ELECTRICITY METERS MNT 12
OPERATING MANUAL

CONTENT

Introduction

This Operation Manual (hereinafter referred to as OM) covers multi-tariff electricity meters type MNT 12 (hereinafter referred to as meters).

OM covers operation of meters, their intended usage, maintenance, calibration, storage and handling.

Operating personnel shall be specially trained with electric safety access not less than of 3rd group when operating units up to 1000 V.

1. Meters Description and Their Operating Principle
1.1. Meters intended use
1.1.1 Electric energy meters MNT 12 are intended for measuring active and reactive energy, instantaneous values of power, voltage, current rate, as well as organizing multi-tariff accounting in one-phase circuits of alternative current in domestic household and other branches.

1.1.2. All meters are equipped with pulse output, optical port, and depending on the version, may be equipped with four-wire electric interface RS-485, electric interface GSM or Wi-fi for remote communication.

1.1.3. Depending on the version, the meters may be equipped with loading control relay and relay output.

1.1.4. The meter may be used in automated electric energy control and accounting systems The meters versions differ by initial and maximum current rate, a number of measured elements in current circuit, availability of auxiliary modules and availability of relay output and/or power control relay.

1.1.8. Meters identification when their ordering and in documentation to other products, where they may be used, shall include the name of the meter, its type, version code according to table 1.1 of this manual and TU specification:

“Electricity meter MNT 12”.

Table 1.1 – Meters type designation

A	P2	T	B	X	X	0	X	X	X	X

X X — Voltage

1	220 V
2	230 V
3	240 V

X — Active energy measurement direction

1	Directly
2	Reverse

X — Availability of sensors

0	Not available
M	Availability of magnetic field sensor
MC	Availability of magnetic and electromagnetic field sensors

X — Availability of relay outputs

0	Not available
1	Relay output
2	Power control relay
3	Availability of relay output and power control relay

0 — Availability of interfaces

0	Module is not installed
2	RS-485 interface module is installed
4	RF interface module is installed (by radio channel)
6	GSM/GPRS interface module is installed
8	wi-fi interface module

X — 1 Optical port is installed

X — B Meter construction specific features

B — T Added only to indicate multi-tariff meters

T — Connection diagram to electricity network

P2

P1	Direct connection 5 (100) A, 10 (100) A
P2	Direct connection 5 (60) A, 10 (60) A
P3	Direct connection 5 (100) A, 10 (100) A
P6	Direct connection 5 (80) A, 10 (80) A

A — Energy measurement

A	Active energy
AR	Active and Reactive energies

General Specification:
Single 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.

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 Sun shine 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

1.2 Technical Specifications

1.2.1 The meters conform to requirements of TU U 33.2-33401202-008:2008, DSTU EN 62503-21, DSTU EN 62052-11, DSTU EN 50470-1, DSTU EN 50470-3.

Item	Technical Description
Service type	Single-phase two-wire (1P2W), Direct-connected
Terminal connection	Bottom-connected
Nominal voltage (Un)	AC 240V
Operating voltage	70% ~ 120% Un
Basic current (Ib)	5A
Max. current (Imax)	100, 80, 60 A
Starting current	20 mA
Frequency	50 Hz ± 5 %
Accuracy class	Class 1 for kWh, Class 2 for kvarh
Disconnect switch	One-coil latch relay / 100 A / 10,000 operations
Display	LCD with backlight
Operating temperature	from - 40 ~ 70 ℃
Limit temperature range of storage	from -40 ~ 85℃
Relative humidity	≤ 95% RH
Ingress protection	IP 54 without suction
Insulation protection	Class II
Meter and modem life	≥15 years,
Data retention	>20 years

Battery life/ type Read-without-power	15 years (internal built-in battery)/ Lithium type or other advance technology, Charge cycle : 1000 times
Internal super Capacitor	72 hours without power
Enclosure material	Poly carbonate + Glass fiber
Dimensions	To be filled by supplier
Weight	To be filled by supplier
Real-time clock	≤ 0.5 seconds per day (<5 ppm)
Meter constant	1600 imp/kWh (default) Configurable from 1000 imp/kwh to 8000imp/kwh
Power consumption in voltage circuit	≤1.5w
Power consumption in current circuit	≤ 0.5 VA
Cable connector /Terminal size	Should be withstand for Max. Current (100 A)

1.2.2. Meter shunt running. In case of no current in current circuit and if the voltage value is 1.15 of nominal value, the basic transfer unit will not create more than one pulse for the time not less than 9.5 min.

1.2.3 The meters resist short-time current overloads, 30 times exceeding I_{max} within one half-period at the rated frequency.

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 Imax current.
- The meter can be remotely Off & On electricity supply from a central data center.

1.3.4 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.

1.3.5 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.

1.4 Operating principle

1.4.1 Measurement of active and reactive energy is performed by means of analogue-to-digital conversion of electric signals, received from primary transducers of current rate and voltage on the input of in-built AD converter of microcontroller, which processes the signal to digital code. Microcontroller rates the mean square value of current, voltage, power, current value of power factor for each phase, as well as the value of reactive and reactive energy in aggregate and for each tariff.

Microcontroller controls electronic display, electric and optical interfaces, radio channel, pulse outputs, as well as processes information, received from mechanical buttons, opening sensors for housing and terminal cover of the meters.
Non-volatile memory is used to save data in the meters. Measured values of electric energy and meter parameters are stored in the memory. The measured values of electric energy and meter parameters shall be stored at least 10 years if there is no voltage on the terminals.
The meter is equipped with seven-segment electronic display with additional symbols.

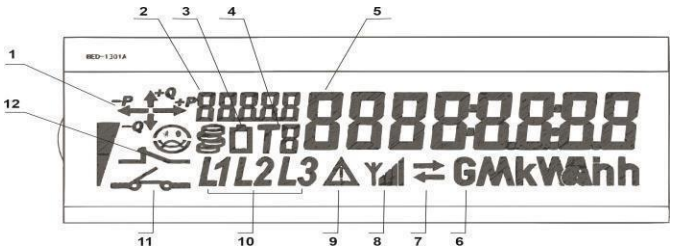


Figure 1.

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 code of the displayed parameter.

3. Low battery indicator for the internal backup battery. If the indicator is lit, the battery needs to be replaced

4. Indicator of the current tariff number.

5. Display group for the value of the measured parameter.

6. Measuring unit display group:

6.1. A current in amperes.

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

11. Relay output status indicator: – relay output is closed, – relay output is open.

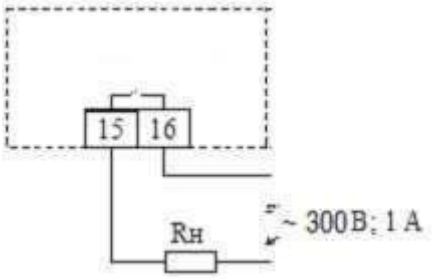


Figure 1.3

RH – loading, connected to relay output.

Relay actuation may be configured in two modes:

1) normally opened contacts are connected when the selected tariff is active;

2) normally opened contacts are connected in twelve programmable day intervals;

1.4.4 The meters are equipped with real-time clock, built in microcontroller, regulated with crystal resonators, which count out years, months, days of the week, hours, minutes and seconds. Clock data is used for performance of tariff program, formation of average power integration period and events registration with temporary mark. The clock has the function of switching between winter and summer time.

Time switching may be performed in automatic mode or according to the date, installed manually in process of parameterization.

The meter is equipped with temperature sensor for reduction of clock tolerance and ambient temperature dependence. Lithium-type battery supply (pos. 11 on figure 1.1) is used to ensure operational continuity on in-built clocks in case of power dump. Meter microcontroller switches to economic mode in case of voltage absence in the electric network, lithium-type battery is a power source. Only internal clocks of the meter operate in this mode. In case of

voltage supply, the energy of lithium-type battery is not applied. The meter may operate min for 6 years under extreme conditions in volt-free network (provided that the meter is equipped with terminal cover, tightened with sealing screw).

1.4.5. When pressing “View” button, the meters turn on for some time and operate in indication mode. Duration of meter operation in operation mode and the list of displayed windows depends on meter parameterization.

1.4.6 In the meter versions with loading control relay, consumer power disconnection may be performed through interface or radio channel. The relay also turns off at set values of maximum allowable power or maximum allowable voltage, at exceeding of which consumer power is automatically disconnected.

1.4.7 Switched mode power supply is used for meter in-feeding, which converts rectified input to voltage, required for in-feeding of all units and modules of the meter.

1.5 Meters parameterization

1.5.1 In process of parameterization, meter configuration constants are input in the memory. Parameterization is performed via optic port in two steps:

- factory parameterization;

- consumer parameterization.

In process of factory parameterization serial numbers and constants are input into meter memory, required for functioning of meters and auxiliary modules. The constants cannot be changed within the whole period of meter operation. Factory parameterization of the meter may be done only in factory environment.

In process of consumer’s parameterization, the constants are input into meter memory via electric interface or radio channel, which customize the meter to local operating conditions. The example of information, which may be input into meter memory, is given in Table 1.5. Consumer’s parameterization of the meters is performed by energy supply or authorized organization, using special software. Parameterization may be done only by password with operator permission.

Meters parameterization Table 1.5.

Table 1.5

Parameter	**Value**	
	by default	**valid**
Data flow rate - for optical port; - for electric interface RS-485 - for radio channel	 9600 baud 9600 baud 115200 baud	 invariant 30 to 19200 baud invariant
Time before disconnection in case of interface inactivity	120 sec.	30 to 250 sec.
Meter address: - senior “HI” - junior “LOW”	generated based on meter serial number	 16 to 16383 16 to 16383
Radio channel setup: - PAN-ID network identifier; - channel number	2104 12	0 to 65535 11 to 26

User's password Operator's password	1111111111111111 2222222222222222	0 to 16 symbols 0 to 16 symbols
Meter installation site (1 field) Meter installation site (2 fields) Meter installation site (3 fields) Meter installation site (4 fields)	- - - -	0 to 100 symbols 0 to 100 symbols 0 to 100 symbols 0 to 100 symbols
Relay output actuation	Influenced by tariff 1	If one of four tariffs is valid, or 12 time intervals in hours and minutes
Parameters of switching to summer/winter time	Automatic switch	- automatic switch; - switch in the set month, day; - no switching
Number of tariffs Number of week profiles Number of tariff seasons Number of day profiles Holidays	3 3 5 3 0	1 to 4 1 to 10 1 to 12 1 to 16 0 to 30

1.6. Tariff module

1.6.1. Programmable tariff module of the meters distributes data, measured by the energy meters to active and reactive energy registers, conforming to four available tariffs. The function of this module also includes recording of register energy to long-term memory, when changing the day and the month. In process of parameterization tariff seasons are entered into the mater, as well as week profiles and day profiles, in which the tariff switching time is set.

1.6.2 Tariff program analyzes data of internal real time clock and compares them with data on tariff seasons start, set in process of meter parameterization.

1.6.3 Availability of tariff seasons make it possible to use more than one register switching order during a calendar year, in which information of accounting energy by applicable tariff is stored. Up to 12 tariff seasons may be used in the meter. Tariff season start corresponds to season activation date and week profile number, which will be applied during the whole season.

1.6.4 Week profile settles a certain order of day profile use within the calendar week, which includes additional holiday. Up to 10 week profiles may be used in the meter.

1.6.5 Day profile is an order of active tariff switching within a day with corresponding switching time. Up to 16 profiles may be used in the meter with option to use up to 12 switching of active tariff within a day.

1.6.6 Holiday list. Up to 30 dates may be stores in meter memory. Holiday date format – month- day.

1.6.7 Tariff registers. Measured energy values are entered into appropriate registers in meter memory.

1.6.8. Emergency tariff. In case of internal clock fault, emergency tariff is automatically triggered in the meters, and all calculated energy values are recorded into the emergency tariff register and the letter "A" is shown on electronic display on current tariff indicator (refer to table 2.2)

1.7 Unauthorized access protection of the meters

1.7.1 The housing and cover of meter terminals are connected to package header, sealed with the screws. The joint from package header perimeter ensures overlapping of package header and housing when connecting min. 4 mm, which eliminates possibility of unauthorized access to measuring part of the meter without case damage.

1.7.2 The sealing screws of meter housing, on customer's order, may be sealed by epoxy resin.

1.7.3. The meter versions with additional modules are equipped with terminal board opening sensor and meter housing opening sensor. The meters provide recording of 65635 actuations of each sensor.

1.7.4. Depending on meter version, the information is available for readout via optic port, electric interface RS-485, electric interface GSM or radio channel only after entering password.

The user password allows only reading out data from the meters. Recording data to the meter, using user password, is impossible. Operator's password allows recording and reading out the data.

2. Intended Use

2.1 Operating limits

2.1.1 Operating limits are described in the table 2.1. Table 2.1.

Parameter name	Value
Input voltage range, V	168 to 288
Current rate operating range, mA	40
Maximum allowable voltage on testing output terminals in open state, V	20
Maximum allowable current rate of output circuit of testing output in closed state, mA	20
Operating temperature range, °C	-40 to +70
Operating temperature extreme range, °C	-40 to +85
Relative humidity turn down (at temperature +30°C), %	0 to 95
Atmosphere pressure turn down, kPa	70 to 106.7

2.2.1 Meter preparation for use and operating procedure

Meter assembling, disassembling, opening and packaging shall be performed only by authorized organizations and persons with the access by electric security according to applicable laws of electric plants installation.

2.2.2. The lithium-type battery type 1/2 AA 3.6 V or CR 2032 is used to feed the meter clock, depending on the version. The battery shall be replaced only by electricity supply or authorized organization.

Please, note! To ensure safety in the process of battery replacement, it is necessary to de-energize the meter.

The procedure of battery replacement is performed as follows:
- unscrew the sealing screw and open the cover of optic port and case with installed battery;
- remove the old battery from the case and conforming to polarity, install the new one.
- insert the case with the battery to the meter. If after the battery replacement the symbol 4 on figure 1.2 is displayed on the screen for a long time, uncharged battery is installed or battery polarity was not observed in the process of installation;
- set the current date and time on the meter via optic port, interface or radio channel;
- close the cover of the optic port, tighten the sealing screw and hang the seal.

2.2.3. The meter shall be installed in the premises according to conditions 1.2.7-1.2.11.

2.2.4. Before meter installation, it is necessary to de-energize the electric main. After that, remove the meter from the packaging and make sure of absence of mechanical damages, integrity of sealing and availability of passport.

2.2.5. Fix the meter in accounting point using three screws, or install it on the DIN-rail. Installing the meter on the DIN-rail, do not use the fixing bracket. Dimensions and installation dimensions are specified on figure A.1 in the Annex A.

2.2.6. The meter connection shall be performed according to diagram, specified on the cover of terminal plate and Annex B. The screws shall be tightened with screwdriver (blade thickness 1 mm) until tight with torque min. 3 N*m.

2.2.7. Energize the meter and make sure that indication on the electronic display denotes normal operation of the meter, described in 2.2.9, otherwise correct the connection or replace the meter.

2.2.8. Indication of meter operating modes to display the operating modes, the meter is equipped with optic functioning indicator “6400 imp/kW*h”, which blinks with the frequency, proportional to consumed power and switches simultaneously with testing output, and additional symbols, described in 1.4.1.3 are shown on electronic display.

Tariff number is displayed by means of three or two additional symbols, shown on figure 2.1.

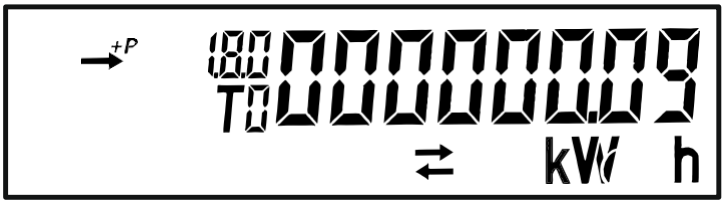


Figure 2.1

The third symbol letter “T”, which denotes the tariff.

The second symbol denotes the number of currently applicable tariff. It can assume the numerical value 1 to 4, as well as letter value “A”. Tariff “A” is emergency tariff, which turns on after the fault of internal clock or tariff systems of the meters. If after meter installation emergency tariff is shown on display, it is necessary to parameterize the meter, or set the correct time. Tariff parameterization and clock setting shall be performed by energy supply or authorized organization, using special software.

The first symbol denotes the number of the viewed tariff and may assume the value 1 to 4. When viewing the aggregate energy for all tariffs, the third symbol is not displayed.
If the symbol 2 is shown on electronic display on figure 1.2, the housing of the meter is opened (in meter versions with opening sensor). If the meter is sealed and sealing screws are tightened to the max, the meter needs repairing.

If the symbol 3 is shown on display on figure 1.2, the terminal box of the meter is opened (in meter versions with opening sensor). If the terminal box cover is sealed and sealing screws are tightened to the max, the meter needs repairing.

If symbol 4 is displayed on electronic display on figure 1.2, the battery of the meter clock shall be replaced. The procedure of battery replacement is described in 2.2.2. Battery replacement shall be performed only by energy supply or authorized organization.

2.2.9 If the symbol 11 is displayed on electronic display on figure 1.2, internal error is fixed in the meter and it needs repairing.

2.2.10 After energizing the meter terminals, make sure of normal operation of indicators, fix the terminal cover, using the screw, let the thread through special device in the cover and hole in screw head and hang the seal.

2.3 Meter use

2.3.1 In the operating mode, the meter measures active and reactive electric energy (depending on meter version), with accrual character.

2.3.2. Energy consumption by the power is displayed by means of optical indicator of functioning “8000 imp/kW*h” on the meter front panel.

2.3.3 Test outputs are implemented on electronic keys with optical isolation. The maximum allowable key power in open position is 30 V, the maximum allowable key current in closed position is 20 mA.

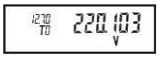
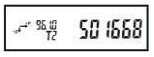
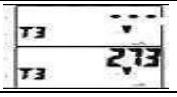
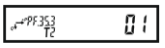
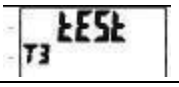
2.4 Data readout

2.4.1 The measured values, stored in meter memory or computed based on results of measuring, depending on the meter version, may be read out as follows:

- visually on electronic display;
- via any interface;
- via radio channel;
- via optic port

2.4.2 After energizing the meter, depending on parameterization, the data are consecutively formed in form of “windows’, specified in table 2.2. When the meter turns on, all segments of LCD are illuminated for the first moment. Indication of each data type lasts for 10 seconds. Data type in the window is set in the process of meter parameterization.
Table 2.2

No.	Data type	Displayed windows
1	Illumination of all segments of electronic display	
2	Active energy value aggregate for all tariffs, in kilowatt-hours	

3	Active energy value for the first tariff, in kilowatt-hours	
4	Active energy value for the second tariff, in kilowatt-hours	
5	Active energy value for the third tariff, in kilowatt-hours	
6	Active energy value for the fourth tariff, in kilowatt-hours	
7	Instantaneous power, kW	
8	Instantaneous voltage, V	
9	Instantaneous current rate, A	
10	Scrolling text, displaying information in consumer's indebtedness, in which the sum in UAH and date in format	 
11	Meter serial number	
12	Set voltage value, when exceeding of which power control relay turns off, kW (the function is disabled in upper	
13	Meter address in system in Cover open counting system	
14	Test window for calibration of meter clock rate (	

2.4.3. The function of data manual view enables to display the most of saved data, using mechanical button 2 on the figure 1.1.

2.4.4. To read out data through electric interface RS-485, GSM or Wi-Fi, appropriate transducer or software is required. To read out data through optic connection interface, optic head and software are required.

Connecting with the meter allows:
- calculate or change meter tariff model;
- calculate the power profile of each type of measured energy for the last 60 days with integration period 30 minutes;
- calculate the value of each type of energy, measured by the meter, for each tariff and in aggregate for all tariffs for the last day or month;
- calculate a number of events, which happened to the meter, and the last 16 dates of each event (housing removing, terminal cover removing, magnetic field influence, meter clock setting, parameterization, loss of voltage, voltage exceeding and lowering, entering wrong password);
- adjust the meter clock;
- calculate all values, measured by the meter;
- calculate or readout interfaces settings, parameters of voltage or power limits, at which the power control relay turns off, information on place of meter installation;

- change the access password;
- turn on or turn off audio signal of the meter, which occurs when pressing the buttons;
- change the tariff numbers or time intervals, when the relay output is actuated.
- change the number and order of windows displaying on electronic display.

Note - The meters calculate the value of each energy type to three decimal places, and the values to two decimal points are displayed on electronic display (the third one is not taken into account), thus

- the value of each type of aggregate energy by all tariffs, displayed on meter electronic display $T_{\Sigma ед}$ may exceed the value of aggregate energy $T_{\Sigma в}$, calculated using formula (2.1) by no more than 0.04 (2.2).

$T_{\sum в} = T1+T2+T3+T4$

(2.1) $T_{\sum ед} - T_{\sum в} \leq 0.04$

(2.2) where T1, T2, T3, T4 are energy values, shown on meter electronic display for the first, second, third and fourth tariffs correspondingly.

- the value of each energy type for a certain period Wп, read out from the meter, using parameterization program, may exceed the sum of energy values for 30-minutes intervals $W_{\Sigma 30}$, read out from the meter, using parameterization program for the same period by more than 0.48
(2.3).

$Wп - W_{\Sigma 30} \leq 0.48$ (2.3)

2.5. The meter versions with radio channel are equipped with magnetic field sensor, which is actuated if influenced by the magnetic field exceeding 100 mT for more than 3 sec. Under the influence of magnet, the inscription “Magnet” appears on electronic display from time to time. The message “Magnet” may be deleted via radio channel or optic port by means of password.

2.5.1. The meter versions with radio channel are equipped with electromagnetic field sensor, which is actuated if influenced by the electromagnetic field exceeding 10 V/m in frequency diapason 80 to 2000 MHz for more than 3 sec.

After the influence of electromagnetic field, the inscription “Radio” appears on the electronic display from time to time. The message “Radio” may be deleted via radio channel or optic port by means of password.

3 Maintenance

3.1 General instructions

3.1.1 Provided the operating conditions are observed, the meter maintenance shall be performed once in 16 years.

3.1.2 The maintenance is composed of adjustment operations, repair and meter calibration.

3.1.3 Adjustment operation shall be performed by Ukr meter test standard.

3.1.4 Repairing and calibration operations shall be performed at manufacturing plant.

3.1.5 The meter conforms to requirement of for safe operation.

3.1.6 According to the manner of electric shock hazard protection, the meter conforms to class II Under DSTU EN 62053-21, DSTU EN 62052-11, DSTU EN 50470-1 and DSTU EN 50470-3.

3.1.7 Insulation between all circuits of current, voltage and “ground” withstands testing voltage 4 kW (mean square value) with frequency (50±2.5 Hz) within 1 minute.
3.1.8 Insulating resistance between the body and electric circuits shall be at least:

- 20 mΩ – under normal conditions;

- 7 mΩ – at ambient temperature (30±2) °C and relative humidity 90%.

3.1.9 The meter conforms to GOST 12.1.004-91 by fire safety regulations.

4 Storage

4.1 Conditions of meter storage in warehouse premises of consumer (supplier) in consumer packaging is in conformity to GOST 22261-94.

5 Handling

5.1 Requirements to product handling and performance conditions
5.1.1 Conditions of handling and meter storage in transport packaging of manufacturing plant conform to conditions 3 according to GOST 15150. Shipping type – less than truckload.

5.1.2 The meter may be handled in covered rail carriages, transported by road with rain and snow protection, by water transport, as well as handled in sealed heated aircraft modules. Transportation shall be performed in conformity with handling rules, applicable for each means of transport.

5.1.3 The meter in transport packaging is resistant to ambient temperature -40 to +85°C and relative humidity up to 95% at temperature 30°C and atmospheric pressure 70 to 106.7 kPa (537 to 800 mm Hg).

5.1.4 The meter in transport packaging is resistant to transport shaking at sweep count 80 to 120 per minute with acceleration 30 m/s^2.

6 Manufacturer’s warranty

6.1 If the meters are supplied within the territory of india, the manufacturing plant guarantees compliance with requirements of DSTU EN 62053-21, DSTU EN 62052-11, DSTU EN 50470-1 and DSTU EN 50470-3 provided that the consumer observes the conditions of operation, storage, assembling, specified in this operating instructions.

6.2 Guarantee service life of the meters is 5 years from the date of sale. If there is no mark on sales date, the guarantee period is counted from the date of production.

6.3 With the purpose of export shipping, the manufacturing enterprise guarantees the quality of meters and their conformity to requirement of operating instructions within 5 years after the meters are taken over the State border of provided that the customer observed operating and storage conditions under this operating manual and is the seal of manufacturing plant is preserved.

6.4 In case of failure or meter non-conformity to the requirements of this operating instruction within the guarantee service life, the meters shall be repaired by organization, authorized to perform guarantee repairing or replaced by the manufacturing plant.

6.5 If the security seal of manufacturing plant was broken, or if there are mechanical damages of the package header, housing, terminal plate, traces of intensive heating or in case of

violation of operating rules, stated herein, the meters are removed from the warranty and repairing is performed at customer's cost.

6.6 The manufacturing plant is not liable for the meters, which broke down in process of operation due to wrong connection.

6.7 Post-warranty repair shall be performed by organization, authorized to perform repairing or by manufacturing plant under the standalone agreement.

6.8 Guaranteed shelf life is 1 year after meters dispatch.

7 IS Standards

7.1 standards:

The electricity smart meters are designed in conformant to the following standards:

- IEC 62052-11 Electricity metering equipment (a.c.)-General requirements, tests and test conditions, Part 11: Metering equipment.

- IEC 62053-21 Electricity metering equipment (a.c.)-Particular requirements, Part21: Static meters for active energy (classes 0.5, 1 and 2).

- IEC 62053-24 Electricity metering equipment - Particular requirements - Part 24: Static meters for fundamental component reactive energy (classes 0,5S, 1S, 1, 2 and 3)

- EN 50470-1 Electricity metering equipment (a.c.) Part 1: General requirements, tests and test conditions

- Metering equipment (class indexes A, B and C).

- EN 50470-3 Electricity metering equipment (a.c.) Part 3: Particular requirements - Static meters for active energy (class indexes A, B and C).

- IEC 62056-21 Electricity metering- Data exchange for meter reading, tariff and load control, Part 21: Direct local exchange.

- IEC 62056-46 Electricity metering- Data exchange for meter reading, tariff and load control, Part 46: Data Link Layer using HDLC-protocol.

- IEC 62056-51 Electricity metering- Data exchange for meter reading, tariff and load control, Part 51: Application layer protocols.

- IEC 62056-53 Electricity metering- Data exchange for meter reading, tariff and load control, Part 53: COSEM Application Layer.

- IEC 62056-61 Electricity metering- Data exchange for meter reading, tariff and load control, Part 61: OBIS Object Identification System.

Image of Meter:

8. Test:

8.1 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.

8.2 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.

8.3 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

8.4 Data Exchange Protocol (DLMS)

8.5 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.

9. 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 market.
- 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)

10. Prepaid Method:

Smart Meter should support prepayment according to international Standards, and support the work as postpaid and prepaid from the system software HES/MDMS.

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).

11. Samples:

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

12. Availability and Reliability

12.1 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.

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

13.1. Appearance

An example of the appearance of Nik2104...A... meters and the arrangement of their controls is shown in Figure 13.1.

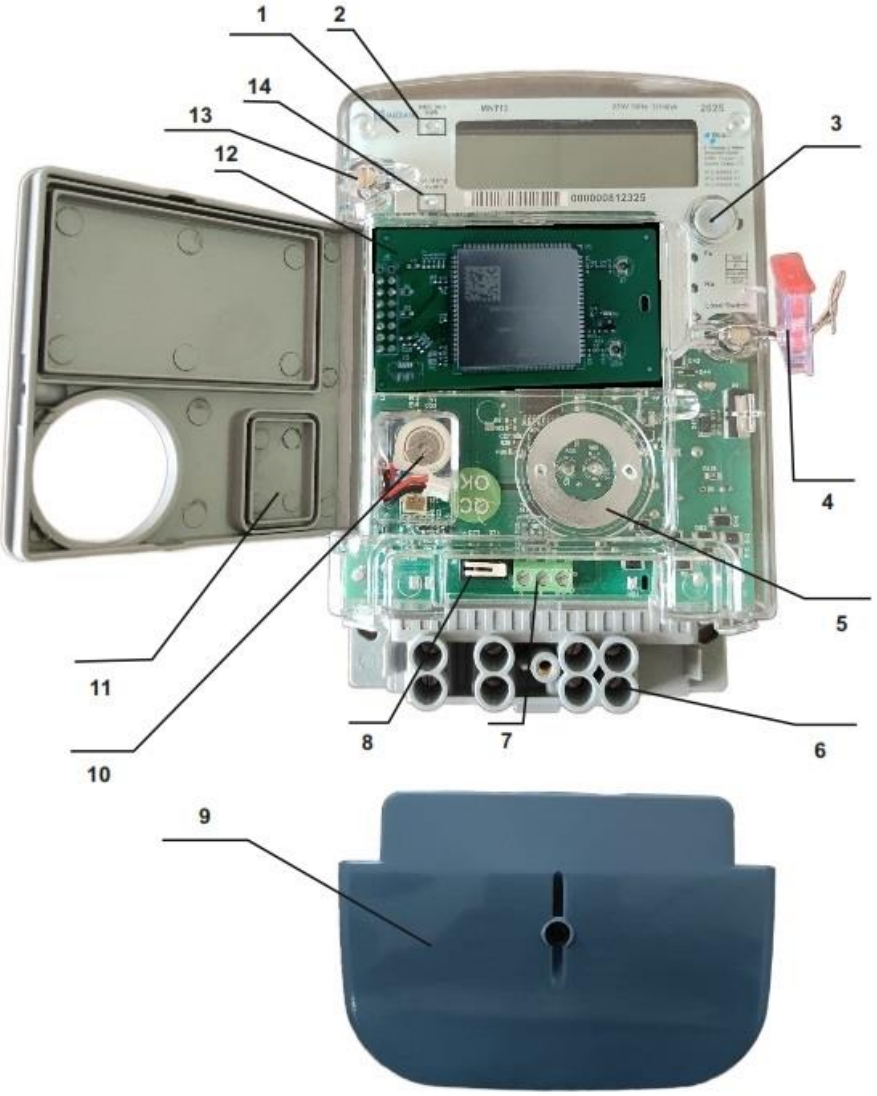


Figure 13.1. General view of the meter

The figure shows the following elements:

1. Meter top cover.
2. Optical pulse test led for active energy (kwh).
3. Push button.
4. Seals.
5. Optical port.
6. Terminal block.
7. RS-485 connector.
8. Sensor for opening the cover of the terminal block.
9. Terminal cover.
10. External backup battery.
11. Optical and Module flip cover.
12. GSM module .
13. Top cover & Sealing screw.
14. Optical pulse test led for reactive energy (kvarh)

13.2 The design of the nameplate of MNT 12...A... meters is shown in Figure 4 and Figure 13.2.

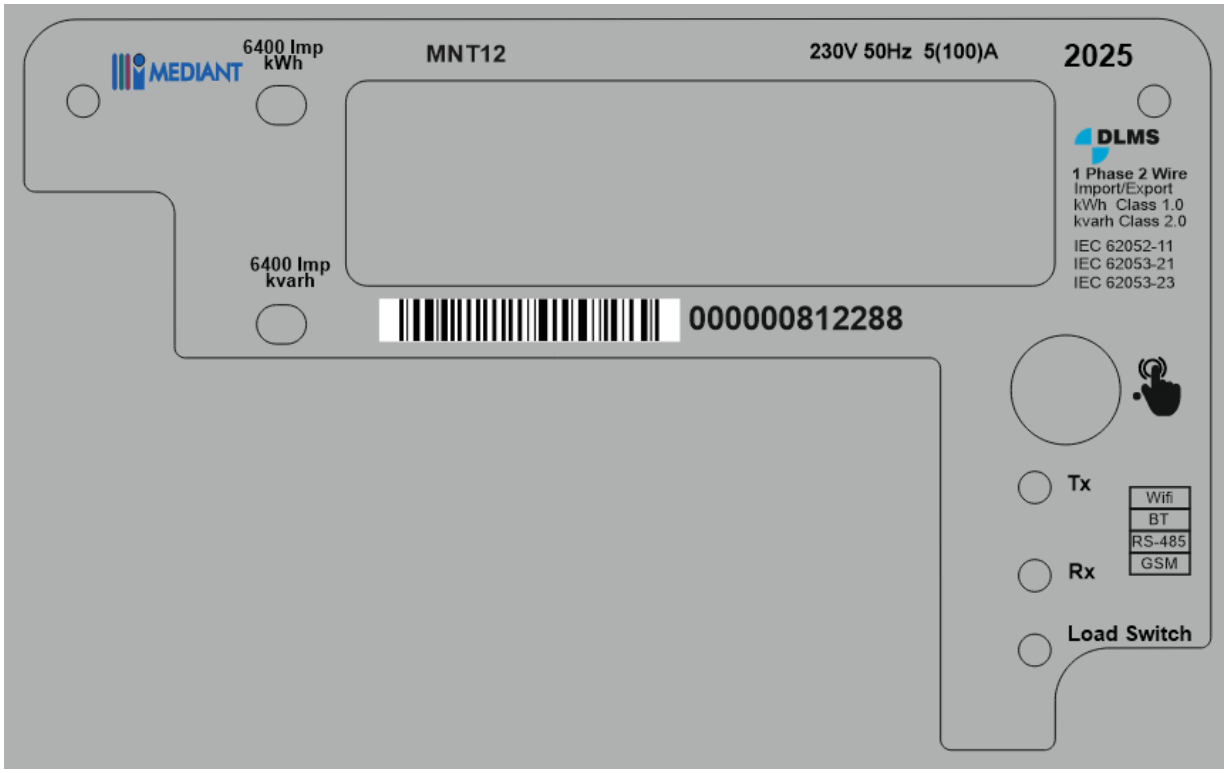


Figure 13.2. Nameplate marking for directly connected MNT 12…A… meters

The figure shows the following elements

1. Registered trademark
2. Marking of the optical test pulse output when measuring active energy (Kwh).
3. Meter version code.
4. Main technical data (basic and maximum current strength, rated voltage, rated frequency).
5. DLMS mark.
6. Meter Details (1 phase 2 wire)
7. Symbols of meter accuracy classes for active and reactive energy measurement and their corresponding standards.
8. Push button symbol.
9. Year of manufacture of the meter.
10. Load switch Led.
11. 12. Rx-Tx Leds.
13. Meter Serial Number.
14. Place for the meter barcode.
15. Marking of the optical test pulse output when measuring reactive energy (Kvarh).

Annex A

(compulsory)

Dimensions and installation dimensions of the meters

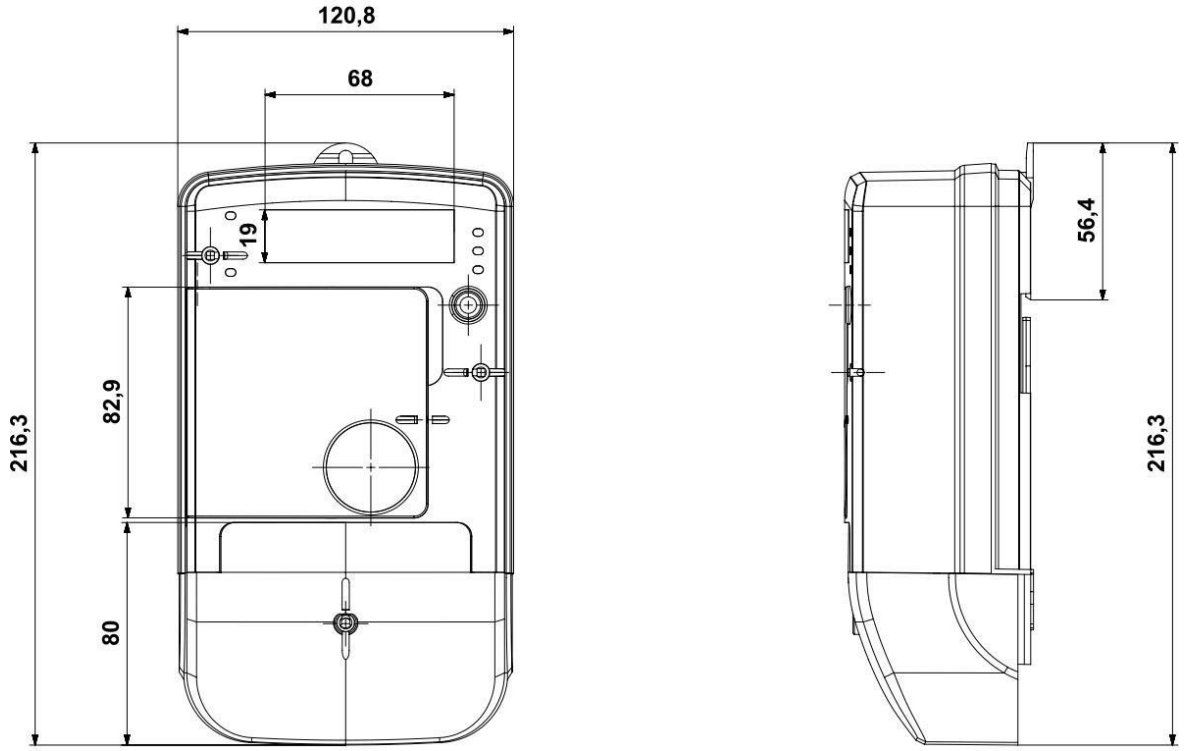


Figure A- Dimensions and installation dimensions of the meters

Annex B

Meter connection diagram