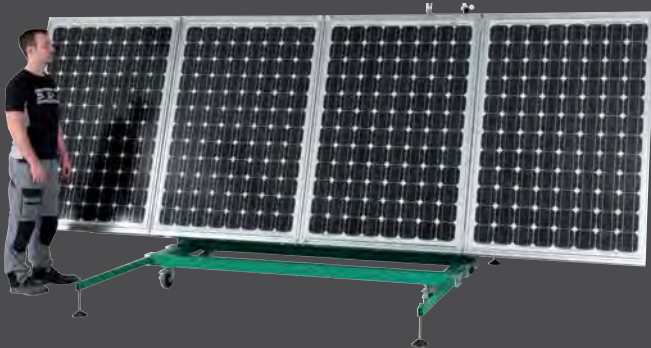


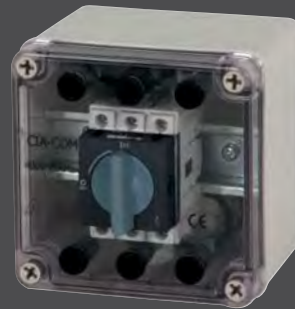
RENEWABLE ENERGY

Solar central systems & Accessories



P. 122 - 133

Photovoltaic kits & components



P. 134 - 137

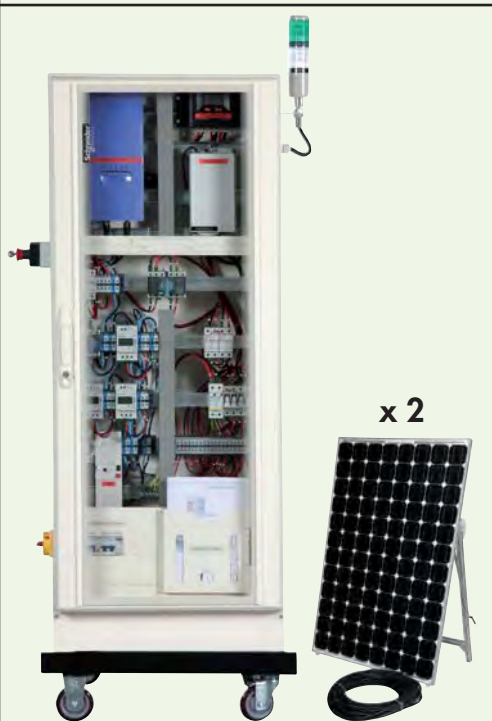
Wind turbine simulator



P. 138 - 139

Choose your solution for studying photovoltaic energy

SOLAR CENTRAL UNIT WITH NETWORK INJECTION AND ISOLATED SITE

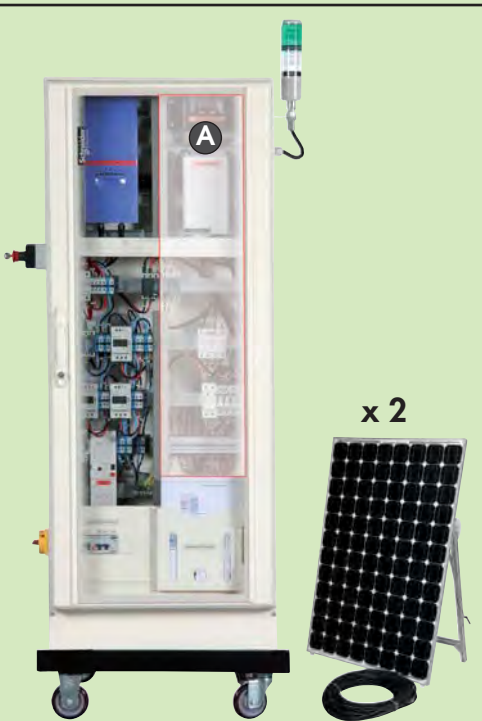


Complete solution comprising an electrical cabinet, 2 portable photovoltaic panels (on frames), and all the accessories required for studying solar energy on the network and an isolated site.

REF. SOL-1

SEE PAGE 124

SOLAR CENTRAL UNIT WITH NETWORK INJECTION

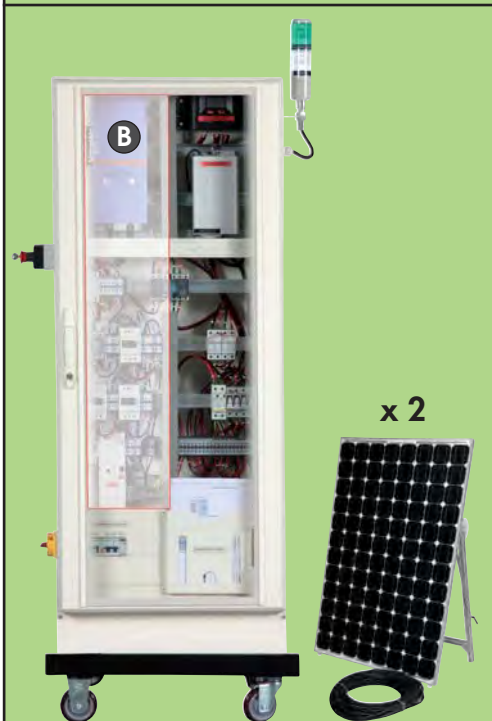


In this version, zone **A** of the cabinet remains blank. Supplied with 2 portable photovoltaic panels (on frames), and all the accessories required for studying solar energy on the network.

REF. SOL-2

SEE PAGE 125

SOLAR CENTRAL UNIT WITH ISOLATED SITE



In this version, zone **B** of the cabinet remains blank. Supplied with 2 portable photovoltaic panels (on frames), and all the accessories required for studying solar energy on an isolated site.

REF. SOL-3

SEE PAGE 126

LOADING ZONE FOR USE ON SITE WITH ELECTRICITY NETWORK OR ISOLATED SITE



REF. HABITAT-1

SEE PAGE 127

LOADING ZONE FOR USE ON SITE WITH ELECTRICITY NETWORK



REF. HABITAT-2

SEE PAGE 127

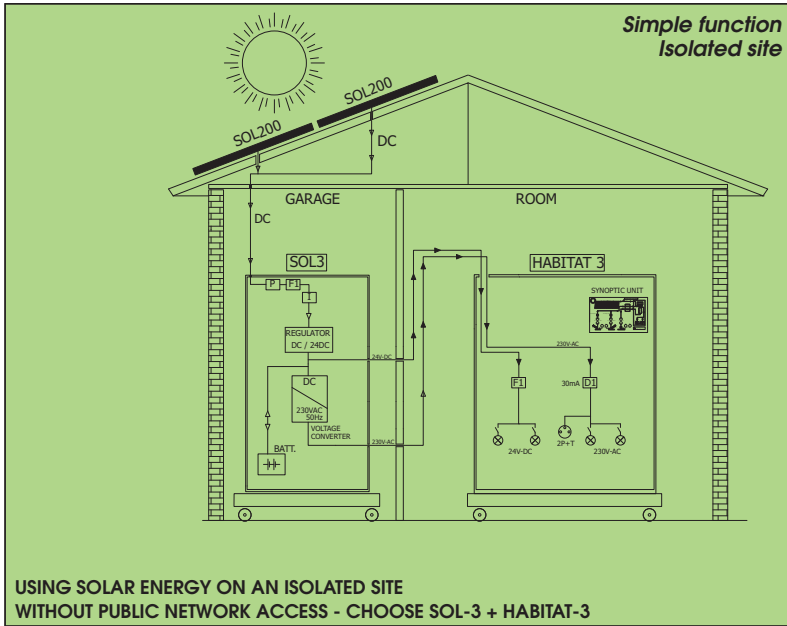
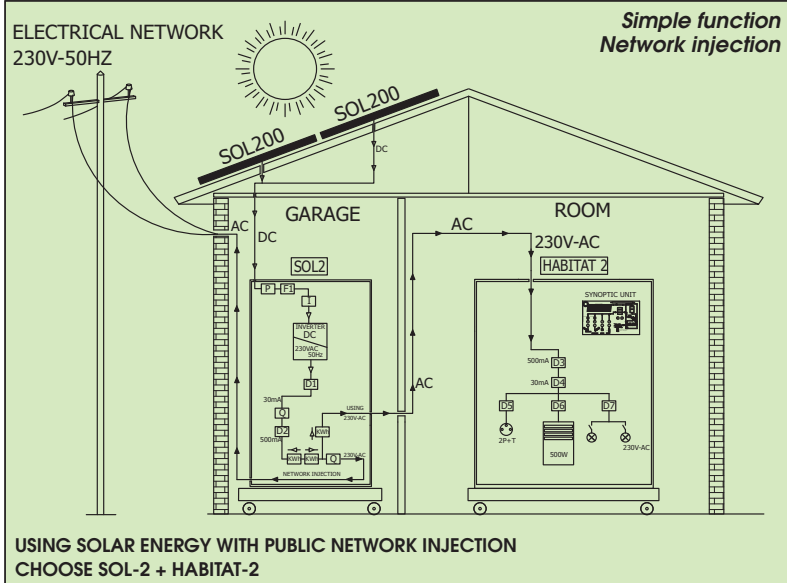
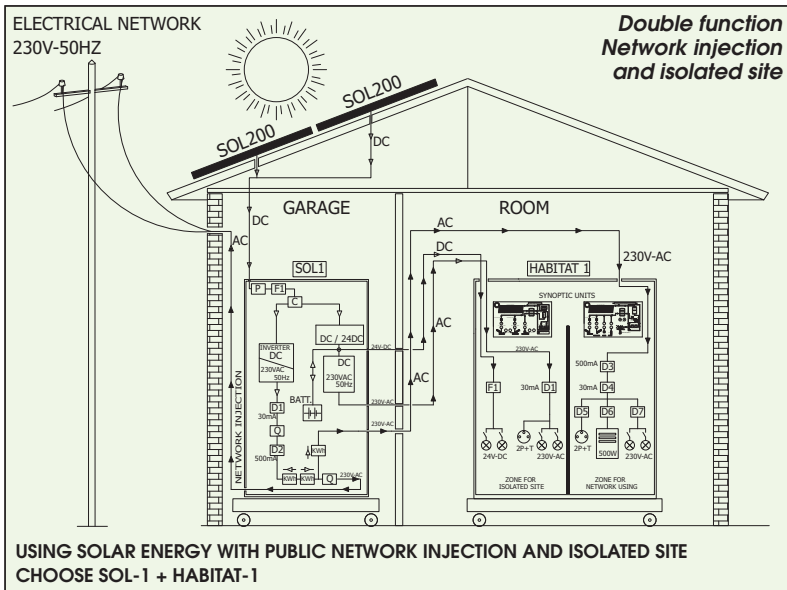
LOADING ZONE FOR ISOLATED SITE USE



REF. HABITAT-3

SEE PAGE 127

Acquisition for central unit



NEW



Set of sensors, interfaces and software for the real time data monitoring of a photovoltaic installation.

COMPOSITION

- Three 4-20mA sensors for reading wind speed (ms), solar irradiation (W/m2) and the temperature of the solar panel (°C).
- 1 sealed "solar panel power interface" box for reading the voltage and current supplied by the photovoltaic panels. This interface transmits information (U / I / Wind speed / temperature / irradiance) to the data interface as 4-20mA signals. Voltage 250VDC Max./Current 25A Max.
- 1 "inverter power interface" box to be installed near the inverter reads the voltage and current supplied to the installation. U/I information is transmitted to the data interface as 4-20mA signals. Voltage 250VDC Max./Current 20A Max
- 1 "battery power interface" box to be installed near the batteries reads the voltage supplied to the installation. U information is transmitted to the data interface as 4-20mA signals. Voltage 250VDC.
- 1 "data interface" box collects the 4-20mA signals from the different power interfaces to transmit them to your PC. Mains power supply 230VAC - PC link by USB lead supplied.
- 1 Software for monitoring photovoltaic settings and data Allows:
 - you to create your photovoltaic installation.
 - real time display as curves and numeric blocks of the different data of: wind speed, solar irradiation, panel temperature; U / I supplied by the solar panel; U / I supplied by the inverter; U supplied by the battery
 - the display, after acquisition, of the curves of electrical power supplied by the solar panels, electrical power supplied by the inverter, installation efficiency
 - selection of the sampling frequency for data acquisition (1 to 60 minutes), the acquisition period (1 minute to 24H), the display scales of the curves and their colours, data export to a spreadsheet like Excel®.

The Software is compatible with Windows XP, W7. Supplied on CD.
All the connection cables and mounting accessories are supplied.

Solar central unit with network injection and isolated site



ref. SOL-1 electrical cabinet + 2 photovoltaic solar panels + 1 link cable

SOL-1 is a standard compliant solar central unit, comprising an electrical cabinet (with its protection and metering components), 2 photovoltaic solar panels with power 2 x 200Wc on tilting frame and 30-m link cable.

PARTIAL OR TOTAL RESALE OPERATION

In the cabinet a DC/AC inverter converts the DC from the photovoltaic panels to AC 220VAC 50Hz, and injects its power in synchronism into the network through an isolation transformer. This inverter is protected against any polarity reversal and any overload on the DC or AC side. When the panels are not lit, the inverter consumes no current.

Technical characteristic for the inverter coupled to the public network.

INVERTER	VOLTAGE	Max current	Power
INPUT	65~125VDC	8A	
OUTPUT	230VAC-50Hz	2,25A	525VA

OPERATION IN ISOLATED SITE WITH NO RESALE

The photovoltaic current charges two 12V sealed batteries cabled in series through a charging controller. This DC voltage is used directly by low energy consumption lamps 24VDC, and/or converted to 250VAC 50Hz by a 200W voltage converter.

Technical characteristics for the isolated site converter

VOLTAGE CONVERTER	Voltage	Max Current	Power
INPUT	20~32 VDC	11A	210W
OUTPUT	230VAC 50Hz	1A	200VA

RECOMMENDED OPTION
ARTIFICIAL SOLAR SOURCE
QTY 2
SEE PAGE 131

1. ELECTRICAL CABINET

Technical cabinet of standardized solar central unit on wheeled frame.

Dimensions: 810 x 600 x 1890mm

COMPRISES

- 2 disconnectors
- 1 500mA -30A differential
- 1 30mA differential
- 1 lightning arrester + fuses
- 3 100 Wh resolution meters
- 1 Mushroom head emergency stop
- 1 source inverter
- 1 charging controller 12/24VDC-20A
- 2 batteries 12V-12Ah
- 1 set of photovoltaic connectors
- 1 500W inverter for network synchronisation
- 1 Voltage converter 24VDC/230VAC-200W

2. LINK CABLE

30-m cable for connecting the solar panels to any type of solar system.

3. PHOTOVOLTAIC SOLAR PANEL 200Wc ON TILTING FRAME

- Open circuit voltage: 57V DC
- Short-circuit current: 4.8A
- Optimum operating voltage: 46V DC
- Optimum operating current: 4.3A
- Maximum power: 200Wc (variation of $\pm 10\%$ depending on the series)
- Sealed connections IP65 – 1000V on the rear of the panel.
- Type of cells: Monocrystalline silicon
- Robust aluminium frame.
- Useful surface area of the cells 1.5m².
- Output 47VDC – 4.2A – 200Wc per panel on 2 photovoltaic terminals.
- Device for measuring the tilt angle
- Tilt adjustable from 5° to 70°
- Two ball joints with clamping levers for positioning the panel to the required tilt angle.
- Light and easy to move.

Dimensions:

Folded position: 1620 x 1060 x 100mm

Unfolded to 70° position: 2100 x 1060 x 700mm

Solar central unit with network injection

RECOMMENDED OPTION
ARTIFICIAL SOLAR SOURCE
QTY 2
SEE PAGE 131

1. ELECTRICAL CABINET

Technical cabinet of standardized solar central unit on wheeled frame.

Dimensions: 810 x 600 x 1890mm

COMPRISES

- 2 disconnectors
- 1 500mA -30A differential
- 1 30mA differential
- 1 lightning arrester + fuses
- 3 100 Wh resolution meters
- 1 set of photovoltaic connectors
- 1 500W inverter for network synchronisation

2. LINK CABLE

30-m cable for connecting the solar panels to any type of solar system.

3. PHOTOVOLTAIC SOLAR PANEL 200Wc ON TILTING FRAME

- Open circuit voltage: 57V DC
- Short-circuit current: 4.8A
- Optimum operating voltage: 46V DC
- Optimum operating current: 4.3A
- Maximum power: 200Wc (variation of $\pm 10\%$ depending on the series)
- Sealed connections IP65 – 1000V on the rear of the panel.
- Type of cells: Monocrystalline silicon
- Robust aluminium frame.
- Useful surface area of the cells 1.5m².
- Output 47VDC – 4.2A – 200Wc per panel on 2 photovoltaic terminals.
- Device for measuring the tilt angle
- Tilt adjustable from 5° to 70°
- Two ball joints with clamping levers for positioning the panel to the required tilt angle.
- Light and easy to move.

Dimensions:

Folded position: 1620 x 1060 x 100mm

Unfolded to 70° position: 2100 x 1060 x 700mm



ref. SOL-2 electrical cabinet + 2 photovoltaic solar panels + 1 link cable

IN THIS VERSION, ZONE **A** OF THE CABINET REMAINS BLANK.

SOL-2 is a standard compliant solar central unit, comprising an electrical cabinet (with its protection and metering components), 2 photovoltaic solar panels with power 2 x 200Wc on tilting frame and 30-m link cable.

PARTIAL OR TOTAL RESALE OPERATION

In the cabinet a DC/AC inverter converts the DC from the photovoltaic panels to AC 220VAC 50Hz, and injects its power in synchronism into the network through an isolation transformer. This inverter is protected against any polarity reversal and any overload on the DC or AC side. When the panels are not lit, the inverter consumes no current.

Technical characteristic for the inverter coupled to the public network.

INVERTER	VOLTAGE	Max current	Power
INPUT	65~125VDC	8A	
OUTPUT	230VAC-50Hz	2,25A	525VA

Solar central unit for isolated site

RECOMMENDED OPTION
ARTIFICIAL SOLAR SOURCE
QTY 2
SEE PAGE 131



ref. SOL-3 electrical cabinet + 2 photovoltaic solar panels + 1 link cable

IN THIS VERSION, ZONE **B** OF THE CABINET REMAINS BLANK.

SOL-3 is a standard compliant solar central unit, comprising an electrical cabinet (with its protection and metering components), 2 photovoltaic solar panels with power 2 x 200Wc on tilting frame and 30-m link cable.

OPERATION IN ISOLATED SITE WITH NO RESALE

The photovoltaic current charges two 12V sealed batteries cabled in series through a charging controller. This DC voltage is used directly by low energy consumption lamps 24VDC, and/or converted to 250VAC 50Hz by a 200W voltage converter.

Technical characteristics for the isolated site converter

VOLTAGE CONVERTER	Voltage	Max Current	Power
INPUT	20~32 VDC	11A	210W
OUTPUT	230VAC 50Hz	1A	200VA

1. ELECTRICAL CABINET

Technical cabinet of standardized solar central unit on wheeled frame.

Dimensions: 810 x 600 x 1890mm

COMPRISES

- 2 disconnectors
- 1 lightning arrester + fuses
- 1 Mushroom head emergency stop
- 1 charging controller 12/24VDC-20A
- 2 batteries 12V-12Ah
- 1 set of photovoltaic connectors
- 1 Voltage converter 24VDC/230VAC-200W

2. LINK CABLE

30-m cable for connecting the solar panels to any type of solar system.

3. PHOTOVOLTAIC SOLAR PANEL 200Wc ON TILTING FRAME

- Open circuit voltage: 57V DC
- Short-circuit current: 4.8A
- Optimum operating voltage: 46V DC
- Optimum operating current: 4.3A
- Maximum power: 200Wc (variation of $\pm 10\%$ depending on the series)
- Sealed connections IP65 – 1000V on the rear of the panel.
- Type of cells: Monocrystalline silicon
- Robust aluminium frame.
- Useful surface area of the cells 1.5m².
- Output 47VDC – 4.2A – 200Wc per panel on 2 photovoltaic terminals.
- Device for measuring the tilt angle
- Tilt adjustable from 5° to 70°
- Two ball joints with clamping levers for positioning the panel to the required tilt angle.
- Light and easy to move.

Dimensions:

Folded position: 1620 x 1060 x 100mm

Unfolded to 70° position: 2100 x 1060 x 700mm

Loading panels for solar central units



Wheeled frame which reproduces domestic electrical installations on a vertical panel and enables the use of the voltage sources (AC + DC) produced by our solar central units SOL-1 to SOL-3. At the back another blank panel protects the electrical cables.

Dimensions: 1000 x 500 x h 1600mm

The frame is supplied assembled, fully cabled, ready to operate, with safety leads for the measuring units, and a CD including the technical data and cabling diagram.



Profile view of the frame

Measurement with a clamp



ref. HABITAT-1

LOADING ZONE FOR ISOLATED SITE USE

This part includes a standard unit with standardized protection described below, and the different loads.

- 1 differential circuit-breaker 16A/30mA
- 1 two-pole fuse holder with fuse cartridges gPV 10x38 1000V
- 2 24V DC low energy consumption light fittings with switches
- 2 light fittings 230VAC with switches
- 1 230VAC 50Hz 2P+E socket
- 1 mimic unit with safety terminals for I and U measurements in different circuits.

LOADING ZONE FOR USE ON SITE WITH ELECTRICITY NETWORK

This part includes a standard unit with standardized protection described below, and the different loads.

- 1 connection circuit-breaker 500mA
- 1 differential circuit-breaker 16A/30mA
- 3 magnetothermal circuit breakers
- 2 light fittings 100W-230VAC with switches
- 1 500W convector
- 1 230VAC 50Hz 2P+E socket
- 1 mimic unit with safety terminals for I and U measurements in different circuits.

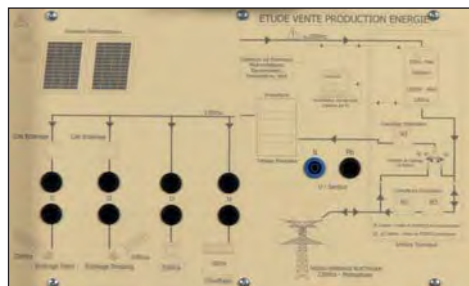


ref. HABITAT-2

LOADING ZONE FOR USE ON SITE WITH ELECTRICITY NETWORK

This part includes a standard unit with standardized protection described below, and the different loads.

- 1 connection circuit-breaker 500mA
- 1 differential circuit-breaker 16A/30mA
- 3 magnetothermal circuit breakers
- 2 light fittings 100W-230VAC with switches
- 1 500W convector
- 1 230VAC 50Hz 2P+E socket
- 1 mimic unit with safety terminals for I and U measurements in different circuits.



Synoptic sale of energy production

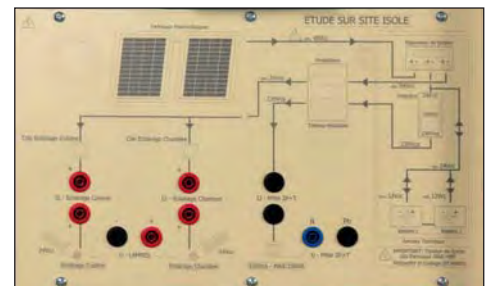


ref. HABITAT-3

LOADING ZONE FOR ISOLATED SITE USE

This part includes a standard unit with standardized protection described below, and the different loads.

- 1 differential circuit-breaker 16A/30mA
- 1 two-pole fuse holder with fuse cartridges gPV 10x38 1000V
- 2 24V DC low energy consumption light fittings with switches
- 2 light fittings 230VAC with switches
- 1 230VAC 50Hz 2P+E socket
- 1 mimic unit with safety terminals for I and U measurements in different circuits.



Synoptic for isolated site use

Solar central unit with supervisor



Complete central unit with synchronization to the public network and touchscreen combined with PLC. For selecting different operating types, electrical measurements and full supervision of 5 scenarios by touchscreen:

- Use of energy supplied by the solar panel.
- Recharges the batteries using the charger.
- Automatic source inverter. Consumption of solar + battery energy then automatic switching to public network as soon as the batteries are flat.
- Use of solar energy in the day and the public network at night.
- Use of the energy supplied by the public electricity network.

TOUCHSCREEN

As well as being a control interface between the operator and the central unit, it displays all the electrical quantities needed to understand the operation. It has a simple and complete role of supervision, control and command.

SUPERVISOR

All the scenarios described above can be modified by means of the programming software of the PLC and touchscreen. The central unit can be networked.

SYNOPTIC ZONES

As well as supervision, SOLHAB enables the taking of conventional measurements on the 2 synoptic zones with the safety terminals.

Three indicator lamps provide general system information

TECHNICAL CHARACTERISTICS

On the top surface:

- 1 main ON/OFF switch.
- 1 24VDC batteries charging switch.
- 1 touchscreen 3x4" colour QVGA, 320 x 240 pixels, Ethernet socket.
- 1 emergency stop button.
- 1 solar load regulator.
- 1 set of signalling indicator lamps.
- 2 synoptics / complete diagram of the system with terminals and indicator lamps.
- Safety terminals for 230V-AC use output (200W from solar energy or 800W from the public network), 24VDC-10A from solar energy.

On the side:

- 2 safety terminals for voltage input from the solar panel.
- 1 main isolating switch from the public network.
- 1 solar panel isolating safety switch
- 1 RJ45 Ethernet connector.

In the cabinet

- 2 batteries 12VDC-12Ah.
- 1 battery charger 24V.
- 1 pure sine inverter 24VDC/230VAC-50Hz - 300W.
- 1 TWIDO PLC Ethernet.
- 1 analogue board 2 Inputs 0-10V/4-20mA and 1 Output 0-10V/4-20mA
- 1 4-port Ethernet coupler.
- 1 set of protection devices, residual current circuit-breaker 30mA and fuse cartridges gPV, lightning arrester.
- 1 open door safety device

Photovoltaic solar panel on tilting frame

- Useful surface area of the cells 1.5m².
- Output 47VDC - 4.2A - 200Wc per panel on 2 photovoltaic terminals.
- Device for measuring the tilt angle
- Tilt adjustable from 5° to 70°
- Two ball joints with clamping levers for positioning the panel to the required tilt angle.
- Light and easy to move.

Dimensions:

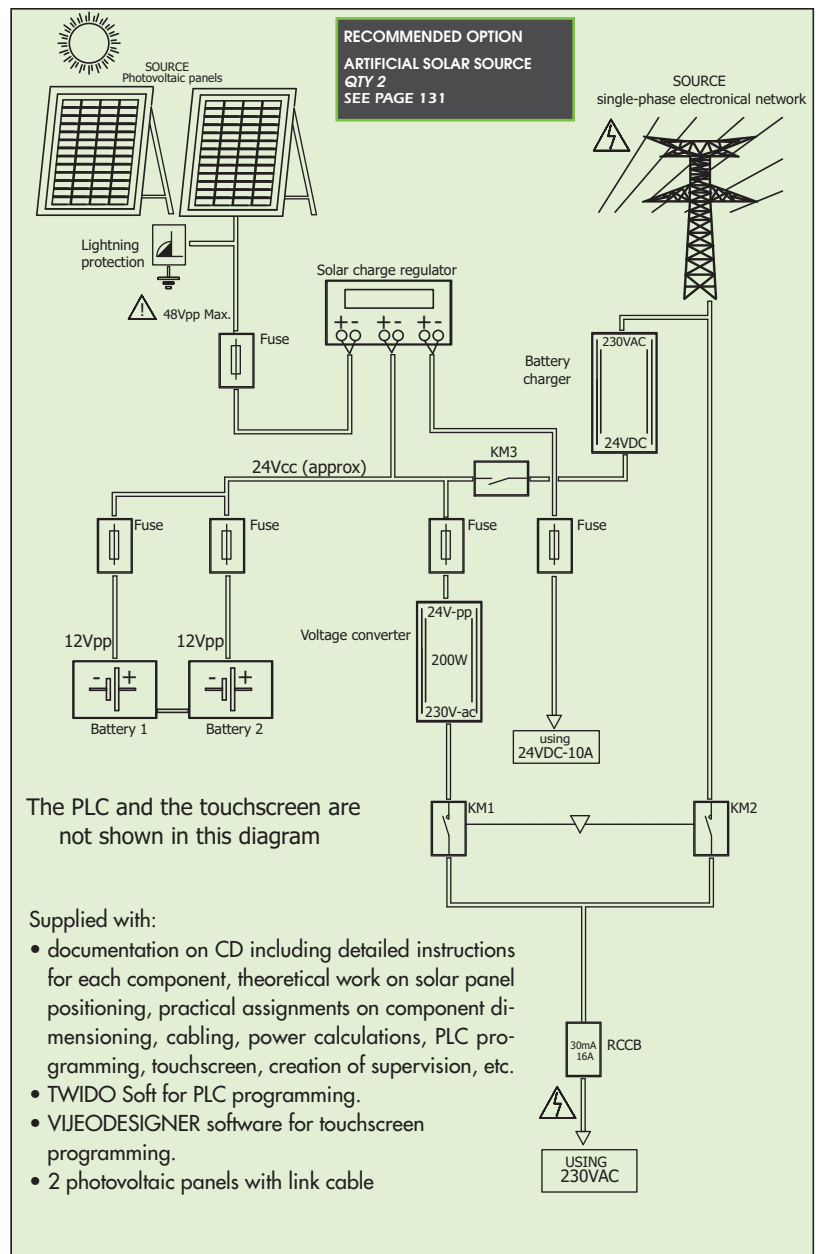
Folded position: 1620 x 1060 x 100mm

Unfolded to 70° position: 2100 x 1060 x 700mm

System power by plug. 2P+E. 230VAC 50/60Hz



ref. SOLHAB



Solar pumping station



SOLPUITS is a fully self-contained solar pumping station with electrical energy. This system lets students understand and analyse its operation and cable solar electrical components.

COMPRISES

- 1 photovoltaic solar panel 200Wc mounted on a robust frame that tilts from 5° to 70°. Output 47VDC-4.2A on 2 photovoltaic terminals. 1 30-m link cable.
- 1 100-l tank simulates the underground water source.
- 1 60-l transparent container acts as water reserve. A tap simulates user consumption and returns water to the tank.
- 1 sealed motor pump 140W- 24DVC-6A. 13l/min capable of pumping dry. It takes water from the tank and fills the reserve water container.
- 2 12V/6Ah batteries supply the pumping station when sunlight is absent.
- 1 24VDC-20A regulator controls battery charging. One 2-button display accessible outside the cabinet enables configuration and viewing of the currents of the solar panel, the battery charge and the lamp and the battery voltage.
- 1 electrical cabinet includes the cabling of all the solar components on connection terminals. A lightning arrester protects the installation and each component is protected by fused circuit-breaker type gPV. The cabling is fully marked and students can easily remove the original strand to do their cabling. Students can also take voltage and current readings. A main switch isolates the solar panel from the electrical cabinet.
- A switched 24VDC lamp lights the area.

A wheeled frame for passing under doors.

SOLPUITS requires no direct water connection. Once the 80-l tank is filled with water, the system is totally self-contained.

Supplied cabled with detailed instructions and complete practical assignments.

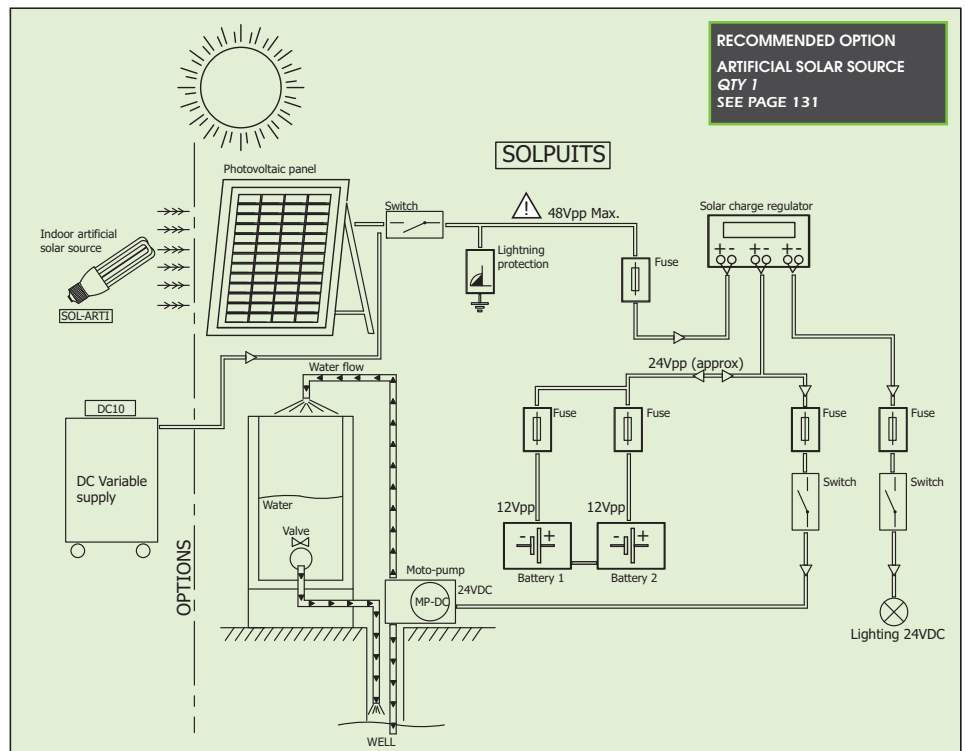
Dimensions: 750 x 670 x 1980mm



ref. SOLPUITS



Simply remove the strand before asking students to do the cabling.



Photovoltaic solar panels and frame

FEATURES OF EACH PANEL

- Open circuit voltage: 57VDC
- Short-circuit current: 4.8A
- Optimum operating voltage: 46VDC
- Optimum operating current: 4.3A
- Maximum power: 200Wc (variation of $\pm 10\%$ depending on the series)
- Sealed connections IP65 – 1000V on the rear of the panel.

PHOTOVOLTAIC SOLAR PANELS 200Wc ON TILTING FRAME (1 PANEL)

- Robust aluminum frame.
- Useful surface area of the cells 1.5m².
- Output 47VDC – 4.2A – 200Wc per panel on 2 photovoltaic terminals.
- Device for measuring the tilt angle
- Tilt adjustable from 5° to 70°
- Two ball joints with clamping levers for positioning the panel to the required tilt angle.
- More SOL-200 can be coupled electrically to increase power.
- Light and easy to move.

Dimensions Folded position: 1620 x 1060 x 100mm

Dimensions Unfolded to 70° position: 2100 x 1060 x 700mm

ref. SOL-200



LINK CABLE

30-m cable for connecting the solar panels to any type of solar system.

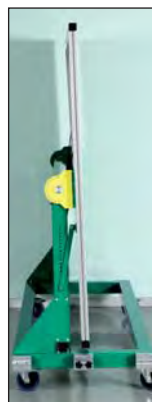


ref. SOL-CAB30

PHOTOVOLTAIC SOLAR PANELS 400Wc ON TILTING WHEELED FRAME (2 PANELS)

- Compact wheeled frame.
- Sufficiently compact to be rolled through a door-way.
- An instantly removable stand is fixed to the wheeled frame
- Four actuators raise the SOL-400 to a stable and horizontal position
- Unfolded stand wheelbase: 225 x 260cm
- Overall folded stand dimensions: 227 x 75cm high 195cm
- Effective surface area of cells: 3.1m²
- Total power of the panels 400Wc (may vary by 10%)
- Tiltable from the vertical to the horizontal position in 5° increments.
- A protractor measures the panel tilt.

ref. SOL-400



PHOTOVOLTAIC SOLAR PANELS 800Wc ON TILTING WHEELED FRAME (4 PANELS)

- Compact wheeled frame.
- sufficiently compact to be rolled through a door-way.
- an instantly removable stand is fixed to the wheeled frame
- four actuators raise the SOL-800 to a stable and horizontal position
- Unfolded stand wheelbase: 225 x 260cm
- Overall folded stand dimensions: 227 x 75cm high 195cm
- Effective surface area of cells: 6.3m²
- Total power of the panels 800Wc (may vary by 10%)
- Tiltable from the vertical to the horizontal position in 5° increments.
- A protractor measures the panel tilt.

ref. SOL-800



Artificial solar source



In cloudy conditions photovoltaic panels do not produce significant power and the related practical assignments cannot be performed. SOL-ARTI is a source for getting around the loss of sunlight by illuminating the solar panel with artificial light whose spectrum is close to sunlight. While not having as much luminosity as unclouded sunlight, SOL-ARTI illuminates with sufficient intensity for the panel to generate 1/3 of its peak power W_c (corresponding to sunlight at 1 kW/m^2)

SOL-ARTI is comprised of a solar panel placed facing a set of evenly distributed spotlights.

The panel-to-spotlight distance can be adjusted to find the maximum photovoltaic power.

Two opaque side panels prevent the accidental blinding of a student. With the solar panel and spotlight support they also make a closed duct for evacuating heat by an air current going from bottom to top. Centrifugal fans, located in the bottom part, inject fresh air that runs up the panel.

Grids in the bottom and top parts let the air flow pass evacuating the heat, and prevent accidental contact by hand with a burning spotlight or with the fan blades.

The solar panel can be removed easily in order to replace a spotlight quickly if necessary.

The unit located on the back of the spotlights panel includes

- a key-operated emergency stop button for cutting the electricity supply to the spotlights
- a digital thermometer shows the temperature at the surface of the solar panel. Accuracy 1°C .
- a potentiometer for lighting adjustment, by dimmer built into the unit
- a flow control for the forced ventilation
- automatic power supply cut-off to the spotlights in the event of abnormal temperature rise of the solar panel

PRACTICAL WORK

Adjustment of the light intensity demonstrates the correlation between the light flow and the current delivered by the photovoltaic panel, at constant voltage.

A temperature probe linked to the unit thermometer is located on the solar panel. This shows its instantaneous temperature. Any reduction of the ventilation flow causes the panel temperature to rise, and lowers the photovoltaic current in constant lighting.

ELECTRICAL FEATURES OF THE SOLAR PANEL AT 25°C

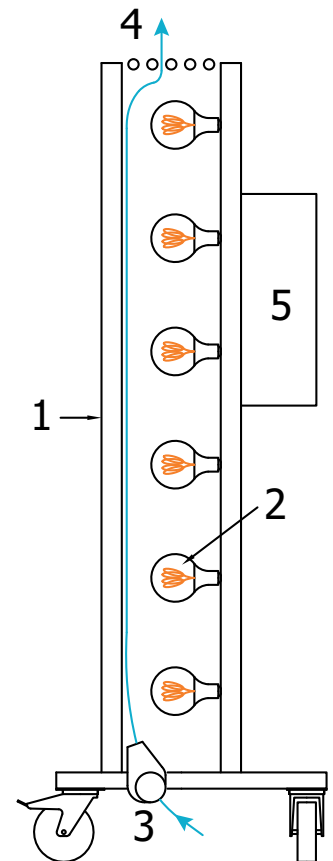
LIGHTING	SOLAR	ARTIFICIAL
Maximum power	220Wc	70Wc
Open circuit voltage	43V	43V
Short-circuit current	6.2A	2.3A

- Sealed connections IP65 – 1000V
- Power supply: 230VAC.
- Dimensions/Weight: 1228 x 665mm height 1926mm / 40kg
- 4 casters including 2 with brake

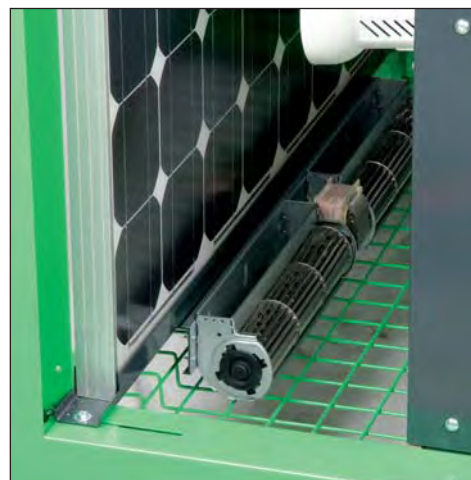


Side protection panel removed for the photograph.

ref. SOL-ARTI



1. solar panel
2. spotlights
3. fan and air inlet
4. grid and air outlet
5. electrical cabinet.



Ventilation system with protection grid.



Side view with side protection panel.

Solar analyser



Package includes:

- bag
- AC power
- accumulators
- cables connecting panels
- USB cable and software.

battery Info : 8 x LR6 (AA)

ref. VA200



- Current/voltage graph drawing (characteristic of the solar panel)
- Autoscan search of the solar panel maximum power – Pmax (60V – 6A)
- Maximal voltage Vmaxp at Pmax power
- Maximal voltage Imaxp at Pmax power
- Opened circuit voltage Vopen
- Short-circuit opened Ishort
- I = f(V) graph with a cursor
- Efficiency calculation in %
- Power by area unit (in W/m²)
- Manual test for a particular point
- Range 10V / accuracy 0.001V
- Range 60V / accuracy 0.01V
- Range 1A / accuracy 0.1mA
- Range 6A / accuracy 1mA
- Accuracy 1% + 18dgt

Pyranometer

The PYR1307 pyranometer measures the power of solar radiation in watts per m²: W/m²

- Ratings: 199.9 W/m² and 1,999 W/m²
- Measuring error: < 10W/m² or 5% of the reading
- Display: 2,000 pixel LCD
- Captures min. and max. values
- "Hold" key allows one to freeze the display
- Backlighting
- Supplied with a carry case
- Dimensions: 162 x 63 x 28mm
- Weight: 250g



battery Info : 2 x LR03 (AAA)

ref. PYR1307

Simulation of solar panel



Supplied with cable (1m) for connection to the management system of photovoltaic panels.

ref. DC10

Given that photovoltaic panels do not produce significant power in cloudy conditions, it is not possible to complete the related tutorials. DC10 is a source which, by replacing the solar panels, overcomes unpredictable sunshine.

- Mains input
- Stop/start switching
- Emergency stop
- DC output
- Maximum current
- Filtering
- Adjustment method
- Display of outputs
- Output terminals in parallel

- Upstream protection
- Output protection
- Protection of individuals
- Dimensions/Weight
- Castors

- 230V single-phase
- Push-button + LED indicator lights
- Key operated
- Adjustable from 0 to 230V DC
- 10A
- 5% of residual ripple at 10A.
- Button on the top
- 1 voltmeter and 1 ammeter
- 2 photovoltaic type connectors
- 2 4mm safety terminals
- By fuse
- By circuit breaker
- By safety isolation transformer
- 330 x 280mm height 510mm/40kg
- 4 including 2 with brakes

Solar kit



ref. VALSOL



VALSOL is a kit for studying the principles of solar energy, its storage and conversion. The kit consists of two solar panels which are connected in parallel and can be seen immediately the kit is opened. When closed, the panels are protected against impact and scratches. These industrial panels are identical to those found in stand-alone weather stations.

The following can be found underneath the solar panel:

- a standard 15V DC 15 Ah Li-ion battery
- a 12V DC/220V AC, 50Hz, 150W converter
- a safety and monitoring electronics device

CONTROL PANEL

- On/Off button
- a circuit breaker to protect against over-currents
- 4mm safety terminals for voltage and electric current inputs, with jumpers
- the converter's On/Off button
- a 220V AC 50Hz socket with on and defect lamps
- a two-line LCD display delivering messages about the battery: temperature, % charge, charging current and voltage, usage current and voltage, undercharged battery, overcharged battery and overheating, etc., as well as the power output. NB: these are indications, rather than highly accurate measurements.

PROTECTION OF COMPONENTS IN THE CASE OF

- battery overcharge: when its voltage reaches 16.5V the charging current is automatically cut, in order to preserve the battery's service life.
- excessive battery discharge: When its voltage reaches 11.5V, an audible alarm will be triggered. When it falls below 10.5 V the output will be disconnected automatically.
- abnormal increase in the battery temperature
- overload or short-circuit on the converter's output

SUGGESTED TUTORIALS

One of the jumpers isolates the photo-voltaic panels from the rest of the electronics. In this way, students can measure

- the voltage in the no-load circuit (approximately 21V)
- The short-circuit current (approximately 1.9A)
- the current and the voltage according to the lighting, by covering one of the two panels or by varying the tilt of the kit's lid in relation to the sun by an angle α ; and check that the power output is a function of the power factor
- Using a rheostat (e.g. ECO1/2-330), students can look for the charge which corresponds to a maximum power supplied by the panel

The control panel's second jumper measures the DC level at the converter's input. Students can:

- measure the no-load voltage and current at the converter's input, and calculate the no-load power input
- measure currents and voltages upstream and downstream of the converter and calculate the converter's efficiency and losses by loading the 220V AC output.
- check that the converter can supply up to 150W. Compare this power with the power supplied instantly by the panels. Draw conclusions about the role of the battery.

MEASURING OF THE SUN RAYS ANGLE OF INCIDENCE

The solar kit VALSOL is supplied with a protractor and a simplified targeting system ③ allowing the measuring (within a few degrees of precision) the angle of incidence of sun rays on the solar panels. This targeting system which is placed on side can be removed and stored in the side compartment ② dedicated to accessories storage. A stand ① (also removable) allows the stepless adjustment of the inclination of the solar panels.

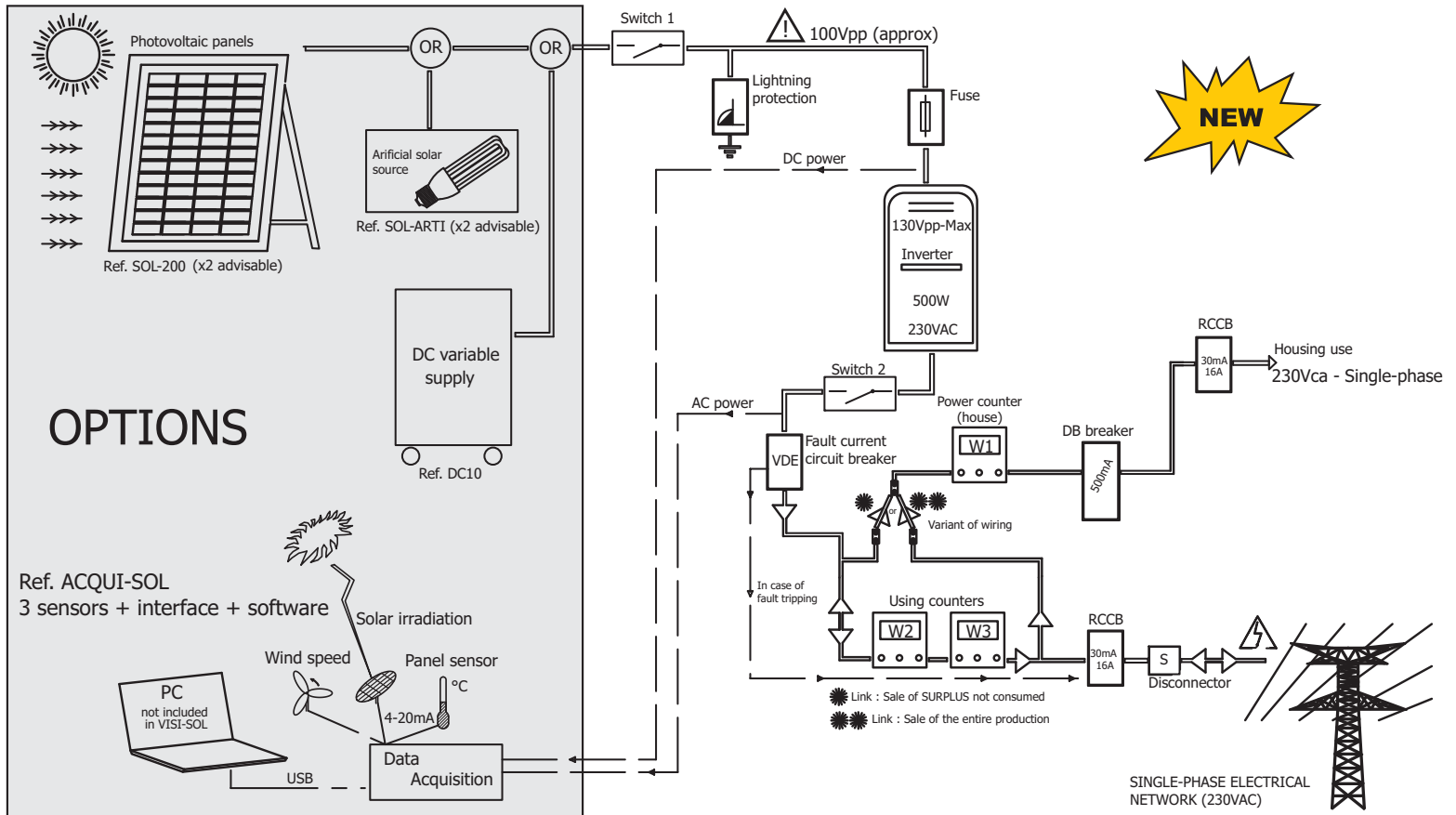
SPECIFICATIONS OF THE SOLAR PANEL

- Total surface area: 420 x 680mm
- Typical voltage: 17.5V
- Short-circuit current: 1.9A
- Total power: 30W
- Typical current: 1.7A
- No-load circuit: 21.5V

OTHERS FEATURES

- Dimensions: 570 x 380 x 160mm. Weight 14kg.
- Fitted side compartment for the storage of leads, jumpers, the targeting system and the inclination stand ②.

Photovoltaic kit for energy injection



Kit of photovoltaic components for studying a solar installation with total or partial energy injection to the electricity network 230VAC-50Hz.

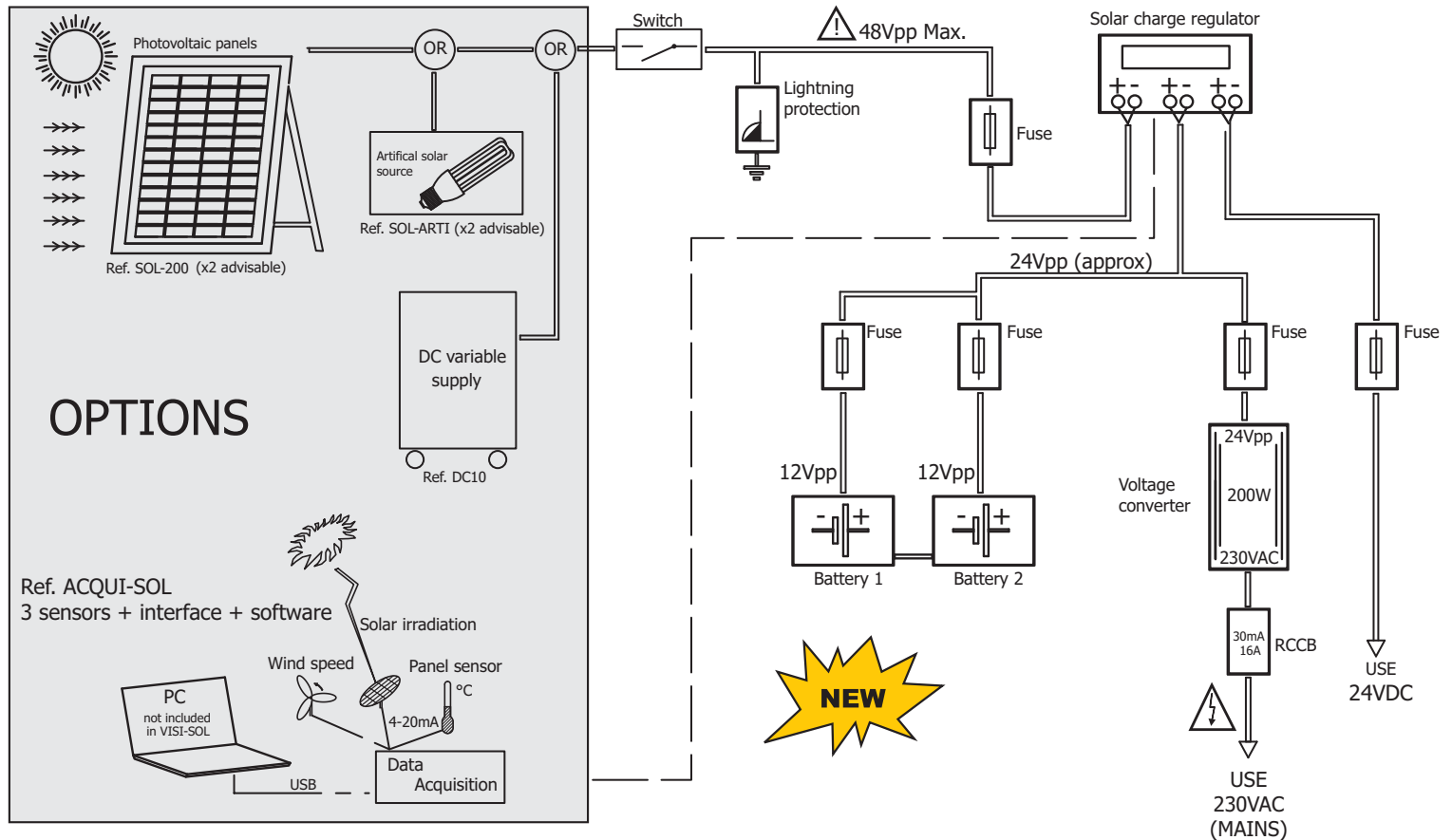
The kit comprises

- 2 photovoltaic switches 0/1 – 32A/500VDC – 3-pole.
- 1 lightning arrester 500VDC
- 1 photovoltaic fuse holder 1000VMax. 2-pole. 10x38mm
- 4 photovoltaic fuse cartridges gPV 1000V. 10x38mm
- 1 network inverter 500W. Automatic synchronization on the network 230VAC-50Hz. Input voltage from 65 to 130VDC. Thermal protection integral to the box. 1 residual current circuit-breaker 30mA-10A two-pole.
- 3 single-phase modular energy meters 63A. Gauges key kWh/kW/Partial. Reset key. Resolution 0.1kW
- 1 two-pole Photovoltaic circuit-breaker with EMS default current in compliance with Standard VDE0126. Gauge 16A-30mA. Use voltage from 196 to 250VAC
- 1 Main switch 25A – 5.5kW/400V.
- 2 residual current circuit-breakers 30mA/16A two-pole.
- 1 two-pole connection circuit-breaker 500mA, 230 V CA, 15/30/45 A
- 1 plug 2P+E male.
- 1 set of 10mm² connection terminals
- 1 set of photovoltaic connectors 4-6mm²
- 1 sheet of 10 photovoltaic labels showing different safety operations
- 1 file on CD: detailed instructions for each component, cabling diagram and practical assignments.

OPTIONS

- Ref. SOL-200** (2 panels recommended) Photovoltaic panel 200W on tilting foot with device for measuring the tilt angle (description P. 130)
- Ref. SOL-CAB30** Connection cable for photovoltaic panels 30m 3G6mm² (description P. 130)
- Ref. ACQUI-SOL** Interface with 3 sensors and acquisition software to read the installation's electrical characteristics. (description P.123).
- Ref. DC10** Power supply DC 0 - 220 volts - 10A protected. Simulates the panels. (description P.132).
- Ref. SOL-ARTI** Source of artificial sunlight. (description P.131).
- Ref. HABITAT-2** Load panel for use on site with electricity network. (description P 127)

Photovoltaic kit for isolated site



ref. KX-TEST

Kit of photovoltaic components for studying a solar installation on isolated site.

The kit comprises

- 2 sealed solar batteries 12VDC -12Ah.
- 1 photovoltaic switch 0/1 – 32A/500VDC – 3-pole.
- 1 pure sine-wave voltage converter with power 200W. input voltage from 20 to 32VDC and output voltage 230VAC-50Hz.
- 1 lightning arrester 500VDC
- 5 photovoltaic fuse holder 1000VMax. 2-pole. 10x38mm
- 12 photovoltaic fuse cartridges gPV 1000V. 10x38mm
- 1 Solar charge regulator with LCD. Max current 20A. Operating voltage 12V or 24V with automatic recognition. Input voltage area from 6.9 to 17.2VDC and from 17.3 to 43VDC. Front pushbuttons for displaying the voltage and current of the charge in the battery and in the use circuit. Solar panels input 48VDC Max. Minimum battery voltage 6.9V.
- 1 residual current circuit-breaker 30mA-16A two-pole.
- 1 set of 10mm² connection terminals
- 1 set of photovoltaic connectors 4-6mm²
- 1 sheet of 10 photovoltaic labels showing different safety operations
- 1 file on CD: detailed instructions for each component, cabling diagram and practical assignments.

OPTIONS

- Ref. SOL-200** (2 panels recommended) Photovoltaic panel 200W on tilting foot with device for measuring the tilt angle (description P. 130)
- Ref. SOL-CAB30** Connection cable for photovoltaic panels 30m 3G6mm² (description P. 130)
- Ref. ACQUI-SOL** Interface with 3 sensors and acquisition software to read the installation's electrical characteristics. (description P.123).
- Ref. DC10** Power supply DC 0 - 220 volts - 10A protected. Simulates the panels. (description P.132).
- Ref. SOL-ARTI** Source of artificial sunlight. (description P.131).
- Ref. HABITAT-3** Load panel for use on isolated site. (description P 127)

Boxed components for studying solar energy

These components are made safe in plastic boxes with transparent covers. They are perfectly visible and the cabling is facilitated by the different safety terminals Ø4mm. Each box is supplied with detailed instructions.

OPTIONS

- Ref. SOL-200** Photovoltaic panel 200W on tilting foot with device for measuring the tilt angle (description P. 130)
- Ref. SOL-CAB30** Connection cable for photovoltaic panels 30m 3G6mm² (description P. 130)
- Ref. ACQUI-SOL** Interface with 3 sensors and acquisition software to read the installation's electrical characteristics. (description P.123).
- Ref. DC10** Power supply DC 0 - 220V - 10A protected. Simulates the panels. (description P.132).
- Ref. SOL-ARTI** Source of artificial sunlight. (description P.131)



ref. CIA-BAT24

- Lot of 2 sealed solar batteries 12V-12Ah.
- Separate cabling of the two sources for putting the 2 batteries in series or parallel.
- L x l x h: 280x190x130mm



ref. CIA-PRF

- Lightning arrester protection for 2-pole DC circuit - 500VDC.
- L x l x h: 180x80x90mm



ref. CIA-REG

- Solar charge regulator with LCD.
- Max current 20A.
- Operating voltage 12V or 24V with automatic recognition.
- Input voltage area from 6.9 to 17.2VDC for 12VDC and from 17.3 to 43VDC for 24VDC.
- Front pushbuttons for displaying the voltage and current of the charge in the battery and in the use circuit.
- Solar panel input 48VDC Max
- Minimum battery voltage 6.9V.
- L x l x h: 200x200x130mm



ref. CIA-OND05

- Network inverter 500W.
- Automatic synchronization on the network 230VAC-50Hz.
- Input voltage from 65 to 130VDC.
- Input on safety terminals and output on 2 1-m cables fitted with safety plugs Ø 4mm male.
- Thermal protection integral to the box.
- L x l x h: 350x150x60mm



ref. CIA-CONV

- Pure sine-wave voltage converter 200W.
- Input voltage, on safety terminal, from 20 to 32VDC and output 230VAC-50Hz on 2P socket.
- Thermal protection integral to the box.
- L x l x h: 210x210x70mm

For instance : set of components for the study of the wiring of a solar energy system with energy release on the electrical network 230 Vac (mains).

2 x CIA-COM
1 x CIA-PRF
1 x CIA-FUS
4 x SBT-FUS10
1 x CIA-OND05
3 x CIA-CPT
1 x CIA-BORN
1 x CIA-VDE

1 x CHT-V6 (see Page 111)
1 x CIA-SE0 (see Page 115)
2 x CIA-MT37 (see Page 115)
2 x SOL-200 (see Page 130)
1 x SOL-CAB30 (see Page 130)

6 leads 302S-R (see Page 259)
15 leads 302S-N (see Page 259)
10 leads 302S-B (see Page 259)
2 leads 304S-R (see Page 259)
6 leads 304S-N (see Page 259)
2 leads 304S-B (see Page 259)
4 leads T200 (see Page 259)

Tips and wiring diagrams provided



ref. CIA-FUS

- Photovoltaic two-pole fuse holder 10x38mm,
- 2-pole for DC.
- Fuse replacement without opening box
- Max: 1000VDC.
- L x l x h: 130x80x90mm
- Supplied without fuse cartridges gPV.
Option Fuse gPV 10x38 1000V:
Ref. SBT-FUS10



ref. CIA-CPT

- Single-phase modular energy meter 63A.
- Gauges key kW.h/kW/Partial.
- Reset key.
- Resolution 0.1kW
- L x l x h: 170x140x100mm



ref. CIA-COM

- Photovoltaic switch 500VDC.
- 3-pole – 32A.
- Front operation control 90°
- Position: O/I
- L x l x h: 120x120x100mm



ref. CIA-INV

- Photovoltaic inverter switch 500VDC.
- 6-pole – 32A.
- Front operation control 190°
- Position I/O/I
- L x l x h: 170x140x100



ref. CIA-VDE

- 0126 two-pole Photovoltaic circuit-breaker with EMS default current in compliance with Standard VDE0126.
- Adjustable without opening box
- Gauge 16A-30mA.
- Use voltage from 196 to 250VAC
- L x l x h: 170x140x100mm



ref. CIA-BORN

- Interface unit for converting 2 photovoltaic type terminals into safety terminals 4mm.
- 32A Max.
- L x l x h: 105x80x90mm

Option for hanging on rails



Option for fast attachment onto a universal rail. In this way, you can attach your various industrial components onto a grid in order to make wiring and testing easier. To order this option, simply add -FIX to the end of the reference

Ex : CIA-VDE-FIX

For instance : set of components for the study of the wiring of a solar energy system for isolated site using batteries.	1 x CIA-COM	1 x CIA-MT37 (see Page 115)
	1 x CIA-BAT24	2 x SOL-200 (see Page 130)
	1 x CIA-PRF	1 x SOL-CAB30 (see Page 130)
	5 x CIA-FUS	15 leads 302S-R (see Page 259)
	12 x SBT-FUS10	15 leads 302S-N (see Page 259)
	1 x CIA-REG	2 leads 304S-R (see Page 259)
	1 x CIA-CONV	2 leads 304S-N (see Page 259)
	1 x CIA-BORN	2 leads T200 (see Page 259)

Tips and wiring diagrams provided

Wind turbine

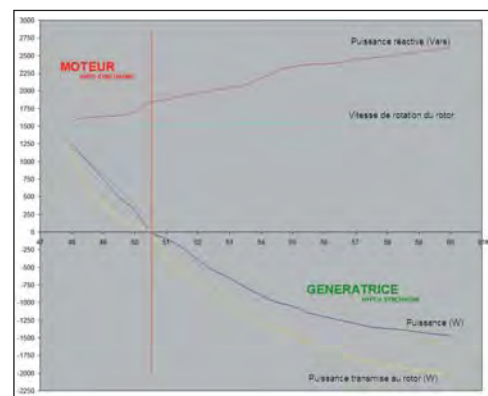
Wind turbine simulator – Network injection

EOLYP is a test bench dealing with the study of the hyper synchronous activity of a wind turbine for its electricity production aspects, excluding the mechanical aspects. Due to noise pollution and draughts, which are incompatible with a classroom environment, the propeller has been replaced by a variable speed drive motor.

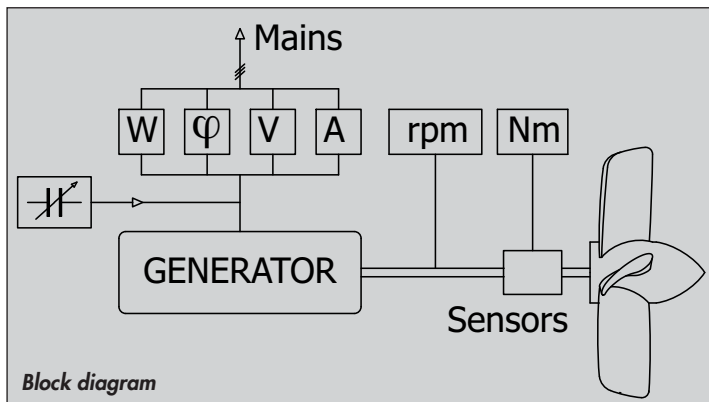
The functional diagram presents the operating principle. The safety components placed in the electrical cabinet are not represented to simplify reading. The propeller, for which the operator adjusts the speed, drives the generator from 0 to 1800 rpm. Two sensors placed on the shaft, returns rotation speed and torque information to the console which displays this information. The generator is coupled to the public three-phase network, through an electrical measurement bench indicating the:

- active power injected into the network.
- voltage between phases
- current
- power factor.

The central-zero wattmeter shows that depending on the drive speed, the generator consumes or produces energy highlighting the hypersynchronous and hyposynchronous operations. The voltage/current distortion also changes with the rotation speed as indicated by the central-zero power factor meter. The adjustable capacitors battery is used to adjust the power factor to around 1 depending on the speed and power produced.



Studying the conversion of renewable energy



COMPRISES

- 1 frame on casters, dim. 1200x750mm height : 1820mm
- 1 asynchronous motor 1.5 kVA
- 1 generator
- 1 DC tachogenerator / 1 torque sensor
- 1 command console
- 1 electrical cabinet
- 1 network coupling unit

GENERATOR FEATURES

- Generator: 3x400VAC Asynchronous motor.
- Active power injected into the network: 0 to 1.2kVA
- Generator efficiency: 78%
- Speed variation: 0 to 1800 rpm

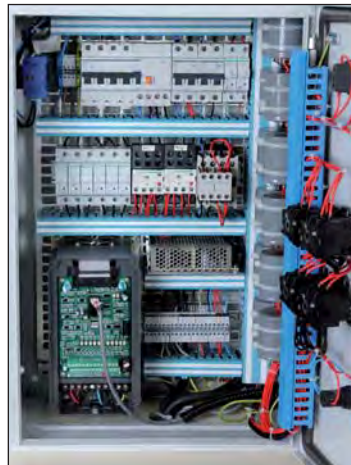
ELECTRICAL CABINET

Interior:

- 30 mA circuit breakers and magneto-thermal and thermal circuit breakers.
- 2.2kVA speed controller with control unit on the console.
- stepped capacitors battery

On the front:

- 1 emergency stop circuit breaker
- 1 switch disconnector
- 1 stop/Start button with push button
- 4 switches triggering the capacitors to rectify the $\cos\phi$
- 2 indicator lights show a thermal fault on the motor and generator



Several tutorials are delivered with the teacher and student folders:

- Plot of the active power curve as a function of the rotation speed.
- Demonstration of the reactive power injected into the network at synchronism speed.
- Compensation by the capacitors battery in hypersynchronous operation.
- Demonstration of the reactive current at maximum active power and compensation.
- Impact of the speed on the $\cos\phi$ and solutions to automate the regulation.
- Efficiency calculation: Electrical power injected into the network/mechanical drive power
- Checks before coupling with the network. Limit speed, electricity production peak.

This converter operates on the same principle as an industrial model. It treats the electrical power supplied by a wind turbine equipped with squirrel-cage motor in hypersynchronous operation or ring generator or synchronous machine. The output cannot be synchronized with the network but can be used in isolated site.

CONVERTYS is compatible with the EOLYP wind turbine.



OPERATING PRINCIPLE

The three-phase voltage supplied by the wind turbine is galvanically separated by isolation transformer, then rectified by a Graetz bridge. This DC voltage is converted using a DC/AC converter to an AC voltage 230V 50Hz / 500VA. Should this power be exceeded, the converter instantly offloads the output, lights an overload indicator lamp, and re-starts 15 seconds after load reduction.

TECHNICAL CHARACTERISTICS

- The converter's synoptic, printed on the front, facilitates location of the components and measurement points.
- The three-phase voltage from the wind turbine is applied to CONVERTYS through 4 safety terminals 4mm dia. The wind turbine-to-converter interconnection is made using laboratory leads. Inputs between 375 and 460V three-phase.
- A main switch located on the top of the box, starts and stops the converter's power supply.
- Safety terminals 4mm dia. located between each component enable the voltages and currents to be measured at each conversion step.
- A thermal-magnetic circuit-breaker protects the transformer primary against any overload.
- Output converter 500W/230V.
- A residual current circuit-breaker 30mA protects the output to the use network cabled according to neutral system TT.
- Unit on casters dimensions: 600x450mm. Height 530mm

