

# Solar UPS Module V1



The device can serve constant uninterruptible power supply (UPS) in low consumption equipment where mains power supply could not be or is difficult to be solved. Power may come from a 10W solar panel, but it is also possible to charge from the AC adapter. The device stores the energy in a 8800mAh Li-ion battery pack. Charging of the battery pack is performed intelligently with a Maximum Power Point Tracking function, using the power fed from the solar panel very efficiently. The circuit shuts off in dark operation, so the own consumption of the device remains below 10uA.

***Maximum Power Point Tracking:*** the charger circuit regulates charging - and at the same time current of DC input – automatically, so that the solar panel would work always at the maximum performance. So the most energy could be gained from the solar panel with the lowest losses of charging. The value of nominal voltage belonging to the maximum performance of the solar panel can be adjusted with a trimmer potentiometer in the device, thus the maximum charging efficiency can be reached with any type of solar panels

## Power supply

Direct connection from the battery pack is also possible with a higher current output (max 2A) and 2,9...4,2 V voltage. It is useful for instance in case a GPRS or 3G modem must be fed and it can be directly connected. The device also involves a built in buck-boost power supply, it produces optionally 3,3V or 5V system power, with at least 500mA of maximum loadability (in Buck mode it can be either 900mA). Permitted loading as per the battery voltage is exactly:



## Protection

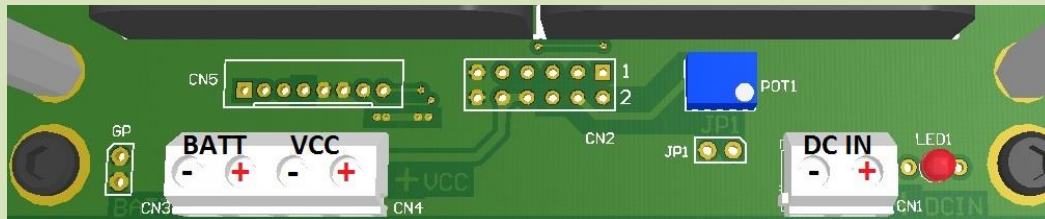
The device is having battery protection functions, e.g. the built-in supply unit does not let the cells discharge below 2,9V. It switches off in this case and reconnection is only performed if the terminal voltage of the battery reaches 3,3V again. Further charging protection function is the built-in thermal protection: this can be activated optionally with an inside jumper and it permits charging of the battery pack only in the ambient temperature range of 0...45 degrees. In addition the output of the built-in supply unit is protected against short circuit and the DC input against polarity error.

## Functions

There is a charge current monitor circuit in the device, it measures the charging current of the battery pack. Its voltage output releases maximum 2V and the charging current can be measured with 1V/1A conversion. Charging may be disabled also from outside, SHUTDOWN input should be pushed to GND. The signals of charging status (charging, fault) are led to the 3,3V level TTL output. Voltage of the supply unit can be selected with the JP3 jumper: the built-in supply unit produces 5V in closed position and 3,3 V in open condition. There is a LED on the board showing two colours for charging (green) and fault (red)..

## Formation

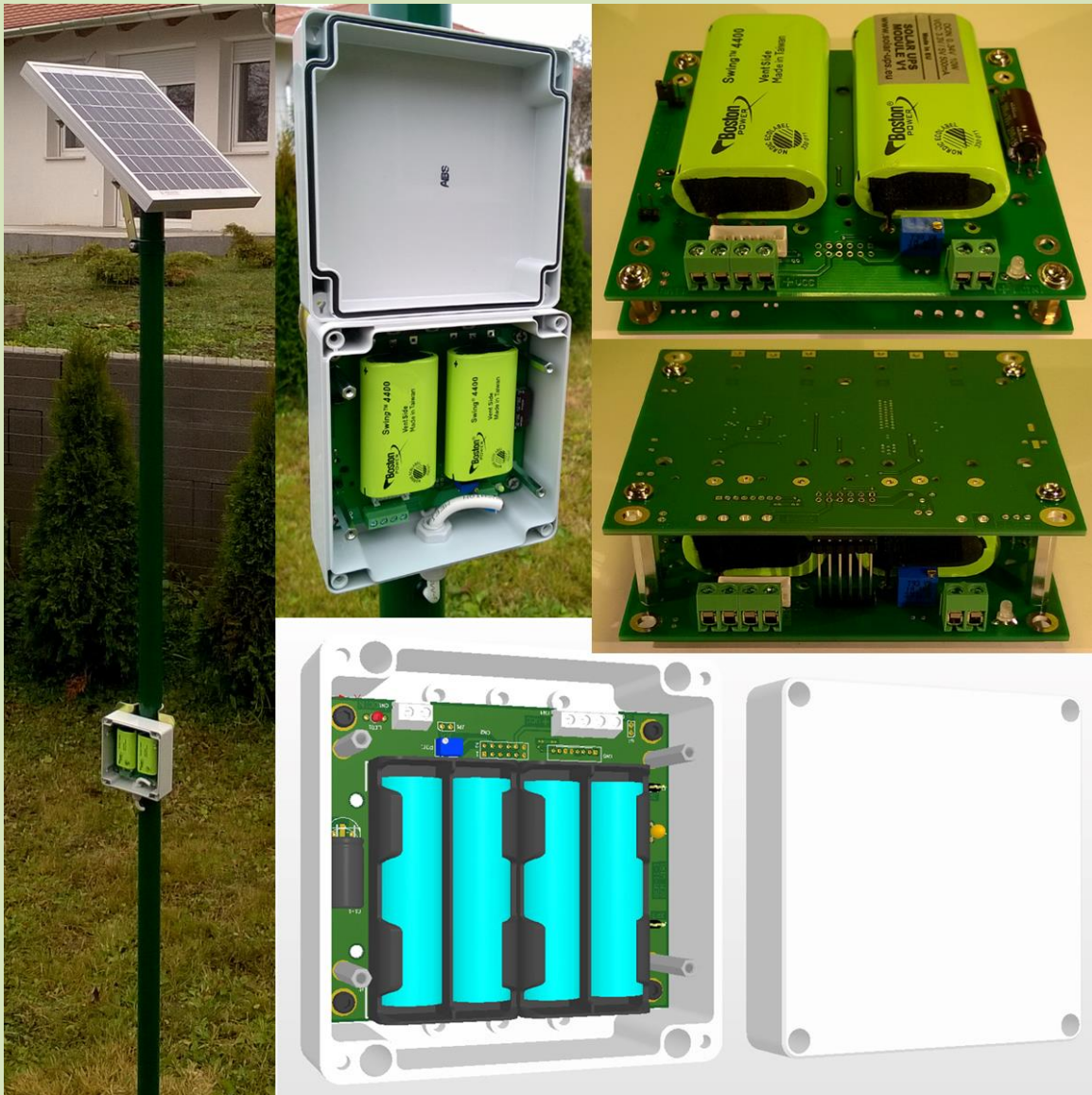
The device can be mounted as an add-on panel to any other device panel of at least 110x74 mm size. Soldering side of the device requires 5mm and the components side needs 22 mm of free height. Outlet of the power supply and inlet of DC power is performed through pcb terminal blocks. The connections can receive cables of maximum 1,5mm<sup>2</sup>. In addition it is also possible to connect to the device through 2x6 pin / 2.54mm and 1x8 pin / 2mm board connector, too.



CN5		CN2	
1	O BATT+	BATT+	o o BATT+
	O BATT+	CHARGE	o o DCIN+
	O VCC+	FAULT	o o DCIN+
	O DCIN+	SHUTDOWN	o o VCC+
	O GND	CHG CURR	o o VCC+
	O GND	GND	o o GND
	O CHARGE		
	O CHG CURR		

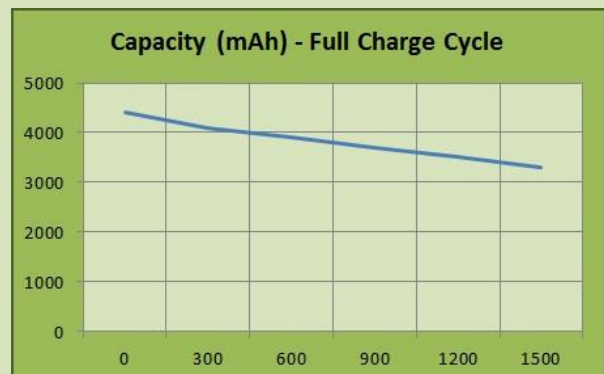
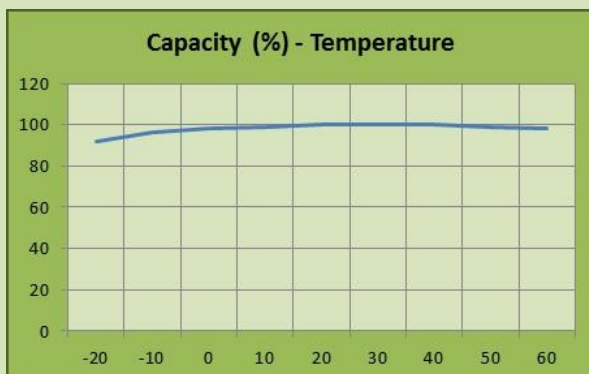
<b>GND</b>	Power Ground (0V)
<b>DCIN+</b>	DC power (solar panel) positive input (0...34V)
<b>BATT+</b>	Battery pack direct positive output (2,9...4,2V / max 2A!)
<b>VCC+</b>	System power output (3,3V or 5V / 500mA)
<b>CHARGE</b>	Charging sign, TTL 3,3V level output (low= charging)
<b>FAULT</b>	Fault sign, TTL 3,3V level output (low= fault)
<b>SHUTDOWN</b>	Charge shutdown input (to GND: charge circuit in shutdown state)
<b>CHG CURR</b>	Charging current output (voltage output, 1V/1A, max 2V)

It is also possible to mount the device into Fibox Euronord housing of series 1212xx with IP67 protection, the fixing points are dimensioned accordingly. In this case sandwich structure may be constructed with the carrying panel; the fixing points are available on the panel of the energy module. These should reasonably be equipped with 30 mm long M3 metal spacers with external and internal threads, and the other panel can be fixed to them. Connection can also be solved with high row of pins from CN2 and CN5 connections, either in a releasable or fixed soldered way. The Fibox Euronord 1212xx series is available in different heights: 65-75-95-105 mm. The solar cable can be connected to the house through a simple cable gland. The construction is shown on the following picture:



## Battery pack

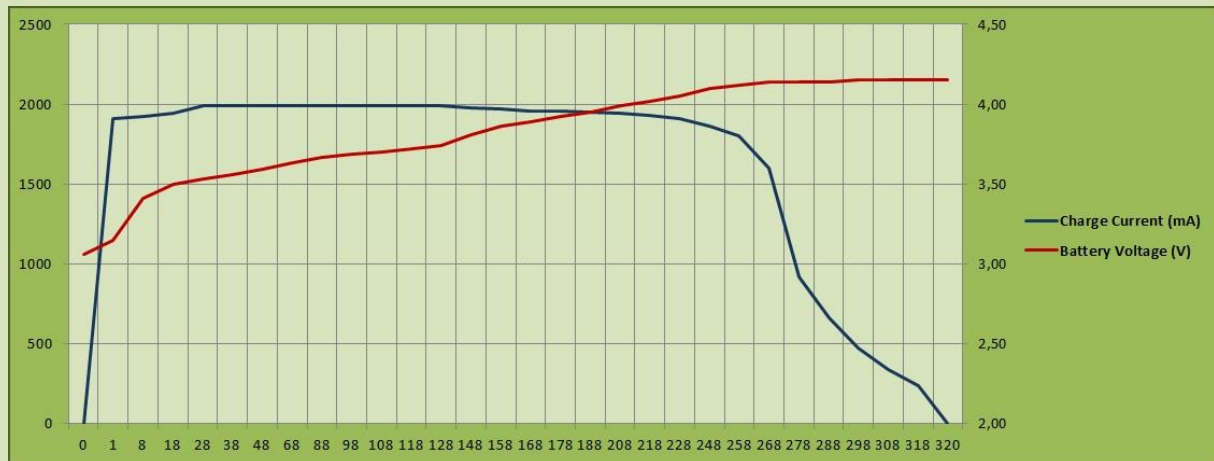
The device includes a double 4400mAh Li-ion battery pack with 3,6 V nominal voltage. The batteries have wide range of operating temperature and longer full charging cycle (life time) than the usual. More exact data:





## Charging characteristics

Full charge characteristics with 10W cheap polycrystalline solar panel (type MF-10W, maximum performance: 17.5 V/ 0.58A ). The measurement was performed from full discharged to full charged condition of the battery pack in undisturbed sunny weather (ideal case of charging). Time elapsed in minutes on the horizontal axle.



## Device availability

The device availability and discharge capacity of almost one-to-one can be calculated from the nominal capacity of the battery pack. Availability time can be calculated by averaging the consumption profile. For instance the consumer will be operable from the device for about  $8800\text{mAh}/200\text{mA} = 44$  hours with an average current consumption of 200mA, starting from fully charged condition (-10%, ~40 hours in worst case).

## Specification

Recommended solar cell capacity	10 W
DC power input voltage	0 ... 34 V
DC power input max current	1 A
Battery pack direct output voltage	2,9 ... 4,2 V
Battery pack direct output max current	2 A
Battery pack max charging current	2 A
Power supply output voltage	3,3 V or 5 V
Power supply output max current	500 – 900 mA
Battery pack type	Li-ion
Battery pack capacity	8800 mAh
Charging environmental temperature	-10 ... +60 degree
Discharging / Storage environmental temp.	-40 ... +60 degree
Device size (without housing)	110 (w) * 95 (d) * 28 (h) mm
Device weight (without housing)	300 g