

**SINGLE-PHASE  
STATIC  
WATT-HOUR  
METER WITH  
DIFFERENTIATED  
RATING**

**SINGLE-PHASE STATIC  
WATT-HOUR METER WITH  
DIFFERENTIATED RATING**

**1. GENERAL**

**1.1 Application**

This product is intended for the metering of the active energy consumed by users connected to the single phase, low voltage network. The product can be used by both domestic and industrial users

**1.2 Notation, codification and orderig code**

Notation:

Single phase static watt-hour meter, type

**CSM - [x][x][x]**



The combination of the letters specifies the constructive and the electrical parameters of the meter, as follows:

First letter	Constructive variant	<b>A</b> meter with internal change-over clock; <b>B</b> meter without internal change-over clock;
Second letter	Reference current / Maximum current ( $I_b / I_{max}$ )	<b>A</b> 10 A / 40 A <b>B</b> 20 A / 80 A
Third letter	Reference voltage ( $U_{ref}$ )	<b>A</b> 230 V <b>B</b> 240 V

**The meter can operate at maximum current for an indefinite period**

Ordering code

Example: CSM - ABA

Meter with internal change-over clock, for reference current  $I_{ref} = 20$  A, maximum current 80 A, reference voltage  $U_{ref} = 230$  V.

Available variants

with internal clock for tariff change-over:

- CSM AAA
- CSM AAB
- CSM ABA
- CSM ABB

without internal clock for tariff change-over:

CSM BBA

NOTE:

The meter is intended to operate at  $f_{ref} = 50$ Hz.

Upon request, meters for  $f_{ref} = 60$ Hz - 5% can be delivered.

**1.3 Classification according to IEC**

<b>Accuracy class</b>	Class 1
<b>Operating conditions</b>	Continuous
<b>Network</b>	Single phase
<b>Meter connection</b>	Directly connected meter
<b>Number of wires</b>	Two-wired (phase and neutral wire) meter
$I_b / I_{max}$	High measuring capacity meter
<b>Temperature coefficient</b>	< 0,05% /°C at cos $\phi=1$ < 0,07% /°C at cos $\phi=0,5$ (The value for the range -25°C ... +55°C is 0.02% /°C)



**ELECTROMAGNETICA S.A.**  
Bucharest, 050912  
266-268 Calea Rahovei,  
Phone: 021 4042 146  
Fax: 021 4042 148  
<http://www.electromagnetica.ro>



# SINGLE-PHASE STATIC WATT-HOUR METER WITH DIFFERENTIATED RATING

## 1.4 Environmental conditions

The meter is designed to work both indoors and outdoors, within the following conditions:

Macro climatic zone	N
Operation category	3
Atmosphere aggressiveness degree	3
Operating temperature	-25°C to +55°C
Transport and storage temperature	-25°C to +70°C
Relative humidity	80 % at 20°C
Maximum humidity	100 % at 25°C
Maximal altitude	2000 m
Normal degree of protection	IP 51

## 1.5 Product description

Constructively the product consists of the case that encloses:

- a) Base
- b) Transparent cover of meter, which allows reading the display indications and the marking elements printed on meter front panel. Two buttons and the optical port output are located on the transparent cover. They allow the user and the maintenance personnel to access the meter.

The user can sequentially display the indexes of the four tariffs and the TOTAL index, by pressing the unsealed button of the meter. The display time for each screen is 20 seconds, then the normal display conditions are restored. For the meters of AXX type (where xx could be any of the letter combinations presented above) the information displayed when pressing the unsealed button includes also current date and time and the display test.

Displaying the indexes by means of the unsealed button depends on the meter current programming method, the following variants (valid beginning with the meter software version 1.0) being possible:

- display of used tariff indexes only (according to the rating schedule programmed in the meter);
- display of tariff indexes selected by user when reprogramming the meter (only part of the 4 tariffs can be selected for display).

Changing the displayed information has no influence on the electrical energy consumption recording.

The second button is active only on the A[X][X] type for the maintenance personnel. This button allows exchanging internal information on the current date and time. The button is sealed in the "blocked" position during the meter normal operation.

Through the transparent cover, information can be read / written in the meter registers, by connecting the Hand Held Unit designed for this purpose to the infrared port. In this way, the maintenance personnel can read the energy consumption values, can verify or correct the information on the current date and time or can completely program the meter (i.e. tariff change-over schedule, season distribution along the year - see "Meter operation"). Communication through the infrared port is made in accordance with IEC 1107.



### Auxiliary port

The meter has one auxiliary port provided with mechanical connecting elements for wiring:  
CSM AXX - auxiliary port with one input and two outputs, with functions depending on the



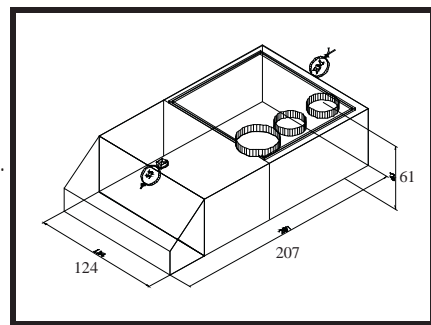
# SINGLE-PHASE STATIC WATT-HOUR METER WITH DIFFERENTIATED RATING

- meter programming method.
- CSM BXX - two inputs for establishing the active tariff.

- c) Terminal block - which connects the meter to the electrical network.
- d) Terminal block cover - which protects and secures the terminal block. The cover is sealed by the personnel of the power distribution company that installs the meter at the user's place.

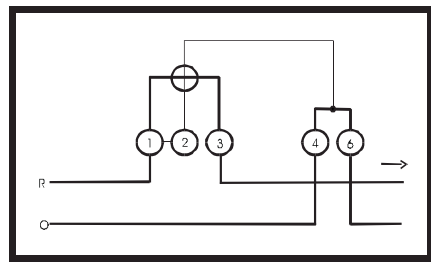
## 1.6 Construction, dimensions and weight

The meter construction and dimensions are in accordance with the Romanian STAS 4198-79 (see next picture). Installation is thus ensured on the fastening systems used in Romania until 1989. Meter net weight: max 0.85 kg.



## 1.7 Connection diagram

The connection diagram is in accordance with Romanian STAS 4198-79. The diagram is marked on the inner side of the terminal block cover.



## 2. METER OPERATION

The method used for measuring the active energy consumption is the numerical integration and multiplication of the current and the voltage values, obtained from two digital-analog converters with automatic offset cancellation.

### 2.1 Active tariff setting depending on the season, the day type and the day moment

The number of tariffs is 4 (T1...T4)  
Setting the active tariff is differently made for the two meter variants as follows:

#### CSM A[X][X] - with internal change-over clock:

- the current date determines the season;
- for each season up to eight day moments (hour, minute) can be defined, which determine the tariff change;
- hour and day type (week-day, weekend day, holiday and special day) determine the active tariff.

The change-over clock is synchronized with quartz (as per CEI 1038:1990) and allows programming the tariff change moments with an increment of 1 minute. The change-over moments can succeed at 1 minute intervals. For this meter variant the active tariff can be established considering the consumed power, too.

The power threshold for the tariff change-over can be programmed.

#### CSM B[X][X] - without internal change-over clock:

- For this variant the active tariff is determined by the signals status at the auxiliary port. In absence of the external control, the active tariff is T4.

### 2.2 Active tariff setting depending on the season, day type, day moment and power

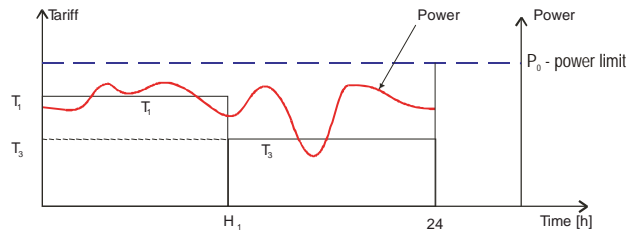
Whether the differentiated rating will also be done according to the power consumption may be established by programming. In this case the active tariff will be established depending on the upper parameters and on the power consumption compared to a programmed power threshold. This power is estimated with an accuracy of 1% by one minute integration.

# SINGLE-PHASE STATIC WATT-HOUR METER WITH DIFFERENTIATED RATING

**Example:**

**a. Rating sequence depending on the date/time or when the power threshold is not exceeded**

In this example, the registration are made in T1 and T3 tariffs representing simple "day, night" type registrations.

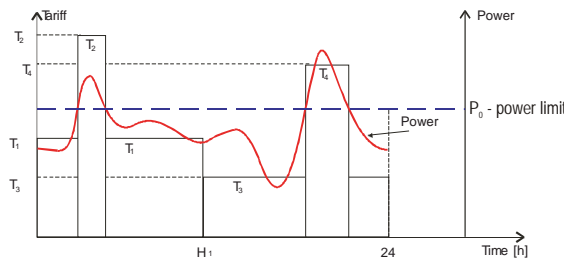


**b. Rating sequence when the power threshold is exceeded:**

T1 and T3 have the same significations as in the upper example;

T2 is the metered energy in case the  $P_0$  power threshold is exceeded during "day" type rating period (T1);

T4 is the metered energy in case the  $P_0$  power threshold is exceeded during "night" type rating period (T3);



The rating conditions according to the power threshold allow distinctly highlighting the consumed energy when  $P_0$  is exceeded.

**NOTE:**

The relay outputs may be set to trigger when the  $P_0$  threshold is exceeded both for signaling and for different actuators.

For details see *Technical Description and Application Notes*.

All these parameters can be programmed using the Hand Held Unit without interrupting the normal operation of the meter.

**2.3 Liquid Crystal Display**

A liquid crystal display (LCD) is used, with 7 figures and symbols for active tariff and totaliser. The indexes for tariffs 1...4, total index, hour, minute, date, day of week are displayed on "screens" with different symbols for identification.

Under normal operating conditions, the meter type BXX (without internal clock of tariff change-over) displays the index of the active tariff. The display of other "screens" is made by scrolling initiated by pressing the upper button (SC) on the meter transparent cover.

For the meter type AXX (with internal clock), program version up to 1.0, under normal operating conditions the active tariff index is displayed. Starting with the program version 1.0 (inclusive) the following possibilities are available for the data display (they can be selected at when re-programming the meter):

Continuous display of active tariff index

TOTAL index display

Continuous scrolling of displayed index, at 60 seconds interval; the indexes can be displayed successively in the variants:

- scrolling of used tariffs indexes (according to the rating program) and of TOTAL index
- scrolling of tariffs indexes selected by user at meter reprogramming (it can be selected to be automatically displayed all 4 tariffs or only part of them) and of TOTAL index



# SINGLE-PHASE STATIC WATT-HOUR METER WITH DIFFERENTIATED RATING

## 2.4 Communication

The communication is made through the Optical Port that ensures the interface at physical level as per IEC 1107:1996 and the meter reading to protocol D (IEC 1107:1996). The meter variant with internal change-over clock allows programming the meter, the calendar and the rating information as per a subset of the protocol C (IEC 1107:1996).

## 2.5 Data retention

The meter maintains the indexes, the TOTAL index, real time clock information and the rating schedule (the last two for the internal clock variant) for a period of 2 years without power supply by observing the maintenance program.

## 2.6 Pulse output

The meter has pulse outputs placed as follows:

### CSM A [X][X] - with internal change-over clock:

an output is red LED on the panel and another is IR LED from the optical port. The later generates test pulses in TEST MODE (P1), established by programming from the meter buttons;

### CSM B [X][X] - without internal change-over clock:

an output is on red LED of front panel (that also signals the working condition) and another one is on IR LED from optical port. The frequency of the generated pulses is proportional to the measured active energy.

## 2.7 Supplementary facilities of meters type AXX (with internal clock for tariff change-over):

- automatic pass at summer hour/return to the winter hour on programmed dates (starting with program version 1.0 these can be programmed as fixed dates for time updating or in accordance with the local rule of summer hour passing - it does not need data reprogramming at each year beginning.
- monthly "autosave" of meter indexes at a programmable date
- storage of date when last energy consumption was registered
- storage of user's ID (series and password) for the last reprogramming of the clock/of the working parameters of the meter
- programmable functions of auxiliary port.

## 3. TECHNICAL DATA

### 3.1 Constructive, functional, physical, mechanical, chemical characteristics

#### Meter case

- The case is designed in such a way to prevent any non-permanent deformation from disturbing the good operation of the meter.
- The base allows fastening the counter on a panel.
- The transparent cover can be detached to access the internal electronic circuit, only after removing the seal and only by means of a screwdriver.

#### Terminal block

- The terminal block is made of insulating, non-hygroscopic material complying with ISO 75-2:1993 specifications for the temperature of 135°C and the pressure of 1.8 MPa.
- The holes for passing the wires have at least 8 mm diameter.
- The minimal distance between two conductive parts measured on the insulating surface is 10 mm, in conformity with IEC 61036:2000.
- The minimal distance between two conductive parts measured in the air is larger than 5.5 mm in conformity with IEC 61036:2000.
- The terminal block cover protects the terminal block and the conductors on a distance of at least 40 mm.
- The terminal block cover is fixed and sealed separately from the meter casing.

#### Terminals

- The terminals are accessible after removing the terminal block cover, without removing the meter cover.
- The voltage terminals are separated from the current terminals by the insulation barrier.
- The terminals are marked on the insulated body of the terminal block as per the connection diagram
- The terminals allow connecting wires of up to 6 mm diameter.



# SINGLE-PHASE STATIC WATT-HOUR METER WITH DIFFERENTIATED RATING

## 3.2 Electrical characteristics

### Circuits consumption

- The apparent and active powers consumed in the meter voltage circuit at the reference voltage, the reference temperature and the reference frequency shall not exceed 3W (typically 0.6W) and 25VA (typically 4VA) capacitive for the AXX types and 2W (typically 1W) and 10VA (typically 8VA) for the BXX types (according to IEC 1038:1991 and IEC 1036:1996, respectively)
- The apparent power consumed by the current circuit of a meter directly connected to the rated current, the reference frequency and the reference temperature, shall not exceed 4VA, according to IEC 1036:1996.

### Calibration

- The meter can be re-calibrated every 5 years, along with the periodical metrological check, according to the Official List approved by BRLM.

### Accuracy class

- The meter accuracy class is 1.
- The relative errors shall not exceed the values provided in IEC 1036:1996.

### Meter constant

- 640 pulses/KWh for CSM BXX.
- 2560 pulses/KWh for CSM AXX.

### Initial start-up of the meter

- The meter begins to operate in less than 5 s after supplying the nominal voltage to the terminals.

### No load running

- When the voltage is supplied without any current flow through the current circuit, the meter test output gives no more than 1 pulse, regardless of the period.

### Sensitivity

- The meter starts and continues to register for a current  $I = 0,004 I_b$  and power factor 1.

### Influence of short-time over currents

- The meter can withstand a short-time over current of  $30 I_{max}$  for a half-cycle at the rated frequency and of  $20 I_{max}$  for 0,5 s.
- The meter correctly operates when it returns to the initial operating conditions and error variation does not exceed 1,5%.

## 3.3 Protections

- The product is designed in such a way to avoid any danger during the normal operation.
- The meter ensures:
  - staff protection against electrical shocks;
  - protection against over temperature;
  - protection against fire spread;
  - minimal risk of touching any accessible under voltage or conductive parts caused by the accidental loosening of a winding or a screw.

### Electrocution protection class

- The meter is designed in the electrocution protection class II (STAS 11054-78).

### Fire spread

- The terminal block, the terminal block cover and the meter case the fire spread protection.
- The parts composing the meter case are resistant to the glow wire test in conformity with IEC 695-2-1:1980.

## 3.4 Influence of environment on the product

### Protection against sun radiation

- The meter resists to the sun radiation. The meter operation and appearance, especially the marking accuracy shall not be affected.

### Resistance to mechanical stress

- The meter resists to the shock test, according IEC 68-2-27:1987.
- The meter resists to the vibration test, according IEC 68-2-6:1982.



# SINGLE-PHASE STATIC WATT-HOUR METER WITH DIFFERENTIATED RATING

- The meter resists to the spring hammer test, according IEC 817.
- The meter resists to usual mechanical stress that could occur during transport or operation.

#### Protection against penetration of dust and water

- The meter complies with the protection degree IP 51.

#### Electromagnetic compatibility

- The meter is not affected by electrostatic discharge according to IEC 1000-4-2:1995.
- The meter is immune to external electromagnetic field or high frequency according to IEC 1000-4-3:1995.
- The meter is not affected by repetitive pulses according to IEC 1000-4-4:1995.

### 3.5 Influence of product on the environment

#### Radio interference

- The meter does not produce conducted or radiated radio interference, which could affect other equipment, according to SR CISPR 22:1996 equipment class **B**.

### 3.6 Endurance test

- The product resists to an endurance test of 200 h.

## 4. MARKING, CONSERVATION, PACKING, TRANSPORT, STORING, ACCOMPANYING DOCUMENTS, DELIVERY INVENTORY

### 4.1 Marking

A plate with the following markings is fixed inside the meter, behind the transparent cover:

- Manufacturer's trademark;
- Meter type and symbol for single phase meter connected with 4 wires;
- Serial number and year of manufacture;
- Reference voltage in V;
- Reference current and, between the brackets, the maximum current in A;
- Rated frequency in Hz;
- Meter constant in pulses / KWh;
- Accuracy class, marked by the corresponding index in a circle;
- Symbol of the electrocution protection class;
- Symbol for unidirectional recording for AXX types;
- Bar code (serial number and year of manufacture, ordering code, manufacturing code);

### 4.2 Conservation

- The meter are delivered with the transparent cover sealed by the State metrological authority.
- The lithium battery for data retention is connected and activated;
- The 2 years period of data maintaining when the meter has no power supply begins with the delivery date.

### 4.3 Packing

- The meter is packed in a plastic bag introduced in a corrugated cardboard or polystyrene box, together with delivery inventory and lot measurements report.
- The individually packed meters can be also delivered in collective packing, observing the following conditions:
  - the number of superimposed rows should be max. 8 individually packed meters;
  - the empty spaces among the individual packing should be filled in with industrial wood chips or corrugated cardboard.
- The individual and collective packing shall be visibly marked with humidity resistant warning signs according to Romanian STAS 5055-66 for: humidity protection, fragile contents warning and indicating the right position of packing during handling, transport and storage.
- The collective packing include a packing sheet with the manufacturer's trademark, the meter denomination, type and number and the packing date.

### 4.4 Transport

- The transport is made in the own packing boxes, in containers, by any means of transport.
- Temperature limits during transport     -25°C to 70°C.
- Air relative humidity                             80% at 20°C.



# SINGLE-PHASE STATIC WATT-HOUR METER WITH DIFFERENTIATED RATING

## 4.5 Storage

- the meter should be stored in dry closed rooms, free of dust, corrosive agents, steam and gas with degrading action.
- storing temperature  $-25^{\circ}\text{C}$  to  $70^{\circ}\text{C}$ .
- Air relative humidity 80% at  $20^{\circ}\text{C}$ .
- Maximum number of meter rows upon storage is 8.

## 4.6 Accompanying documents

- Quality certificates, made according to the regulations accompany each delivery lot.

## 4.7 Delivery inventory

The product is delivered with the following delivery inventory:

- Declaration of conformity.

## 5. WARRANTY / LIFETIME

- Lifetime 20 ani.
- Warranty 12 months after installation, but no more than 18 months after delivery.

## 6. REFERENCE DOCUMENTS

IEC 60-1:1989, IEC 68-2-2:1974, IEC 68-2-30:1980, IEC 68-2-5:1975, IEC 387:1982, IEC 695-2-1:1980, IEC 1000-4-2:1995, IEC 1000-4-3:1995, IEC 1000-4-4:1995, IEC 1036:1996, IEC 1038:1991, IEC 1107:1996, SR EN 55022, SR EN 60529:1995, ISO 75, SR CISPR 22, STAS 2872/2-86, STAS 4198-79, STAS 4640/1-71, STAS 5055/2-91, STAS 6535-83, STAS 6669/1-86, STAS 6669/3-86, STAS 6692-83, STAS 6705-90, STAS 6854-90, STAS 7222-90, SR 7293:1993, STAS 8393/16-90, STAS 8393/19-89, STAS 10911-77, STAS 11054-78, STAS 11239-89, STAS 10307-75, STAS 11351-89, NP1-1/87 ICPE.

## 7. QUALITY

Electromagnetica has implemented an Integrated Management System, Quality, Environment, Health and Safety. This System is certified by AEROQ S.A. according to SR EN ISO 9001, SR EN ISO 14001 and OHSAS 18001 and by DQS according to ISO/TS 16949, for the design, development, manufacture, installation and service of products meant for the technological equipment for electric energy measurement and distribution.

