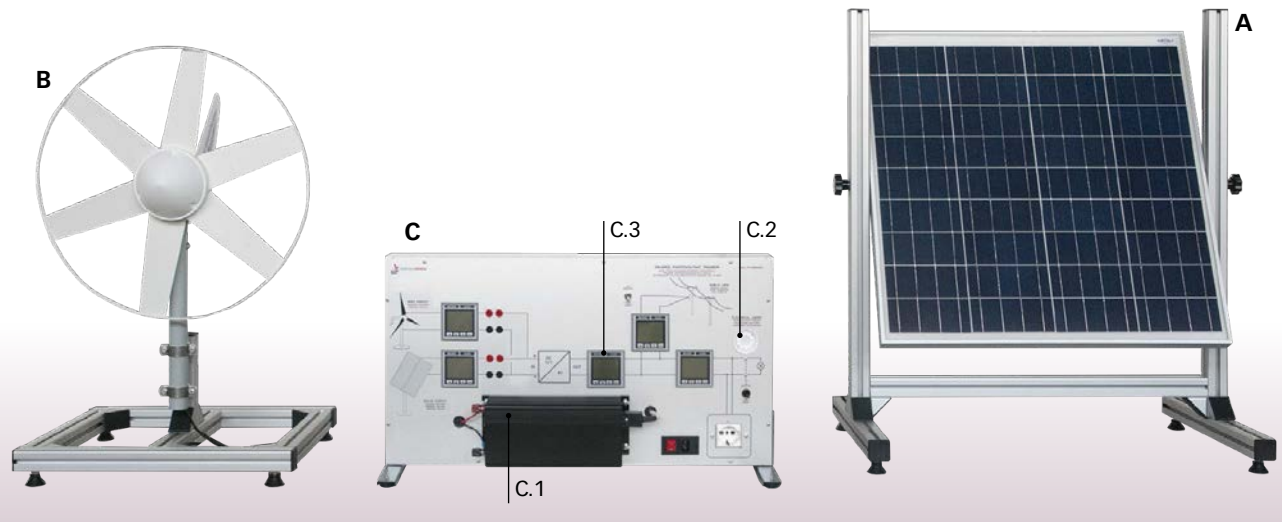


# ON-GRID PHOTOVOLTAIC-WIND POWER PLANT TRAINER

Mod. PVWG-EGR/EV

Mod. PVWG-GR/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 and of wind energy into electricity by means of a wind power generator. The equipment is manufactured using real components available on the market.

## DESCRIPTION

**System configuration:** grid-connected

**The system consists of:**

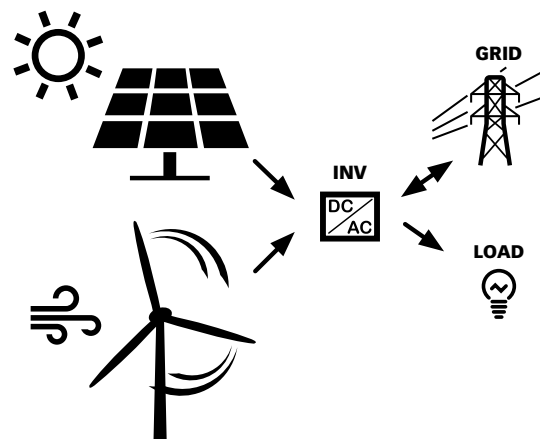
- A)** Table top silicon cell photovoltaic panel
  - A.1)** Solar radiation sensor (PVWG-GR/EV only)
  - A.2)** Temperature sensor (PVWG-GR/EV only)
- B)** Horizontal axis wind power generator
- C)** Table top control panel including:
  - C.1)** Grid-Tie Inverter
  - C.2)** Electric load
  - C.3)** Electric instrumentation for detecting the energy flows in the circuit branches
  - C.4)** PC data acquisition system (PVWG-GR/EV only)
- D)** Wind speed sensor (PVWG-GR/EV only)

**Relevant features:**

- The PV panel can be used both outdoors and indoors. In case of indoor use, the indoor operation device SS-2/EV is required (**optional item** - refer to the end of this data sheet)

- The PV panel can be disconnected from the system to draw the characteristic curve. The portable rheostat PRH-1 is required (**optional item** - refer to the end of this data sheet)
- To operate the wind generator the indoor operation device WG-IE is required (refer to the end of this data sheet)

**Operating principle:**



- In case the user consumption is lower than the available energy from the photovoltaic panel and wind power generator, the excess power is fed to the grid
- On the contrary, when consumption is higher than the available energy, the additionally required energy is supplied by the grid

## TRAINING PROGRAM

- Components of a combined on-grid wind and solar system for electricity production
  - Effect of solar radiation on the panel output voltage (\*)
  - Effects of shading on a real solar installation (\*)
  - Photovoltaic panel energy conversion efficiency (\*)
  - Effect of the wind speed on the generator output voltage (\*\*)
  - Wind generator energy conversion efficiency (\*\*)
  - Interconnection of solar/wind energy to the public grid
  - Operation and efficiency of a DC/AC inverter
  - Connection to portable rheostat *PRH-1* (**optional item** - refer to the end of this data sheet) for photovoltaic panel characteristic curve construction
  - Connection to wind power generator indoor operation device *WG-IE* (**required** - refer to the end of this data sheet) for wind generator characteristic curve construction
- (\*) For *PMWG-EGR/EV* Solar radiation meter *SORM* (**optional item** - refer to the end of this data sheet) required
- (\*\*) For *PMWG-EGR/EV* Cup vane air velocity meter *THAC* (**optional item** - refer to the end of this data sheet) required

## TECHNICAL SPECIFICATIONS

### Silicon cell photovoltaic panel

- Adjustable tilt table top aluminum frame
- 60 W photovoltaic panel

### Horizontal axis wind power generator

- 6 blades with outer ring (turbine diameter 510 mm):
  - Cut in Wind Speed: 3 m/s
  - Nominal power output: 49 W at 15 m/s
- Low friction 3 phase, brushless alternator
  - Output nominal voltage: 12 Vdc
- Metal supporting frame with protecting grid

### Table top control panel

- Metal structure with complete colour synoptic diagram
- Grid tie power inverter:
  - Rated AC Output Power: 450 W
  - AC Output Voltage: 230 V
  - AC Output Frequency: 50 Hz
  - DC Input Voltage Range: 11 ÷ 28 V
  - Output Current Waveform: Pure Sine-wave
  - MPPT Function
  - Protection vs: Over Current, Over Temperature, Reverse Polarity, Anti-Island
- Electric load: 230 V lamp
- Socket for connection to the external AC load *ACL220V* (**optional item** - refer to the end of this data sheet)
- Microprocessor-based instruments for DC/AC parameters

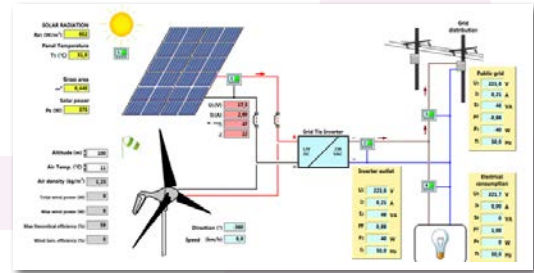
### Sensors (*PVWG-GR/EV* only)

- Solar radiation sensor for measuring and transmitting the global solar radiation incident on the PV panel to the control panel
- Temperature sensor for measuring and transmitting the PV panel temperature to the control pane
- Wind speed sensor for measuring and transmitting the wind speed to the control panel

### PC data acquisition (*PVWG-GR/EV* only)

- All instruments and sensors, as described above, are connected in Modbus network. This network is connected to a PC via an adapter RS485/USB
- A specific software (developed with LabView) is supplied to monitor the system parameters

- Parameters displayed:
  - All DC / AC parameters
  - Photovoltaic panel incident solar radiation
  - Photovoltaic panel temperature
  - Wind speed



- The software enables to:
  - Calculate solar energy conversion efficiency
  - Visualize the trend in time of the solar radiation incident on the photovoltaic panel surface and its temperature and the wind speed and the energy flows to and from photovoltaic panel, wind power generator, public grid and load
  - Save the exercises data for future analysis or project work

<b>Power supply:</b>	230 Vac 50 Hz single-phase - 50 VA (Other voltage and frequency on request)
<b>Dimensions</b>	Control panel: 80 x 40 x 10 cm Solar panel: 80 x 50 x 88 cm Wind gen. rotor diameter: 51 cm
<b>Net weight:</b>	50 kg

## REQUIRED

### WIND POWER GENERATOR INDOOR OPERATION DEVICE Mod. WG-IE

To operate the aerogenerator



**PERSONAL COMPUTER**  
- NOT INCLUDED -  
(*PVWG-GR/EV* only)

## SUPPLIED WITH

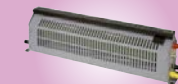
### THEORETICAL-EXPERIMENTAL HANDBOOK



## OPTIONAL (REF. ACCESS. AND INSTRUMENTS)

### INDOOR LIGHTING DEVICE Mod. SS-2/EV

To operate the photovoltaic panel indoor



**PORTABLE RHEOSTAT Mod. PRH-1**  
To draw the PV panel characteristic curve

### SPOTLIGHT Mod. ACL220V

To be used as 230 Vac electric load



**SOLAR RADIATION METER Mod. SORM** (*PVWG-EGR/EV* only)  
To calculate the solar energy into electric energy conversion efficiency

### CUP VANE AIR VELOCITY METER Mod. THAC

For the calculation of the wind energy into electric energy conversion efficiency

