SOL30

Solar Panel Controller

Instruction Manual

Thank you for having chosen one of our products for your work.
We are certain that it will give the utmost satisfaction and be a notable help on your job and application.

1 Product Description

SOL30, Solar Panel Controller is a device that works with the DC-UPS system. The controller transfers the energy from a photovoltaic panel (Sun) and supports the charging process of the battery connected to the DC-UPS.
Data exchange between the devices allows to manage and configure the system.

The device technology includes a buck-boost charge circuit aimed at controlling of the maximum power point of the PV module (MPPT). The main difference of this controller comparing to other types with buck circuit is that it works with the PV module at voltages than can be both higher or lower than battery voltage, in this way it is possible automatically connect the device to 12V and 24V systems. PV module voltage during the working of MPPT circuit can span from 10 V to 30 V with both 12V and 24V batteries.

SOL30 completes the ADELSystem DC-UPS solution with applications including off-grid PV systems, such as road signs systems, lighting systems, small low voltage systems in isolated field around the world.
The several strategies of load management, selectable by the user on the Web Server, make the SOL30 the proper solution in several applications; from power supply of video cameras that have to work only during the day, to power supply of flashing systems/road signs that have to work only during night or to power supply of lighting systems that have to work only for a certain number of hours during night or day in alternative to the energy from the grid.

The DC-UPS Web server dashboard allows to easily monitor the working status with simple and intuitive diagrams of charge current, battery voltage, energy produced by the PV module, load current and energy consumed by the load.

When power is available from both the sun and the grid, the system acts in a “green” way, giving priority to the energy from the sun to supply the load.

2 Safety and warning notes

WARNING – Explosion Hazard Do not disconnect Equipment unless power has been switched off or the area is known to be non-hazardous.
WARNING – Explosion Hazard. Substitution of components may impair suitability for class I, Division 2.
WARNING – Switch off the system before connecting the module. Never work on the machine when it is live. The device must be installed according to EN61010 or EN62368-1. The device must have a suitable isolating facility outside the power supply unit, via which it can be switched to idle. Danger of fatal Injury!
WARNING – The device is equipped whit an internal fuse. If the internal fuse blows Up (fails opens), it is most probable that there is a fault in the device. If this failure occurs, the device must be returned to the factory.

3 How to Install

3.1 Mounting

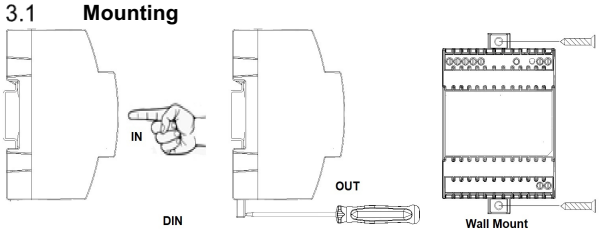


Fig. 1 – Drawing of the DEVICE

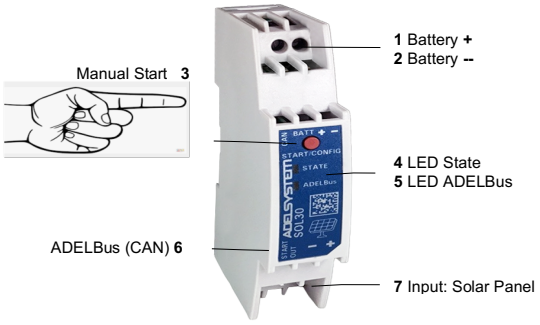
3.2 Din Rail or Panel Mounting

Fig. 1 shows a dimensional drawing of the Device. It is possible to mount the device on Din rail or in panel and fix it by 4 screws 2.9x8-16. There is no limit for the Panel thickness.

3.3 How to Connect SOL30

The DEVICE is supplied directly from the power source which provides power to the load and the battery. The device it is protected by internal physical fuse, also in worst case situations. The input rating is 8 – 35Vdc.

3.4 Device Connection (Fig.2)



3.5 The following cable cross-sections may be used:

	Solid (mm2)	**Stranded** (mm2)	AWG	Torque (Nm)	**Stripping Length**
In:	0.2–2.5	0.2–2.5	24 – 14	0.5–0.6	7 mm
Out:	0.2–2.5	0.2–2.5	24 – 14	0.5–0.6	7 mm
Signal:					AMP Modu II

Connection by the screw, type 2.5 mm2. Wiring terminal shall be marked to indicate the proper connection for the power supply. Use copper cables only, for supply connections use wires suitable for at least 75°C

3.6 Connection terminal and wiring

Reference	Description
1	+ Battery Connection to DC Ups
2	-- Battery Connection to DC Ups
3	Push button: Manual Start for configuration with no sun power.
4	LED Green, Orange, Red: Device Status
5	LED Green, Orange, Red: ADELBus status
6	AUX1: ADELBus connection (CAN)
7	Input from Solar Panel
8	Start Command for Switch On DC Ups. Only Sun Become Present

3.7 LED indicators

Two LEDs could be ON or flashing depending on the state of the device.

LED	**Color - pattern**	**Meaning**
Status LED	green - blinking	Describe controller operating state, warning or fault
	yellow – blink 2Hz	Solar low irradiation
	yellow - fixed	Powering off
	yellow - blink 10Hz	Service mode
	red - 1 blink/pause	Alarm -reverse battery or too high
	red - 2 blink/pause	Alarm – battery disconnected
	red - 7 blink/pause	Charging failure
	red - 15 blink/pause	Overtemperature
Adel bus LED	green - fixed or blinking	CAN active
	red/green - blinking	Awaiting configuration
	red - fixed	CAN bus error

LED indications should be interpreted together with the status shown on the CBI60 web server. If a communication fault is reported, check CAN wiring, bus termination, node ID configuration and power supply before restarting the system.
Note: battery disconnection may be require up to 5 minutes to be detected.

3.8 Push Button

The Solar Panel Controller includes one push button.
When the controller is powered by the photovoltaic panel, the push button has no function. In this condition, the controller operates automatically according to the operating principles described in the previous sections.
When the photovoltaic panel is not connected, but a battery—or another DC power source within the accepted battery voltage range—is connected, the Solar Panel Controller can be started manually to get the Service mode configuration through CBI web server

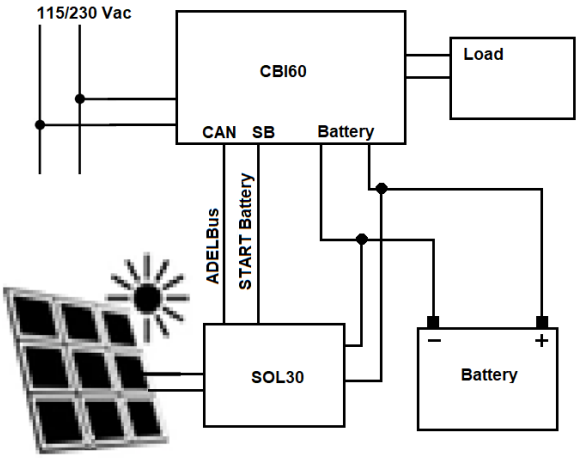
4 System overview

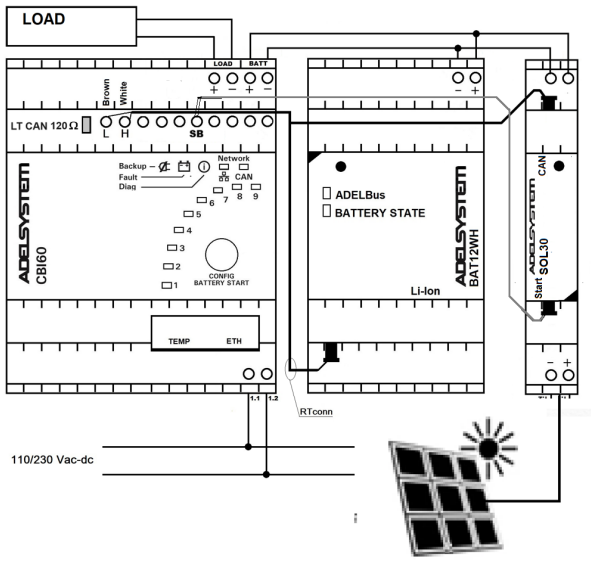
The Solar Panel Controller is in continue dialog with the DC-UPS through the ADELBus connection (CAN technology). This communication allows the DC-UPS and the SOL30 to manage the complete system for charging and control the output power.

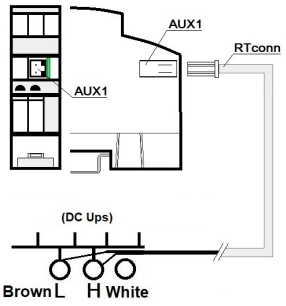
4.1 System Connection

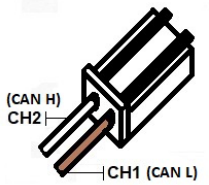
The complete system consists of the following main elements:

- Photovoltaic panel: provides the available solar energy.
- Solar Panel Controller (SOL controller): extracts usable energy from the panel and transfers it to the battery under the control of the CBI.
- CBI DC-UPS: supplies the load, manages the battery and coordinates the different energy sources.
- Battery: stores energy for normal operation and backup operation.
- Load: the equipment powered by the CBI output.
- Ethernet web server: provides the user interface for monitoring and configuration.









4.2 Operating principle

The SOL controller autonomously monitors the voltage available from the photovoltaic panel.
When the panel voltage rises above **10V V**, the device switches on and start to communicate with the CBI through the ADELBus but it starts to transfer energy from the panel when the voltage goes above the configured "turn-on voltage" parameter...
When the available solar power is at least **3 W**, the controller can contribute to recharge the battery, with the same charging philosophy of the CBI. During battery charging, the controller implements a **Maximum Power Point Tracking (MPPT)** algorithm. The MPPT continuously searches for the panel's actual maximum power point and adjusts the operating conditions so that the available solar energy can be extracted as efficiently as possible.
When the panel voltage falls below the configured "turn-off voltage" parameter, the solar panel controller goes in powering-off state and it will shut down completely below 8V.. The difference between the turn-on and turn-off thresholds provides a voltage hysteresis, helping to prevent repeated switching when the panel voltage is close to a threshold.
The CBI remains the main system supervisor. It determines whether the battery can be charged and coordinates the contribution of the primary source and the solar source. The ADELBus is used to exchange the relevant status and control information.
When the primary/grid source is available and the panel can provide usable power, the solar energy contributes to charge the battery and reduces the energy requested from the primary source. If the solar power available from the photovoltaic panel exceeds the power currently required to charge the battery, the remaining available power is supplied to the load. In this condition, the solar energy directly supports the load demand and reduces the power required from the primary/grid input.

During backup operation, if the photovoltaic panel is generating usable energy, the SOL controller transfers this energy to the battery. This reduces the battery discharge rate and can increase the available backup duration.

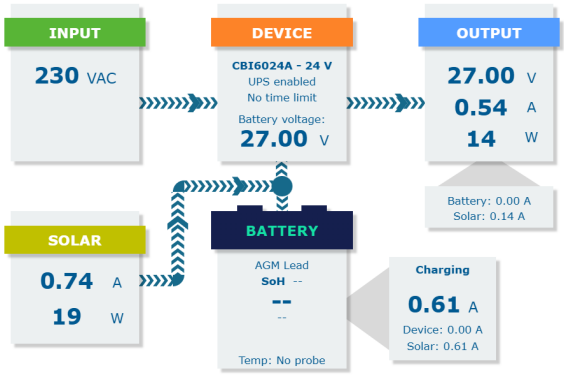
4.3 Operating modes and benefits

System condition	Solar controller behavior	System benefit
Primary/grid source available	When solar power is >= 3 W, the solar energy is used first to support battery charging. If the available solar power exceeds the battery charging requirement, the remaining power is supplied to the load.	The power requested from the primary/grid input is reduced both for battery charging and, when applicable, for supplying the load.
Backup operation	If the panel is generating usable energy, that energy is stored in the battery while the DC-UPS supplies the load from the battery.	The battery discharge rate is reduced and the backup duration can be increased.
Low or unavailable solar power	The controller provides no significant solar contribution and reports its condition to the DC-UPS.	The DC-UPS continues to operate according to its normal source and battery-management strategy.
Stand-alone operation	The Solar Panel Controller manages the battery charging process independently. It uses MPPT to extract the maximum available power from the photovoltaic panel and adapts the charging current according to the available solar energy.	The battery can be charged using the photovoltaic panel without requiring a CBI/DC-UPS.

5 Control and Programming

5.1 Monitoring through the CBI web server

The dashboard provides overall overview for all energy elements connected in to the system: primary source, SOL controller, battery and load and the other more interfaces connected. Depending on the product configuration, the synoptic may show source availability, power flow, battery status, charging condition and alarms.

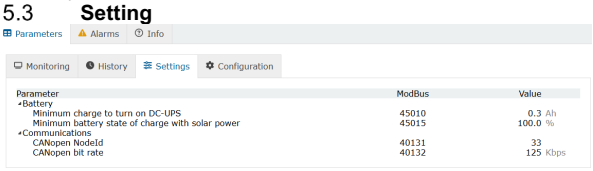


The charging current and power generated, depend on photovoltaic panel conditions. The battery voltage, state of charge, controller limits, temperature and system protection functions are drive throw the device.
Displayed values may change with solar irradiation, load demand and the battery charging strategy. A temporary reduction of solar power does not necessarily indicate a fault.

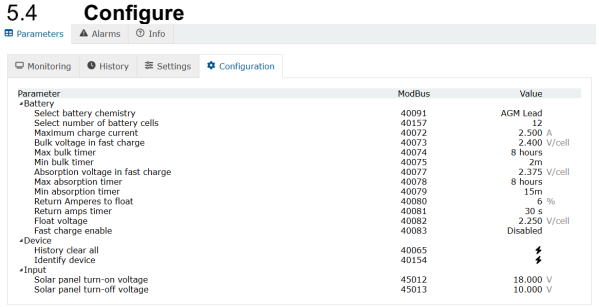
5.2 How to configure the DEVICE for best performance via Web Server

The web server provides status information to set, configurable and monitoring the parameters associated with the SOL controller

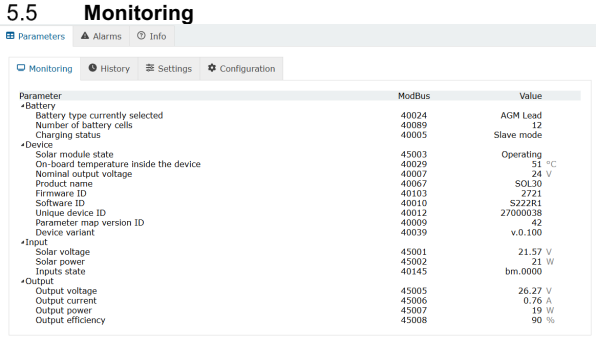
5.3 Setting



5.4 Configure



5.5 Monitoring



6 Technical Data

6.1 Please Refer to the product data sheet

7 Accessory

- RTConn: connector cable for the connection of CAN and SB. This is needed for data exchange with the DC-UPS through the ADELBus (if supported by the DC UPS) and Start from Sun when the DC-UPS is still OFF.