Mass Sine Ultra

24/4000

SINE WAVE INVERTER

EN	USER'S AND INSTALLATION MANUAL
NL	Zie www.mastervolt.com/products/inverters-sine-wave/
DE	Siehe www.mastervolt.com/products/inverters-sine-wave/
FR	Voir www.mastervolt.com/products/inverters-sine-wave/
ES	Vea www.mastervolt.com/products/inverters-sine-wave/
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MASTERVOLT
THE POWER TO BE INDEPENDENT

OVERVIEW MASS SINE ULTRA

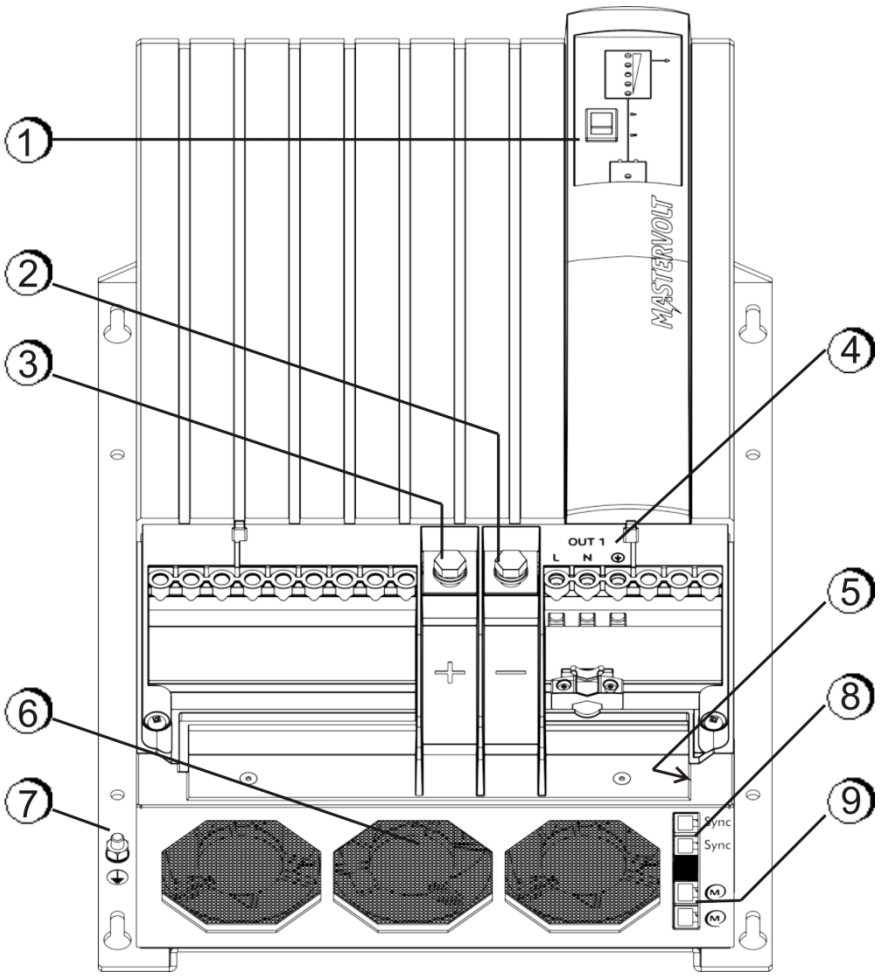


Figure 0-1: Overview of the Mass Sine Ultra

1. Display with front switch	6. Fan (3x)
2. Battery negative	7. Ground stud
3. Battery positive	8. Sync connector (2x)
4. AC output	9. MasterBus connector (2x)
5. DIP switch unit (1x8)	

TABLE OF CONTENTS:

1 GENERAL INFORMATION

1.1 Product description

The Mass Sine Ultra is a sine wave inverter. It converts DC energy from the battery into AC output power.

1.2 Use of this manual

This manual serves as a guideline for the safe and effective use and installation of the Mass Sine Ultra:

- For the installer this manual gives directions for the installation, operation and commissioning.
- For the end user, this manual gives directions for the operation, maintenance and possible correction of minor malfunctions.
- Every person who works with the device should be familiar with the contents of this manual, and must carefully follow the instructions contained herein.
- Store the manual in an accessible place.

1.3 Validity of this manual

This manual is valid for the following model:

Part no	Model
26024000	Mass Sine Ultra 24/4000

All the specifications, provisions and instructions contained in this manual apply solely to the Mastervolt-delivered standard version of a single Mass Sine Ultra.

1.4 Scope of warranty

Mastervolt assures the product warranty of the Mass Sine Ultra during two years after purchase, on the condition that all instructions and warnings given in this manual are taken into account during installation and operation.
Among other things, this means that installation is carried out by a qualified electrician, that installation and maintenance are executed according to the stated instructions and correct working sequence, and that no changes or repairs may have been performed on the Mass Sine Ultra other than by Mastervolt. The warranty is limited to the costs of repair and/or replacement of the product by Mastervolt only.
Costs for installation labour, shipping of the defective parts and indirect damage are not covered by this warranty. For making an appeal on warranty you can contact your supplier directly, stating your complaint, application, date of purchase and part number / serial number.

1.5 Liability

Mastervolt accepts no liability for:

- consequential damage due to use of the Mass Sine Ultra;
- possible errors in the manuals and the results thereof.

1.6 Changes to the Mass Sine Ultra

Changes to the Mass Sine Ultra may be carried out only after obtaining the written permission of Mastervolt. This is not applicable for DIP-switches which are used for user settings.

1.7 Identification label

Figure 1-1: Example of an identification label

The identification label is positioned at the right side of the Mass Sine Ultra, see figure 1-1.

CAUTION!
Never remove the identification label.

2 SAFETY GUIDELINES AND WARNINGS

2.1 Warnings and symbols

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

A procedure, circumstance, etc. which deserves extra attention.

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 Mass Sine Ultra if the installer / user does not (carefully) follow the stated procedures.

Read this manual before installation and use.

This product has been declared conform the EC directives and standards.

IP23 Degree of protection: IP23. The product is protected against touch by fingers and water spray < 60 degrees from vertical.

Safety class 1. This product must be provided with an equipment grounding conductor to the AC-output ground terminal.

2.2 Use for intended purpose

1 The Mass Sine Ultra is constructed as per the applicable safety-technical guidelines.
2 Use the Mass Sine Ultra only:
- for the conversion of battery DC voltage to AC voltage;
- with a fuse, protecting the wiring between Mass Sine Ultra and battery;
- in a technically correct condition;
- in a closed, well-ventilated room, protected against rain, moist, dust and condensation;
- observing the instructions in the user's manual.

WARNING
Never use the Mass Sine Ultra in situations where there is danger of gas or dust explosion or potentially flammable products!

3 Use of the Mass Sine Ultra other than mentioned in point 2 is considered to be inconsistent with the intended purpose. Mastervolt does not hold itself liable for any damage resulting from the above.

2.3 Organizational measures

The user must always:
- have access to the user's manual;
- be familiar with the contents of this manual. This applies in particular to chapter 2, Safety Guidelines and Warnings.

2.4 Warning of special dangers

1 If the Mass Sine Ultra is switched off during maintenance and/or repair activities, it should be secured against unexpected and unintentional switching on:
- remove the connection to the batteries
- be sure that others cannot reverse the measures taken.

2 If maintenance and repairs are required, use only original spare parts.

2.5 General safety and installation precautions

- Do not expose the Mass Sine Ultra to rain, snow, spray, moisture, excessive pollution and condensing circumstances. To reduce risk of fire hazard, do not cover or obstruct the ventilation openings. Do not install the Mass Sine Ultra in a non-ventilated area, overheating results.
- The Mass Sine Ultra must be provided with an equipment grounding conductor to the AC-output ground terminal. Grounding and all other wiring must comply with local rules and regulations.
- In case of fire, you must use a fire extinguisher which is appropriate for electrical equipment.
- Short circuiting or reversing polarity will lead to serious damage to batteries, Mass Sine Ultra and wiring. Fuses between batteries and Mass Sine Ultra cannot prevent damage caused by reversed polarity and warranty will be void.
- Protect the DC wiring with a proper fuse, according to the guidelines in this manual.
- Connection and protection must be done in accordance with local standards.
- Do not work on the Mass Sine Ultra or system if it is still connected to a power source. Only allow changes in your electrical system to be carried out by qualified electricians.

- Check the wiring and connections at least once a year. Defects such as loose connections, burnt cables etc. must be corrected immediately.
- Do not touch the equipment when wet or with clammy hands.
- Not only the batteries, but the Mass Sine Ultra as well can become a projectile if your transport is involved in an accident! Ensure adequate and secure mounting and always use suitable transportation handling equipment.
- Except for the connection compartment, see section 4.5, the cabinet of the Mass Sine Ultra must not be opened. There are no serviceable parts inside the cabinet. Only qualified, authorized and trained electricians are authorized to open the connection compartment.

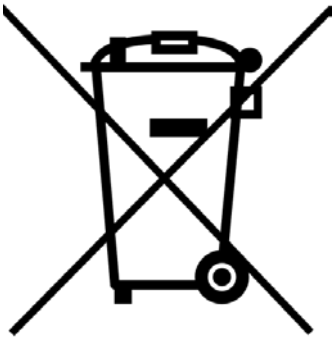
2.6 Warning regarding life support applications

The Mass Sine Ultra products are not sold for applications in any medical equipment intended for use as a component of any life support system unless a specific written agreement pertaining to such intended use is executed between the manufacturer and Mastervolt. Such agreement will require the equipment manufacturer either to contract additional reliability testing of the Mass Sine Ultra parts and/or to commit to undertake such testing as a part of the manufacturing process. In addition the manufacturer must agree to indemnify and not hold Mastervolt responsible for any claims arising from using Mass Sine Ultra parts for life support equipment.

2.7 Warning regarding the use of batteries

Excessive battery discharge and/or high charging voltages can cause serious damage to batteries. Do not exceed the recommended limits of your batteries. Avoid short circuiting batteries, as this may result in explosion and fire hazard. Installation of the batteries and adjustments of the Mass Sine Ultra should only be undertaken by authorised personnel!

2.8 **Correct disposal of this product** (waste electrical & electronic equipment).



This product is designed and manufactured with high quality materials and components, which can be recycled and reused. When this crossed-out wheeled bin symbol is attached to a product, it means the product is covered by the European Directive 2012/19/EU.
Please be informed about the local separate collection system for electrical and electronic products.
Please act according to your local rules and do not dispose of your old products with your normal household waste. The correct disposal of your old product will help prevent potential negative consequences to the environment and human health.

3 OPERATION

The Mass Sine Ultra is a fully automatic inverter. It converts a DC voltage to a pure AC sine wave voltage. Under normal circumstances there is no need for adjustment or operation besides switching on and off.

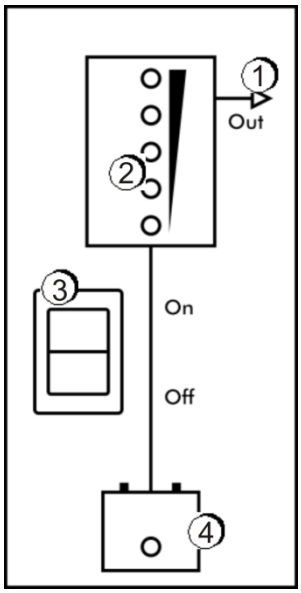
3.1 General

The inverter provides voltage and frequency regulated AC power from a battery bank. Fast acting electronic circuits and fuses protect the inverter against extreme overloads, low and high battery voltage and overheating of the inverter.
A large momentary surge power is available for starting up electric motors. High efficiency ensures long battery usage between recharges. A built in energy saving feature can reduce battery power consumption when no loads are connected to the inverter.

3.2 Energy saving mode (selectable)

The Mass Sine Ultra has a built-in automatic energy saving feature that reduces battery power consumption when no load is present on the outputs. Response from idle is instant. In most cases the operation is not noticeable. The energy saving mode can be set by means of MasterBus or dipswitch, refer to chapter 6, Configuration.

The Mass Sine Ultra scans the AC output with pulses of 230 V every 2½ seconds. When it detects a load that is larger than 50 W (adjustable), it switches On the inverter automatically. Small loads such as clocks in VCR's or micro waves are most likely not to work in this mode.



1 AC Output LED, section 3.3.1
2 Power bar LED's, section 3.3.2
3 Main switch On/Off, section 3.3.3
4 Battery LED, section 3.3.4

Figure 3-3: Front panel

3.3 Front panel

See figure 3-3. The operation of the Mass Sine Ultra is controlled by the main On/Off switch and displayed by means of LED indicators at the front side of the housing. If the Mass Sine Ultra is activated and as long as none of the red indicators are illuminated, no failure is detected and the unit is operating normally.

3.3.1 AC Output LED

See figure 3-3 item 1. The illuminated arrow indicates that AC Output is powered.

3.3.2 Power bar LED's

See figure 3-3 item 2. Every LED indicates 20% of nominal inverter power. If the upper LED illuminates red, the inverter is in overload. On: inverting, Off: not inverting.

3.3.3 Switching On and Off

See figure 3-3 item 3. The only control on the Mass Sine Ultra itself is the main switch on the front of the unit. This switch controls inverter On and Off. Switching the main switch or an optional remote control panel to the "ON" position activates the Mass Sine Ultra. After switching On, expect a three till five second delay before the unit is activated.
With the main switch in position "On", the Mass Sine Ultra inverter can also be switched Off and On via MasterBus.
Move the main switch or the optional remote control panel to the "Off" position to switch off the Mass Sine Ultra.

3.3.4 Battery LED

See figure 3-3 item 4. This LED illuminates red when the voltage of the connected battery is too high or low.

3.4 Protections

The Mass Sine Ultra is protected against overload, short circuit, overheating and under and over voltage. You can detect failures from the front panel by means of the indicators or from one of the (optional) remote control panels.

CAUTION!
The Mass Sine Ultra is not protected against reversing polarity of the DC-input, AC voltage on the DC-input and extreme over voltage (>300 VAC) on the AC-output.

3.4.1 Output overload or short circuit

In case of overload or short circuit, the Power bar top LED illuminates red and the output voltage of the Mass Sine Ultra is limited. The Mass Sine Ultra shuts down if this overload or short circuit lasts over 5 seconds. The Mass Sine Ultra will automatically restart after shutdown. After 5 failed start attempts the Mass Sine Ultra shuts down permanently, the Power bar top LED stays blinking red. You can restart the Mass Sine Ultra only by switching the unit manually off and on with the main switch on the Mass Sine Ultra after the overload or short circuit is removed. Restart is also possible via MasterBus and when DC supply was interrupted.

3.4.2 Overheating

The Mass Sine Ultra shuts down in the event of overheating. Overheating is most likely caused by:

- heavy or non-resistive loads operating for a longer period,
- high ambient temperature,
- disrupted air flow (dust or too little space).

The Mass Sine Ultra is powered up automatically as soon as the temperature drops below the factory default threshold.

3.4.3 Under and over voltage

The DC-input of the Mass Sine Ultra is protected against over and under voltage. See specifications. The Mass Sine Ultra switches off if the DC-input voltage is out of range.

3.4.4 Dynamic DC input window

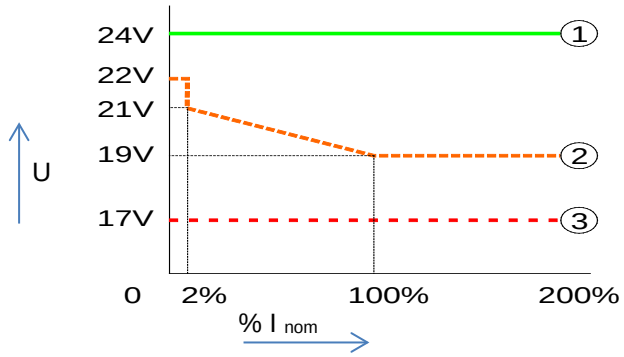


Figure 3-4: Dynamic DC input window

The Mass Sine Ultra was designed to switch off depending on both the battery voltage and current. The reason for this is that low current loads cause a small voltage drop but they are responsible for severe battery damage. By switching the Mass Sine Ultra off at higher voltages with lower currents, your batteries are saved.
Shown in figure 3.4 is the graph for a 24 V lead acid battery. The horizontal axis shows the battery current. The graph shows three lines:

(1) Low voltage switch on. Above this voltage the Mass Sine Ultra switches On.
(2) Low voltage switch off with delay. Under this line the Mass Sine Ultra switches Off after a delay. Note the 2% point at which the line drops 1 Volt. From 2% till 100% of nominal battery current it declines 2 Volts.
(3) Low voltage switch off without delay. Under this line the Mass Sine Ultra switches off without delay.

3.5 Maintenance

Checking all connections every 6 months is required. Further, no specific maintenance is required. If necessary, use a soft clean cloth to clean the Mass Sine Ultra. Do not use any liquids or corrosive substances, such as solvents, alcohol, petrol or abrasive components.

3.6 Daily use, MasterBus monitoring

The MasterBus Monitoring page offers the option to do your daily settings and it shows your settings from the Configuration page. The table below shows the Mass Sine Ultra monitoring values. The values with a default value are adjustable.

Value	Meaning	Default	Range	Group-item	Index
General					
Device state	The state of your Mass Sine Ultra		Standby; Inverting; Alarm; Overload; Low battery	1-1	16
Inverter	Option to switch Off the inverter to prevent depleting of your batteries	On	On, Off	1-3	20
Mode	User mode		Disabled; On; Error; Shutdown	1-4	60
Battery (DC)					
Main battery	Battery voltage		0..32 V	2-2	6
Main battery	Approximate battery current (minus is discharging)		-500..0 A	2-3	7
AC output					
AC output	AC output voltage		0..300 V	5-1	10
AC output	AC output current		0..70 A	5-2	11
AC output	AC output power		0..20000 W	5-3	98

4 INSTALLATION

During installation and commissioning of the Mass Sine Ultra, the Safety Guidelines and Warnings are applicable at all times. See chapter 2 of this manual.

4.1 Unpacking

In addition to the Mass Sine Ultra the delivery includes:

- this user's manual;
- MasterBus terminating device.

After unpacking, check the contents for possible damage. Do not use the product if it is damaged. If in doubt, contact your supplier.
Check from the identification label (see section 1.7) whether your Main battery voltage is the same as the DC-input voltage of the Mass Sine Ultra (e.g. 24 V main battery set for a 24 V input voltage). Also check that the AC output voltage and output power of the Mass Sine Ultra complies with your system and loads.

4.2 Environment

Obey the following stipulations during installation:

- The Mass Sine Ultra is designed for indoor use only.
- Ambient temperature: -25˚C to 60˚C, (power derating above 40˚C).
- Maximum usage/installation height: 2000 m.
- Humidity: 0-95% non-condensing.
- Mount the Mass Sine Ultra on a solid surface, with the connecting cables downwards.
- Make sure that the hot air produced during operation can be discharged. The Mass Sine Ultra must be mounted in such a way that obstruction of the airflow through the ventilation openings will be prevented.
- No objects must be located within a distance of 10 cm / 4 inch around the Mass Sine Ultra. Keep at least 15 cm / 6 inch free space below the Mass Sine Ultra.
- Do not locate the Mass Sine Ultra in the same compartment as the batteries.
- Do not install the Mass Sine Ultra straight above the batteries because of possible corrosive fumes.

4.3 Wiring

The wiring is connected inside the connection compartment. If necessary, the wiring can be fed from the top to the bottom side of the cabinet along the back of the cabinet.
Always feed the wiring through the strain reliefs of the cabinet, and then connect the wiring to the terminals. Connect the phase line wire to terminal L, the neutral wire to terminal N and the ground wire to terminal PE, see figure 4-3.

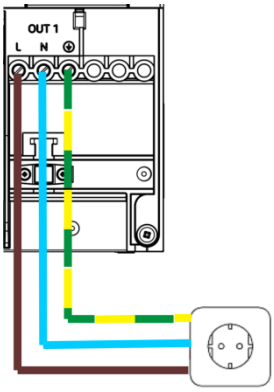


Figure 4-3: AC terminal connection

4.3.1 AC-wiring

For a safe installation the correct wire cross section must be applied. Don't use a cross section that is smaller than indicated. See table below to select the appropriate cross section for the AC wiring:

AC-Current	Minimum cross section:	
0-20 Amp	2.5 mm²	AWG 13
20-32 Amp	4 mm²	AWG 11
32-48 Amp	6 mm²	AWG 9
48-80 Amp	10 mm²	AWG 7

Recommended wire colours (refer to local rules and fig 5-1)

Wire colour	Meaning	Connected to:
Brown or black	Phase	L1
Blue	Neutral	N
Green/Yellow	Earth	PE / GND

4.3.2 DC wiring

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 table shows recommended DC wire size:

Model	Minimum cross section:	
24/4000	70 mm²	2/0 AWG

Use M8 cable lugs terminals on the ends of the wires. These lugs should be crimped with a proper crimping tool. Use the following wire colours for DC wiring (refer to local rules):

Wire colour	Meaning	Must be connected to:
Red	Positive	+ (POS)
Black	Negative	– (NEG)

Position the positive and negative cables next to each other to limit the electromagnetic field around the cables. The negative 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 or hull of the ship as the negative conductor. Tighten the Mass Sine Ultra connections securely (15 - 20 Nm / 130 - 175 In-Lbs.). The positive battery cable must be fused and connected to the positive post of the battery bank. Fuse rating depends on the applied cable cross section. The fuse with fuse holder is available from your local Mastervolt distributor or Customer Service Representative.

4.3.3 AC safety grounding

WARNING
The ground wire offers protection only if the cabinet of the Mass Sine Ultra is connected to the safety ground.

The ground stud is positioned at the left foot of the cabinet, see the overview on page 2, position 7. Connect the earth terminal (PE / GND) to the hull or the chassis with a minimum 10 mm².

CAUTION!
For safe installation it is necessary to:

- connect the neutral conductor (N) of the AC output to the earth (PE / GND);
- insert a Residual Current Device (earth leakage switch) of 30 mA in the AC output of the Mass Sine Ultra.

Refer to local regulations on these issues!

4.4 Things you need

Make sure you have all the parts you need to install the Mass Sine Ultra:

- Mass Sine Ultra (included);
- AC wiring. Double insulated three wire cable with wire colours according to the locally applicable standards. The applicable length and wire diameter depend on the electrical installation. See section 4.3.1;
- DC-wiring to connect the DC connections of the Mass Sine Ultra to the DC-distribution. See section 4.3.2;
- DC-fuse holder with a DC-fuse, to be integrated in the positive DC-cable. For specifications see section 4.3.2;
- Screws / bolts (Ø 6 mm) (with plugs) to mount the cabinet to a surface. Use mounting materials which are suitable to carry the weight of the Mass Sine Ultra;
- Batteries. Refer to chapter 8 for specifications;
- Appropriate and reliable cable terminals, cable lugs, battery terminals and cord end terminals.

We recommend as a minimum tool kit:

- Socket wrench 13 mm to fix the DC-input (battery) cables;
- Flat blade screw driver 1.0 x 4.0 mm to fix the screw terminals;
- Tools to fix the screws / bolts (Ø 6 mm) (with plugs) to mount the cabinets to a surface;
- Philips screw driver to open the connection area of the Mass Sine Ultra.

4.5 Removal of the front lid

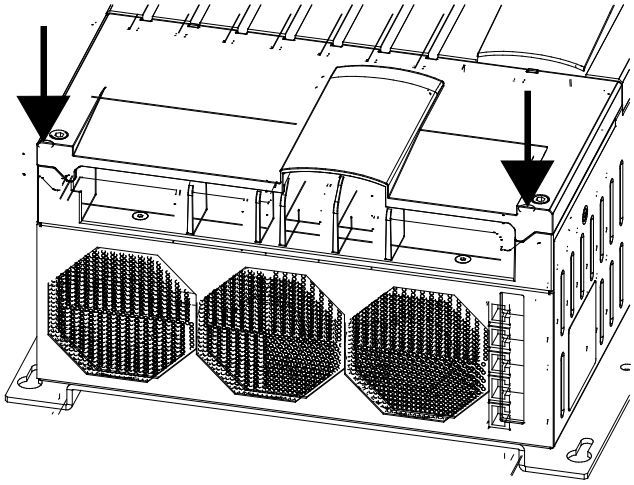


Figure 4-5.1: Removal of the front lid

Steps:

1 Loosen the two screws that secure the front cover plate;
2 Lift the front cover plate from the cabinet. See figure 4-5.2.

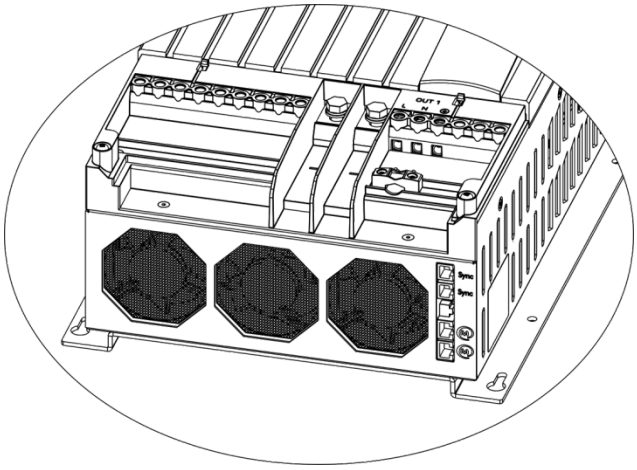


Figure 4-5.2: Front lid removed

WARNING
The front panel is never to be removed while the Mass Sine Ultra is still connected to a power source!

4.6 Mounting the cabinet to a surface

M6 bolts can be used for the mounting of the cabinet vertically to a surface, like shown on the front page of this manual and figure 4-6.
Take the following steps to mount the cabinet:

1 Determine the four mounting spots on basis of the outline drawings. 150 mm of free space is required below the Mass Sine Ultra for installation and DIP switch operation;
2 Screw the topmost bolts somewhat into the wall;
3 Hang the cabinet with its key holes over the two bolts and screw these bolts finger tight, so shifting is still possible;
4 Place the two lowermost bolts;
5 Fasten all bolts securely;
6 Fix cabinet to the surface with remaining two bolts.

4.7 Wiring instructions

WARNING
Have installation work done by a licensed electrician only. Before connecting the wiring, make the AC distribution as well as the DC distribution voltage free. Move the main switch to the “Off”-position.

CAUTION!
Short circuiting or reversing polarity may lead to serious damage to the batteries, the Mass Sine Ultra, the wiring and/or the terminal connections. Fuses between the batteries and the Mass Sine Ultra cannot prevent damage caused by reversed polarity. The damage as a result of reverse polarity is not covered by the warranty.

CAUTION!
Too-thin cables and/or loose connections can cause dangerous overheating of the cables and/or terminals. Therefore tighten all connections well. Only use cables of the correct size.

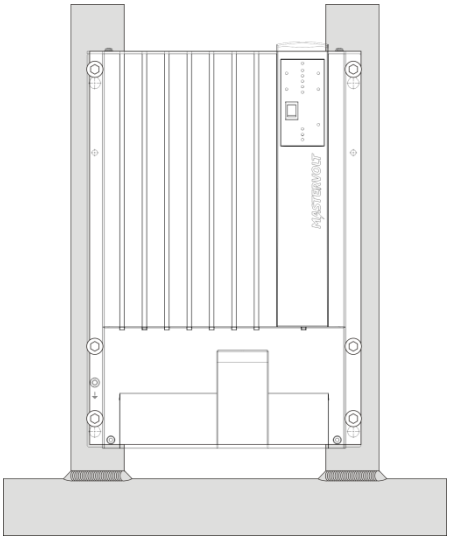


Figure 4-6: Mount the Mass Sine Ultra upright to a solid surface that is part of the construction

4.8 Installation overview

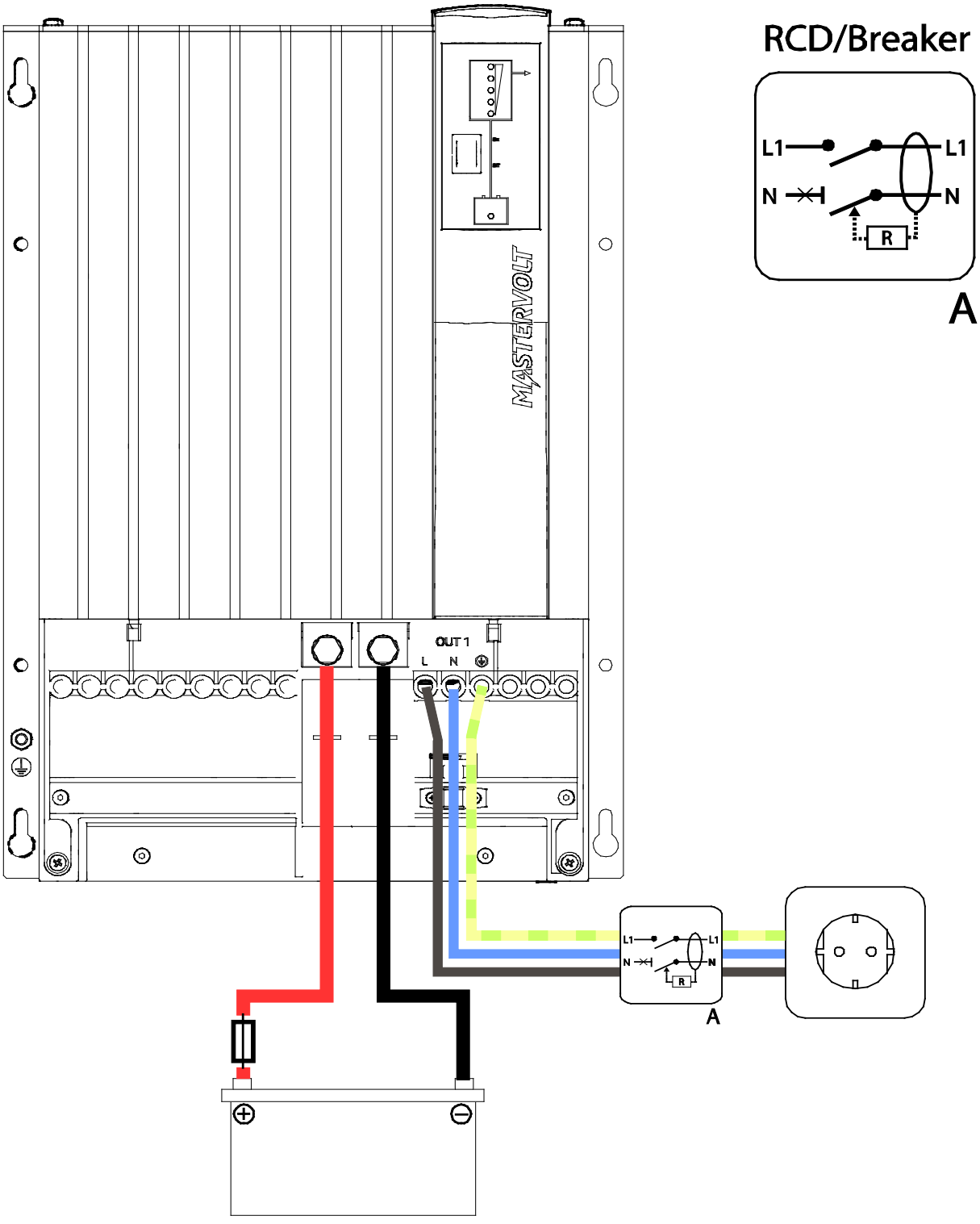


Figure 4-8: Installation overview for one Mass Sine Ultra

CAUTION!
Ensure correct polarities, cross sections and fuses for all wiring. An RCD according to local regulations must be connected to the output.

4.9 Setting up a MasterBus network

All devices that are suitable for MasterBus are marked by the MasterBus symbol.

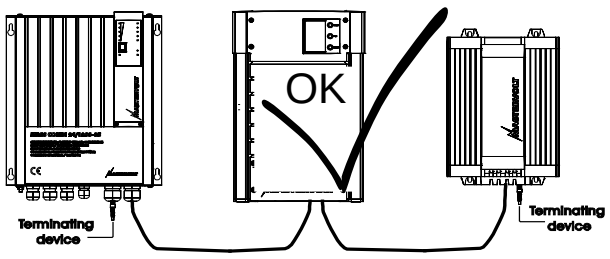
MasterBus is a fully decentralized data network for communication between the different Mastervolt system devices. It is CAN-bus based which has proven itself as a reliable bus-system in automotive applications. MasterBus is used as power management system for all connected devices, such as the inverter, battery charger, generator and many more. This enables communication between the connected devices, for instance to start the generator when the batteries are low. MasterBus reduces complexity of electrical systems by using UTP patch cables. All system components are simply chained together. Therefore each device is equipped with two MasterBus data ports. As only a few MasterBus cables are needed, installation and material costs are reduced importantly.
New devices can be added to the existing network easily. Consequently the MasterBus network is highly flexible for extended system configuration. Mastervolt also offers several interfaces like the Modbus interface, making even non-MasterBus devices suitable to operate in the MasterBus network. For central monitoring and control of the connected devices Mastervolt offers different panels, like the full colour MasterView System panel. All monitoring panels can be used for monitoring, control and configuration of all connected MasterBus equipment.

CAUTION!
Never connect a non-MasterBus device to the MasterBus network directly! This will void warranty of all MasterBus devices connected.

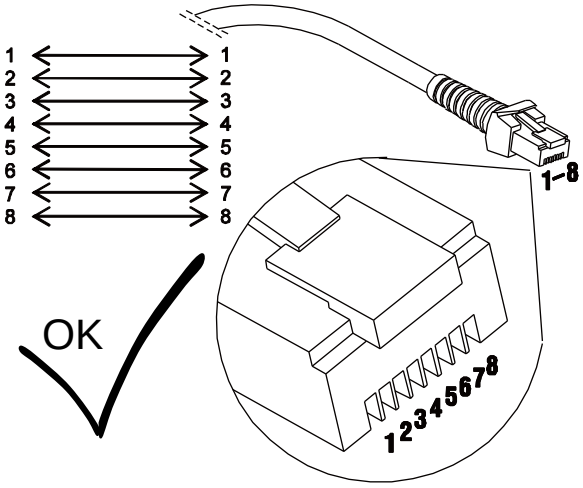
4.10 How to set up a MasterBus network

Every MasterBus device is equipped with two data ports. When two or more devices are connected via these ports, a local data network called the MasterBus is formed. Keep the following rules in mind:

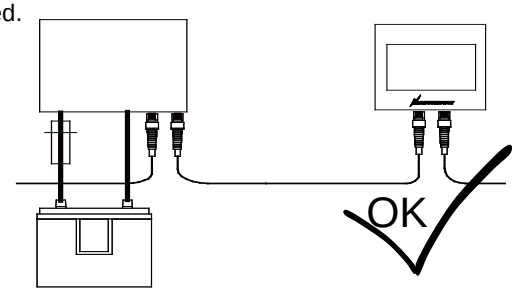
Place a terminating device on both network ends.



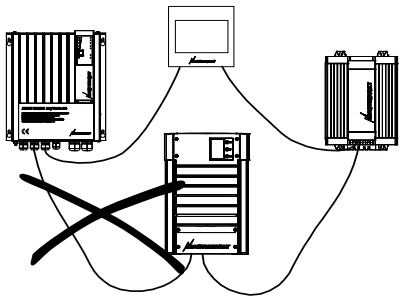
Connections between the devices are made by standard straight UTP patch cables.



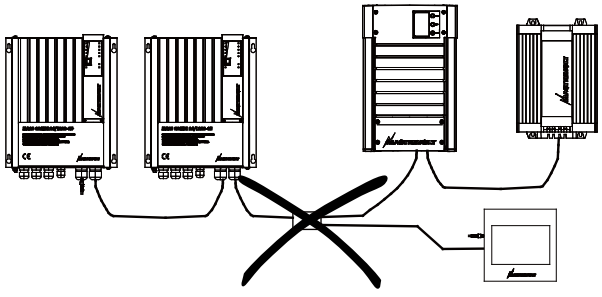
At least one device in the network must be MasterBus powering (see specifications). As all powering devices are galvanic isolated, multiple powering devices are allowed.



Do not make ring networks.



Do not make T-connections in the network.



5 INSTALLATION OF MULTIPLE CLUSTERED MASS SINE ULTRA'S

This installation instruction serves as a guideline for the safe and effective installation of the Mass Sine Ultra in a multiple configuration, i.e.

- a parallel configuration, or
- a split phase configuration, or
- a three phase configuration, or
- a combination of a split phase or three phase in a parallel configuration.

5.1 Purpose of a multiple configuration

There are several reasons for a multiple configuration of the Mass Sine Ultra:

- If more output power is needed than one Mass Sine Ultra can supply, two up to ten Mass Sine Ultra's can be connected in parallel;
- If redundancy is required, Mass Sine Ultra's can be connected in parallel to maintain reliable power supply if one of the Mass Sine Ultra's fails in operation;
- Three Mass Sine Ultra's can be connected in a 3-phase configuration to supply three phase AC power. By connecting more Mass Sine Ultra's in parallel as well, virtually unlimited three phase power can be made available.

5.2 General installation guidelines

When using Mass Sine Ultra's in a multiple configuration, the following requirements are:

- Only identical Mass Sine Ultra's with the same article numbers may be used in a multiple configuration;
- Maximum number of Mass Sine Ultra's in parallel: 10;
- Maximum number of Mass Sine Ultra's in a three phase -parallel configuration: 3 x 3;
- Installation and commissioning of multiple Mass Sine Ultra's requires configuration of MasterBus settings and programming of MasterBus events by means of a MasterBus control panel or a PC (in combination with a MasterBus USB-interface) with MasterAdjust software installed. The installer must be familiar with MasterBus configuration tools and the programming of such events;
- Allow sufficient ventilation to prevent build-up of hot air. When installing multiple Mass Sine Ultra's either side by side or vertically above each other, at least 10 cm / 4 inch free space must be kept in between the units. If necessary, adequate measures must be taken to avoid one Mass Sine Ultra heating up the other.

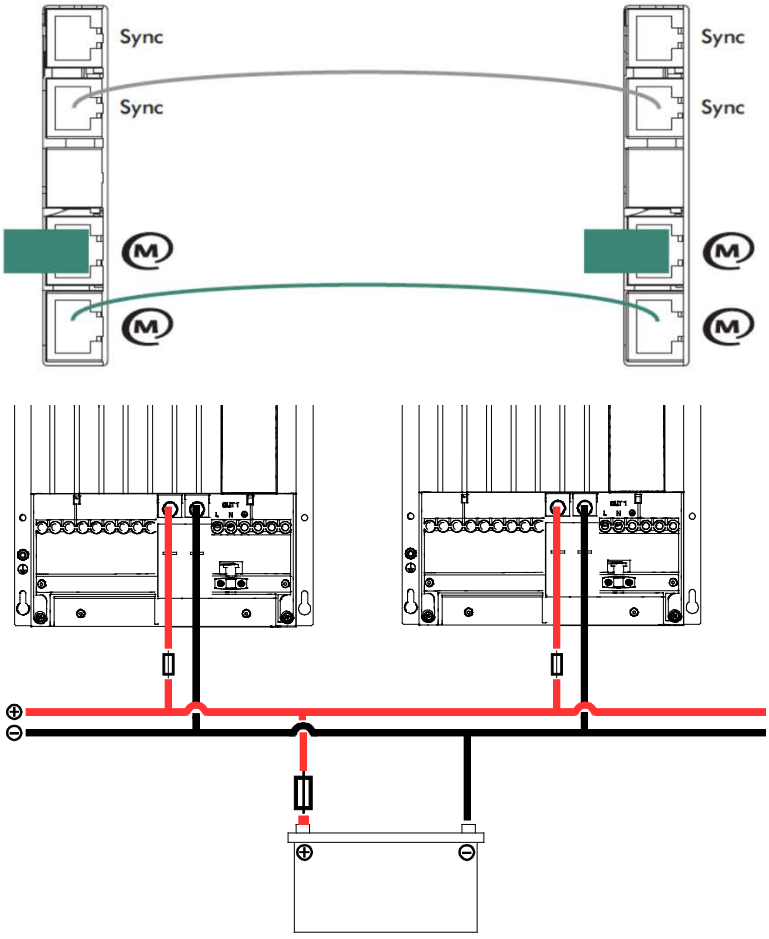


Figure 5-3: Two Mass Sine Ultra's connected in parallel

5.3 Parallel configuration diagram

Figure 5-3 shows a basic installation diagram of two Mass Sine Ultra's in parallel. Both Mass Sine Ultra's are supplying AC to output-1 and the outputs are connected in parallel. All corresponding cables must be the same length.
The connection compartment of two Mass Sine Ultra's is displayed, together with the communication module (figure 0-1, item 8 and 9).

5.4 Three phase configuration diagram

See figure 5-4. Three Mass Sine Ultra's are shown in a three phase configuration. Each Mass Sine Ultra is connected to a phase, and so is delivering power to that phase. All corresponding cables must be the same length.
The connection compartment of three Mass Sine Ultra's is displayed, together with the communication module. As you see, the MasterBus network has a terminator on both ends.

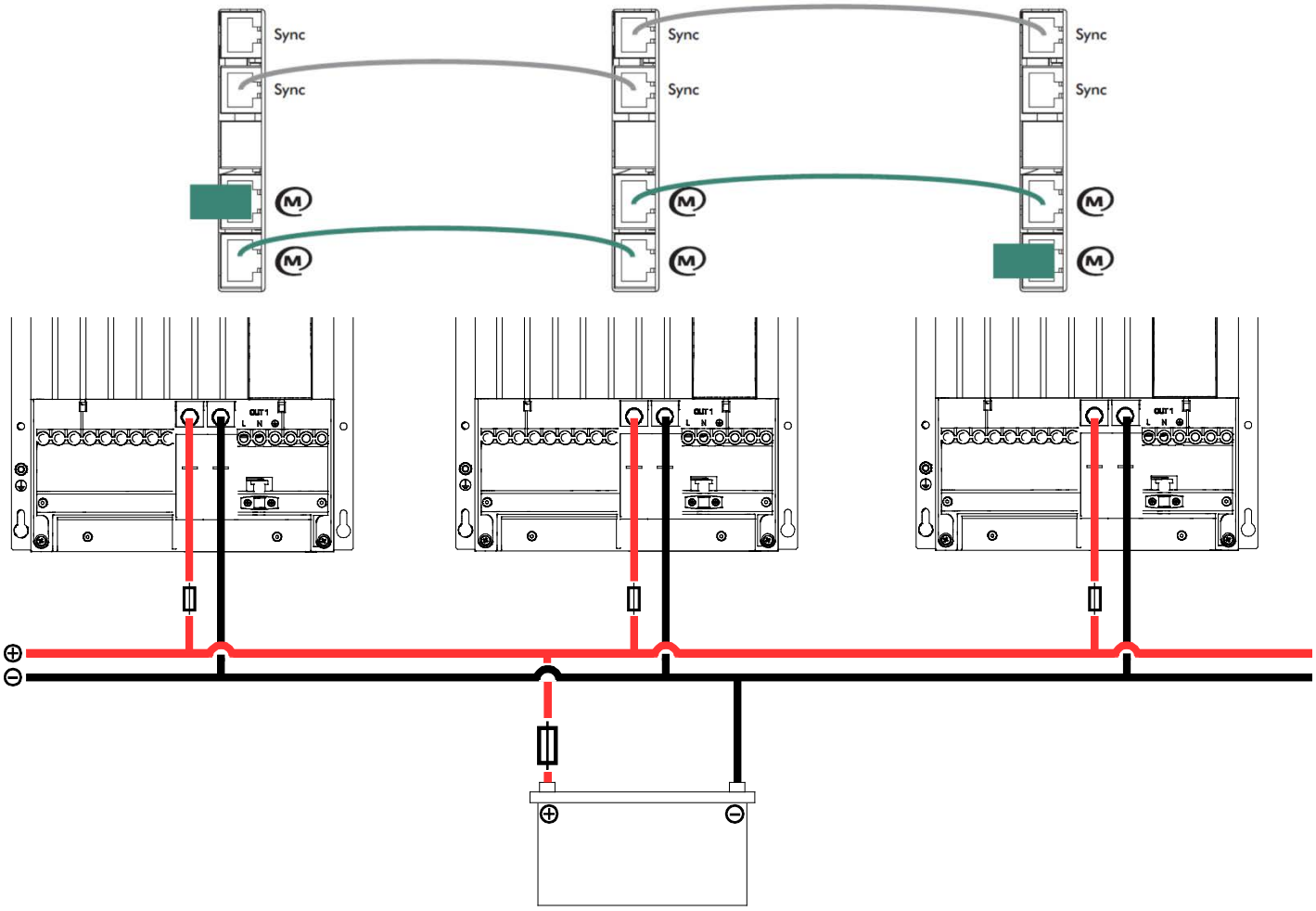


Figure 5-4: Three Mass Sine Ultra's connected in 3-phase

5.5 Multi Mass Sine Ultra communication

Within the MasterBus databus communication protocol, Mass Sine Ultra's connected in a parallel, split phase or a three phase configuration shall be configured as a so called "cluster". After establishing such cluster, it can be operated through MasterBus as one single single power conversion unit.

Always connect the sync cables in cluster connections!

5.6 Synchronization

Synchronization between the Mass Sine Ultra's is necessary for parallel, split phase and 3-phase configurations. For a 3-phase configuration, three Mass Sine Ultra (groups) are connected to the phase cables with a 120 degree phase angle between them. To accomplish this, the Mass Sine Ultra's must be able to communicate. This is done via the sync cables. Each Mass Sine Ultra has two sync ports for this.

5.7 Configuration for multiple Mass Sine Ultra systems

The MasterBus name for a multi Mass Sine Ultra system is “Cluster“. A cluster can be a

- single phase,
- split phase or
- 3-phase

configuration, with one or more Mass Sine Ultra’s in parallel connection per phase.

5.8 MasterBus configuration for clusters

The table below shows the MasterBus configuration variables and their meaning.

Value	Meaning	Default	Range
Cluster			
Phase System	Configuration of your energy system.	Single phase	Single phase, Split phase, Three phase
Dev. per phase	Number of Mass Sine Ultra’s in parallel connection per phase.	1	1…10
Select devices	Button to enable selection of the other Mass Sine Ultra’s in the cluster. It opens the Phase groups to select the Mass Sine Ultra connected via MasterBus. If you wish to return to less Mass Sine Ultra’s per phase, change the Dev. per phase value and press Select devices again.	Mass Sine Ultra’s connected	Maximum 27 Mass Sine Ultra’s
Cluster topology	State of the topology proposed. If not enough Mass Sine Ultra’s are available for the cluster, the topology “needs approval“.	Needs approval	Needs approval, approved
Phase L1, L2, L3 (shows in 3-ph cluster only)	Phase groups with scrollbars for selecting multiple Mass Sine Ultra’s per phase. After cluster activation the phase master and slaves are shown.		
Activate cluser	Button to set the cluster to active.		
Cluster state	Indicates the cluster configuration state.	Inactive	Inactive, double devices, active

5.9 MasterBus monitoring for a three phase cluster

In the monitoring tab, first the data for the single Mass Sine Ultra itself is shown in the groups General and Battery (DC). Next are the Cluster groups (Cluster L1, etc.). Per phase they show the following data respectively.

Value	Variable	Meaning
Cluster L1 out		
AC output 1	V	AC output 1 voltage
	A	AC output 1 current
	W	AC output 1 power

For a three phase system the monitoring page tabs shows the following;.
Cluster L1 out shows the values for the first phase output. If more Mass Sine Ultra’s are clustered per phase, their values are combined. Cluster L2 and L3 are displayed the same way as Cluster L1. The tab with AC outputs shows the values for the Mass Sine Ultra you are looking at.

5.10 MasterBus specific alarms for multi Mass Sine Ultra systems

Value	Meaning
Sync error	Synchronization error. The Mass Sine Ultra switched to standby, there is no output.
Config error	Configuration error. This alarm is triggered when more Mass Sine Ultra's are needed for a cluster than available in the system.
Install error	Error in the system installation, for instance an expected slave is not in the Sync network.

If one Mass Sine Ultra is in alarm, it switches Off together with the other Mass Sine Ultra's in the same cluster. This applies for parallel, split phase and 3-phase configurations.

5.11 DIP switch settings for two Mass Sine Ultra's in parallel

The DIP switches have a combined function for parallel settings of two Mass Sine Ultra's. See table below and section 6.1. MasterBus configuration is necessary for more Mass Sine Ultra's in a parallel connection.

By operating the DIP switches you will lose all previous cluster configuration!

DIP switch #		Meaning
1	**2**	***Parallel connection***
0	0	Mass Sine Ultra as stand-alone device
1	0	Mass Sine Ultra as Master device
0	1	Mass Sine Ultra as Slave device

5.12 Operation of multiple Mass Sine Ultra systems

If connected in a more phase or parallel configuration, it is important which Mass Sine Ultra you selected as the master and which as the slave(s). Operation is done via the main switch on the master. The slave Mass Sine Ultra's must be switched On already but they follow the master. If the master is switched On or Off, the slaves follow. If there is more than one master, for instance in a three phase by two parallel configuration (3X2), operation is done on the L1 master.

6 CONFIGURATION

The Mass Sine Ultra is provided with a group of DIP-switches to adjust the Mass Sine Ultra according to the specifications of the electrical installation, see figure 6-1. DIP-switch settings are 0 for default values. The Mass Sine Ultra also features the more sophisticated MasterBus configuration.
Previously done MasterBus settings are overruled by the DIP-switch settings and they are greyed out in the menu. When a DIP-switch is set to 0, the corresponding MasterBus setting becomes default too, regardless the previous setting.

6.1 Configuration via dip-switches

The DIP-switches are located in the connection compartment. Figure 6-1 shows the location of the DIP-switches and the print on the inside of the front cover plate.

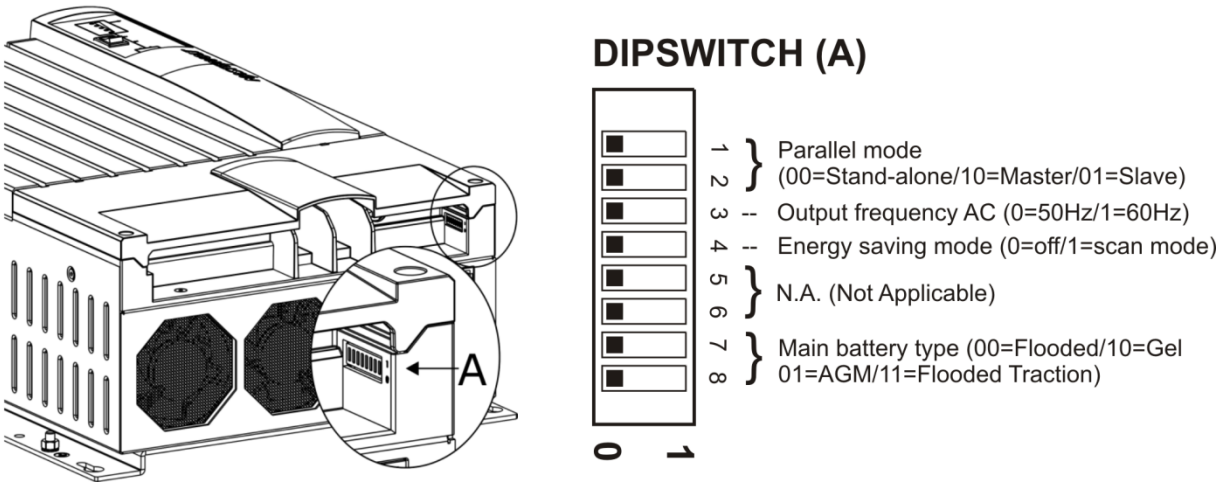


Figure 6-1: DIP-switches and cover print

DIP switch	Function				
A1-A2	Parallel mode	0-0: Stand alone	1-0: Master 0	0-1: Slave	1-1: NA
A3	Output frequency inverter	0: 50 Hz		1: 60 Hz	
A4	Energy saving mode	0: off		1: on (scan mode)	
A5-A6	N.A.				
A7-A8	Main battery type	0-0: Flooded	1-0: Gel	0-1: AGM	1-1: Flooded traction

6.2 MasterBus configuration

Parameters below can be changed via the MasterBus network. See applicable user's manuals for details. DIP switch settings overrule MasterBus settings. If DIP switches are not set to default, the corresponding MasterBus configuration is greyed out.

Value	Meaning	Default	Adjustable range
Device			
Language	Language that is displayed on a monitoring device connected to the MasterBus.	English	English, Nederlands, Deutsch, Français, Castellano, Italiano, Norsk, Svenska, Suomi, Dansk
Name	Name of this particular device in MasterBus. This name will be recognized by all devices that are connected to the MasterBus network.	MSU [Serial number]	All names with a maximum of 12 characters.
Lock config	Option to lock the configuration (installer login).	Not checked	Not checked, Checked
Factory settings	Option to reset the configuration to default (installer login).	Not selected	Not checked, Selected
System			
MasterBus power	Checkbox to have the Mass Sine Ultra power MasterBus or not.	Checked	Checked, Not checked
Inverter			
Voltage	AC voltage.	230 V	180-260 V
Frequency	AC frequency.	50 Hz	50 Hz, 60 Hz
Energy save mode	Option to enable Energy save mode.	Not checked	Not checked, checked
Scanning below	The Mass Sine Ultra starts scanning below this inverted power level in Energy save mode.	10 W	10-250 W
Battery type	Select the battery type.	Flooded (Lead acid wet cell)	User defined, Flooded, Gel, AGM, Spiral, MLi, Flooded traction, Nickel Cadmium
	The below dynamic DC window is configurable when Battery type is User defined. Refer to section 3.4.4.		
DC high off	*High battery voltage for inverter switch off*	*32.00 V*	*26.00-32.00 V*
DC high on	*High battery voltage for inverter switch on after DC High Off alarm.*	*29.00 V*	*26.00-32.00 V*
DC low off I=0%	*Low battery voltage at which the inverter switches off when the battery current is 0-2% of nominal.*	*22.00 V*	*19.00-26.00 V*
DC low off I=2%	*Low battery voltage at which the inverter switches off when the battery current is 2% of nominal.*	*21.00 V*	*19.00-26.00 V*
DC low off 100%	*Low battery inverter switch off voltage, batt. current 100%.*	*19.00 V*	*19.00-26.00 V*
DC low on	*Low battery inverter switch on voltage at DC Low off alarm.*	*24.00 V*	*20.00-26.00 V*
DC low off delay	*Delay time before inverter switches off on a low battery voltage.*	*30 s*	*0-30 s*

6.2.1 MasterBus alarms

This is the Mass Sine Ultra list of MasterBus alarms with their meaning.

Alarm	Description
Overload	Mass Sine Ultra in overload. The loads exceed the nominal inverter power.
Over temperature	Internal temperature of the Mass Sine Ultra is too high.
Battery low	Battery voltage is too low.
Battery high	Battery voltage is too high.
Sync. error	Two or more Mass Sine Ultra's in a multiple configuration do not synchronize well.
Config error	Configuration error, most often in multi inverter installations. Check MasterBus and DIP switch settings.
Install error	Installation error around the Mass Sine Ultra, not inside the unit. Check all connections.
System error	Internal Mass Sine Ultra error. Contact your Mastervolt supplier.

6.2.2 List of event sources

This is the Mass Sine Ultra list of event sources. These can initiate an event at another MasterBus connected device.

Event source	Description
Disabled	(no event programmed)
Inverting	The Mass Sine Ultra is in Inverter mode
Overload	The inverter current is too large
Low bat	The main battery voltage has dropped below the Low bat value
Alarm	A Mass Sine Ultra alarm has been triggered
External fan	Trigger point to activate an external cooling fan

6.2.3 List of event commands

This is the Mass Sine Ultra event commands list. Other MasterBus connected devices can be configured to initiate these commands.

Event command	Description
Inverter On/Off	Change the Mass Sine Ultra inverter state to On/Off

7 COMMISSIONING, DECOMMISSIONING

7.1 Commissioning

CAUTION!
Check the polarity of all wiring before commissioning: plus connected to plus (red cables), minus connected to minus (black cables).
The DIP-switches must be adjusted prior to commissioning; see chapter 6.

Follow the steps described below to switch on the Mass Sine Ultra.

1 Tighten all strain reliefs;
2 Check all wiring and connections;
3 Close the front cover plate of the connection compartment;
4 Place the DC-fuse(s) of the DC-distribution to connect the batteries to the Mass Sine Ultra.

WARNING
When placing this fuse, a spark can occur, caused by the capacitors used in the Mass Sine Ultra. This is particularly dangerous in places with insufficient ventilation, due to the gassing of the batteries an explosion can occur and avoid having flammable materials close by.

Now the Mass Sine Ultra is ready for operation.

7.2 Decommissioning

If it is necessary to put the Mass Sine Ultra out of operation, follow the instructions in order of succession as described below:

1 Move the Main-switch of the Mass Sine Ultra to “Off”;
2 Remove DC-distribution fuses and/or disconnect the batteries;
3 Open the connection compartment of the Mass Sine Ultra;
4 Check with a suitable voltage meter whether the input and the output of the Mass Sine Ultra are voltage free;
5 Disconnect all the wiring.

Now the Mass Sine Ultra can be demounted in a safe way.

7.3 Trouble shooting

If a failure occurs, the origin of the failure is displayed by means of the LED’s at the front of the Mass Sine, see figure 7-3.

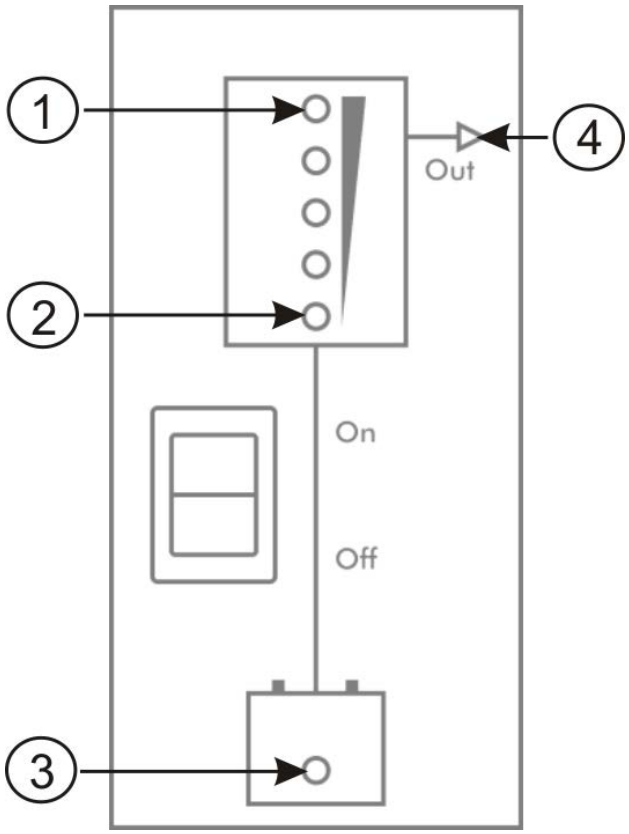


Figure 7-3: Error LED’s

The table at section 7.3.1 shows the meaning of the error indications and their solutions, together with other directions. If you cannot solve a problem using this table, contact your local Mastervolt Service Centre. See www.mastervolt.com. Make sure you have the following information present if you have to contact your local Mastervolt Service Centre to solve a problem:

- Article and serial number (see section 1.7).
- Software version (see summary page in MasterAdjust or the Configuration page in MasterView control panel).

7.3.1 Trouble shooting table

Illuminating LED's	MasterBus alarm	Explanation / Possible cause	What to do
Normal operation and warnings			
None		The Mass Sine Ultra is switched off manually.	Switch on the Mass Sine Ultra by means of the main switch.
(1) red	MB monitoring: Overload	Inverter in overload, inverter exceeds max continuous power.	Check the load connected. Check the connections.
(3) red	Battery low/high	Battery voltage low/high.	Stop inverting
Errors (Mass Sine Ultra shuts down)			
(1) and (3) red, (2) yellow	Over temperature	Mass Sine Ultra too hot. Restart when alarm is over.	Check ventilation. Reduce load.
(1) and (3) red	System error, Sync error, Config error	Communication disturbed. Configuration wrong.	Check communication cables and connectors
Permanent errors (manual reset required)			
(1) and (3) blinking fast red	Overload	Number of inverter overload restart attempts exceeded.	Reduce the output loads, shut the Mass Sine Ultra Off and On.
	System error	Hardware issue.	Shut the Mass Sine Ultra Off and On.
(4) blinking fast	Install error	Installation error.	Correct installation, shut the Mass Sine Ultra Off and On.

8 TECHNICAL DATA

8.1 Specifications

Mass Sine Ultra	24/4000
Article number	26024000
Inverter specifications	
Nominal battery voltage	24 V
Inverter output voltage	230 V (±2%)
Frequency	50/60 Hz (±0.005%) selectable
Continuous power@Tamb=25˚C, cos phi = 1	4000 W
Continuous power@Tamb=40˚C, cos phi = 1	4000 W
Max. peak load	7000 W
Output waveform	True sine wave, Thd < 1 % under standard conditions
Max. efficiency	≥ 92%
DC input voltage range	19 – 32 V programmable
Dynamic input window battery	Current dependent switch-off levels, vary with set battery type (Gel / AGM settings below)
Switch off voltage low battery@ load ≤ 2%	22.0 V(±2%)
Switch off voltage low battery@ load 2-100%	21.0 V - 19.0 V (±2%)
Switch on voltage low battery	24.0 V(±2%)
Switch off voltage high battery	32.0 V(±2%)
Switch on voltage high battery	29.0 V(±2%)
Max. ripple on DC @ full load	10% RMS
Nominal DC current at full load	200 A
Recommended batteries	200 – 600 Ah
No load, DC drain	
Off mode (hard switched)	0 W
Inverter off mode (remote)	4 W
Normal operation mode	16 W
Parallelling/3-phase	
Parallel stacking	Yes, up to 10 standard
3-phase configuration	Yes, up to 3 x 3
General specifications	
Dimensions (H x W x D mm)	472 x 318 x 178
Weight	15 kg
Protection degree	IP23 (vertical wall mounting)
Safety class	IEC protection class I
Grounding	Ground stud (ABYC compliant)
Operating temperature	-25˚C to 60˚C, above 40˚C derating
Overvoltage category	Mains: OVIII
Pollution degree	PDII
Relative humidity	Protected against humidity and condensing air by conformal coating, max 95% relative humidity, none condensing
Standards, approvals & listings	CE, ABYC
Options & features	
Front panel display	Yes, shows inverter power, input/output state and includes on/off switch
MasterBus functionality	
MasterBus powering	Standard on, selectable
Overload protection	
AC Output:	
Short circuit protection	Yes
Battery input:	
Short circuit protection	Yes
Reversed polarity protection	No

8.2 Dimensions

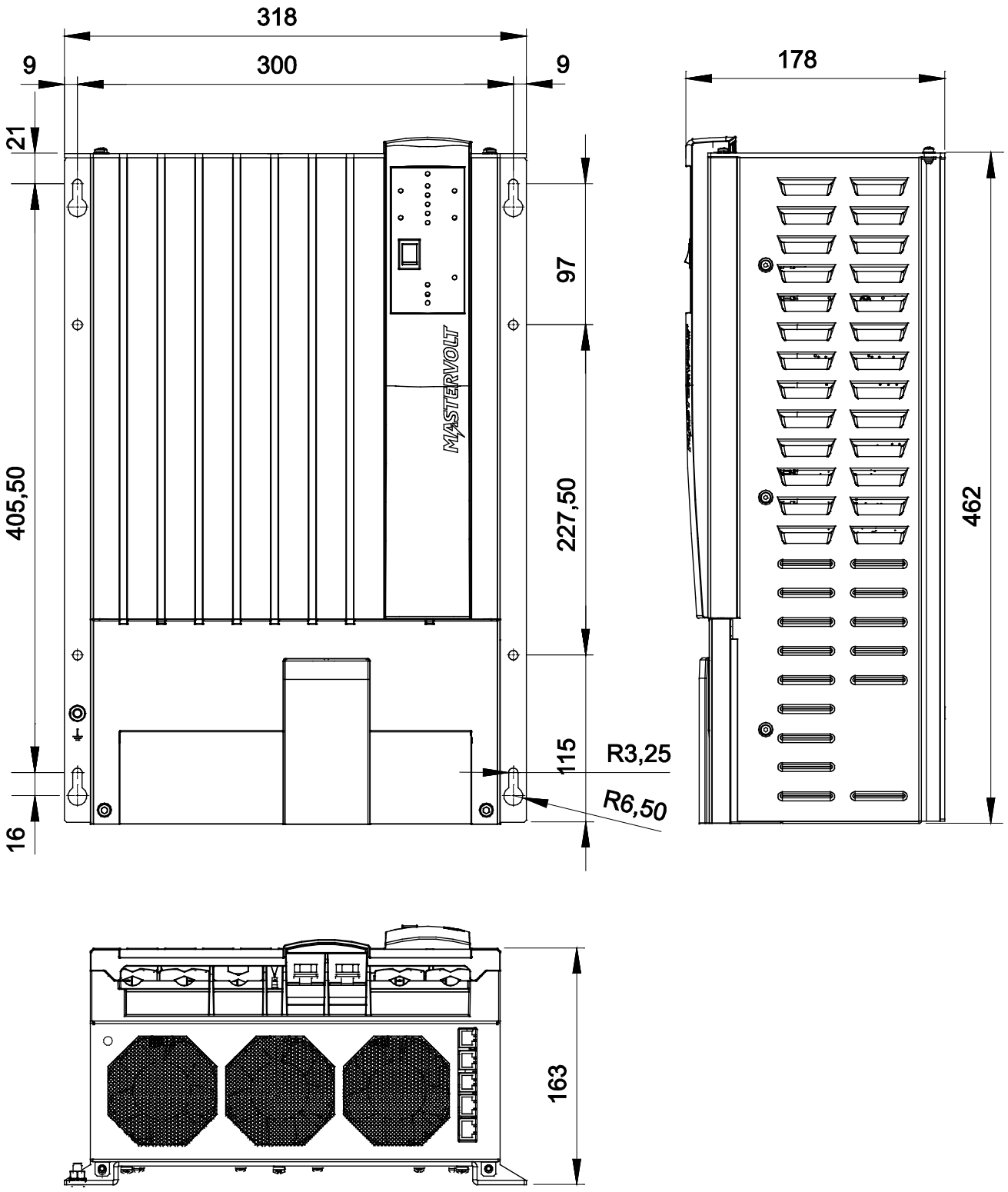


Figure 8-1: Dimensions in mm

9 ORDERING INFORMATION

Part number	Description
77049200	ANL Fuse 200 A
607006	ANL Fuse base
701	Battery switch 275 A
6502000010	Sync cable for parallel and three phase operation, 1 meter / 3 ft
6502000030	Sync cable for parallel and three phase operation, 3 meter / 9 ft
6502001030	Sync cable for parallel and three phase operation, 6 meter / 19 ft
6502100100	Sync cable for parallel and three phase operation, 10 meter / 33 ft
6502100150	Sync cable for parallel and three phase operation, 15 meter / 49 ft
77040000*	MasterBus terminating device
77040020	MasterBus connection cable (UTP patch cable), 0,2 m / 0.6 ft
77040050	MasterBus connection cable (UTP patch cable), 0,5 m / 1.6 ft
77040100	MasterBus connection cable (UTP patch cable), 1,0 m / 3.3 ft
77040300	MasterBus connection cable (UTP patch cable), 3,0 m / 10 ft
77040600	MasterBus connection cable (UTP patch cable), 6,0 m / 20 ft
77041000	MasterBus connection cable (UTP patch cable), 10 m / 33 ft
77041500	MasterBus connection cable (UTP patch cable), 15 m / 49 ft
77042500	MasterBus connection cable (UTP patch cable), 25 m / 82 ft
77045000	100 m / 330 ft MasterBus cable (UTP cable)
77040010	MasterBus RJ45 conn 8-pole 25 pcs
77040015	Cover for RJ45 conn. -set a 25 st
77050000	Complete set to assemble UTP patch cables: 100 m / 330 ft UTP cable, 50 pcs. modular jacks and crimping tool
77030100	MasterBus – USB interface, required when using MasterAdjust or MasterView System software.
77010305	MasterView Easy, Touch screen to control and monitor all MasterBus products
77010400	MasterView System, Full-colour touch screen to control and monitor all MasterBus products
77020100	MasterShunt 500, DC-distribution module for exact readout of battery voltage, charge / discharge current, and state of charge. Continuous rating: 250 A, peak current: 500 A
77020200	DC-Distribution 500. The Mastervolt DC Distribution offers fused DC connections to install up to four different devices

* Standardly included with the delivery of the Mass Sine Ultra

Mastervolt can offer a wide range of products for your electrical installation, including automatic AC transfer switches, remote control panels and DC distribution kits. See our website www.mastervolt.com for an extensive overview of all our products.