

PROFESSIONAL ENERGY METER

RCE PM600

INSTRUCTION MANUAL

Precision instrument, high resolution, with large display with graphic bars, able to measure also powers of tenths of a Watt



The PM600 is a precision instrument with a large LCD display that displays power measurements from 0.250 watts to 3999 watts with a resolution from 10 mW to 1 Watt and bar graph. An acoustic warning can be set when a power or current threshold is reached.

It plugs into an AC socket, and on it one plugs the device to be monitored. The PM600 is equipped with a plug and socket according to the Italian standard CEI 23-16 / VII. The plug is 16 A, the bypass socket is 10 A or 16 A.

It measures voltage (in Volts), current (in Amps), current frequency (in Hertz), power (in Watts), power factor, energy consumption (in Kilowatt-hour), peak power and peak current. It also calculates the cost of energy consumed and the amount of CO₂ equivalent.

The meter RCE PM600 encloses the following functions:

- a) voltmeter, ammeter, power-factor meter (meter power factor), power meter (power is determined by multiplying voltage by current and power factor);
- b) A stopwatch to determine consumption in kWh;
- c) A clock for calculating the cost of energy in case of hourly rates.

Two PR44 batteries power the PM600 (rear compartment) to keep in operation the internal clock and stored to maintain the measurements made, even in case of power failure or disconnection of the meter from the socket. (You can also use batteries LR44 1.5 V, but they have a much shorter duration.)

Do not leave the batteries inserted when not necessary, to prevent running out and deterioration that can produce oxidation and corrosion.

If you do not need the alarm warning for exceeding the power or the current or do not want to know the cost of the energy consumed in Euro or the CO₂ emissions, it is not necessary to carry out its initial settings. You can then go directly to the measurements page, ignoring the readings related to cost and CO₂.

INITIAL SETTINGS

Carry them out only if you want to determine the cost of energy or the equivalent CO₂ or you want to set the alarm.

Hold for longer than 3 seconds the **SET** button.

1) **Setting the time.** It will appear on the display. Initially the first two digits will flash on the left representing the hour. Set the hour using the + and – keys, press HISTORY to go to the minute digits, press HISTORY again to return to the hour digits. AFTER you have set the time, press the OK button.

The display can show the time format in 24 or 12 hours. Choose the hour format with the + button and press OK.

2) **Setting hourly rates. when day/night rates are in use, the meter can be shift from one rate to the other according to time.** In case of fixed hourly rate you do not need to set it.

Rate 1 (in €/kWh format) will appear on the display: set the digit with the + and -, move to the next digits with the HISTORY button, then press the OK button.

The start time for Rate 1 will appear on the display: set the time using the buttons already indicated for the other fields, then press the OK button.

Rate 2 (€/kWh format) will appear on the display: set the digit with the + and - keys, move to the next digits with the HISTORY button, then press the OK button.

The display start time of Rate 2 will appear on the display: set the time using the buttons already indicated for the other fields, then press it OK button.

3) Setting the emission factor for CO₂ equivalent

Will appear on the display the equivalent weight of CO₂ (kg/kWh), if necessary: set the digit with the + and - keys, move to the next digits with the HISTORY button, then press the OK.

4) Setting warnings

The power (W) or current (amperes) thresholds will appear on the display. Choose the + button whether to activate the alarm for the power (in W) or for the current (in A). Then move with the HISTORY button and set them.

The power can be set up to 3999 watts, the current up to 19.99 Amperes: set the digits with the + and – buttons and move with HISTORY button to the next digits, finally press the OK button to finish the settings.

If you do not finalize the setting procedure within 30 seconds from the last key pressed, the PM600 abandons the settings and returns to displaying measurements.

MEASUREMENTS

The PM600 measures and displays various data.

Initially the PM600 displays cyclically on the first line of the display the current and power, each for three seconds.

With the **VALUE** button you can choose data to display: voltage in volts, current in amps, wattage, frequency in Hz, power factor (Cos φ), maximum current in amperes, maximum power in watts.

If after the selection you press the **OK** button the size is displayed indefinitely, otherwise after 30 seconds are again displayed sequentially voltage, current and power.

Initially the PM600 displays on the second line of the display (to the left) time and the hourly rate in use (rate 1 or 2). With the **DISPLAY** button you can choose the data: time, total consumption in kWh, time during which there was consumption, total cost in Euro, CO₂ equivalent in Kg.

At the bottom of the display shows a bar graph that represents the cost of the last seven days or month, or the differences in consumption in the last seven days or month (also in a bar chart). The column marked by -1 refers to the previous day or month, up to -7 which refers to seven days or months earlier.

RESET DATA

The stored measurements, maximum power, maximum current consumption in kWh and the bar chart, can be reset with the following procedure:

- 1) Press the + and - buttons simultaneously for 3 seconds, the display will flash;
- 2) Press the – and OK buttons simultaneously for 3 seconds, the bar graph will clear gradually.

At the end of this sequence all stored values will be deleted.

BASICS OF ELECTRICAL ENGINEERING

Energy and power are confused very often misused, especially when dealing with electric measurements. Making it very simple, we could say that **energy** measures the *total quantity of work done*, while **power** relates to *how fast you can get this work done*¹.

Electrical power is commonly measured in Watts (W) or kilowatts (kW), where 1000W = 1kW.

The amount of **electrical energy** absorbed by a device (a refrigerator, a television, a stove, a lamp, etc.) is measured in Kilowatt-hours (kWh). A device with an electrical power of 1000W (1kW) operating for one hour will absorb 1 Kilowatt-hour of electric energy:

$$1\text{kW} \times 1\text{h} = 1\text{kWh}$$

A different device, this time with a 100 Watts of electrical power, would absorb the same amount of energy after 10 hours of continuous operation:

$$0.1\text{kW} \times 10\text{h} = 1\text{kWh}$$

Other parameters help describing electricity:

- **Potential difference**, or voltage, which is measured in volts (V)
- **Current**, which is measured in Amperes (denoted by A)

Current can be **alternating** (AC) or **continuous** (CC). In Alternating current, voltage oscillates continuously and regularly over time between positive and negative values. Our electric grid works in AC. Low Voltage current is usually supplied at 230V, but can vary between 200V and 250V. Electric power can be calculated by multiplying voltage by current ($1\text{W} = 1\text{V} \times 1\text{A}$). For example a 2Amps current through a 230V voltage will produce a power of 460W.

- **Power factor** also referred to as $\text{Cos } \varphi$, which is a dimensionless unit.

In AC circuits, $\text{Cos } \varphi$ will tell us something about how effectively is power flowing to the load. Power factors <1 cause energy losses, where useful energy is dissipated as heat.

Hence in AC circuits, power is equal to voltage x current x power factor:

A 2 Amps current through a 230 V voltage with $\text{Cos } \varphi = 0,9$ will produce a power of 414 .

The meter can also estimate the **cost** of the electric energy measures, based on an average cost for a Kilowatt-hour (order of magnitude: 0.2€). When energy is supplied on the basis of hourly rates, energy costs will vary throughout the day. Providers will usually apply a fine when users make $\text{Cos } \varphi$ drop under specific values.

¹ <http://cleantechnica.com/2015/02/02/power-vs-energy-explanation/>