User's Manual

Three-phase static electricity meters for active energy measurement with LCD, internal clock and Load Profiles

AMT B2x-Fx

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1 Purpose and usage

Three-phase static electricity meters AMT B2x-Fx are the programmable three-system electricity meters determined for the active, reactive and apparent electric energy measurement in 3-phase 4-wires networks with the frequency of 50 Hz with data displaying on LCD.

The electricity meters allow active, reactive and apparent energy measurement in both directions, rective energy measurement in quadrants; measurement of all energies per tariffs controlled from outside (two tariffs) or controlled by the internal clock (four tariffs); active, reactive and apparent total maximum demand measurement in both directions; total active maximum demand measurement in tariffs, measurement of the total instantaneous active, reactive and apparent power in both directions, measurement of instantaneous voltage and current values per phases, measurement of power factor and frequency, historical records of measured quantities (energy, maximum demands, voltages and currents), record of the load profiles 1, 2, 3, and Logbook Event records.

The electricity meters allow displaying of the following data on LCD: energies, powers, voltages, currents, frequency, power factor, messages about internal statuses, internal errors, used firmware version, serial number, date, time and number of events.

Active energy measurement can be performed in one of three measuring modes: Summary mode – measurement „using a mechanical register“, Separate mode – consumption and supply measurement and Ferraris mode – measurement of consumption and supply, “consumption – supply, Ferraris” mode. The active energy measuring mode also corresponds active power measuring mode.

The communication (data and parameters readout and parameters change) is available via optical serial interface (standard equipment), interface RS485, PLC and GPRS.

The electricity meters is connected to a circuit directly or through current measuring transformers. They are intended for indoor installation.

The meters comply with EN 50470-1, EN 50470-3, EN 62052-11, EN 62053-21, EN 62056-21, EN 62056-6-1, EN 62054-21, EN 62052-21 and with the requirements of European Parliament and EC Directive 2014/32/EU (MID).

2 Technical description

2.1 Product designation

AMT B2x_1-F$x_2$$x_3Tx_4Ix_5$

AMT B2..... type designation

x_1 ..... *overload capacity:* **3** – 200 % (semi-direct connection through current measuring transformers), **4** - 400 %, **5** - 500 %, **6** - 600 %, **8** - 800 %, **A** - 1000 %, **B** - 1200 %, **D** - 1600 %, **E** - 2000 %, **F** - 2400 %

F ..... *basic version:* multifunctional electricity meter with LCD and real-time clock

x_2 ..... *measured energy:* **A** - active energy, **F** - active energy - Ferraris mode, **R** - active energy and reactive energy

x_3 ..... *network connection:* **2** – 2-phase 3-wire, **4** – 3-phase 4-wire,

T ..... *current converter:* **T** – transformer

x_4 ..... *case version:* **E** – up to 100 A, **9** - up to 120 A

I ..... *used processor type*: Texas Instruments

x_5 ..... *special modules:* **E** - external control of the second tariff,**4** - RS 485 interface, **M** - Mesh-wireless communication modude; **G** - GSM/GPRS interface, **P** – PLC interface, **Y** - auxiliary relay 2 A

2.2 Technical data

Accuracy Class		**A**, **B** (according to MID); **2**,**1**
Reference voltage U_n [V]		3x230/400
Reference current I_{ref}/ Nominal current I_n [A]		5 and 10 / 5
Transient current I_{tr} [A] *direct / indirect connection*		0,5 and 1 / 0,25
Starting current I_{st} [mA]		< 10
Minimum current I_{min} [A] *direct / indirect connection*		0,25 and 0,5 / 0,05
Maximum current I_{max} [A] *direct / indirect connection*		40, 50, 60, 80, 100, 120 / 10
Current overloadability [%] *direct / indirect connection*		**4** - 400, **5** – 500, **6** - 600, **8** - 800; **A** - 1000, **B** - 1200, **D** – 1600, **E** – 2000, **F** – 2400 / **3** - 200
Nominal frequency f_n [Hz]		50 (± 2 %)
Consumption	*in voltage circuits [VA/W]*	transf. for RS485 ≤ 1,96/ 1,30 in L1, 0,85/ 0,32 (L2, L3) MYRRA for RS485 ≤ 1,42/ 0,55 in L1, 1,10/ 0,40 (L2, L3)
	in current circuits [VA]	≤ 0,01 at I_{ref}
Climatic conditions	*Specified operating range*	from -40 °C to +70 °C (3K7)
	Limiting operating range	from -40 °C to +70 °C (3K7)
	Limiting operating range for storage	from -40 °C to +70 °C (1K5)
	Limiting operating range for transport	from -40 °C to +70 °C (2K4)
	Humidity	<75 % ... annual average; 95 %.... during 30 days naturally dissipated through the whole year; 85 %... occasionally in other days
Mean temperature coefficient [%/K]		≤ 0,04
Testing output impulse constant k_{TO} [imp/kWh]		Parametrizable 1 up to 30000 Default value - 1 000
Mechanical and electromagnetic environment		M1, E2
Degree of protection		IP53
Tariff control voltage		230 V_{AC}
Terminals - current; voltage; auxiliary [mm]		ø 8 or ø 9,5; ø 3 ; ø 3
Maximum section of connecting current wires [mm^2]		35 or 50
Maximum section of connecting auxiliary wires [mm^2]		6
Dimensions - w x h x d [mm]		177 x 251 x 60
Fixing holes distance *w x h* **[mm]**		150 x 215-230
Control voltage switching tariffs		230 V_{AC}
Weight		≤ 1,23 kg

2.3 Electricity meter case

Electricity meter is placed in an all-plastic case determined for assembly by means of the fixing screws. Ingress protection IP53 is guaranteed only if the electricity meter is fixed by the screws in three fixing points and vertically on a plain and smooth panel. The electricity meter case is completely insulated in the Protection Class II.

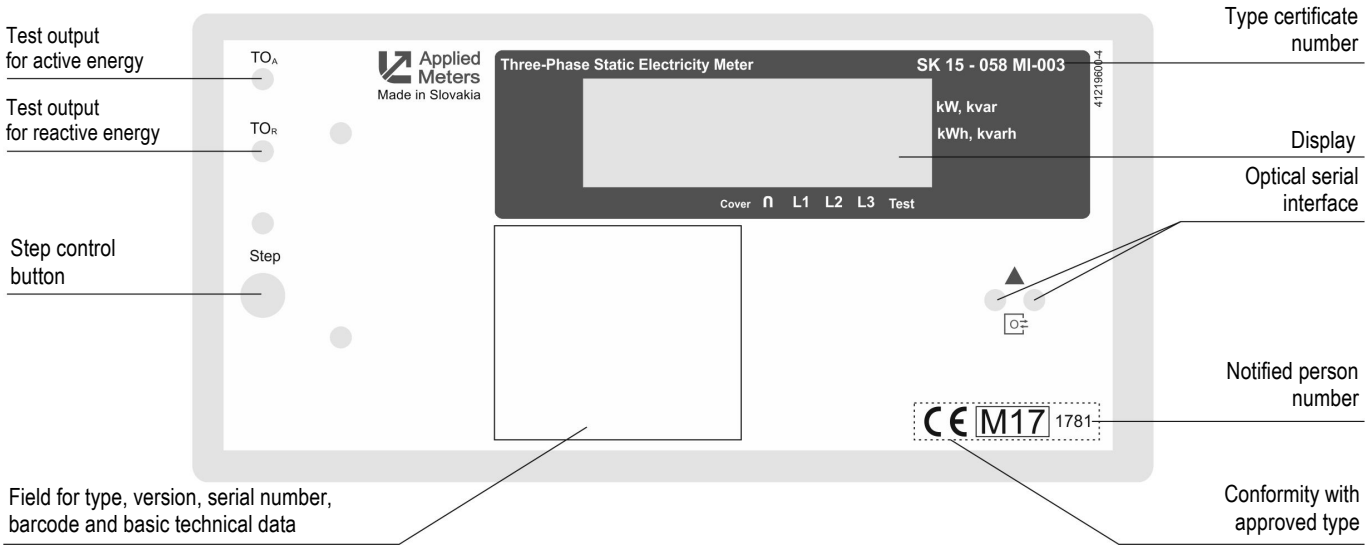
The case consists of base, terminal block, terminal block cover, meter cover and cover insertion. The cover insertion is made of transparent polycarbonate and inserted into the meter cover. The case allows sealing of the electricity meter cover (two points) and the terminal block cover (two points).

3 Functional description

The electricity meter is made on the PCB using SMD technology.

3.1 Data representation on nameplate

Every electricity meter is equipped by a nameplate containing the mandatory data (technical data, type approval number, mark of conformity with MID directive), data required by customer (connecting diagram, customer logo), and it allows an access to some input/output elements (button for display mode control, optical serial interface, testing outputs). The nameplate contain information about the current of the electricity meter in the form: minimum current – reference current (maximum current), e.g. 0.25 - 5 (100) A.



Electricity meter nameplate (example)

3.2 Input/output elements and circuits

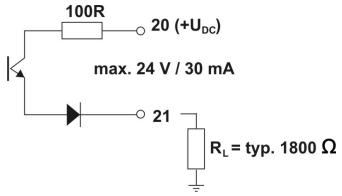
TO_A and TO_R testing outputs

TOA LED – testing output for active energy. LED flashing frequency depends on the testing output constant for active energy kTOA [imp/kWh] and it is proportional to the measured active energy. The electricity meter nameplate contains kTOA value. In the status without load (current is lower than Starting current - at cosφ=1) the LED lits permanently.

TOR LED – testing output for reactive energy. LED flashing frequency depends on the testing output constant for reactive energy kTOR [imp/kvarh] and it is proportional to the measured reactive energy. The electricity meter nameplate contains kTOR value. In the status without load (current is lower than Starting current - at sinφ=1) the LED lits permanently.

SO pulse output

The meter can be equipped with two pulse outputs, which are parametrizable for energy +A (according to active energy measuring mode – corresponds to the energy in the register 1.8.0), -A, +R, -R. Outputs are connected to the terminals 20(+), 21(-) and 22(+), 23(-). They are realized as SO passive output (open collector) requiring connection of the external power source with voltage up to 24 V and load up to max. 30 mA.



Optical serial interface

Optical interface is accessible from the front side of the meter cover. Optical interface represents a standard optic interface for two-way communication according to EN 62056-21, mode C, with communication speed of 300/9600 bauds, i.e. the initiatory speed of 300 baud, the proposed speed 9600 bauds. The proposed speed (implicitly 9 600 Bd) is parameterizable and can take the values (according to EN 62056-21): 300, 600, 1 200, 2 400, 4 800, 9 600, 19 200 bauds. Usage of the optical probe and PC or hand held unit (HHU) allows the electricity meter parametrizing, modification or zeroing of the programmed parameters and the readout of the electricity meter data. Status of communication with PC/HHU is signalised on the display by ⇇ mark. For communication with AMT electricity meters (also with the electricity meters from other producers containing the optical interface according to IEC 62056-21) Applied Meters, a.s. company supplies the optical probes with magnetic head AMOS type with USB interface or RS 232 interface.

RS 485 output

The communication module is an additional equipment designed by an internal PCB with an active communication link RS 485.

Mesh communication module

The communication module is an additional equipment designed by internal Mesh PCB (wireless 868 MHz).

GSM/GPRS communication module

The communication module is an additional equipment designed by internal PCB.

PLC communication module

The communication module is an additional equipment designed by internal PCB.

Communication protocol for interfaces RS 485, Mesh, GPRS and PLC is according to EN 62056-21, mode C, with communication speed of 9 600 / 9 600 bauds, i.e. the initiatory speed of 9 600 bauds, the proposed speed 9600 bauds. The both speeds initiatory and proposed are parameterized and they can take any values (according to EN 62056-21): 300, 600, 1 200, 2 400, 4 800, 9 600, 19 200 bauds.

Output relay

The meter can be equipped with an output relay, corresponding to the tariff (tariff) T1, T2, T3, T4 (programmable with the program AMsoft PFO). If the tariff is active, the contact is closed. Closed contact can be indicated by arrow on LCD.

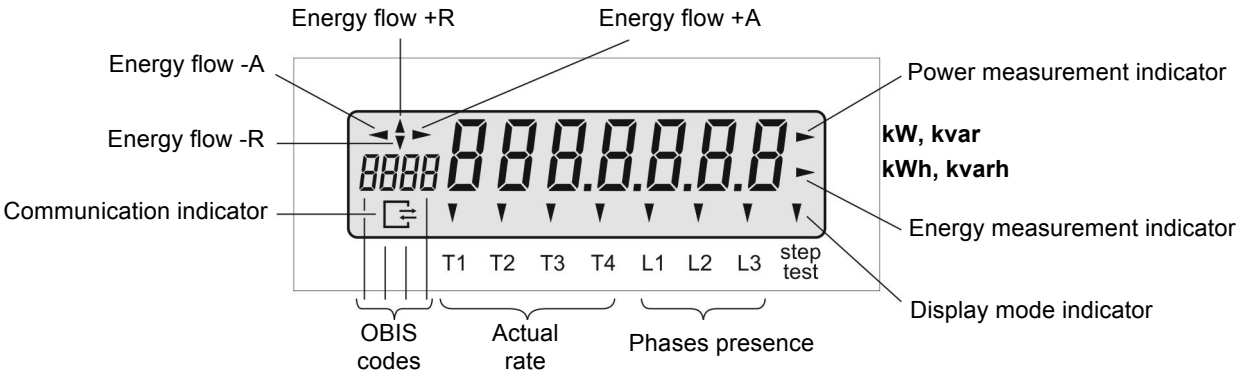
External input of tariff control

The electricity meter can be equipped by the input intended for tariff control by means of an external signal. There is a programmable selection between this tariff control or control by internal clock. External input is connected to the meter terminals (13, 15 as a standard) and the control signal is on the supply voltage level.

Button to control LCD displaying mode

Mechanical button is accessible from the front of the meter through the meter cover and is marked as “step". Duration of the button pressing determines which of the LCD displaying modes will be called (LCD test, cyclic, stepping, testing mode or displaying of historical values).

3.3 Data displaying on LCD



Display description (example)

Data are displayed on LCD containing couple of characters in the following groups:

- measured/calculated values are displayed in the field with 7 digits (dimensions 8 x 4 mm);
- displaying of OBIS codes– the field with 4 digits;
- energy flow direction, energy measurement quadrant, active energy consumption (►), active energy supply or reverse wire connection (◄); reactive energy consumption (▲), reactive energy supply (▼). No load status or the electricity meter status when the meter does not register the energy (current is lower than the electricity meter Starting current) is indicated by permanent and simultaneous light of four arrows for the energy flow direction (◄▲▼►).
- the active tariff (T1 to T4) can be indicated by an arrow.

Indication of the measured energy quadrants on the display is stated in the following table:

Quadrant	Active component	Reactive component
QI	► +A	▲+R
QII	◄ -A	▲+R
QIII	◄ -A	▼-R
QIV	►+A	▼-R

Network voltage presence, phase sequence

Connection to voltage and correct phase sequence are indicated by L1 L2 L3 arrows on LCD. When the phase sequence is not correct, the arrows are scrolling. When the phase voltage is missing, the corresponding arrow is off.

LCD arrows

The electricity meter allows indication of different meter statuses. Each of the 10 parameterizable arrows can be assigned for a function to be displayed. An exception is the Back-up mode (state without voltage). The arrow in the lower right corner is used for its indication, regardless of how it was parameterized (in the picture referred to as "display mode indicator"). Its status is inverted every time the button is pressed.

For each arrow it is possible to set one of the following functions:

Function	Description
Magnet	Indication of magnetic field influence
Terminal Cover	Indication of terminal cover opening
Main Cover	Indication of meter cover opening
T1	Active tariff T1
T2	Active tariff T2
T3	Active tariff T3
T4	Active tariff T4

kWh	Units *kWh*
kW	Units *kW*
kvarh	Units *kvarh*
kvar	Units *kvar*
Hz	Units *Hz*
V	Units *V*
A	Units *A*
kVA	Units *kVA*
kVAh	Units *kVAh*
PowerUnit	Units *kW, kvar, kVA*
EnergyUnit	Units *kWh, kvarh, kVAh*
Bar1	Bargraf Level 1
Bar2	Bargraf Level 2
Bar3	Bargraf Level 3
Bar4	Bargraf Level 4
Bar5	Bargraf Level 5
Bar6	Bargraf Level 6
R1	Indication for Relay 1
Step	Indication of Stepping display mode
Test	Indication of Testing display mode
Battery	Low battery indication
Warning	Indication of tampering (meter cover, terminal cover, magnet)
L1	Indication of L1 voltage presence
L2	Indication of L2 voltage presence
L3	Indication of L3 voltage presence
ON	Switch on indications
Mode	Indication of LCD mode - Step, Test, Back-up, Cyclic

Instantaneous power indication by bargraf

The instantaneous power value can also be indicated by arrows. If the current is below the starting value, the bargraph arrow is not displayed, this status is indicated by all four arrows of energy flow direction (◂▴▾▸). When the current value is higher than the starting current, depending on the value of the instantaneous power, the corresponding arrow bargraph lights up. The power for illuminate the arrow can be parameterized by the manufacturer. Indication of instantaneous power on bargraph is dependent on the measuring mode. In separate measuring mode and Ferraris mode power +P is indicated, in summary measuring mode power +P+|-P| is indicated.

Default set value of total power indicated by bargraph arrows:

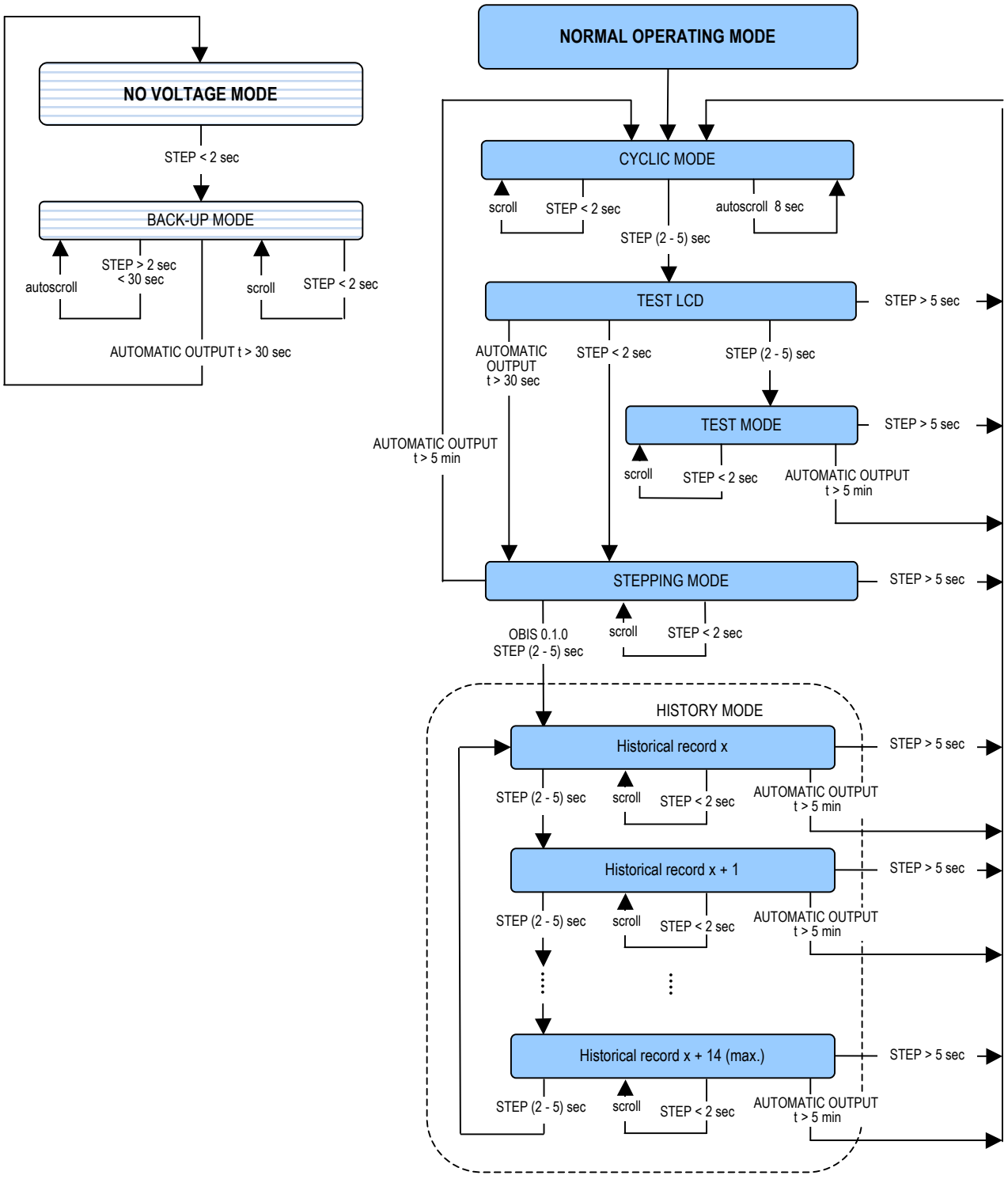
Lit up segment	Power
(lit up vector diagram)	Starting power
Segment 1	24 W
Segment 2	96 W
Segment 3	384 W
Segment 4	1 536 W
Segment 5	6 144 W
Segment 6	24 576 W

LCD backlight

The electricity meter can be equipped by backlit LCD. The backlight is permanently active for 2 minutes after pressing the button.

3.4 Initiation in to the operation and display modes

When the reference voltage is connected to the electricity meter terminals, the LCD automatically enters cyclic mode. The meter design allows visual readout of the data in cyclic, stepping and testing mode at active voltage or in backup mode without load. List of selectable items for displaying on LCD is stated in Art. 3.15. Maximum number of displayed items is 16. In the testing mode only the parameterized energy registers can be displayed.



Cyclic display mode

Displaying in this mode is the electricity meter standard mode intended for displaying of general statuses, measured data and time data. The cyclic mode periodically displays the items, which list is programmed by the producer or authorized person at customer by means of AMsoft PFO software. List of selectable items is stated in Art. 3.15. The display time of an item can be parameterized from 6 sec to 60 sec. Default value is 8 sec.

Data displayed on LCD contains:

- Item OBIS code;
- Item value;
- Indicator of measured variable units (arrow at the data on nameplate: kWh, kvarh, kVAh, kW, kvar, kVA, V, A, Hz);
- Current energy flow direction and quadrant: ◂▴▸, in the upper left corner above OBIS code.

Data stepping can be performed: by pressing the button (< 2 sec). After displaying of the last item, the cycle returns back to the start.

Termination of the mode: by pressing the button (2 - 5 sec) with passing to the LCD test.

When passing to the cyclic mode from any other mode, on LCD appears ***CYCLIC***.

LCD test

It is intended for checking of display faultlessness. During the LCD test all display segments are lit. LCD test mode is activated by pressing the button (2 - 5 sec) during cyclic mode.

LCD test termination:

- by pressing the button (< 2 sec) with passing to the stepping mode;
- by pressing the button (2 - 5 sec) with passing to the testing mode;
- by longer pressing the button (> 5 sec) with passing to the cyclic mode;
- automatically (>30 sec) with passing to the stepping mode.

Stepping display mode

Stepping mode is intended for displaying of data during a visual readout. List of items displayed in this mode is set by the manufacturer or an authorized person by means of AMsoft-PFO software. Maximum displayed items at the mode are 16. List of selectable items is stated in Art. 3.15.

Stepping mode is activated from LCD test mode by pressing the button < 2 sec.

System of data displaying on LCD is the same as in the Cyclic mode (OBIS code, value, indicator of the measuring unit). When passing to the Stepping mode, on LCD appears ***STEP***.

Data stepping can be performed:

- by pressing the button < 2 sec. After displaying of the last item, the cycle returns back to the start.

Termination of stepping display mode:

- by pressing the button 2 – 5 sec at the time when the item 0.1.0 is displayed with passing to the History mode,
- by pressing the button > 5 sec with passing to the Cyclic mode,
- automatically, after > 5 min from the last button pressing, with passing to the Cyclic mode.

History mode (submode of stepping mode)

History mode is intended to data displaying, which are monitored at the visual readout of meter historical records. The mode allows to display the last 15 historical records. List of display data for this mode is programmed by the manufacturer or by an authorized person using the program AMsoft-PFO. This mode is activated, if the item 0.1.0 is selected in stepping mode.

The history mode is call out from Stepping mode by button (2-5 sec) at the time when the item 0.1.0 is displayed.

Data display on the LCD is the same as in Cyclic mode (OBIS code, value, indication of measured quantities units). When going to the History mode, text ***HISTORY*** appears on the LCD.

Data stepping can be performed:

- by pressing the button (< 2 sec) the items of an historical record are scrolled. After displaying of the last item the cycle returns to the start.
- by pressing the button (2 – 5 s) the historical records are scrolled. After displaying of the last item the cycle returns to the start.

Termination of the history mode and passing to the Cyclic mode:

- by pressing the button longer than 5 sec;
- automatically, > 30 min.

Testing display mode

Testing mode is intended for displaying of measured energy with higher precision (3 decimal places) during the electricity meter testing and setting. Only energy registers are displayed.

Data stepping can be performed by pressing the button < 2 sec. The same way as in cyclic or stepping display mode.

Testing display mode can be activated:

- by pressing the button 2 - 5 sec in LCD test mode;
- by sending a direct command via serial interface – for electricity meters equipped with optical serial interface.

When passing to the Testing display mode, the LCD displays text ***TEST*** for a short time. Format of the displaying item (OBIS code, value, indicator of the measuring unit) on the LCD is the same as in the cyclic display mode.

Termination of testing display mode with passing to the cyclic mode:

- by pressing the button > 5 sec,
- automatically, after > 5 min from the last button pressing, with passing to the cyclic mode,
- by sending a direct command via a serial interface.

Back-up display mode

Back-up display mode is intended for data displaying on LCD when no voltage.

List of displaying items in the display mode is programmed by the manufacturer or an authorised person at customer by means of AMsoft PFO software. Maximum number of displayed items in this display mode is 16. List of selectable items is stated in Art. 3.15.

The arrow in the lower right corner is used for indication Back-up mode, regardless of how it was parameterized (in the picture in chapter 3.3 referred to as "display mode indicator"). Its status is inverted every time the button is pressed.

Back-up display mode can be activated by pressing the button < 2 sec.

Format of item displaying (OBIS code, value, indicator of the measuring unit) on the LCD is the same as in the cyclic display mode.

Data stepping can be performed:

- by pressing the button < 2 sec for viewing items one by one;
- by pressing the button 2 sec – 30 sec for displaying of items automatically.

Termination of back-up display mode: automatically after >30 sec from the last button pressing.

If the data are not displayed in Back-up mode after pressing the button, but the arrow in the lower right corner is inverted every time the button is pressed, it means that the meter does not have data. The possible reason is data protection from destruction. Data is not displayed e.g. because of detecting interference at source, or short starting (less than 10 seconds). In this case, the meter is not damaged or defective. This is normal and after connecting to the network for at least 10 seconds the necessary data for Back-up mode are prepared, and they will display at the next failure.

Resistence against permanent pressing of the button

Protection against permanent long press of the button prevents self-activating and interrupting modes.

3.5 Measuring and Displaying

3.5.1 Energy measuring

Measurement of electricity energy is indicated by flashing red LEDs of test outputs TO_A and TO_R. Flashing frequency is proportional to the measured energy. The meter measures active energy in both directions also in phases, reactive energy in both directions and in quadrants and apparent energy in both directions. The measured values are stored in the registers. The smallest energy quanta to be displayed and read are 1 Wh, 1 varh, 1 VAh.

The electricity meter can work with up to 20 energy registers set according to customer's requirements. This registers can by selected from 80 optional energy registers. Energy register setting according to customer's requirements is carried out by the manufacturer.

Total energy registers:

1.8.0 – storage of energy in this register can be done in three ways:

- **In summary mode** (measurement „using a mechanical register") - summation of the energy absolute values in the individual phases irrespective of a direction is stored in one register: $|+A_{L1}|+|+A_{L2}|+|+A_{L3}|+|-A_{L1}|+|-A_{L2}|+|-A_{L3}|$
- **In separate mode** (consumption – supply) - summation of the energy absolute values in the individual phases in direction „consumption" is stored in one register: $|+A_{L1}|+|+A_{L2}|+|+A_{L3}|$
- **In Ferraris mode** (consumption – supply, Ferraris) – when arithmetical sum of the energy values in the individual phases is consumption, energy is recorded to the register 1.8.0: $(A_{L1}+(+A_{L2})+(+A_{L3})+(-A_{L1})+(-A_{L2})+ +(-A_{L3}))>0$,

2.8.0 – total supplied active energy register: $|-A_{L1}|+|-A_{L2}|+|-A_{L3}|$ (for normal summary mode or normal separate mode) or $(A_{L1}+(+A_{L2})+(+A_{L3})+(-A_{L1})+(-A_{L2})+(-A_{L3}))<0$ (for Ferraris mode)

3.8.0, 4.8.0 – reactive energy registers - consumption, supply

5.8.0, 6.8.0, 7.8.0, 8.8.0 - reactive energy registers measured in quadrants

9.8.0, 10.8.0 - apparent energy registers - consumption, supply

21.8.0 – register of consumed energy in phase L1: $|+A_{L1}|$

41.8.0 – register of consumed energy in phase L2: $|+A_{L2}|$

61.8.0 – register of consumed energy in phase L3: $|+A_{L3}|$

22.8.0 – register of supplied energy in phase L1: $|-A_{L1}|$

42.8.0 – register of supplied energy in phase L2: $|-A_{L2}|$

62.8.0 – register of supplied energy in phase L3: $|-A_{L3}|$

Tariff (rate) registers

The AMT B2 electricity meter allows energy measuring in 2 tariffs using external control or in 4 tariffs using internal tariff control (ToU). The meter allows storing of energy into tariff registers for each type of the measured energy.

3.5.2 Displaying of measured energy

User can select from the following formats of the energy displaying:

Formats of energy displaying in the cyclic display mode

Format number	Format	LCD format [kWh]	LCD max. number [kWh]
0	5 + 2	XXXXX.XX	99999.99
1	6 + 1	XXXXXX.X	999999.9
2	6 + 0	XXXXXX	999999
3	7 + 0	XXXXXXX	9999999

Identification code (OBIS) (e.g. OBIS code 1.8.0 is displayed as 180), arrow at measured variable unit stated on the nameplate (e.g. *kWh*) are parts of the displayed value. If a bargraph is selected as arrow function then information about the current consumption power (proportionally energy in the register 1.8.0 – according to measuring mode) is displayed. Other displayed segments describe the actual meter status and they are not directly related to the displayed value.

Format of energy displaying in test mode is: **XXXX.XXX** (4 + 3).

3.5.3 Indication of the measured energy on the Test output

Instantaneous value of the measured active energy is indicated on the impulse output by LED diode. Light pulses generated by the LED are proportional to the instantaneous active (or reactive) energy value. The electricity meter constant is set implicitly to 1 000 pulses/kWh (respectively imp/kvarh), the equivalent of 1000 pulses generated during one hour at constant consumption of 1 kWh (respectively imp/kvarh). The constant is parameterizable (at the manufacturers' level) in a wide range, from 1 pulse/kWh (respectively imp/kvarh) to 30 000 pulses/kWh (respectively imp/kvarh).

3.5.4 Power measurement

Instantaneous powers (registers 1.7.0, 2.7.0, 3.7.0, 4.7.0, 9.7.0 and 10.7.0) are calculated from the consumed energy per 1 sec: power +P (register 1.7.0) –P (register 2.7.0), +Q (register 3.7.0), –Q (register 4.8.0), +S (register 9.7.0), –S (register 10.7.0). Instantaneous power 1.7.0 is not related to the set measurement mode, it is always proportional to the consumed energy per 1 second.

Maximum demand (registers 1.6.0, 1.6.1, 1.6.2, 1.6.3, 1.6.4, 2.6.0, 2.6.1, 2.6.2, 2.6.3, 2.6.4, 3.6.0, 4.6.0, 5.6.0, 6.6.0, 7.6.0, 8.6.0, 9.6.0, 10.6.0) – is the highest value of average demands of the current billing period. Average power (demand) is calculated from total energies per a parameterizable measuring period. When a new average power value is measured, the value is compared with the value recorded in the register. If the new value is higher, the value is recorded to the register. Recording date and time are part of the demand value. The data are available in readout performed by AMsoft-PFO software. Maximum demand (register 1.6.0) is related to the set active energy measuring mode. It is proportional to the energy recorded in register 1.8.0 in summary mode.

Power (both instantaneous and maximum demand) is displayed in format 2+3.

Measuring period

Measuring period of demand is programmable and the following values can be set: 5, 10, 15, 20, 30, 60 min. The measuring period start is defined to 00 min.

Historical maximum demands values (registers 1.6.0.F etc.)

The electricity meter records values of maximum demands of the last 15 months, except for the current maximum. At the end of the current billing period the maximum demand value with the time and date are recorded to the historical registers. After exceeding the maximum number of historical records, the oldest value is deleted.

3.5.5 Load profiles

Three profiles P.01 (so-called load profile), P.021 (so-called network analysis) and P03 (so-called daily) are functional in the electricity meter.

Profile P.01 (load profile)

Channels: 20 channels (registers):

- 20 configured energy registers (marked ER, set up from the list of 80 available registers) - registers x.8.x,
- 10 configured power registers (marked AD, so called “Average demand” – demand per profile period, set up from the list of 10 available registers) - registers 1.5.0 – 10.5.0
- energy increment per a profile period from 20 configured energy registers (set up from the list of 80 available registers) - registers x.29.x.

Registry period: 1, 2, 3, 5, 10, 15, 20, 30, 60 minutes.

Profile P.02 (network analysis)

Channels: 20 channels (registers):

- average values of U1, U2, U3, I1, I2, I3, frequency, power factor per registry period (average value calculated from average values per 1 sec),
- 20 configured energy registers (marked ER, set up from the list of 80 available registers) - registers x.8.x.

Registry period: 1, 2, 3, 5, 10, 15, 20, 30, 60 minutes.

Profile P.03 (daily)

Channels: 20 channels (registers):

- 20 configured energy registers (marked ER, set up from the list of 80 available) - registers x.8.x,
- 10 configured power registers (marked AD, so called “Average demand” – demand per profile period, set up from the list of 10 available registers) - registers 1.5.0 – 10.5.0
- energy increment per a profile period from 20 configured energy registers (set up from the list of 80 available registers) - registers x.29.x.

Registry period: 1, 2, 3, 4, 6, 8, 12, 24 hours.

Profile capacity

P.01		
Number of channels	**Period [min]**	**Number of days**
20	1	5
20	**15**	**81**
20	60	161
10	1	10
10	**15**	**154**
10	60	615
2	1	1257
2	**15**	**1257**
2	60	1257

P.02		
Number of channels	**Period [min]**	**Number of days**
20	**1**	**12**
20	15	181
20	60	723
10	**1**	**21**
10	15	320
10	60	1280
2	**1**	**55**
2	15	832
2	60	3328

P.03		
Number of channels	**Period [h]**	**Number of days**
20	1	99
20	12	1187
20	**24**	**2373**
10	1	189
10	12	2265
10	**24**	**4530**
2	1	692
2	12	8306
2	**24**	**16612**

Header structure:

P.01 (ZYYMMDDHHMMSS)(SK)(RP)(K)(OBIS1)(UNIT1)(OBIS2)(UNIT2)...(OBIS5)(UNIT5)

where: **P.01** ... OBIS code for data profile
Z=1 ... summer time, **Z**=0 ... winter time
YY ... year, **MM**...month, **DD** ... day,
HH ... hours, **MM** ... minutes, **SS** ... seconds
SK ... status code
K ... number of profile items
RP ... registration period length (period of data record)
OBISx ... OBIS code of x-th item (x=1..5)
UNITx ... value unit

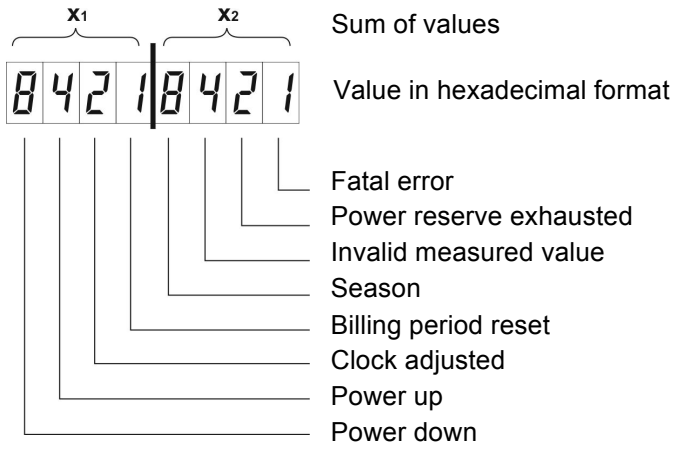
Status code of the data profile

Status code (SK) indicates that during registration period the event occured The list of events that may occur is given below and the status of each event is represented by one bit.

SK final display consists of two characters in v hexadecimal format $\mathbf{x_1x_2}$, where x_1, x_2 = 0...F.

If an event occurs, the corresponding bit is in state **1**. If the event does not occur, the corresponding bit is in state **0**.

Example: *If the SK value is 44, the individual events are in a state of 01000100, i.e.- power supply was connected measured value is invalid (during the registration period were set time).*



Data profile readout example (defined for the registration period: 60 min, registers: A+, A-, P+, P- number of registered items - channels in the readout: 4):

P.01(1160328090000)(44)(60)(04)(1.8.0)(kWh)(2.8.0)(kWh)(1.5.0)(kW)(2.5.0)(kW)
(0000002.968)(0000043.398)(00.000)(00.003)
(0000003.821)(0000046.212)(00.000)(00.000)
P.01(1160328110000)(00)(60)(04)(1.8.0)(kWh)(2.8.0)(kWh)(1.5.0)(kW)(2.5.0)(kW)
(0000004.972)(0000046.212)(01.151)(00.000)
P.01(1160328120000)(44)(60)(04)(1.8.0)(kWh)(2.8.0)(kWh)(1.5.0)(kW)(2.5.0)(kW)
(0000006.056)(0000046.212)(00.001)(00.000)
(0000007.030)(0000046.212)(00.000)(00.000)
(0000008.515)(0000046.687)(00.000)(00.000)
(0000009.154)(0000046.687)(00.000)(00.000)
P.01(1160328160000)(00)(60)(04)(1.8.0)(kWh)(2.8.0)(kWh)(1.5.0)(kW)(2.5.0)(kW)
(0000009.154)(0000046.687)(00.000)(00.000)
P.01(1160329090000)(44)(60)(04)(1.8.0)(kWh)(2.8.0)(kWh)(1.5.0)(kW)(2.5.0)(kW)
(0000009.154)(0000046.687)(00.000)(00.000)
P.01(1160329100000)(00)(60)(04)(1.8.0)(kWh)(2.8.0)(kWh)(1.5.0)(kW)(2.5.0)(kW)
(0000009.154)(0000046.687)(00.000)(00.000)

3.6 Errors and events

Internal error message (register F.F.0)

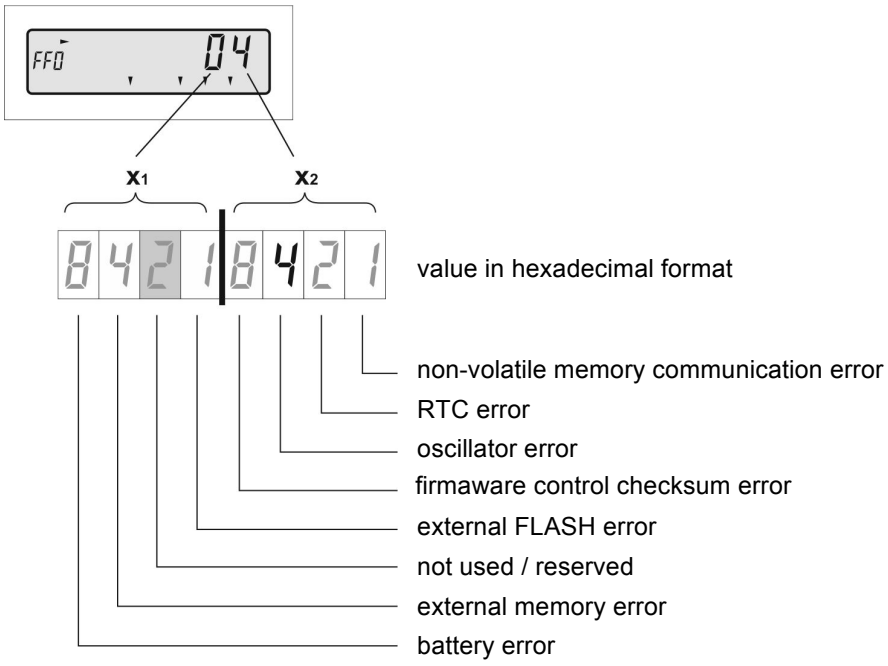
During operation the electricity meter permanently monitors activities of some important circuits and prepares information for user in form of the internal error message. The running of the following circuits is monitored:

- non-volatile memory;
- microprocessor and its peripheries;
- oscillator;
- RTC activity status;
- battery voltage.

In case the status of the monitored circuits is evaluated by the microprocessor as defective (voltage drop, incorrect communication with memory), then that fact is recorded in the modification of the respective status value: **0** – status without failure, **1** – failure status. Internal error message is displayed on LCD in hexadecimal format $\mathbf{x_1x_2}$.

The final error message includes information about several messages at once. When creating an error message, a bit sum operation is applied. For examples, the error message 0x46 is created from the following 3 errors: 0x02, 0x04 a 0x40.

Part of displayed value is identifier OBIS - identification code before the value (F.F.0), without displaying of units. Other displayed segments describe the electricity meter actual status, they are directly unrelated with the displayed value.



Description of error register displaying

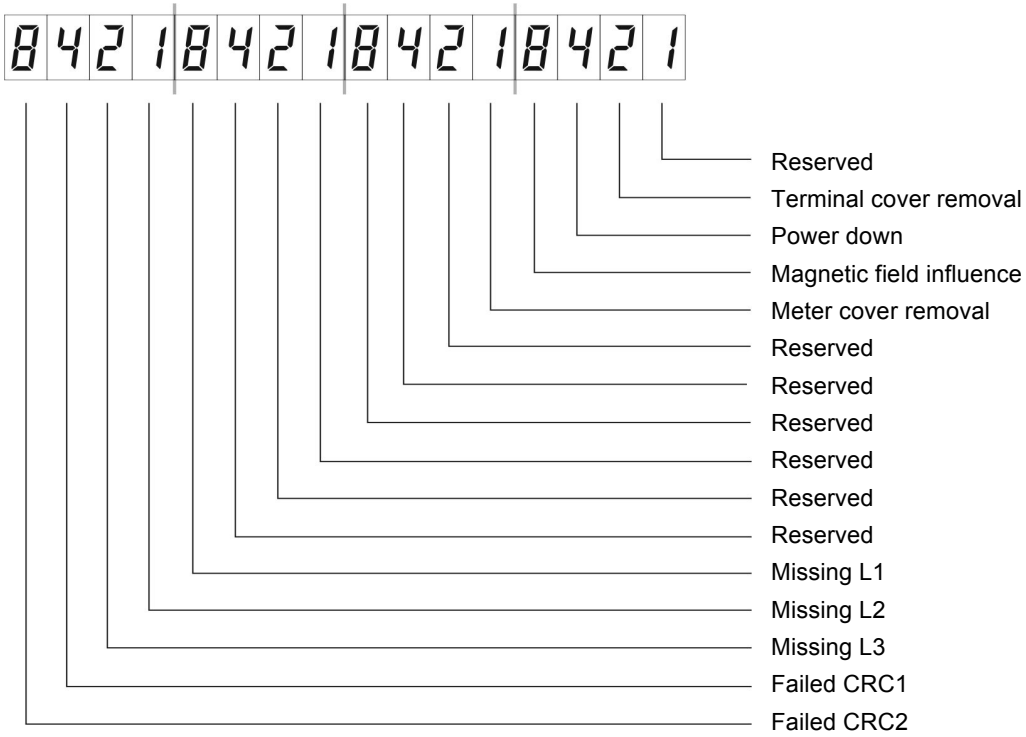
Internal status message (register F.0.1)

The electricity meter can registered in F.0.1 and record the following events:

- power failure of all three phase,
- terminal block cover removal,
- tampering of measurement by magnetic field influence,
- electricity meter cover removal,
- missing voltage in phase L1,
- missing voltage in phase L2,
- missing voltage in phase L3,
- control checksum CRC1 error,
- control checksum CRC2 error.

Event message can have 2 status values: **0** – event did not occur, **1** – event occurred.

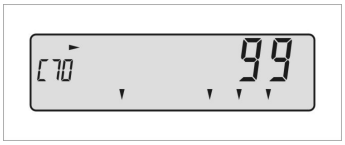
The final internal status message can consists of information about several meter statuses at once. When creating an status message, a bit sum operation is applied. For examples, the error message 0x000A is created from the errors: 0x0002 a 0x0008. Internal status message is displayed on LCD in hexadecimal format $\mathbf{x_1x_2x_3x_4}$:



Description of status register displaying

Number of events (maximum number 99, from 00 to 99) recorded into the registers:

C.7.0 – total number of voltage failures (all phases),
C.7.1 – total number of voltage failures in phase L1,
C.7.2 – total number of voltage failures in phase L2,
C.7.3 – total number of voltage failures in phase L3,
C.C.0 – total number of terminal block cover removals,
C.C.2 – total number of disturbances by magnetic field influence,
C.C.3 – total number of electricity meter cover removals,
C.2.0 – total number of performed parameterizations.



Register C.7.0 displaying

Date of Event occurrence is recorded into the following registers:

C.2.1 – date of the last parameterization,
C.2.9 – date of the last readout
C.3.7 – date of the last terminal block cover removal,
C.3.8 – date of the last meter cover removal,
C.3.9 – date of the last disturbance by magnetic field influence.

3.7 Logbook

Every occurrence of the defined events is recorded by the electricity meter to the event profile (P.98) as an individual record.

- number of records: max.300;
- recording to the memory by the circular recording mode, i.e. when a new value is recorded into a full circular queue, the oldest record is deleted;
- readout is possible via a communication interface;
- readout in one block.

Structure of one record:

- event occurrence date/timestamp;
- event number.

Event types:

Event code (N)	Event type
1	Missing voltage L1
2	Restoration of voltage L1
3	Missing voltage L2
4	Restoration of voltage L2
5	Missing voltage L3
6	Restoration of Voltage L3
7	Power failure in all phases
8	Power restoration of all phases
20	Terminal cover opened
21	Terminal cover closed
22	Meter cover opened
23	Meter cover closed
24	Magnetic field influence on
25	Magnetic field influence off
91	Communication blocked
92	Communication unblocked
99	Changing parameters (Parametrization)

Description of selected types of events

Measurement is tampered by magnetic field influence (event 24)

A short-time (< 10 sec) influence is detected immediately on LCD by the arrow at symbol „Ω”.

The continuous influence of the magnetic field during at least 10 seconds (adjustable from 10 to 90 seconds) is recorded to the event profile (Logbook) and to the internal status message F.0.1. Simultaneously the counter of the total tamperings by the magnetic field influence (C.C.2) is incremented. Date and time record of the tampering occurence is created (register C.3.9). The arrow lights permanently even when the magnetic field influence ended. The indication and detection in the internal status event message F.0.1 can be cancelled only by an external message via an optical interface.

Electricity meter cover removal (event 22)

Meter tampering caused by meter cover removal is signalized by the arrow on the display at symbol „Cover“. The event is detected in the internal status message F.0.1 and recorded to the event profile when it lasts continuously at least 2 seconds. It also increments the counter of the meter cover removal C.C.3. Date and time record of the influence occurrence is created (register C.3.8) and the arrow lights permanently even when the meter cover is closed – the influence ended. The indication and detection in the internal status event message F.0.1 can be cancelled only by an external message via an optical interface.

Terminal block cover removal (event 20)

Meter tampering caused by terminal block cover removal is signalized by the arrow on the LCD at symbol „Tcover“. The event is detected in internal status message F.0.1 and recorded to the event profile when it lasts continuously at least 7 seconds. It also increments the counter of the terminal block cover removal C.C.0. Date and time record of the influence occurrence is created (register C.3.7) and the arrow lights permanently even when the terminal cover is closed – the influence ended. The indication and detection in the internal status event message F.0.1 can be cancelled only by an external message via an optical interface.

Missing voltage phases L1, L2, L3 (events 1, 3 and 5)

The presence of the individual phases is indicated on the LCD by lighting the relevant arrows at L1, L2 and L3. If there is no voltage in any phase the relevant arrow on LCD (at L1, L2 or L3) does not light up. The event is recorded to the event profile when it lasts continuously at least 5 seconds.

Events profile readout

Record readout can be performed by means of the optical probe, RS485 interface and AMsoft PFO communication program.

Record structure:

P.98 (ZYYMMDDHHMMSS)(SR)()(K)(OBIS)()(N)

where: **P.98**...OBIS code of Event profile
Z=1...summer time, **Z**=0..winter time
YY...year, **MM**...month, **DD**...day
HH...hours, **MM**...minutes, **SS**...seconds
SR means status register
K means number of items
OBIS means OBIS code of the item
N...Event code

Readout example:

P.98 (0110302070513)(00)()(1)(201.152.0)()(8)
P.98 (0110301150651)(00)()(1)(201.152.0)()(7)
P.98 (0110301072542)(00)()(1)(201.152.0)()(22)
P.98 (0110301072330)(00)()(1)(201.152.0)()(23)
P.98 (0110301071524)(00)()(1)(201.152.0)()(5)
P.98 (0110301071524)(00)()(1)(201.152.0)()(1)

3.8 Time synchronization

Synchronization is performed on basis of received time setiing command via a communication interface. If the time difference between the current time of electricity meter and the new time received via the communication interface is higher than 1 sec, the synchronization occurs as follows:

- If the time difference is **smaller than 1 sec** - *no reaction*.
- If the time difference is between **1 sec and 9 sec** - *time shift by the time difference*.
- If the time difference is between **9 sec and 30 sec** - *time shift by 9 sec*.
- If we want to set the time, it is needed to repeat the commands for synchronization. Resyncing can be blocked for a period of 1 min up to 1 440 min (1 day).
  Example: *If the time difference is 25 sec, the exact time is achieved by repeated synchronization 9 sec + 9 sec + 7 sec.*
- If the time difference is **higher than 30 sec** - *new time setting*.

Note: *The synchronization does not affect the time meter operations (demand, data profiles), but time setting affects this operations.*

The program AMsoft allows:

- To enable or disable the synchronization feature.
- Not to block reapeating of the enabled synchronization or to block for a defined number of minutes (from 1 up to 1 440 min).

3.9 Time display

Real time function is provided by the real time circuit (RTC) providing the actual date, time and day of week. Those parameters can be set up or modified by means of optical probe and AMsoft-PFO program. Hundred years' calendar is programmed in RTC circuit. After date setup the day of week is set automatically according to that calendar. RTC circuit accuracy is within the range of ± 15 sec / month.

In the case of phase voltage failure the RTC circuit is supplied from the backup lithium battery (3V, 10 years lifetime).

Note: *Date (092) is displayed in YY.MM.DD format, time (091) is displayed in HH:mm:ss format.*

Summer time (Daylight Saving time)

The electricity meter's time shift is set according to European Union standards.

Summer time starts on the last March Sunday. That day the real time clock is shifted from 02.00 a.m. to 03.00 a.m. Summer time ends on the last October Sunday. That day the real time clock is shifted from back from 03.00 a.m. to 02.00 a.m. Time shift can be enabled or prohibited.

3.10 Data archiving

Processor stores all measured data in non-destructive memory. Data recording is performed automatically each 60 minutes and at every voltage failure.

3.11 Serial number (register C.1.0)

Serial number is set up by manufacturer at the electricity meter setting.

3.12 Electricity meter password

The electricity meter password P1 is 8-characters alphanumeric combination with starting value of 00000000. The password is required by the electricity meter in AMsoft PFO parametrizing program of each access level, at modification of any parameter or at zeroing of the allowed registers.

3.13 Parameterization of the electricity meters

Manufacturer´s software AMsoft PFO allows (except readout, switching to the testing mode and deleting error registers on level 5) at some access levels to perform commands or change some meter parameters. Access levels and list of parameters and commands that can be set, changed or implemented are stated in the table below:

Conditions for access level setting

	Password P1	***Password P2***	***Terminal block cover***	***Switch under the seal***
Level 0	Not used	Not used	Closed	Unactivated
Level 1	Requested	Not used	Closed	Unactivated
Level 2	Requested	Requested	Closed	Unactivated
Level 3	Not requested	Requested	Opened	Unactivated

Object access rights

Value	***Right***
0	No right
1	Only reading
2	Staring
3	Reading and writing

List of objects with their range and access rights according to access level

Name of the object	***Range of values***	***Access level***			
		0	**1**	**2**	**3**
Firmware version	000.00...999.99	1	1	1	1
Firmware checksum	0000 -FFFF	1	1	1	1
Error register	00..0xFF	1	1	1	3
Status register	0x0000..0xFFFF	1	1	1	1
Operational register	0x0000..0xFFFF	0	1	1	1
Total power fails	00000000 - 99999999	1	1	1	1
power fails L1	00000000 - 99999999	1	1	1	1
power fails L2	00000000 - 99999999	1	1	1	1
power fails L3	00000000 - 99999999	1	1	1	1
Date of last Terminal Cover tampering	All allowed settings of date and time	1	1	1	1
Date of last Mag. Field tampering	All allowed settings of date and time	1	1	1	1
Date of last Main Cover tampering	All allowed settings of date and time	1	1	1	1
Terminal cover tampering	00 - 99	1	1	1	1
Magnetic field tampering	00 - 99	1	1	1	1
Meter cover tampering	00 - 99	1	1	1	1
Maximum Demand Reg 1	00.000...99.999 & All allowed settings of date and time	1	1	1	1
Maximum Demand Reg 2	00.000...99.999 & All allowed settings of date and time	1	1	1	1
Maximum Demand Reg 3	00.000...99.999 & All allowed settings of date and time	1	1	1	1
Maximum Demand Reg 4	00.000...99.999 & All allowed settings of date and time	1	1	1	1
Maximum Demand Reg 5	00.000...99.999 & All allowed settings of date and time	1	1	1	1
Maximum Demand Reg 6	00.000...99.999 & All allowed settings of date and time	1	1	1	1
Maximum Demand Reg 7	00.000...99.999 & All allowed settings of date and time	1	1	1	1
Maximum Demand Reg 8	00.000...99.999 & All allowed settings of date and time	1	1	1	1
Maximum Demand Reg 9	00.000...99.999 & All allowed settings of date and time	1	1	1	1
Maximum Demand Reg 10	00.000...99.999 & All allowed settings of date and time	1	1	1	1
Clock status register	00..0xFF	1	1	1	1
Date and time	All allowed settings of date and time	1	1	3	3
Actual Date	All allowed settings of date	1	1	1	1
Actual Time	All allowed settings of time	1	1	1	1
Day of week	01 - 07	1	1	1	1
Current - instantaneous value	000.00...655.35	1	1	1	1
Current - instantaneous value	000.00...655.35	1	1	1	1
Current - instantaneous value	000.00...655.35	1	1	1	1
Voltage - instantaneous value	000.00...655.35	1	1	1	1
Voltage - instantaneous value	000.00...655.35	1	1	1	1
Voltage - instantaneous value	000.00...655.35	1	1	1	1
Frequency - instantaneous value	00.0…127.5	1	1	1	1
Power factor - instantaneous value	0.00...1.00	1	1	1	1
Active Power - Import	00.000...99.999	1	1	1	1
Active Power - Export	00.000...99.999	1	1	1	1
Active power - import L1	00.000…65.535	1	1	1	1
Active power - import L2	00.000…65.535	1	1	1	1
Active power - import L3	00.000…65.535	1	1	1	1
Active power - export L1	00.000…65.535	1	1	1	1
Active power - export L2	00.000…65.535	1	1	1	1
Active power - export L3	00.000…65.535	1	1	1	1
Reactive Power - Import	00.000...99.999	1	1	1	1
Reactive Power - Export	00.000...99.999	1	1	1	1
Reactive power - import L1	00.000…65.535	1	1	1	1

Reactive power - import L2	00.000…65.535	1	1	1	1
Reactive power - import L3	00.000…65.535	1	1	1	1
Reactive power - export L1	00.000…65.535	1	1	1	1
Reactive power - export L2	00.000…65.535	1	1	1	1
Reactive power - export L3	00.000…65.535	1	1	1	1
Apparent Power - Import	00.000...99.999	1	1	1	1
Apparent Power - Export	00.000...99.999	1	1	1	1
Apparent Power - import L1	00.000…65.535	1	1	1	1
Apparent Power - import L2	00.000…65.535	1	1	1	1
Apparent Power - import L3	00.000…65.535	1	1	1	1
Apparent Power - export L1	00.000…65.535	1	1	1	1
Apparent Power - export L2	00.000…65.535	1	1	1	1
Apparent Power - export L3	00.000…65.535	1	1	1	1
Energy Reg 1	00000000.000...99999999.999	1	1	1	1
Energy Reg 2	00000000.000...99999999.999	1	1	1	1
Energy Reg 3	00000000.000...99999999.999	1	1	1	1
Energy Reg 4	00000000.000...99999999.999	1	1	1	1
Energy Reg 5	00000000.000...99999999.999	1	1	1	1
Energy Reg 6	00000000.000...99999999.999	1	1	1	1
Energy Reg 7	00000000.000...99999999.999	1	1	1	1
Energy Reg 8	00000000.000...99999999.999	1	1	1	1
Energy Reg 9	00000000.000...99999999.999	1	1	1	1
Energy Reg 10	00000000.000...99999999.999	1	1	1	1
Energy Reg 11	00000000.000...99999999.999	1	1	1	1
Energy Reg 12	00000000.000...99999999.999	1	1	1	1
Energy Reg 13	00000000.000...99999999.999	1	1	1	1
Energy Reg 14	00000000.000...99999999.999	1	1	1	1
Energy Reg 15	00000000.000...99999999.999	1	1	1	1
Energy Reg 16	00000000.000...99999999.999	1	1	1	1
Energy Reg 17	00000000.000...99999999.999	1	1	1	1
Energy Reg 18	00000000.000...99999999.999	1	1	1	1
Energy Reg 19	00000000.000...99999999.999	1	1	1	1
Energy Reg 20	00000000.000...99999999.999	1	1	1	1
Billing period reset (BPR)		0	0	2	2
Reset Status register		0	2	2	2
Test mode enable		0	2	2	2
Cyclic mode enable		0	2	2	2
Delete events		0	2	2	2
Read parameters		0	1	1	1
Read logbook	(;)	0	1	1	1
Manufact. number	00000000...99999999	1	1	1	1
Meter constant	1 .. 32767	1	1	1	1
Energy registers configuration	0x00 .. 0x4F	0	1	1	1
Maximum demand registers configuration	0x00 .. 0x11	0	1	1	1
Bargraph - segment1	0..65536	0	1	1	1
Bargraph - segment2	0..65536	0	1	1	1
Bargraph - segment3	0..65536	0	1	1	1
Bargraph - segment4	0..65536	0	1	1	1
Bargraph - segment5	0..65536	0	1	1	1
Bargraph - segment6	0..65536	0	1	1	1
Measurement mode	0x00 / 0x01 / 0x02	0	1	1	1
Programing mode timeout	5..255	0	1	1	1

LCD segments configuration		0	1	1	3
IEC device address	00000000...99999999	0	1	1	3
TOU table name	0..9,A..Z,a..z,-,_,SPASE	0	1	3	3
Password elm P1 (nekod.)	0..9,A..Z,a..z,-,_,SPACE	0	3	3	3
SO Divider	0, 1, 2, 4, 5, 10	0	1	1	3
DST enable/disable	0..1	0	1	3	3
Proposed baudrate opto	0..6	0	3	3	3
Start baudrate RS485	0..6	0	3	3	3
Proposed baudrate RS485	0..6	0	3	3	3
Readout list		0	1	3	3
Count of billing item - RS485	01..15	0	1	1	3
Count of billing item - opto	01..15	0	1	1	3
External tarif control	0..1	0	1	3	3
Format of LCD	0..8	0	1	1	3
Display list - cyclic mode		0	1	3	3
Display list - step mode		0	1	3	3
Display list - Back-up mode		0	1	3	3
Display time - cyclic mode	0..255	0	1	3	3
Magnet action duration	0..255	0	1	3	3
SO Mode	0..FFFF	0	1	1	3
MaxD Measure period	5, 10, 15, 20, 30, 60	1	1	3	3
Day of BPR	1-28, 29- last day of month	0	1	1	1
Manufacturer ID5	0..9,A..Z,a..z,-,_,SPACE	0	1	1	1
Manufacturer ID6	0..9,A..Z,a..z,-,_,SPACE	0	1	1	1
Manufacturer ID7	0..9,A..Z,a..z,-,_,SPACE	0	1	1	1
Manufacturer ID8	0..9,A..Z,a..z,-,_,SPACE	0	1	1	1
Manufacturer ID9	0..9,A..Z,a..z,-,_,SPACE	0	1	1	1
Identication number	0..9,A..Z,a..z,-,_,SPACE	1	1	1	1
Custormer ID5	0..9,A..Z,a..z,-,_,SPACE	0	1	3	3
Custormer ID6	0..9,A..Z,a..z,-,_,SPACE	0	1	3	3
Custormer ID7	0..9,A..Z,a..z,-,_,SPACE	0	1	3	3
Custormer ID8	0..9,A..Z,a..z,-,_,SPACE	0	1	3	3
Custormer ID9	0..9,A..Z,a..z,-,_,SPACE	0	1	3	3
TOU Day profil 1		0	1	1	3
TOU Day profil 2		0	1	1	3
TOU Day profil 3		0	1	1	3
TOU Day profil 4		0	1	1	3
TOU Day profil 5		0	1	1	3
TOU Day profil 6		0	1	1	3
TOU Day profil 7		0	1	1	3
TOU Day profil 8		0	1	1	3
TOU Special Days 1		0	1	1	3
TOU Special Days 2		0	1	1	3
TOU Special Days 3		0	1	1	3
TOU Special Days 4		0	1	1	3
TOU Special Days 5		0	1	1	3
TOU Week profil 1	PoUtStŠtPiSoNe, 01 - day profil1,02 -day profil2, ...	0	1	1	3
TOU Week profil 2	PoUtStŠtPiSoNe, 01 - day profil1,02 -day profil2, ...	0	1	1	3
TOU Week profil 3	PoUtStŠtPiSoNe, 01 - day profil1,02 -day profil2, ...	0	1	1	3
TOU Week profil 4	PoUtStŠtPiSoNe, 01 - day profil1,02 -day profil2, ...	0	1	1	3
TOU Week profil 5	PoUtStŠtPiSoNe, 01 - day profil1,02 -day profil2, ...	0	1	1	3
TOU Season profil 1		0	1	1	3
Software para version	0..9,A..Z,a..z,-,_,SPACE	1	1	1	1

Billing period counter	00 - 99	1	1	1	1
Date and time BPR	RRMMDDhhmm	1	1	1	1
Number of realized parametrizations	0 -99	1	1	1	1
Date of last parametrization	All allowed settings of date and time	1	1	1	1
Date of last reading	All allowed settings of date and time	1	1	1	1
Date of unauthorized access	All allowed settings of date and time	1	1	1	1

3.14 Starting-up and operation

The electricity meter is connected to the measured network according to the external connection diagram (see connection diagram). After connecting to a network LCD automatically passes to the cyclic display mode and the electricity network actual status is indicated by signaling elements.

3.15 Marking of the electricity meter registers (OBIS codes)

The electricity meter stores data into its memory to the special registers. LCD allows displaying of of selected registers in the cyclic mode. Content of the registers can be read in the electricity meter readout. Readout items sequence and display format are fixed and they can not be changed.

Energy register (for measurement it is possible to select 20 energy registers from 80 available)

Registers (OBIS ID)	Name of register
1.8.0	Active energy +A, (for separate or Ferraris mode) or |+A|+|-A| (for summary mode), total
1.8.1	Active energy +A, (for separate or Ferraris mode) or |+A|+|-A| (for summary mode), total, tariff 1
1.8.2	Active energy +A, (for separate or Ferraris mode) or |+A|+|-A| (for summary mode), total, tariff 2
1.8.3	Active energy +A, (for separate or Ferraris mode) or |+A|+|-A| (for summary mode), total, tariff 3
1.8.4	Active energy +A, (for separate or Ferraris mode) or |+A|+|-A| (for summary mode), total, tariff 4
2.8.0	Active energy -A, total
2.8.1	Active energy -A, total, tariff 1
2.8.2	Active energy -A, total, tariff 2
2.8.3	Active energy -A, total, tariff 3
2.8.4	Active energy -A, total, tariff 4
3.8.0	Reactive energy +R, total
3.8.1	Reactive energy +R, total, tariff 1
3.8.2	Reactive energy +R, total, tariff 2
3.8.3	Reactive energy +R, total, tariff 3
3.8.4	Reactive energy +R, total, tariff 4
4.8.0	Reactive energy -R, total
4.8.1	Reactive energy -R, total, tariff 1
4.8.2	Reactive energy -R, total, tariff 2
4.8.3	Reactive energy -R, total, tariff 3
4.8.4	Reactive energy -R, total, tariff 4
5.8.0	Reactive energy +Ri (QI -1. quadrant), total
5.8.1	Reactive energy +Ri (QI -1. quadrant), total, tariff 1
5.8.2	Reactive energy +Ri (QI -1. quadrant), total, tariff 2
5.8.3	Reactive energy +Ri (QI -1. quadrant), total, tariff 3
5.8.4	Reactive energy +Ri (QI -1. quadrant), total, tariff 4
6.8.0	Reactive energy +Rc (QII -2. quadrant), total
6.8.1	Reactive energy +Rc (QII -2. quadrant), total, tariff 1
6.8.2	Reactive energy +Rc (QII -2. quadrant), total, tariff 2
6.8.3	Reactive energy +Rc (QII -2. quadrant), total, tariff 3
6.8.4	Reactive energy +Rc (QII -2. quadrant), total, tariff 4

7.8.0	Reactive energy -Ri (QIII -3. quadrant), total
7.8.1	Reactive energy -Ri (QIII -3. quadrant), total, tariff 1
7.8.2	Reactive energy -Ri (QIII -3. quadrant), total, tariff 2
7.8.3	Reactive energy -Ri (QIII -3. quadrant), total, tariff 3
7.8.4	Reactive energy -Ri (QIII -3. quadrant), total, tariff 4
8.8.0	Reactive energy -Rc (QIV -4. quadrant), total
8.8.1	Reactive energy -Rc (QIV -4. quadrant), total, tariff 1
8.8.2	Reactive energy -Rc (QIV -4. quadrant), total, tariff 2
8.8.3	Reactive energy -Rc (QIV -4. quadrant), total, tariff 3
8.8.4	Reactive energy -Rc (QIV -4. quadrant), total, tariff 4
9.8.0	Apparent energy +S, total
9.8.1	Apparent energy +S, total, tariff 1
9.8.2	Apparent energy +S, total, tariff 2
9.8.3	Apparent energy +S, total, tariff 3
9.8.4	Apparent energy +S, total, tariff 4
10.8.0	Apparent energy -S, total
10.8.1	Apparent energy -S, total, tariff 1
10.8.2	Apparent energy -S, total, tariff 2
10.8.3	Apparent energy -S, total, tariff 3
10.8.4	Apparent energy -S, total, tariff 4
21.8.0	Active energy +A, phase L1
21.8.1	Active energy +A, phase L1, tariff 1
21.8.2	Active energy +A, phase L1, tariff 2
21.8.3	Active energy +A, phase L1, tariff 3
21.8.4	Active energy +A, phase L1, tariff 4
41.8.0	Active energy +A, phase L2
41.8.1	Active energy +A, phase L2, tariff 1
41.8.2	Active energy +A, phase L2, tariff 2
41.8.3	Active energy +A, phase L2, tariff 3
41.8.4	Active energy +A, phase L2, tariff 4
61.8.0	Active energy +A, phase L3
61.8.1	Active energy +A, phase L3, tariff 1
61.8.2	Active energy +A, phase L3, tariff 2
61.8.3	Active energy +A, phase L3, tariff 3
61.8.4	Active energy +A, phase L3, tariff 4
22.8.0	Active energy -A, phase L1
22.8.1	Active energy -A, phase L1, tariff 1
22.8.2	Active energy -A, phase L1, tariff 2
22.8.3	Active energy -A, phase L1, tariff 3
22.8.4	Active energy -A, phase L1, tariff 4
42.8.0	Active energy -A, phase L2
42.8.1	Active energy -A, phase L2, tariff 1
42.8.2	Active energy -A, phase L2, tariff 2
42.8.3	Active energy -A, phase L2, tariff 3
42.8.4	Active energy -A, phase L2, tariff 4
62.8.0	Active energy -A, phase L3
62.8.1	Active energy -A, phase L3, tariff 1
62.8.2	Active energy -A, phase L3, tariff 2
62.8.3	Active energy -A, phase L3, tariff 3
62.8.4	Active energy -A, phase L3, tariff 4

Maximum demand registers (for measurement it is possible to select 10 MD registers from 18 available)

Registers (OBIS ID)	Name of register
1.6.0	Maximum demand +P (for separate or Ferraris mode) or |+P|+|-P| (for summary mode), total
1.6.1	Maximum demand +P (for separate or Ferraris mode) or |+P|+|-P| (for summary mode), total, tariff 1
1.6.2	Maximum demand +P (for separate or Ferraris mode) or |+P|+|-P| (for summary mode), total, tariff 2
1.6.3	Maximum demand +P (for separate or Ferraris mode) or |+P|+|-P| (for summary mode), total, tariff 3
1.6.4	Maximum demand +P (for separate or Ferraris mode) or |+P|+|-P| (for summary mode), total, tariff 4
2.6.0	Maximum demand –P, total
2.6.1	Maximum demand -P, total, tariff 1
2.6.2	Maximum demand -P, total, tariff 2
2.6.3	Maximum demand -P, total, tariff 3
2.6.4	Maximum demand -P, total, tariff 4
3.6.0	Maximum demand +Q, total
4.6.0	Maximum demand -Q, total
5.6.0	Maximum demand +Qi (QI), total
6.6.0	Maximum demand +Qc (QII), total
7.6.0	Maximum demand -Qi (QIII), total
8.6.0	Maximum demand -Qc (QIV), total
9.6.0	Maximum demand +S, total
10.6.0	Maximum demand -S, total

List of registers possible to be displayed on LCD (energy registers C.8.E and maximum demand registers C.6.E are marked by OBIS ID according to the selected register – stated in the tables above)

Registers (OBIS ID)	Name of register
C.1.0	Electricity meter serial number
0.2.0	Firmware version
F.F.0	Internal error message
F.0.1	Internal status message
0.9.1	Actual time
0.9.2	Actual date
0.9.5	Week day
0.2.2	Name of ToU table
C.8.E	1st energy register according to the configuration
C.8.E	2nd energy register according to the configuration
C.8.E	3rd energy register according to the configuration
C.8.E	4th energy register according to the configuration
C.8.E	5th energy register according to the configuration
C.8.E	6th energy register according to the configuration
C.8.E	7th energy register according to the configuration
C.8.E	8th energy register according to the configuration
C.8.E	9th energy register according to the configuration
C.8.E	10th energy register according to the configuration
C.8.E	11th energy register according to the configuration
C.8.E	12th energy register according to the configuration
C.8.E	13th energy register according to the configuration
C.8.E	14th energy register according to the configuration
C.8.E	15th energy register according to the configuration
C.8.E	16th energy register according to the configuration
C.8.E	17th energy register according to the configuration
C.8.E	18th energy register according to the configuration
C.8.E	19th energy register according to the configuration

C.8.E	20th energy register according to the configuration
C.6.E	1st maximum demand register according to the configuration
C.6.E	2nd maximum demand register according to the configuration
C.6.E	3rd maximum demand register according to the configuration
C.6.E	4th maximum demand register according to the configuration
C.6.E	5th maximum demand register according to the configuration
C.6.E	6th maximum demand register according to the configuration
C.6.E	7th maximum demand register according to the configuration
C.6.E	8th maximum demand register according to the configuration
C.6.E	9th maximum demand register according to the configuration
C.6.E	10th maximum demand register according to the configuration
1.7.0	Instantaneous power P+
2.7.0	Instantaneous power P-
3.7.0	Instantaneous power +Q
4.7.0	Instantaneous power -Q
9.7.0	Instantaneous power +S
10.7.0	Instantaneous power +S
32	Instantaneous voltage L1
52	Instantaneous voltage L2
72	Instantaneous voltage L3
31	Instantaneous current L1
51	Instantaneous current L2
71	Instantaneous current L3
13	Power factor
14	Frequency
0.8.0	Average power period
C.7.0	Total number of phase voltage failures
C.7.1	Total number of phase L1 voltage failures
C.7.2	Total number of phase L2 voltage failures
C.7.3	Total number of phase L3 voltage failures
C.C.0	Total number of terminal cover openings
C.C.2	Total number of tampering by magnetic field influence
C.C.3	Total number of meter cover openings
C.50.1	Firmware checksum
0.1.0	Total number of historical records

List of readout items – readout (energy registers C.8.E and maximum demand registers C.6.E are marked by OBIS ID according to the selected register – stated in the tables above)

Registers (OBIS ID)	Name of register
C.1.0	Electricity meter serial number
C.1.1	Electricity meter IEC address
0.2.0	Firmware version
0.3.0	Electricity meter constant
0.2.1	Software version
F.F.0	Internal error message
F.0.1	Internal status message
0.9.1	Actual time
0.9.2	Actual date
0.9.5	Week day
C.10.1	Clock status register
0.2.2	Name of ToU table

C.8.E	1st energy register according to the configuration
C.8.E	2nd energy register according to the configuration
C.8.E	3rd energy register according to the configuration
C.8.E	4th energy register according to the configuration
C.8.E	5th energy register according to the configuration
C.8.E	6th energy register according to the configuration
C.8.E	7th energy register according to the configuration
C.8.E	8th energy register according to the configuration
C.8.E	9th energy register according to the configuration
C.8.E	10th energy register according to the configuration
C.8.E	11th energy register according to the configuration
C.8.E	12th energy register according to the configuration
C.8.E	13th energy register according to the configuration
C.8.E	14th energy register according to the configuration
C.8.E	15th energy register according to the configuration
C.8.E	16th energy register according to the configuration
C.8.E	17th energy register according to the configuration
C.8.E	18th energy register according to the configuration
C.8.E	19th energy register according to the configuration
C.8.E	20th energy register according to the configuration
C.6.E	1st maximum demand register according to the configuration
C.6.E	2nd maximum demand register according to the configuration
C.6.E	3rd maximum demand register according to the configuration
C.6.E	4th maximum demand register according to the configuration
C.6.E	5th maximum demand register according to the configuration
C.6.E	6th maximum demand register according to the configuration
C.6.E	7th maximum demand register according to the configuration
C.6.E	8th maximum demand register according to the configuration
C.6.E	9th maximum demand register according to the configuration
C.6.E	10th maximum demand register according to the configuration
0.1.0	Total number of readout with zeroing
0.1.2 N	Date of readout with zeroing
x.8.x N	Historical energy registers
x.6.x N	Historical maximum demand registers
32 N	Historical registers - voltage L1
52 N	Historical registers - voltage L2
72 N	Historical registers - voltage L3
31 N	Historical registers - current L1
51 N	Historical registers - current L2
71 N	Historical registers - current L3
1.7.0	Power P+
2.7.0	Power P-
3.7.0	Power +Q
4.7.0	Power -Q
9.7.0	Power +S
10.7.0	Power +S
32	Voltage L1
52	Voltage L2
72	Voltage L3
31	Current L1
51	Current L2
71	Current L3

13	Power factor
14	Frequency
0.8.0	Demand period
C.7.0	Total number of phase voltage failures
C.7.1	Total number of phase L1 voltage failures
C.7.2	Total number of phase L2 voltage failures
C.7.3	Total number of phase L3 voltage failures
C.C.0	Total number of terminal cover openings
C.C.2	Total number of tamperings by magnetic field influence
C.C.3	Total number of meter cover openings
C.2.0	Number of parametrization sessions
C.50.1	Firmware checksum
C.2.1	Date and time of last parametrization
C.50.2	Date and time of last unauthorized access
C.2.9	Date and time of last readout
C.3.9	Date and time of last magnetic field influence
C.3.8	Date and time of last meter cover opening
C.3.7	Date and time of last terminal cover opening

4 Assembly, operation and maintenance

The electricity meter is intended for internal assembly. The meter is connected by using 3 screws in the fixing openings. Protection of the meter complies with IP 53 on condition that it is fixed in three points on vertical position on direct and smooth panel and the terminal cover is duly tightened.

The electricity meter is connected in accordance with the connection diagram given in the internal part of the terminal cover. Connection of the meter to the distribution network may be performed only by persons with corresponding qualification. After connection to the network, the LCD automatically starts in the cyclic mode.

Simultaneously it is necessary to verify normal function:

- Connection to voltage is indicated by lighting of the LCD. Corresponding phase connection is indicated by arrows at L1, L2, L3 on LCD. If the phase sequence is correct the arrows L1, L2, L3 rotate.
- Electrical energy measurement is indicated by flashing of LEDs **TO_A** and **TO_R**, whose frequency corresponds to measured energy – instantaneous active or reactive energy.
- Correctness of the wires connection shall be monitored on LCD according to arrows for energy flow direction: (quadrants QI - QIV).

When the functioning correctness is verified, it is necessary to cover and seal the terminal block.

The electricity meters do not require their own operating and maintenance. It suffices to clean them from dust and dirt and to tighten the screws on the terminal block.

The producer is not responsible for possible damages arisen out by wrong assembly, operating or maintenance of the electricity meter.

Minimum necessary number of pulses for achieving of measurement repeatability at verifying (electricity meter with constant 1000 imp/kWh)

Current	Three phase symmetrical load		
	PF=1	PF=0.5 ind	PF=0.8 cap
I_{min}	1	-	-
I_{tr}	1	1	1
$10I_{tr}$	1	1	1
I_{max}(80 A)	16	8	13
I_{max}(100 A)	20	10	16
I_{max}(120 A)	23	12	19

5 Packing, transport and storage

Each electricity meter is packed in a cardboard box. The packed electricity meters are sent in the cardboard boxes per 10 pieces individually or on pallets. The package is environmentally friendly and recyclable.

The packed electricity meter can be transported by usual transportation means. With respect to its sensitivity it is necessary to avoid the excessive impacts and to transport it at ambient temperature from -40 °C to +70 °C and at corresponding humidity max 95 % at temperature of +30 °C. The electricity meters must be stored at ambient temperature from -40 °C to +70 °C in dry environment without aggressive vapors, gases and dust. The average relative humidity must not exceed 75 %.

6 Service and guarantee

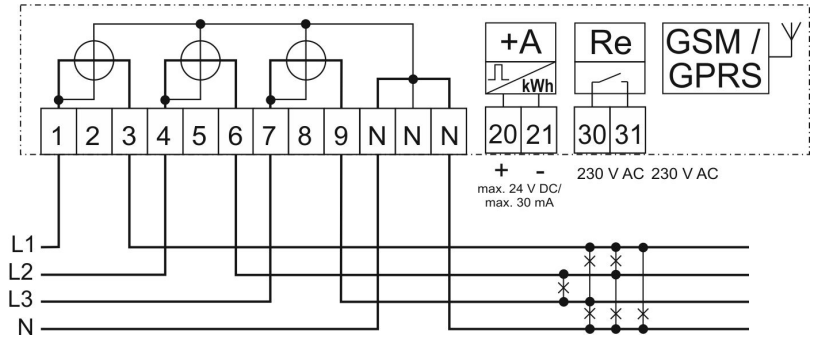
For this kind of product the service is provided by its manufacturer, the firm Applied Meters, with the seat in Prešov, Budovateľská 50, Slovak Republic, tel. No. 051 – 758 1169, fax No. 051 - 758 11 68, E-mail: info@appliedmeters.sk. The firm Applied Meters will provide the service in particular countries through the business partners and agreed service organizations.

Guarantee period for this kind of meter is 24 months since the day of delivery. Length of the guarantee period may be modified in purchase agreement. The seller is responsible for complexity of the product and for production errors, what were complained in time and in the written form. The seller is responsible for keeping the product performance settled by technical standards for prescribed period or other performance features, agreed in the purchase agreement, eventually usual performance described in catalogue sheet and in this user manual. The electricity meter, what during guarantee period has presented error of the manufacturer will be repaired by the manufacturer or by the firm, entitled to perform guarantee repairs free of charge or will change it for a new one.

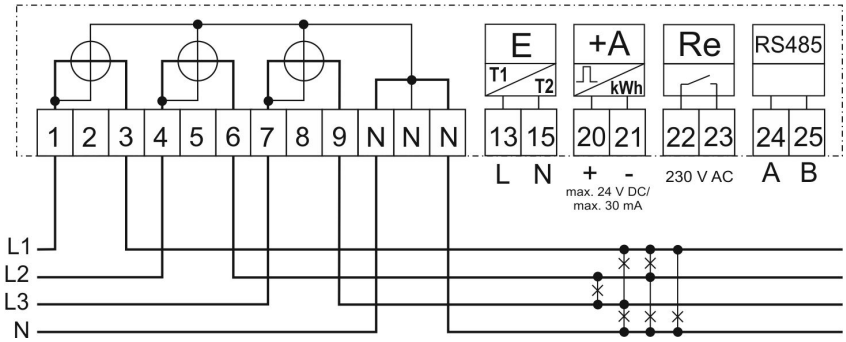
The seller is not responsible for the product features worsening or for its damage, what was caused by the purchaser or somebody else by not appropriate storing, transport, performing product modification, by violent or negligent influence of the product, or by other means, or if it was caused by unavoidable events.

After finishing the guarantee period, during life expectancy of the meter, the repairs are realized by the manufacturer or by service firms.

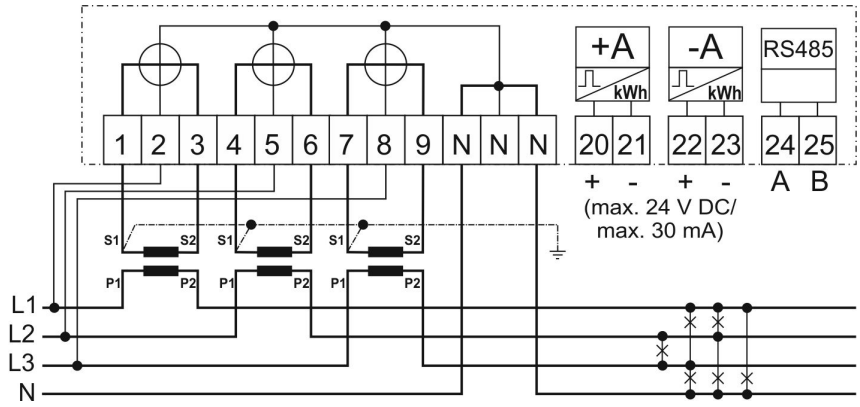
7 Connection diagram - examples



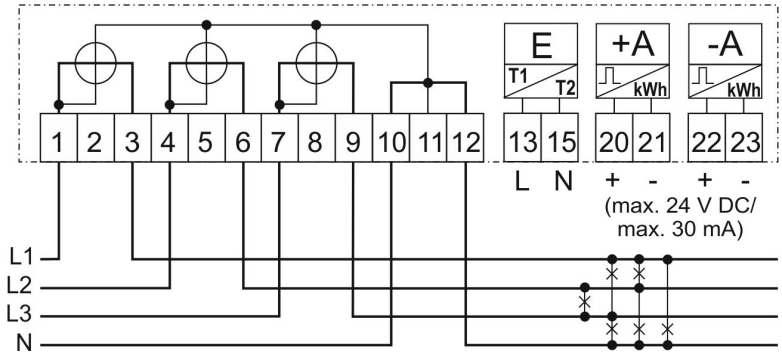
Direct connection AMT B2x FA4TEIGY with transmitting output of active energy +A, switching relay and internal GPRS module



Direct connection AMT B2x FA4TE with external tariff control, transmitting output of active energy +A, switching relay and interface RS 485

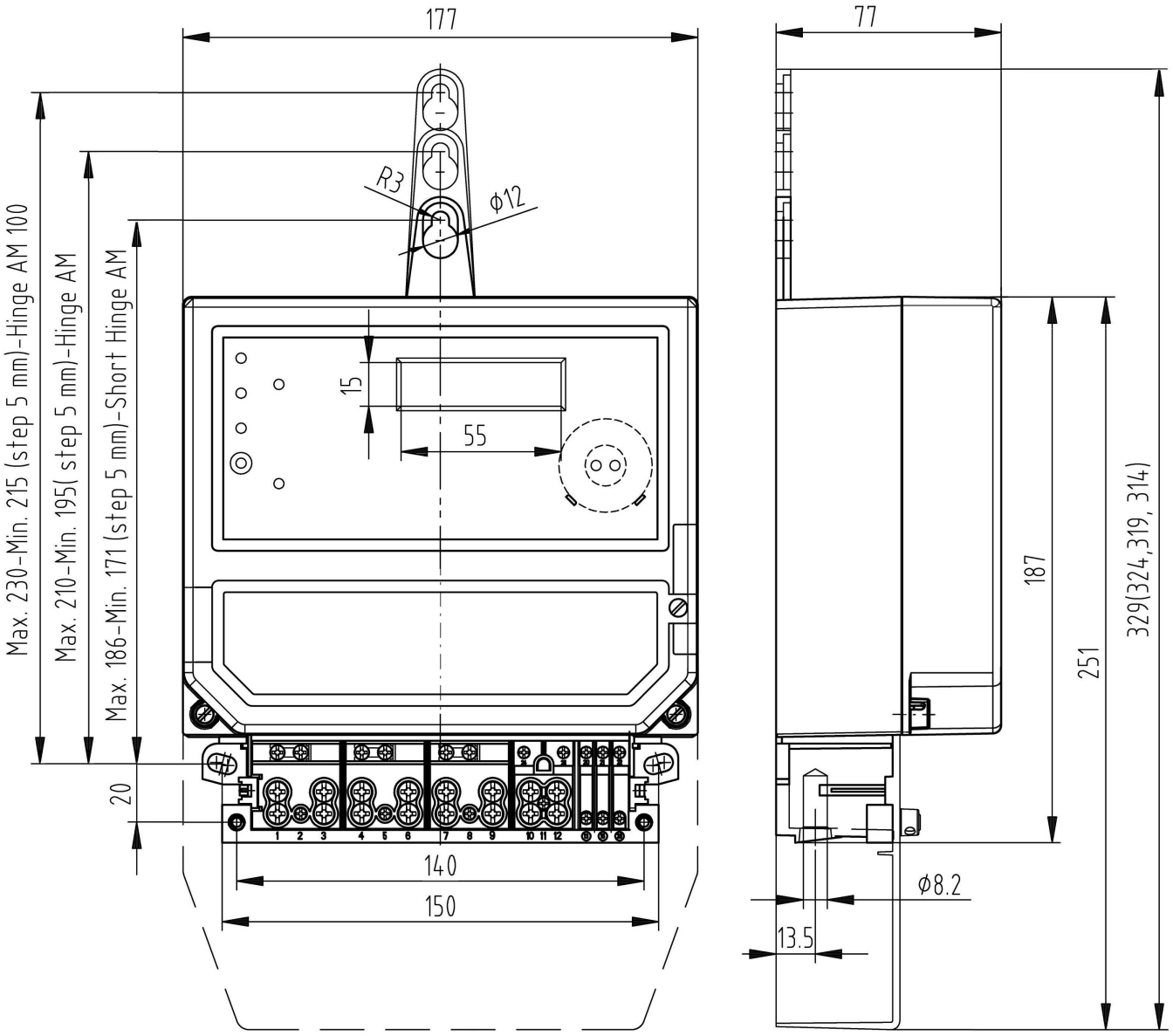


Semi-direct connection AMT B2x FA4TE with transmitting outputs of active energy +A and –A and interface RS 485

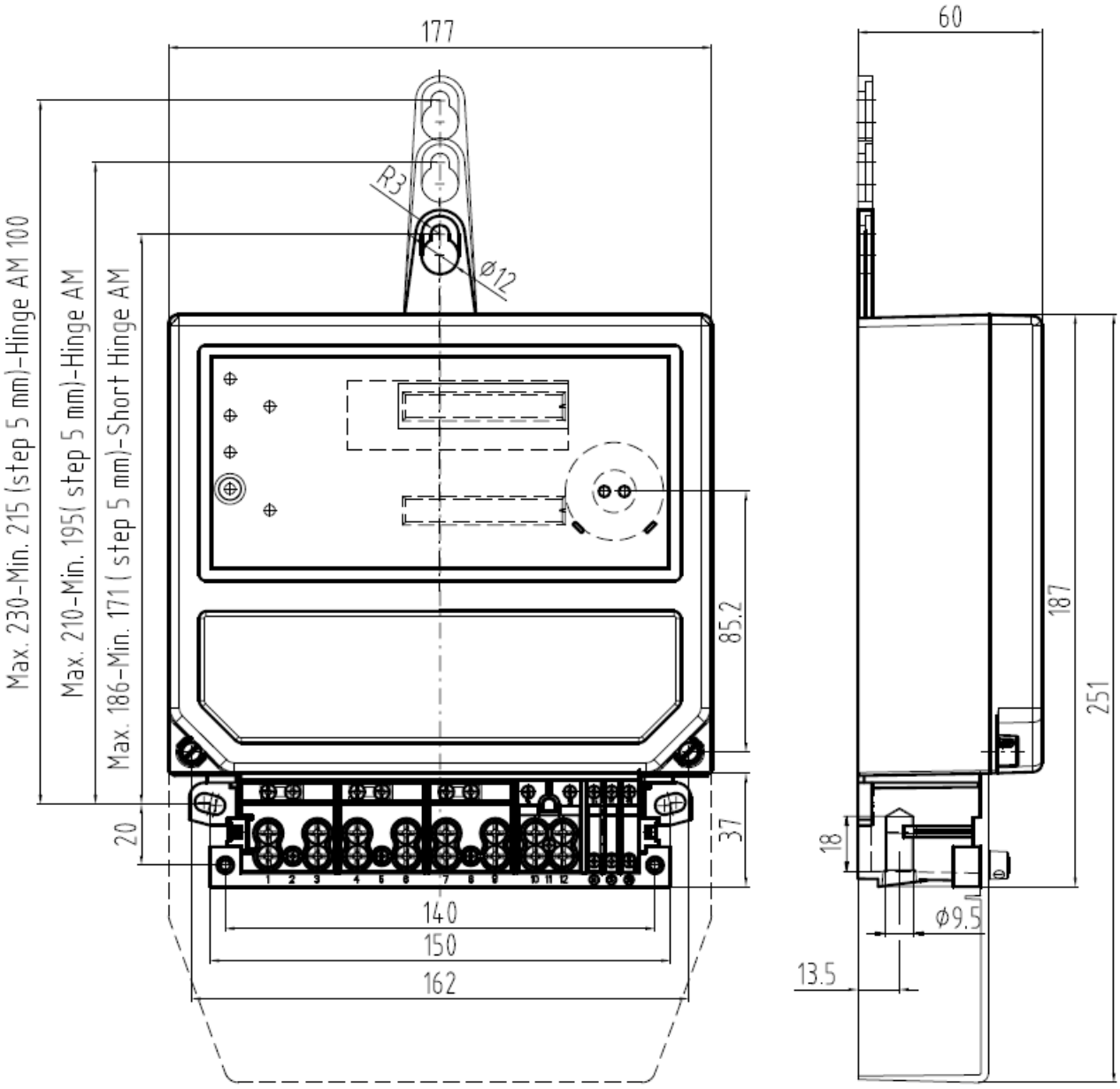


Direct connection AMT B2x FA4T9 with external tariff control, with transmitting outputs of active energy +A and –A

8 Dimensional drawing



Dimmensions of the case „E“



Dimmensions of the case „9“