

MG Solar Battery 1500

Version: 1.0

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1 SAFETY INSTRUCTIONS

1.1 In general

Please read the documentation supplied with this product first, so that you are familiar with the safety signs and directions before using the product.

This product is designed and tested in accordance with international standards. The equipment should be used for the designated application only.



WARNING: DANGER OF ELECTRICAL SHOCK

The product is used in combination with a permanent energy source (battery). Even if the equipment is switched off.

The product contains no internal user-serviceable parts. Do not remove the front panel and do not put the product into operation unless all panels are fitted. All maintenance should be performed by qualified personnel.

Never use the product at sites where gas or dust explosions could occur. Refer to the specifications provided by the manufacturer of the battery to ensure that the battery is suitable for use with this product. The battery manufacturer's safety instructions should always be observed.



WARNING: do not lift heavy objects unassisted.

1.2 Installation

Read the installation instructions before commencing installation activities.

Ensure that the connection cables are provided with fuses and circuit breakers. Never replace a protective device by a component of a different type. Refer to the manual for the correct part.

Check before switching the device on whether the available voltage source conforms to the configuration settings of the product as described in the manual.

Ensure that the equipment is used under the correct operating conditions. Never operate it in a wet or dusty environment.

Ensure that there is always sufficient free space around the product for ventilation, and that ventilation openings are not blocked.

Install the product in a heatproof environment. Ensure therefore that there are no chemicals, plastic parts, curtains or other textiles, etc. in the immediate vicinity of the equipment.

1.3 Transport and storage

On storage or transport of the product, ensure that the battery leads are disconnected.

No liability can be accepted for damage in transit if the equipment is not transported in its original packaging.

Store the product in a dry environment; the storage temperature should range from -30°C to 55°C .

1.3.1 *Storage instructions of Lithium batteries*



Store the Lithium batteries always fully charged.

Check the voltage of the stored Lithium battery periodically. If the voltage is dropped below 42V, recharge it. Because of the battery management electronics there is always a small leakage current which will eventually empty the battery.

2 DESCRIPTION

2.1 General

The lithium polymer battery consists of several lithium polymer battery cells which are connected in series and/or parallel. This depends on the battery voltage and capacity. To monitor all individual battery cells the battery also contains a battery management system (BMS). This management system measures each cell voltage, in and output current and temperature. After measurement it checks if the values are within the limits. If one of the values is exceeded the limits the management systems acts on this. It automatically turns off the load or charger connected to the battery to preserve that the battery is not damaged.

3 LED INDICATIONS

To indicate the status of the BMS, a bi-colored is located at position '3' in appendix A.

LED state	Description
Continuously green	System is operating normally
Blinking green/orange	System has CAN-Bus passive error
Continuously orange	CAN-Bus is in Bus-off mode

4 INSTALLATION

All connection locations and details can be found in appendix A of this manual. A complete example system schematic can be found in appendix B.



This product may only be installed by a qualified electrical engineer.

MG Electronics cannot be held responsible for any damage or physical injury caused by incorrect and ignorant installation.



Before connecting anything to the MG Solar battery. Be sure it is switched off. Switching the battery off is done by removing the connection of connector 'F'. The connection between pin 1 and 2 must be open.

4.1 Safety precautions

1. Be careful when using metal tools in vicinity of batteries. Dropping a metal tool onto a battery might cause a short-circuit and possibly an explosion.
2. Always use isolated tools when working with batteries.
3. Remove personal metal items such as rings, bracelets, necklaces and watches when working with a battery. A battery can produce a short-circuit current high enough to melt such items, leading to severe burns.

4.2 Location

The product must be installed in a dry and well-ventilated area.

Excessively high ambient temperature will result in a reduced battery lifetime.



For safety purposes, this product should be installed in a heat-resistant environment. You should prevent the presence of e.g. chemicals, synthetic components, curtains or other textiles, etc., in the immediate vicinity.

4.3 Connection of the BMS CAN-Bus network

To connect the BMS CAN-Bus communication network you will need:

- CAT5 cable (twisted pair) with RJ45 connectors.
- Two termination resistors (one is supplied with the MG Solar battery. One is integrated in the MG Color display cable).

Procedure

1. Use one of the RJ45 connectors of connection 'I' in appendix A of the MG Solar battery to connect the MG Color Display to it (in chapter ...are the connection details of the MG Color Display).
2. Then use the other RJ45 connector on the MG Solar Battery to connect the Solar MPPT's (if there are any) with the next CAT5 cable.
3. Repeat this until all Solar MPPT's are connected.
4. Place a termination resistor in the last connected Solar MPPT' s or if there isn't any, place it on the battery.

Now the BMS CAN-Bus network is connected.

4.4 Connection of the DC/DC converter

To power peripherals such as the MG Color Display, a DC/DC converter is needed to convert the battery voltage down to 12V or 24V. On the MG Solar battery there is a special connection to connect the DC/DC converter to. This connection can be switched off by the management system to prevent draining the battery. When this connection is switched on the output will be pre-charged to prevent inrush currents.

Procedure

1. Connect the DC/DC converter input to connection 'J' pin 4 and 5.
2. The output of the DC/DC converter must be connected back to the battery to provide the CAN-Bus and battery fans of a power supply. Connect the output of the DC/DC converter to connection 'G' pin 3 and 4.



Make sure that if a 24V DC/DC converter is used also the battery fans can handle 24V.

4.5 Connection of the MG Solar battery



Never short a Lithium-Ion battery. There will flow a very high current and can lead to damage of the battery and its environment.



Always use isolated tools when installing batteries.



Make sure that the connections are connected tightly. This prevents series resistance at the connections.

Do not use washers between the connections.

To connect the MG Solar battery make sure you have followed all the steps above.

Connection of the MG Solar battery must be done by the following procedure.

Connecting chargers

All chargers must be connected to the 'Charge -' (connection 'A' in appendix A) and 'Charge +' (connection 'D' in appendix A) of the battery. These are separated inputs that can be switched off by the management system of the battery when the battery is fully charged.



Chargers can also drain the battery if they are connected and not charging. Therefore it is recommended to place a separate charge safety contactor between the chargers and the battery. This contactor must be controlled by the contactor control outputs of the battery (connection 'E' in appendix A).

Procedure

1. Connect the '-' of the charger to connection 'A' of the battery.
2. Now connect the '+' of the charger to the charge safety contactor. Make sure the pre-charge is also connected (see chapter 4.5 for connection instructions of the pre-charge).
3. Connect the other side of the charge safety contactor to connection 'D' of the battery.

Connecting energy consumers (loads)

All loads (energy consumers) must be connected to the 'Discharge -' (connection 'B' in appendix A) and 'Discharge +' (connection 'C' in appendix A).



Make sure that all loads can be switched off by the allow-to-discharge or by the discharge safety contactor. In this way the battery is protected against fully draining and is safe to use.

Procedure

1. Connect the '-' of the loads to connection 'B' of the battery.
2. Now connect the '+' to the discharge safety contactor. Make sure the pre-charge is also connected (see chapter 4.5 for connection instructions of the pre-charge).
3. Connect the other side of the discharge safety contactor to connection 'C' of the battery.

IMPORTANT!



All chargers and loads must stop charging or discharging when the battery is switched off.

4.6 Using the I/O of the MG Solar Battery

On/Off switch

A contact-key or switch can be connected to connection 'F' to turn the system on and off. If a connection between pin 1 and 2 of connection 'F' is closed, the system will turn on. If the connection is open the system will turn off.

Allow-to-charge and allow-to-discharge

The most important contacts are 'allow-to-charge' and 'allow-to-discharge'. These are used to control loads and chargers based on the battery specifications.

These contacts are potential free and normally open. They are closed when the system is normally working. If the battery is fully charged the 'allow-to-charge' contact will be opened. Now the charger knows that it has to stop charging. If it does not stop charging, the safety contactor will eventually open. This also applies for the 'allow-to-discharge' contact. It is set open when the battery is fully discharged. All consumers have to stop discharging.

See appendix A, connection 'H' for the connections of the allow-to-charge and allow-to-discharge contacts.

Safety Contactors

It is recommended to use a charge and discharge safety contactor with the MG Solar battery. These contactors guarantee a safe operation of the MG Solar battery. It switches off loads and charger when the battery is empty and fully charged. This prevents over-charging and fully draining the battery which can cause permanent damage to the battery.

The contactors must be controlled by the contactor control outputs of the MG Solar battery (connection 'E' in appendix A).

The supply voltage of the contactors depends on the coil voltage of the contactors. If a 12V coil voltage is needed to control the contactors, a DC/DC converter is needed to provide this voltage.

The supply voltage for the contactors must be connected to connection 'E' pin 3 and 4.

1. Connect the charge safety contactor to connection 'E' pin 1 and 2.
2. Connect the discharge safety contactor to connection 'E' pin 5 and 6.

To prevent contactor welding when the safety contactors are switched, the loads and chargers are pre-charged. The MG Solar battery has two pre-charge outputs, one for the charge and one for the discharge safety contactor (connection 'J' pin 2 and 3).

1. Connect pin 2 of connection 'J' to the charger side of the charge safety contactor.
2. Connect pin 3 of connection 'J' to the load side of the discharge safety contactor.

Battery fans

There are several ways to connect battery fans to the battery. The most common way is to power the fans directly from the DC/DC converter. It is also possible to connect the fans to pin 1 and 2 of connection 'G'. The supply voltage depends on the supply of pin 3 and 4 of connection 'G'.

I/O Switching limits

Contact	Closed / On	Open / Off
Allow-to-charge signal	If one of the cell voltages drops below 4,14V for 10 sec.	If one of the cell voltages reaches 4,19V for 10 sec.
Allow-to-discharge signal	If one of the cell voltages reaches 3,05V for 10 sec.	If one of the cell voltages drops below 2,90V for 10 sec.
Charge contactor	If one of the cell voltages drops below 4,14V for 10 sec.	If one of the cell voltages reaches 4,225V for 10 sec.
Discharge contactor	If one of the cell voltages reaches 2,95V for 10 sec.	If one of the cell voltages drops below 2,85V for 10 sec.
Onboard charge switch	If one of the cell voltages drops below 4,15V for 10 sec.	If one of the cell voltages reaches 4,20V for 10 sec.
DC/DC converter output	If one of the cell voltages reaches 2,95V for 10 sec.	If one of the cell voltages drops below 2,70V for 10 sec.
BMS active	If one of the cell voltages reaches 2,60V.	If one of the cell voltages drops below 2,60V for 5 sec.

5 MAINTENANCE

The MG Solar battery does not require specific maintenance. It will suffice to check all connections once a year. Avoid moisture and oil/soot/vapors and keep the device clean.

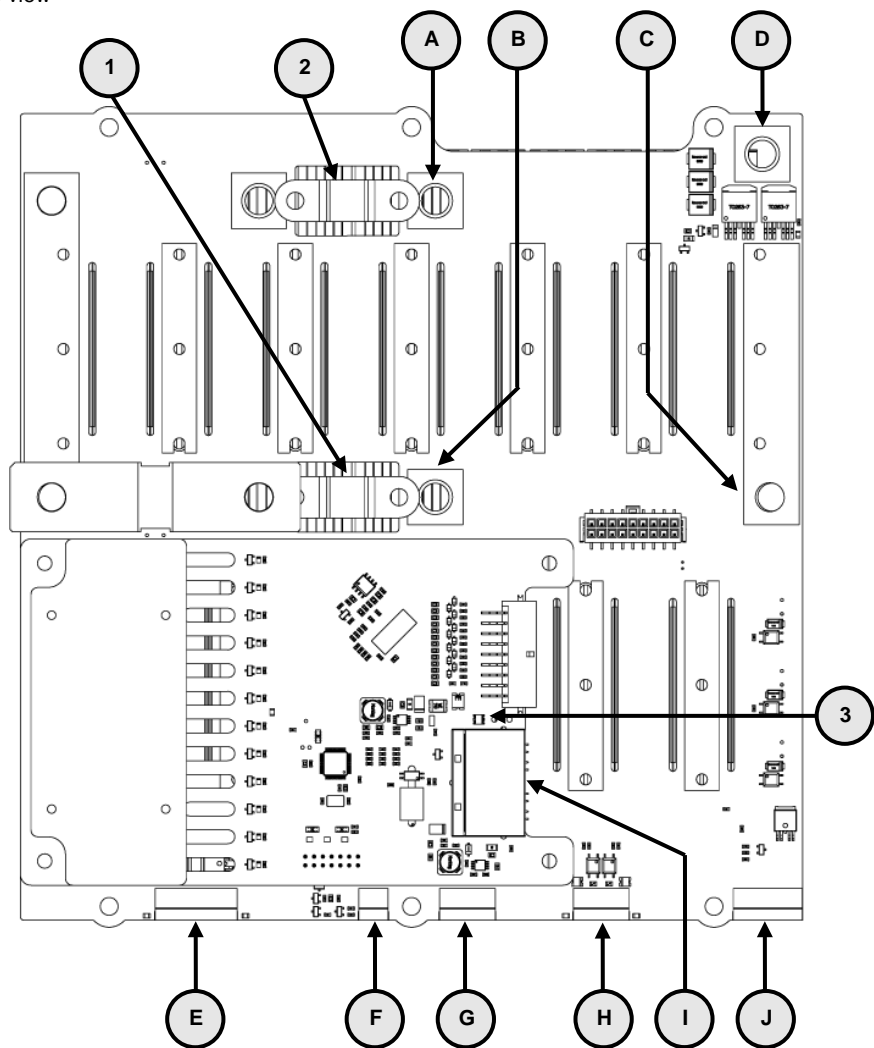
Check the voltage of the stored Lithium battery periodically. If the voltage is dropped below 42V, recharge it.

6 TECHNICAL SPECIFICATIONS

MG Solar Battery 1500	
Technology	Lithium-Ion Polymer
Nominal voltage	44,4 V
Nominal capacity	33,6 Ah
Nominal energy	1492 Wh
Power / Weight ratio	129 Wh/Kg
Charge/Discharge	
Charge cut-off voltage at 0,05C	50,4 V
Discharge cut-off voltage	34,8 V
Maximum charge current	50 A
Maximum discharge current	150 A
Cycle Life @80% DOD (0,3C)	1500
Enclosure	
Common Characteristics	Material: ABS; Protection: IP20;
Battery connections	M8
Weight	11,6 Kg
Dimensions (l x w x h in cm)	30 x 28 x 29
Temperature	
Operating temperature during charge	0~55 °C
Operating temperature during discharge	-30~55 °C
Storage temperature	-25~55 °C

APPENDIX A: OVERVIEW

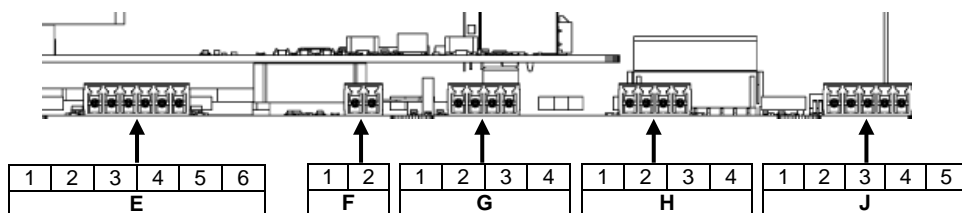
Top view



	Description
1	Discharge Fuse
2	Charge Fuse
3	Status LED

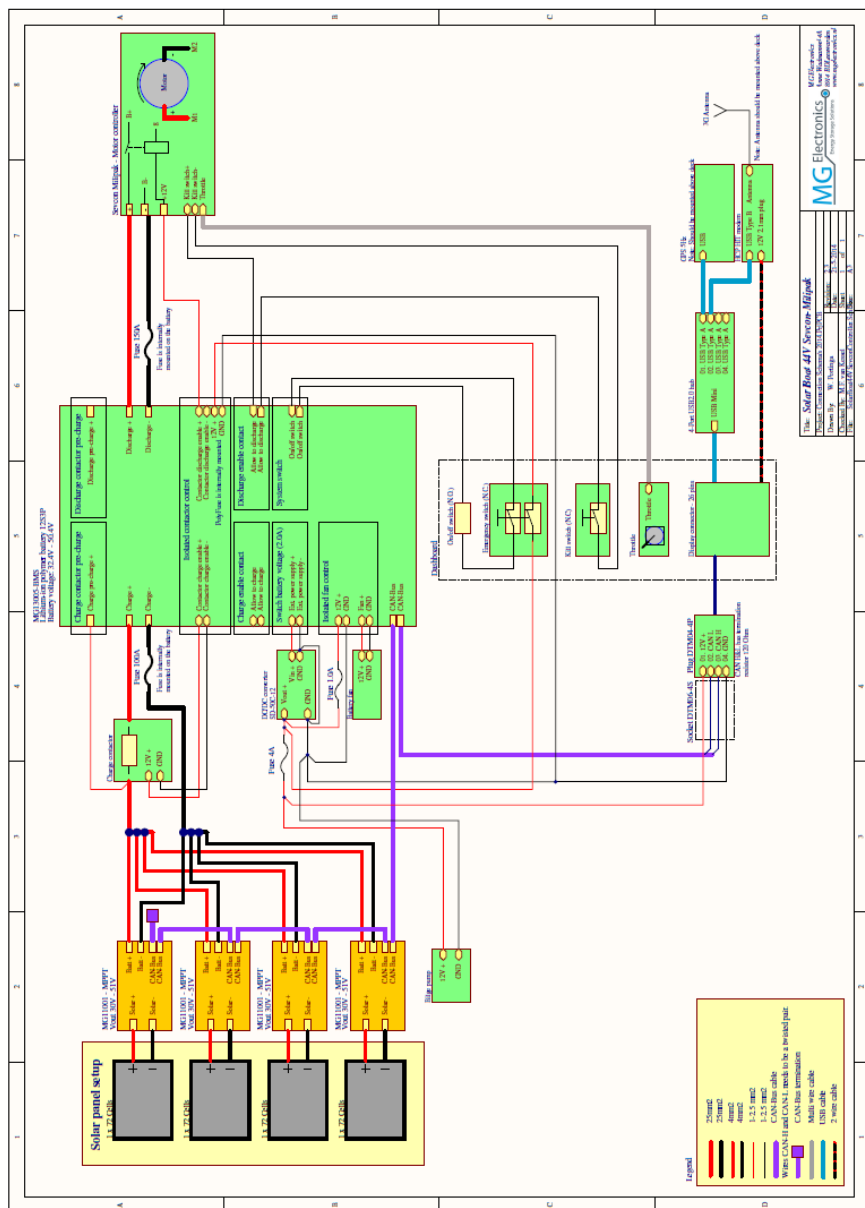
Connector	Description
A	Charge '-' power connection
B	Discharge '-' power connection
C	Discharge '+' power connection
D	Charge '+' power connection
E	Charge/Discharge contactor/relay control
F	On/Off switch
G	Battery Fan control
H	Allow-to-Charge and Allow-to-Discharge signal control
I	2x RJ45 CAN-Bus connection
J	Pre-charge and DC/DC converter connection

Signal connectors zoomed view



Connector pins and specifications					
Conn.	Pin	I/O	Voltage	Current Max.	Purpose
E	1	Out	+	3A	Charge contactor/relay control output to protect the battery
	2		GND		
	3	In	10 to 55VDC		This voltage is used to switch the charge/discharge contactor/relay
	4		GND		
	5	Out	+	3A	Discharge contactor/relay control output to protect the battery
	6		GND		
F	1	In	-	-	On/Off control of the battery
	2				
G	1	Out	+	0,5A	PWM output for fans controlled by temperature.
	2		GND		
	3	In	10 to 26VDC		Power supply for CAN-Bus and fan control
	4		GND		
H	1	Out	55VDC	50mA	Allow-to-Charge contact
	2				
	3	Out	55VDC	50mA	Allow-to-Discharge contact
	4				
J	1				Not connected
	2	Out	Battery voltage +		Pre-charge Charge
	3	Out	Battery voltage +		Pre-charge Discharge
	4	Out	Battery voltage +	5A	DC/DC converter output. This output is pre-charged.
	5	Out	Battery GND		

APPENDIX B: SYSTEM SCHEMATIC





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