

**TECHNICAL SPECIFICATION**  
**ELECTRONIC SINGLE-PHASE AND THREE-PHASE L.V. METERS**

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**TECHNICAL SPECIFICATION**  
**ELECTRONIC SINGLE-PHASE AND THREE-PHASE L.V. METERS**

**SCOPE**

This specification determines the manufacture, testing, acceptance check and packing for transportation and delivery to PPC warehouses of electronic single-phase and three-phase Low Voltage (L.V.) meters for direct connection to the network with active energy measurement.

**OPERATING CONDITIONS**

**OPERATING TEMPERATURE**

The temperature zone in which the meter functions properly must be from -20 °C to +55 °C.

The storage and transport temperature zone shall be between -20°C and +70°C.

**HUMIDITY**

The electronic meter shall operate under an average annual relative humidity of less than 75%.

Moreover, for 30 days in total interspersed within the year, it shall operate under relative humidity 95 %.

Additionally, at random moments within the day, it shall operate under relative humidity 85 % (IEC 1036).

**TABLE OF CLIMATIC AND ENVIRONMENTAL CONDITIONS**

Maximum altitude	2000 m
Minimum ambient temperature	- 20° C
Average ambient temperature	2 0° C
Maximum ambient temperature	55° C
Maximum temperature at external surfaces due to solar radiation	70° C
Minimum relative humidity	5 %
Maximum relative humidity	95 %

## **REGULATIONS - SPECIFICATIONS**

REGULATIONS	TITLE
EN / IEC62052/11 & EN/IEC62053/21-22-23	Alternating current static watt-hour meters for active energy (classes 0.5 & 1)
EN/IEC 62058-11	Electricity metering equipment (A.C.) - Acceptance inspection Part 11: General acceptance inspection methods
EN/IEC 62058-31	Electricity metering equipment (AC) - Acceptance inspection - Part 31: Particular requirements for static meters for active energy (classes 0,2 S, 0,5 S, 1 and 2)
EN 50470-1	Electricity Metering equipment (a.c.) Part 1: General requirements, tests and test conditions - Metering equipment (class indexes A, B and C)
EN 50470-3	Electricity Metering equipment (a.c.) Part 3: Particular requirements - Static meters for active energy (class indexes A, B and C)
EN / IEC 60529	Degrees of protection provided by enclosures.
EN/IEC 60068-2-6	Basic environmental testing Procedures Part 2: Tests. Test EA : shock
EN/IEC 60068-2-30	Basic environmental testing Procedures Part 2: Tests. Test Db and guidance: Damp, neat cyclic (12 + 12 - hour cycle).
EN/IEC 60695-2-1	Fire hazard testing part 2: test methods. Glow wire test and guidance.
EN/IEC 60695-2-2	Fire hazard testing part 2: Test methods Needle flame test.

The electronic meters shall be industrial products manufactured according to the global-European EN / IEC regulations / standards and to the Technical Specifications of PPC as mentioned below, which are valid on the day of the submission of the bids.

In cases where the requirements of this Specification contradict with the above

Technical Specification of Meters of the Project: "Pilot Telemetry and Management System for the Electric Power Supply Demand by Residential and Small Commercial Consumers and Implementation of Intelligent Networks".

editions of International Regulations / Standards or any other relevant Standards, the corresponding PPC specification shall prevail.

The meters shall have markings pursuant to the European Standards, and they are also required to have the "CE" conformity mark.

The offered meters shall be of **class A**, in compliance with the EU Directive 2004/22/EC (Measuring Instruments) and according to the Ministry Decision (Government Gazette 521 / issue B' / 12.04.2007, No. F2 - 1393).

"All the necessary certificates for the above compliance, that have been issued for the offered meters by a competent Notified Body, should be submitted"

Moreover, the supplier of the meters shall submit a certificate proving that all procedures specified in ISO 9001 are observed.

## **EQUIPMENT DESCRIPTION**

### **MECHANICAL REQUIREMENTS**

#### **Cover**

The electronic meter shall be designed and manufactured according to the protection class IP51 as specified in EN/IEC 60529 for indoor installation (but with the meter covers closed).

The cover window shall be made of a high purity transparent material, enabling the meter's data to be easily read even after 15 years.

The meter width shall be according to DIN43857.

The meter cover shall be according to the EN/IEC standard for direct connection of the phase and neutral conductors and for the connection of the pulse inputs, pulse outputs, signal inputs, signal outputs and communication units etc..

The electronic meter cover shall contain the communication port through the optical head, which shall be waterproof.

The electronic meter shall be properly connected to the communication medium each time used (modem plc, gsm/gprs, etc.). It must be possible to secure the said communication device inside the meter's housing or inside the meter's cover. When the communication device is not modular and must be installed outside the meter, it must feature a communication port (e.g. RS485).

The communication with the optical head port must be performed in accordance with CENELEC standards.

The electronic meter must be delivered with its cover sealed.

It shall be possible to perform the following tasks without unsealing the meter cover:

- Reading through the display and activation of its functions by button (push buttons).
- Reading of the meter's characteristics (name table).
- Programming and reading of the electronic meter by a portable computer or

portable register, using the optical communication port.

- Manual reconnection of supply via a waterproof button (push button) mounted on the front cover.
- Check of measuring accuracy of active energy by a pulse signal from a LED installed on the front cover of the meter.

### **Terminals and Terminal Cover**

The size and position of the terminals shall be according to the EN / IEC Standards.

The terminals shall be of front connection type and shall have lifted insulation diaphragms in order to provide protection against accidental short-circuits between phases and neutral during the connection or disconnection of the meter.

Each terminal must ensure correct electric contact and no risk of temperature rise or conductor loosening under normal operating conditions must arise.

The terminal's cover must feature a tampering alarm and be sealed, so that any internal intervention in the terminals requires breaking the cover seals with simultaneous activation of the alarm signal.

### **Nameplate**

The nameplate shall be in compliance with the EU Directive 2004/22/EC (Measuring Instruments), according to the Ministry Decision no. F2 - 1393 (Government Gazette 521 / issue B' / 12.04.2007 No F2 - 1393). The nameplate must be designed and installed so that the following capacities or information are provided:

- PPC logo
- The meter constant
- The control diode (LED – DIODE).
- The optical head communication port (IR Port)
- The symbol for double insulation protection and the CE mark for compatibility with EU regulations/standards
- A push-button for rolling display indications
- A push-button for reconnecting the supply
- Meter information (type, serial number, nominal values / ratings, year of manufacture)
- The nominal values shall include rated voltage, rated current and maximum voltage.

### **Communication via the optical head (IR- Port)**

The electronic meter shall be equipped with a communication port through an optical head. The communication port shall be infrared (IR) type.

The communication protocol of the IR Port must be recognized by CENELEC for reading and two-way communication purposes. The communication speed shall be at least 9600 bauds.

The optical head shall be connected with a portable register or PC. Moreover, it shall

Technical Specification of Meters of the Project: "Pilot Telemetry and Management System for the Electric Power Supply Demand by Residential and Small Commercial Consumers and Implementation of Intelligent Networks".

be self-supported in a manner that does not affect the proper operation of the meter (e.g. magnetic).

### **Physical requirements**

The electronic meter shall be manufactured according to the requirements of DIN 43857 and DIN 43852. This facilitates the installation of the meter inside meter cabinets standardized by PPC.

## ELECTRICAL REQUIREMENTS

### **Type of Connection with the Network**

The electronic meter must be designed for connection to a low voltage network.

### **Metering System**

#### **General**

The metering system must be digital, enabling direct connection to the network.

The meter must calculate at least the following measured volumes:

- Incoming – Outgoing active energy
- Incoming – Outgoing inactive energy
- Voltage and current
- Phase sequence (for three-phase meters)
- Energy flow

#### **Accuracy Class**

The electronic meter must be of Class A.

#### **Operating Voltage Range**

The meter shall be suitable for operation with rated voltage 230 Volts, and shall operate within a voltage range of 0,8 to 1,15xUn (where Un is the nominal voltage).

#### **Measured Current Range**

The meter maximum current shall be  $I_{max} = 60 \text{ A}$ .

The meter shall have basic current value  $I_b = 10 \text{ A}$ .

#### **Load Capacity**

The meter must withstand load according to EN/IEC 62052-11, 62053-21,-22 and -23 and EN 50470.

#### **Network Frequency**

Technical Specification of Meters of the Project: "Pilot Telemetry and Management System for the Electric Power Supply Demand by Residential and Small Commercial Consumers and Implementation of Intelligent Networks".

The electronic meter shall operate with a network frequency of 50 Hz and a variation zone of  $\pm 2\%$ .

## **OPERATION REQUIREMENTS**

### **Starting current**

The direct connected electronic meter shall begin the energy measuring when the current reaches at least 0.5% of the nominal current  $I_n$ , according to EN 50470-3.

The electronic meter shall use the starting power instead of the starting current in order to define the starting limit.

### **Accuracy**

The electronic meter shall achieve the accuracy at power measuring (W) according to EN/IEC 62053 and EN 50470.

### **Meter Power Supply**

The meter shall be suitable for low voltage measuring, with network voltage 230V ( $\pm 10\%$ ).

The electronic meter shall be able to operate in each of the following cases of power failure, with the accuracy that characterizes the corresponding voltage asymmetry:

- Neutral loss
- Phase loss in three-phase meter
- Neutral inversion

Upon voltage restoration, the meter must be able to operate after 5 sec maximum.

The electronic meter must be consistent with EN/IEC 62053, EN 50470 with regard to the overload and over-current requirements. In case of continuous voltage loss, the meter nonvolatile (EEPROM) memory shall permit the retrieval of information even after a period of 10 years without help from any auxiliary supply.

### **Meter self-consumption**

The energy consumption shall be according to EN / IEC 62052-11, EN/IEC 62053/21-22-23 for multifunction meters.

Without the communications unit and the display backlight the energy consumption shall not exceed the values specified in EN/IEC 62052-11 & EN/IEC 62053/21-22-23

### **Auxiliary Supply (Clock autonomy)**

The auxiliary supply shall provide power only to the real time clock (R.T.C).

The billing values of the meter must be reserved in its memory for at least ten (10) years.



## **REGISTERS**

### **Energy registers**

The meter shall be provided with at least four (4) tariff zones.

The measured values of selected quantities shall be registered as follows:

- In the active energy registers (in at least eight (8) )
- In the cumulative (total) energy registers (in at least eight (8)).

### **Historical data registers**

The control of the integration period shall be performed by the internal calendar clock of the meter.

Integration period shall be programmable from 5 to 60 minutes (5, 10, 15, 20, 30 and 60).

### **Instantaneous information**

The registers of the measured quantities shall be updated at least every second.

This information shall be available to be shown on the display or as events, e.g. demand overstepping, for activation of output signal.

### **Diagnostic functions**

The electronic meter shall perform a diagnostic check of its circuits each time it is placed under voltage, after every voltage outage and at regular time intervals.

In case an error is detected, a corresponding fault message, identifiable by the optical head and via telemetering, shall be displayed on the meter display.

### **Display readings**

Beyond measuring information (energy registers, instantaneous values of current-voltage-power, network quality data), the meter shall store in its memory and shall be programmable which of the following additional information shall be shown on the display:

- Meter serial number (up to 12 digits)
- The current date and time
- User Tariff zone / calendar information
- Error reading

### **State check**

The state of the meter shall be checked in the following cases:

- Voltage loss
- Supply outage (or lower than voltage limit)

- Overstepping of agreed power

### **Definition of Tariff Zones**

The definition of the meter's tariff zones shall be performed with the following methods:

- through the internal time switch
- through appropriate meter programming

### **TIME SWITCH / CALENDARS**

The meter must be equipped with a calendar time switch for changing tariff zones and must determine the end of the billing period.

The clock mechanism shall be high precision Quartz (according to IEC: <5 ppm).

The calendar time switch shall drive the registers of the energy and power tariff zones according to the programming of "TARIFFS" and "DAILY PROFILES".

### **Real Time Clock (RTC)**

The clock shall provide all required timings for the proper operation of the three-phase meter.

The calendar shall support leap years and programming of daylight time adjustment.

The clock shall support automatic change to/from daylight time according to the European standard.

When synchronization is performed by the internal crystal, the achieved accuracy shall be greater than 5 ppm.

Moreover, a synchronization accuracy of one second shall be achieved through the communication unit.

### **Display**

The display shall be able to show information from the energy and tariff zone maximum (peak) demand registers, as well as information from the historical registers, which have been programmed.

The information shall be read based on CENELEC methods and standards. The decimal digits, the units, the multipliers, the content and the display sequence shall be defined through programming.

Similarly, the list content and the display sequence shall be defined through the same way.

It is required to include at least the following readings:

- Units: W, kW, Kvar, Kvarh, Wh, kWh, V, A, Hz

- Error code
- State of selected Outputs
- Active tariff zone

The meter reading shall be displayed and therefore visible from a distance of 1 m below and 0.75 m horizontally from the front side of the meter (observation angle 30°). All screens shall feature lights to be visible also under low lighting conditions. The lighting of the screen must be settable:

- On/off
- Off after a certain time.

The date display type shall be user-definable as follows:

- dd/mm/yy
- yy/mm/dd

The meter shall support the following operation modes of the display:

- Normal (automatic rotation of displayed information)
- Technical Check (Programming - Set mode)

### **Load switch and push-button**

The disconnection switch must not require maintenance throughout the meter's lifecycle, be adjustable relating to the power of the customer's supply and change state (connection/ disconnection) only following a relevant order in one of the following functions:

The meter must be equipped with a push-button for handling the load switch with the following functionality:

1. Local operation: the customer can use the local button to manually connect or disconnect. In this operating mode, remote disconnection is possible, but remote connection is not.
2. Remote operation: This operating mode does not allow local operation (manual disconnection and connection). To safely execute remote reconnection of a disconnected customer, local operation mode is provided and, then, the customer may reconnect his supply.
3. Alternating operation: the operating mode of the push-button's disconnection switch must enable remote alternation between "remote operation" and "local operation" and vice-versa.

The default operating mode of the disconnection switch when delivered must be "local operation". During a power outage, the disconnection switch must be kept in the same position as before the power outage. After power restoration, the disconnection switch must be kept in the same position as before the power outage. The state of the disconnection switch must be remotely readable and any change thereto must be entered in a special file.

## **OUTPUTS**

### **Integrated Relay Output(s) (Load Management Facility)**

The provision of at least 2 integrated relay output(s) will be included in all meters to provide for the remote switching of dedicated customer circuits in instances where customers have agreed to engage with PPC in the provision of specific load management services.

The relay outputs will be capable of operating switches with the ability to isolate the supply to the customer completely (if required); or switching dedicated circuits within the customers installation, or isolating supply at an agreed customer operating threshold, or at an agreed operational parameter within the customers premises.

The meters should have control capability (on/off) of relay outputs (at least two) by specific commands of the telemetering software.

The technical specifications of the relay outputs are the following:

- Solid state relay,
- Voltage 12 - 240 V ac/dc,
- Minimum current 100mA,

Maximum frequency alternation 25Hz, for pulse amplitude 20ms.

The above relay outputs should be programmable remotely from the software that parameterizes the meters.

## **COMMUNICATION PROTOCOL**

The meter must be compatible with a communication protocol that is described in internationally established and published CENELEC standards. The standards with which the meter is compatible must be in effect at the time the relevant bid is submitted.

It shall be possible to use the protocol for communication with the meter through every channel, like the optical head port, or communication line (modem PSTN or GSM/GPRS etc..)

The meter's manufacturer is required to submit the codes of the objects used (according to the international recognized CENELEC standards), together with the meter technical data, otherwise the bid shall not be accepted.

Reading and parameterisation (for setting date-time-change of tariff or full reparameterisation of the meter) of the meters must be possible with relevant discreet passwords. The list of these codes and their relevant access rights (read-write) shall be communicated in writing and electronic format and will be defined before the production line.

## **COMMUNICATION WITH THE IN HOME DISPLAY**

The electronic meter must ensure two-way communication with the in home display. In

any case, it must be able to transmit readings to the in home display at a radius of at least thirty (30) meters inside a building constructed by reinforced concrete.

## **ELECTROMAGNETIC COMPATIBILITY (EMC)**

The meter shall comply with the following standards:

- Electrostatic discharge according to IEC 61000-42
- High frequency electromagnetic field according to IEC 61000-4-4
- Line transients according to IEC 61000-4-4
- Radio interference attenuation according to IEC/CISPR22 class B

Additionally:

- Electrostatic discharge: 15 kV minimum
- HF electromagnetic fields: 10 V/m minimum
- Temporary voltage transients without load (IEC 1036-5-5): 2 kV minimum
- Radio interference: less than 64 dB  $\mu$ V.

## **COMMUNICATION INTERFACE**

The meters must have obligatory the capability of connection, via added communication medium (e.g. modem PSTN, GSM/GPRS, PLC, TCP/IP etc), for their telemetering - parameterization»

The communication medium may be provided inside (modular) or outside (external) the meter.

When the communication device is not modular and must be installed outside, it must feature a communication port (e.g. RS485).

If the communication medium is provided inside the meter, it must be independent and allow removal and replacement by authorized personnel without deactivating the meter.

The communication port, if any, must be in a protected, confined point of the meter, not accessible by the customer. The access to the communication port must be protected with a tampering event logging.

## **LOAD PROFILE**

The meters must have the capability to register load profile for the following quantities:

- Incoming – Outgoing active energy
- Incoming – Outgoing inactive energy

and for integration period of 15min, the load profile data shall be stored for at least the past sixty (60) days.

The integrated memory shall be non volatile, which means that during the loss of supply to the memory, it shall have a minimum preservation time equal to 10 years.

## **FRAUD DETECTION EVENT LOGGING**

The meter shall have the capability, via appropriate arrangements and parameterization, of detecting and logging at least the following events, of potential attempt for tampering the meter while in normal operation under voltage (each event individually), by logging the time (date and hour) of appearance and disappearance of each event :

- strong DC magnetic field influence
- terminals' cover removal
- over-current in the neutral wire

Also, use of passwords for restriction of the access to the meter for data reading, parameterization, etc

## **POWER QUALITY MONITORING**

The meter shall have the capability, via appropriate parameterization, of monitoring at least the following events (each event individually), by logging the time (date and hour) of appearance and disappearance of each event:

- under-voltage
- over-voltage
- over-current
- power-down

## **TESTS**

### **DEFINITION OF TESTS**

- Type Tests

All tests intended for identifying the type characteristics of the meter in order to prove the compliance with the requirements of the relevant standards/regulations that these characteristics are required to comply with.

- Series tests

Tests performed on new meters to ensure that they comply with the results of the above tests or to prove that the batch meets the specialized general and specific requirements of the relevant specification.

- Acceptance tests

Sampling tests performed on a batch of meters prior to delivery for the purpose of making a decision regarding the acceptance or rejection of the batch.

All tests shall be performed as described in each relevant and most recent issue of the IEC standards / regulations.

### **Type Tests**

Applicable type tests are those included in the current most recent EN or IEC standards / regulations, and they shall be performed in a PPC laboratory, or in an accredited laboratory.

### **Series tests**

They shall be performed in the manufacturer's factory and their cost shall be borne by the manufacturer.

### **Sample tests (acceptance tests)**

Sampling tests for acceptance during the acceptance check are all the tests specified in IEC EN 62058-31.

The sampling procedure for the tests shall be according to issue 410 of the IEC regulations / standards, using the following criteria:

- Test level II table I, IEC 60410.
- Simple or double sampling (tables II and III, IEC 60410).
- Acceptable quality level A.Q.L. = 1 for each separate test.

### **SUBMITTAL OF TEST CERTIFICATES**

The bidders shall submit, together with their bid, type tests certificates and samples of series tests certificates specifying the series tests performed in their factories.

Any bids that do not include the abovementioned certificates shall be rejected during

the technical evaluation stage.

Acceptable test certificates shall be only those issued by a PPC laboratory or an internationally recognized laboratory.

### **SUBMITTAL OF SAMPLES**

The tender's participants are required to submit together with their offer, two (2) complete meter samples (which are returnable), for the technical evaluation of the material.

The meter samples shall be obligatory accompanied by their respective software for parameterization, control and configuration.

Additionally, they shall be accompanied by all the necessary information and instructions for their telemetering and billing data retrieval

Any other information or potential presentation that may be required, concerning the offered material, must be provided to PPC's Technical Department.

It is noted that any additional capabilities of the offered meters, beyond the specified ones, should be described in detail

### **SPARE PARTS**

The suppliers shall guarantee the availability of spare parts for a period of 5 years after expiry of the guarantee.

The suppliers are required to submit, together with their bid, a price list for the necessary spare parts.

### **OPERATING INSTRUCTIONS**

Together with their bids, the bidders shall submit one copy of the operating instructions of the meters.

### **METERS PARAMETERISATION**

- The meters shall be delivered programmed with the parameterization that will be advised and agreed by (DD/MSS – Network Department/Metering System Section), during the sample approval procedure, before the starting of the series production of the meters
- The meters shall be delivered with the real-time clock (RTC) programmed at the local Greek time.

### **GUARANTEE**

The meters shall be accompanied by five (5) years warranty from their delivery date.



## **PACKING**

The meters shall be placed, carefully packed, inside protective cardboard boxes.

The cardboard boxes shall be placed on EU palettes to facilitate transport.

These boxes shall be externally and indelibly marked with the Contract number, the material Code and the Manufacturer's Data.

Using the above packing, it shall also be possible to store the meters in open spaces without additional protection against weather conditions (rain or moisture).