

SOL-1 (MPPT) series Instruction manual

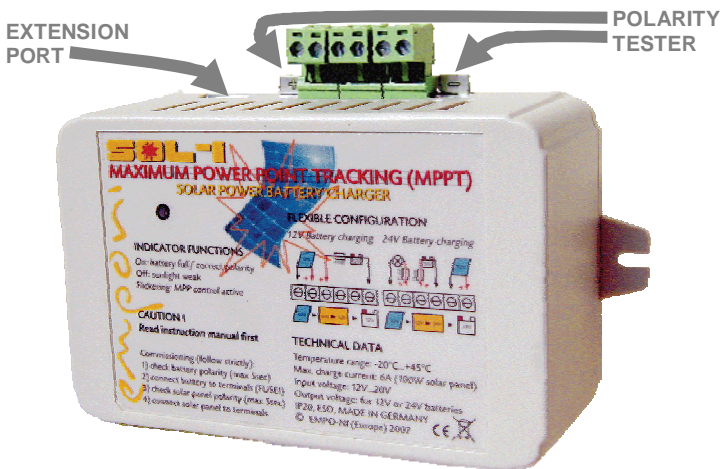
Maximum Power Point Tracking Solar Battery Charger for lead acid batteries 12V/24V

Relevant models: SOL-1, SOL-1(A)

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Thank you very much for buying this SOL-1 unit and congratulations for having chosen this high tech, high performance MPPT solar battery charger. The SOL-1 has been carefully designed and tested under harsh real environmental conditions for many years. Reliability, ruggedness, performance and improving the efficiency of solar systems have been key objectives in the development of the compact and versatile SOL-1 solar charger family. The mechanical and electrical installation of the SOL-1 is user friendly ; the flanged housing and a built-in polarity tester ease the installation. We hope you will enjoy many years of use from your SOL-1.



- Standard 12V Solar panel input → 12V or 24V battery charge (auto detected)
- Suitable for lead-acid batteries of wet cell or AGM or gel technology
- Maximum Power Point Tracking for up to 35% better use of the solar panel
- For up to 100W solar panel rating, max 6A charging current
- Streetlight control software implemented in 24V mode / deep discharge protection
- Built-in battery and solar panel polarity tester
- Microprocessor controlled MPPT, SMPS and PWM technology.
- LiIon versions available
- RS232 / RS485 serial interface connection for control / readout optionally available

SAFETY ADVICE

- 1.1) Avoid short circuits and incorrect connections to the SOL-1: risk of fire!
- 1.2) Avoid reverse polarity of the solar panel and of the battery! (Use built-in polarity tester! maximum test time: 5sec). Keep batteries in a well ventilated area!
- 1.3) Do not exceed the maximum operating conditions ! (Details in section 6 - “Technical data”)
- 1.4) Add a suitable fuse into the (+) cable to the battery and the load output (for 24V systems only). (Details in section 6 - “Technical data”)
- 1.5) Sparks / arc-overs can occur during installation and whenever cables make contact with terminals. Do not install this solar equipment in rooms where potentially flammable gases might be released (e. g. near gas bottles, laquers, solvents, etc.)!
- 1.6) The SOL-1 must be mounted horizontally without any obstruction of the ventilation slots of the housing and in suitable climatic conditions! Do not expose the unit to rain and snow! (Details in section 6 - “Technical data”)
- 1.7) The cable connected to the terminals must be of a suitable diameter and must not exceed a certain length! (Details in section 6 - “Technical data”)
- 1.8) Follow the mechanical / electrical installation procedure strictly to avoid any malfunction or incorrect commissioning of the SOL-1!
- 1.9) Do not attempt to charge non-rechargeable batteries!
- 1.10) Keep electrically conducting material such as metals and liquids well away from the areas around the terminal blocks: Risk of short circuit!

1. INSTALLATION PROCEDURE

2.1) Mechanical installation: The case of the SOL-1 has flanges to mount the device on a wall or any other non-vibrating surface. Simple screws and washers (not supplied with the SOL-1) can be used to fix the flanges to the (wall) surface. Mount the case horizontally ensuring free air ventilation around the housing.

2.2) Electrical installation: The SOL-1 includes a built-in polarity tester to simplify the installation of the system and to avoid potentially hazardous reverse polarity situations which might damage the SOL-1.

2.2.1) Use of the polarity tester:

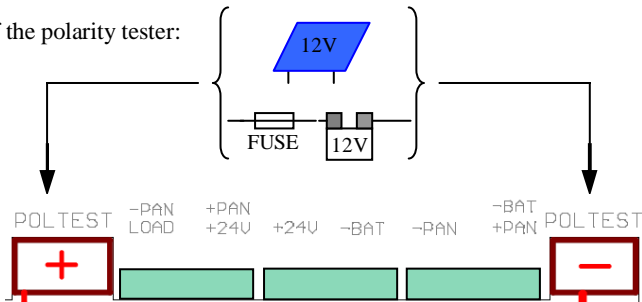
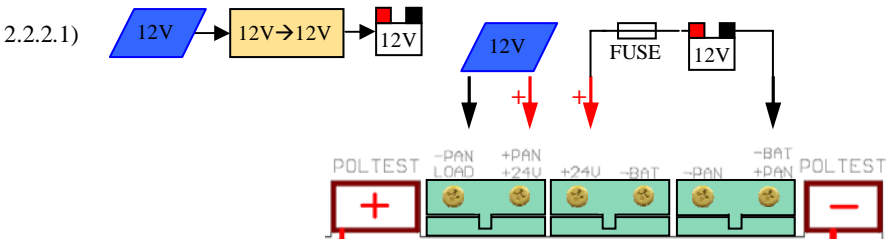
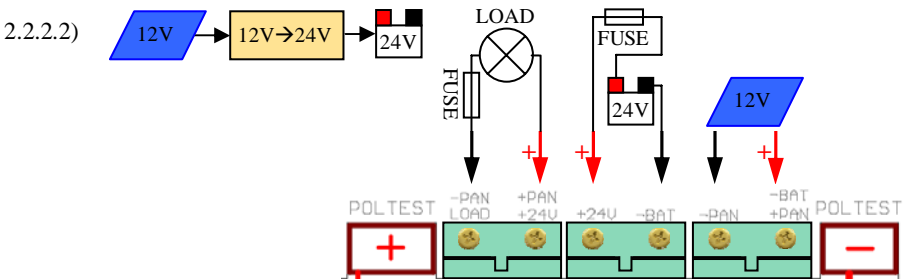


Figure 2.2.1 shows how to utilise the polarity tester. For up to 5 seconds the cables of unknown polarity and maximum voltage of 24V (minimum voltage = 12V) may be brought into contact with the square shaped metalized part of the Input/Output Board below the “POL(+)” and “POL(−)” markings. If the LED indicator on the front of the SOL-1 lights up, the polarity of the cables touching the metalized pads is as per the markings above the pads. If the LED does not light up, please swap the cables and try again. In case there is no LED indication in either direction, please check the cabling / fuse / battery voltage. This polarity test is only effective before the SOL-1 has started to operate, i.e. prior to complete initialisation of the unit. Make sure never to bring the cables into contact with each other !

2.2.2) The battery, solar panel and the load (only applicable in 24V battery systems) must be connected to the terminals of the SOL-1 in the correct sequence. Firstly, the voltage of the system must be determined since different configurations are used depending on whether the SOL-1 is charging a 12V battery or a 24V battery, from a 12V solar panel. The corresponding connections to the SOL-1 for the alternative battery voltages are indicated on the label on the front of the SOL-1. Figure 2.2.2.1 below shows the connections of the 12V battery system and figure 2.2.2.2. shows the connection of the 24V battery system. Before connecting anything to the SOL-1 please read section 2.2.3 regarding the commissioning sequence to ensure that the SOL-1 is correctly initialised.

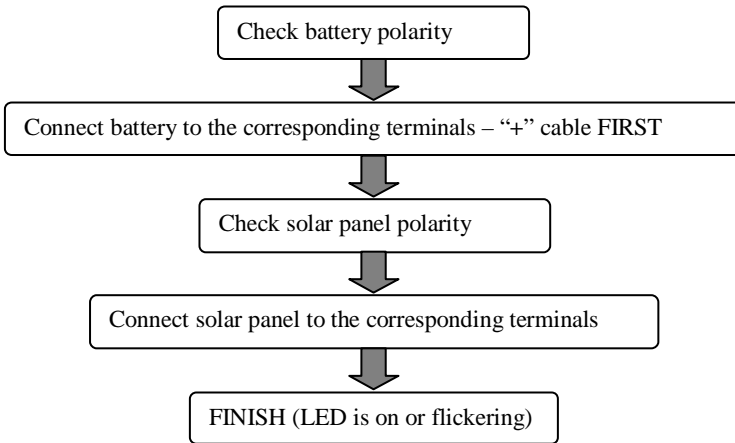


Connection diagram 2.2.2.1 indicates the configuration for a 12V battery system. The solar panel is a “12V” type.



The connection diagram 2.2.2.2 indicates the configuration for a 24V battery system. In this configuration an optional 24V rated non-capacitive and non-inductive load of up to 100W may be connected between the “LOAD” output and the +24V terminal. A suitable fuse must be included in this circuit close to the output terminals of the SOL-1 to protect the unit.

2.2.3) Electrical commissioning sequence



Correct initialization of the SOL-1 is confirmed by a lit LED, or a flickering LED provided that the solar panel is sufficiently exposed to sun. Otherwise the commissioning has failed and the SOL-1 must be decommissioned and re-commissioned again.

2.2.4) Electrical decommissioning sequence

- 1) Disconnect the solar panel
- 2) Disconnect the “-“ terminal from the battery
- 3) Disconnect the “+” terminal from the battery.

2. LED FUNCTIONS

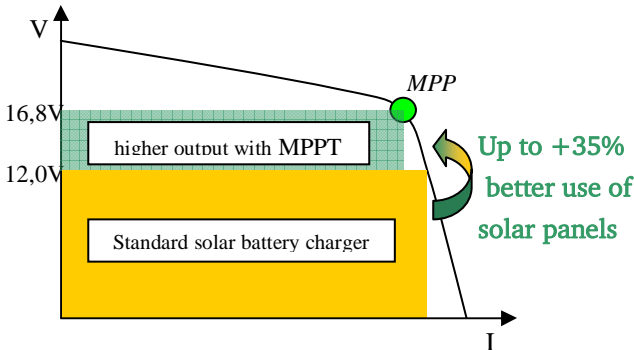
MODE	LED	STATUS
Polarity test	ON	correct polarity
Normal Operation	OFF	Solar panel low (low sunlight)
	FLICKERING	MPPT operating
	ON	battery fully charged

Table 1 indicates the LED status both during the “polarity test” whilst commissioning the SOL-1, and during “normal operation”.

3. MPPT (Maximum Power Point Tracking) function

The SOL-1 series utilises a Maximum Power Point tracking software algorithm which efficiently optimizes the operation of the solar panel. Through the MPPT functionality the solar system can achieve up to 40% more output of the solar panel compared with standard solar battery chargers.

The decoupling of the best operating point for the solar panel (MPP) from the actual battery voltage by Switch Mode Power Supply (SMPS) technology and state-of-the-art microprocessor technology for efficient MPPT are the main features of the SOL-1 solar battery charger systems. The typical, highly temperature dependent MPP voltage of solar panels is around 16,8V at 25°C and 1000^W/_{m²} of solar irradiation intensity under reference conditions. Assuming an empty battery at 12V the difference in the achievable performance between conventional and the SOL-1's MPP technology becomes apparent by the following graph showing an example of a V/I characteristic of a solar panel charging an empty battery:



A simple calculation on this curve reveals the advantage of the SOL-1's MPP tracking function, which can achieve up to 35% more output power compared with conventional systems. Smaller and much more cost efficient solar panels can be used to reach the same performance as conventional standard battery chargers plus large solar panels.

4. EXTENSION PORT functions, LOAD output, streetlight driving

The extension port "EXTPORT" enables the control of dedicated applications such as street lights. The new version of the SOL-1 with production lot codes of August 2010 and later can be highly customized in our factory. Complex control implementation, custom specific built-in application boards and connection to RS232 / RS485 networks are possible upon request. As standard (only in 24V mode) the software implements a streetlight function which turns on the LOAD output at sunset and turns it off at dawn, continuously monitoring the battery voltage and turning off the LOAD when an under-voltage condition is detected. Deep discharge protection may also be activated by setting an internal jumper - please contact engineering@emponi.de or your dealer for this to be factory-selected. Furthermore through this EXTENSION port a LED current source (EMPO-NI products LEDrive-54W

and LEDrive-18W) can be activated and, in customized versions, also dimmed following a predefined time vs. LED intensity profile

5. LiIon option

The SOL-1 is capable of use with LiIon battery packs. A dedicated charging strategy is pre-programmed and can be factory-enabled. The LiIon version of the SOL-1 is highly customized considering voltage range and LiIon specific protection functions. Please contact EMPO-NI for further details

6. TECHNICAL DATA

<i>PARAMETER</i>	<i>Min.</i>	<i>Typ.</i>	<i>Max.</i>	<i>Unit</i>
Operating temperature range	-20		45	°C
Storage temperature range	-40		85	°C
Solar panel voltage (open loop, entire temperature range)	12,0		24,0	V
Battery voltage	11,0		28,0	V
Under-voltage detection threshold (12V system detected)		11		V
Under-voltage detection threshold (24V system detected)		22		V
Solar panel rated power	15		100	Wp
Charging current	0		6,0	A
Internal consumption (indicator = off)		3	12	mA
Battery end of charge protection voltage (24V system)	26,3	27,0	28,0	V
Battery end of charge protection voltage (12V system)	13,0	13,5	13,9	V
MPP voltage control range	12,0		19,0	V
Streetlight threshold detection voltage (sunset)*		0,7		V
Streetlight threshold detection voltage (dawn)*		1,5		V
Time between sunset detection and LOAD activation*		2		sec
Time between dawn detection and LOAD deactivation*		2		sec
Power terminal cable diameter	1,0	1,5	2,5	mm ²
Cable length (power / EXTPORT)			2,5	m
Humidity (non condensing)	20		60	rel%
Polarity tester usage time			5	sec
Fuse rating for battery and load output (fast time lag)		7,5	8,0	A
Capacity of charged battery	20			Ah
LOAD terminal output power (24V configuration only)			100	W
Mass		300		g

* applicable only in 24V operation mode

Classification according to EN60529: IP20, 2002/95/EC directive: RoHS compliant, 2002/96/EC ANNEX II (WEEE) directive: Electronic waste - do not dispose in unsorted municipal waste, dispose only at dedicated recycling /disposal centres for electronic waste !

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**CE KONFORMITÄTSERKLÄRUNG
DECLARATION OF CONFORMITY
DECLARATION DE CONFORMITE**

Wir EMPO-NI (EUROPE) erklären, dass das Produkt:

MPPT solar battery charger

Type: SOL-1

Batch 01/08/2010

auf das sich diese Erklärung bezieht, mit der/den folgenden Norm(en) oder normativen Dokument(en) übereinstimmt:

EN 61000-4-2, EN 61204-3

We EMPO-NI (EUROPE) declare that the product:

MPPT solar battery charger

Type: SOL-1

Batch 01/08/2010

to which this declaration relates is in conformity with the following standard(s) or other normative document(s):

EN 61000-4-2, EN 61204-3

Nous EMPO-NI (EUROPE) déclarons que le produit:

MPPT solar battery charger

Type: SOL-1

Batch 01/08/2010

auquel se réfère cette déclaration est conforme à la (aux) norme(s) ou autre(s) document(s) normatif(s):

EN 61000-4-2, EN 61204-3

Düsseldorf, 6.Aug.2010, Dipl.-Ing. (univ.) Marco Honsberg