within a day, week, season, or in the event of a configured holiday.

#### **1.11.7. Tariff schedules**


The set of configured tariff plans (days, holidays, weeks, and seasons) that are currently in effect is called the active annual tariff plan or active tariff schedule. You cannot edit the active tariff schedule. The tariff module of the meter software allows you to additionally configure

another, currently passive, tariff schedule. It can be activated later. This ensures the possibility of making the necessary changes to the tariff plans. The diagram of the tariff schedule is described in Appendix H.

#### **1.11.8. Changing tariff plans**

The tariff module of the meter software monitors the moments of activation of the corresponding tariffs, controlling the current time, day of the week and date using the built-in clock and real-time calendar. When the moment configured in the daily, weekly, seasonal or holiday tariff plans occurs, the corresponding tariff is activated, and it is valid until the next tariff is activated. At the same time, all accumulated data is recorded in the registers of the current tariff.

#### **1.11.9. Emergency tariff**

In the event of a failure of the built-in real-time clock, the emergency tariff is automatically activated in the meter, and all calculated energy values are recorded in the registers of the emergency tariff, and the corresponding symbol (  icon and tariff number) flashes on the electronic display. The emergency tariff number is set during parameterization.

#### **1.11.10. Accumulation of data by tariffs**

Measured values of energy parameters are accumulated in the corresponding registers in the meter memory. The tariff module provides a separate set of registers for each tariff to accumulate the values of energy parameters.

#### **1.12. Load profiles**

To collect statistical energy consumption data during the meter operation, you can create a load profile in advance, at the stage of meter parameterization, i. e. a list of measured values (up to 8 values) for which the integration period is specified. The values of the measured parameters included in the load profile will be periodically (with the specified period) recorded and stored in the corresponding meter memory registers. The accumulated data can be read out of the meter using the appropriate software via the available interfaces.

The integration period during the load profile parameterization is set in minutes from a range of fixed values of 1, 2, 5, 10, 15, 20, 30, 60 minutes.

The storage depth for the load profile of each type of measured energy depends on the integration period and for the longest configured period of 60 minutes can be up to 180 days.



### **1.13. Tempering protection**

#### **1.13.1. Structural protection measures**

The case and the terminals cover of the meter are fastened to the base with sealing screws. A groove around the perimeter of the base ensures overlap of the base and the case of at least 4 mm during connection, which excludes unauthorized access to the measuring part of the meters without damaging the housing. At the request of the customer, the meter housing can be welded.

There are special tides with holes on the optical port cover and on the meter housing, which allow, if necessary, to additionally seal the case with the backup battery and the optical port when closed.


#### **1.13.2. Opening sensors for case and terminal cover**

The case opening sensor is installed at the customer's request. The terminal cover opening sensor is installed on all meters. The opening of the meter case or terminal cover is detected by the case opening sensor or the terminal cover opening sensor, respectively, and is recorded in the meter event log (for more details, see F). When the case opening sensor is triggered, the “” symbol appears on the display. When the terminal cover opening sensors are triggered, the symbol “”<sup>4</sup> appears on the display.

#### **1.13.3. Data protection**


Data protection is provided by software. The meter data is available for writing and reading via the interfaces and optical port only after entering the password. After entering the wrong password 5 times in a row, the meter is blocked for 30 minutes. Each such event is recorded in the meter's event log.

#### **1.13.4. Magnetic field sensor**

The magnetic field sensor, which can be installed in meters, is triggered when exposed to a constant magnetic field of more than 100 mT. If the exposure lasts for more than 3 seconds, a  message periodically appears on the meter display, and a record of this event is recorded

in the meter's event log. If within 60 seconds after the first exposure, the sensor detects repeated magnetic field effects of the same level, then 60 seconds after the last of them is completed, a record of the magnetic field effect will be generated in the event log with registration of their total duration. If the pause between the magnetic field exposures is longer than 60 seconds, each of them will be recorded in the log with a separate entry with the duration of each of them.

#### **1.13.5. Electromagnetic field sensor**

The electromagnetic field sensor, which can be equipped with meters, is triggered by exposure to an electromagnetic field with a strength of more than 10 V/m in the frequency range from 80 to 2000 MHz. If the exposure lasts for more than 3 seconds, a  message periodically appears on the meter display, and a record of this event is recorded in the meter's event log. If within 60 seconds, the sensor will record repeated exposures to the electromagnetic field of the same intensity, then 60 seconds after the last exposure is over, a record of the electromagnetic field exposure will be generated in the event log with the registration of their total duration. If the pause between electromagnetic field exposures is longer than 60 seconds, each of them will be recorded in the log with a separate entry with the duration of each of them.

Notifications about sensor triggering can only be disabled using the MNT Parameterization software (using a password) by sending a special command through any available meter interface.

### **1.14. Labeling**

The meter labeling complies with DSTU EN 62053-52, DSTU EN 62053-21, DSTU EN 62052-11, DSTU EN 62053-23 and the manufacturer's drawings.

Possible symbols indicated on the meter nameplate depending on the version are described in Table 9.

The design of the nameplate of MNT 32...A... meters is shown in Figure 4 and Figure 5.



1. Registered trademark.
2. Meter version code.
3. Push button.
4. DLMS mark.
- 5-6. Main technical data (basic and maximum current strength, rated voltage, rated frequency).
7. Rx. Tx. Leds.
8. Load switch Led.
9. CE mark.
10. Year of manufacture of the meter
11. Place for marking the availability of a load-breaking relay.
12. Place for marking the availability of Bluetooth
13. Place for marking the availability of wi-fi.
14. Place for marking the availability of 4G Gsm module.
15. Place for marking the availability of RS-485.

16. Place for marking the availability of an optical port.
17. Symbol for the number of measuring elements.
18. Symbol of protection class II.
19. Symbol of casing water proof.
20. Symbol of Reactive and active energy .
21. Symbols of meter accuracy classes for active and reactive energy measurement and their corresponding standards.
22. Symbol of antenna.
23. Place for the meter barcode.
24. Meter Serial number.
25. IDIS mark.
26. Marking of the optical test pulse output when measuring reactive energy (Kvarh).
27. Marking of the optical test pulse output when measuring active energy (Kwh).

### 1.15. Delivery set

The delivery set is described in Table 11. Table 11. Meter delivery set

Component	Quantity
AC watt-hour meter (appropriate version)	1 pc.
N58 neoway GSM with Antenna or wifi module	1 pc.
AASHH.411152.095 PS data sheet *	1 pc.
AASHH.411152.095 NE Operation manual*	1 pc.
Software**	1 pc.
Consumer packaging	1 pc.
Declaration of conformity	1 pc.

### 1.16. Packaging

One meter with the operating documentation is placed in a consumer packaging.

The consumer packaging with the packaged meter is sealed with adhesive tape. A packing list is glued to the top of the consumer packaging.

Another options of the meter packaging are possible at the request of the customer and shall be specified in the supply agreement.

Meters packed in consumer packaging are placed in transportation containers. The shipping documentation, including the packing list containing the following information, shall also be placed in the transport container:

- manufacturer's trademark;
- designation and code of the meters;
- number of meters packed;
- signature or personal stamp of the packer;
- mark of the manufacturer's quality control department;
- gross weight, in kilograms;
- date of packaging.

Overall dimensions of consumer packaging do not exceed: 265 mm x 180 mm x 88 mm; Overall dimensions of the transport container do not exceed: 372 mm x 277 mm x 457 mm; Gross weight: no more than 2.0 kg.

## 2 Intended use

### 2.1. Preparing the meters for use and installation procedure

The meters should be installed in premises that meet the requirements of section "1.6 Requirements to operating conditions".

Installation, dismantling, connection and disconnection of the meters may be performed only by an authorized organization.

The organization authorized to install, maintain and dismantle the meters is fully responsible for ensuring that its personnel have carefully studied this manual, are qualified to perform the work, and strictly comply with the requirements of local safety and electrical installation regulations.

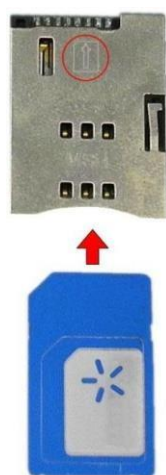
Installation, dismantling, connection, disconnection and maintenance of the meters must be carried out in accordance with the applicable electrical installation and safety regulations, only by qualified personnel in accordance with the requirements hereof.

Installation, dismantling, connection and disconnection of meters must be performed by personnel who has a qualification group corresponding to the rules for the safe operation of consumer electrical installations – at least group 3.

Installation and connection of the meter shall be performed according to the following procedure:

1. Before installing the meter, de-energize the electrical grid;
2. Unpack the meter and make sure that there is no mechanical damage and that the seals are intact.
3. For meter versions equipped with LTE module, install the SIM card in the appropriate slot of the meter. The relative position of the slot and SIM card when installing it is shown in Figure. In the figure, a red circle indicates the correct position of the SIM card. Only Mini-SIM cards should be used (ISO/IEC 7810:2003, ID-000). We do not recommend to use hybrid SIM cards with perforations of other sizes, as well as adapters for Micro-SIM and Nano-Sim cards.
4. Fasten the meter at the metering point. The meter is mounted on a DIN rail and secured with two clamps. It is also possible to install the meter at the metering point using three screws according to Figure 1. The type of DIN rail is TH/35 7.5, a standard 35 mm wide special- profile metal rail.
5. Connect the meter in accordance with the diagrams provided on the terminal cover (or on the nameplate) and in “Appendix B. Meter connection diagrams” and “Appendix C. Connection of meters to the consumer grid”. To connect transformer-connected meters with a rated voltage of a wide range (3x57.7...240/100...416V) to the grid using the delta option with two current transformers (Figure C. 4), set the meter's operation mode for three-wire grids using the UNIK software. The screws of the terminal block must be tightened using a slotted screwdriver (blade thickness 1 mm) until tight, with a torque of  $3.5 \pm 0.5$  N·m (for transformer-connected meters, the torque shall not exceed  $2.5 \pm 0.5$ ).
6. Fasten the terminal cover with screws until tight, with a torque of  $0.5 \pm 0.1$  N·m and seal it.
7. Apply voltage to the meter, and make sure that the indication on the LCD confirms the normal operation of the meter described in section “2.6

Description of the windows displayed on the screen”, otherwise, adjust the connection or replace the meter.



**Figure 6**

When connecting the meter to the power grid, use the following types of conductors: rigid, rigid stranded, or flexible stranded. Conductor material: copper or aluminium. When connecting the meter to the electrical grid using aluminium wire, these wires shall be pressed into special sleeves that prevent corrosion of the connections in the meter terminals.




The cross-sectional diameter is selected depending on the maximum current flowing through the conductor (3 to 6 mm).

## **2.2. Replacing procedure for backup battery**

A backup battery is used to power the meter clock.

The battery may be replaced only by the power supply company or an authorized organization. Battery replacing procedure:

1. Cut off the seal of the optical port cover, unscrew the sealing screw;
2. Open the optical port cover;
3. Pull out the battery case;
4. Remove and disconnect the old battery and, observing the polarity, install and connect the new one.
5. Put the battery case back into the meter. If the symbol  is still displayed on the LCD after replacing the battery (see "Figure 2. LCD appearance"), the installed battery is discharged or the battery polarity was not observed;
6. Set the current date and time in the meter via the optical port or other available interface;
7. Close the optical port cover on the meter, tighten the sealing screw and apply the seal.

To save the date and time settings, before replacing the battery, it is recommended to connect the meter via a service backup power supply (installed additionally by agreement with the customer). The connection diagram to the service backup power supply is given in the appendix "Appendix B Meter connection diagrams".

## **2.3. Types of conductors used for meter connection**

Types of conductors: rigid, rigid stranded or flexible stranded. Conductor material: copper or aluminium.

When connecting the meter to the electrical grid using aluminium wire, these wires shall be sleeved.

The cross-sectional diameter is selected depending on the maximum current flowing through the conductor (3 to 6 mm).

## **2.4. Using the meters**

In operating mode, the meter measures active and reactive electrical energy in the forward and reverse directions with an increasing total (depending on the version according to the table of versions).

The meters are equipped with optical pulse test leads, which are also used as LED function indicators for measuring active and reactive energy. Through special holes in the nameplate, they are led under the meter's transparent case. When a load is connected to the measured circuit, the optical pulse test leads blink with a frequency proportional to the power consumption and switch synchronously with the electrical pulse test leads.

The electrical test pulse outputs use electronic keys with optical decoupling. The maximum permissible open-circuit voltage of the key is not less than 30 V, the maximum permissible closed-circuit current of the key is not less than 30 mA.

## **2.5. Data reading**

The information from the meters can be read:

- visually, from the electronic display;
- via any interface installed in the meter.

### **2.5.1. Options for reading data via interfaces**

The following options for reading data via interfaces are provided:

- via RS-485 electrical interfaces;
- via 4G/LTE interface (if available);
- via optical communication interface (optical port).

For a description of the interfaces, see 1.10. For connection via the optical communication interface, the OP200 optical head (Optical-Probe or equivalent) and software are used.

### 2.5.2. Interface communication functions

By connecting to the meter, you can:

- read or change the tariff model of the meter;
- read the load profile of each type of energy measured;
- read the value of each type of energy for each tariff, and the total for all tariffs for the last day or month;
- read the event log;
- set the clock and calendar;
- read the values of all the quantities measured by the meter;
- read or change interface settings, display thresholds, information about the meter installation location;
- change the access password;
- switch on or off the meter's sound signal that appears when you press the buttons;
- change the tariff number or time intervals of the relay output;
- change the number and order of windows on the LCD.

### 2.5.3. Data exchange via the optical port

Data reading via optical communication interface in accordance with IEC 62056 21.

The meters include unauthorized data reading via an optical communication interface in accordance with IEC 62056 21 (MODE-C). OBIS codes and their values that are read from the meter in MODE-C mode without authorization are given in Appendix D.

### 2.5.4. Displaying total energy and total power

The meters calculate the values of each type of energy to the third decimal place, and the LCD displays the values to the second decimal place, therefore:

- the value of each type of total energy for all tariffs displayed on the meter's LCD ( $W_{\Sigma LCD}$ ) may be greater than the value of total energy  $W_{\Sigma W}$  calculated according to formula (1) by no more than 0.004 kW (2).

$$W_{\Sigma W} = W_1 + W_2 + W_3 + W_4$$

$$(1) W_{\Sigma LCD} - W_{\Sigma W} \leq 0.004 \text{ kW}$$

(2) where  $W_1, W_2, W_3, W_4$  – are energy values displayed on the meter's LCD for the first, second, third and fourth tariffs, respectively.

- the value of each type of energy for a certain period  $W_p$ , read from the meter using the parameterization software, may exceed the sum of the values of the energy of 30 minute intervals  $W_{\Sigma 30}$ , read from the meter using the parameterization software for the same period, by more than 0.048 kW(3).

$$W_p - W_{\Sigma 30} \leq 0.048 \text{ kW}$$

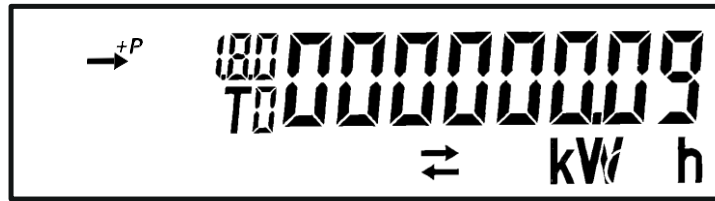
## 2.6. Description of windows displayed on the screen

The liquid crystal display and the meaning of its symbols and symbol groups are described in detail in section “1.8.4 Data display”.

### 2.6.1. Sequence of displaying windows

After the meter is powered up, windows with data and the corresponding OBIS code are generated in the memory in a sequential order. The order of the windows depends on the meter settings. When the meter is switched on, all segments of the LCD are illuminated. In the automatic menu mode, the

information on the LCD changes every 10 seconds. The type of data in the window is set when parameterizing the meters. The table with the full list of OBIS codes is given in Appendix D.



**Figure 7. Exemplar displayed window**

Figure 7 shows an example of one of the possible meter windows. In the table “Table D. 1. List of OBIS codes that can be displayed” (see ‘Appendix D. Table of OBIS codes that can be displayed’), you can find that the OBIS code ‘1.8.0’ in this window displays the active energy (A +) total for all tariffs. The symbol “T0” means that the meter is currently accumulating energy according to the second tariff..

### **2.6.2. Manual viewing of windows**

The manual data viewing function allows you to display most of the stored data on the LCD using the mechanical buttons 4 and 5 (see Figure 1).


The list of possible LCD windows and the order in which they are displayed is set when parameterizing the meters. Each time you press the View button, the measured values with the corresponding OBIS code and units are displayed in the windows. Pressing the Select button enters and switches windows within the submenu.


### **2.6.3. Indication of different meter operating modes**

If one or more of the symbols “L1”, “L2”, “L3” blink synchronously in the window during the energy measurement display, the voltage in the corresponding phase has exceeded the set thresholds. The corresponding indicator blinks with a frequency of 0.5 Hz if the voltage is too low, and with a frequency of 2 Hz if it is too high.

The reverse direction of energy is displayed as a “-” sign in front of the symbols “L1”, “L2”, “L3”.

If the symbols “L1”, “L2”, “L3” alternately light up and go out in the window during the energy display, the meters are not properly connected to the network (wrong phase sequence).

If the “” symbol is displayed on the LCD (see Figure 2), the meter has malfunctions, sensors (magnetic field sensor or electromagnetic field sensor) are triggered, or debt notification is detected.

If the “” symbol is displayed on the LCD (see Figure 2), the meter's clock battery needs to be replaced. The procedure for replacing the battery is described in section “2.2. Procedure for replacing the backup battery”.

### **2.6.4. Indication of error codes**

If a malfunction occurs during the meter operation, the LCD displays a window with the error and its code. For example, opening of the terminal cover or case cover, magnetism or radio field, overvoltage or undervoltage. The error code consists of three characters.

Error 004

→<sup>+P</sup> 0200000009  
T000000009  
⇌ kWh

091  
T0

13.3727

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Figure 13. Window for displaying the current date on the clock 25/02/2000

### 3 Maintenance

#### 3.1. General instructions

Maintenance of the meters, subject to the operating conditions, is carried out at least once every 6 years (check with the manufacturer).

Maintenance consists of verification or repair and calibration of the meter. The verification shall be carried out by an authorized body.

The repair and calibration shall be carried out at the manufacturer's factory.

#### 3.2. Safety measures

The meters correspond to class II in accordance with DSTU EN 61140:2019 in terms of protection against electric shock.

The insulation between all current, voltage, and ground circuits on one side and the interface and test leads on the other side can withstand a test voltage of 4 kV (rms) with a frequency of (50-2.5) Hz during 1 minute.

Insulation resistance between the housing and electrical circuits shall be not less than:

- 20 MΩ - under normal conditions;
- 7 MΩ - at an ambient temperature of (30±2) °C and relative humidity of 90%. The meters comply with DSTU 8828:2019 in terms of fire safety requirements.

### 4 Transportation and storage

#### 4.1. Requirements to transportation and storage of meters

The conditions of transportation and storage of meters in the manufacturer's transport packaging comply with the conditions described in section "1.6 Requirements to operating conditions".

Meters can be transported in covered railway cars, transported by road upon their protection against rain and snow, by water, and also transported in sealed heated aircraft compartments.

Transportation must be carried out in accordance with the transportation rules applicable to each type of transport.

Meters in transport packaging are resistant to ambient air temperature from minus 40 to plus 70°C, relative humidity up to 95% at a temperature of 30 °C and atmospheric pressure from 70 to 106.7 kPa (537 to 800 mm Hg).

Meters in transport packaging are resistant to transport shaking with a number of impacts from 80 to 120 per minute with an acceleration of 30<sup>m/s<sup>2</sup></sup>.

### 5 Environmental and disposal requirements

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

To prevent possible damage to the environment due to uncontrolled waste disposal, please separate this product from other waste and reuse it or its components. Industrial waste must be disposed of in accordance with DSTU 4462.3.01:2006.

### 6 Manufacturer's warranties

The manufacturer guarantees that the meters comply with DSTU EN 62052-11, DSTU EN 62053-21, DSTU EN 62053-22, DSTU EN 62053-23, provided that the consumer complies with the installation, operation, transportation and storage conditions.

Before operating the meters, read the operating manual included in the delivery set or posted on the official website - see Table 11.

The warranty period (service life and storage period in total) is 3 years after the sale.

Meters that do not meet the requirements of the technical specifications and the valid data sheet during the warranty period must be replaced or repaired by the manufacturer or a company authorized to carry out warranty repairs.

The warranty period for meters shall be extended for the period calculated from the date of consumer's application until the defect is eliminated by the manufacturer. Upon expiry of the warranty period, during the service life of the meters, repairs are carried out by the manufacturer or service organizations. In this case, the repair is carried out at the expense of the consumer.

Meters that have been transported, stored, mounted and operated in violation of the requirements specified in the operating manual and meters that have damage to the case, base, clamp block or evidences of their thermal heating, damaged manufacturer's seal, as well as meters which have mechanical damage resulting from any actions of the buyer or third parties, are not subject to warranty repair.

The manufacturer's warranty obligations do not apply to external backup batteries. Please report any defects in the meters to the manufacturer, Mediant.

## **7. Documents and Drawings:**

The tenderer shall submit all required documents and drawings:

- Type and origin of component and manufacturer.
- DLMS Compliant Certificate.
- IDIS Compliant Certificate
- All test reports, and Accelerated life test.
- Complete set of drawing of the energy meters with dimension clearly marked.
- Catalogues and technical data and literature consist of the following:
  - Electrical and electronic diagram for each type of meters.
  - The trouble shooting for each type of meter.
  - All software and data base of the meter.
  - All the above documentation should be provided in three copies in English language as well as in form computer disc (CD)

## **8. Prepaid Method:**

Smart Meter should support prepayment according to international Standards, and support the work as postpaid and prepaid from the system software HES/DLMS. Payment method shall be through Applications (mobile application, application of ATM, .. etc), this facility should be supported by the Software of HES, the payment can be achieved by one or more of the following methods:

- a) Electronic Wallet. b) Bank Account.
- c) Point of Sale (PoS).
- d) Any other applications (except; charging through meter keypad or RFID card)

## **9. Samples:**

- Samples of different rating of energy meters are required and to be sent with the offer.
- Offers without samples will be rejected.

## **10. Availability and Reliability**

10.1 The required Availability and reliability for equipment is at least 99.9% or better. The supplier must specify the mean time between failures (MTBF) for each different type of equipment offered

10.2 The required reliability for data is at least 99.9% or better

11. Appendix A. Overall and installation dimensions of meters

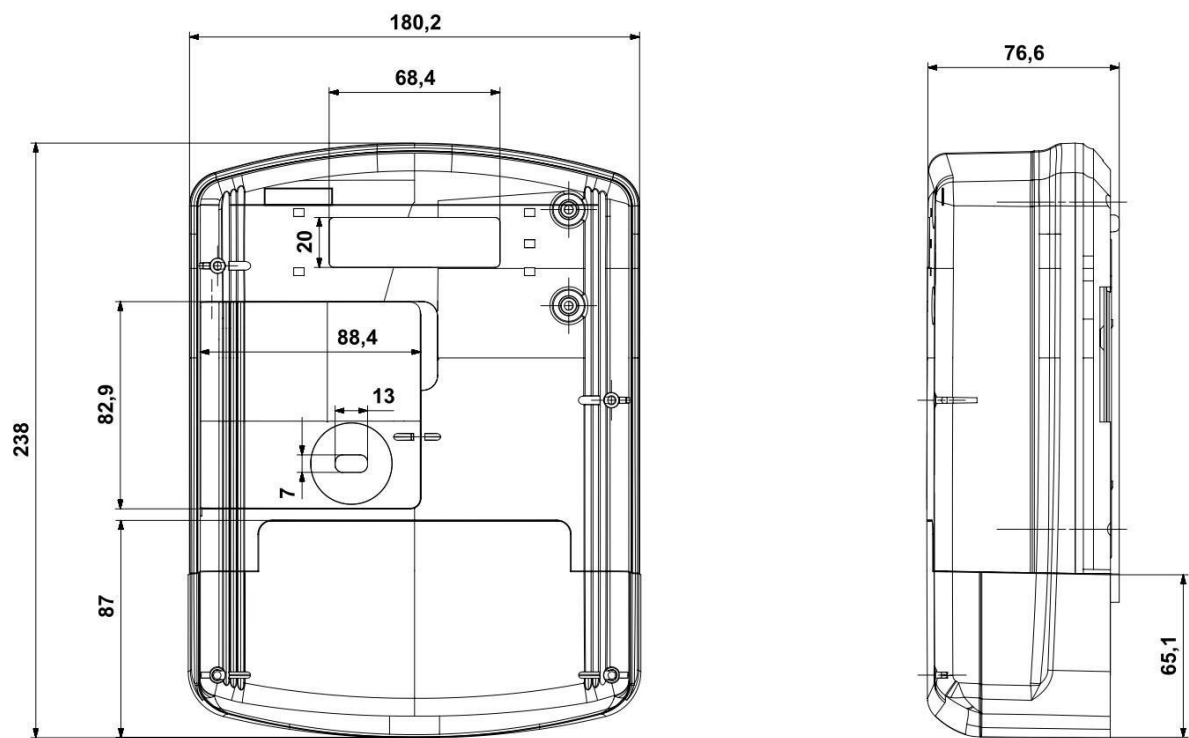


Figure A 1. Overall and installation dimensions of meters

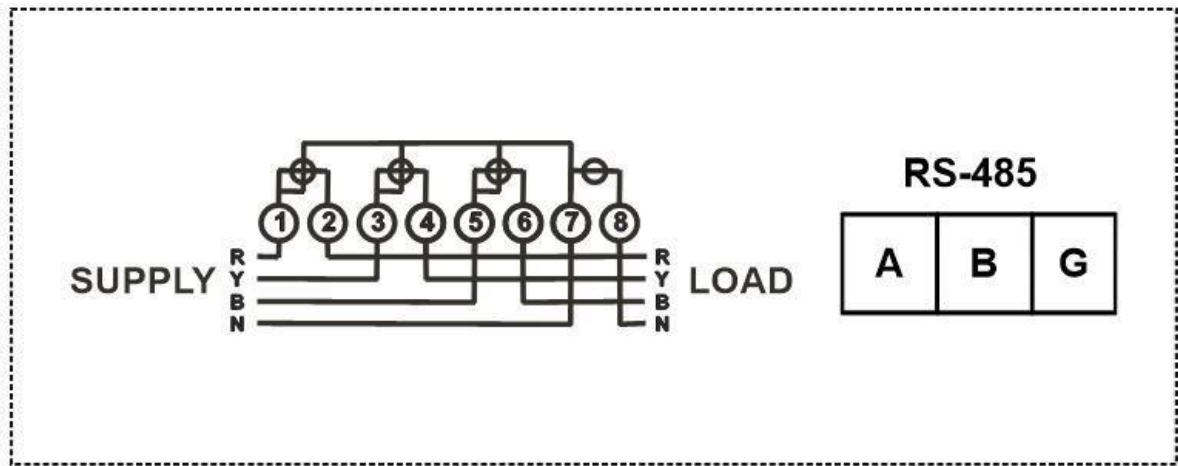


Figure A 2. Meter connection diagram