

# MASTERVOLT

THE POWER TO BE INDEPENDENT

## SOLAR CHARGEMASTER 60 MPPT

BATTERY SOLAR CHARGE REGULATOR

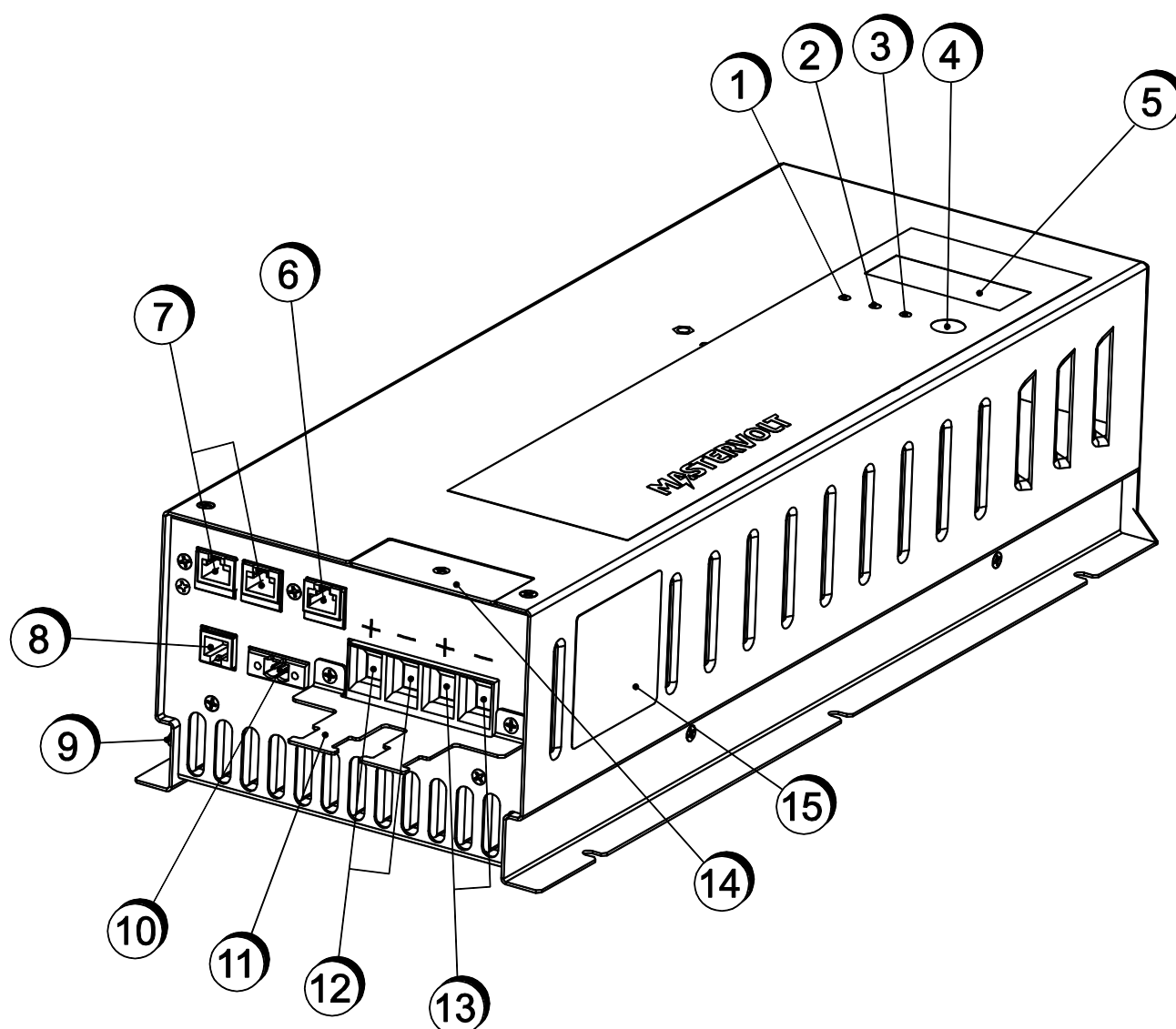


### USER AND INSTALLATION MANUAL

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## OVERVIEW



1. Power On / Charge indicator LED (Section 2.6)
2. Fault indicator LED (Section 2.6)
3. Wiring fault indicator LED (Section 2.6)
4. Menu switch (Section 2.5)
5. LCD-display (Section 2.6)
6. Service port (do not use, for factory use only)
7. MasterBus ports (Section 3.6)
8. Temperature sensor jack (Section 3.6)
9. Grounding terminal (Section 3.6)
10. Battery voltage sense (Section 3.6)
11. Strain relief bracket (Section 3.6)
12. Solar input (Section 3.6)
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Figure 1: Overview

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## 1 GENERAL INFORMATION

### 1.1 USE OF THIS MANUAL

This manual serves as a guideline for the safe and effective operation, maintenance and possible correction of minor malfunctions of the Solar ChargeMaster 60 MPPT. It is therefore obligatory that every person who works on or with the Solar ChargeMaster must be completely familiar with the contents of this manual and the Important Safety Instructions, and that he/she carefully follows the instructions contained herein.

Installation of, and work on the Solar ChargeMaster 60 MPPT may be carried out only by qualified, authorised and trained personnel, consistent with the locally applicable standards and taking into consideration the Important Safety Instructions.

### 1.2 VALIDITY OF THIS MANUAL

All specifications, provisions and instructions contained in this manual apply solely to standard versions of the Solar ChargeMaster delivered by Navico Group.

This manual is only valid for the following model:

Part number	Model
131906000	Solar ChargeMaster 60 MPPT

This model is further referred to as “Solar ChargeMaster”.

### 1.3 USE OF PICTOGRAMS

Safety instructions and warnings are marked in this manual and on the product by the following pictograms:



#### CAUTION!

Special information, commands and prohibitions in order to prevent damage.



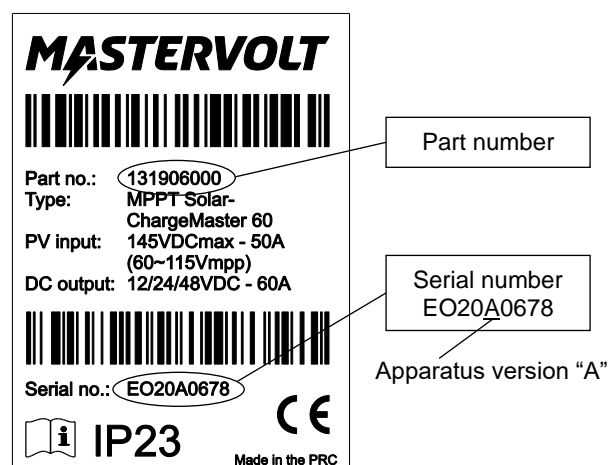
#### WARNING

A WARNING refers to possible injury to the user or installer or significant material damage to the Solar ChargeMaster if the installer / user does not (carefully) follow the stated procedures.



Read this manual before installation and use.

### 1.4 IDENTIFICATION LABEL



#### CAUTION!

Never remove the identification label.

Figure 2: Identification label

The identification label is located at the right-hand side of the Solar ChargeMaster (see Figure 1). Important technical information required for service, maintenance & secondary delivery of parts can be derived from the identification label.

### 1.5 LIABILITY

Mastervolt is a brand of Navico Group. Navico Group cannot be held liable for:

- consequential damage due to use of the Solar ChargeMaster;
- possible errors in the manuals and the results thereof.

## 2 OPERATION

### 2.1 GENERAL

The Mastervolt Solar ChargeMaster is a fully automatic battery charger which converts power from photovoltaic (PV) array to a regulated battery voltage. The PV-array connected to the Solar ChargeMaster is operated at its optimum voltage to obtain an optimal yield (Maximum Power Point Tracking). The Solar ChargeMaster can automatically adjust itself to a 12V, 24V or a 48V system. The 36V option must be selected manually. Under normal circumstances the Solar ChargeMaster remains switched on with the PV-array and batteries connected. If power from the PV-array is sufficient, the Solar ChargeMaster will initiate the charging process.



#### WARNING

The Solar ChargeMaster has no on/off switch. Charging will be initiated as soon as power from the PV-array becomes available.

As long as there is MasterBus communication, the Solar ChargeMaster will consume power from the connected battery bank.

The Solar ChargeMaster is protected against overload, short circuit, overheating and under and over voltage.



#### CAUTION!

The Solar ChargeMaster is not protected against:

- Excessive overvoltage on the Solar input
- Surges induced by lightning.

### 2.2 MAINTENANCE

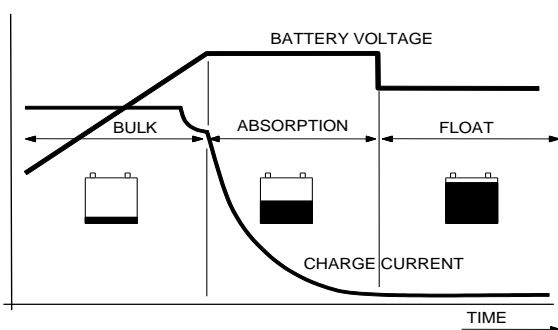
No specific maintenance to the Solar ChargeMaster is required. Examine your electrical installation on a regular base, at least once a year. Defects such as loose connections, damaged wiring etc. must be corrected immediately.

If necessary, use a soft, clean cloth to clean the casing of the Solar ChargeMaster. Do not use any liquids or corrosive substances, such as solvents, alcohol, petrol or abrasive components.

**Note:** In the event of decommissioning, refer to section 3.8.

### 2.3 THREE STEP CHARGE ALGORITHM

See Figure 3. Battery charging is accomplished in three automatic stages: BULK, ABSORPTION and FLOAT.



- **BULK:** At this stage the charger delivers its maximum current for quick charging from 0 to 80%
- **ABSORPTION:** The charger has reached its maximum charge voltage and the charge current will slowly decrease until the battery is charged up to 100%.
- **FLOAT:** This stage begins once the battery is fully charged. The battery remains in fully charged state.

Figure 3: Three step charge system

By installing the battery temperature sensor, the charge voltages are automatically adapted for deviating temperatures.

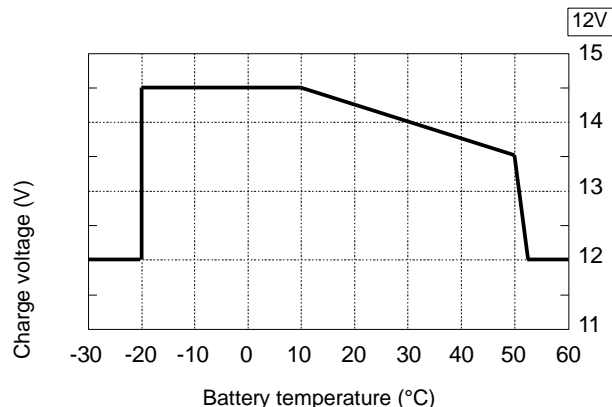


Figure 4: Temperature compensated charging

For a 24V system, double the voltage.

For a 36V system, triple the voltage.

For a 48V system, quadruple the voltage.

See Figure 4. When the battery temperature is low, the charge voltage increases. On the other hand, when the battery temperature is high, the charge voltage is decreased. Over charge and gassing are prevented this way. This will extend the life of your batteries.

## 2.4 OVERVIEW

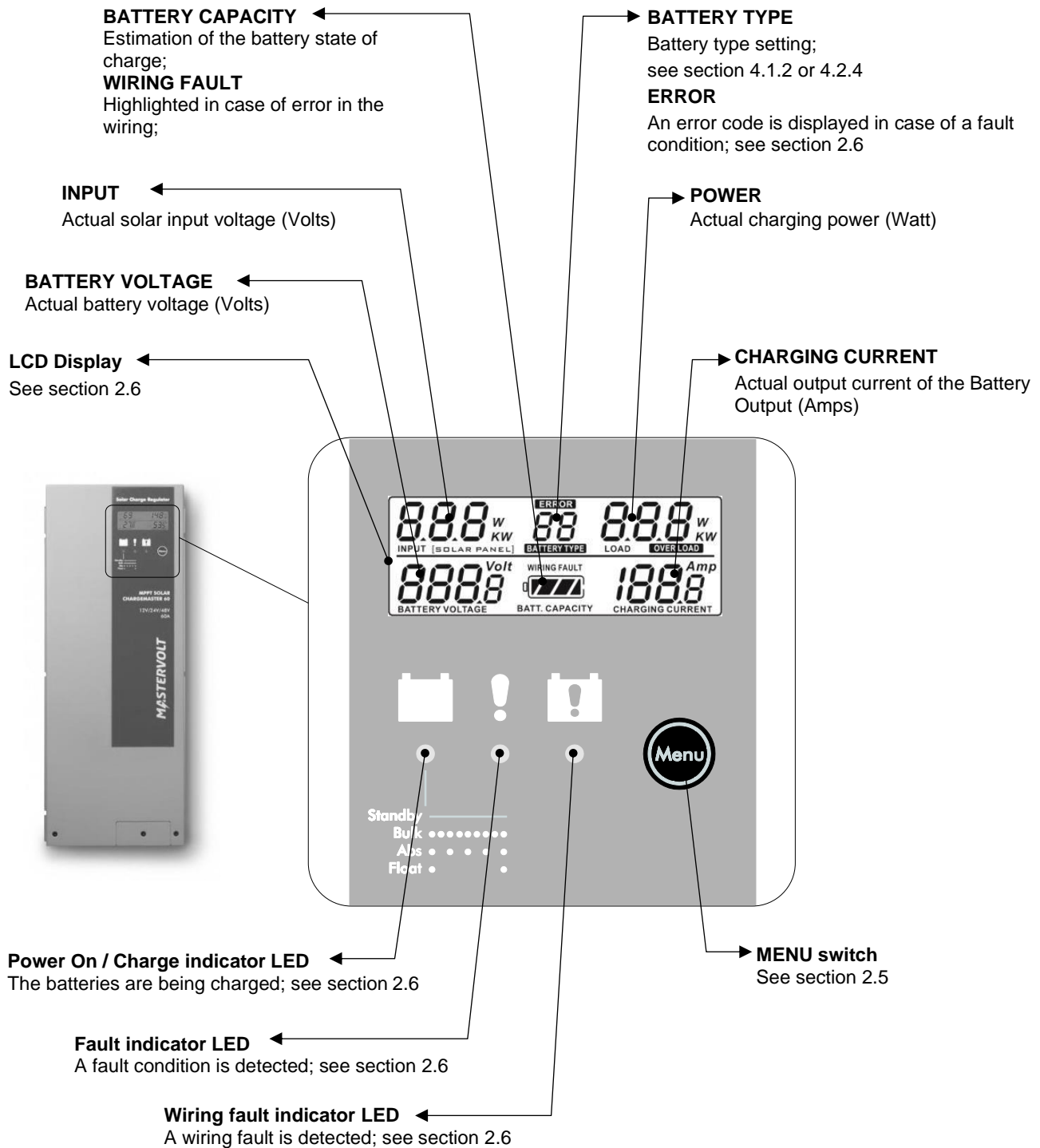






Figure 5: operation of the Solar ChargeMaster

## 2.5 MENU SWITCH

MENU switch operation	Meaning
Press shortly	Activate LCD-display
1 second	Switch on Solar ChargeMaster again after a fault or error situation
>5 seconds	Configuration menu, see section 4.1

## 2.6 LEDS AND LCD DISPLAY

LED indication			LCD indication	Meaning
				
Green flashing	(Off)	(Off)	--	Normal operation, batteries are being charged. ●●●●●●●● (every 0.5 second): Bulk charge stage ● ● ● ● ● (every second): Absorption charge stage ● ● ● (every 5 seconds): Float charge stage
Green solid on	(Off)	(Off)	--	The Solar ChargeMaster is in Standby mode. This can be due to a MasterBus controlled command; see section 4.2. If used in combination with Mastervolt MLI battery: <i>Stop charge event</i> was triggered.
(Off)	(Off)	(Off)	--	Irradiation on the PV modules is insufficient (for instance during nighttime). The Solar ChargeMaster is in Standby mode to reduce power drain from the batteries. The display can be activated temporarily by pressing the MENU switch shortly. The display will be deactivated automatically after 1 minute.
(Off)	(Off)	(Off)	--	No power from the PV-modules. Check wiring to PV-modules if the Solar ChargeMaster is switched off during daytime. Check for loose connections or incorrect polarity.
--	(Off)	--	20	Power on the Solar input is too low, irradiation on the PV modules is insufficient. This is a normal situation during sunrise and sunset.
			21	Pre-warning for too high voltage (>130V) on the Solar input.
			22	Output power de-rating due to too high internal temperature (>80°C/176°F) of the Solar ChargeMaster. Check cooling. See also section 3.2.
			23	Battery temperature low. Check batteries & battery temperature sensor.
			24	Battery temperature too high. Check batteries & battery temperature sensor.
			25	Battery sensor is short-circuited.
--	Red flashing	--	01 + <b>ERROR</b>	Charge current is too high due to over-current/power situation on the Solar input. Check PV-array.
			02 + <b>ERROR</b>	Internal temperature of the Solar ChargeMaster is too high. Check cooling. See also section 3.2
			03 + <b>ERROR</b>	Battery voltage too low (see section 6.1). Check batteries. Reduce load connected to the batteries and charge batteries.
			04 + <b>ERROR</b>	Battery voltage too high (>15V@12V / >30V@24V / >45V@36V / >60V@48V). Check batteries, check output voltage of other charging devices.
			05 + <b>ERROR</b>	Voltage from PV-modules is too high (>140V). Check PV-array.
			06 + <b>ERROR</b>	Battery temperature too low (<0°C/32°F). Check batteries, check battery temperature sensor.
			07 + <b>ERROR</b>	Battery temperature too high (>50°C/122°F). Check batteries, check battery temperature sensor.
			08 + <b>ERROR</b>	Battery voltage sense error: Difference between voltage measured at battery output and battery voltage sense function is too high. Check battery voltage sense wiring (section 3.3.2)
		Red solid on		Reversed polarity on the Battery connection. Check battery wiring.

### 3 INSTALLATION

During installation commissioning and maintenance of the Solar ChargeMaster, the Important Safety Instructions are applicable at all times.

#### 3.1 UNPACKING

The delivery includes the following items:

- Solar ChargeMaster;
- Mounting bracket;
- Strain relief bracket;
- Battery temperature sensor;
- MasterBus terminator;
- Battery voltage sense connector (pre-assembled);
- Important Safety Instructions;
- This user manual.

After unpacking, check the contents for possible damage. Do not use the product if it is damaged. If in doubt, contact your supplier.

#### 3.2 ENVIRONMENT

Obey the following stipulations during installation:

- The Solar ChargeMaster is designed for indoor use only. It is suited for use in Marine, Mobile and stationary applications.
- Ambient operating temperature: -20°C ... 55°C / -4°F ... 131°F (power de-rating above 40°C / 104°F to decrease the internal temperature).
- Humidity: 5-95%, non-condensing.
- The Solar ChargeMaster must be mounted to a vertical, solid and heat-resistant surface, with the connecting cables downwards.
- Do not expose the Solar ChargeMaster to excessive dust, aggressive environments, ammonia or salt.
- Make sure that the hot air that is developed during operation can be discharged. The Solar ChargeMaster must be mounted in such a way that obstruction of the airflow along the heatsink on the backside of the casing will be prevented.
- No objects must be located within a distance of 20 cm / 8 inch to the side and 50 cm / 20 inch above and below the Solar ChargeMaster.
- Do not locate the Solar ChargeMaster in the same compartment as the batteries.
- Do not install the Solar ChargeMaster straight above the batteries because of possible corrosive sulphur fumes.
- Although the Solar ChargeMaster fully complies with all applicable EMC limits, it may still cause harmful interference to radio communication equipment. If such interference appears, it is recommended to increase the separation between the Solar ChargeMaster and the equipment, to relocate the receiving antenna or to connect the equipment to a circuit different from that to which the Solar ChargeMaster is connected.

#### 3.3 WIRING AND FUSES

##### 3.3.1 Battery output



##### WARNING

The wire and fuse sizes stated in this manual are given as example only. Prescribed wire and fuse sizes may be different due to local applicable regulations and standards.

Keep in mind that high current will pass through the DC wiring. Keep the cable length as short as possible, this will keep the system efficiency as high as possible. The recommended minimum cross sections of the wiring are:

Connection	Minimum DC Cable cross section	
	<3m / 10ft length	3 - 5m / 10 - 16ft
Battery	25mm <sup>2</sup> / AWG4	35mm <sup>2</sup> / AWG2

Use boot lace ferrules on the wire ends. These ferrules must be crimped with a proper crimping tool.

Use the following wire colors for DC wiring:

Wire color	Meaning	Connect to:
Red	Positive	+ (POS)
Black	Negative	- (NEG)

Lay the positive and negative cables next to each other to limit the electromagnetic field around the cables. The negative battery cable should be connected directly to the negative post of the battery bank or the ground side of a current shunt. Do not use the chassis frame as the negative conductor. Tighten securely. The positive battery cable must be fused and connected to the positive post of the battery bank. The recommended DC fuse is:

Connection	DC fuse
Battery fuse	80A



### 3.3.2 Voltage sense (optional)

To compensate the charge voltage of the Solar ChargeMaster for losses over the battery cables the voltage sense function can be used. Connect wiring as indicated in Figure 6. Recommended cable cross section and DC fuse:

Connection	Minimum DC Cable cross section	DC-fuse
Voltage sense	0.75mm <sup>2</sup> / AWG18	3A

**Note:** Do not connect the voltage sense wiring if the *Shunt device* function is enabled (section 4.2.4)

## 3.4 PV-ARRAY

### 3.4.1 External DC Switch



#### WARNING

When the PV-array is exposed to light, it supplies a DC voltage to the Solar ChargeMaster which can be dangerous to touch.

For this reason, use of an external DC-switch to disconnect the PV-modules from the Solar ChargeMaster is strongly recommended and can even be mandatory. For example, international standard IEC60364-7-712 prescribes a DC switch in solar electric installations in buildings. Please acquaint yourself with locally applicable regulations and standards on this aspect. Alternatively, before attempting any maintenance or cleaning the PV-array should be protected from light exposure, e.g. by covering the PV modules.

### 3.4.2 Specifications of the PV-array



#### CAUTION!

Do not connect Solar ChargeMasters in parallel on the PV-array side.

The Solar ChargeMaster can be used with any PV-array configuration that satisfies the following requirements:

- Maximum open circuit PV voltage: 145 V DC;
- The MPP voltage from the PV-array must be at least 5Volts higher than the battery voltage.

Configuration examples for PV-arrays consisting of monocrystalline or polycrystalline PV-modules:

Battery voltage U <sub>NOM</sub> = 12V		
Panel type	# in series	# in parallel*
36 cells	1 – 5 or 6**	Max. 900Wp
60 cells	1 – 3	Max. 900Wp
72 cells	1 – 2 or 3**	Max. 900Wp

Battery voltage U <sub>NOM</sub> = 36V		
Panel type	# in series	# in parallel*
36 cells	3 – 5 or 6**	Max. 2700Wp
60 cells	2 – 3	Max. 2700Wp
72 cells	2 – 3**	Max. 2700Wp

Battery voltage U <sub>NOM</sub> = 24V		
Panel type	# in series	# in parallel*
36 cells	2 – 5 or 6**	Max. 1800Wp
60 cells	1 – 3	Max. 1800Wp
72 cells	1 – 2 or 3**	Max. 1800Wp

Battery voltage U <sub>NOM</sub> = 48V		
Panel type	# in series	# in parallel*
36 cells	3 – 5 or 6**	Max. 3600Wp
60 cells	2 – 3	Max. 3600Wp
72 cells	2 – 3**	Max. 3600Wp

\* If more than two PV-strings are connected in parallel, string fuses must be integrated in both the positive and negative legs of the string cabling. Fuse ratings should be chosen 50 % higher than the MPP current of the PV modules used.

\*\* See the following caution.



#### CAUTION!

Never connect voltages higher than specified to the PV-input, as this will cause permanent damage to the Solar ChargeMaster. Always verify the maximum open circuit PV voltage at lowest possible temperature in which the PV-array will be used!

**Note:** The Solar ChargeMaster will automatically limit the input current and power to its specified rating (see section 6.1). Excess power will not be converted.

In case of high risk of lightning strikes, installation of external Surge Protection Devices (SPD) is recommended.

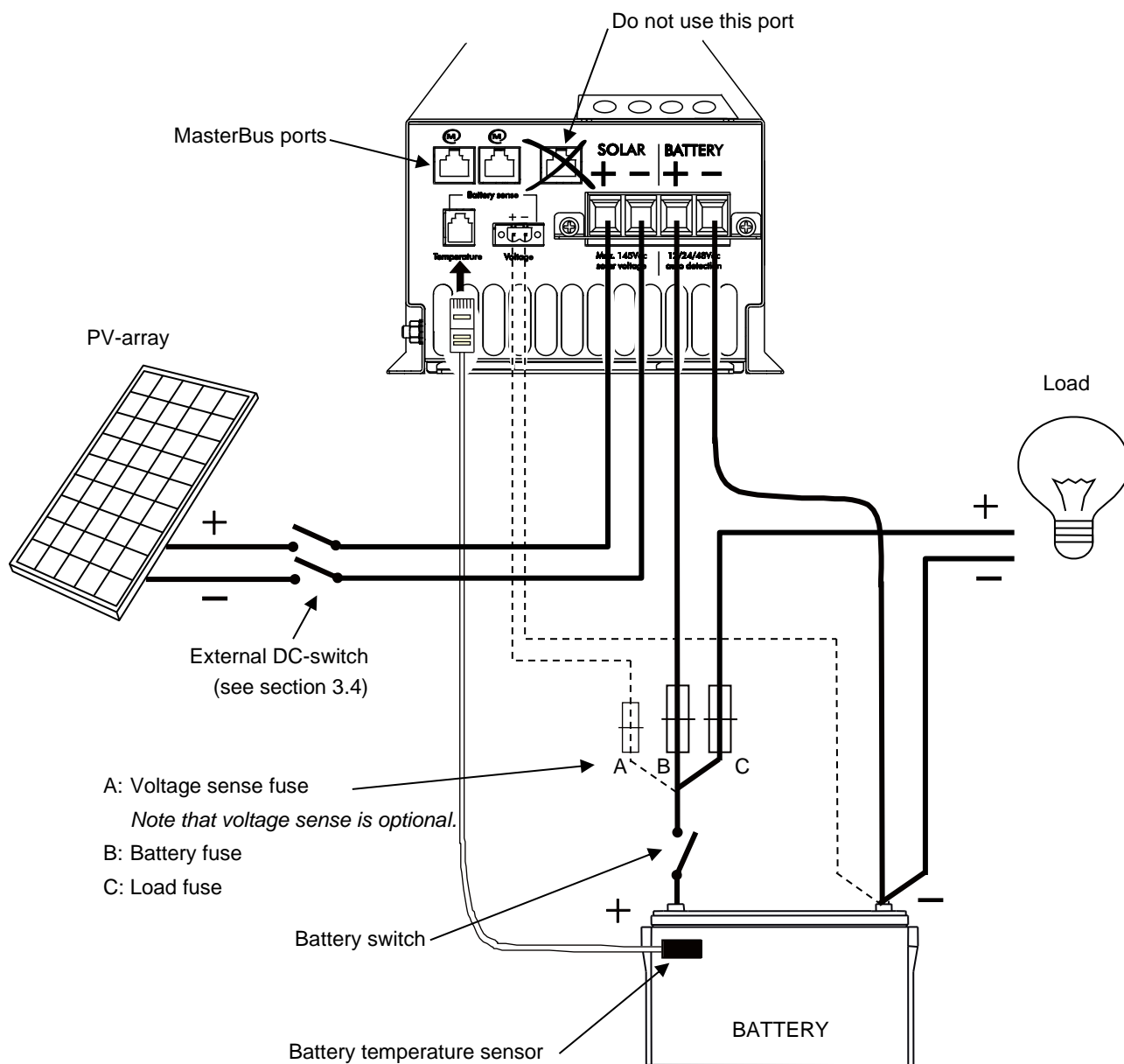


Figure 6: Wiring diagram

Above schematic is to illustrate the general placement of the Solar ChargeMaster in a circuit. It is not meant to provide detailed wiring instructions for any particular electrical installation.

### 3.5 THINGS YOU NEED

Make sure you have all the parts you need to install the Solar ChargeMaster:

- Solar ChargeMaster (included);
- Battery temperature sensor with cable and plug (included);
- DC cables to connect the Solar ChargeMaster; see section 3.3.1 for specifications;
- DC-fuse holder with a DC-fuse, to be integrated in the positive DC-cable to the battery; see section 3.3.1;
- Option: Wiring, fuse and fuse holder for voltage sense connection; see section 3.3.1;
- Screws / bolts (Ø 4mm max.) (with plugs) to mount the Solar ChargeMaster to a surface;
- DC-switch to disconnect the PV-modules from the Solar ChargeMaster, see section 3.4.1;
- PV-panels; see section 3.4.2;
- Batteries;
- Battery switch;
- Appropriate and reliable cable terminals, strain reliefs, battery terminals and boot lace ferrules.

We recommend as a minimum tool kit:

- Isolated Phillips screwdriver nr.2 or flat blade screwdriver 5 mm to fix the DC-cables;
- Tools to fix the screws / bolts with plugs to mount the Solar ChargeMaster to a surface.

### 3.6 CONNECTION

#### 3.6.1 General



#### **WARNING**

Let installation work be done by a licensed electrician.

All electrical systems must be disconnected from any power source during the entire installation!



#### **CAUTION!**

- Short circuiting or reversing DC polarity may lead to damage to the Solar ChargeMaster, the cabling and/or the terminal connections.
- Follow all steps of the installation instructions in order of succession as described.



#### **CAUTION!**

Too-thin cables and/or loose connections can cause dangerous overheating of the cables and/or terminals.

Therefore, tighten all connections well, in order to limit transition resistance as far as possible. Use cables of the correct size. Use additional strain reliefs to prevent the transmission of stress to the screw connectors.



#### **CAUTION!**

The negative connections of the Solar ChargeMaster are common and therefore have the same electrical potential. If grounding is required, always do this on the negative wires. Use one grounding point only.

Minimum wire cross section for grounding: 10mm<sup>2</sup> / AWG8.

**Note:** If the battery temperature remains within 15-25°C, connection of the battery temperature sensor is optional. Do not connect the battery temperature sensor to the *Temperature sensor jack* (Figure 1, item 8) if *Battery Type* is set to Lithium or if the *Shunt device* function is enabled, see section 4.2.4

### 3.6.2 Installation step by step

1

Fix the strain relief bracket to the casing of the Solar ChargeMaster.

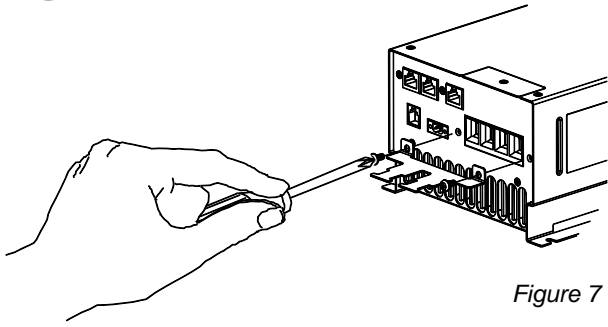


Figure 7

2

Mark the position of the mounting spots by using the mounting bracket. Then fix the mounting bracket to the wall.

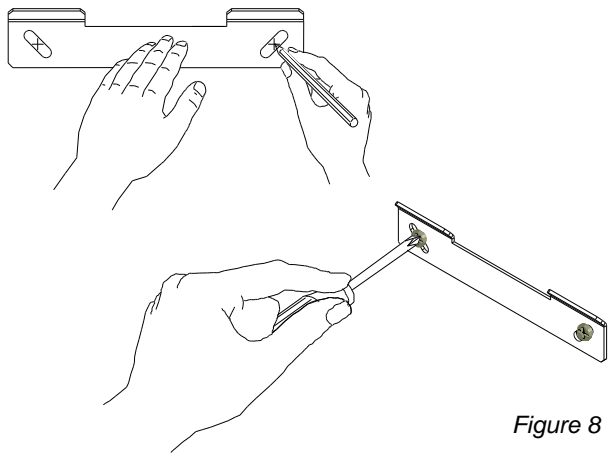


Figure 8

3

Place the Solar ChargeMaster over the mounting bracket and then move it downwards until it is suspended from the mounting bracket.

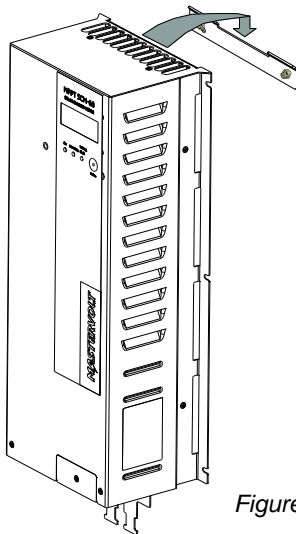


Figure 9

4

Fix the enclosure to the wall by fastening the other screws as well.

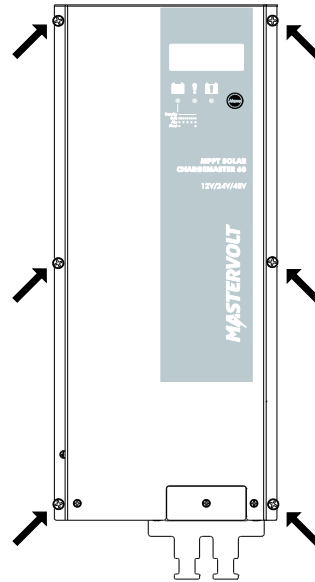


Figure 10

5

If grounding is required, connect the grounding terminal to the central grounding point of the electrical installation; see Figure 1, item 10.

See also section 3.6.1

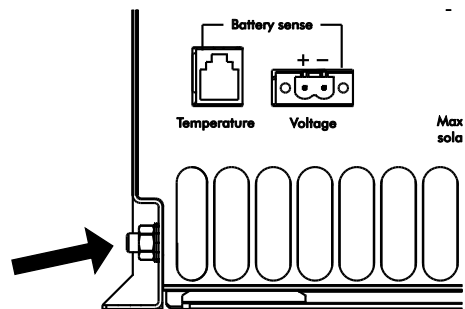


Figure 11

6

Take off the terminal cover by releasing the screw.

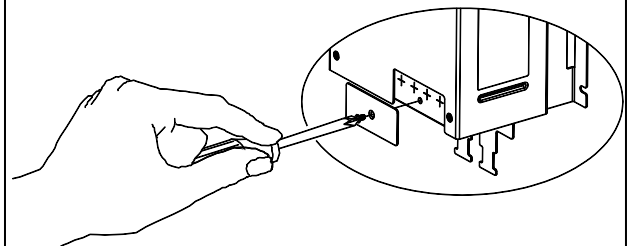


Figure 12

7

Connect the wiring to the battery. See figure 6. Fix the wires to the strain relief by means of tie-wraps. Integrate a fuse holder in the positive battery wire, but do not place the fuse yet.

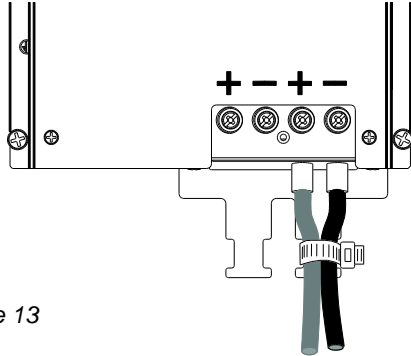


Figure 13

8

If required, connect the battery voltage sense wires. Integrate a fuse holder in the positive battery wire, but do not place the fuse yet.

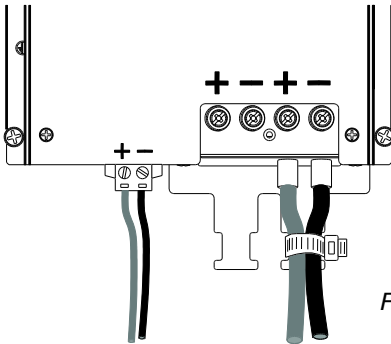


Figure 14

9

Attach the battery temperature sensor to the casing of the battery. Plug the temperature sensor cable into the Temperature sensor jack (Figure 1, item 8).

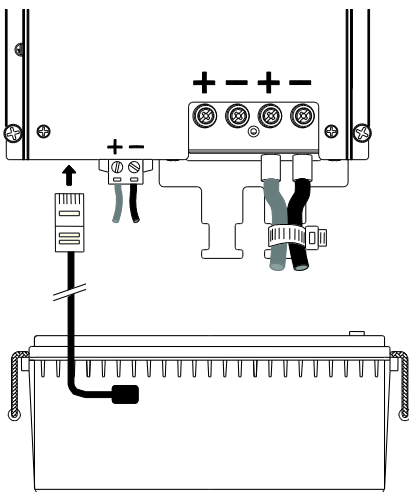


Figure 15

**WARNING**

Risk of shock! When the PV-array is exposed to light, it supplies a dangerous DC voltage. See section 3.4.1.

10

Connect the PV-array

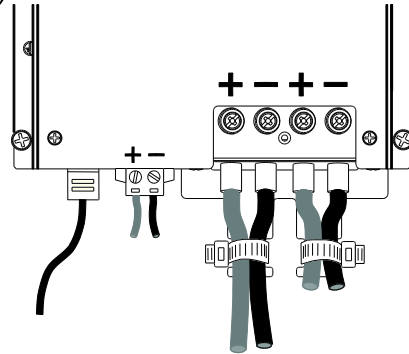


Figure 16

11

Close the terminal cover.

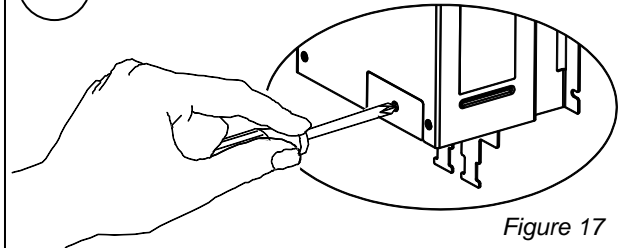


Figure 17

12

Option: Connect the Solar ChargeMaster to the MasterBus network.

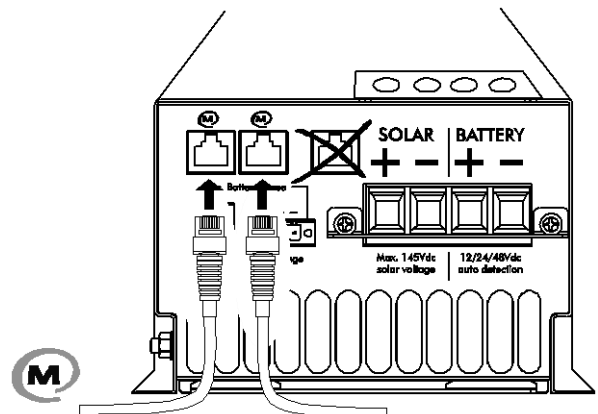


Figure 18

13

Check all wiring: positive to +, negative to -. See also Figure 6 for wiring example. Continue with section 1.1 for commissioning of the Solar ChargeMaster.

### 3.7 COMMISSIONING AFTER INSTALLATION



#### CAUTION!

Check the polarity of all wiring before commissioning: positive connected to positive (red cables), negative connected to negative (black cables).

- 1 If all wiring is OK, place the DC-fuse in the *Battery voltage sense* wiring.
- 2 Place the DC-fuse between the *Battery output* of Solar ChargeMaster and the battery. Move the battery switch in the “ON” position.



#### WARNING

When placing this fuse, a spark can occur, caused by the capacitors used in the Solar ChargeMaster. This is particularly dangerous in places with insufficient ventilation, due to the gassing of the batteries an explosion can occur. Avoid having flammable materials close by.

- 3 The Solar ChargeMaster will initiate the charging process if the voltage from the PV-array is 5VDC higher than the battery voltage; see chapter 2.

**Note:** If the Solar ChargeMaster does not switch on, press the MENU switch for 1 second.

- 4 Continue with chapter 4 for settings.



#### CAUTION!

If the system voltage is still set to automatic detection (Auto), and the batteries are discharged to the point that the voltage is below the system threshold, the Solar ChargeMaster will assume that the complete system changed to a lower voltage. The result might be that the batteries do not reach their full capacity. To prevent this, select the required system voltage from a display like the EasyView 5, or from a PC with MasterAdjust.

### 3.8 DECOMMISSIONING

To put the Solar ChargeMaster out of operation, follow these instructions in order of succession:

- 1 Switch off all loads that are connected to the Solar ChargeMaster;
- 2 Disconnect the PV-array by switching off the switch between the PV-array and the Solar ChargeMaster (or protect the PV-array from light exposure, e.g. by covering the PV modules);
- 3 Move the battery switch in the “OFF” position and remove the DC-fuse between the Solar ChargeMaster and the battery;
- 4 Check with a suitable voltage meter whether the Battery connection of the Solar ChargeMaster is voltage free;
- 5 Disconnect the negative cable to the PV-array from the terminal block of the Solar ChargeMaster. Isolate the core of the wire with insulating tape;
- 6 Do the same for the positive cable to the PV-array;
- 7 Disconnect all other remaining wiring.

Now the Solar ChargeMaster can be demounted in a safe way.

### 3.9 STORAGE AND TRANSPORTATION

When not installed, store the Solar ChargeMaster in the original packing, in a dry and dust free environment.

Always use the original packing for transportation. Contact your local Mastervolt Service Centre for further details if you want to return the apparatus for repair.

### 3.10 RE-INSTALLATION

To reinstall the Solar ChargeMaster, follow the instructions as described in this chapter (chapter 3).

## 4 SETTINGS

Adjustment of the settings of the Solar ChargeMaster can be made in two different ways:

- By means of the Configuration menu; see section 4.1;
- Via the MasterBus network; see section 4.2. Some settings can only be changed in this way.



### WARNING

The MLI charging voltages on this charger fit the Mastervolt Li-ion (MLI) batteries but do not necessarily fit other Li-ion batteries! See also section 4.3. Always follow the instructions provided by the battery manufacturer!



### CAUTION!

Invalid settings of the Solar ChargeMaster can cause serious damage to your batteries and/or the connected load! Adjustments of settings may be undertaken by authorized personnel only.

**Note:** If your Solar ChargeMaster is not new, you have to take into account that former users may have changed the settings.

### 4.1 CONFIGURATION MENU

#### 4.1.1 Readout of software version

To check the version of the installed software:

- Hold the MENU switch (Figure 1) pressed until the Battery type indication starts blinking;
- The version of the installed software is shown at the right upper side of the display (Figure 19);
- After 10 seconds the Solar ChargeMaster returns to the normal operation mode.



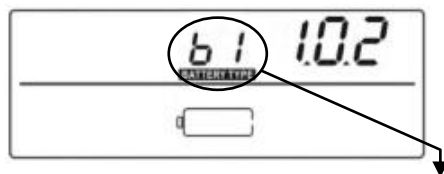
Figure 19: Software version

#### 4.1.2 Battery type and output current

To change the setting for Battery type or maximum output current:

- Hold the MENU switch (Figure 1) pressed until the setting for Battery type ("b1", "b2", "b3", etcetera) is shown;
- Press the MENU switch shortly to toggle between configuration modes: Battery type ("b") or Maximum output current ("C").
- Hold the MENU switch pressed to until the selected configuration mode starts blinking.
- Press the MENU switch shortly to scroll through the settings as shown in below table.
- Hold the MENU switch pressed until the preferred setting stops blinking to confirm the desired setting.

When the MENU switch is not touched for 10 seconds, the Solar ChargeMaster returns to the normal operation mode without changing a setting.



Indication	Battery type / voltage	Indication	Maximum output current
b1	Flooded	C1	10A
b2	Float voltage 13.6V*	C2	20A
b3	AGM / Gel (float voltage 13.8V)*	C3	30A
b4	Flooded traction	C4	40A
b5	Mastervolt MLI (see section 4.3)	C5	50A
b6	User defined (see section 4.2.4)	C6	60A

\* For a 24V system, double the voltages. For a 36V system, triple the voltages. For a 48V system, quadruple the voltages.

Figure 20: Battery type and output current

## 4.2 MASTERBUS FUNCTIONS

Adjustment of the settings of the ChargeMaster can be made via the MasterBus network (by means of a remote control panel like the EasyView 5, or a Mastervolt USB interface connected to a PC with MasterAdjust software).

**Note:** Refer to the user manual of the MasterBus remote control panel for more information about MasterBus.

### 4.2.1 Monitoring

Value	Meaning	Default	Adjustable range
<b>General</b>			
Device state	Shows the actual operation mode of the Solar ChargeMaster (Charging / Standby / Alarm/Off)		(read only)
Charge state	Actual state of charge algorithm: Bulk / Absorption / Float / Off		(read only)
Solar voltage	Voltage at the Solar input		(read only)
Charge current	Output current of the Battery output		(read only)
Battery voltage	Voltage measured at the Battery output. If the voltage sense wires are connected: voltage measured at the <i>Battery voltage sense</i> input. If the <i>Shunt device</i> function is enabled for a <i>MasterShunt</i> (MSH) or an <i>MLI Ultra</i> (BAT) (section 4.2.4): voltage measured by the <i>MasterShunt</i> / <i>MLI Ultra</i> .		(read only)
Battery temp.	Actual battery temperature measured by the Battery temperature sensor. If the <i>Shunt device</i> function is enabled for a <i>MasterShunt</i> (MSH): Battery temperature measured by the <i>MasterShunt</i> . “---“ is shown if no battery temperature sensor is used or when <i>Battery Type</i> is set to “MLI”.		(read only)
Total energy	Total amount of energy (kWh) converted by the Solar ChargeMaster (measured at the Battery output)		(read only)
Charger temp.	Temperature of the Solar ChargeMaster		(read only)
On/Off	Button to toggle the <i>Device state</i> . NOTE: If the Solar ChargeMaster was switched off by means of this button, it will switch on again the next day (after sunset and sunrise).	On	On/Off
<b>Shunt</b>			
State	Shows whether a current measuring shunt is connected or not. See configuration for settings	Not selected, Connected	(read only)

### 4.2.2 Alarm

Value	Meaning	Adjustable range
Over current	Load connected to the Battery output is too high	(read only)
Solar volt. high	Input voltage at the Solar input is too high	(read only)
Battery low	Battery voltage is too low (see section 6.1)	(read only)
Battery high	Battery voltage is too high (see section 6.1)	(read only)
Battery temp.	Battery temperature is out of range <0°C/32°F or >50°C/122°F	(read only)
Charger temp.	Internal temperature of the Solar ChargeMaster is too high	(read only)
Temp sense error	Battery temperature sensor is in short circuit	(read only)
Shunt mismatch	Setting for nominal voltage (12, 24, 36 or 48V) at the <i>MasterShunt</i> or the nominal voltage of the <i>MLI Ultra</i> battery differs from nominal voltage detected by the Solar ChargeMaster. Check battery voltage and settings of the <i>MasterShunt</i> or voltage of the <i>MLI Ultra</i> battery.	(read only)
Hardware error	Internal hardware error. Contact Navico Group.	(read only)

### 4.2.3 History

This menu shows the historical data of the Solar ChargeMaster.

Value	Meaning	Adjustable. range
<b>Solar</b>		
Total energy	Total amount of energy (kWh) converted by the Solar ChargeMaster (measured at the Battery output)	(read only)



#### 4.2.4 Configuration

Below parameters can be changed via the MasterBus network by means of a remote control panel or by means of an interface connected to a PC with MasterAdjust software. See applicable user manuals for details.

Value	Meaning	Factory setting	Adjustable. range
<b>Device</b>			
Language	Language that is displayed on a monitoring device connected to the MasterBus	English	EN, NL, DE, FR, ES, IT, NO, SV, FI, DA
Name	Name of this device. This name will be recognized by all devices connected to the MasterBus	SCM [serial number]*	0-12 chars
Lock config	Option to lock the configuration (requires installer rights)		
Factory settings	Button to reset the Solar ChargeMaster to default settings (requires installer rights)		
<b>Charger</b>			
Max Charge curr.	Setting of the maximum output current	60A	10...60A
Battery type	Selection of pre-set charge algorithm. Individual adjustments of <i>Absorption</i> , <i>Float</i> and <i>Max. absorpt. time</i> are only possible if "User defined" is selected here.	Flooded	Flooded, Gel, AGM, Traction, MLI, User defined
Absorption	Absorption voltage (@ 25°C); see section 2.3	14.25V **	12.00-15.50V **
Float	Float voltage (@ 25°C); see section 2.3	13.25V **	12.00-15.50V **
Max. absorp. time	Maximum absorption timer	240min	0-1440min
System voltage	Select the rated system voltage instead of Auto. (requires installer rights)	Auto***	Auto, 12 Volt, 24 Volt, 36 Volt, 48 Volt



#### WARNING

An incorrect setting can cause overvoltage and DAMAGE the connected batteries!

<b>Shunt</b>			
Shunt device	Selection of the shunt device to which the Solar ChargeMaster is connected. This can either be a <i>MasterShunt</i> (MSH) or a <i>MLI Ultra</i> battery (BAT). Enabling this function allows the Solar ChargeMaster to: <ul style="list-style-type: none"> <li>- Compensate the charge voltage for cable losses (Voltage sense function);</li> <li>- Adjust the actual <i>Charge state</i> based on the state of charge of the battery</li> <li>- Compensate the charge voltage for deviating battery temperatures (<i>MasterShunt</i> only)</li> </ul>	No connection	No connection, MSH+Product Name, BAT+Product Name

<b>Processor 1</b>			
Version	Firmware version of the Solar ChargeMaster		(read only)
Revision	Product version		(read only)
MB bootloader	Firmware bootloader version		(read only)

<b>Processor 2</b>			
Version	Firmware version of MasterBus		(read only)

\* See section 1.4

\*\* For a 24V system, double the voltage. For a 36V system, triple the voltage. For a 48V system, quadruple the voltage.

\*\*\* Does not apply to 36V.

### 4.2.5 Events

Value	Meaning	Factory setting	Adjustable. range
Event x source	<i>Event-based command</i> Event by the ChargeMaster that should result in an action by another device on the <i>MasterBus</i> network.	Disabled	(See List of event sources, section 4.2.6)
Event x target	<i>Event-based command</i> Selection of device on the <i>MasterBus</i> network that should take action due to an event by the ChargeMaster.		(See Device list)
Event x command	<i>Event-based command</i> Action to be taken by the selected device.		(See <i>List of event commands</i> in the manual of the selected device.)
Event x data	<i>Event-based command</i> Value of the action to be taken by the selected device.		(See <i>List of event commands</i> in the manual of the selected device.)
Event x+1	The next event appears after enabling Event x.	Disabled	See Event x.

### 4.2.6 List of events sources (Solar ChargeMaster as event source)

Below the list of event sources of the *Solar ChargeMaster* is shown. These event sources can be used to initiate an event command and an event action at another device that is connected to the *MasterBus*.

Event source	Description
Disabled	(no event programmed)
Device state	A change in the <i>Device state</i> occurs
Bulk	Charge state is Bulk
Absorption	Charge state is Absorption
Float	Charge state is Float
Battery low	Battery voltage is too low (see section 6.1)
Solar low	Input voltage at the Solar input is too low (see section 6.1)
Any alarm	Any of the Alarms is triggered (see section 4.2.2)

### 4.2.7 List of event commands (Solar ChargeMaster as event target)

Below is shown the list of event commands and event data of the *Solar ChargeMaster*. Other devices connected to the *MasterBus* can be programmed to initiate these commands and actions at the *Solar ChargeMaster*.

Event command	Description
On/Off	Command to switch on/off the Solar ChargeMaster. NOTE: If the Solar ChargeMaster was switched off by means of this event command, it will switch on again the next day (after sunset and sunrise).
Bulk	Command to toggle the Charge state to Bulk
Abs	Command to toggle the Charge state to Absorption
Float	Command to toggle the Charge state to Float

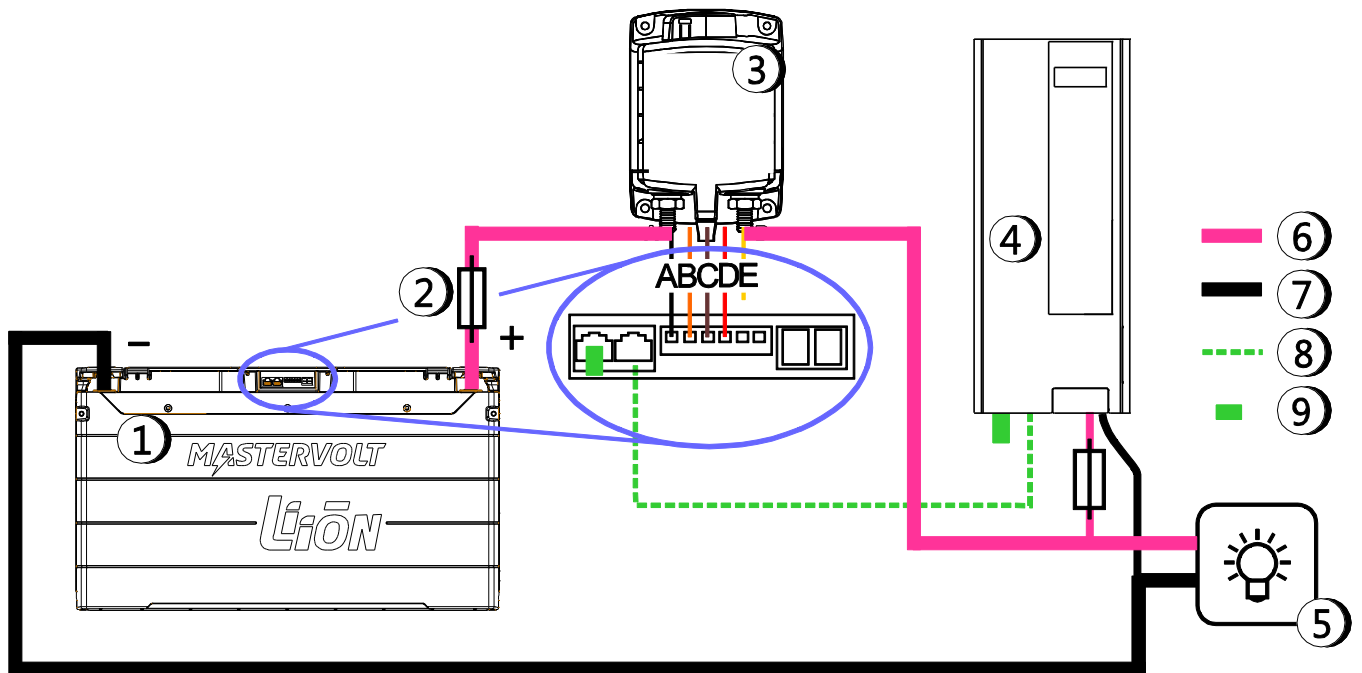
## 4.3 USE IN COMBINATION WITH MASTERVOLT MLI BATTERY

If the Solar ChargeMaster is used in combination with a Mastervolt MLI Ultra type Li-ion battery, charging shall be terminated if the MLI Ultra battery generates the *Stop charge event*. The Solar ChargeMaster is able to process such a *Stop Charge event*. Follow next additional steps to install the Solar ChargeMaster in combination with a Mastervolt MLI type Li-ion battery:

- 1 Connect the DC main wiring and other components as indicated in Figure 21.
- 2 Connect the MasterBus cabling between the devices as indicated. Do not install the battery temperature sensor!
- 3 Add a MasterBus control panel to the MasterBus network.
- 4 Configure the following *Stop Charge event* at the Li-ion battery:

Configuration	Event 1 (obligatory)
Event source	Stop Charge
Event target	SCM [serial number] (see section 1.4)
Event command	On/Off
Event data	Copy invert

- 5 Set the Battery type to Mastervolt MLI (see section 4.1.2 or 4.2.4).
- 6 Option: enable the *Shunt device* function of the Solar ChargeMaster by selecting the *MLI Ultra* battery (BAT) as shunt device (see section 4.2.4).
- 7 Continue with the “Commissioning” section in the manual of the MLI Ultra battery.



- |  |                         |
|--|-------------------------|
| 1. MLI Ultra battery                     | 5. Loads                |
| 2. Battery fuse in positive battery line | 6. DC positive cable    |
| 3. Safety relay                          | 7. DC negative cable    |
| 4. Mastervolt Solar ChargeMaster 60 MPPT | 8. MasterBus cable      |
|  | 9. MasterBus terminator |

Figure 21: Use of the Solar ChargeMaster in combination with a Mastervolt MLI Ultra battery

## 5 TROUBLE SHOOTING

If you cannot solve a problem with the aid of this chapter, contact your local Mastervolt Service Centre. See [www.mastervolt.com/technical-support](http://www.mastervolt.com/technical-support). Make sure you have the following information present:

- Part and serial number; see section 1.4
- Software version; see section 4.1.1

Malfunction	Possible cause	What to do
No output voltage and/or current	Solar ChargeMaster was switched off due to a previous fault situation	Investigate the cause of the fault situation (section 2.6) and correct the problem. Press MENU-switch for one second to switch on the Solar ChargeMaster again.
Display shows <b>ERROR</b> or an error code	Check section 2.6 for an overview of fault indications of the LEDs and the LCD display	
A red LED is on or blinking	Check section 2.6 for an overview of fault indications of the LEDs and the LCD display	
No display	The Solar ChargeMaster is in Standby mode	Press the MENU switch shortly to activate the display
Output voltage too low, charger supplies maximum current	Load that is connected to the batteries is larger than charger can supply.	Reduce load taken from the batteries.
	Batteries not 100% charged	Measure battery voltage. After some time this will be higher.
	Wrong battery type setting	Check settings (see section 4.1.2 or 4.2.4).
Charge current too low	Batteries almost fully charged	Nothing, this is normal when the battery is almost fully charged.
	High ambient temperature	Nothing; if ambient temperature is above 40°C / 104°F the charge current is automatically reduced.
	Low irradiation on the PV-array.	Check PV-array, check for shading.
	Output current is limited	Check settings (see section 4.1.2 or 4.2.4).
Battery not fully charged	Current to load is too high	Reduce load taken from the batteries.
	Charge time too short	Use an additional battery charger
	Battery temperature too low	Use the battery temperature sensor.
	Defective or worn-out battery	Check battery and replace if necessary.
Battery is discharged too fast	Wrong battery type setting	Check settings (see section 4.1.2 or 4.2.4).
	Battery capacity reduced due to sulphation or due to plate corrosion	Charge and recharge a few times, this might help. Check battery and replace if necessary.
Batteries are too warm, gassing	Defective battery (short circuit in cell)	Check battery and replace if necessary.
	Battery temperature too high	Use the battery temperature sensor.
	Wrong battery type setting	Check settings (see section 4.1.2 or 4.2.4).

## 6 TECHNICAL DATA

### 6.1 SPECIFICATIONS

Model	Solar ChargeMaster 60 MPPT			
Article no.	131906000			
Nominal battery voltage (U <sub>NOM</sub> )	Auto detection, 12V, 24V and 48V (36V must be selected manually)			
PV-INPUT	@ U <sub>NOM</sub> = 12V	@ U <sub>NOM</sub> = 24V	@ U <sub>NOM</sub> = 36V	@ U <sub>NOM</sub> = 48V
Maximum connected PV power	900Wp	1800Wp	2700Wp	3600Wp
Maximum input PV power*	800W	1600W	2400W	3200W
Full power voltage MPPT range	15 V ~ 115 V	30 V ~ 115 V	45 V ~ 115 V	60 V ~ 115 V
Absolute maximum PV Voltage	145V <sub>DC</sub>	145V <sub>DC</sub>	145V <sub>DC</sub>	145V <sub>DC</sub>
MPP tracking	Yes, integrated MPP tracker			
Start-up voltage	Battery voltage + 3V <sub>DC</sub>			
Maximum PV input current	50A <sub>DC</sub>			
EU efficiency	>97%			
Peak static power conversion efficiency	>98%			
Static MPPT efficiency	>99%			
BATTERY OUTPUT	@ U <sub>NOM</sub> = 12V	@ U <sub>NOM</sub> = 24V	@ U <sub>NOM</sub> = 36V	@ U <sub>NOM</sub> = 48V
Maximum charge current (I <sub>MAX</sub> )	60 A	60 A	60 A	60 A
Charge voltage, Absorption	14.25V (Traction: 14.45V)	28.5V (Traction: 28.9V)	42.75V (Traction: 43.35V)	57.0V (Traction: 57.8V)
Charge voltage, Float;	13.25V (AGM, gel: 13.8V, MLI: 13.5V)	26.5V (AGM, gel: 27.6V, MLI: 27.0V)	39.75V (AGM, gel: 41.4V, MLI: 40.5V)	53.0V (AGM, gel: 55.2V, MLI: 54.0V)
Low voltage disconnect / reconnect	8.5V / 9.0V	17.0V / 18.0V	25.5V / 27.0V	34.0V / 36.0V
High voltage disconnect / reconnect	15.0V / 14.5V	30.0V / 29.0V	45.0V / 43.5V	60.0V / 58.0V
Battery temperature compensation	–30 mV/°C	–60 mV/°C	–90 mV/°C	–120 mV/°C
DC consumption (at night)	<1mA	<1mA	<1mA	<1mA
DC consumption (on, no charging)	<130mA	<130mA	<130mA	<130mA
Charge algorithm	Three step (Bulk, Absorption, Float)			
Battery types**	Flooded, AGM, Gel, Traction, MLI (Mastervolt Lithium-Ion).			
GENERAL				
Galvanic isolation between PV and battery	No, common negative conductor			
Dimensions in mm [inch] (h x w x d)	168 x 398 x 107 mm [6.6 x 15.7 x 4.2 inch]; see also section 6.2			
Weight	5.5 kg [12.1Lbs]			
Operating Temperature Range	–20°C ≤ T <sub>AMB</sub> ≤ +55°C [–4°F ≤ T <sub>AMB</sub> ≤ 131°F] (power de-rating > 40°C / 104°F)			
Full Power Temperature range	–20°C ≤ T <sub>AMB</sub> ≤ +40°C [–4°F ≤ T <sub>AMB</sub> ≤ 104°F] (no power de-rating)			
Non-operating Temperature range	–40°C ≤ T <sub>AMB</sub> ≤ +75°C [–4°F ≤ T <sub>AMB</sub> ≤ 167°F] (storage temperature)			
Relative Humidity	5% to 95% non-condensing			
Protection degree	IP23			
MasterBus connectivity	Yes			
Terminals	Screw terminals, max. wire size 35mm <sup>2</sup>			

\* Automatic limitation of input power; excessive power will not be converted

\*\* Refer to section 4.1.2 or 4.2.4 for battery type settings.

Specifications are subject to change without prior notice.

## 6.2 DIMENSIONS

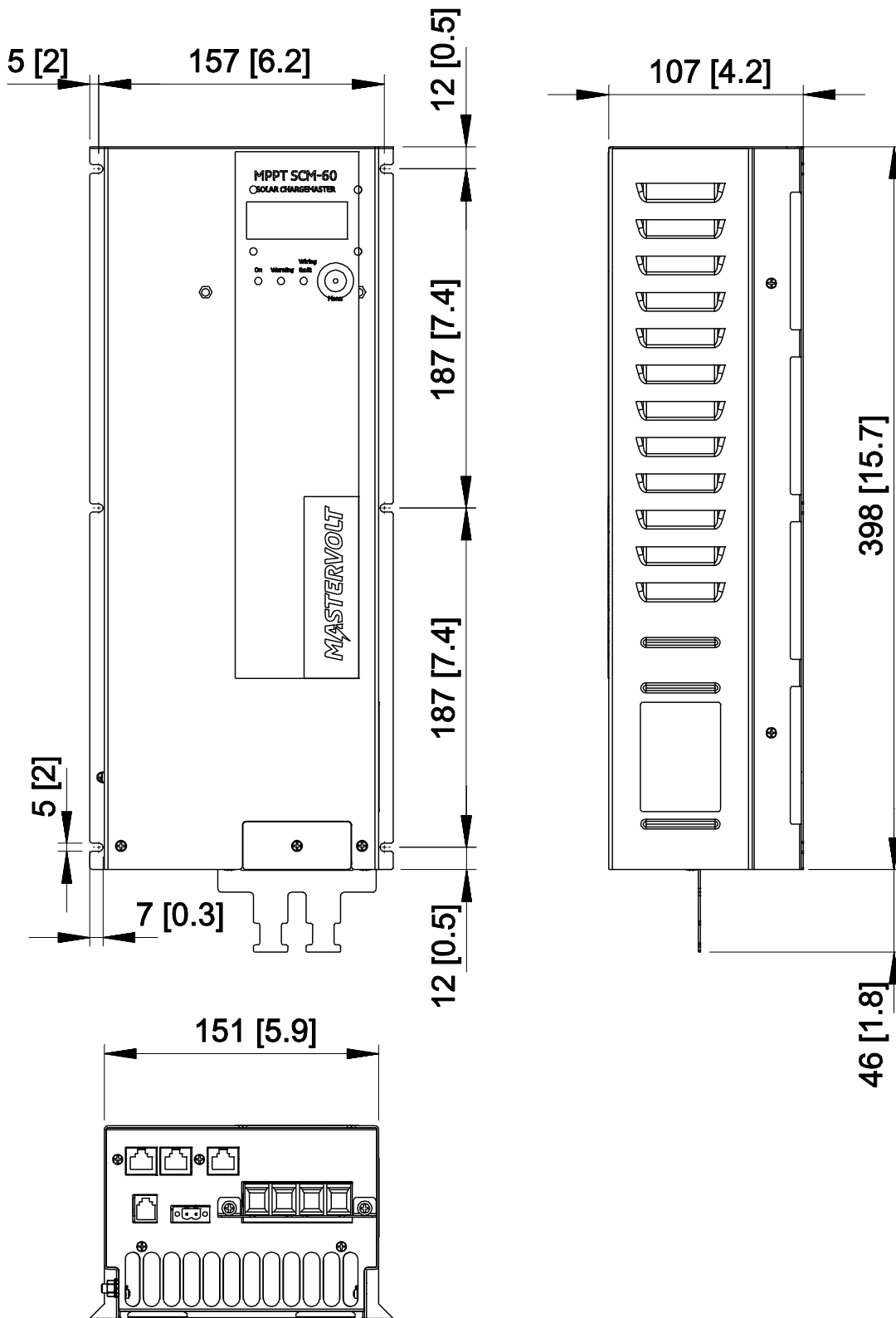


Figure 22: Dimensions of the Solar ChargeMaster in mm [inches]

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We welcome your feedback and suggestions!  
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