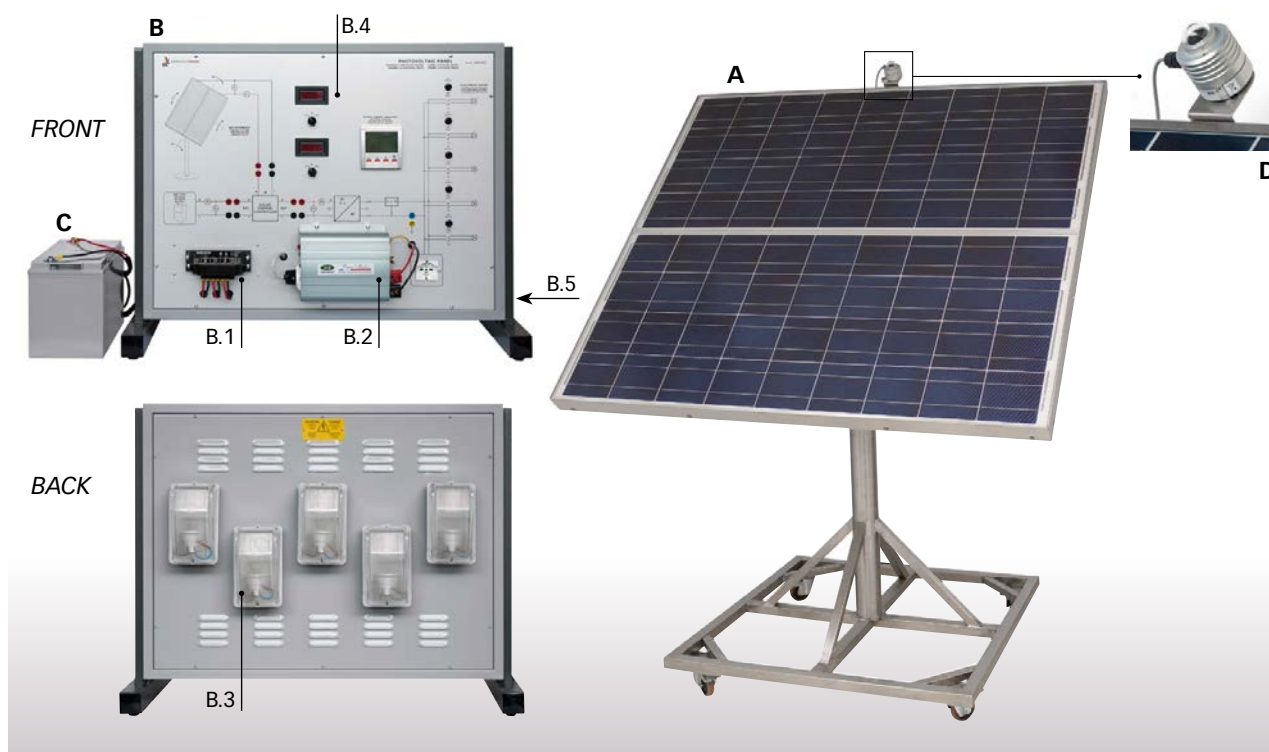


PHOTOVOLTAIC PANEL TRAINER

Mod. PM-E/EV

Mod. PM/EV (computerized vers.)



INTRODUCTION

Energy saving and environmental pollution reduction are crucial global issues. Using renewable energies as alternative sources to fossil fuels can address both issues, with great benefits especially in countries where traditional energy sources are scarce.

Considering the above, this system enables experimental investigation on the conversion of solar energy into electricity exploiting the photovoltaic effect. The equipment is manufactured using real components available on the market.

DESCRIPTION

System configuration: stand-alone (isolated from the grid)

The system consists of:

- A)** Mobile silicon cell photovoltaic (PV) panel
- B)** Table top control panel including:
 - B.1)** Charge controller
 - B.2)** Sinewave inverter
 - B.3)** Electric loads
 - B.4)** Electric instrumentation for detecting the energy flows in the different branches of the circuit
 - B.5)** Data acquisition board with USB interface for PC connection (PM/EV only)
- C)** Buffer battery
- D)** Solar radiation sensor (PM/EV only)

Relevant features:

- The trainer can operate with or without the sun
- The PV panel can be used both outdoors and indoors. In case of indoor use, the lighting device SS-1/EV is required (**optional item** - refer to the end of this data sheet)

A video demonstration is available on Elettronica Veneta YouTube channel

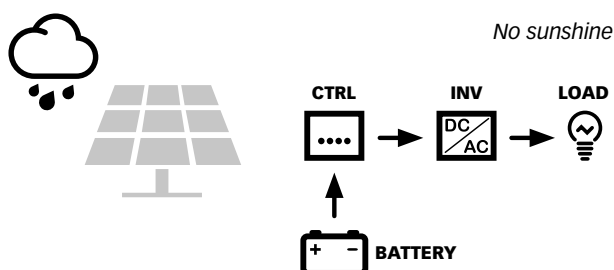
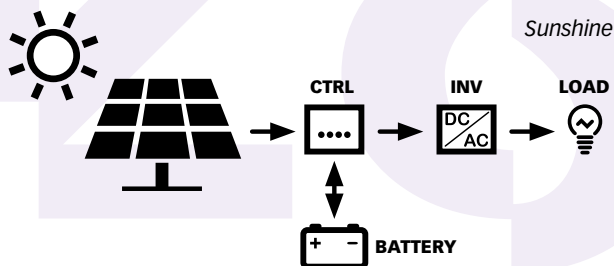


Scan code to watch



- The PV panel can be disconnected from the system to draw the characteristic curve (one single module, two modules - parallel connection, two modules - series connection). The portable rheostat *PRH-2* is required (**optional item** - refer to the end of this data sheet)
- The PV panel can track the sun along two axes, to allow the comparison of the performance between a fixed installation (such as the one on the roof of a house) and an installation with tracking device. In this case the solar tracker *SOLTR/EV* is required (**optional item** - refer to the end of this data sheet)

Operating principle:



- In case there is no sunshine, all the energy consumed by the user (loads) is taken from the battery.
- In case there is sunshine but no load is connected, all the energy produced by the system charges the battery.
- In case there are both sunshine and loads, the energy produced by the system partially charges the battery and partially powers the loads.
- When the consumption is higher than the power available from the sun, the power surplus is given by the battery.

TRAINING PROGRAM

- Components of a stand-alone solar system for electricity production
- Effect of solar radiation on the panel output voltage (*)
- Effect of applied load variation on the electric power produced by the panel
- Effects of shading on a real solar installation (*)
- Photovoltaic panel energy conversion efficiency (*)
- Battery charging system management
- Operation and efficiency of a DC/AC inverter
- Connection to portable rheostat *PRH-2* (**optional item** - refer to the end of this data sheet) for photovoltaic panel characteristic curve construction

(*) For *PM-E/EV* Solar radiation meter *SORM* (**optional item** - refer to the end of this data sheet) required

TECHNICAL SPECIFICATIONS

Mobile photovoltaic solar array:

- Wheeled stainless steel frame
- Photovoltaic panel consisting of two modules, 120 W peak power each

Table top control panel

- Steel structure with:
 - Front side: comprehensive colored diagram of the system
 - back side: AC loading system consisting of 5 30 W (equivalent) switchable lamps
- Charge controller:
 - rated voltage: 12 Vdc
 - max. power input from solar panel: 20 A
 - max. switch off current at LOAD-output: 20 A
- Inverter:
 - continuous output power: 600 W
 - peak output power: 1200 W
 - input voltage: 12 Vdc
 - output voltage: 230 Vac - 50 Hz
 - output waveform: modified sine wave
 - stop for low battery charge
 - protection against overload, short circuit, overtemperature
- Instrumentation:
 - digital voltmeter for DC parameters
 - digital ammeter for DC parameters
 - multifunction instrument, microprocessor-based, for AC parameters
- Socket for connection to the spotlight *ACL220V* (**optional item** - refer to the end of this data sheet)
- Ø 4 mm safety holes for connection to the portable rheostat *PRH-2* (**optional item** - refer to the end of this data sheet)
- Ø 4 mm safety holes for connection to the lamp *DCL12V* (**optional item** - refer to the end of this data sheet)

Solar radiation sensor (PM/EV only) for measuring and transmitting the global solar radiation incident on the PV panel to the control panel.

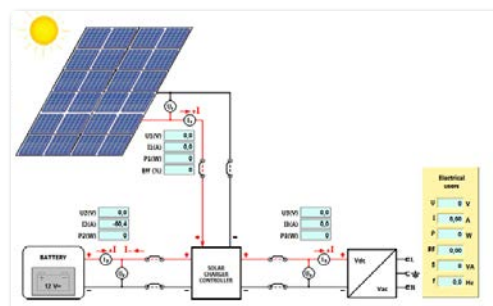
- Transducer type: pyranometer
- Range: 0 ÷ 2000 W/m²

Buffer battery

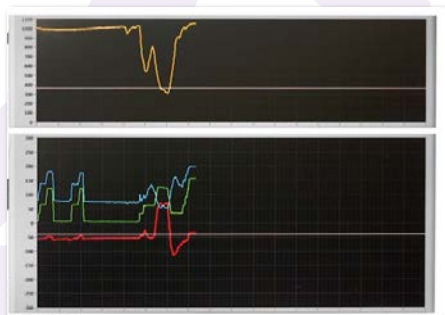
- Rated voltage: 12 Vcc
- Capacity: 100 Ah

PC data acquisition (PM/EV only)

- The trainer includes a data acquisition board with USB interface for connection to PC and voltage and current converters.
- A specific software (developed with LabView) is supplied to monitor the system parameters.



- Parameters displayed:
 - All DC and AC parameters
 - Global solar radiation incident on the PV panel
- The software enables to:
 - Calculate solar energy conversion efficiency
 - Visualize the trend of the solar radiation incident on the PV panel and the energy flows to and from buffer battery, inverter and PV panel



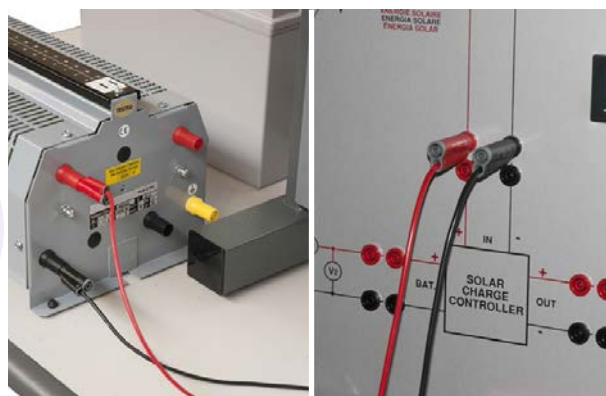
- Draw the PV panel characteristic curves output current vs output voltage and output power vs output voltage to find out the point of panel maximum performance
- Save the exercises data for future analysis or project work

Power supply: 230 Vac 50 Hz single-phase - 50 VA
(Other voltage and frequency on request)

Dimensions:

Control panel: 92 x 46 x 72 cm
Mobile solar array: 120 x 120 x 200 cm

Tot weight: 180 kg



Connection of rheostat PRH-2 (optional item) to the control panel to draw the photovoltaic panel characteristic curve.

REQUIRED

PERSONAL COMPUTER

- NOT INCLUDED -
(PM/EV only)



SUPPLIED WITH

THEORETICAL-EXPERIMENTAL HANDBOOK



OPTIONAL (REF. ACCESS. AND INSTRUMENTS)

SOLAR TRACKER Mod. SOLTR/EV

Steel framework and gearing system for orienting the panel on two degrees of freedom in space (up-down, east-west)

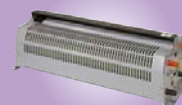


ELECTRIC BATTERY CHARGER Mod. EBCH

To recharge the buffer battery after a prolonged period of inactivity of the system

PORTABLE RHEOSTAT Mod. PRH-2

To draw the PV panel characteristic curve



INDOOR LIGHTING DEVICE Mod. SS-1/EV

To operate the photovoltaic panel indoor

SPOTLIGHT Mod. ACL220V

To be used as 230 Vac electric load



LAMP Mod. DCL12V

To be used as 12 Vdc electric load

SOLAR RADIATION METER Mod. SORM (PM-E/EV only)

To calculate the solar energy into electric energy conversion efficiency



Detail of the Solar tracker SOLTR/EV (optional item) and its control box.