Electronic electricity meter

EMS

User's manual
Version 5.

"ELGAMA – ELEKTRONIKA" Ltd., Lithuania 2006

"ELGAMA-ELEKTRONIKA" Ltd

Electronic electricity meter EMS

USER'S MANUAL

Contents

1 Designation

This User's manual introduces a description and exploitation instruction of electronic electricity meter EMS.

Electricity meter EMS (further referred to as EMS) is an electronic three-phase multi-tariff meter, which measures active and reactive energy (or only active energy). Furthermore some of EMS modifications (see Table 2-1) register maximum demand, store load profile and measure instantaneous RMS values of current, voltage and power.

EMS conforms with the requirements of standard IEC 62053-21 for the accuracy class 1 for active energy measurement, requirements of standard IEC 62053-23 for the accuracy class 2 for reactive energy measurement, and requirements for the accuracy class 1 for RMS instantaneous values of current, voltage, power, load profiles and Maximum Demand.

Meter is used in the utilities, different fields of industry, transport, agriculture, and in domestic sector. It may be also used in energy management and billing systems – meter has S0 and serial communication interfaces for data transmission into dispatchers.

EMS resistance to climate and mechanical influences correspond to the requirements of standard IEC 62053-11. Meter must be kept and exploited in the room protected from dust, aggressive steam and gas.

Note: Tables and Figures of this User's manual present measurement values and pulse outputs in the quantities of energy and power (+A, -A, +R, -R, +P, -P, +Q, -Q). Exact number of measurement values and pulse outputs of a certain meter are indicated in its passport.

2 Meter modifications

2.1 Types of EMS meter

Two types of EMS meter are manufactured:
- **Meters of active energy** measure import [+A] and export [-A] active energy;
- **Meters of active and reactive energy (combimeters)** measure import [+A] active energy, import [+R] and export [-R] reactive energy).

2.2 Main functions of meter

Four modifications of the meter with different amount of main functions are produced:
1. Registration of energy consumption;
2. Registration of energy consumption and maximum demand;
3. Registration of energy consumption, maximum demand and load profiles;
4. Registration of energy consumption, maximum demand, load profiles and instantaneous value.

2.3 Additional functions

All EMS meters have S0 pulse outputs. Active energy meters usually have 1 or 2 outputs, and combimeters – 3 outputs. Meters can be implemented with electrical communication interface (20mA "current loop" or RS485) and programmable relay output. Multi-tariff meters have internal real time clock for the control of tariff module. Single tariff meters (modifications EMS XXX.X0.X) have no internal clock.

2.4 Meter connection

There are meter modifications for three-phase four-wire and for three-phase three-wire electricity networks. Both, direct-connected and transformer-operated meters are available.

Table 2-1 Type designation

EMS	X	X	X.	X	X.	X
Connection:						
Three element four-wire connection	1					
Two element three-wire connection	2					
Nominal meter voltage:						
3x57,7/100V; 3x63,5/110V; 3x69,2/120V		1				
-		2				
3x220/380V; 3x230/400V		3				
3x120/208V; 3x127/220V		4				
Nominal meter (maximum) current:						
Connection via transformers, 5 (6,25) A			1			
Connection via transformers, 5 (10) A			2			
Direct connection, 10 (60) A			3			
Direct connection, 10 (100) A			4			
Direct connection, 5 (60) A			5			
Measured quantities:						
Active energy (A+)				0		
Active energy (A+) and reactive energy (R+, R-)				1		
Energy (A+, R+, R-), maximum demand (P+, Q+, Q-)				2		
Energy (A+, A-), maximum demand (P+, P-)				3		
Energy (A+, R+, R-), maximum demand and profiles (P+, Q+, Q-)				4		
Energy (A+, A-), maximum demand and profiles (P+, P-)				5		
Energy (A+, R+, R-), maximum demand and load profiles (P+, Q+, Q-), instantaneous values				6		
Internal clock:						
Without internal clock					0	
With internal clock					1	
Auxiliary outputs:						
S0 outputs						1
S0 outputs, relay						2
S0 outputs, electrical communication interface						3
S0 outputs, relay, electrical communication interface						4

3 Technical specifications

Table 3-1. Main technical specifications

Accuracy class:	Active energy	1 (IEC 62053-21)
	Reactive energy	2 (IEC 62053-23)
	Average active power	1
Nominal voltage, V:		see Table 2-1
Voltage range, % from U_{nom}:		-20%... +15%
Nominal (maximum) current, A:		see Table 2-1
Starting current, % I_{nom}:		0,4 (direct-connected)
		0,2 (transformer-operated)
Nominal frequency, Hz:		50 or 60
Power consumption, VA:	In voltage circuits	< 1,0 (< 0,5 W)
	In current circuits (I = I_{nom})	< 0,05 (direct-connected)
		< 0,5 (transformer-operated)
Meter constant, imp/kWh, imp/kvarh:		500 or 1000 (direct)
		5000 or 10000 (transformer)
Internal clock (IEC 61038):	Accuracy	< 0,5 s/24 h (T=23°C),
		< 0,1 s/°C/24 h
	Backup power supply	Li-ion battery or SuperCap
	Backup time (power reserve) with battery	> 10 years
	Backup time (power reserve) with SuperCap (optional)	> 7 days
	Loading time of SuperCap for max backup time	<1 hour
	Overall lifetime of SuperCap	>15 years
Tariff module functions:	Number of energy tariffs	programmable (1…4)
	Number of maximum demand tariffs	programmable (1…4)
S0 output (IEC 62053-31):	number	1…3
	Output constant, imp/kWh (imp/kvarh)	1...19999 (direct)
		1…60000 (transformer)
	pulse duration, ms	30
Relay:		programmable
	Maximum switching voltage, V	250
	Maximum switching current, mA	120
Communication interfaces:	Optical interface	IEC 62056-21
	Electrical interface (20mA current loop or RS485)	IEC 62056-31
Insulation strength:	AC voltage tests (IEC 62053-21)	4 kV
	Impulse voltage tests (IEC 60060-1)	6 kV
Electromagnetic Compatibility:		
	Electrostatic Discharges (IEC 61000-4-2)	15 kV
	Electromagnetic RF Fields 80MHz-2GHz (IEC 61000-4-3)	10 and 30 V/m
	Fast Transient Burst Test (IEC 61000-4-4)	4 kV
	Fast Transient Surge Test (IEC 61000-4-5)	4 kV
Operation temperature range		- 40 … +60°C
Storage and transportation temperature range		- 40 … +70°C
Mass, kg:		< 1,3
Dimensions, mm^3		325x177x55

4 Construction

4.1 Housing

Meter case, terminal block and fixing holes comply with requirements of standards IEC 62053-21 and DIN 43857. The meter conforms to the degree of protection IP51 given in IEC 60529. Clearances and creepage distances conform to IEC 62052-11 requirements for indoor meters of protective class II.
A highly mechanically resistant transparent cover is made of ultraviolet stabilized polycarbonate material. It protects meter interior and the name-plate. The transparent cover is fixed to the base by two sealing bolts. Figure 4-1 presents meter exterior and location of control elements. In addition, Annex B indicates meter dimensions and location of fixing holes.

exterior
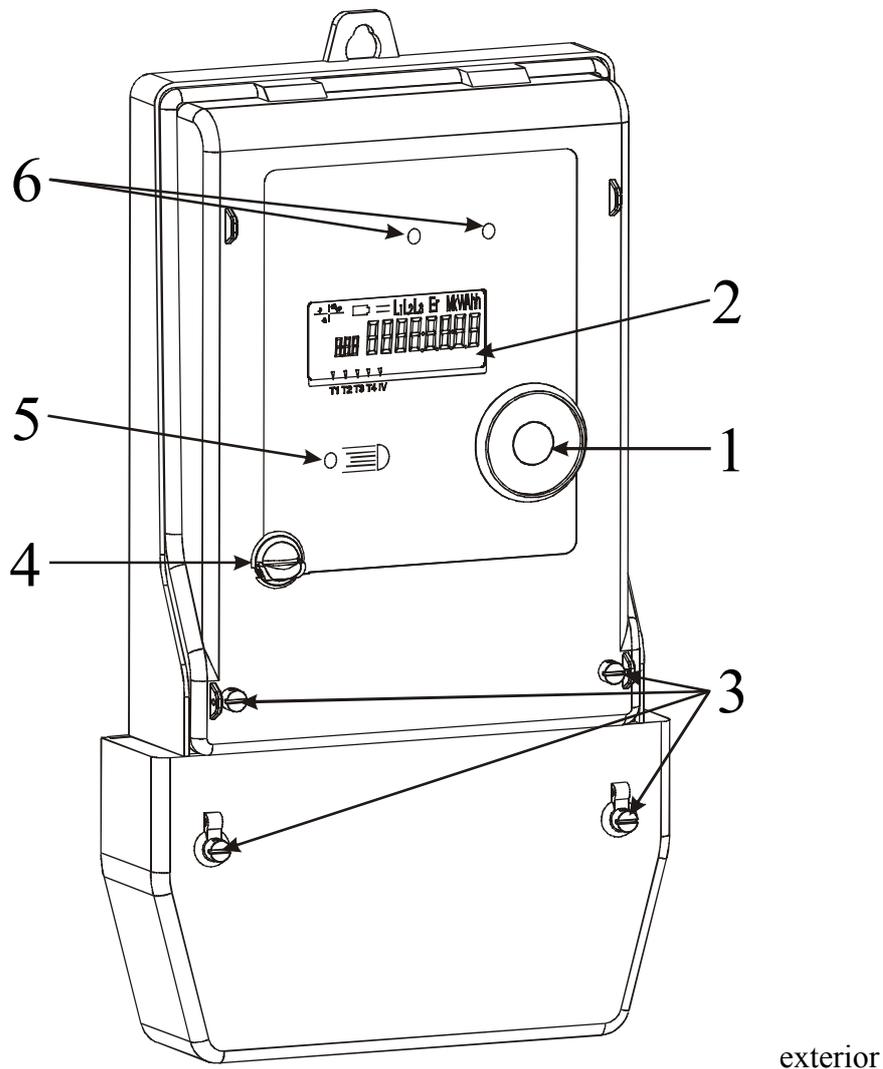
Figure 4-1. EMS meter

Table 4-1. Explanation of Figure 4-1

1	Optical communication interface	**4**	Two-position push button
2	Liquid crystal display (LCD)	**5**	Photo-sensor for display control
3	Sealing bolts	**6**	Optical pulse outputs

There is a liquid crystal display (LCD), optical communication interface, photo-sensor (optional) for display control and two-position push button on the meter cover. See chapter 10.1 for the explanation of display control commands, and chapter 4.6 for the description of control push button.

Nameplate bears all the necessary information about the meter according to the standard IEC 62052-11. Furthermore, designation of main measured value codes and connection diagram are presented on the nameplate. Printed circuit board (PCB) with surface mounted electronics devices is placed under the cover. Metal screens that protect electronic devices from external electromagnetic field influence cover PCB.

4.2 Electronics and operation principle

4.2.1 Measurement module
In measurement module, current and voltage values of each phase are transformed into proportional analogous signals. Precise current transformers are used for current measurement, and resistive voltage dividers – for voltage measurement.

4.2.2 Signal processing
Six-channel Sigma - Delta converter transforms analogous signals into digital codes and passes them to microprocessor.

4.2.3 Microprocessor
The microprocessor calculates average power P(t) by multiplying digital codes with calibration constants. Combimeters use a value of voltage, phase turned by 90º, for reactive power Q(t) calculation. Energy values are calculated by means of integrating power values over time. In accordance with the valid tariff program, the received values are registered in the corresponding energy and demand registers of non-volatile memory.
Furthermore, microprocessor controls liquid crystal display, communication interfaces, meter outputs, tariff module and internal clock.

4.2.4 Non-volatile memory
Meter contains a non-volatile EEPROM memory, where billing data, meter parameters and information about events are stored. The EEPROM memory guaranties more than 20 years of data retention. Different memory variants (sizes) are available on request (see Table 6-2).

4.2.5 Liquid crystal display
Liquid crystal display (LCD) contains 84 controlled segments. LCD displays majority of data accumulated in meter and parameterization constants. Figure 4-2 presents the arrangement of LCD segments and chapter 10 introduces the detailed schemes of information displayed.
Liquid crystal display can be divided into 14 information fields (field is composed of one or several segments):

- **Energy direction indicator** shows load quadrant (active, reactive).
- **Battery state indicator** warns when battery has to be replaced or super capacitor is discharged.
- **Communication indicator** is activated when communication is carried out via optical communication interface.
- **Phase sequence indicator** shows a number and a sequence of phase voltages connected.

- **Measurement unit indicator** shows measurement unit of the displayed value.
- **Index** shows the identification code of displayed value. The last numeral of the code indicates a tariff zone (only for energy and power data). "0" means accumulated value of all tariffs.
- **Arrow of historical values** is activated when data of expired interval is reviewed.
- **Arrow of demand monitor** indicates a state when demand monitor threshold is exceeded;
- **Tariff arrows** are switched on when a corresponding tariff is active. At the same time only one arrow, indicating active energy tariff, and another arrow, indicating active demand tariff, are turned on (tariff numbers are written on the nameplate below the corresponding arrows).
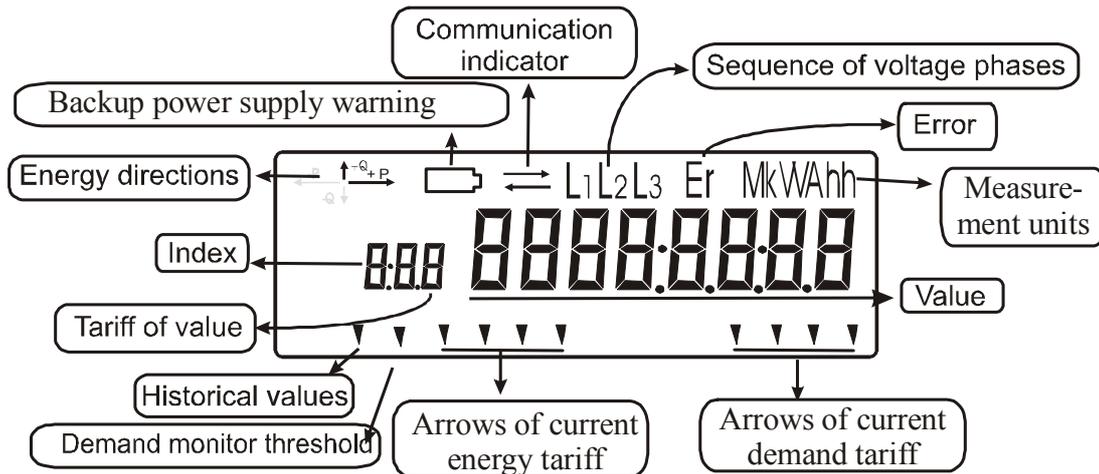

Figure 4-2. Segments of liquid crystal display

While network voltage is disconnected, microprocessor operates in an energy saving mode, thus, display is not active. When meter is disconnected data may be reviewed by affecting photo-sensor or push-button (in unsealed position) for 2 seconds (this feature is available only in meters with backup battery, not with super capacitor). Accumulated energies of each activated tariff are displayed three times repeatedly, and afterwards display becomes inactive.

4.2.6 Internal clock

Meter contains internal real time clock, which counts years, months, weekdays, hours, minutes and seconds. Clock information is used to control the time switch of energy and demand tariffs, to form integration periods of average demand and to register events with date and time stamps. Clock is synchronised by quartz resonator. Temperature errors are compensated by the firmware (only when network voltage is applied to the meter). Table 3-1 presents main characteristics of the internal clock.

Changeover to daylight saving time (summer time) and back to normal time is performed automatically. Start and end of daylight saving time can be set according to the European standard or the user may define their own specifications (see Table 4-2 for available variants).

In case of power outage, backup power supply for the clock is provided by a Li-ion battery or super capacitor (SuperCap). Please refer to the meter passport, in order to find out what type of backup power supply is implemented in a certain meter. When the network voltage is available, energy from the backup power supply is not consumed. The Li-ion battery can backup internal real time clock for not less than 10 years without the main power supply. The SuperCap has a capacity for at least 7 days supply of the real time clock. If a blinking battery state indicator appears on the display, the time and date of the internal clock is not guaranteed and the battery must be replaced or the super capacitor has to be recharged. In this case, the meter performs as a single-tariff device, and the data is assigned to the specific tariff (default on failure), specified during the parameterization. It can be any of the activated

energy or demand tariffs. The time and date of the internal clock has to be set in order to recover a normal tariff operation.

Only the manufacturer or its authorized representative may replace the Li-ion battery!

It takes not more than 1 hour for the main power supply to completely recharge the SuperCap.

Table 4-2. Specification of daylight saving time

Date format [MM.DD.hh]	Daylight saving time
00.00.00	Daylight saving time is deactivated.
MM.00.00	A changeover to summer time is carried out on the last Sunday of a specified month MM at 2 a.m., by setting the clock 1 hour forward. A changeover back to normal time is carried out on the last Sunday of a specified month MM at 3 a.m. by setting the clock 1 hour backward.
MM.00.hh	A changeover to summer time is carried out on the last Sunday of a specified month MM on the specified time hh:00 by setting the clock 1 hour forward. A changeover back to normal time is carried out on the last Sunday of a specified month MM on the specified time hh:00 by setting the clock 1 hour backward.
MM.DD.hh	A changeover to summer time is carried out on the time and date specified by setting the clock 1 hour forward. A changeover back to normal time is carried out on the time and date specified by setting the clock 1 hour backward.

4.3 Communication interfaces

All EMS meters have an optical communication interface. In addition, EMS XXX.XX.3 and EMS XXX.XX.4 modifications have electrical communication interface - 20mA "current loop" or RS485. *Exact type of electrical interface of a certain meter is indicated in its passport*

4.3.1 Optical communication interface

Optical communication interface meets the requirements of standard IEC 62056-21 and is used to download data locally into PC via an optical head. Interface is also used for the adjustment and parameterisation of the meter.

Characteristics of optical communication interface are the following:

Data transmission rate	300 ... 9600 baud;
Recommended data reading rate	4800 baud;
Recommended parameterization rate	2400 baud.

Some modifications of EMS meters maintain the blocking function of the optical communication interface. This function prevents unauthorized data reading and changes of parameters. Pushing a button in sealing position (when seal is eliminated) unblocks communication. Read more about this function in Chapter 12.3. In other modifications of EMS meters, long press (>6 seconds) of push button in sealing position invokes reset of billing period (see Chapter 8).

4.3.2 Electrical communication interface

Electrical interface is designated for remote data transmission to external equipment. There can be different interface implementations. A default variant of the interface is a two-wired passive 20 mA "current loop" type electrical interface powered by external device. The maximum supply voltage of open circuit is <30V, and the maximum loop current is <30 mA. In case of reverse connection, interface is not active, but it is protected from damage. The current loop interface is used to link a maximum of 8 meters to a bus system and allows data transmitting up to 2 km distance.

As an alternative, passive or active RS485 electrical interface can be implemented in some modifications. For the passive interface, the power supply has to be provided by the external communication devices connected to the meter. The voltage of the power supply must be in the range 8…20 V. The passive RS485 interface is used to link a maximum of 128 meters in a daisy-chain

network, while in case of active RS485 interface a maximum of 32 meters can be connected. The communication is possible within a distance of several hundreds of meters.

Please refer to the passport of certain EMS meter to find out about exact type of electrical interface implemented. In any case, data are transmitted by means of IEC 62056-31 protocol with a baud rate up to 9600 bauds.

4.4 Outputs

4.4.1 Optical pulse outputs

Meter is equipped with a red light emitting diode (LED), which produces light pulses with frequency proportional to the energy measured. LED is used for meter calibration and metrological verification. Pulse constants (imp/kWh, imp/kVarh) and pulse duration (30 ms) are programmed by manufacturer and can not be changed by the user. Active energy meters have only one LED for active energy, whereas combimeters have two light emitting diodes: the first LED - for active energy, and the second - for reactive energy.

4.4.2 Electrical pulse outputs (S0)

Meter has electrical pulse outputs for transmission of pulses to external pulse receivers. Pulses carry information about the measured energy. Outputs are electrically isolated by opto-couplers. Pulse constant is programmed in the interval from 1 to 60000 imp/kWh (imp/kVAh) for transformer-operated meters and from 1 to 19999 imp/kWh (imp/kVAh) for direct-connected meters. Maximum switching voltage is 24 V, and maximum switching current is 100 mA. Active energy meters have one or two outputs (it depends on energy directions measured), whereas combimeters can have three electrical pulse outputs. *For the exact number of electrical pulse outputs, please refer to the meter passport.*

4.4.3 Relay output

Relay output can commutate direct and alternating 120 mA current with voltage up to 250 V. Relay operation may be programmed in two modes:
- normally disconnected contacts are connected when specified energy tariff is valid;
- normally disconnected contacts are connected for two programmed periods during the 24-hour interval (periods are set in 15 minutes step).

4.5 Power supply

EMS meter is equipped with pulse mode power supply. It guarantees stable operation of meter when network voltage ranges from -15 ... +20% of the nominal voltage. In case of voltage disconnection, microprocessor switches into energy saving mode, where backup power supply for internal real time clock is provided by Li-ion battery or super capacitor (SuperCap). Please refer to the meter passport, in order to find out what type of backup power supply is implemented in a certain meter. When the voltage is restored, energy from backup power supply is not consumed. Li-ion battery can backup internal real time clock for not less than 10 years without main power supply. SuperCap has a capacity for at least 7 days supply of real time clock, and it takes not more than 1 hour for main power supply to completely recharge SuperCap.

4.6 Control push button

Two-position push button is mounted on the main cover of meter.

In position A (see Figure 4-3) the button is used to control data scrolling on LCD. Two commands are used:

- Short button push (<0,5s – further referred to as a short signal);
- Long button push (>2s – further referred to as a long signal).

Data scrolling commands generated by a push button correspond to the light signal commands received by photo sensor.

Read Chapter 10.1 to find out more about the control of data scrolling.

(*Optional*) In position B (see Figure 4-3) button can be used to unblock communication via optical interface (read more about communication blocking function in Chapter 12.3) or, as an alternative, to invoke billing period reset (see Chapter 8).

A   B

Control of data scrolling   Unblocking of optical interface

Figure 4-3. Two-position push button

Switching of push-button function
In order to change the push button function, please use a screwdriver and turn the button by 90º clockwise.

Button sealing
Push button can be sealed only in position A (see Figure 4-3). A sealing wire of 2mm diameter is recommended for that purpose. However, if a wire of 1mm diameter is used, it is necessary to make it double. Moreover, wire has to be stretched tightly.

5 Energy registration

Energy values are obtained by integrating single-phase values of power over the integration interval of 1 second. The resulting energy values with a fixed period (energy portions) are summed up continuously in appropriate energy registers.

5.1 Total energy registers

In total energy registers, energy is recorded as a cumulative value, i.e. the memory continuously replaces the old value of energy with the new value (previous value + energy portion). Cumulative values are calculated from the origin (first start of meter measurements) to the instantaneous time point. The following total energy registers can be available in the meter (see Table 5-1). Please refer to symbol * in type designation EMS xxx.*x.x (see Table 2-1) in order to find out what energy quantities are registered in a certain type of meter. Total energy registers are displayed on LCD (see Figure 10-7) and can be readout via communication interfaces.

Table 5-1. Total energy registers

Code	Register
1.8.0	Total energy register for import active energy (+A)
2.8.0	Total energy register for export active energy (-A)
3.8.0	Total energy register for import reactive energy (+R)
4.8.0	Total energy register for export reactive energy (-R)

5.2 Rated energy registers

In rated energy registers, energy is recorded as a cumulative value for a time span of specified rate (energy tariff). The following rated energy registers can be available in the meter (see Table 5-2). Please refer to symbol * in type designation EMS xxx.*x.x (see Table 2-1) in order to find out what energy quantities are registered in a certain type of meter. Each energy quantity may have several rated energy registers. It depends on the number of activated energy tariffs. Rated energy registers are displayed on LCD (see Figure 10-7) and can be readout via communication interfaces.

Table 5-2. Rated energy registers

Code	Register
1.8.T	Rated energy register of tariff T for import active energy (+A)
2.8.T	Rated energy register of tariff T for export active energy (-A)
3.8.T	Rated energy register of tariff T for import reactive energy (+R)
4.8.T	Rated energy register of tariff T for export reactive energy (-R)
T = [1…4] – energy tariff	

5.3 Billing period energy registers

Billing period energy registers record energy as a delta value, in order to obtain energy consumption during a billing period. The procedure is as follows. At the end of the billing period, the meter saves the content of the energy register to the billing profile and clears the content of the energy register. During the following billing period, the meter records the energy consumption beginning with a meter reading of 0 and, at the end of the period, the value is again saved and the register is cleared. The following billing energy registers can be available in the meter (see Table 5-3). Please refer to symbol * in type designation EMS xxx.*x.x (see Table 2-1) in order to find out what energy quantities are registered in a certain type of meter. Each energy quantity may have several billing period energy registers. It depends on the number of activated energy tariffs.

At the end of the billing period, the energy value of current billing period is stored in a non-volatile memory. Energy consumption history of 16 last billing periods is available. Every time a new value is stored, the oldest stored value is overwritten. Only energy values of current and last billing periods are displayed on LCD (see Figure 10-7). The entire history of billing period energy values is readout via communication interfaces.

Table 5-3. Billing period energy registers

Code	Register
1.9.T	Billing period energy register of tariff T for import active energy (+A)
2.9.T	Billing period energy register of tariff T for export active energy (-A)
3.9.T	Billing period energy register of tariff T for import reactive energy (+R)
4.9.T	Billing period energy register of tariff T for export reactive energy (-R)
T = [1…4] – energy tariff	

6 Demand registration

Measured energy portions are recorded in demand registers as average demand values over integration period. Integration period is the regular period of time during which the demand is measured and continuously integrated. Integration period can be selected from the array of [5, 10, 15, 20, 30, 60] minutes during parameterisation of the meter. Control of the integration period takes place internally by the internal clock. The integration period is synchronised with the time-of-day, so that it always starts on the hour (e.g. integration periods of 15 minutes start at 10:00, 10:15, 10:30, 10:45, 11:00, 11:15 etc.).

6.1 Current average demand

Current average demand registers record average power of current integration period. Each register sums up the corresponding energy portions during the current integration period. Current average demand (CD) is calculated according to Equation 1:

Equation 1

$$CD = \frac{\Delta E \cdot 3600}{\Delta t}$$

where ΔE – energy registered from the beginning of current integration period [kWh, kVArh]; Δt – number of seconds elapsed from the beginning of current integration period.

At the end of integration period the current average value of demand is available for further processing in the maximum demand registers and can be stored in load profile.

The following current average demand registers can be available in the meter (see Table 6-1). Please refer to symbol * in type designation EMS xxx.*x.x (see Table 2-1) in order to find out what demand quantities are registered in a certain type of meter.

Table 6-1. Current average demand registers

Code	Register
1.4.0	Current average demand register for import active power (+P)
2.4.0	Current average demand register for export active power (-P)
3.4.0	Current average demand register for import reactive power (+Q)
4.4.0	Current average demand register for export reactive power (-Q)

6.2 Load profile

Load profile function is available only in EMS XXX.41.X, EMS XXX.51.X and EMS XXX.61.X modifications. Average values of demand can be stored to the load profile at the end of every integration period. Maximum load profile width, i.e. number of demand quantities stored in load profile, is 3. Please refer to symbol * in type designation EMS xxx.*x.x (see Table 2-1) in order to find

out what demand quantities are registered in a certain type of meter. During parameterisation, user selects the measured demand quantities to be captured in the load profile.

Memory depth, i.e. number of days to be recorded in the load profile, is presented in Table 6-2. It depends on the integration period, as well as, on non-volatile memory variants (sizes A, B and C), that are available on request. Table 6-2 presents the total storage time of load profile for all demand quantities. It may be divided for measured demand quantities at any ratio. For example, if the meter is equipped with memory variant C, if the integration period is set to 15 minutes, and if only import active demand (+P) is parameterised for recording, then 63 days can be recorded in the load profile.

Load profile entries are not displayed on LCD, however they can be readout via communication interfaces.

Table 6-2. Storage interval of load profile (in days)

Integration period, min.	Memory variant (selectable by ordering)		
	A	**B**	**C**
	Number of days		
5	7	14	21
10	14	28	42
15	21	42	63
20	28	56	84
30	42	84	126
60	84	168	252

6.3 Maximum demand of billing period

Billing period maximum demand is the highest average value of demand determined during the entire billing period. At the end of each integration period, the meter compares the current average value of demand with the previously highest average value of demand for the current billing period. The comparison is only made if the corresponding demand tariff is active. If the current average value is equal or less than the highest average value, the maximum demand remains unchanged. If the current average value is greater than the highest average value, the meter stores the current average value as new maximum demand and simultaneously records the date and time at which the new maximum occurred. The following billing period maximum demand registers can be available in the meter (see Table 6-3). Please refer to symbol * in type designation EMS xxx.*x.x (see Table 2-1) in order to find out what demand quantities are registered in a certain type of meter. Each demand quantity may have several billing period maximum demand registers. It depends on the number of activated demand tariffs.

At the end of the billing period, the current maximum demand value together with date and time is stored in a non-volatile memory. Maximum demand <u>history of 12 last billing periods</u> is available. Every time a new value is stored, the oldest stored value is overwritten. Only maximum demand values of current and last billing periods are displayed on LCD (see Figure 10-7). The entire history of billing period maximum demand values is readout via communication interfaces.

Table 6-3. Billing period maximum demand registers

Code	Register
1.6.M	Billing period maximum demand register of tariff M for import active power (+P)
2.6.M	Billing period maximum demand register of tariff M for export active power (-P)
3.6.M	Billing period maximum demand register of tariff M for import reactive power (+Q)
4.6.M	Billing period maximum demand register of tariff M for export reactive power (-Q)
M = [1…4] – demand tariff	

6.4 Daily maximum demand

Similarly to maximum demand of billing period, meter registers daily maximum demand, i.e. the highest average value of demand determined during the 24-hour period. A history of 480 daily maximum demand values can be stored in the non-volatile memory in total. Memory depth, i.e. number of values (number of days) to be stored for each demand quantity, is calculated according to Equation 2:

Equation 2

$$N = \frac{480}{N_M * N_E}$$

where N_M – number of activated demand tariffs [1…4]; N_E – number of measured demand quantities [1…3]. For example, if meter measures +P, +Q and –Q demand, and 4 demand tariffs are activated, the history of 40 days of daily maximum demand is available. Please refer to symbol * in type designation EMS xxx.*x.x (see Table 2-1) in order to find out what demand quantities are registered in a certain type of meter. One demand quantity must share at least one day.

Daily maximum demand is not displayed on LCD, however it can be readout via communication interfaces.

6.5 Demand monitor and cumulated maximum demand

Demand monitor of the meter monitors average demand values of import power (+P). For this purpose, the user has to parameterise the demand monitor threshold (i.e. an upper limit of +P average demand). At the end of each hour, meter selects the highest average demand, registered during this hour. If the highest demand value exceeds the parameterised threshold, this value is added to cumulative maximum demand register, and the demand monitor counter is incremented. Furthermore, an arrow "Demand monitor threshold" is activated on LCD, and stays active until the end of billing period. At the end of billing period, values of cumulative maximum demand and demand monitor counter are stored in a non-volatile memory. The cumulative maximum demand register and demand monitor counter register are cleared then and a new demand monitor for the next billing period starts.

Demand monitor history of 5 last billing periods is available in the meter. It is not displayed on LCD, however it can be readout via communication interfaces.

7 Registration of instantaneous values

Instantaneous values are measured only in EMS XXX.61.X modification. Available registers of instantaneous values are listed in table7-1.Instantaneous values are integrated over the integration interval of 1 second, thus the registers are updated every second. Registers of instantaneous values are displayed on LCD (see Chapter 10.1.3) and can be readout via electrical interface.

Table 7-1. Registers of instantaneous values

Code	Description
32.7.0	Instantaneous RMS voltage (V) of phase L1
52.7.0	Instantaneous RMS voltage (V) of phase L2
72.7.0	Instantaneous RMS voltage (V) of phase L3
31.7.0	Instantaneous RMS current (A) of phase L1
51.7.0	Instantaneous RMS current (A) of phase L2
71.7.0	Instantaneous RMS current (A) of phase L3
1.7.0	Instantaneous active power (kW) of all phases
21.7.0	Instantaneous active power (kW) of phase L1
41.7.0	Instantaneous active power (kW) of phase L2
61.7.0	Instantaneous active power (kW) of phase L3
3.7.0	Instantaneous reactive power (kVAr) of all phases
23.7.0	Instantaneous reactive power (kVAr) of phase L1
43.7.0	Instantaneous reactive power (kVAr) of phase L2
63.7.0	Instantaneous reactive power (kVAr) of phase L3

8 Billing period reset

At the end of billing period, the billing period reset signal triggers the storage of the current values to the non-volatile memory. The billing period reset may be initiated:

- Automatically by the internal real-time clock at the end of each month;
- (*Optional*) Manually by pressing the push button in position B (secured by the seal);
- Locally by sending an appropriate command via the optical interface;
- By opening a terminal cover of the meter (tampering recording).

After every billing period reset, regardless how it was initiated, no further reset is possible until the end of current month (reset lockout).

If billing period reset has to be initiated manually, the push-button needs to be pressed longer than 6 seconds. If billing period reset is carried out successfully, all LCD arrow segments are switched on. Otherwise, reset lockout is active, and only first 7 arrow segments are switched on.

9 Tariff module

Tariff module uses the internal clock as time base to perform a time switch function for tariff control, i.e. to activate and deactivate rated registers and the arrows in the display. It can control up to 4 energy and 4 demand tariffs, which are related to each other. Relations of energy and demand tariffs are configurable parameters and are available for display on LCD (seeTable 10-2). Tariff on and off times can be set with the help of day tables, week tables, season table and special day table.

9.1 Day tables

Day table describe tariff switching times during a 24-hour period. Up to 8 tariff transitions can be described in one table. Up to 16 different day tables can be parameterised in the meter. An example of day table is presented in table 9-1

Table 9-1. Example of day table

No.	Time	Tariff
1	07:00	T2
2	08:00	T1
3	11:00	T2
4	18:00	T1
5	20:00	T2
6	23:00	T1
7		
8		

9.2 Week tables

Week table defines the number of the day table, which is applicable at a particular day of the week and on special days. Maximum 10 week tables can be parameterised in the meter. Table 9-2 introduces an example of week table.

Table 9-2. Example of week table

No	Monday	Tuesday	Wednes-day	Thurs-day	Friday	Saturday	Sunday	Special day
1	0	0	0	0	0	1	1	1
2	2	2	2	2	2	1	1	1
3	3	3	3	3	3	1	1	1

9.3 Season table

Season table allows activation of the specified week table on the specified date (MM.dd). The year can be divided in up to 12 seasons.

9.4 Special day tables

There are two special day tables in the meter memory. One table contains permanent special days (the same date each year, e.g. New Year) and the other table is composed of movable special days (different date each year, e.g. Easter).
The permanent day table is not limited (every day of the year can be parameterized as a special day), whereas the movable day table can contain up to 16 days (year, month and day must be specified). LCD does not display movable days, however, they may be readout via communication interfaces. The table of permanent special days can be reviewed on LCD (see Figure 10-6).
At each change of the date, the tariff module checks whether or not the following day is a special day and selects the day table accordingly.

9.5 Tariff Module Operation in Case of Clock Failure

The tariff module controls tariff schedule on the basis of data received from the internal real-time clock. In the case of clock failure (i.e., clock provides not-guaranteed time data), the control of tariff schedule becomes impossible because real time is unknown. Should this happen, a blinking battery state indicator is displayed in LCD, the performance of tariff schedule is interrupted, and all energy and maximum demand data are recorder in "default on failure" energy and demand tariffs. Those "default on failure " tariffs are defined during the parameterization. Time and date of internal clock have to be set in order to recover the normal operation mode of the tariff module.

10 Data reading

Meter data can be accessed in the following ways:
- manual data scrolling on LCD;
- automatic data scrolling on LCD;
- data reading via optical interface;
- data reading via electrical interface.

Notice: Meter does not multiply data by voltage and current transformation coefficients stored in the memory of the meter. All data obtained from the meter need to be multiplied by transformation coefficients.

10.1 Manual data scrolling on LCD

Almost all data of the meter can be displayed on LCD. Data accessible on LCD and scrolling diagrams are presented in Figure 10-1 ... Figure 10-8.

Data scrolling can be controlled by:
- photo sensor;
- push button in position A.

Photo-sensor is used as an optical switch. A light beam, e.g. from a torch, has the same function as the push button. This enables readings to be made from a distance, e.g. through a protective glass screen in front of the meter. Meter modifications with backup super capacitor have no photo sensor.

There are two LCD control commands regardless of the source they are generated:
- **short signal** - light beam with duration of <0,5 s or push of the button in position A for <0,5 s;
- **long signal** - light beam with duration of >2s or push of the button in position A for >2 s.

Main menu includes the following data (see also Figure 10-1):
- *time* (code **0.9.1**) - time of internal clock. Format hh:mm:ss*;*
- *date* (code **0.9.2**) - date of internal clock. Format - programmable (see Table 10-1);
- *LCD test* - all segments of LCD are switched on for the inspection purposes;
- *Serial Number* (code **0.0.0**);
- *CD +A* (code **1.4.0**) – average demand of current integration period for active energy (+A);
- *CD -A* (code **2.4.0**) – average demand of current integration period for active energy (-A);
- *CD +R* (code **3.4.0**) - average demand of current integration period for reactive energy (+R);
- *CD –R* (code **4.4.0**) - average demand of current integration period for reactive energy (-R);
- *_InSt_ -* Instantaneous RMS values of voltage current and power;
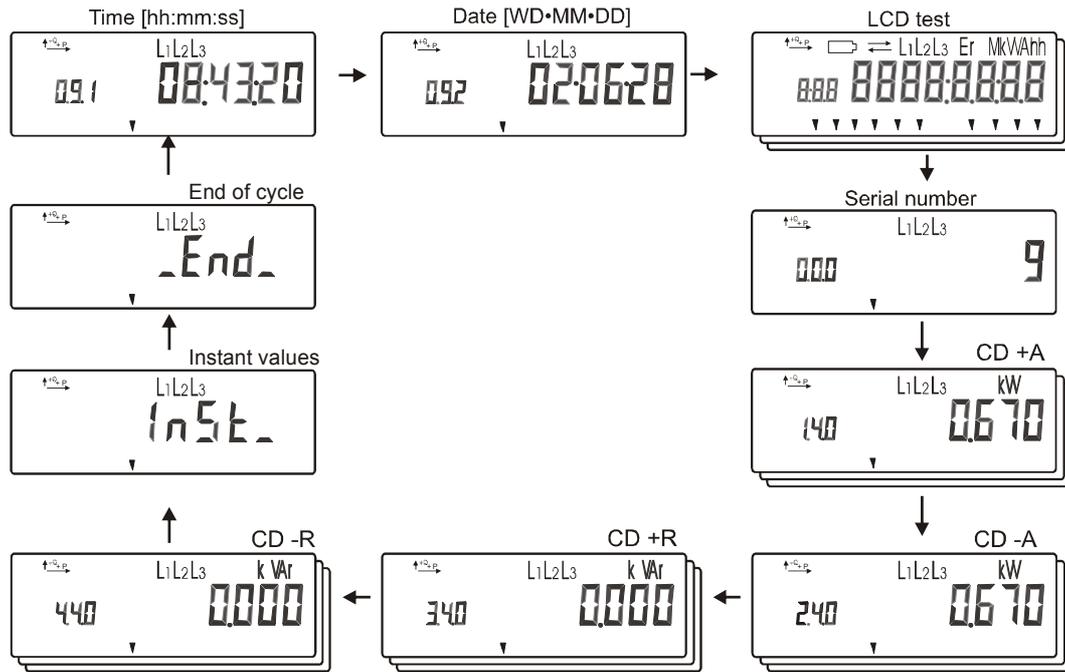- *_End_* - end of main cycle.

Figure 10-1. Main data scrolling cycle

10.1.1 Scrolling through menu of parameters

Menu of parameters can be activated by means of long signal while LCD test is displayed. Further data scrolling is presented in Figure 10-2. First column in this diagram presents main cycle of parameter menu. Short signals initiate scrolling through this menu. Long signal activates scrolling through submenu (if parameter has the one). Scrolling diagrams of certain parameters are presented in Figure 10-3 ... Figure 10-6.

Every parameter has unique index, which is used to identify parameter. Indexes of main parameters and their descriptions are presented below.

Index 1_. Number of five digits **abcde** describes current meter configuration. Meaning of each digit is described in Figure 10-2. Available values of each digit are presented in Table 10-1. Long signal from this parameter activates scrolling of relay configuration (see Figure 10-3).

Table 10-1. Meaning of digits in meter configuration

Description	Values	Comments
a. Directions of active energy	0	Import only
	1	Import and export
b. Format of date indication	0	Year-Month-day [YY-MM-DD]
	1	Weekday-Month-day [WD-MM-DD]
c. Number of activated tariffs	1 ... 4	One ... four tariffs
d. Decimals for energy indication	0	No decimals
	1 … 3	One … three decimals
e. Activity of relay	0	Programmable intervals
	1 ... 4	Relay activity assigned to particular tariff 1..4

Index 2_. Type designation of the meter (see Table 2-1).

Index 3_. Contains caption "_SEAS_" only. Long signal activates scrolling through the season table. Scrolling diagram is presented in Figure 10-4.

*Index 4_* Contains caption "_uEE-P_" only. Long signal activates scrolling through each week table. Scrolling diagram is presented in Figure 10-4.

Index 5_. Contains caption "_day-P_" only. Long signal activates scrolling through each day table. Scrolling diagram is presented in Figure 10-5.

Index 6_. Contains caption "S_day_" only. Long signal activates scrolling through the special day table. Scrolling diagram is presented in Figure 10-6. Note that movable special days are not displayed on LCD.

Index 7_. Start of daylight saving time (see Table 4-2*).*

Index 8_. End of daylight saving time (see Table 4-2*).*

Index 9_. Constant (imp/kWh) of pulse outputs. Constant is the same for active and reactive energy.

Index A_. Contains two parameters: number of maximum demand tariffs and integration period in minutes.

Index b_. Number (hexadecimal) of days, daily maximum demand values (-R, +R, +A) are stored in the memory.

Index C_. *Hexadecimal number X1.X2.X3.X4 describes relations between maximum demand tariffs M1 ... M4 and energy tariffs T1 ... T4. X1 describes energy tariffs, related with maximum demand tariff M1, X2 – energy tariffs, related with M2 and so on (see*
Table 10-2).

Index d_. Date of manufacture of the meter.

Table 10-2. Description of relations between maximum demand tariffs and energy tariffs

M(1...4)	0	1	2	3	4	5	6	7	8	9	A	b	C	d	E	F
Related energy tariff		T1	T2	T1 T2	T3	T3 T1	T3 T2	T3 T2 T1	T4	T4 T1	T4 T2	T4 T2 T1	T4 T3	T4 T3 T1	T4 T3 T2	T4 T3 T2 T1

10.1.2 Scrolling of billing data

Scrolling cycles of billing data can be accessed by means of long signal while average demand registers (codes 1.4.0, 2.4.0, 3.4.0 and 4.4.0) are displayed in the main scrolling cycle (see Figure 10-1). Scrolling diagram of billing data is presented in Figure 10-7.
Figure 10-8 presents examples of data indication on LCD. Only data of activated energy tariffs can be displayed on LCD.

10.1.3 Scrolling of instantaneous values

Scrolling cycles of instantaneous values can be accessed by means of long signal while caption "InSt_" is displayed in the main scrolling cycle (see Figure 10-1). Available registers of instantaneous values are presented in table7-1

10.2 Automatic data scrolling

If meter receives no display control signals for 1 minute, microprocessor activates automatic data scrolling mode. In this indication mode, meter sequentially displays data from a data list. User can modify the list as well as time of indication of one value, but data accessible in automatic scrolling mode is limited to the amount of registers presented in Table 10-3.

Table 10-3. List of registers available for display in automatic scrolling mode

Value	Comments
Time	
Date	
LCD test	
Serial Number	
Average demand of current integration period	
Maximum demand of current billing period	Displays values of activated tariffs only
Maximum demand of last billing period	Displays values of activated tariffs only. Arrow "Historical values" is activated.
Energy of current billing period	Displays values of activated tariffs only
Energy of last billing period	Displays values of activated tariffs only. Arrow "Historical values" is active.
Rated energy registers	Displays values of activated tariffs only
Total energy registers	

Display period of one value can be programmed from 5 to 99 sec.

10.3 Indication of abnormal states

If meter detects internal failures or abnormal state in network (power outages, reverse current flow), it displays on LCD the following messages:

Er   fatal failure of the meter. Further exploitation of the meter is not allowed. If this message occurs, meter has to be uninstalled.

L1L2L3 The whole non-blinking message indicates presence of voltage in all three phases.
- If some character disappears it means that there is no voltage in that phase.
- Blinking character indicates reverse current flow in that phase.
- Blinking of the whole message indicates abnormal sequence of voltage phases.

⬒   Voltage of backup power supply felt below critical level. It means super capacitor has to be charged or battery has to be changed. Only manufacturer or it representative can change the battery! In case of super capacitor, time switching of tariffs is not possible, therefore single-tariff operation is carried out. Time and date has to be set in the meter in order to recover a normal operation of the tariff module.

Internal meter errors
A list of internal meter errors can be accessed only via communication interfaces. If there are internal errors registered in the list, read meter data again (a single internal error can be random and caused by various reasons). If there is no new error in the newly received list, the meter can be exploited further. If the newly received list contains a new internal error, the meter has a fatal error and must be uninstalled.
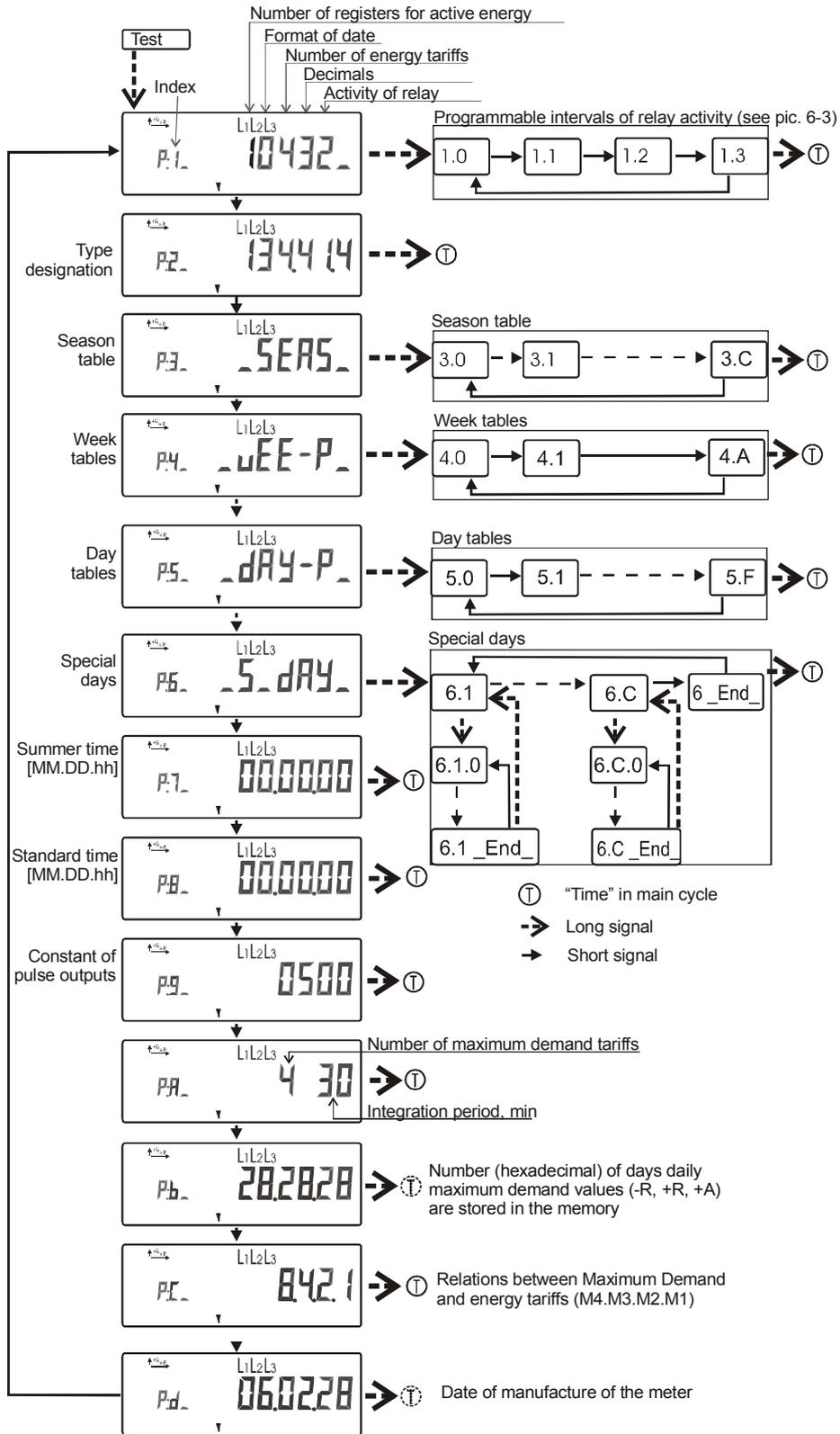
Figure 10-2. Scrolling diagram of parameters
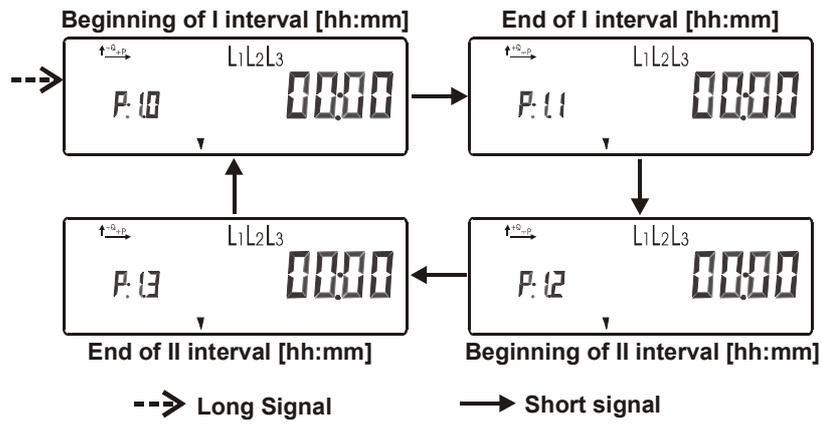
Figure 10-3. Scrolling diagram of relay program
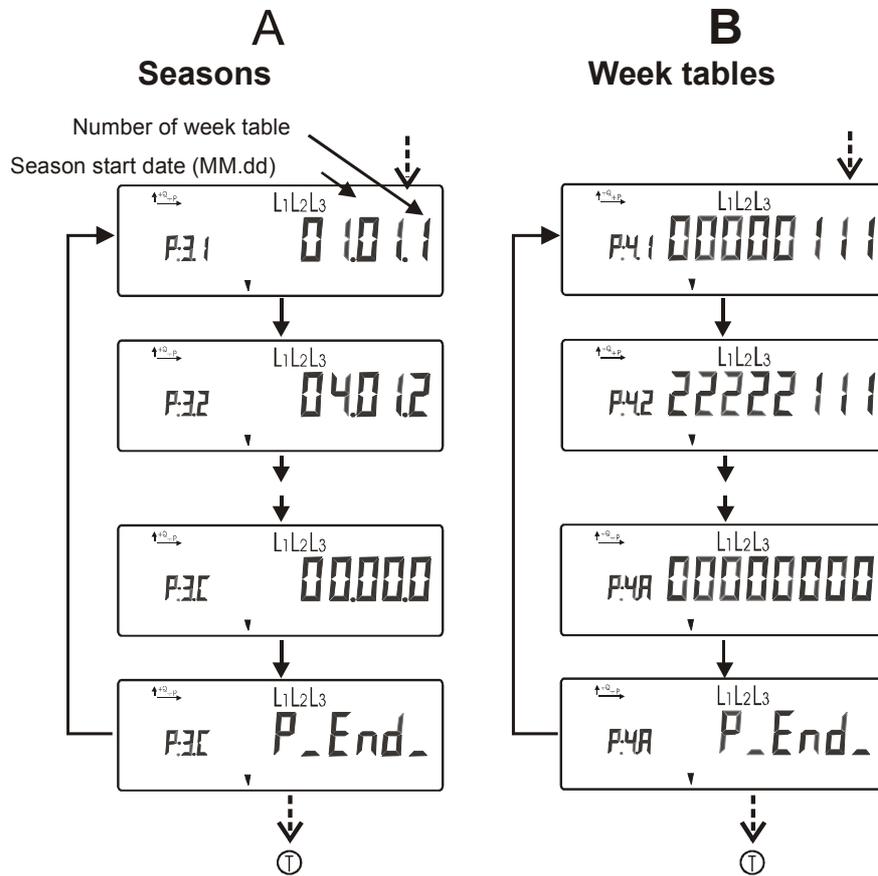
Figure 10-4. Scrolling diagram of season and week tables

Indicator of active profile

Time of tariff change (hh.mm)

Number of
of change of tariff

Number of tariff
to be activated
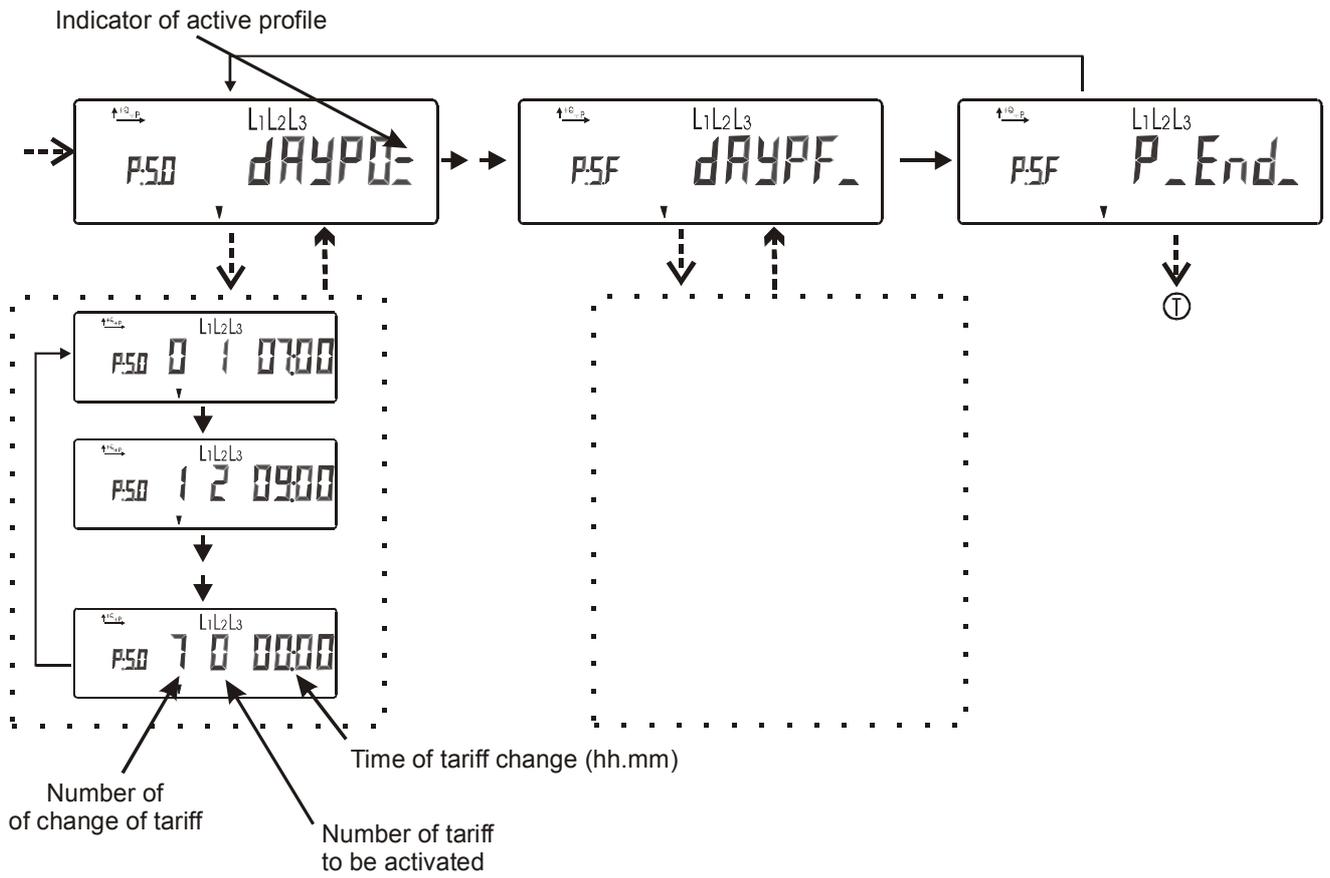
Figure 10-5. Scrolling diagram of day tables

January

Number of special days in month

February

December

Special days

Time

Long signal   Short signal
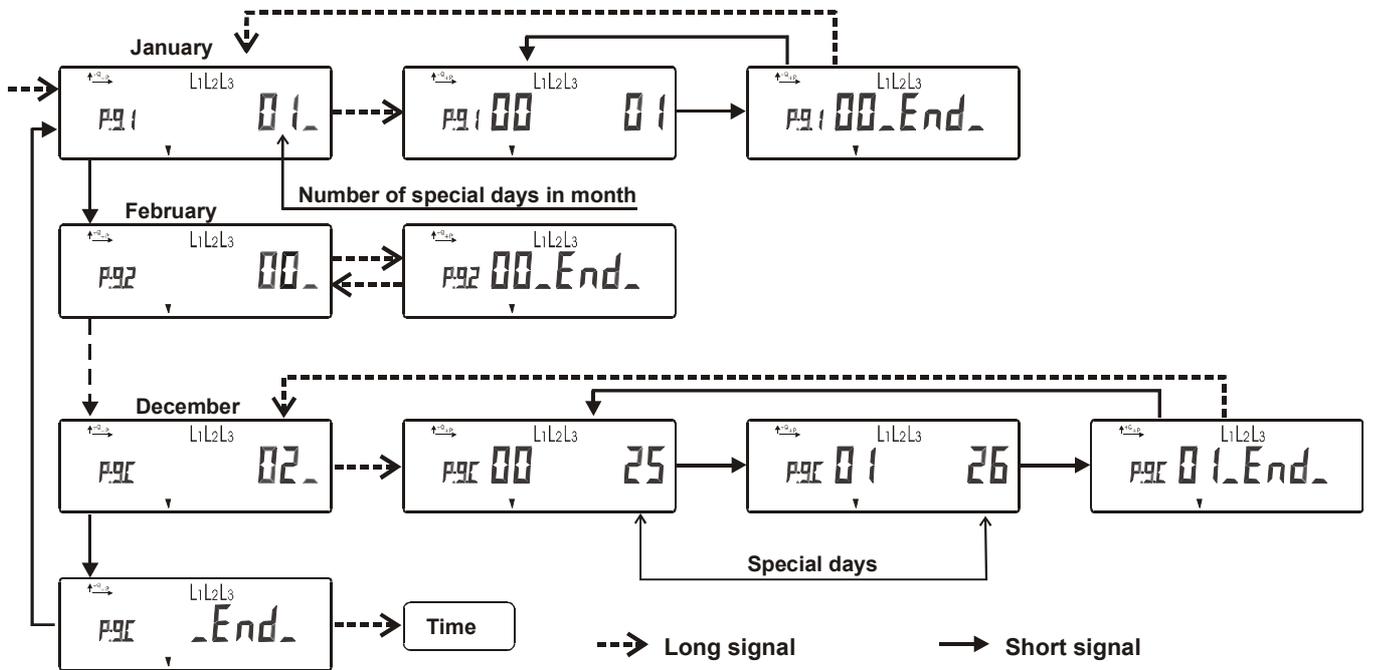
Figure 10-6. Scrolling diagram of special days

Active +	Active -	Reactive +	Reactive -	
140 0670 kW	240 0670 kW	340 0.000 kVAr	440 0.000 kVAr	
161 (T1)	261 (T1)	361 (T1)	461 (T1)	**Maximum demand of current billing period**
162 (T2)	262 (T2)	362 (T2)	462 (T2)	
163 (T3)	263 (T3)	363 (T3)	463 (T3)	
164 (T4)	264 (T4)	364 (T4)	464 (T4)	
161 (T1)	261 (T1)	361 (T1)	461 (T1)	**Maximum demand of last billing period**
162 (T2)	262 (T2)	362 (T2)	462 (T2)	
163 (T3)	263 (T3)	363 (T3)	463 (T3)	
164 (T4)	264 (T4)	364 (T4)	464 (T4)	
191 (T1)	291 (T1)	391 (T1)	491 (T1)	**Energy of current billing period**
192 (T2)	292 (T2)	392 (T2)	492 (T2)	
193 (T3)	293 (T3)	393 (T3)	493 (T3)	
194 (T4)	294 (T4)	394 (T4)	494 (T4)	
191 (T1)	291 (T1)	391 (T1)	491 (T1)	**Energy of last billing period**
192 (T2)	292 (T2)	392 (T2)	492 (T2)	
193 (T3)	293 (T3)	393 (T3)	493 (T3)	
194 (T4)	294 (T4)	394 (T4)	494 (T4)	
181 (T1)	281 (T1)	381 (T1)	481 (T1)	**Total energy**
182 (T2)	282 (T2)	382 (T2)	482 (T2)	
183 (T3)	283 (T3)	383 (T3)	483 (T3)	
184 (T4)	284 (T4)	384 (T4)	484 (T4)	
180 (TΣ)	280 (TΣ)	380 (TΣ)	480 (TΣ)	

Figure 10-7. Scrolling diagram of billing data

Code of data

Reactive energy +R

Indicator of voltage phase sequence

Active energy +A

L₁L₂L₃   kW h   Measurement unit

Value identificator

19   16.85

Historical values

Tariff of value

Value

Index of parameter

Active energy -A

L₁L₂L₃

Reactive energy -R

P.33   08-31

Parameter symbol
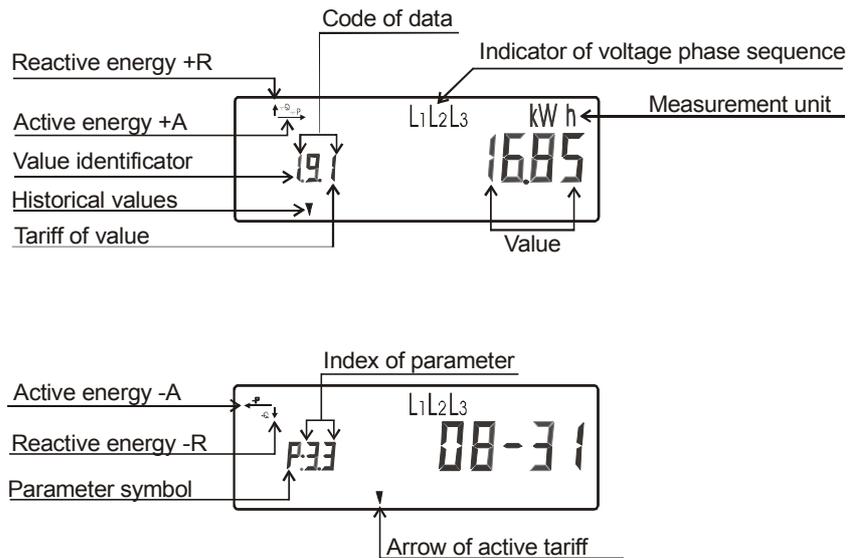
Arrow of active tariff

Figure 10-8. Examples of data indication

10.4 Data reading via communication interfaces

For local data readout via optical interface, an optical head shall be used to connect meter to a serial port of PC. Communication is performed according to the standard protocol IEC62056-21. Manufacturer provides software LZEMSGS for data reading. The software features graphical user interface for data readout, database management and graphical interpretation of meter data. For detailed information see user manual of the appropriate software.

Electrical interface enables connection of the meter to Automatic Meter Reading (AMR) system for remote data readout. Please refer to chapter 4.3.2 for information about available electrical interface options. For local data readout via electrical interface, an appropriate converter shall be employed (e.g. current loop/RS232 or RS485/RS232). PLC, RF, PSTN, GSM, GPRS modems can be implemented for further data transmission. Please note, that electrical interface employs IEC62056-31 protocol.

11 Parameterization

Parameterization has to be carried out in order to adopt meter settings to the utility requirements. An example of meter settings is presented in annex A.
Parameterization is performed by means of LZEMSGS software via an optical interface. For detailed information on using parameterization software refer to the LZEMSGS user manual.

Meter settings (parameters) are protected by password (see chapter 12.2).
Changing of certain parameters causes a reset of some data stored (see Table 11-1 for a list of such parameters).

Table 11-1. Parameters that cause stored data reset

Parameter	Data		
	Maximum demand of billing period	Daily maximum demand	Load profiles
Integration period	reset	reset	reset
Relation between energy and demand tariffs	reset	reset	–
Number of maximum demand tariffs	reset	reset	–
Daily maximum demand storage time	–	reset	–

12 Security system

The data and parameters of the meter are protected against unintended or improper access by a multi-stage security system.

12.1 Sealing

The utility seals must be broken in order to open the terminal cover. Opening of main cover is secured by the verification seals. Location of seals is shown in Figure 4-1. Furthermore, a special function of the push-button (e.g. billing period reset) can be sealed by utility also.

12.2 Password

Meter parameterization is protected by a static 8-character password. For the password any of the ASCII symbols is allowed. If password is set, the user needs to know the password. It is checked by the meter and access is granted, only if the passwords match.

A system of prevention from password guess is implemented too. If the meter registers more than four cases of trying to parameterize the meter by using the wrong password, optical communication interface is blocked for 24 hours period. During this period the meter does not accept even the correct password.

12.3 Blocking of optical communication interface (optional)

In some modifications, blocking of the optical communication interface is implemented, in order to protect against unauthorized data readout and parameterization. The utility seal needs to be broken and the push button has to be pressed in order to unblock communication (see Chapter 4.6). Communication is unblocked for 1hour, and afterwards it is blocked automatically again.

12.4 Event Log

The event log is an aperiodic memory in which irregular events are captured that may occur in the meter or in the network the meter is connected to. Entries of the event log can be readout via communication interfaces. The list below presents all events that are recorded in the event log:

Internal errors of meter
- Resets of the microprocessor (watchdog);
- Checksum errors.

Date and time of last parameterization

Power outage
- total number of power outages,
- date and time of last 32 power outages.

Remark: if duration of power outage is less than parameterized threshold, date and time of this power outage is not registered, although total number of power outages is incremented.

Missing of any phase voltage
- date and time of last 10 occurrences when any phase voltage was missing.

Reverse current flow
- total duration of reverse current flow;
- date and time of last reverse current flow:
  - ✓ begin date and time;
  - ✓ end date and time;
  - ✓ duration.

Influence by a strong magnetic field
- total number of influences;
- total duration of influences;
- date and time of last influence.

Opening of terminal cover
- total number of openings;
- total duration of openings;
- date and time of last cover opening,

Remark: opening of terminal cover causes an immediate billing period reset and billing data (energy and maximum demand registers) are stored in the non-volatile memory.

12.5 Other means of prevention

Independently of the current flow direction, energy is recorded as an increasing cumulative value. In case of reverse current flow, LCD displays a warning – symbol (**L₁**, **L₂**, **L₃**) of a corresponding phase flashes.

13 Technical service of the meter

13.1 Installation

Installation, de-installation and verification of meter must be carried out only be a person who has an adequate qualification and is familiar with this manual. Figure 13-1, Figure 13-2 and Figure 13-3 present schemes of meter connection into electricity network.
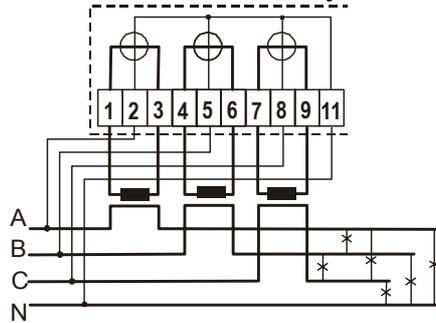

Figure 13-1. Three element meter connection into four-wire network via current transformers
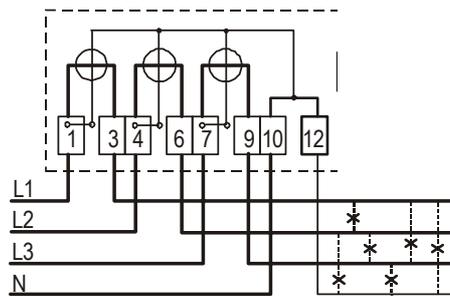
Figure 13-2. Three element meter connection into four-wire network
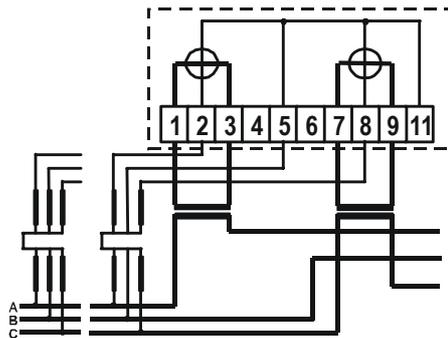
Figure 13-3. Two element meter connection into three-wire network via current and voltage transformers

Prior to installation of the meter it is necessary to make sure that there is no humidity condensate inside. In case meter was stored in a non-heated room, it is necessary to keep meter for at least 6 hours in a heated room before installation.

Note: *this instruction presents general schemes of meter connection. Connection scheme of auxiliary terminals may slightly differ as it depends on the number of auxiliary outputs and allotment of*

auxiliary terminals in the terminal block. Please refer to the passport of the meter for the exact connection scheme. Location of auxiliary terminals is presented in Figure 13-4 and Figure 13-5.
In case of installation of direct-connected meter, voltage and current circuits of each phase need to be connected by means of voltage links (see in Figure 13-4).
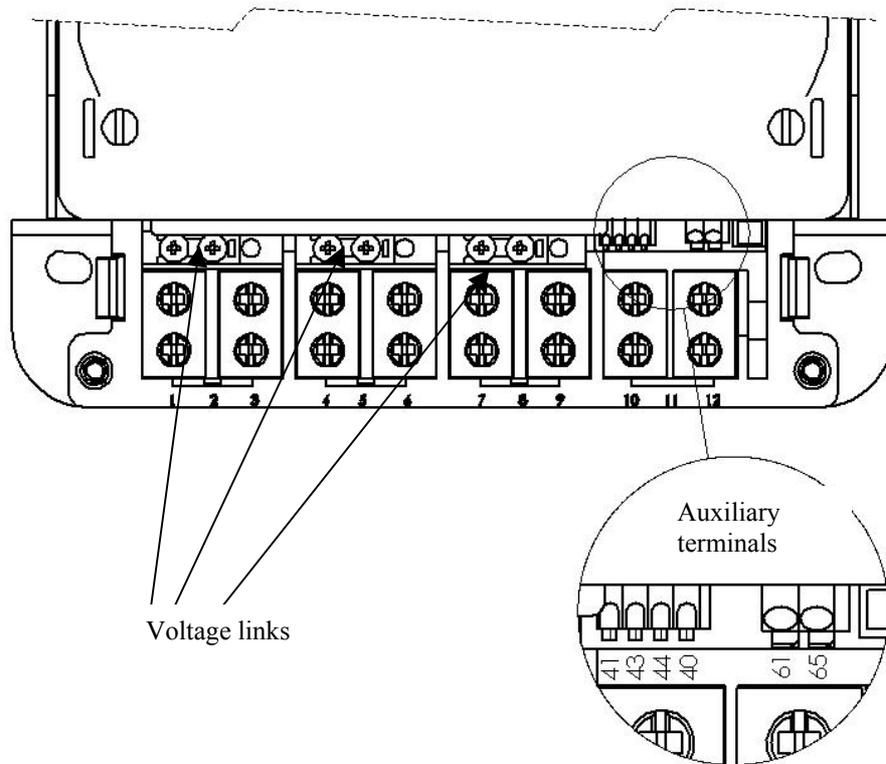

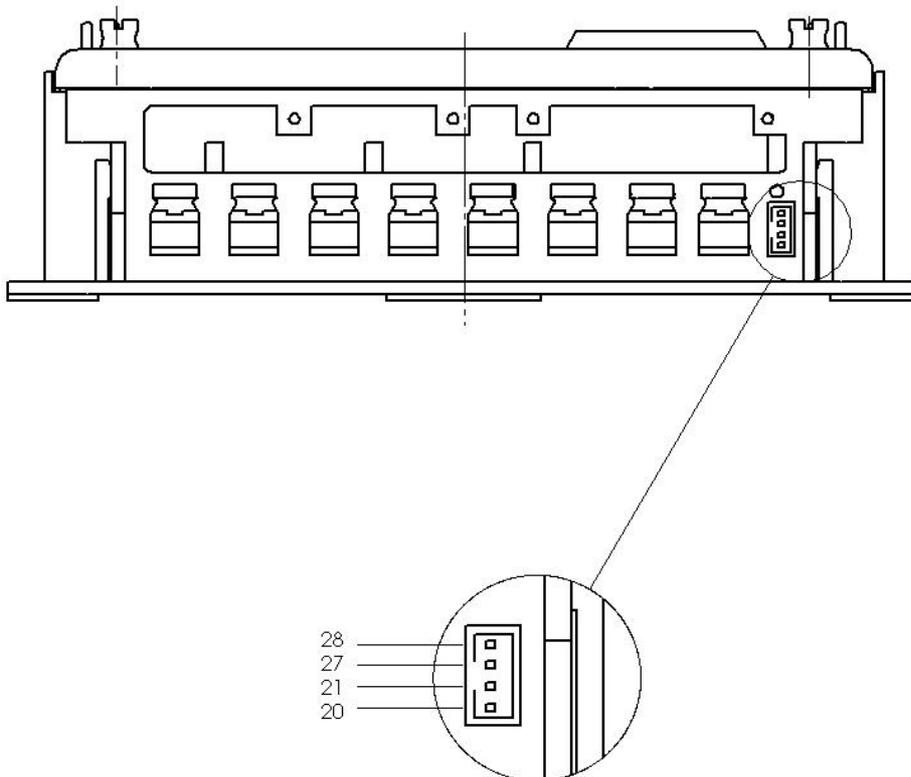*Figure 13-4. Location of voltage links and auxiliary terminals*

Figure 13-5. Location of electrical interface terminals

13.2 Safety requirements

1. Safety rules of electric equipment maintenance should be followed while installing and using a meter.
2. Installing, uninstalling, parameterization and verification can be performed only by an authorized organizations that have technicians with necessary qualifications.
3. Meter's connection or disconnection from the network should be done when voltage in the network is turned off. A protection from accidental network voltage connection must be established.
4. No accessories can be hung on a meter, it is forbidden to hit or strike meter's case.

13.3 Transportation and storage rules

1. Prior to the usage meter has to be kept in a closed room, where the temperature ranges from 5°C to 40°C and average air humidity is up to 80% when temperature being 25°C, in a transportation packing. The room must be without harmful gas or steam.

2. Packed meters are put in the shelves not more than five rows on each other and not nearer than 0.5 m from heating devices.

3. Unpacked meters can be kept only in repair workshop. Meter can be loaded not more than five rows on each other and separators must be used. The temperature must range from 10°C to 35°C, average area humidity must not exceed 80% when temperature being 25°C.

4. During wintertime meters must be kept in a heated room for 6 hours or more.

5. Meters are to be transported only in closed vehicles (carriage, container, hold). Shake acceleration is to be up to 30m/s², 80-120 strikes per minute. The temperature must range from -50°C to +50°C, average area humidity must not exceed 98% when temperature being 35°C.

13.4 Prevention and elimination of malfunctions

If it is suspected that meter works improperly, the following actions should be performed:

13.4.1 Exterior inspection

Before applying voltage to the meter, make sure that the case has no mechanical damages, there are no signs of overheating, all wires are properly connected.

Do not plug a meter into network if it is mechanically damaged. This can cause staff injuries and destroy meter as well as other equipment!

13.4.2 Inspection of connection and parameterization

After plugging a meter into electric network check whether date and time are correct, whether meter shows the correct energy direction, valid tariff time zone, calendar and tariff seasons.
1. If meter shows wrong date and time, contact a representative from the organization in charge of the meter installation.
2. If LCD indicator shows a warning message **'Er'**, the meter should be uninstalled and passed for repair works.
3. If energy direction is wrong, check if inputs are connected properly to the terminal block.

4. If meter calendar season, season time or valid tariff time zone does not correspond to the real situation, meter's parameterization data has to be checked and errors has to be corrected by repeating meter parameterization.

13.4.3 Procedure of returning to manufacturer

In case malfunctions cannot be eliminated on the spot, the meter should be returned to the manufacturer for repair or replacement. Meters on their return to enterprise must have their passport with remarks, made by organization in charge of their exploitation, and short description of meter malfunctioning.

14 Annex A. Example of parameter set

Parameterization data

User identifier:	**LIETUVA**				
Active energy directions:	**1**, 2				
Number for energy tariffs:	1, 2, 3, **4**				
Number for demand tariffs:	1, 2, 3, **4**				
Integration period, min:	5 10 15 20 **30** 60				
Display scroll time	**10s**				

Daylight saving time	[MM-DD hh:nn]			
Start:	**00-00, 00**			
End:	**00-00, 00**			
Voltage transf. coefficient	**1,00**			
Current transf. coefficient	**1,00**			
Date format:	[WD], **[YY]**			
Number of decimals in energy:	0, **1**, 2, 3			

Duration (in days) of data storage:	**+A**	**-A**	**+R**	**-R**
for daily maximum demand	**40**	**X**	**40**	**40**
for load profiles	**14**	**X**	**14**	**14**

Do not register power outage if outage duration is:	**<10s**	

Relation between energy and demand tariffs		**T1**	**T2**	**T3**	**T4**
	M1	√			
	M2		√		
	M3			√	
	M4				√

S0 pulse output constant:	**500**	Imp/kWh, imp/kVArh
Relay output function:	**T0 T1 T2 T3 T4**	
T0 – relay activation intervals	[hh:mm-hh:mm]	
T0(1):	**00:00 – 00:00**	
T0(2):	**00:00 – 00:00**	

Selection of registers in automatic scroll

Time	Date	Test	Sr. No.	CD +A	CD -A	CD +R	CD -R	
	+A	1_Cd	1_Ld	1_C	1_L	Total	SUM	CD – average demand of current period;
	-A	2_Cd	2_Ld	2_C	2_L	Total	SUM	Cd – max. demand of current month;
	+R	3_Cd	3_Ld	3_C	3_L	Total	SUM	Ld – max. demand of last month;
	-R	4_Cd	4_Ld	4_C	4_L	Total	SUM	C – energy of current month;

L – energy of last month;
Total – total energy

Special days

Month	Day	Month	Day	Month	Day
January	**1**	May	**1**	September	
February	**16**	June		October	
March	**11**	July	**6**	November	**1**
April		August	**15**	December	**25, 26**

Movable Special days

2004.04.12	2005.03.28	2006.04.17	2007.04.09	2008.03.24	2009.04.13	2010.04.05	2011.04.25
2012.04.09	2013.04.01	2014.04.21	2015.04.06	2016.03.28	2017.04.17	2018.04.02	2019.04.22

Tariff seasons and week profiles related to them

No.	Date	W. pr	No.	Date	W. pr	No.	Date	W. pr	No.	Date	W. pr
1	04.01	1	4	10.01	3	7	00.00	0	10	00.00	0
2	05.01	2	5	00.00	0	8	00.00	0	11	00.00	0
3	09.01	1	6	00.00	0	9	00.00	0	12	00.00	0

Week profiles

No	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday	Spec. day
1	1	1	1	1	1	0	0	0
2	2	2	2	2	2	0	0	0
3	3	3	3	3	3	0	0	0

Day profiles

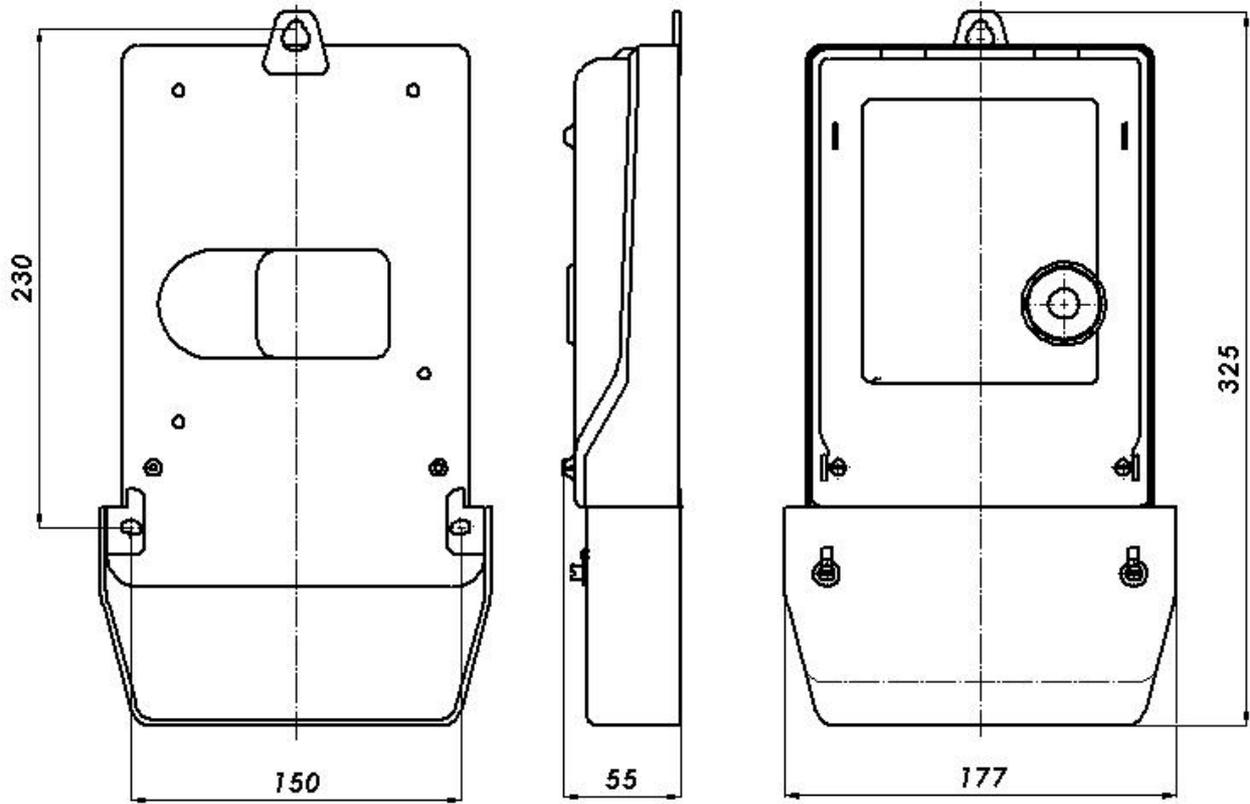| No	Switch of tariffs															
	1		2		3		4		5		6		7		8	
0	07:00	T3	23:00	T4												
1	07:00	T2	09:00	T1	12:00	T2	19:00	T1	21:00	T2	23:00	T4				
2	07:00	T2	09:00	T1	12:00	T2	23:00	T4								
3	07:00	T2	08:00	T1	11:00	T2	18:00	T1	20:00	T2	23:00	T4				

15 Annex B. Dimensions of the meter

Figure 15-1. Dimensions of the meter and fixing holes