Frequently asked questions about **battery chargers**

What factors should I consider when choosing a battery charger?

1. How many battery banks will you be charging? Take into account main, starter, bowthruster, etc. Also consider any possible future extension of your system (= sufficient battery charger outputs).
2. Battery charger must have the same voltage as the battery bank, i.e. 12 V battery voltage = 12 V battery charger.
3. To safely charge the batteries you need to have the correct charging current (measured in amps). See the battery charger specifications in the Powerbook Products for the recommended capacity.
4. Compare the specifications and prices of the different battery chargers based upon their capacity. The charge current is standard specified for the nominal output voltage (12 or 24 V). Mastervolt applies a considerably higher output voltage of 14.25 or 28.5 V. This means a shorter charge period and faster recharging of your batteries.

Which battery charger is necessary for a battery capacity of 200 Ah and a 100 Ah starter battery?

The starter battery is generally not considered when calculating the charger capacity - it is only used for starting the engine and will therefore tend to be only partially discharged if at all. While you are sailing, the alternator recharges the battery and when in harbour, it is charged via the second or slave outlet of the Mastervolt battery charger. As a rule, a charge capacity of 25% (up to 50% for gel batteries) of the battery capacity is sufficient to charge the battery quickly and safely, and also power the onboard system. For a battery of 200 Ah, for instance, a battery charger of 50 amps would be appropriate.

Is having 10% of my battery capacity as charge capacity sufficient?

Definitely not. You can assume 25% and up to as much as 50% with Mastervolt batteries. The old 10% rule was common in the days when battery chargers had no current and voltage regulation, and too high a current could overcharge the batteries. Mastervolt battery chargers have perfect current/voltage regulation and are also equipped with a temperature sensor that ensures the voltage is regulated according to the battery's temperature.

What type of battery can I charge?

You can easily charge all battery types, such as wet, AGM, gel and Lithium Ion batteries.

Can a Mastervolt battery charger remain connected throughout the winter?

Yes, your Mastervolt battery charger can easily be left connected in the winter. In fact, this is better for the batteries, as they will then remain in optimum condition and there is no need to take them home for recharging. The 3-step⊕ charging method ensures a monthly absorption cycle so the battery stays active. If you do not have access to shore power during the winter we advise you to fully charge the batteries before the winter and then disconnect the battery poles so small users cannot discharge your battery. We also advise charging your battery every two months.

I sometimes have a limited shore connection. Can I still use a large battery charger?

Yes. All Mastervolt battery chargers and Combis are fitted with the very latest electronics, reducing their power consumption by about 40% compared to conventional battery chargers. The power intake of Mastervolt 12 Volt battery chargers is summarised below for 230 Volt models. The levels of current specified are relevant to maximum capacity operation, i.e. measured at the moment the battery charger supplies its full capacity.

ChargeMaster 12/25	1.9 amps
ChargeMaster 12/50	3.8 amps
ChargeMaster 12/70	5.2 amps
ChargeMaster 12/100	7.4 amps
Mass 12/60	4.6 amps
Mass 12/80	6.3 amps

In addition, each battery charger with a charge current higher than 15 amps (12 Volt) can be equipped with a remote control panel. This allows output current to be reduced, causing the battery charger to draw even less shore power and preventing the shore power fuse from blowing.

Can I install my battery charger in the engine room or compartment?

Yes. All Mastervolt battery chargers can easily be installed in the engine room as higher temperatures do not negatively affect their current output. The output current will be automatically reduced if the ambient temperature becomes very high, ensuring that the battery charger is not damaged.

Can I charge batteries separately?

Most Mastervolt battery chargers have an additional outlet for the starter battery. This outlet supplies the starter battery with a maintenance charge. A number of models are even fitted with three outlets, allowing three battery sets to be charged independently of each other. It is also possible to charge multiple battery sets via a battery isolator (also known as a diode splitter). The voltage loss that occurs in the battery isolator is compensated for by adjusting the charger (jumper or dipswitch settings) or connecting positive and negative voltage sense wires.

Can the battery charger be connected to the same battery isolator as the alternator?

Although this is possible, it is better and more convenient to fit two separate battery isolators. If this should be problematic, use the battery isolator for both. In this case, make sure that the battery isolator or Battery Mate is powerful enough to simultaneously handle both the battery charger and alternator current.

ChargeMaster 24/40.

What should the cable diameter be between the battery charger and the battery?

When calculating the required diameter of these cables follow this rule of thumb: 1 mm^2 of cable thickness for every 3 amps. A battery charger of 50 amps, for instance, calls for a cable of 50:3 or 16.6 mm^2. The standard cable closest to this is 16 mm^2. This applies when the distance between the charger and the inverter is three metres at most. For longer distances you will either require a thicker cable or need to connect a voltage sense cable.

What is the maximum distance allowed between the battery charger and the batteries?

In general, three metres is the maximum length when you are using the calculation method described earlier. A cable length of 6 metres is also possible, but thicker cables must then be used. In the example used above, it is best to use 25 mm^2 cables if the distance between the charger and the batteries is up to 10 metres.

How long will it take before my batteries are fully recharged?

The charging time of a battery is directly related to the ratio of battery to charger capacity. Other important factors that decide how long it takes for an empty battery to completely recharge are the battery type and the power consumption of the potential consumers.

As a rule, divide the battery capacity by the maximum charge capacity and add four hours. The four hours are for the absorption time, during which the battery determines how much more current is necessary for it to return to its fully charged state. Of course, this rule does not consider the power consumption of other connected equipment: If loads such as a refrigerator or lights are connected, their power consumption needs to be subtracted from the available charge capacity.

Example:

Take an empty 200 Ah battery, a 50 amps battery charger and a connected load consuming 10 amps. Charging time in this case would be around 200/(50-10) = 5 h, or 9 h in total including four hours of absorption time. If the batteries are only half-discharged, the recharge time would be 100/(50-10) = 2.5 + 4 h, 6.5 h in total. The absorption time is shorter with gel and AGM batteries at around two to three hours. These types of battery will therefore recharge faster than conventional ones.

What is voltage sense?

No matter how thick, every cable has some resistance, resulting in a certain amount of voltage being lost between the battery charger and the batteries. This voltage loss depends on the thickness of the cable and the battery charger current. A battery charger measures as standard the voltage at the output clamps. This voltage is higher than the battery voltage. The output voltage of the battery charger minus the voltage loss via the cables is the battery voltage. When a lot of voltage is being lost via the cables the battery charger might switch to the absorption phase too early, which means that the battery will not become fully charged. To compensate for voltage loss via the cables, sense wires have to be connected between the battery charger and the batteries. These thin wires ensure that the charger measures the voltage directly at the positive and negative pole of the battery rather than the output terminals of the charger. The voltage lost during conduction is then compensated for and the batteries are charged quickly and effectively. The voltage drop over, for example, a diode bridge can also be simply compensated in this way.

What is 3-step⊕ charging technology?

Mastervolt's 3-step⊕ charging technology is the fastest and safest way to charge gel, AGM and open wet cell batteries. It consists of the following phases:

First step: BULK phase

In the first step, the bulk phase, the battery charger delivers its maximum current (e.g. 50 amps for an IVO 12/50) and battery voltage increases. The duration of this phase depends on the battery capacity, charger capacity and any consumers connected to the battery during charging. The bigger the battery, the longer this step takes; the larger the charger, the shorter the stage. If a consumer such as a refrigerator is connected, it will also need to be powered by the charger, reducing the charge current going to the batteries and increasing the time necessary for charging.

Second step: ABSORPTION phase

The second step, the absorption phase, begins once the battery has reached its maximum voltage. At this point the battery is around 80% full, and the charge voltage begins to slowly decrease. At 25 °C, the maximum voltage is 14.25 Volts for a 12 V battery and 28.5 Volts for a 24 V one. The absorption phase lasts three to four hours on average, depending on the battery type and the extent to which the battery was charged at the beginning. During this stage the battery will be charged to 100%.

Third step: FLOAT phase

Once the battery is fully charged at the end of the absorption phase, the float phase begins. The Mastervolt battery charger switches over to a maintenance voltage so that the battery remains fully charged and in optimum condition. Any existing consumer loads are also powered. The charger remains in the float phase until the battery voltage falls due to a major load, or the battery charger is unplugged because the shore power connection was removed.

PLUS phase
Most Mastervolt battery chargers are equipped with an extra step, the PLUS phase. During periods when the battery is resting, an absorption cycle lasting one hour will take place every 12 days to ensure that the battery plates stay in perfect condition. This enhances the conservation of your batteries.

Return Amps
During the absorption phase, the battery accepts progressively less current. Once the charge current remains under a certain level for a given period of time, the battery is considered to be fully charged. This maximum charge current is called the Return Amps, and the corresponding period the Return Amps Time. The battery charger takes this as a signal to switch over to the next step, the float phase. Just like many other parameters of the battery charger, Return Amps and Return Amps Time can be set by the installer with the help of software that is freely available on the Mastervolt website. In fact, the installer can use this software to customise the battery charger to your onboard system requirements.

What is a temperature sensor for?
It is vital that you use the right charge voltage to charge a battery. The correct charge voltage is not always the same however: Cold batteries need a slightly higher voltage to fully charge and, conversely, warmer batteries require a lower charge voltage to avoid overcharging. Mastervolt battery chargers are pre-set to a battery temperature of 25 °C. When the temperature sensor is connected to the charger, the output voltage will vary by 0.03 V per °C (for a 12 Volt system) and 0.06 V per °C (for a 24 Volt system). This is in accordance with the advice of most battery manufacturers. At a temperature of 15 °C, for instance, the maximum charge voltage for a 12 Volt system is 14.55 Volt, and at 30 °C it is 14.1 Volt (the corresponding values for a 24 Volt system are 29.1 and 28.2 Volt). Voltage is no longer increased once temperatures drop below 12 °C, ensuring that the onboard system is protected against excessive voltage. Conversely, the charge voltage is reduced to 12 or 24 Volt above 55 °C in order to protect the battery against overcharging at this extremely high temperature. The connection of a temperature sensor ensures that the battery is quickly and safely charged with the right voltage.

Can I charge different types of Lithium Ion batteries?
Yes, that is no problem with a Mastervolt battery charger because the desired charge characteristic can be set.

Can multiple battery chargers be parallel connected?
In addition to simply being chargers, Mastervolt battery chargers also provide power for the 12 or 24 Volt onboard system. They can easily be parallel connected should you wish to increase capacity. In fact, this is often the only way to power your 12 or 24 Volt system with the 230 or 380 Volt shore power connection. Similarly, should you need a charge current higher than 100 amps for a 24 V system or 80 amps for a 12 V system, several battery chargers can be parallel connected. A parallel system with multiple battery chargers does not require any special equipment. It can be installed in exactly the same way as a single charger, except that each charger will have its own cables leading to the battery or the DC distribution.

Wiring for the voltage compensation is also connected separately for each charger: Remember to make sure that the sense wires used to compensate for voltage loss over the cables are connected before the main fuse and on the system side. This will prevent the output voltage of the charger from becoming too high if a fuse is defective. The temperature sensor for each charger needs to be separately connected to the battery that you expect to reach the highest temperature. If the chargers and sensors are properly linked, the requisite charge current will be evenly distributed over the connected chargers.

The possibility remains that one of the chargers will switch to the absorption phase sooner than the others. This is a perfectly normal phenomenon caused by tolerances in the adjustment, with no effect on charge time and charger operation. When parallel connecting multiple battery chargers, we recommend that they be of the same model, type and charge capacity. For instance, when a 100 amps charger is linked parallel to a 50 amps charger, the charge current will not be evenly distributed over both. Although this will not affect the charging process or be detrimental for the chargers, it is more efficient to install two chargers of 75 amps each. Mass battery chargers are also capable of synchronising the charging process.

Can I parallel connect a battery charger to the alternator?

It is possible to parallel connect a battery charger with, for instance, the alternator of the propulsion engine. This situation occurs if the 230 V generator is also started up while the engine is running, and is not a problem in itself.

How can I charge batteries with limited shore power?

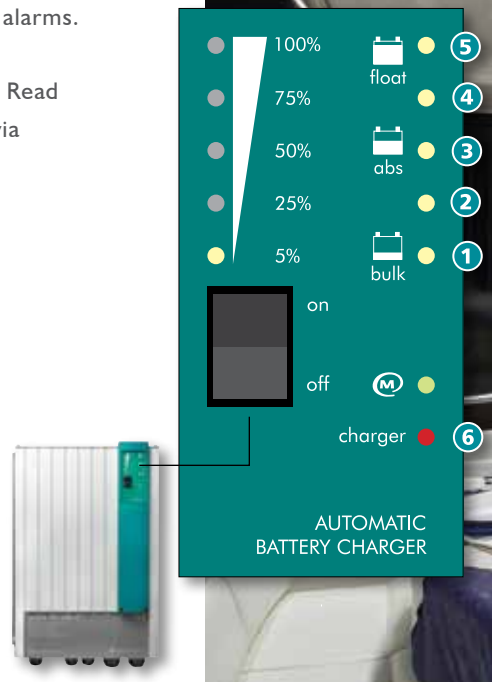
The available shore power connection is often too weak when multiple battery chargers are fitted in parallel. In order to prevent the shore power connection from being overloaded, it is best to only connect one of the battery chargers. Although this will increase the time needed for charging, you are normally moored for a longer period of time (overnight) anyway. Both battery chargers can be powered if the generator is running, as the generator usually delivers more output than a shore power connection. The two battery chargers will not cause the shore power connection to be overloaded.

Mastervolt battery charger alarms

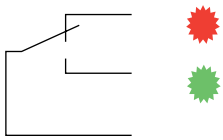
The Mass battery chargers come standard with alarms.

The following alarm signals are indicated on the Read Out Module on the front of the Mass chargers via LED combinations:
1&6 = Voltage sense error
2&6 = Battery charger temperature too high
3&6 = Short-circuit on output
4&6 = Battery voltage too high/low
5&6 = Battery temperature sensor error

In addition to these visual alarms, all Mass battery chargers have a potential-free relay contact.



A) Charger Status Interface (CSI) with combined DC alarm, active as standard



Relay contact is activated (no alarm) if:
- Charger on (AC on input, switch turned to 'on').
- Temperature sensor within range.
- DC voltage within range.
- No short-circuit on output.
- Voltage sense (cable loss less than 3 V).

Relay contact is disabled (alarm situation) if:
- Charger off (no AC on input, switch turned to 'off').
- Temperature sensor out of range.
- DC voltage out of range.
- Short-circuit on output.
- Voltage sense (cable loss more than 3 V).

The DC alarm only works if the battery charger is switched on. If you require a permanent DC alarm, regardless of whether the charger has input voltage and/or the charger is turned on, select the DC Alarm setting (see overleaf).
A separate CSI alarm is optionally available for the Mass battery chargers and is placed in the connection box (if you require multiple alarms). Art. no. 21702000.

B) DC alarm, active after programming dipswitch

Relay contact is activated (no alarm) if:

• DC voltage is within range

Relay contact is disabled (alarm situation) if:

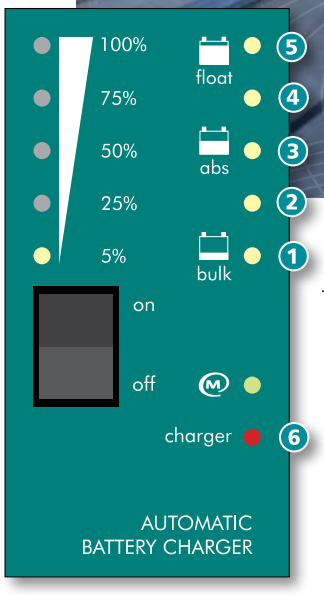
• DC voltage is out of range

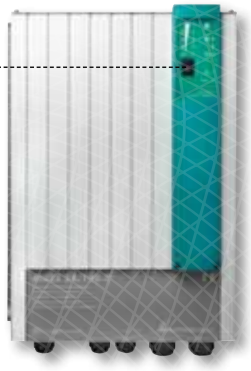
The DC alarm works whether or not the charger has input voltage and/or the charger is turned on or off. Programming of the dipswitch is marked with continuous monitoring mode (ContMon). Optional: A separate DC alarm is available for all Mass battery chargers and is placed in the connection box (if you require multiple alarms). Art. no. 21702100.

Alarms - schematic

Front panel indication by means of LED combination:

1&6 = Voltage sense error
2&6 = Battery charger temperature too high
3&6 = Short-circuit on output
4&6 = Battery voltage too low/high
5&6 = Battery temperature sensor error





Alarm options/settings:

A

Non continous mode

C.S.I. / DC alarm

N.C. =
charger off, or failure

N.O. =
charger on, and non failure

common

B

Continous mode

DC high/low alarm

N.C. =
battery voltage out of range

N.O. =
battery voltage in range

common

Internal alarm contact

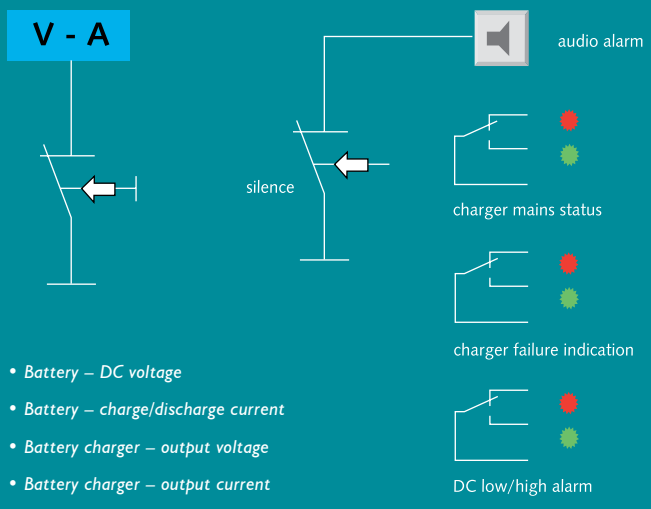
Mass Charger Interface

Every Mass battery charger can be equipped with an intelligent front panel. The Mass Charger Alarm Interface combines the following functions:

- LCD display: DC voltage and charge/discharge current.
- Alarm functions: DC high/low voltage alarm visual/acoustic and potential-free contact.
- Alarm functions: AC alarm, no input voltage AC visual/ acoustic and potential-free contact.
- CSI-alarm: Charger Status Interface, charger error visual/ acoustic and potential-free contact.

The Mass Charger Interface makes your Mass battery charger suitable as a power supply/battery charger for devices such as GMDSS emergency systems for seagoing vessels and yachts. The alarm settings, charge current and charging method can easily be adapted using the LCD display and control button, and the front display can be easily and quickly installed on the charger. The Mass Charger Alarm Interface is optional and is delivered complete with shunt and detailed manual. The battery charger needs to be separately ordered.

Operating principle:



- *Battery – DC voltage*
- *Battery – charge/discharge current*
- *Battery charger – output voltage*
- *Battery charger – output current*

For professional use: GMDSS

For the professional user, there is a front display with alarm functions according to GMDSS available. The GMDSS ("Global Maritime Distress and Safety System") is a global maritime communication system which is part of SOLAS (Safety Of Life At Sea), using DSC and satellite communications.